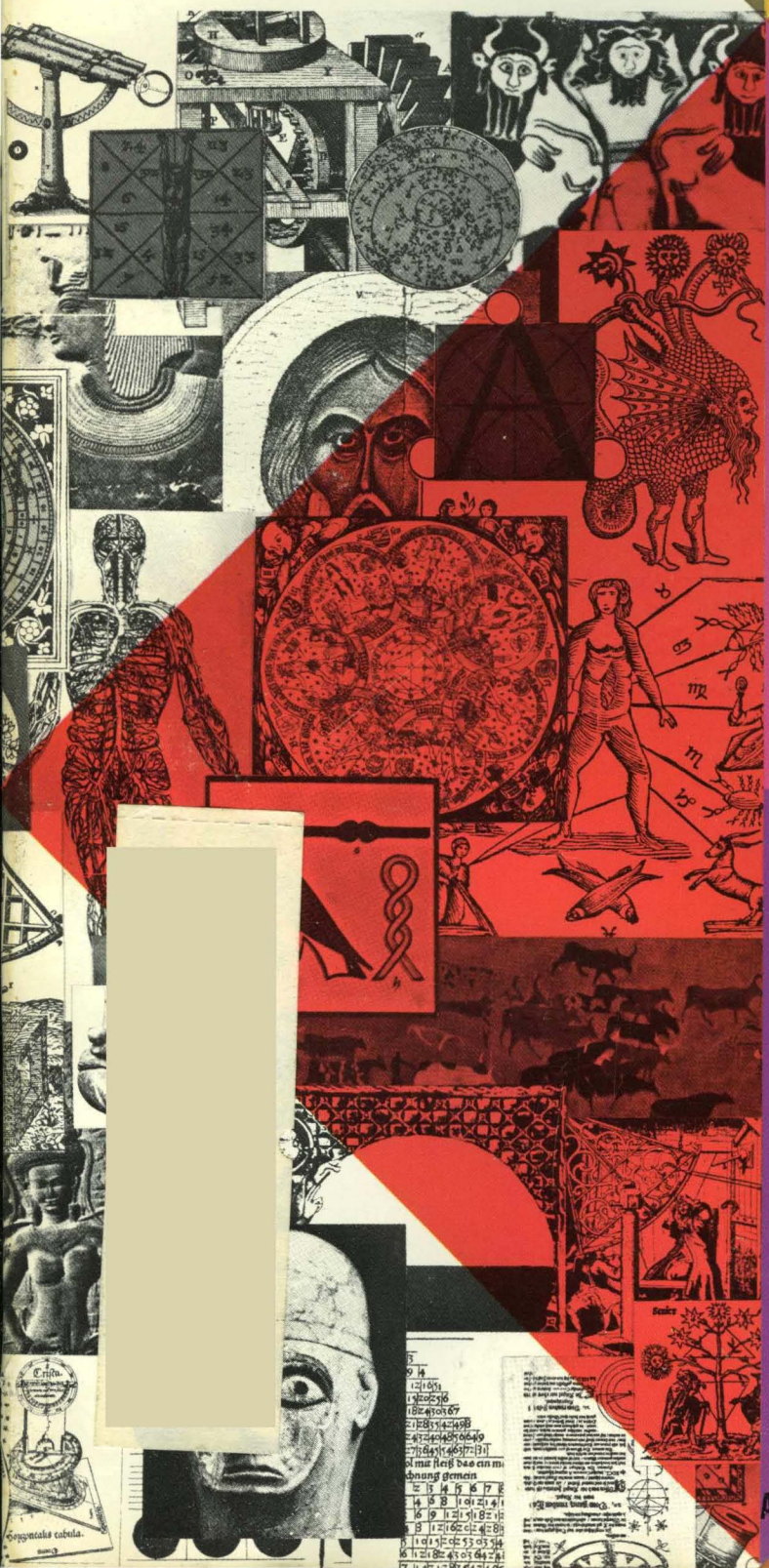
DATAMATION 70®

January



A LOOK AT THE PAST... AND THE SHAPE OF THE FUTURE

Try dropping this in your computer!

Antienvironment is the name of Varian's latest computer game. We call it the R-620/i, a ruggedized version of the popular 620/i (over 1000 sold worldwide).

The new R-620/i is a systems-oriented, general-purpose computer that offers highly reliable operation in the most severe environments. It is specifically designed to withstand vibration, shock, humidity, dust and corrosion. Ideal for mobile or permanent facilities in both military and industrial applications.

With ceramic integrated-circuit reliability, the computer features easy interfacing, compactness, choice of 16- or 18-bit precision and a high-temperature memory that can be expanded up to 32K words.

A large library of software, field-proven on the functionally identical 620/i, is available to you for the R-620/i. As well as one of the largest service and maintenance organizations in the small-computer field. The price is only $16,900. The R-620/i, a good new reason for you to talk to the big company in small computers.

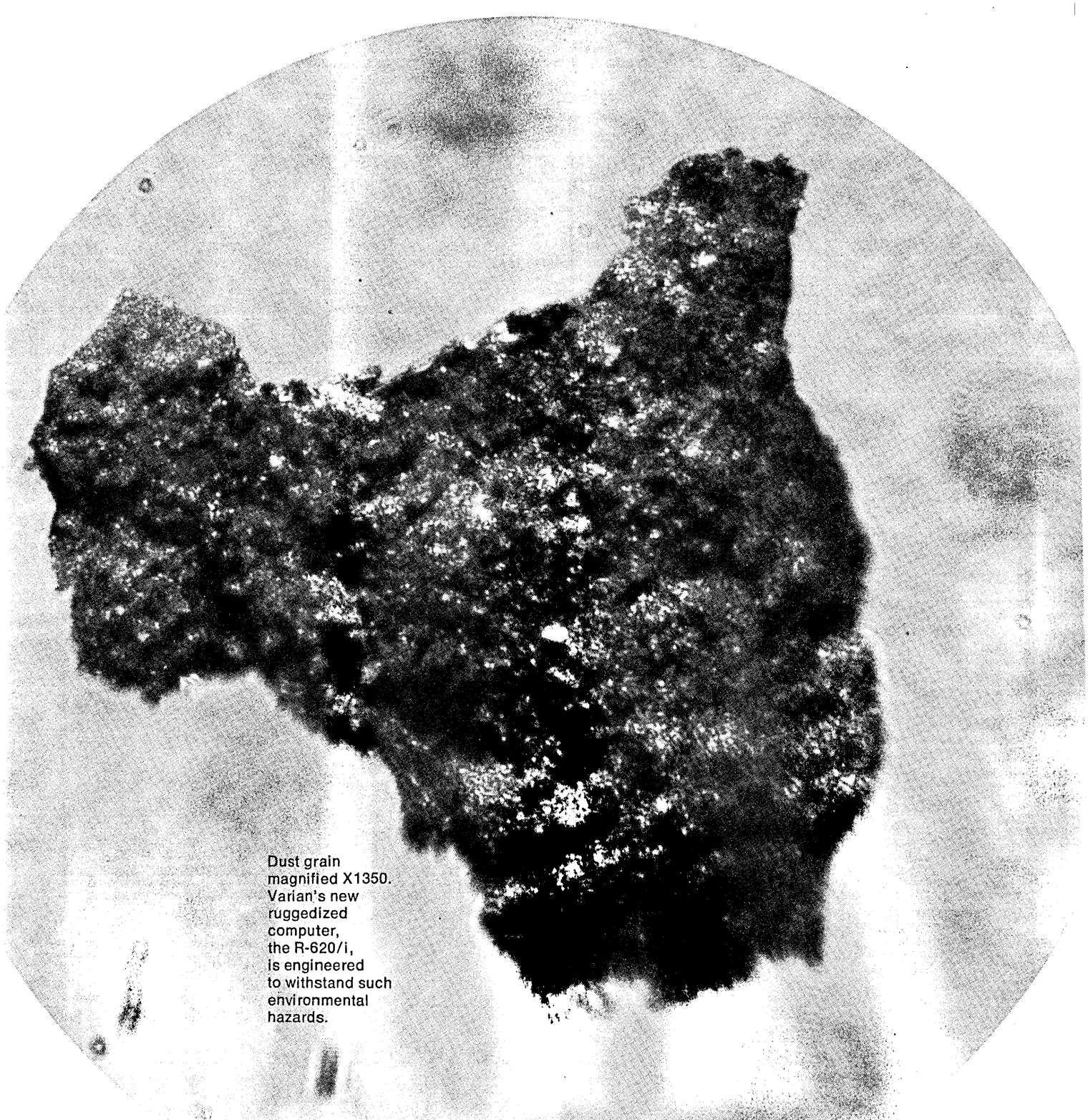
U.S. Sales Offices: Downey, San Diego, San Francisco, Calif.; Washington, D.C.; Atlanta, Ga.; Chicago, Ill.; Waltham, Mass.; Ann Arbor, Mich.; New Rochelle, N.Y.; Fort Washington, Pa.; Houston, Tex. Other offices worldwide.

Varian Data Machines, a Varian subsidiary, 2722 Michelson Dr., Irvine, Calif. 92664. Telephone: 714/833-2400.

varian data machines

The Big Company in Small Computers

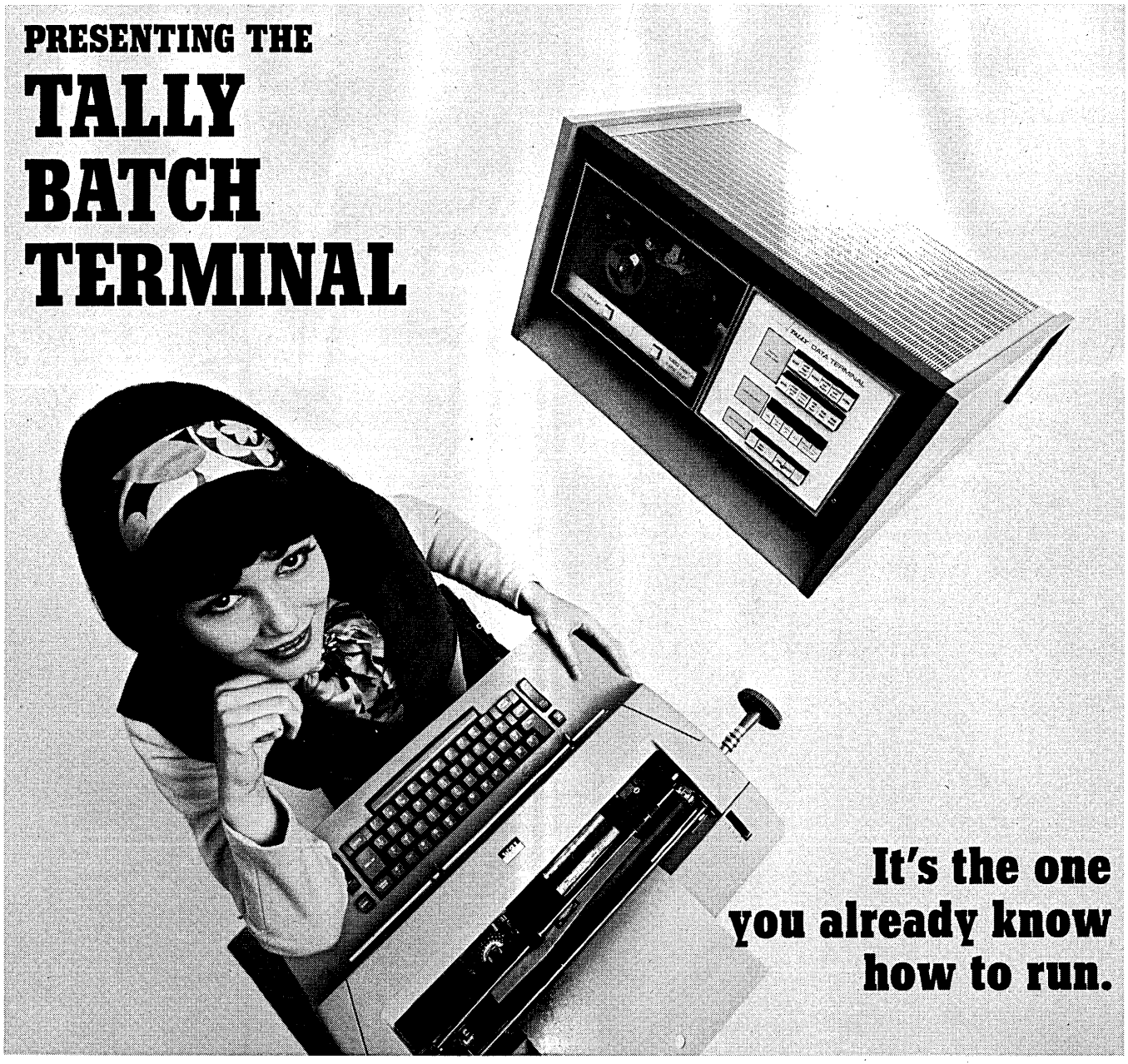
CIRCLE 1 ON READER CARD



Dust grain magnified X1350. Varian's new ruggedized computer, the R-620/i, is engineered to withstand such environmental hazards.

PRESENTING THE

TALLY BATCH TERMINAL



It's the one you already know how to run.

Everybody who types already knows how to run the fastest batch terminal on the market. As a non-labor byproduct of your regular office typing routines, data is entered on the Tally 1021 Batch Terminal.

At the end of the day or any other convenient time, you can transmit at 1200 words per minute to any size computer. The Tally 1021 Batch Terminal gives you full error control, variable record length, reusable media, two way communication, code flexibility, simplicity of operation, proven reliability, and operating economies. Options include computer interface, paper tape reader, cardreader, and computer compatible mag tape recorder.

Your Tally Batch Terminal comes with the works, all tape formatting, parity checking, switching, and tape control functions. As a matter of fact, all you add is the girl.

TALLY®

For complete information, please write or call Tally Corporation, 8301 South 180th Street, Kent, WA 98031. Phone (206) 251-5500. TWX 910-423-0895. Or contact one of the regional offices: New York: 45 N. Village, Rockville Centre, NY 516-678-4220. Chicago: 33 N. Addison Rd., Addison, IL 312-279-9200. Seattle: 8301 South 180th St., Kent, WA 206-251-5500. England: 6a George Street, Croydor Surrey (01) 686-6836.

CIRCLE 54 ON READER CARD

Sanders can throughput more input...

Misteak? It probably hit you right where you live. Error-free input is the life blood of any EDP man.

That's why Sanders designed a system that gets input moving, yet keeps it error free. The Sanders System 6000* Display Data Recorder.

The operator taps a key. Instantly, a replica of the source document—we call it a format—appears on the screen. Then the operator simply types information into the blanks. Logically. In the same order and position as on the original. Notice how the System 6000 displays data in two intensities. It makes it easy to verify. Errors are corrected by simply overtyping. Text automatically adjusts for insertions and deletions.

Once all the data is correct—and only then—the operator enters it on computer-compatible tape. Up to twelve units can share the same reel, so tape pooling is eliminated. And the operator can select many formats from a changeable tape cartridge.

If you don't look at the system that can throughput more error-free input, you're making a mistake. Any way you spell it. Call your nearest Sanders sales office, or contact Marketing Manager, Data Systems Division, Sanders Associates, Inc., Daniel Webster Highway S., Nashua, New Hampshire 03060. Or call (603) 885-4220.

SA * SANDERS ASSOCIATES, INC.

*TM Sanders Associates, Inc.

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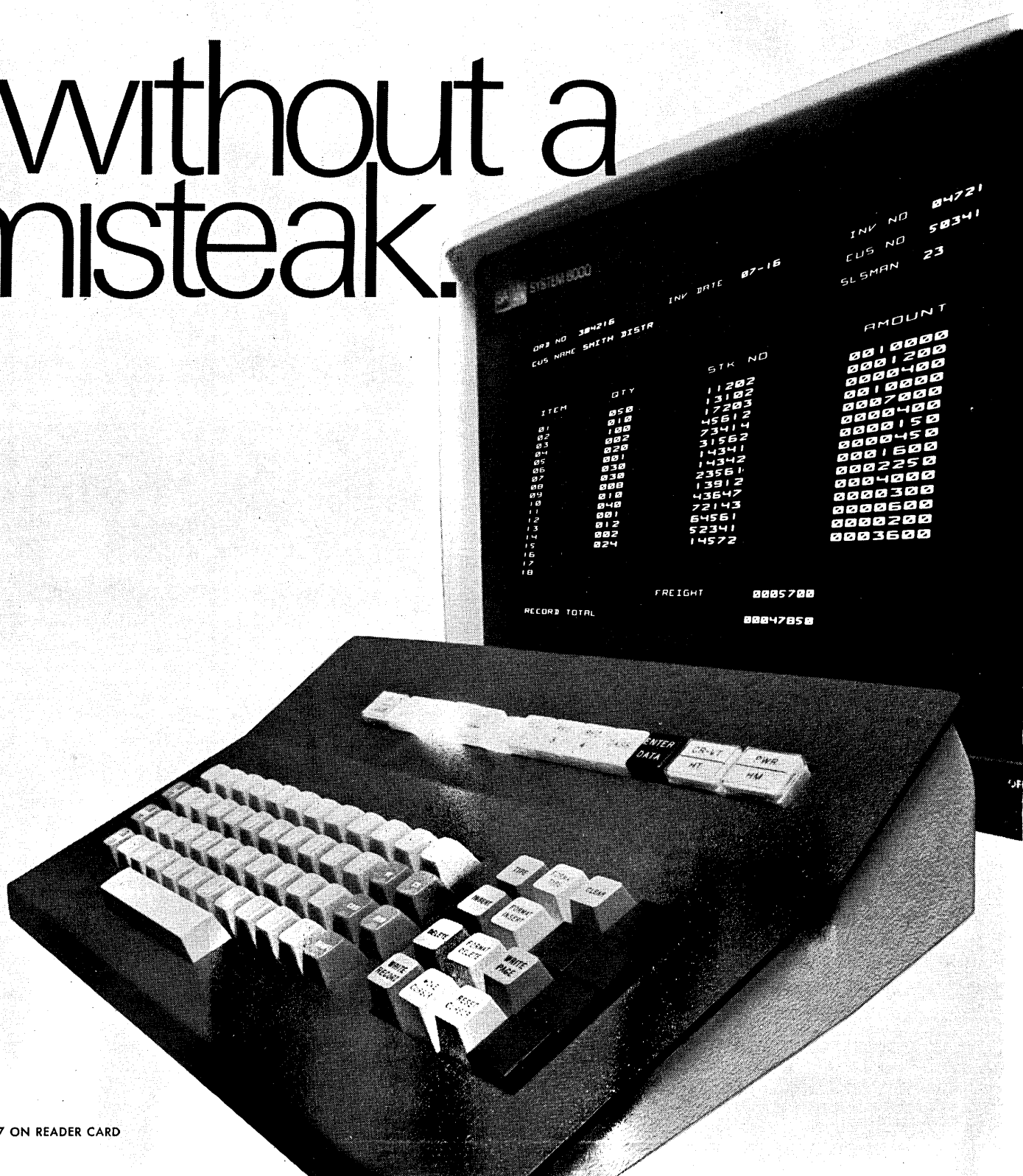
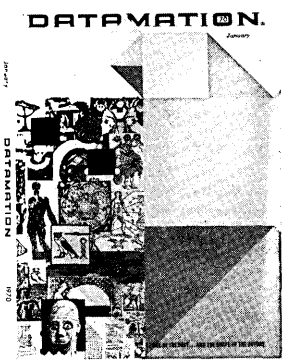


CIRCLE 47 ON READER CARD

DATAMATION



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The Octopeeper

RCA's Video Terminal. Our TV experience puts you eye to eye with Octoputer. It's your best view of remote computing.

Remote computing is working with your computer from wherever you are to wherever it is.
It can be yards or miles away.
And hundreds of people can share it.
For those people, user terminals are hooked up to the remote computer.
There are all kinds of terminals, in all sizes and shapes.
But none of them sizes up to the terminal you see on the Octoputer's arms.

It's RCA's Video Terminal. The Octopeeper.
There's no better way to find facts, feed in facts, or solve problems.
It's like a combination TV and typewriter. You see what you type.
You see what the Octoputer says.
Instantly. Clearly. In bright letters on the screen.
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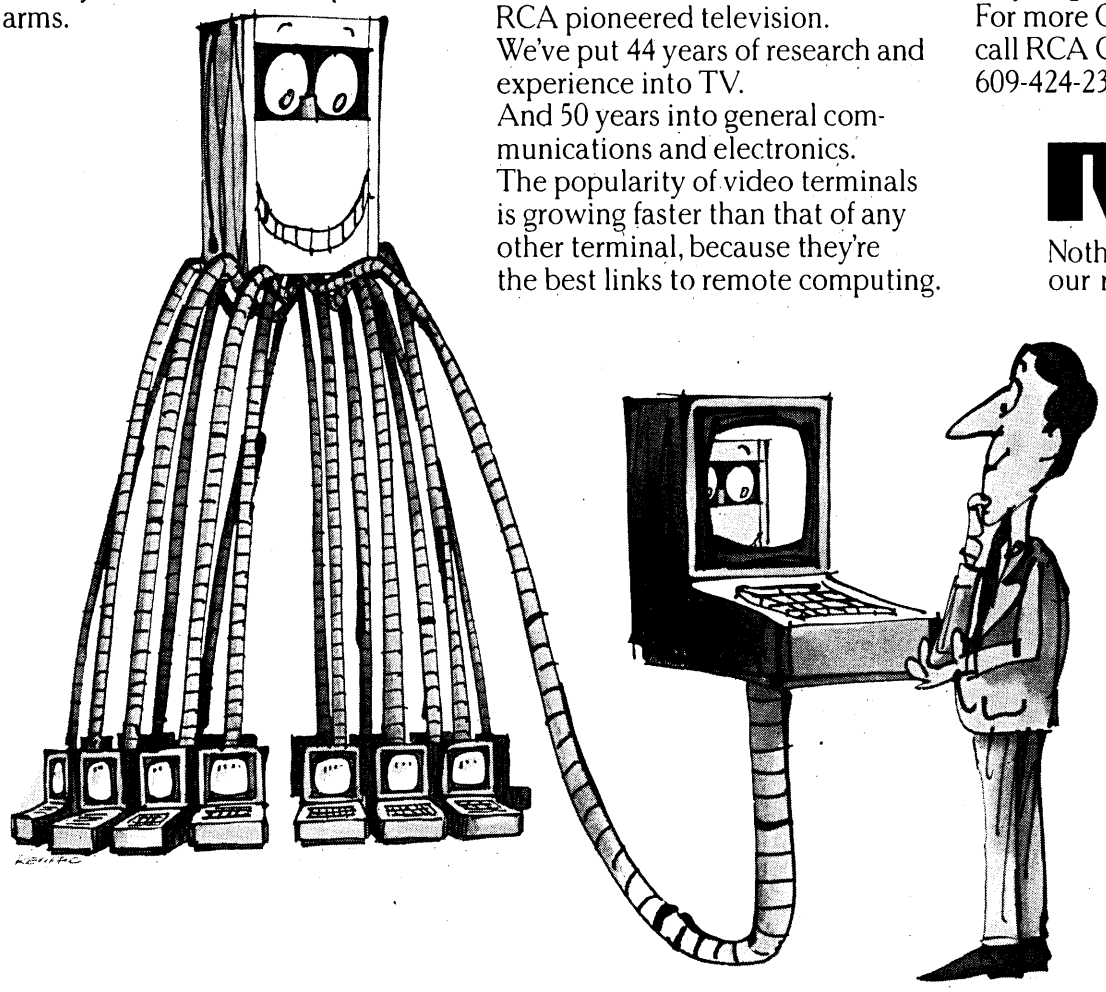
It should be.
RCA pioneered television.
We've put 44 years of research and experience into TV.
And 50 years into general communications and electronics.
The popularity of video terminals is growing faster than that of any other terminal, because they're the best links to remote computing.

Remote computing is the coming thing in this business.
That's why RCA is concentrating on it.
We got there first because it's based on communications.
The Octoputer puts us a whole generation ahead of our major competitor.
It can put you ahead of yours.
And the Octopeeper is the best way to get to it.
For more Octopeeper information, call RCA Computers at 609-424-2385.

RCA

Nothing comes close to our remote computers



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digital
COMPUTERS · MODULES

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january
1970

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Pick the biggest winner yet.

We did. i-3301

New LSI memory is largest bipolar ever. A 1024-bit ROM with 60 nsec maximum access.

Introducing Intel Model 3301, a Schottky-process bipolar ROM memory with 256 x 4 organization. It's fully-decoded and dissipates only 0.5 mW/bit power. All inputs are Schottky diode clamped, and all outputs are capable of wired OR operation.

Two "chip select" leads permit expansion to a 1024 word memory without need for external decoding. Addition of two quad gates allows further expansion to 2048 words.

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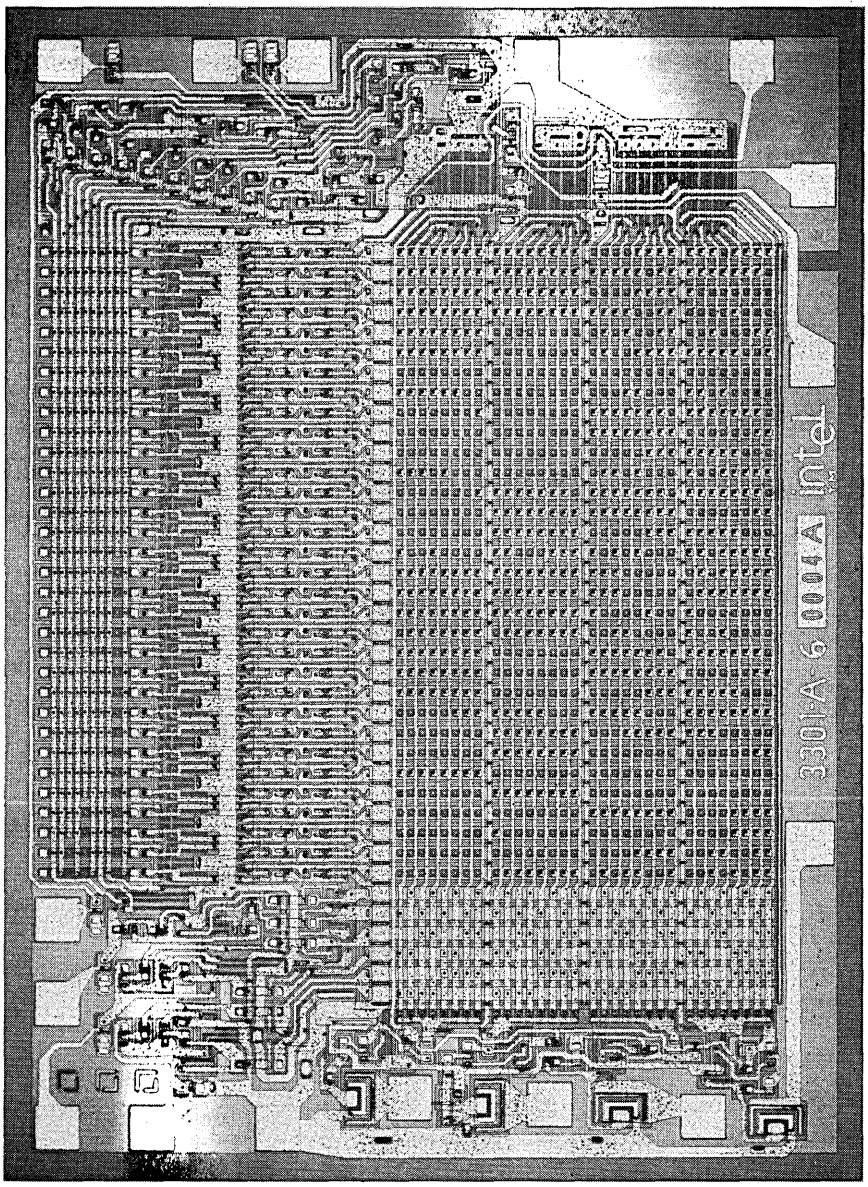

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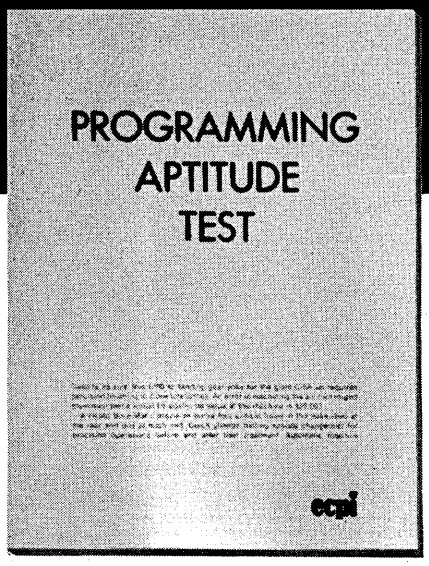
If you think getting into ECPI is easy, you could have another think coming.



At ECPI, we run what is probably the toughest obstacle course in the business. But not every would-be programmer gets a chance to run it.

First, he has to get by our aptitude test. Because desire is one thing, and ability another. Then, if he's got the ability, we give him an in-depth interview just to make sure he's got the proper attitude. In fact, our screening is so intense that 7 out of 10 high school graduates who apply don't meet the requirements.

But that's only the beginning. In his course of study, each student has to sweat through hundreds of hours of class work, plus several hundred more of homework. He has to write 21 programs. What's more he gets practical work on third-generation equipment and plenty of time to de-bug what he's written.

Then, just to make sure he's got it all filed away in its proper form, each ECPI student has to pass five tough mid-term exams and a three-hour final that's the final crusher.

Our course isn't easy. In fact it's pretty tough. More than 20% of our students don't even make it through. But, we figure the harder we make it for them, the quicker they'll make it with you.

ecpi ELECTRONIC COMPUTER PROGRAMMING INSTITUTE

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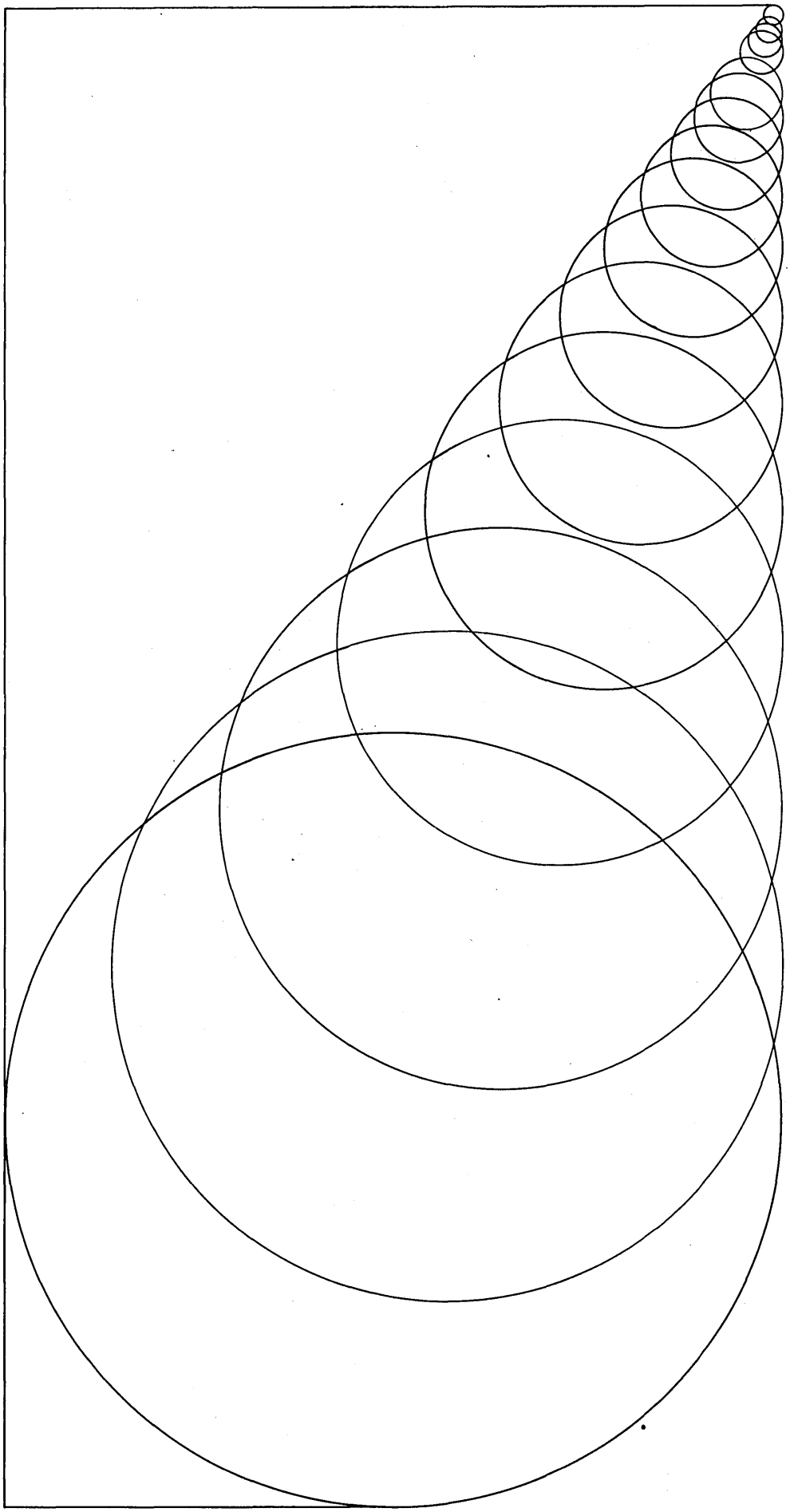

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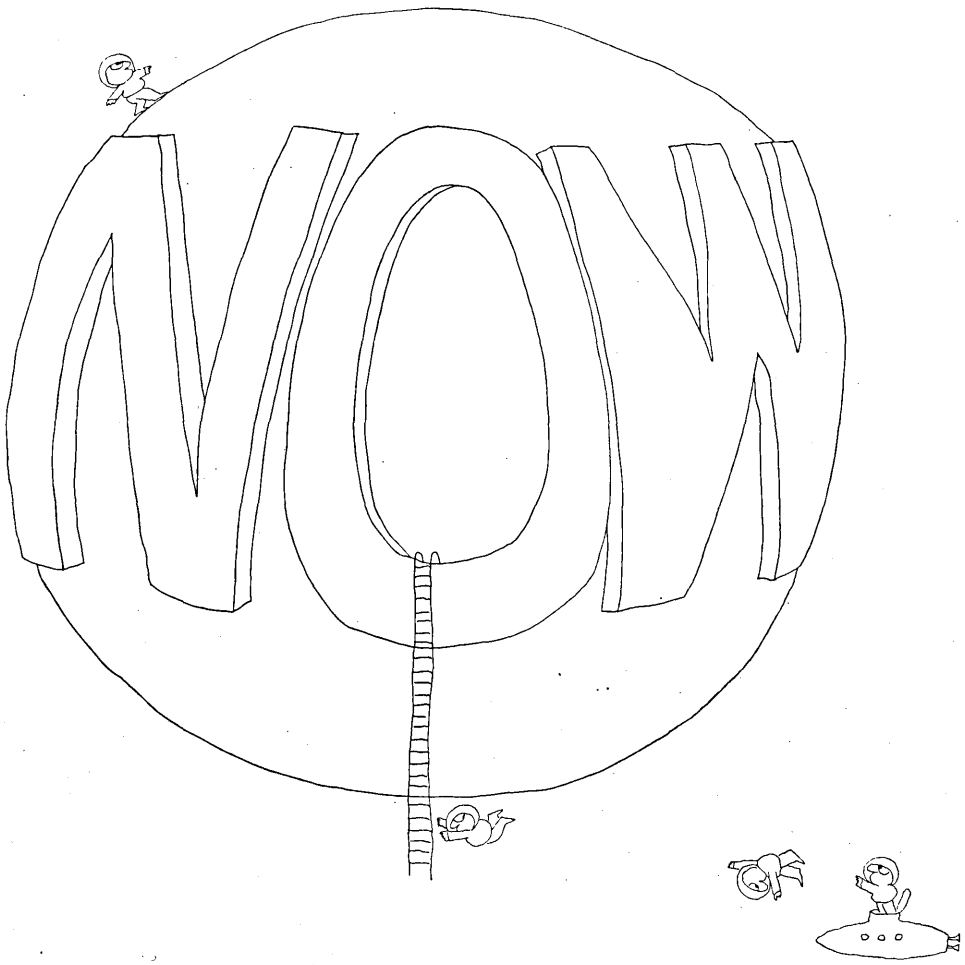

Discover the world of now.

The world of now was created by UNIVAC® real-time computer systems that continuously gather, organize, update and communicate information to any level of management. Only what's needed. Only where needed.

In the world of now you enjoy real-time management for the first time. Management that's constantly in the present.

What's more, you can accomplish this with a medium-scale system like the UNIVAC 9400.

This system offers low cost, high performance multiprogramming usually found in larger and more expensive computer systems.

Up to five problem programs, such as communications, sequential batch processing, random processing, disc or tape sorting and complex engineering calculations can be run concurrently.

The UNIVAC 9400 System has outstanding real-time data communication capabilities. It can talk to any other computer in the 9000 series, to terminals, and to the large-scale UNIVAC computers.

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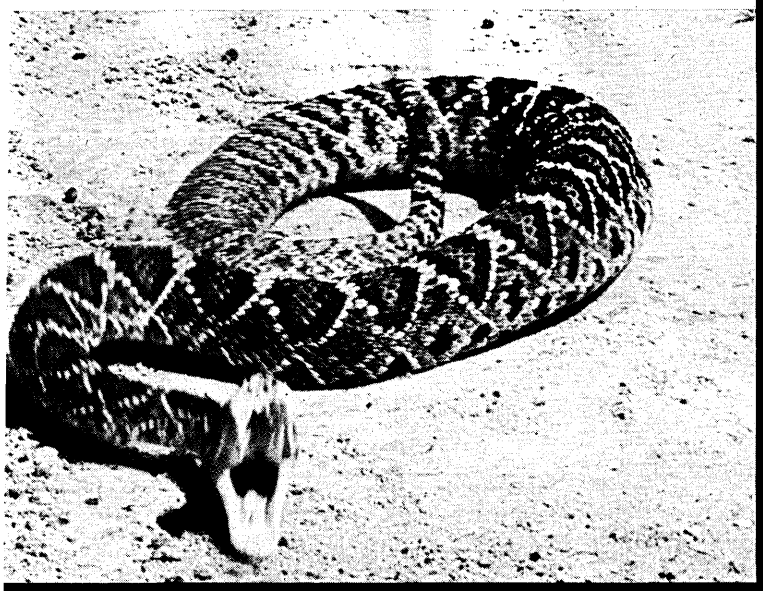

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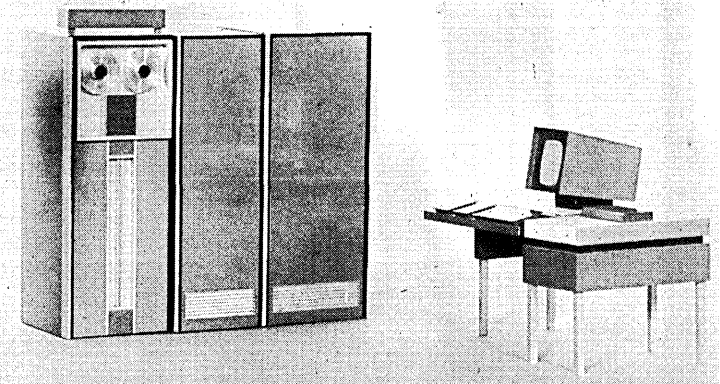

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GENERAL ELECTRIC'S RAPID SEARCH MACHINE-FASTER THAN A STRIKING RATTLER!

... In the same time, General Electric's Rapid Search Machine, Model GESCAN-1, can search through 4,166 words! This represents a search speed of 3 minutes for a 2,400', 3.5 million word magnetic tape file.

The General Electric RSM Model GESCAN-1 is a revolutionary new free standing information handling device designed expressly to perform high speed versatile search and retrieval of textual data on magnetic tape files.

The GESCAN-1 is a digital, solid state, wired logic machine that uses an associative, natural language processor to compare any search request entered on the console keyboard to the entire contents of the tape, word for word, seeking a match.

The output of a search will be printed in natural language on the system printer and may be either records, selected sub-records, or up to 990 characters on either side of the matched word or phrase.

The search request, or query, may be linked by the logical connectives "and", "and not", "or", "or not". Erroneous and alternate spellings, as well as incomplete words or phrases in the search query are accommodated. These features allow greater system versatility and flexibility to the user.

The digital magnetic tape data file to be searched is formatted, simply, into "records" and if desired, "sub-records" which may be any logically complete quantity of information as a report or abstract or both. Records may be in any location on the tape and need not be in any sequence. No physical indexing is necessary and no record gaps are required.

UNIQUE FEATURES:

- Searches natural language tape files at one million words per minute.
- Searches for desired word combinations entered directly via keyboard.
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TELETYPE

phi data kappa set

Meet the data terminal of many letters. The versatile, heavy-duty Model 37. At the head of its class in complex data transmission and reception. Another exciting answer from Teletype R&D for moving data efficiently, at very low cost.

* * * *

Forms. Tabular material. Text. Equations. Charts. Formulae. Graphs. Teletype's Model 37 is equipped to handle your most complex business communications. Sends and receives 150 words per minute in print or on punched paper tape. And the line features ASR (automatic send-receive), KSR (keyboard send-receive), and RO (receive only) sets. With important options that give you completely integrated data moving capability.

A great computer tutor

Computer dialog has never been easier. The Model 37 generates all 128 ASCII (U.S.A. Standard Code for Information Interchange) code combinations. And its unique operating features simplify the ins and outs of problem solving.

Prints standard numerals, symbols, and upper and lower case characters.

Shift-out feature produces special symbols and characters you need in your particular data operation.

Control character generation puts all 32 ASCII control functions on-line.

Escape sequence offers a number of terminal functions. Two-color printing, for example.

And you get all of this flexibility from a sleek keyboard arrangement that is similar to the familiar keyboard you find on a typewriter.

Big faculty for tabbing

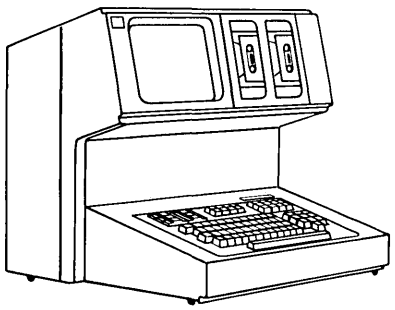
The Model 37 has a tab stop for every horizontal and vertical place on the page. An operator, computer, or any remote terminal that uses ASCII can set terminal tabs on-line. Enables you to produce multiple copy business forms with new speed and efficiency. Fill them in, in any number of remote locations. Or handle large volumes of tabular material on-line.

When it comes to printing equations or complex formulae, the Model 37 has no peer. Forward and reverse half and full line space help create the data configuration called for with no problem.

Graduate . . .

move up to the Model 37. One of many exciting moves being made by Teletype R&D *in moving data at very little cost.* That's all we're really concerned with. Providing equipment that keeps data moving quickly, reliably, economically . . . machines that can help you move data a mile, thousands of miles or just down the hall. If you would like more information on the Model 37, write Teletype Corporation, Dept. 81A, 5555 Touhy Avenue, Skokie, Illinois 60076.

the skilled data terminal for unskilled operators



Forget about keypunch girls or teletype operators. If your employees know their jobs, they already know how to use our new computer terminals.

Each machine has a mini-computer that we program to fit your business. It guides the operator step-by-step and "beeps" when a mistake is made. It can cut errors *by 90 percent.* It will search a file, sort information, and copy records. The custom keyboard is simple to use.

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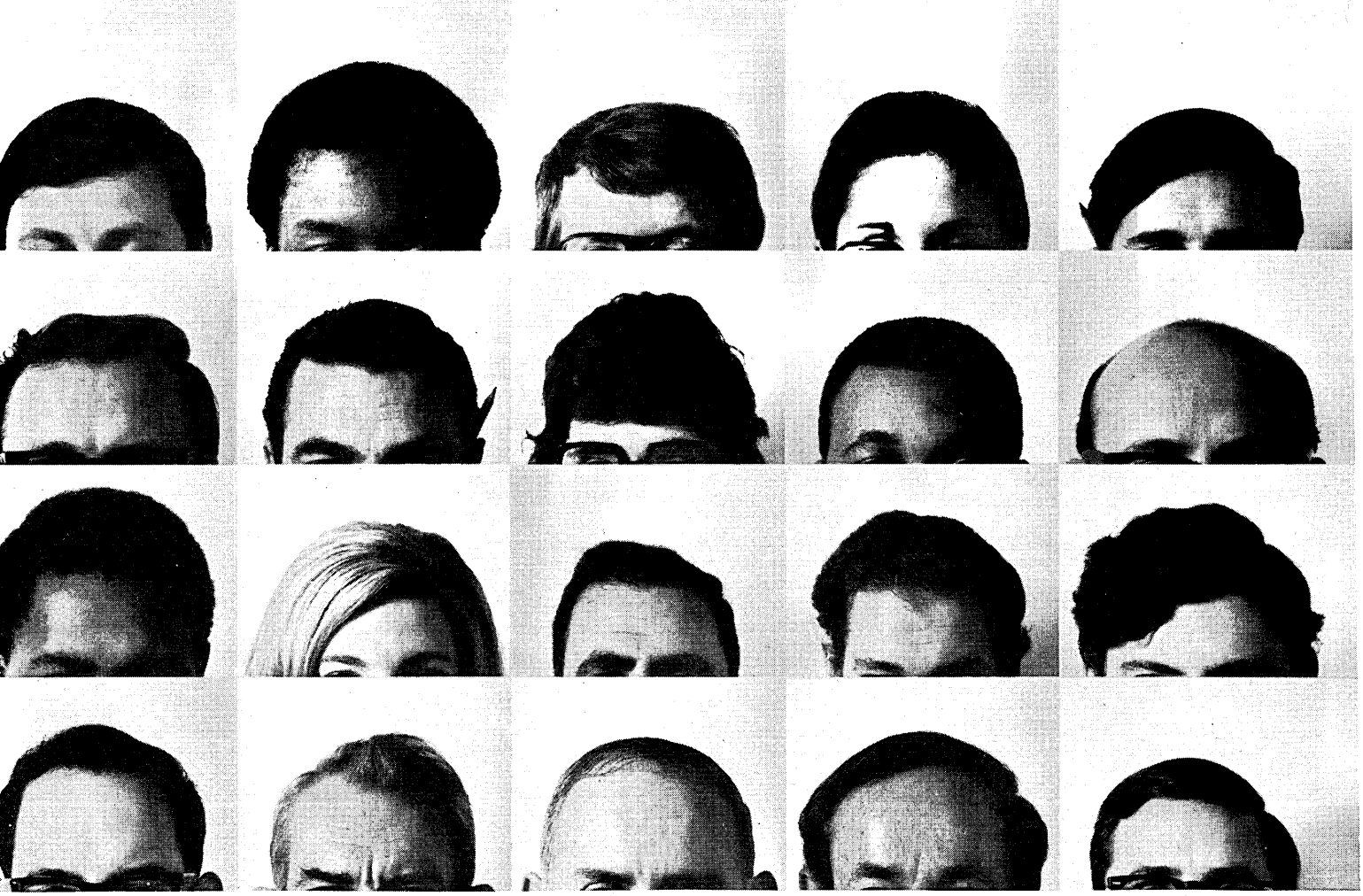
CIRCLE 157 ON READER CARD



Give your computer a head start.

We're IBM systems engineers.

Many of us majored in mathematics or business or engineering in college.

All of us have had a healthy dose of IBM training in all facets of systems engineering.

And lots of time in the field and classroom learning about your business.

And now we'd be more than happy to help you give your computer a head start.

The first step is to sign an agreement for IBM Systems Engineering Services.

Then when you call us in, one of the things we might do is take a long, hard, professional look at your data processing system and provide application development assistance to improve its performance.

Or we might work out some new ways to get things done.

Like using a new computer language.

Or assist in the installation of terminals for your computer.

So you can get your critical projects on stream a lot faster.

Maybe we'll work with you to map out a long-range detailed plan for evaluating and improving your computer installation, to meet your business needs.

We might help you in systems analysis and design.

Whatever we do, you'll know it's all with one thing in mind.

To make sure you get the most out of your computer system.

We're professionals, trained in your business.

And in the business of data processing.

Give your computer a head start.

IBM®

New Data Communication Terminal

- ECONOMICAL TELEPRINTER
- HARD COPY — Upper & Lower Case
- 3 CODE VERSATILITY
- DUAL BAUD RATES

Plugs in directly as a new addition to your business/engineering office or as a replacement for old style machines. A compact, Selectric-type terminal that will transmit and receive alpha-numeric data in (1) ASCII code (110 baud, 10 cps); (2) BCD code; (3) Correspondence IBM code (135 baud, 15 cps).

Utilizing the latest solid-state microcircuit technology, the ADS-715 Data Communication Terminal is completely contained within a 15" carriage Selectric typewriter enclosure. Fully portable, it can be used any time as a regular typewriter. Optional coupler and read/write magnetic tape unit. Send for details on this economical new terminal.

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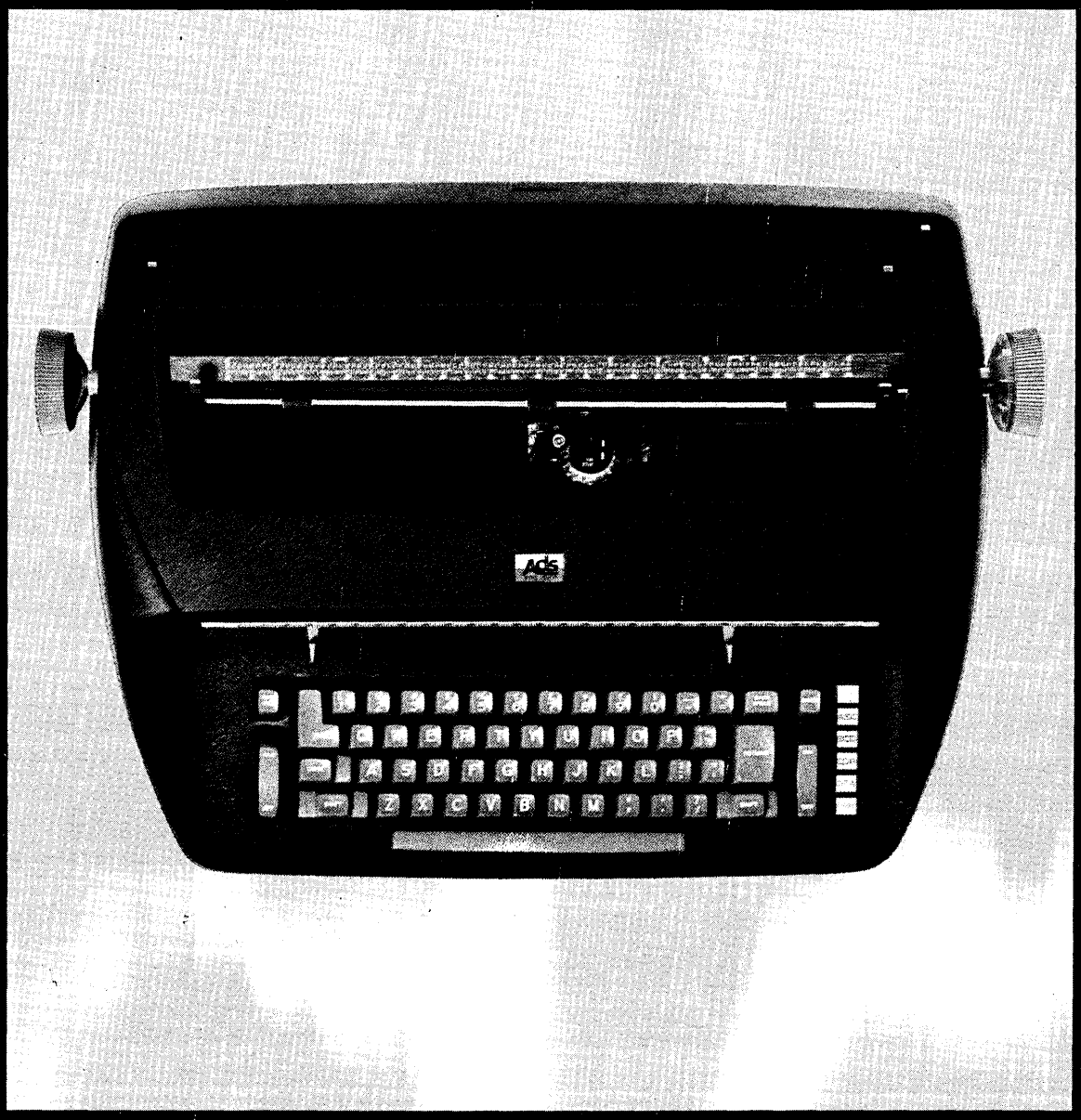
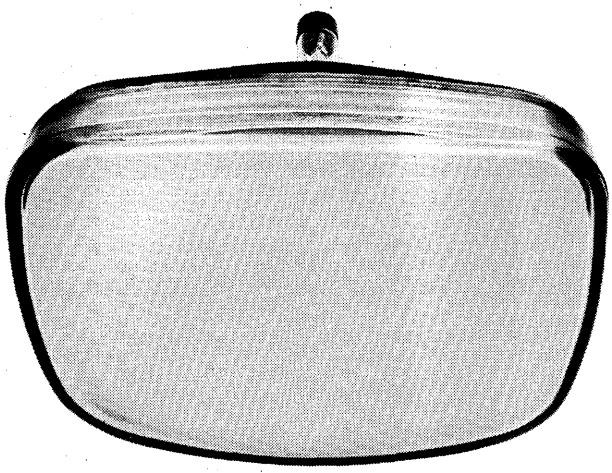
DATA TERMINALS/DATA SYSTEMS

Ads

AMERICAN DATA SYSTEMS
Telephone 213-882-0020
20747 Dearborn St.,
Chatsworth, Calif. 91311





CRT Tubes—buy the components and build the display system you need.

CRT Terminals—buy the full-scale system and get more than you need.

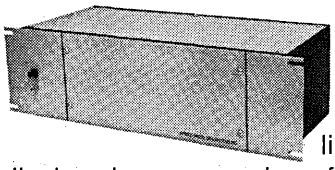
Minimum Maximum

New CRT Readout—buy exactly what you need and pay less to get it.

Optimum

Announcing the MRD-200—a new, low-cost way to display alphanumeric data using TV monitors.
Now there's a practical way to read out alphanumeric data from computers, keyboards, magnetic tapes or any other sequential source.

The MRD-200 accepts ASCII data, stores it in its own memory, converts it to a composite video signal and displays it on any 525-line TV monitor. In from 32 to 1024 character positions in 1, 2, 4, 8, or 16 lines with either 32 or 64 characters per line. Data may be displayed on any number of monitors at any number of locations with just a single coaxial cable.



Cost for an MRD-200, not including monitors, starts at $1250.

Control features let you advance to any line or character position, blink any character or combination of characters on and off, use a cursor symbol for tracking the location of the next character, and erase all or part of the screen.

The MRD is also available in other configurations. The MRD-500, for example, can read as well as write, and has random access capability. Thus, it's ideal for custom-designed display systems.

So if you have an alphanumeric display problem in process control, test equipment, data acquisition, computer consoles or data transcriber displays, you no longer have to go to extremes.

Now there's a happy medium.

From the company that specializes in innovative data communications systems.

ADDS
Applied Digital Data Systems, Inc.

Mr. Richard Kaufman, Dept. 20
Applied Digital Data Systems, Inc.
89 Marcus Boulevard
Hauppauge, New York 11787

Please send more information about the MRD-200.

Name_____

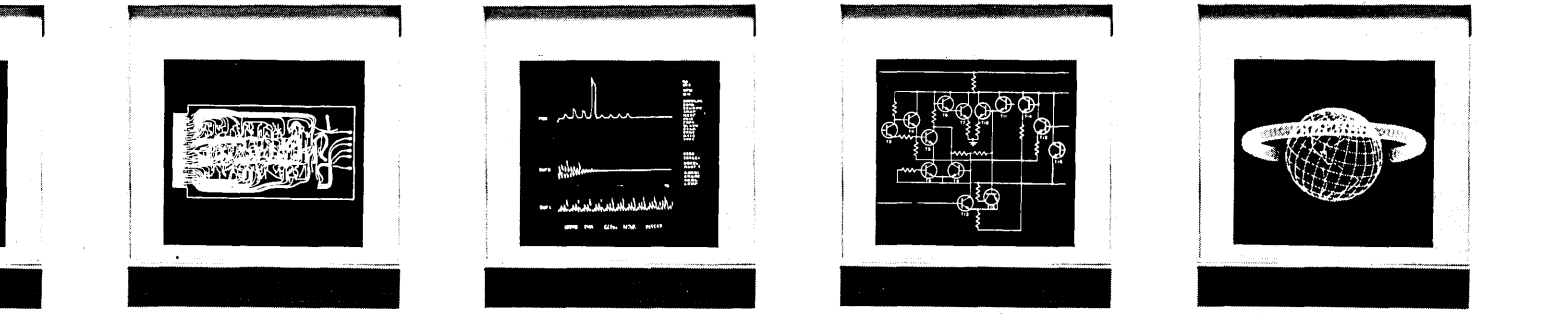
Title_____

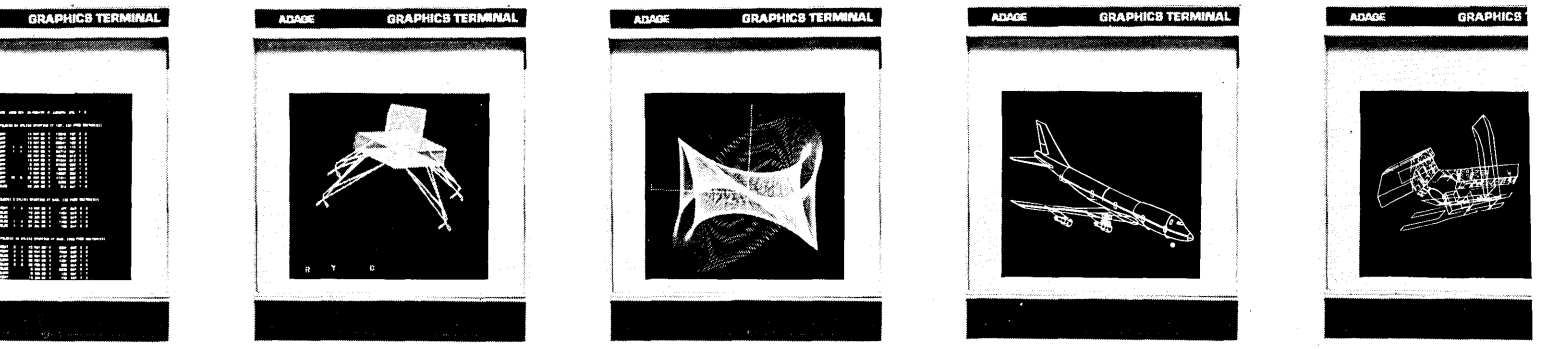
Company_____

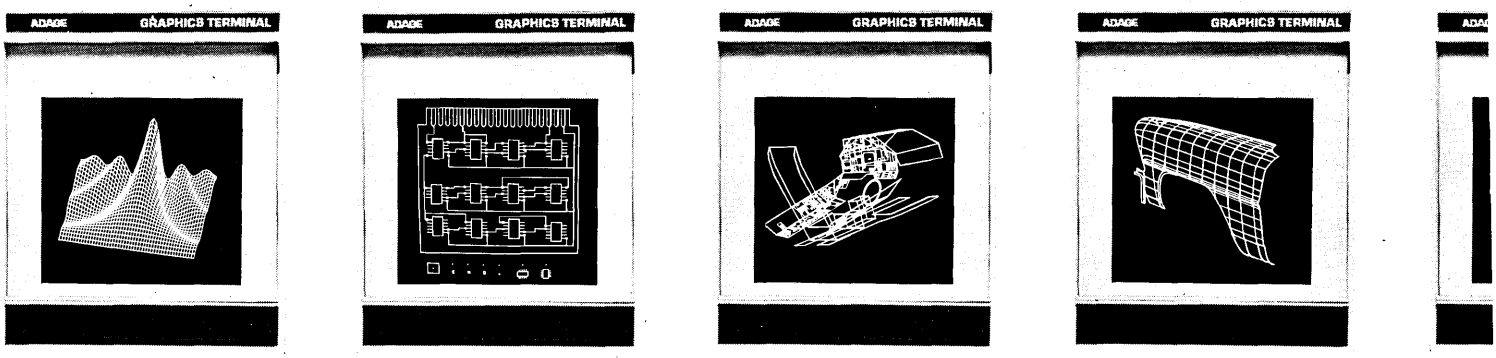
Address_____

City_____

State_____ Zip_____







Looking for interactive graphics? Shop Adage first.

We're not an interactive graphics supermarket, but we're beginning to look like one. That's because we are the only company marketing a full line of standard off-the-shelf graphics terminals covering a broad range of price and performance.

Because of our experience in many fields, we can provide you with the best and quickest solution for your specific application. Adage Graphics Terminals are now in operation in government facilities, the oil industry, processing and manufacturing plants, aerospace, and in university research laboratories. Applications range from three-dimensional dynamic simulations to information retrieval and decision making. And from automating PC-board production to supporting engineering design of new aircraft. Our terminals are being used for computer-aided signal analysis, for geophysical data reduction, and for geological contouring.

Maybe we are an interactive graphics supermarket!

When you consider its features, it's easy to see the reasons for the wide-spread use and acceptance of the Adage Graphics Terminal. The AGT is a general-purpose CRT display system designed especially for interactive graphics applications. It has a digital display processor, display generation hardware, and a large screen CRT console with a full set of operator controls. An AGT has extensive built-in image manipulation capability, it normally includes magnetic tape or disk storage, and it's always supplied with comprehensive systems software. These result in a terminal with a high degree of autonomy: an AGT can be connected to a central computer system without burdening the response time or arithmetic capabilities of the central system, or it can be used in a stand-alone mode.

Model AGT/10 is designed for efficient handling of two-dimensional displays. Images can be continuously expanded or reduced or moved about on the screen. The AGT/30 is configured to optimize its use in applications involving dynamic display of three-dimensional images, i.e., such images can be rotated, translated, and scaled with picture changes made from frame to frame. The AGT/50 is our super-powered model with a variety of extra display modes. It can generate very complex dynamic pictures containing up to 8,000 line segments. AGT's start at $60,000.

One very nice feature – any model can be upgraded in the field. So, if your problem expands, so does your terminal.

If you're in the market for interactive graphics, shop our supermarket first. Write to our Super Market Manager. Adage, Inc., 1079 Commonwealth Avenue, Boston, Massachusetts 02215, (617) 783-1100.

adage
Computer Graphics

CIRCLE 15 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
Feb. 17-19	Compso Midwest	Chicago	COMPSO/Bernard Lane Computer Expositions, Inc. 37 W. 39th St., New York, N.Y. 10018
Feb. 23-25	Winter General Meeting	New Orleans	DPSA P.O. Box 1333, Stamford, Conn. 06904
Feb. 25-27	Annual EDP Conference	New York City	AMA 135 W. 50th St., New York, N.Y. 10020
March 9-12	Spring Conference	Washington, D.C.	EIA 2001 Eye St., N.W., Washington, D.C. 20006
March 23-25	Info-Expo-70	Washington, D.C.	Info. Indus. Assoc. 1025 15th St., N.W., Washington, D.C. 20005
March 23-26	Int'l Convention & Exhibition	New York City	IEEE 345 E. 47th St., New York, N.Y. 10017
April 8-10	Numerical Control Conference	Boston	NCS/Lawrence Levine Hitchiner Mfg. Co., Inc. Milford, N.H. 03055
April 10-19	Electronics Fair	Tokyo, Japan	Int'l Commerce Bur./ U.S. Commerce Dept. Washington, D.C. 20230
April 14-16	Computer Graphics Int'l Symposium	Uxbridge, England	Brunel Univ./R. D. Parslow Computer Sci. Dept. Uxbridge, Middlesex, Eng.
April 27-30	Nat'l Telemetering Conference	Los Angeles	IEEE/R. D. Rankin c/o WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005
April 28-May 1	Nat'l Microfilm Convention	San Francisco	NMA 250 Prince George St., Annapolis, Md. 21404
May 5-7	Spring Joint Computer Conference	Atlantic City	AFIPS 210 Summit Ave., Montvale, N.J. 07645
May 13-15	Educational Data Systems Convention	Miami Beach	AEDS/Dr. Henry Fox 3525 N.W. 79th St., Miami, Fla. 33128
June 10-12	Computer Simulation Conference	Denver, Colo.	ACM, IEEE/O. P. Hall, Jr. TRW, 1 Space Park, Redondo Beach, Calif. 90278
June 16-18	Computer Group Conference	Washington, D.C.	IEEE/D. E. Doll IBM, 18100 Frederick Pike, Gaithersburg, Md. 20760

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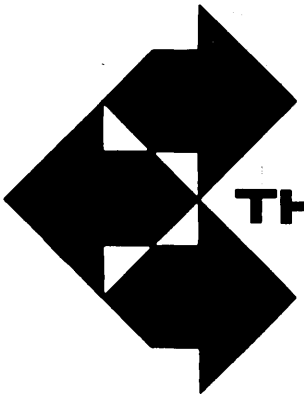
And every one of our computers is available immediately because we buy and sell through our own inventory. So we'll even take your old machine in trade.

One more thing. Support. If you insist, we'll even give you a good deal there.



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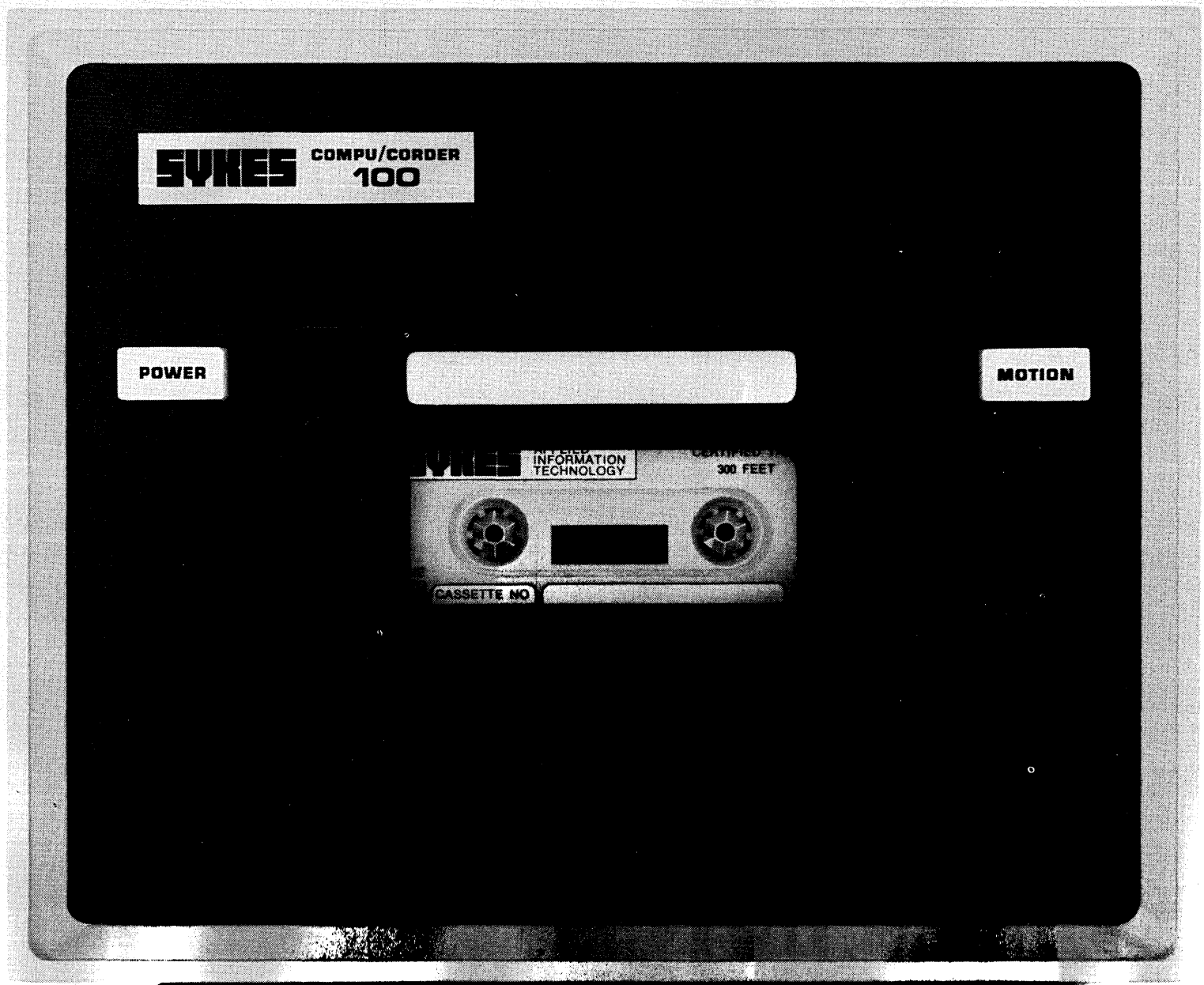
CALIFORNIA	44 MONTGOMERY ST., SAN FRANCISCO, CAL. 94104	415 362 5556

Increase the ins and outs of your mini-computer with a Sykes Direct Access COMPU/CORDER™ System* for less than $3,000.

The Sykes COMPU/CORDER is a high speed, direct access, magnetic tape transport system that behaves like a disc. It represents a new and unique generation of cassette-loaded direct access devices.



TM Trademark *Patent pending

Why is the COMPU/CORDER System Unique?

The system is completely reliable. Its high-speed, direct access and bi-directional capabilities, together with its modern engineering design, complement any mini-computer installation.

Other major features include:

- Bi-Directional access up to 120 inches/second.
- Average direct access time within 100 feet—5 seconds.
- Exclusive tape addressing system.
- Specialized cassette.
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- Software is comprehensive and ready to use.
- Block length truly variable. Limited only by tape length.
- Interfaces available.
- System capacity of up to 8 COMPU/CORDERS
- System data storage 28,800,000 bits.
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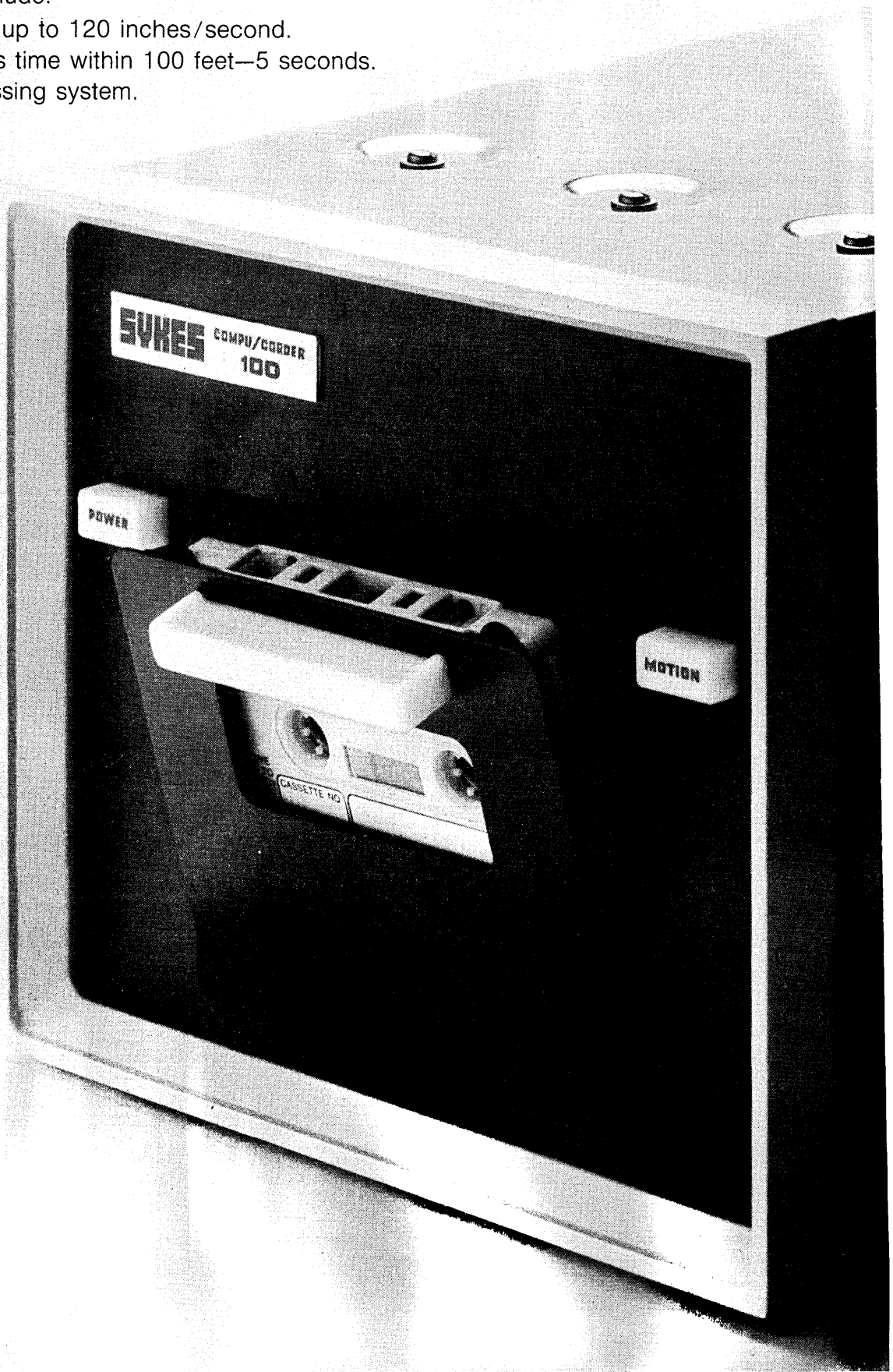
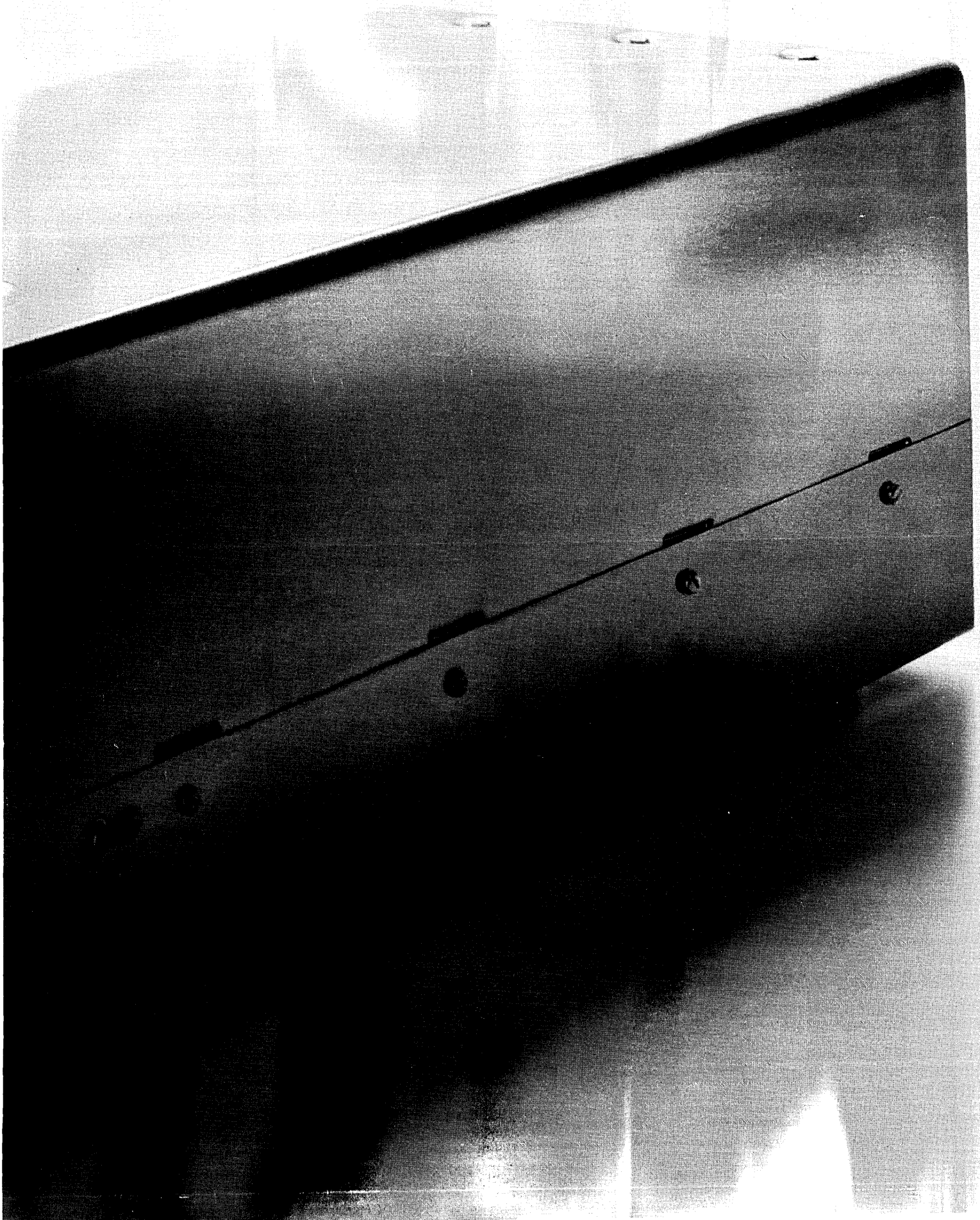
- Initial installation and instruction provided.
- 90 day warranty.
- National customer field service





We think you'll want to know more about COMPU/CORDER. Just fill out the coupon and one of our representatives will be in touch.

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ROCHESTER, NEW YORK 14606

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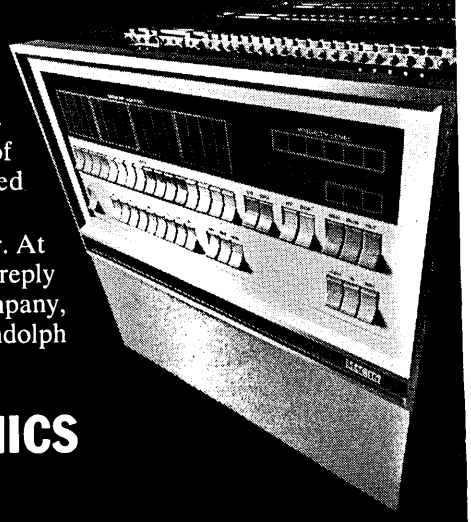
MAC gives you a 2-microsecond add time in a 16-bit, parallel-word computer. And a repertoire of 72 instructions that execute in 4 microseconds or less.

MAC's standard hardware priority-interrupt system responds in 6 microseconds. Which means, with its 1-microsecond access time, MAC delivers speed that really pays off.

Now, add that speed to MAC's standard features: programmed data channel serving up to 255 devices; 4 priority interrupt levels that automatically store/restore the hardware registers on interrupt; and a basic 4K memory. What you've got is a powerhouse in your system.

Expansion? MAC makes that fast and easy with such options as multiply/divide hardware, memory expansion to 64K, memory parity, power fail and restart, remote control panel, automatic bootstrap loader, multiplexed or direct memory access channels, up to 64 levels of priority interrupts, and the most-wanted peripheral devices.

Our speed isn't limited to MAC, either. At the drop of an inquiry, you'll get a fast reply from MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.



LOCKHEED ELECTRONICS
A Division of Lockheed Aircraft Corporation

CIRCLE 34 ON READER CARD

WE'VE BEATEN PAPER ALL TO SHREDS

Especially when it comes to digital data. The new Bell & Howell DIR-6100 Incremental Digital Magnetic Tape Unit can be used to read and write digital information in any system that now employs punched paper tape. The instrument offers several important advantages.

Speed, performance. Data is written incrementally from 0 to 150 steps/second (as opposed to paper's 60 steps/sec) and is read continuously at up to 3000 characters/sec.

Economy, convenience. Magnetic tape can be used hundreds of times, paper only once. The tape is in cartridge form, so you simply change it in seconds without threading or reel loading. Thus, lower operating and maintenance costs. And you pay little more than for a paper-tape system.

Versatility. Up to seven channels of information can be recorded. Read and write functions are selected automatically or by remote control. The unit is also available in read-only or write-only versions. The DIR-6100 is easily interfaced with any digital system.

For all the facts, call our nearest office, or write Bell & Howell, Pasadena, Calif. 91109. Ask for Bulletin Kit 3352-X3

CEC/DATA INSTRUMENTS DIVISION

BELL & HOWELL

Nelson McKinney of
NCI Dallas tells how

"WORK TEN whips the complex"

"Most DP departments are moving into a more complex operational environment. Working with more data elements in more complex forms. Using more kinds of records and files. Combining functions. Going for more sophisticated applications. Creating larger and more involved programs. Using added core storage to do more things. And do them better.

"So we developed WORK TEN, the new computer language that makes it easy for programmers to visualize and code complex multiple file problems. That's because WORK TEN is structured and uses segmented logic to clearly define when each action occurs.

"In addition, your programmer does only the very small creative part of even the most complicated program. He tells WORK TEN what to do and when to do it. WORK TEN then creates the rest of the program automatically on the computer in COBOL. With WORK TEN, programmers use very few statements to code even the most involved tasks quickly and easily.

"This new language effortlessly handles programming elements that are staggering with ordinary languages. For example, WORK TEN automatically determines all conditions to multiply match up to 52 files. Ask your programmers how much time that alone saves. And how much simpler it makes the programming job when they don't have to worry about coding a monster like that.

"Write today for information on WORK TEN. Before you are buried in programming backlog."

NATIONAL COMPUTING INDUSTRIES
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PHOENIX, ARIZONA 85012
TELEPHONE 602: 264-1394

NCI

From the original painting by Neil Boyle

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Business data systems are still being designed and programmed to produce oceans of data, most of it useless to top management executives. We design and implement systems to produce information that management can *use* to improve operations.

We can do this because, in addition to the computer sciences, our professional staff represents more than 40 areas of knowledge: business, economics, the physical, life and behavioral sciences, and most branches of engineering. We probably already have knowledge in your field; but we believe that only by knowing about *your* operation and *your* people can we design a business data system for you.

A brochure, *Computer Systems Design and Implementation,* describes our capability. For a complimentary copy write to Dr. Rue W. Harris, General Manager, Management Data Systems Division.

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How we uncomplicated COM.

We built the 1603 Microfilm Printer. It increases the efficiency of your System/360 with no modifications in hardware or software.

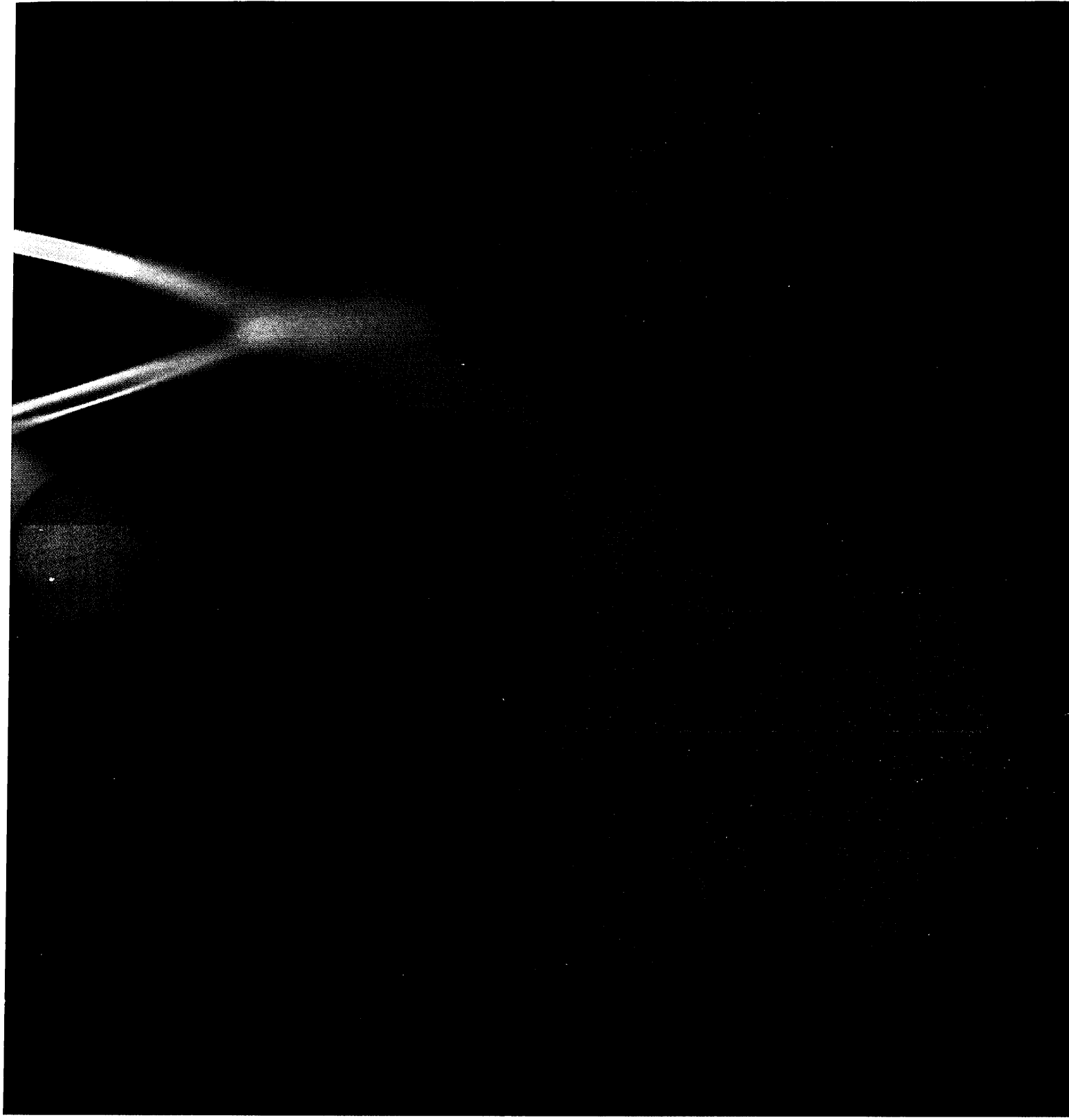
It uses fiber optics. Light pipes, like the three magnified above. They convert digital signals to alphanumerics.

A simple translation matrix, light-emitting diodes, and an array of factory-sealed fiber optics do what it took a lot of complicated things to do before.

The only moving parts are the shutter and film transport. So our 1603 needs no adjusting and very little maintenance.

It operates on-line, prints 132-character lines at 10,000 a minute, and costs less than any other COM device.

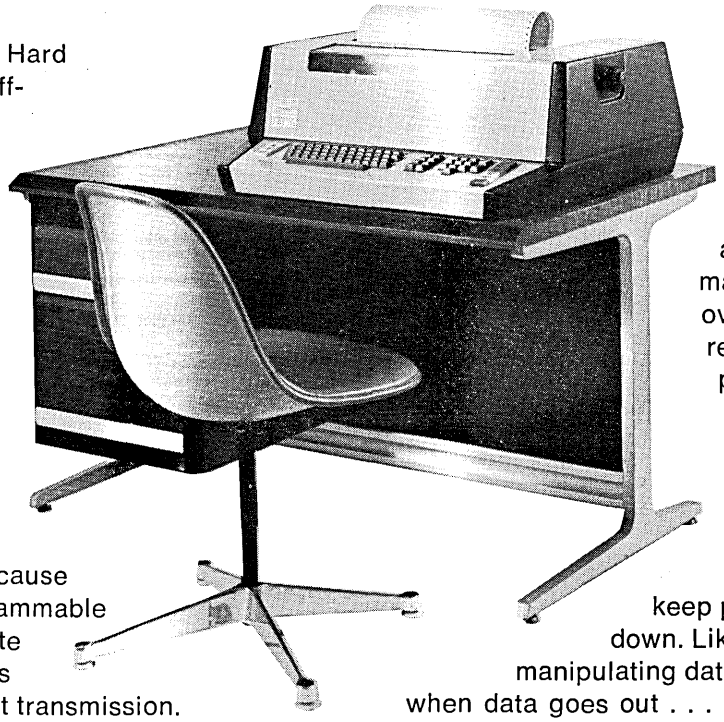
For full technical description, price list, and catalog of supporting equipment and supplies, write: Memorex, Santa Clara, California 95050.



MEMOREX

Tape could be the medium for your message.

It all depends on the data. That's why the Daedalus 711 Programmable Data Terminal lets you communicate in the most economical way possible.



Mag tape cassettes. Hard Copy. On-line and off-line via Ma Bell. These are the ways you can get your message across to any central processor with the Daedalus 711 Programmable Data Terminal. Pick the medium you want when you want it. Which makes sense and makes profit. Because our 711 PDT is programmable you can set-up, update and change programs via mag tape or direct transmission. And you can batch data and transmit it a la cassette and Ma Bell during off-hours. Or, if the data is not timely enough for direct interchange, you could put it on tape and put it in the mail. Another medium? Hard copy documentation, on preprinted forms, of data transmitted and received makes our terminal with full arithmetic and logic capabilities all the more logical for your application. And this is all due to the fact that the Daedalus 711 Programmable Data Terminal is the one and only truly programmable data terminal, with over 45 instructions in its repertoire, an under-11K pricetag, and the ability to do whatever you want to do in a frugal manner. Like changing programs from a central location to keep programming expenses down. Like editing, verifying and manipulating data at the terminal site so when data goes out . . . it stays out. Like interchanging data independently and unmanned off-hours to be even more economical.

Like . . . well, you get the message. And you might like to get more information from: 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.

Daedalus
Computer Products, Inc.

be your own time sharing expert.

It is estimated that there will be over 30,000 time sharing terminals in use by the end of this year. Yours may be one of them. If so, you will be called upon to make objective recommendations involving over 200 companies offering time sharing services. You'll need comprehensive, objective facts. And you'll need them in a hurry.

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AUERBACH Time Sharing Reports now answers your need to know. It puts at arm's reach all the facts you need to be your own time sharing expert. This unprecedented service not only acquaints you with every major aspect of time sharing but keeps you up to date through quarterly supplements. It's a user's guide, reference source, and evaluation tool—all superbly edited and organized in a single two-volume set.

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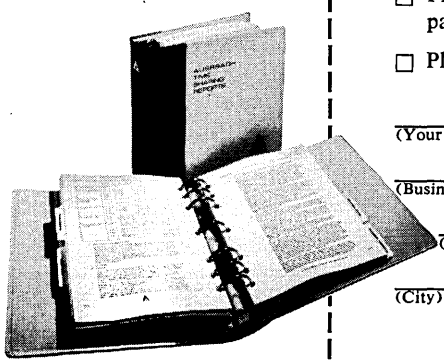
Take the first step toward becoming a time sharing expert. Fill out the coupon and be "in the know" on the fastest growing development in computer technology.



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From Tel-Tech

3 new modems

New design approach yields top performance and reliability... no adjustments required

Tel-Tech has taken some new and very novel approaches to data set design. The result: three Bell compatible modems that are small in size, small in price, and yet absolutely superb in performance and reliability.

The new Tel-Tech modems are maintenance-free. There are no adjustable components. There's no tuning, tweaking. . . even at the factory.

The TT-103, TT-202 and TT-201 are designed to transmit data up to 300, 1800 and 2400 bps. Their compactness makes them ideal for integral terminal installations. And it doesn't take much of a rack to mount a hundred. You can also get desk-top units for stand-alone applications.

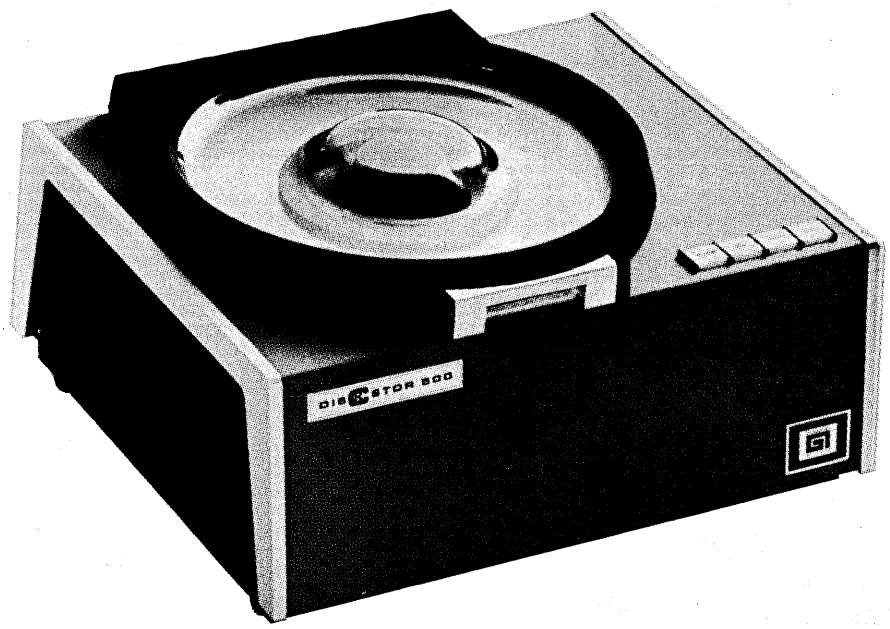
You can depend on these elegantly simple modems. And their simplicity keeps the price low.

For information call or write:

BELL COMPATIBILITY

Tel-Tech modem	Bell modem	Speed
TT-103	*103*	*0-300 bps*
TT-202	*202*	*0-1800 bps*
TT-201	*201*	*2000-2400 bps*

TEL-TECH CORPORATION
TELECOMMUNICATIONS TECHNOLOGY
9170 Brookville Road
Silver Spring, Maryland 20910
Phone: (301) 589-6035



the new DISKSTOR 505 breaks through access time barrier!

Systematics/Magne-Head announces the new **DISKSTOR 505**. . .the first **head-per-track removable media rotating memory system** to overcome the access time limitations of conventional disc pack memories. Memory capacity up to 5 million bits per pack...and, some of the features that are **standard** with **DISKSTOR 505** and "first" in a head-per-track disc pack are: • The first disc pack memory system with 12, 16, and 18 bit data bus interfaces. • The first fast access disc pack memory system designed for small to medium size central processing units.

For complete information, call or write . . . or visit:

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The UCC COPE family of programmable remote terminals offers industry's best cost/benefit ratio. This family includes seven members, allowing you to select the reading/printing combination best suited to your requirements.

You can grow with COPE as your data communication requirements grow. The COPE family can be field upgraded from the low cost COPE .30 series to COPE .41 status. (1250 LPM, 600 CPM). And the top of the COPE line, the .45 (1250 LPM, 1500 CPM), is software compatible with all other COPEs.

COPE terminals feature dial-up flexibility, allowing them to access most large-scale computers in the United States through the standard telephone network by simulating the IBM 2780 and Univac 1004 terminals. COPEs also operate in the full-duplex (concurrent reading and printing) mode over voice-grade telephone lines utilizing 4800 or 9600 bps modems.

Speed, compatibility, flexibility, adaptability — these four words best describe the COPE product line. Need further convincing? Then contact: Marketing Coordinator, Data Communication Systems Division, 2659 Nova Drive, Dallas, Texas 75229, (214) 241-3501.

Terminal Type	Communications Mode		Input/Output Device Speeds (Maximum)	
	Half Duplex	Full Duplex COPE	Reader C.P.M.	Printer L.P.M.
C.30	ATT 201A/B	No	200	240
C.32	No	Yes	200	360
C.34	Option	Yes	300	360
C.36	Option	Yes	300	480
C.38	Option	Yes	600	480
C.41	Option	Yes	600	1,250
C.45	No	Yes	1,500	1,250

UCC

UNIVERSITY COMPUTING COMPANY

DATA COMMUNICATION SYSTEMS DIVISION

2659 Nova Drive / Dallas, Texas 75229

CIRCLE 82 ON READER CARD

Time Share vs.

Remote Batch

It's all the same to us.

Only a software-configurated machine could do it. The IC-7000 is available in whatever shape you want it, when you want it, with optimum characteristics in any configuration because the hardware is designed and built so the shape is in the software. Immediate process-to-completion. Scheduled process-to-completion. Or multiple use through many terminals on-line simultaneously. No wired-in limitations in any mode.

This is a fourth generation interactive computer with a 256K-36 bit word core. It is the first time-sharing computer to handle overhead in an economical manner while number-crunching tasks are slammed through tremendously fast, optimized areas. Each user has up to 64K words available in core and can control access to his files at security levels up to 'inviolate.'

Search your memory with tight or loose addressing. "Get me all **m**'s with an **n** and anything with **x**, **y** or **z**." Dynamic time slicing allows programs of self-modulating queue times to pre-set optimums and you can tie into TTY, CRT, Selectric, Friden, concentrators or even other computers. The IC-7000 handles FORTRAN, COBOL, BASIC and assembly language without degradation in any dialect. And you can mix or match subroutines from different languages within the same program or build your own program language.

If it makes a difference to you, we'd like to send you detailed information and full pricing/leasing schedules. Call Bill Otterson, Vice President of Marketing or any of our sales offices.

Standard Computer

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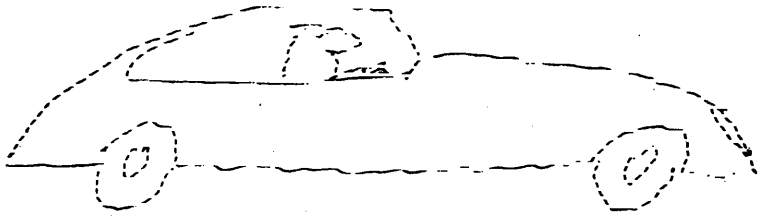
Los Angeles, California 90015
(213) 387-5267

Chicago: (312) 726-0277; Dallas: (214) 239-9627;
Denver: (303) 428-0529; Detroit: (313) 352-1710;
Minneapolis: (612) 926-0706; New York: (212) 661-1834;
Philadelphia: (215) 563-6350; San Jose: (408) 294-7150;
Waltham: (617) 891-5083.

All software for the IC-7000 was developed in conjunction with Call-A-Computer, Inc.



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.

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letters

tribal testimonial

Sir:

I congratulate you on the (news) article "Fairchild Invites Others to Share New Labor Pool" in the October issue (p. 156).

Living and working in New Mexico and Arizona since 1962, I found Navajo people are indeed "idle but eager-to-work" and ". . . known for their skills . . ." They are also very, very poor.

It should be pointed out that nearby are other similarly skilled, and similarly impoverished peoples—Apaches, Hopis, Pueblos, Yaquis, and Zunis. (The list could be extended to fill a page.)

Fairchild is certainly to be commended. Let us hope 1970 proves that this brave beginning builds to a long-range trend. Craftmanship is increasingly scarce in the electronics industry, while Indian Americans are tragically poor. Some solutions to these two pressing problems seem obvious!

DANIEL O'CONNELL
General Electric Company
Phoenix, Arizona

Amuseing

Many thanks for your November Look Ahead item (p. 403) "A Muse for Everyman."

There were a few points in the story, however, that need elaboration so that the reader does not get the wrong impression. To wit:

1. MUSE will ". . . work on any machine . . ."
2. "Most of MUSE's development costs have been borne by Tymshare . . ."
3. "But Potts expects large companies with dedicated t-s systems to be the primary market, rather than t-s vendors, who maybe can't afford its high-cost mass storage requirements."

MUSE has been developed on the XDS 940 and will be converted to a number of other t-s machines, but obviously not all machines of all manufacturers.

Most of MUSE's development costs have been borne by a private financing through Ingalls & Snyder, a NYSE member firm. Tymshare, Inc., has underwritten the machine time necessary to develop MUSE and, in return, will receive MUSE to offer access of *public* data bases to their customers.

The provision for access of private data is another matter. It is quite true that Mr. Potts expects large companies with their own t-s systems to be MUSE's primary market. Nevertheless, this does not preclude remote "turnkey" operations in which a small number of corporate clients might purchase segments of a t-s capability as a precursor to their own in-house installation.

Regarding MUSE's mass storage requirements, I would like to make it clear that "affordability" in this case refers to the actual data residing on disc and not the overhead of the system code itself. The interpretation, then, should be that t-s vendors will find MUSE to be economical with large public data bases, where they can "share" direct access storage among many users in the same manner that they now share the cpu. If they want to provide equivalent private data access, however, their traditional ways of doing business may have to be modified.

HAROLD C. KURFEHS
Meta-Language Products, Inc.
New York, New York

don't be jumpy

Sir:

In spite of your planned conversion to twice a month publishing, I am afraid that DATAMATION will keep getting bigger and bigger. In fact, a newspa-

---

bet your wife

Sir:

I was quite surprised to read Mr. Gohn's article "Money Management—Vegas Style" in the November issue (p. 178). Computer simulation of Mike Goodman's 21 strategy was the subject of my Master's thesis at the University of Utah last year.

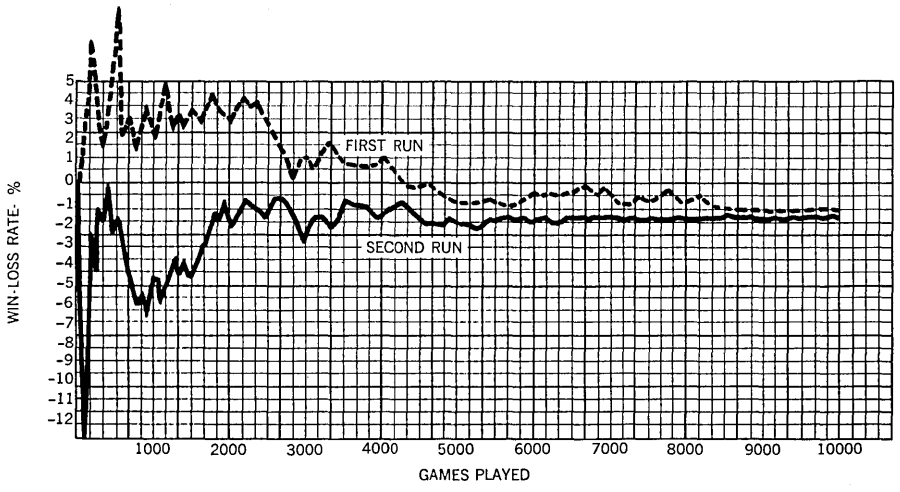
The simulation program was written in RUSH, a language developed by Allen-Babcock Computing for their time-sharing system. Rather than wade through a complicated mathematical analysis of the game or assume a win-loss rate as Mr. Gohn did, I decided on complete simulation of the game as it is played using Goodman's hit-stand rules and betting progression. Essentially, the program consists of a random number generator, a set of decision rules for the dealer, and a set of decision rules for the player. Counters were maintained which gave cumulative totals of (1) games won, lost, and tied, (2) amount the player is "up" or "down" and (3) the ratio of the up or down total to the total of bets placed (money risked).

The basic approach was to plot the win-loss rate which was printed out after every 50 games. I hypothesized that there would be extreme variations in the rate for the first several hundred games with a gradual flattening of the graph to the actual rate. Furthermore, two or more graphs based on different random number "seeds" should converge to the same rate.

The results of two series of 10,000 games each are shown in the attached graph. The actual win-loss rate is shown to be in the range -1.5% to -2.0%. Thus, the player would lose between $1.50 to $2.00 for each $100 he bets in the long run! However, an analysis of the results showed that without progressive betting, the loss rate would have been 3%. Whether this figure is valid depends, of course, on statistical considerations not thoroughly explored in the thesis. Intuitively, I feel that progressive betting has no effect on the eventual outcome.

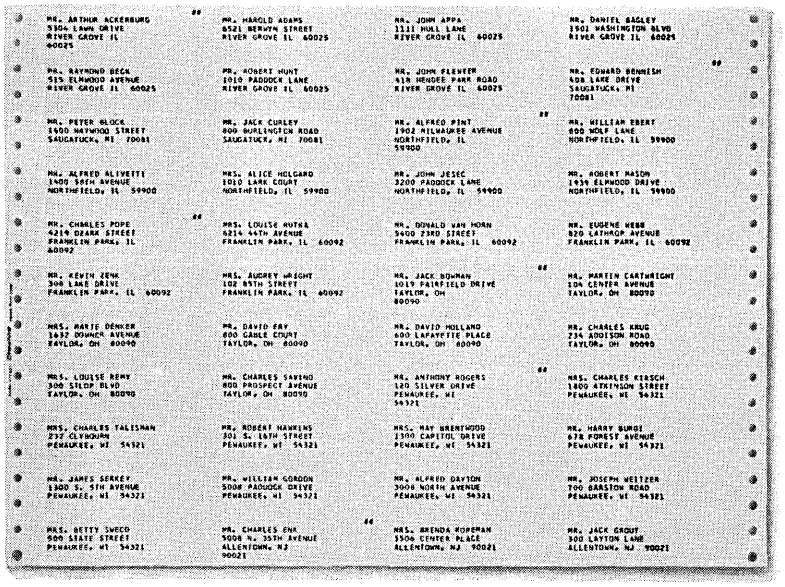
The computer has proved again that a 21 system which does not involve counting cards is a failure. How then, can my wife still be ahead with a 3% win rate after several thousand Las Vegas 21 games using Goodman's system?

DURWARD P. JACKSON
Denver, Colorado



If your accounts receivable are in your computer...

so are your mailing labels.



It's true. You can generate not only the key names of your mailing list but the actual labels themselves. In only a few minutes.

And you may not realize how easy it is. Or how ready-made an audience you have. Your key prospects are the people who already know something about your products and services. Now you can selectively direct your messages to them with our system.

Program your computer to print out only their names and addresses on our label paper. Put the names in one of our Cheshire Distributors and they will be cut and applied to your mailers. Precisely. Neatly. Quickly.

In fact, our Mod III Distributor can label, stack and sort anything from postcard size up to a 13″ x 13″ piece ½-inch thick. It's great for internal distribution involving many departments or bulk ZIP code mailing.

Quiet, simple and space saving, a Cheshire Distributor only needs a part-time operator. You can rent or buy, to fit your needs. It's a small price to pay to make your computer more effective.

If fast and accurate labeling of computer-generated addresses makes sense to you, contact us. We'll help you get it out of your system.

For more information write Cheshire Incorporated, Dept. 10, 408 Washington Blvd., Mundelein, Illinois 60060. Or call 312-566-7880.

XEROX

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CIRCLE 232 ON READER CARD

per story as shown below, appearing some time in the 1970's, appears unavoidable.

SUICIDE MYSTERY SOLVED

The mystery of high suicide rates for computer personnel was solved today by two Stanford sociologists. Professors Prenderfram and Smarb were the first to notice the high suicide rate of computer people, and in a recent study reported in the Journal of Sociology they proved that the peaks occurred on a biweekly cycle. Today they announced the final breakthrough in the mystery, and their detailed findings will be reported shortly.

Briefly, they blame the situation on a magazine called DATAMATION, a trade journal for the computer field. Prenderfram and Smarb claim that recent issues of the magazine, running from three to four thousand pages, have caused extreme anxiety syndromes in unfortunate recipients of the magazine. They indicate that their first hint of this situation was obtained from a despondent programmer who survived a leap from the Golden Gate Bridge. "I tried to read it all the way through," this poor soul mumbled for several weeks after being plucked from San Francisco Bay, thus providing the basic hint that Prenderfram and Smarb needed.

Eighty percent of the suicide victims were found to be subscribers to the magazine. The publishers of the magazine refused comment on the study, pending consultation with their attorneys.

OSCAR FIRSCHEIN
Menlo Park, California

programmers and analysts

Sir:

Peter A. Theimer in his letter in the November issue presents as his tenet the view that "the programmer is generally machine-oriented and . . . the systems analyst on the other hand, is people-oriented." Mr. Theimer takes exception with the view of Mr. John T. Dwyer who states that ". . . the only difference between a programmer and a systems analyst is that the latter doesn't write a code."

Much to my dismay I must agree with Mr. Dwyer, but only in the context of the majority of currently trained and oriented systems analysts.

What Mr. Theimer states, even in the general sense, is not the case but the ideal. The vast majority of currently practicing systems analysts are programmers who have taken one branch of a career path array. By training and inclination they are unable to, have no desire to and cannot even recognize the human subsystem problems inherent in man-machine.

I take no exception with Mr. Dwyer's statement, insofar as it portrays an existing condition. The real harm however, can arise when the belief is prevalent that this relationship is desirable.

It would be remiss on my part to criticize without holding out a possible solution. Although no recognizable technology for handling the problem exists today, there is a large body of knowledge growing out of twenty years of relevant research into human factors (undertaken largely for the Department of Defense) and motivational theory (conducted on university campuses and certain large business organizations). Thus, the problem is not to invent a technology, but to pull one together from pieces which are already available.

GENE ALTSHULER
The Chase Manhattan Bank
New York City

analysts couched

Sir:

I am getting a bit tired of all this talk about the difference between programmers and systems analysts. Much of the confusion and controversy is undoubtedly caused by the fact that there are two mutually exclusive sets of systems analysts:

1. Programmers who make too much money to be called programmers, and are therefore called systems analysts to keep the personnel department happy;

2. Nonprogrammers who qualify as systems analysts by virtue of the following definition published in about 1960 (source unknown): "A systems analyst is anyone who can define systems analysis." This definition correctly implies that the phrase "systems analysis" is meaningless and consequently this type of systems analyst doesn't know what he is talking about.

As a member of group one I have long known that the data processing world is dominated by members of group two.

JOHN T. DWYER
San Jose, California

pay up

Sir:

In "Installation of a Giro Payment System in the United States," (Nov. p. 195) Mr. George C. White confuses the benefits of mechanization with features of the system he proposes, while ignoring its limitations. Ignoring the mechanics temporarily, the present system for payment *of a credit purchase* requires paper to be sent from seller to buyer, back to seller, then to seller's bank, buyer's bank, and finally back to buyer. The Giro system of payment (only credit purchases are possible) requires paper to be sent from seller to buyer to buyer's bank, to seller's bank, and finally back to seller. (If buyer and seller use the same bank, both systems eliminate one step.) It is thus seen that the Giro system is one step shorter, and thus, apparently, superior. But what is the cost of this superiority?

In the present system, direct purchase is also possible, and in fact is widespread (perhaps even dominant for consumers). In this mode, the buyer presents his check (or, occasionally, cash) to the seller at the time of purchase. The check is then handled in the conventional manner. The interchangeability of check and cash is necessary and sufficient for this type of transaction. There is, of course, no Giro analog. Thus, at best, the Giro system cannot replace the present system, but can only complement it.

Mr. White claims the virtues of mechanization for the Giro system. An examination of those virtues shows that they apply more directly to the present system. According to Mr. White, "The key to the whole system is the standardized invoice or statement." Obviously, in the Giro system, the "return portion" must conform to the reader requirements of all the banks (and users) who must operate with it. In the current system, however, a return card need only be compatible with the seller's equipment to facilitate automatic accounts-receivable update. If, in addition, it is readable by the buyer's equipment, then automatic payment by the buyer is possible. Standardization would ensure this, but is, for this system, optional. The "extra" paper handling provides both the buyer and seller with records of the transaction, and the requirement for (and dependence upon) a machine-readable listing from the bank is obviated. Moreover, the return form is only handled by the buyer and seller, eliminating half the chance for damage. The actual check is separate from the seller's return form, and need only be readable by the bank's equipment. In a totally automated system, the buyer could, of course, encode the amount on the check in MICR, enabling no-hands processing of the check from initiation to final return to the buyer. In all cases, the benefits obtained through mechanization (or automation) are virtually independent of the system on which it is used (i.e., Giro or debit transfer). The separation of return form and

(Continued on page 248)

The new Raytheon Computer 704 has big ideas for an under-$10,000 machine.

Ideas like real-time executives and monitors, mag tape Sort/Merge, conversational FORTRAN in 4k...

The new Raytheon 704 is a 16-bit general-purpose computer with 4k of 1.5μs core, direct I/O to the CPU, 4 addressable registers and 74 instructions. A small machine. But bigger than life when it comes to doing a job.

It's big in software. Over 300 programs and subroutines available off-the-shelf. Software that most small computers don't even offer. All tested, debugged and proven.

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 704 is just as big in hardware. With options like hardware multiply /divide, bootstrap, direct memory access 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.

Now doesn't that give you some ideas? Just ask for the Raytheon 704. Under $10,000.

Raytheon Computer, 2700 South Fairview, Santa Ana, California 92704, Telephone (714) 546-7160.

RAYTHEON

CIRCLE 40 ON READER CARD

If you've been wanting someone to build a low-cost digital tape drive with Hewlett-Packard quality, HP just did.

We've taken the OEM experience we've gained from putting almost 4000 digital tape systems in the field. Added what you've told us you'd like to see in a low-cost tape drive for small computers and off-line applications. And produced the HP 7970.

It has all the features you're looking for in a digital transport: IBM and ASCII compatibility, 25 ips speed without program restrictions, DTL/TTL compatible interface. Seven or nine track capability with simple field conversion. Standard 10½ inch reels. Plus handsome appearance, fingertip push-button controls, backlit indicators for quick operational status checks, dual gap head for read-after-write error checking capability.

It also has HP's exclusive trouble-free design and rugged construction, with cast aluminum frame, automatically milled to precise reference planes. The tape transport components are mounted to this frame on precisely indexed bosses to assure that tape path tolerances are routine. The HP 7970 also has electronic deskewing, direct drive motors, single capstan, and dynamic braking that eliminates mechanical adjustments. Plus the back-up capability of 141 Hewlett-Packard sales and service offices around the world.

So if you want a low cost digital tape drive with HP quality, call your Hewlett-Packard field engineer for more information on our new 7970. Or write Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT hp PACKARD

MAGNETIC RECORDERS

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CIRCLE 171 ON READER CARD

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DatagraphiX systems save a fortune in machine rentals, staff time, computer time, print time, 87% less paper/carbon consumables, 99% less storage. Compared to impact printing, DatagraphiX output is roughly 27 times faster, takes 1/18th the computer time, cuts 7/8ths of your supplies cost. If you do multi-part printing in any volume, your paper consumption alone can run into 6 figures. One user switched to DatagraphiX Micromation after discovering the purchase price of his paper had exceeded $300,000 for one year.

Micromation also provides multiple economies in retention and retrieval. Translating computed data into report formats and shrinking storage requirements to 1/525th. Offering access to thousands of facts within a matter of seconds from screen display inquiry stations. Instant replay of the facts in time to effect better decisions, improved profits. Hard copies on demand.

For high volume production printing, paper copies can be produced from data film at 5,200 pages per hour. That means you could turn out 20,000 bank statements in a lunch hour. Or thousands of direct mail pieces on preprinted, multi-color forms.

Only one company offers the complete family of machine systems; service centers; Kalvar dry film processing; all associated supplies; systems and software support; worldwide maintenance. Discover what Micromation can do for you. Contact our local office or National Sales Manager, James P. Whitfield.

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CIRCLE 80 ON READER CARD

Look Ahead

BURROUGHS TOTAL INFORMATION SYSTEM...

A REALISTIC APPROACH

■Burroughs offers a Total Information System you can install now and grow with on a realistic schedule. Realistic because you set the schedule yourself.

This is a modular system, so you can start with standard applications. Next, go to work building your central information file, using Burroughs exclusive disk file software. From there you can develop management information programs to make your operations analysis and planning fast, flexible, and effective.

Burroughs Total Information System lets you set your own priorities and grow at your own pace. You add processing power, memory size, or communications ability whenever you need it, and without reprograming.

Burroughs unique combination of TIS software, head-per-track disk files, and multiprograming '500' Series computers provides a realistic approach to advanced data processing for almost any business or bank. For more information, call your Burroughs office or write Burroughs Corporation, Detroit 48232.

Burroughs

look ahead

WHITHER IBM

Having repeatedly "announced" IBM's New Series Specs, we now hear those systems may never see daylight. The reason, say IBM watchers, is B. O. Evans, new head of Systems Development Div. The tough 19-year IBM vet is reportedly studying this question: Should IBM announce NS soon and impact its 360 installations, many of which are now becoming profitable, or should it simply fill gaps in the current 360 line and aim efforts at a more advanced "4.5" generation further down the road? Some think he'll opt for the latter.

In the meantime, Evans is supposed to be tearing up SDD. He formerly presided over the old Data Systems Div. (large system engineering), then moved to the "difficult" Federal Systems Div, hiking its revenues from $100-plus million to $500 million and developing a profitable commercial contract services group. (Most of this was moved to contract services in the Data Processing Group last July.)

USERS FEELING USED AS UNBUNDLING BEGINS

Only 25% of IBM's users are said to have signed IBM's SE agreement. If true, it doesn't seem to bother IBM, which, sources say, has met 2/3 (over $20 million) of its SE contract goal for Jan. 1. The remaining 1/3 will probably come from nonsigners taking advantage of an IBM clause that allows SE help for emergencies, or if an agreement is in the works. GM has worked out a standard purchase order that "does not imply acceptance" of the IBM agreement.

Those who have signed, mostly small and medium-scale users, have lots of reasons, including personnel shortage, ignorance of needs, and fear. All three may be involved in a fed operation that needs a $3K/month SE for its $65K system because the bureaucracy won't hire in-house personnel.

A confident big user is Ford, which has signed all agreements, plans to let SE contracts to open bid by midyear, has set up in-house education and ceilings on service use, and won't authorize payment for any hardware or software that isn't working, no matter what the contracts say.

The nonsigners of SE, FE, and Program Product contracts have various reasons. Some, like Westinghouse, are in violent disagreement with their provisions, i.e., no software warranty, no fixed-price SE contract, blurry definitions of for-fee software maintenance, limitation of IBM liability, etc. Others have decided they don't need IBM, or consider the prices abusive, or have been assured by their salesmen (erroneously, according to strict IBM policy) that they'll get SE help from personnel titled "salesmen."

Here are some general reactions from some users to date:

--they're all mad at IBM, but not to the point of switching to other makers;

--they'll try to develop in-house capabilities, steer clear of expensive (exorbitant?) SE help;

(Continued on page 55)

RAMPS revamped for 3rd generation equipment

C-E-I-R's RESOURCE ALLOCATION AND MULTI-PROJECT SCHEDULING SYSTEM (RAMPS) capabilities have been significantly increased by utilization of third generation equipment.

New hardware developments have resulted in a faster, more versatile program. In addition, C-E-I-R has implemented important changes, evolving out of six years of testing in practical problem solving situations.

RAMPS is an automated system which government and industry can use to manage their scarce resources in an environment of concurrent project demands.

As a management tool, RAMPS helps to decide when and where men, machines, materials, and money should be assigned, and how much of each will be required.

RAMPS helps to meet deadlines and to cut costs by comprehensive planning and scheduling.

RAMPS, which uses the critical path scheduling concept of the earlier and simpler PERT, goes far beyond PERT, by extending and supplementing it and by allowing competition for scarce resources among project activities. It can simultaneously handle the many activities, many resources and many cost decisions. RAMPS has proven itself in many government, business and industry applications.

Furthermore, the RAMPS system handles the more realistic situations where multiple projects require the use of the same limited resources. RAMPS can manage your "resources," whatever they are:

- Manpower of all skills,
- Equipment of all skills,
- Facilities such as warehouses or office space.

RAMPS is for sale, tailored to your computer.

RAMPS is for rental under the expert guidance of C-E-I-R professionals.

Is RAMPS right for you?

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Phone: (301) 652-2268

C·E·I·R Professional Services Division
CONTROL DATA CORPORATION

--some, seeking savings, are looking hard, for the first time, at IBM-compatible peripherals;
--one big user says the big IBM stuff is safe (CDC, the other major competitor, is out of sight on prices), but mod 30's could give way to RCA units;
--smart users may slicker IBM into free SE services by soliciting proposals for upgrading or improving an installation from the competition;
--estimates of price hikes range from 2-3% to 20%;
--users aren't really ready for unbundling.

BIG MONEY, NEW IDEAS FOR IMAGE STORAGE AND RETRIEVAL

Transamerica Corp., dollar-laden mother company of an empire that includes such winners as Occidental Insurance, has decided to bet a bundle on a new digital image storage and retrieval system to be called Trans-A-File. Briefly, it suits the same kind of applications as the Ampex Videofile but offers the advantages of digital techniques--such as image reproduction without degeneration, sorting facilities, a big variety of input/output media, and voice-grade line communications.

Comparisons with the Videofile come to mind, too, because the new company being set up for the project--Transamerica Systems Corp.--has cagily hired the ex-manager of marketing for that product, Harry Mason, as director of marketing.

Main components of the system are a controlling minicomputer, high density tape units (about 400K bits/inch), and filing, display, and printer units that can be located remotely. Designer Lee Siwecki notes that no new technology is involved--only a new arrangement of proven components. The magnetic tape units, for example, although ahead of commercial computer standards, have been in use for military and aerospace applications for several years. And the very high density allows storage of an 8½ x 11" document on .84" of tape. Input can be various-sized documents, roll film, microfiche, magnetic or punched tape, direct computer interface, or communication lines. Once in, the digitized images can be updated and shuffled around; multiple simultaneous searching is available and up to 18 tape units can be hung on one controller. Output is the same assortment, plus crt display.

Mason plans to offer six-month delivery and to build a marketing and support group of about 100 within a year. Prices will start at $100K--about one-third the tab for a basic Videofile.

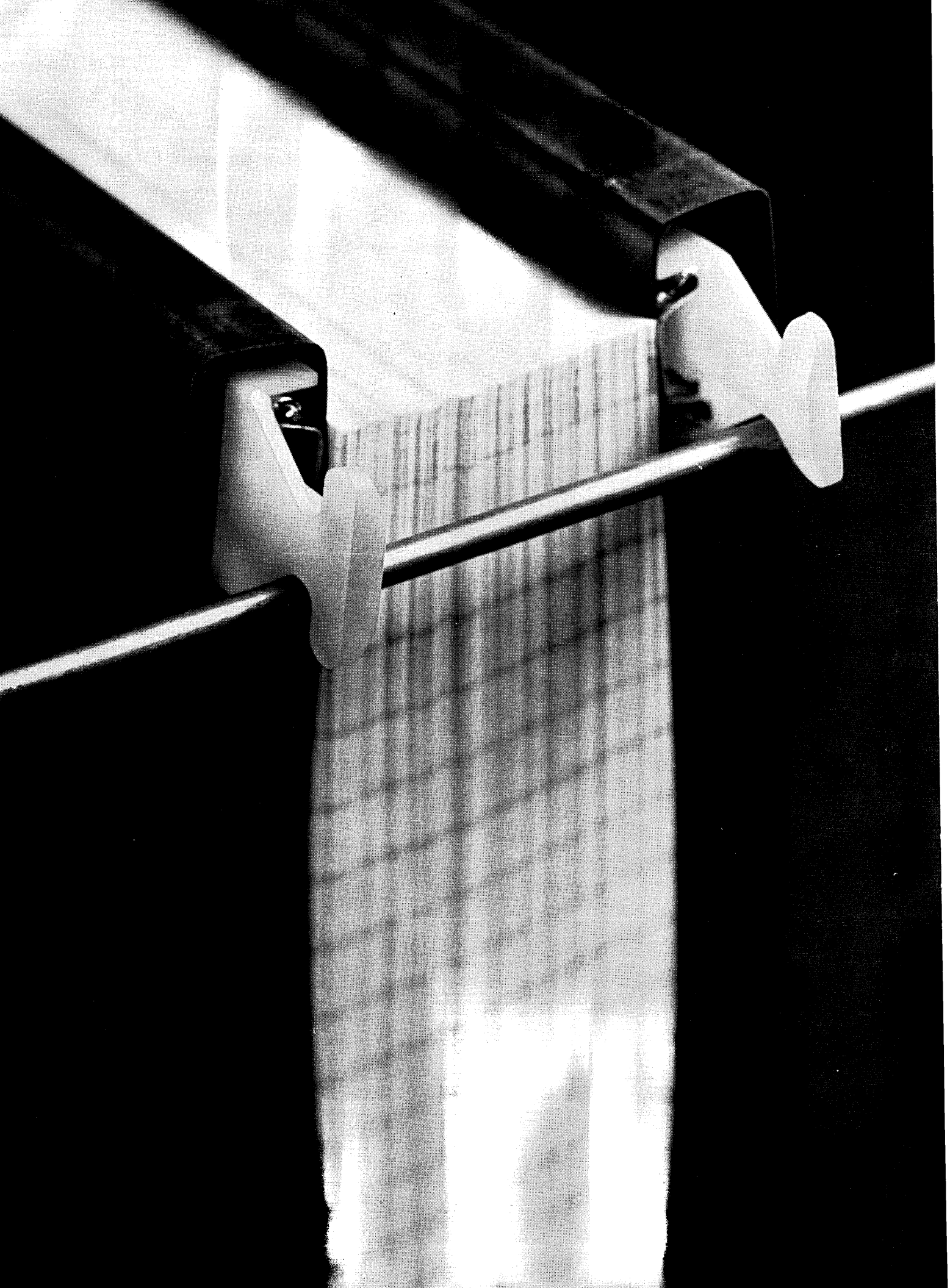
RESERVATIONS SYSTEM MEETS WITH SAME

Late in 1965, United wowed us with plans for a $39-million Univac system ($56 million total) to go on the air February '68. Soon after, TWA proclaimed, more or less, "I choose two Burroughs D-830's, nonstandard types, for a $25 million contract." And that was to be operational by at least mid-68. And almost four years ago, American Airlines took possession of two IBM 360/65's, planned replacements for SABRE, to go it under OS/360.

Well, these and a few smaller counterparts haven't made it yet, and those old pioneering Bunker Ramo systems still bring in the rent wherever they are.

Univac and United admit to being "too optimistic." The lateness of the EXEC 8 operating system, extensive United modifications to it and the related programming efforts, too little R&D time, the combined but incompatible efforts to both stabilize and enhance the system, and the sharply increasing volume requirements --all these problems have stymied the program for over three years. A United spokesman says they are now

(Continued on page 229)



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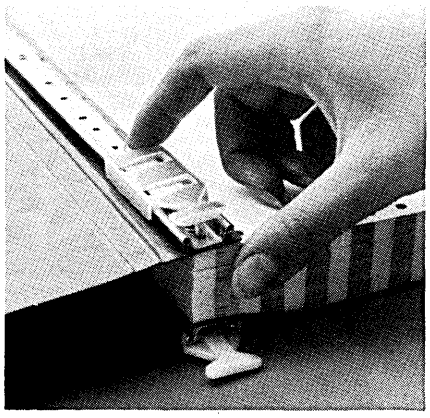

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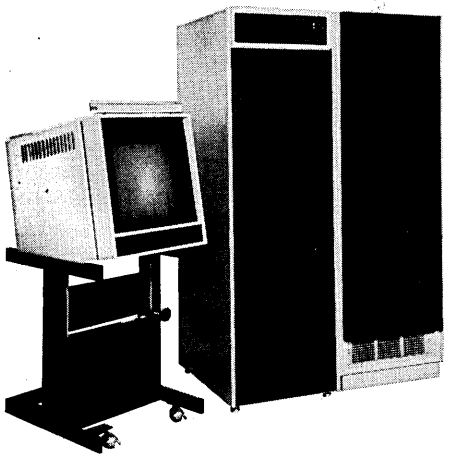

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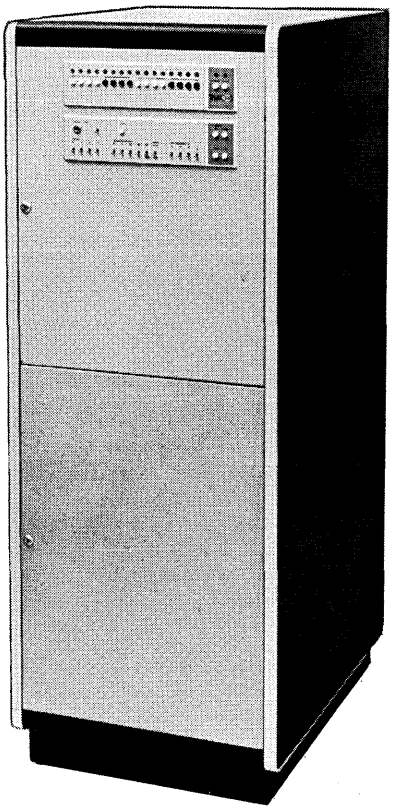

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editor's readout

The Changing Market

Not much happened during 1969 to change the order—whatever it is—of the major firms competing for maybe 25% of the market available after IBM takes its cut. Of course, it's a little like the spread between second and tenth in the major league baseball race: it really doesn't make all that much difference.

We even got the feeling during the year that many of the Big Nine are resigning themselves to the second division, and we know a couple of them who lost key executives who left because they felt their teams weren't aggressive enough. As the pie gets bigger, of course, it's easier to settle for a small percentage of the market . . . especially if you're part of a giant corporation which just might be getting tired of waiting for you to turn the corner.

It's possible, though, that the unbundling decision might just change the ground rules for cutting up the pie. Up until now, the game has been pretty much one of mumbletypeg between the nine primary manufacturers . . . although leasing makes a brief and spirited bid to move in.

Candidates to crowd into the game include software (and software packages), independent peripherals, education and facilities management.

But '69 was not a good year for software package firms. One nearly folded but was rescued by another package outfit. Another package marketing gang went to the brink and got acquired by a more general software firm, which is now bailing out. Nearly all of the software package marketing firms are in trouble. One software package marketing veteran sizes it up this way: "Only one company —or at the outside three—has made money on packages. And the number one package in sales has made only a 2% market penetration. Which means that everybody in the package business is crazy, that the business is about to explode . . . or both."

Generalized software firms fared a little better in '69, which saw an intensification of the shakeout that began a year or two ago. Following the example of fellow software pioneers Bill Wolf and Dr. Herbert W. Robinson, Dr. Cuthbert Hurd appears to be offering to sell the venerable CUC.

The big software firms that have managed to hold on and somewhat prosper are those that have diversified—into service bureaus, packages, dedicated services, leasing, insurance, you name it.

The reasons for this melting quality of the software business are many. For one thing, contract programming is just not very profitable, thanks to high salaries and turnover, cut-throat (and cut-price) competition, and the increasing sophistication and cynicism of users who have been burned twice too often. Parkinson's Law has its effect too: the more programmers there are to manage the more difficult—and expensive—it gets to *try* to manage them.

The tight money situation hasn't helped. Nor has the natural extension of Bauer's Law. (Informatics President Walter F. Bauer's "law" says, in effect, that programming talent tends to gravitate to independent software companies.) What might be called Bauer's Second Law has seen that talent gravitating to

(continued on page 64)

their own software companies in the past year or three. Some will survive.

For independent peripheral makers, '69 was the year of the Big Hope, as the federal government finally took some steps to encourage the specification of mixed systems. And leasing companies began buying IBM-compatible peripherals in big lots from the independents. One of them sold 1,000 key-tape units to a leasing outfit, then spun off the tape deck of that unit as a low-cost device, thanks to the fact that his first tape drive was really his 1001st.

Among peripherals, key-tape/disc showed the biggest flood of new companies and new units, some of which will undoubtedly survive. (The biggest gamble—and question mark—is Viatron, which used a breathlessly big budget to advertise a picture of a product just now getting to market.) Rotating memories continued big.

It was a shaky year for education specialists, thanks to a flood of seminars available in every major city—enough to keep a dp staff busy doing nothing but keeping up with the latest buzz words. But '70 may be different, if enough users begin to realistically assess their training needs, now that IBM won't give it away. But we have a hunch that users will not clearly identify training needs and costs; those who do see an education need will mostly try it themselves with predictably disastrous results. Look for education to come on stronger in '71.

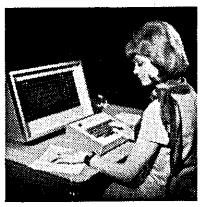
The big threat—or promise—to move into the game is facilities management, the game Ross Perot has parlayed into a profitable and swiftly growing business at Electronic Data Systems. Perot and his crew of clean-cut salesmen move into the edp center through the front door and the corporate suite. Other large non-computer companies are taking the opposite approach: they float off their edp activities into one big edp service, which then takes on all of the corporate data processing before venturing outside in search of other business. Look for lots more of this in the coming year.

This year saw the beginning of the shakeout in (conversational) time-sharing companies, which face lean times in '70. Price cutting, tight money, lack of men and money to develop strong proprietary service lines make most t-s companies indistinguishable . . . and restrict the market. Plenty of people think that remote batch is the way of the future for t-s; it's certainly a smarter short-term bet than the computer utility, which requires immense investments in machines and software for a market that isn't ready for the services if they did exist.

The minicomputer industry has not begun its shakeout yet, but the ability to either mass produce and meet big backlogs or pinpoint specific markets could be major criteria for survival. A much-advertised, but extreme, example in that area could be Viatron again.

Our prediction: the first six months of '70 will see skinny pickings pretty well across the industry, with software and time-sharing continuing to stagger. Software packages aren't going to snap out of it overnight, either. Unbundling is here . . . but the user isn't ready for it. Pity.

—RBF





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ARCHITECTURAL QUESTIONS OF THE SEVENTIES

by Lowell D. Amdahl

Goodbye, 60's. Hello '70's. It has been an interesting and roaring decade. The third-generation infant has toddled, walked and now runs, largely unbundled. Can another generation be far behind?

As we enter this new decade it seems appropriate to reflect on some of the fundamental questions of computer system architecture. Final answers aren't claimed for the questions that are set forth, but some personal viewpoints are injected.

what will be the motive force for the transition to the fourth generation?

It is worthwhile to examine this question against the backdrop of earlier transitions. The first one is easy, and probably universally accepted: the transition from first to second generation was motivated by a hardware technology improvement—transistors replacing vacuum tubes. Other things went along with this transition, like higher level languages and fully buffered I/O channels. But dumping the vacuum tube was undoubtedly the key factor.

To digress for a moment, is it possible that there was a zero*th* generation in the late 40's and early 50's that we have failed to classify properly? A generation with "funny memories" like quartz, mercury, wires and CRT phosphor that was eclipsed by magnetic cores? If so, this would have been another example of a change induced by component technology.

Now to the second-to-third-generation transition. I suspect that individual opinions here will be much more varied. It seems to me that the timing of this transition inescapably coincides with IBM's announcement of System/360. And it seems to me to follow that the key motive force was simply the amalgamation of business and scientific computer products in an upward/downward compatible line. To be sure, there were interesting corollaries to this: operating systems, general registers, microprogramming, multiplexed I/O channels and a step toward integrated circuits. If the above conclusion is warranted, however, it still does not imply that manufacturers who have chosen to maintain a distinction between business and scientific computer systems are not in the third generation—indeed they are.

What about the third-to-fourth-generation transition? It must be raw speculation at this time—it isn't here yet and we may not even recognize it when it arrives. A number of possibilities have been suggested. For example, large scale integration (LSI) for both memory and logic circuits is a popular technology candidate. Architectural concepts of firmware, cache memories (high speed buffer memories), and processor arrays are possibilities. As the motive force, however, I would like to suggest the design—hardware and software from the ground up—of the computer utility system. (By computer utility is meant the computer system that is designed principally for remote users, either for interactive use or for terminal-oriented batch processing. In the main, this will be considered equivalent to time-sharing, but carrying a much stronger connotation of dependability and broad-spectrum usage.) Time-sharing is not new, of course. But there is a surprising amount of time-sharing still being performed on second-generation machines. The rea-

Mr. Amdahl is president of Compata, Inc., Tarzana, Calif., consultants in digital systems, logic design, and applications programming, and is a technical adviser for Datamation. He has a B.S. in engineering and physics from South Dakota State and an MS in physics from Kansas University.

son for this paradox is that, to a great extent, time-sharing was invented and designed by computer users, not by computer manufacturers.

There is some evidence that computer manufacturers have now developed a full appreciation for time-sharing and the computer utility, and have come to believe that as much as half of their equipment sales in 1975 will be destined for this use. The attractiveness of this market will undoubtedly focus creative design efforts on the hardware and software deficiencies of present time-sharing systems, and should produce sound designs for future terminal-oriented systems.

should major processing facilities and file storage be centralized or decentralized?

This is a key question, particularly for the large user with geographically distributed operating entities. There must, of course, be decentralization of terminals for job entry, job output and interactive query/response. But should local systems be engaged in any large way in file storage and data processing?

On the one hand, economy of scale for processors and file devices tends to favor centralization. A strong system programming capability also favors centralization. On the other hand, there is typically a pronounced desire for local processing capability. The local manager has better control of priorities in a decentralized system, has greater confidence in file protection procedures, and feels less susceptible to central system crashes and data communication failures. Undoubtedly, there are notions of prestige that also enter into his thinking.

The effectiveness of centralization will depend on characteristics such as data rates, commonality of files, frequency of file access, language standardization, and—most importantly—reliability of transmission. Centralization of files and processing capability does not preclude reasonable local capabilities for preprocessing and off-line functions. The effectiveness of a given system can be expected to be strongly flavored by the degree of corporate decentralization that is involved.

All things considered, there would seem to be a developing tendency toward centralization for the large corporate user, with remote batch terminals coming into extensive use. This permits centralization of files to avoid replication (and, especially, imprecise replication) at several local sites. It also provides a central system with an extensive operating system and a greater availability of support software.

For computer utilities catering to large numbers of users, it is likely that a more decentralized form of computer network will develop.

are multiprocessor configurations the wave of the future?

Systems with multiple processors have developed rather slowly. Perhaps this is what should have been expected since multiprocessors are blatant violations of Grosch's Law. For example, consider a configuration of two identical processors. Grosch's Law indicates that for twice the cost one should expect four times the performance. But for twice the processor cost one will find he has considerably less than twice the performance in dual processor configurations.

Nonetheless, multiprocessor configurations will be a sheer necessity for computer utility systems. This derives from mandatory system dependability not unlike the requirements for military command systems and air traffic control centers. The majority of existing multiprocessor configurations are weak when assessed from a reliability standpoint.

Hardware features for reliability will require careful attention. These include redundant organization, independent power systems, switchover capability, aids to failure detection, and provisions for maintenance. Software for reliable systems must provide for recognition of equipment failures, equipment substitution, and system recovery. These characteristics imply much greater complexity in operating systems for computer utilities than for present systems.

will there be a processor hierarchy within a system?

There are potentially a number of kinds of processors that might be used in computer utility systems. For example, one can think in terms of main processors, of midicomputers used as I/O channels, and of minicomputers used as data communication controllers. For large-scale scientific use, one might also include a pipeline or array processor. It has

even been suggested that computer utilities will consist of a ragtag assemblage of fully depreciated computers of various makes and vintage. This latter type of processor hierarchy can be safely ignored on the basis of its software complexities.

The architectural trade-offs associated with processor hierarchies aren't entirely clear. For instance, such a hierarchy might be viewed as an example of further corruption of Grosch's Law. But then again, there are subtleties involved that require a deeper analysis, such as the application of an oversized computer to small dedicated tasks. Reliability considerations favor the use of a limited number of kinds of units—processors included. Countering this, separation of function can result in significant simplification of computer utility software. Modularity considerations also tend to favor a hierarchical structure.

what memory hierarchy can be expected to prevail?

There are several levels of memory in third-generation machines. Looking outward from primary core memory one may see bulk core, head-per-track drums or discs, and removable media storage such as disc packs, magnetic tapes and random access magnetic card files. Looking inward from primary core memory one may see high speed scratchpad, high speed look-ahead memories in very large machines, control memories and read-only microprogram memories.

For purposes of computer architecture discussion, an area of significant interest is the expected hierarchy immediately above and below today's primary core memory. For example, there may be justification to think that the boundary between primary core memory and bulk core may vanish. Indeed, it is not clear that this memory will be core; it may be based on thin-film or LSI technology. The justification for elimination of the boundary between primary and bulk core depends upon the assumption that there will be a much faster memory interposed between this composite memory and the processor.

There is a nearly unanimous opinion that high speed LSI memories of meaningful size will be available for the general class of fourth-generation machines. Because the performance of machines has traditionally been paced by memory technology, this component will undoubtedly have a great impact on machine architecture. The architectural question this poses is: What should be the addressing characteristics of the high speed memory? Should it be conventionally addressed, with software paging from the slower but larger memory? Or should a virtual memory concept be used having automatic hardware paging features? The latter approach, with what amounts to a very small page size, has been taken in the cache memory of the 360/85. This is apparently effective for large problems, but it is not clear that this approach will be totally satisfactory for time-sharing with its rapid context-switching. Perhaps improved algorithms for bumping pages out of high speed memory will help, or, alternatively, combining the concepts of scratchpad and virtual memory.

will the use of microprogramming be extended?

Microprogramming has been used as a design technique for a number of computers. Its principal use for third-generation machines has been to achieve downward compatibility, that is, to develop rather complex control sequences that permit a small computer to have the same instruction repertoire that is used in larger machines in the line. Microprogramming also offers advantages for reasonably efficient stimulation of other machines, an important notion in emulation, or "backward compatibility."

There are a number of reasons why microprogramming will be very important in the 70's.

First, it has been proven to be an effective design technique with a great deal of flexibility, to the extent that its use can be expected to be enlarged to a much wider class of machines.

Second, although most microprograms are contained in read-only memories that are not electrically alterable, there is substantial interest in having a variable microprogram storage unit. This type of stored logic was popularized as "firmware" by the late Ascher Opler (DATAMATION, January, 1967). The interest in firmware appears to be for purposes of achieving dynamic backward compatibility, and also appears to derive from a feeling that different machine languages are optimum for particular functions. As an example of this, firmware might provide one machine language for job compilation and another machine language for job execution.

A third reason for the expected importance of microprogramming in the 70's is its relationship to LSI technology. Both permanent and variable microprogram storage devices can be expected to be available at reasonable cost.

what are the trends in i/o architecture?

As noted earlier, there are good reasons to believe that the computer utility concept will be a major force in new architecture. This will mean a great deal of design concentration on remote terminals, particularly remote terminals with batch capabilities.

For the I/O facilities of central computers this will mean large amounts of heavily multiplexed traffic. I/O channel capacity will no doubt be extensively increased during the 70's, with particular attention paid to achieving efficient multiplexing. There is a present tendency for communications controllers to contain stored-program processors, an emphasis that can be expected to become predominant.

Currently, there is also some use of minicomputers as controllers and concentrators in remote terminals. It is not clear that this will be an overwhelming trend, because LSI technology can be expected to also breathe new life into special-purpose designs. In particular, those special-purpose stunt boxes that rely on modest amounts of memory (like electronic calculators and single-message buffers) will have a whole new set of favorable trade-offs.

in conclusion

The 70's should be every bit as much fun as were the 60's. This discussion has concentrated on the broad middle ground of computers, with the suggestion that their architecture will be heavily influenced by a computer utility concept. This concept can be expected to place renewed emphasis on reliability and ease of use. And while hardware/software trade-offs will continue to be important, efficiency considerations that penalize the user or introduce substantial software complexities will be of secondary importance. A significant trend to centralized processing and file storage is seen, especially for larger companies, with remote batch terminals coming into wide use.

At the ends of the spectrum, supercomputers and minicomputers will offer their own kind of design excitement. And to top it off, LSI technology will offer a custom design potential that may generate a new challenge of general purpose structures by economic special purpose equipment. In years to come we may look back at the third generation as an era of symmetry and simplicity. ■

from novelty to necessity

THE SHAKEDOWN DECADE

by Fred Gruenberger

To put the second decade of digital computing into perspective, we might begin by examining the scene at the end of the 50's.

The 1959 volume of DATAMATION contained 340 pages; the 1969 volume has 3436 pages, not counting covers. At the end of 1959 there were perhaps 2500 computers in operation in the U.S., with a combined power (total additions per second) of about 10,000,000. Corresponding figures for 1969 might be 50,000 machines, with a total power of 5,000,000,000.

The machines being announced at the end of the 50's included the Bendix G-15, the LGP-30, the Recomp, the G-20, the PB-250 (all these have died), and the IBM 1620 and 7080. Advertisements made a point of machines being "all transistorized" and featured pretty girls in ankle-length dresses.

Magnetic tape technology had reached the point where 5 million bits could be recorded on one reel and an experimental core stack was announced that could achieve a 1 usec cycle time. FORTRAN was a going thing, and COBOL was about to emerge. Paper tape was of great interest as a storage and communication medium. A prominent software expert announced that the cost of computer programs would be brought down to 80 cents per instruction (note: we never made it).

At the close of 1959, real operating computers were still a novelty and largely unknown to the public. The Recomp people pulled a dramatic stunt by taking one of their machines to a public meeting and operating it, just like that. A few pioneering installations had experienced a conversion from one machine to another and were reporting that it had taken longer than they had thought it would, and had cost a frightening amount. There were some attempts at what we would now call continuous flow batch processing, but in general it was still de rigueur to dedicate an entire computer to one job at a time.

free-for-all

In short, computing was still a slapdash affair which was wildly exciting just because there was no underlying structure or discipline. Those engaged in scientific computing and those involved with business data processing were worlds apart: they used different machines, spoke different languages, attended different conferences, and belonged to different societies.

There is no point in being smug about how things were 10 years ago—one should consider how our status today will appear in 1980. Nevertheless, to put the gains of the 60's into perspective, it is illuminating to review the disorganized structure that was the computing world a decade back.

For example: the "People" column in DATAMATION 10 years ago averaged some six items a month. The news in all our publications then featured flash items about the installation of individual machines of the size of 1620's. It was in 1962 that Jackson Granholm, noting that not every new machine represented progress, formalized the concept of a *kludge*, "an ill-assorted collection of poorly-matching parts, forming a distressing whole." The Kludge articles (there were six of them) were funny at the time; they read a bit sadly today, since there seems to have been little progress to

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report.

The year 1962 saw the inception of the DPMA Certificate program. It was also the year in which an attempt at a second official glossary died. The first (and only) ACM glossary came out in 1954. A large committee spent most of 1961 on an updated version, which reached the galley proof stage only to be killed, ostensibly to avoid conflict with a similar venture by IFIP. The net result is that although we have glossaries by the dozen, there is none with the official imprimatur of a computing society. Gresham's law works best when there isn't even any "good" to drive out.

The use of computers for election predictions began in 1952. By 1960, the notion was well established that computers could be programmed for predictions, and the public was made aware of the fact that, given the same data, different machines with different programs could reach similar answers at different rates. The election night shows have been the only large scale efforts at executing the same programming task three times, under intense pressure.

past, present, and future

The object here is to review the events of the decade and to pick out those that had the greatest effect then; those that hold the greatest promise for future advances; and those that seem now to be eligible to appear as significant when we look back in 1980 (and the three categories may be distinct).

Dr. Richard Hamming, of the Bell Telephone Laboratories, says "the greatest fact of the decade is the continued exponential growth of computing." Just about everything about computing that can be quantified changes by a factor of two every three to four years, and this rate of change has been maintained now for 20 years. If there is a knee to any of the growth curves, it has not made itself evident.

Dan McCracken, whose 10 best-selling books give him a unique position in the field, says "it is my view that the most interesting thing that happened in the 60's was a coming-of-age of computer people, in which people began to get over the idea that complicated problems can be compartmentalized. That is, we have begun to see things whole a little better, with the technical side one important aspect, but only one."

those inevitable languages

Around 1962, articles appeared which argued quite plausibly that ALGOL was the proper language for scientific computing and that it must take over. Seven years later, the arguments are being repeated, almost word for word, in relation to APL and/or PL/I.

This is not the place to air the merits or demerits of any language. It is pertinent, though, to review the ability of computer people to reach a conclusion; to apply, if you will, a little of the scientific method to the discipline that they wish so devoutly to call computing science. The *reasoning* applied to the problem of adopting some language or other is usually neat, plausible—and wrong.

The flaws become more apparent when one examines the case for ALGOL in the early 60's, but a simple test will reveal the same flaws today. Take any argument for *any* language, and substitute in it Esperanto, the 13-month calendar, the metric system, or world government for the name of the language. Now, what do you have? You have egg on your face. ALGOL just didn't make it, and it surely had tremendous effort behind it. If we can't learn something by reading those well-reasoned arguments for ALGOL, then we aren't as smart as we think we are. Richard Hamming says "it is unfortunate that what is called Computer Science is still not on a firm path toward becoming a science. All too few people are even trying to make it into a science; most prefer the 'artistic' approach of unrestricted freedom, and many are constrained by the demands of technology to produce immediate results of immediate value." Computer people still don't act like scientists but rather—on emotion-charged subjects like the merits of specific languages—like the advocates of ESP. And there is little progress to report for the last decade.

the education picture—grim

Hardly a month goes by that the author doesn't receive a letter from someone in secondary education with the flash discovery that computing might be taught to high school students, and please send the plans. These people profess amazement to hear that Richard Andree and George Heller were demonstrating the feasibility of that idea 10 years ago. The real significance of all this, in a review of the 60's, is the poor job we all did in publicizing our efforts beyond the boundaries of the computing world. We may still be in this trap; we blandly assume that whatever we conclude as computer people becomes public knowledge, only to discover some years later that we were really keeping our efforts hidden from outsiders. In short, our public relations work has been, and is, woefully inadequate.

In fact, the biggest single failure of the 60's may be the inability, or lack of desire, of our industry to construct and guide a training pipeline that extends in orderly fashion from the eighth grade through graduate school. The amount of misinformation, fear, superstition, and ignorance about computing at all levels of education is staggering and, except for scattered efforts whose effect is rapidly attenuated, nothing much is done about it. It is usually agreed that an essential ingredient for the learning of computing is an actual stored-program computer, but high schools still have nothing to pick from—which hands the field by default to the makers of sequenced desk calculators. Again, there is no doubt that properly made films can teach, but one looks in vain for films that teach any concepts in computing and that are available to the schools.

There is a bright side to the educational picture. Good textbooks are available. Curricula have been designed, mostly for the college years, and then almost entirely for degree programs in computing science. The person who wants a degree in some other discipline, but who wants more than a survey/introductory course, is still somewhat neglected. And the person who wants to specialize in that half of computing known as business data processing (i.e., the care and massaging of large files) can look in vain for any courses anywhere. But at least these problems are being tackled, systematically and energetically, and by good people.

social awareness

At the start of the decade, the subject of social responsibilities of computer people was considered a joke or, at best, an annoying and irrelevant topic. One of its corollaries, the idea that computers could be used to hurt people (i.e., the privacy problem) had not yet come up.

We seem to have made progress in this area, although public forums on social problems are currently experiencing their own version of student unrest. What is needed is a senior statesman/philosopher to put the issues in sober, literate form. It would help a great deal if that person had extensive firsthand knowledge of computing.

One should also consider the social awareness *about* computers and computer people on the part of the public,

referred to in the preceding section. Our public image is not too flattering; if we believe that the public credits us with the prestige of doctors, lawyers, or engineers, we're in for some surprises. It has long been argued that we should take steps toward establishing a profession, but no one seems to want to take on the responsibilities that go with freedom and/or authority. We have been duly warned by the second law of Dr. Laurence Peter: "For every job that exists in the world, there is somebody somewhere who can't do it."

During the 60's, we have backed ourselves into a corner (perhaps along with other emerging technologies). If the incompetents are going to rule the world, let's not let them begin with computers.

the printed word

Both DATAMATION and the *Communications of the ACM* began in 1958. Prior to 1958, there were *Computers and Automation, Data Processing Digest, Computing News* (now defunct), what is now the *DPMA Journal*, and what is now *Mathematics of Computation*. A man could keep up with the literature in those days; in fact, if he could read it, he probably was contributing to it. By 1968, we had reached the stage of inundation, or deluge. *Data Processing Digest* was by then reviewing over 150 U.S. publications per month, 30 of which were devoted exclusively to computing, not counting overseas publications and the house organs of various manufacturers. This article is adding to the mass (and I don't know how to get out of that trap), but the point is that the second decade has brought us to the point where it is not possible to keep up with the literature of the field. By all indications, since this is part of the exponential growth that Hamming refers to, the third decade will be worse.

The definitive survey of all our literature is W. C. McGee's "Role of the Literature," *Data Processing Digest*, March, 1967, reprinted in the book *Data Processing . . . Practically Speaking*.

the 360 logic

It will not be possible to select the one advance of greatest significance of the 60's until another decade has passed, but the logic of the 360 is probably a leading contender. The widespread copying of the 360 design is not only sincere flattery but overwhelming confirmation of the soundness of the design.

The 360 emerged in April, 1964. Deliveries began in 1965, and after nearly five years we may or may not be ready for yet another advance. What the 360 design did for us was provide a pattern, accepted by a great deal of the industry, which offered some sort of compatibility over a large range of sizes and which could be used by both the scientific community and the business people. Previous efforts at a common machine were fruitless. The data processing people were not going to use machines that did not give them capability for variable field lengths, and scientific types would not settle for anything but fixed-word-binary. The fact that both groups can now live comfortably with a single machine type provides us with a stabilizing influence that lets us advance faster.

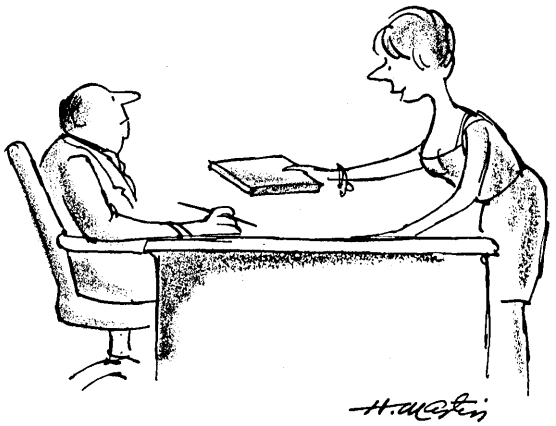
The term "360" here refers not only to the IBM series of computers, but as a generic term to the machines of other vendors that incorporate the byte-logic organization, base register addressing, and decimal/alphabetic capability on a binary fixed-word-length machine. Perhaps what we are talking about is better put in the words of Fred Brooks himself (writing in *Automatic Data Processing*, by Brooks and Iverson):

"In order to show most clearly how information is represented and manipulated, computer coding will be treated generally, but illustrated concretely by discussion of the specific coding for the IBM System/360 . . . which is a logical organization, or detailed functional specification, to which a wide variety of computing systems have been built by several manufacturers. To the extent that these systems match the S/360 specification, and to the extent that the specification is complete, they are *compatible* and will execute programs in the S/360 instruction language. Hence it is possible and appropriate to treat coding in terms of this logical organization, independently of the various physical realizations thereof. This principle, the sharp distinction between logical structure and physical realization, is due to G. A. Blaauw. Blaauw's principle has proved to be one of the most fertile computer design concepts of the 1960's."

Other parts of the 360 dream have not as yet proved out. For example, having a range of machines with the same logic and a common instruction repertoire was supposed to provide for having just one FORTRAN in various sizes and speeds. Instead, we have many more different FORTRANS than we did before, and they are magnificently incompatible.

The 360 also brought with it the concept of operating systems. Just as the user of FORTRAN is, in a sense, not dealing with the object machine, but with a different device called FORTRAN, so the 360 user is really dealing with a machine called OS, which has its own pathology and idiosyncrasies. Moreover, since the user is buffered from the machine by the deep layers of program of the operating system, he has been led to live with tremendous inefficiency which is masked by speed and extensive core. In moving from second- to third-generation equipment, the user has been given about 10-15 times the raw computing power for the same amount of dollars. His throughput has gone up by only a factor of two or so (and this he sees). The loss of a possible factor of five more has been cleverly concealed. Perhaps, on the whole, we're ahead.

The 360 brought with it wide scale use of integrated circuits. Here, progress has been extremely rapid. The early (1964) chips packed half a dozen or so active elements in an area half an inch square. By the end of the decade, circuit packing densities were some 2000 times as great, and the end is not in sight. Such advances in electronics give us physically smaller machines, which are more reli-



"I think Aydex, Inc. is wooing you, Mr. Pendyke. They've sent you a candygram."

able, faster, and cheaper. A more profound effect is that the mass production of these circuits allows for new manufacturers to fabricate peripheral devices and whole computers without having to invest in the entire operation. Thus we see new firms each month offering ever faster and cheaper small computers. And with any computer the purchaser can tie in a bewildering array of devices, each of which is obtained from a different vendor. One nice effect of this is that any mistake made in selecting the proper cpu can be patched by buying add-ons. But Clarence Poland of IBM points out another effect: "It's obvious that the most ignorant savages can use computers today and still be ignorant and still be savages, and this may be the most important single problem of the next decade."

software

"Software has, of course, been the keystone in data processing since computers were invented. But, in the 60's, that fact became fully recognized from technical, management, and financial viewpoints. The emergence of software companies, proprietary software, and separate pricing underscores this."

This statement by Dr. Walter F. Bauer, president of Informatics, sums up another significant advance of the decade. The rise of the independent software firms took place precisely through the 60's. At first, these firms simply offered programming services, to do the same work that in-house programmers did on specific applications. The shift to large-scale programming jobs, conceived, managed, and financed within the software company, leading to packaged programs that could be sold repeatedly (in a manner closely analogous to the production and sale of computer hardware) began around the middle of the decade and is now booming.

Bauer refers to unbundling, about which much is currently being written. It comes at the end of the decade. It may be highly significant, or it may be a simple evolutionary trend. At this point in time, it's one of those time-will-tell things.

Another trend in software, though, is mature enough to be put in focus. Clearly, computing is going on-line. This means much more than time-sharing services which bring BASIC to students and small businessmen; it involves the ability to access a large data base remotely, using sophisticated and powerful tools. On-line computing, as it exists today, is locked in to time-sharing, but it need not be so.

emergence into infancy?

Maybe the Shakedown Sixties have established one point. Computer people are inordinately clever, and sophisticated, and savvy—and they're also human. Even in their own field, they are as capable of repeating known blunders as anyone else. There is the same percentage of charlatans and phonies as in the general population. When computer people venture out of their specialty (to another specialty, or to politics, religion, literature, and what have you), they sound just as silly as an eminent physicist commenting on the new Miss America. So what makes us different? Just this: that we are the people who can mass produce stupidity. Maybe we have learned to automate the Peter Principle. The coming-of-age that McCracken refers to applies to computer people who are dealing with computer problems, and then only on a collective basis. What an individual, acting alone, can do in the way of clobbering everything in sight is truly wonderful.

In short, although the decade just passed has been great for volume, it may have been somewhat short on real, tangible advances. Edison Schroeder, vice president of Edutronics, puts it this way:

"The 60's have witnessed an incredible proliferation of computer hardware, software, jargon, and people; but actually, new *ideas* have been scarce. New people, on the other hand, are very much in evidence. These new people foul things up, and it's next to impossible to get enough qualified people to cope with the resulting problems. Software is often late and full of surprises; manufacturer support is less than it used to be; and at times the jargon is almost impenetrable. Standards are still lacking in many areas. There is confusion over who to teach what, or how, or even whether or not we should try to teach certain subjects at all."

The November, 1969, DATAMATION carried a Forum piece on the woes and weaknesses of our professional conferences. Almost exactly a decade earlier, in the same pages, there was printed an impassioned plea to improve our conferences, covering quite the same points. It's quite characteristics of the 60's—everything has changed quantitatively by at least a factor of ten, but qualitatively perhaps very little. Which suggests that we are overdue for a few really new ideas. ■

REVOLUTION-1970

meme mene

by Howard Bromberg

Most of our ideas and images are still shaped by revolutions which happened in pre-industrial times where differences of wealth, power, and privilege were deeply and hopelessly etched, and where a small and visible ruling class on the top oppressed and exploited the masses on the bottom. Today, any lucid discussion of revolution in the advanced states must begin with the fact of a technological society, not with ideas fashioned to analyze traditional societies. By "technological society" I mean the computer industry as we know it, and those businesses and individuals attempting to thrive therefrom and therein.

The main attitude of the computer industry is not merely rapid change but, as its admirers have said, creative destruction. It not only destroys habits, beliefs, and institutions inherited from the past, but those which were created only yesterday. In this industry, where memory is both a development and an irritant, concepts such as "tradition" or categories like "the past" are essentially meaningless. Revolution 1970 implies striking against the moving present rather than against the burdensome past. It means also that, instead of the traditional struggle against societies and technologies which seemed incapable of moving and growing, this is a protest against a technological society which is in constant movement and which is capable of promising everything from the abolition of poverty to the abolition of death.

As we leave the beginning decades of our industry, we enter the 1970's armed with the greatest arsenal of technological power ever made available to man. We must make it the intent of the next decade to remove the mass of scientific and engineering trivia within which this technological power is packaged. The 1970's present us with the great intellectual task of rethinking every aspect of our computer industry heritage. Having survived the growing pains of the 50's and the economic outrages of the 60's, we find ourselves again at a threshold. This time, the tasks with which we are faced are neither technical nor financial but more basic and far more critical. That is, we must examine what our computer-based pursuits have done to our language, literature, art, politics, and work. It is also retrospective in that we must expose the historical choices that were made in the name of science and technology. We must achieve a meaningful assessment of the gains and losses incurred by our choices. And finally, this task is creative, in that we must acquire the fullest comprehension of the range of computer possibilities.

Before our technical confidence for dealing with the problems of the 70's becomes too self-serving, let us identify some of the mistakes made during the past two decades. For convenience, I categorize these mistakes into corporate entities, people, equipment, and programs.

corporate confusion

Today's businesses are categorized by their managements as being "modern," due primarily to their acquisition and utilization of computing equipment. On the contrary, the proliferation of specialized technical knowledge has turned the modern corporation into a bewildering complex collection of special departments, computer centers, training centers, programming groups, systems and procedures departments, and the like. These units often occupy a semi-autonomous status within the corporation, enjoying their own budgets, governed by their own brand of technical officer, adopting their own standards, and largely oriented toward movements and constituencies outside the corporation. Thus, the modern computer-based corporation becomes a holding company with only nominal control over the agencies which bear its name.

The result of this corporate condition is a phenomenon unrecorded in this country since the days of the snake-medicine peddlers. Mainly, the use of the computer has been accepted as the technological placebo by corporate management. The fact that computer costs were, in the past decades, unmeasurable and to a large extent unaccountable —as well as the strong possibility that computer costs were considerably higher than manual methods—did little to dissolve the corporate computer romance.

people problems

The mistakes made in the past decades with respect to people are inexorably intertwined with the corporate technical activities. A basic mistake was the tendency to inflate into "professional" status many occupations that were really little more than fairly high-skilled jobs. Thus we allowed a substitution of specialization for professionalism.

In no other industry do we see so clearly the application of the Peter Principle, namely, "In a hierarchy every employee tends to rise to his level of incompetence." The humor of this statement is strikingly grim. The rate of change within the industry, the increasing variety of choices, and the corporate growth within an expanding economy has led to the use of people as sandbags with which to hold back the floods. We have accepted as fact that there exists a shortage of technical personnel. We have

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literally ignored the problem of training and have used most of the wrong people to fill the right roles.

The exigencies of change within the computer industry no longer demand that we walk before we know how to crawl. Indeed, they require that those who know how to crawl must now run. Thus, virtually everyone operates in a third-generation environment with very little, if any, understanding of second-generation techniques. Moreover, the solid second-generation technicians were required not to extend their technical capability into third-generation activities, but rather to change completely their entire technical pursuit into one of management. In this way, each succeeding generation destroys the technical giants of the preceding generation and fills its ranks with current-generation neophytes.

In the midst of this shortage and misuse of people, the 60's has created the closed organization of our technical society. Trainees were rarely tolerated, and the ability to "break-in" to the business was made extremely difficult. Not that there were any criteria for judging an individual's capability, but lack of experience alone was enough to decide against the majority of the applicants. Even experience itself was not a sufficient door opener. One had to be familiar with the current jargon if not capable in the use of the new tools. Even such capability was made difficult, if not impossible, to demonstrate because of the complexity of these tools and the lack of understanding by most of the managers. So the game of personnel Russian roulette was instituted, whereby neither the buyer nor the seller knew exactly what he was getting. And those who really profited were the scores of personnel agencies feeding on this internal technology gap.

The cost of acquiring competent help without adequate tools for measuring them is yet another demonstration of one of the most expensive hidden costs of data processing in the past decade. The use of these people without similar techniques for measuring their effectiveness is equally astounding, since it serves only to compound the cost of doing business. With respect to people, then, the grand mistake of the past decades lies primarily in their blind acquisition and indiscriminate use. Indeed, a generation gap has been established between the people and management on the one hand, and on the other hand between people and their major tool—namely, the computing system.

Another fundamental people error that we have experienced involves producing the feeling of powerlessness to evaluate or even object to the technological advancements. Such advancements were forced upon the community in such a way as to promote a common futility. People believed that, once a computer culture was advanced, they must scramble to emulate it in order to avoid the stigma of inferiority. Hence, a mistake perpetrated by a leader in the industry would be promulgated forever by its members. Perhaps the affability of our technical participants has been encouraged by the fact that they operate within an environment that supplies them with a generous margin so that concessions are always possible and mistakes always camouflageable.

equipment errors

The mistakes made in the past decades with respect to equipment are easily summarized. They are, on the one hand, a product of planned obsolescence and, on the other, a manifestation of the "too much, too soon" syndrome. In other less technically based industries, obsolescence is motivated primarily by economics. That is, the continued success of the particular product line is based to a large extent on its replaceability. Building an automobile, for example, that would last for 20 years would be disastrous for the automobile industry and would have a profound negative effect on the economy of the country. In the computer industry, however, our planned obsolescence has not been based on economy but rather has been based upon an attitude of elegance and a striving for greater technological accomplishments.

In such a way, it becomes imperative for our engineers to create larger, faster, and more complex equipment because the state of the art allows them to do so. This newer equipment with built-in enlarged capabilities can be justified economically by measuring the cost per transaction on the new equipment against last generation's model, *even though the cost for achieving savings often outweighs the savings themselves.* Thus this "obsolescence of achievement" literally forces the old equipment into the junkyard prematurely. It is what Vance Packard in *The Wastemakers* calls obsolescence of desirability. The introduction of a new product, because of some change within it, makes the older product less desirable even though it is still sound in terms of quality or performance.

Using the automobile again as an analogy, it appears that the manufacturers have concentrated in the past upon all the wrong problems. It seems unnecessary to build, and hence have the buyer pay for, a machine that will travel at 120 mph. Not only do laws of both traffic and sensibility prevent utilizing this capability, but the important problems of the automobile as a death machine have, in the past, been totally ignored. So it is with computing systems. We are able to process faster, contain more data in immediate storage, interact with computers, teleprocess, and the like. Yet, the important consideration of how our people can use these new capabilities has been sorely ignored.

programming predicament

The final category of mistakes made in the past decades concerns programming systems. Unlike the former case of equipment, wherein we had too much, in the case of programming systems we have traditionally had too little. By this I mean too little discipline and too few tools other than the computing system itself. The art of programming aimed at producing the desired result by any means—including incantation, incense burning, and, at times, human sacrifice. It involved the learning of a new set of languages that would enable one to have the same amount of difficulties encountered on past equipment when producing similar systems for new computers. The unbelievable costs which accrued in the implementation of programming systems within the past decades are, in fact, a summarization of the mistakes involving corporations, people, and equipment. The whole is indeed the sum of all its parts, and it presents a precise definition of the technology gap facing us as we enter the decade of the 70's.

facing forward

For the 1970's, the goals of the various members of the technological society are relatively reasonable. Corporations would like to be in a position of exercising greater control over their data processing operations and, at the same time, being able to reduce those costs associated with their data processing requirements. The people would like to learn to become, and remain, proficient at their jobs. They would like to master the technological advancements rather than be slaves to the tools which theoretically support them. Manufacturers of equipment would like to have their products sold, and more important, would like to have them used, to the proven benefit of the purchaser.

Achievement of these reasonable goals will to a large

degree be determined by how we deal with the new emerging directions of the 70's. Typical of these new directions is the tendency toward unbundling. This has been heralded as both a panacea for growth and an economic disaster. Fundamentally, it means that there will be more "things" for sale. It means that the seller will be able to bring more goods to market, and that this market will be highly competitive. It means that the buyer will have greater choices of items to purchase and probably at lower prices. But more important, it can mean the 1950's and 1960's all over again; the only difference being one of quantity.

sales separation

The existing technology gap which has been inherited from the 50's and 60's has been segregated and kept divided into two specialty fields, hardware and software. Left to its own inertia, unbundling will enable the mistakes of the past to be repeated, but now they will be directly accountable to either hardware or software. It is quite similar to a situation that occurred in the past, when we moved from second-generation to third-generation computer languages. Virtually no corporation recognized that there was any need to do anything different when using the new language than that which had been done in the use of the old. A programming group using SPS carried its same organization into a COBOL environment. Instead of organizing to take advantage of the new tool, they were organized to accommodate the computer.

With respect to unbundling, this same mistake must be avoided. It is not merely a reorganization of bodies that is required, but rather a reorganization of minds. The decade of the 70's will demand a complete rethinking of the use of the computer and its complementary accessories. It will necessitate reordering old priorities and establishing new ones, in order to keep up with the expanding technology. These priorities will see far more emphasis placed upon education and training and, at the same time, will include greater requirements for guarantees of technical excellence and performance.

To accommodate this direction toward computerized apartheid, we will see a proliferation of new companies. These organizations will act primarily as distributors of devices, packages, and educational tools. Unlike past decades wherein the manufacturer supplied his own distribution, the new companies will now distribute for many manufacturers. In the past, the manufacturers were primarily large, well established, blue-chip organizations, primarily due to the huge investment required in the manufacturing of computing equipment. Manufacturers of software, however, are quite a different breed.

The practice of separation between hardware and software sales may soon see as many as 1000 companies, each offering scores of software packages for sale. These packages represent investments in proprietary programming made by large corporate entities as well as by moonlighting programmers. They will include large application systems as well as small utility subroutines. They will initially accommodate all facets of the commercial data processing market and ultimately move into the engineering and mathematical areas. Because the start-up costs of this type of business are extremely low, and because it appears to be the vogue of the 70's, the computer user will find yet another stumbling block in the way of his goal of intelligent computer use. With 1000 companies each offering 100 devices and 100 packages, the possibility of error becomes significant. Measured against this, the choice of acquiring a cpu becomes relatively simple.

The acquisition of a computer is only part of the cost, and to some, it is a small part. The real money is spent in the actual employment of the computer; that is, in the people that support it, the devices that are attached to it, and the programs that it runs. That is why the 70's present the greatest challenge ever for the computer user.

The key to success in the computer industry lies not in equipment, nor in software, but in people. Unlike in past decades, we now see emerging from colleges and universities a new breed of individual to whom the computer is an acceptable, if not familiar, object. Successful companies of the 70's will build upon this by creating and utilizing new educational and training devices and techniques which will transform neophytes into computer professionals. To this end the computer itself will be used, and not only to train its own future masters, but also to train people in other disciplines only indirectly affected by computers.

Perhaps the major difference between the technological society of the 70's and that of the past decades will be the reliance upon techniques for measuring performance. These will of necessity include performance of people, equipment, and programs.

measurements mandatory

There has been a significant reluctance in past decades to get involved in the measurement of people. Indeed, the recent development of accreditation tests by the DPMA was met with opprobrium by a large segment of the technical community. But the fact remains that the cost of doing an acceptable job in data processing today and tomorrow is necessarily dependent upon the performance of the individuals involved in the data processing activity. It is far from impossible to measure capability and performance of individuals, particularly once we have overcome our sociological objections toward artificial categorization of human beings. It is not the function of people measurement to place all individuals in the same category, or even to have them all strive for the same degree of excellence. Rather, it is to identify capability and then to allocate these individuals to the particular jobs at hand, based upon their degree of capability.

Similarly, systems themselves must be evaluated as to their degree of complexity. We will then be able to allocate technical personnel to the performance of the system design and development, according to the capability of the individual and the requirement of the system. Along these same lines, techniques must be devised to measure the value of the unbundled commodities offered for sale. This measure must evaluate the product, not in a general area, but rather in a specific, pragmatic environment that is fundamental to the goal of the prospective purchaser. Without such measurement techniques, the computer industry will continue its course with little regard given to the applicability of the theory of computing.

One unfortunate circumstance into which the entire society of computer consumers has fallen within the past decades involves the immense influence accumulated by the hardware systems manufacturer. He controls the economy, dictates the form of the data, and prescribes the processing techniques that are to be employed. Our very consumption of the major tool of our profession thus becomes our main source of powerlessness. We are powerless to stop advancement, powerless to stop change, and powerless to stop purchasing. It is imperative, if we are to continue, that the decade of the 70's put an end to the basic malady of our computing society—namely, this universal sense of powerlessness disguised as consumption and maintained by rising technical expectations.

There is no doubt but that corporations of the 70's,

operating within our technological society, will place even greater emphasis into areas of technological achievements. Corporate communications will be established complete with war rooms, and integrated systems will be developed so that each corporate division will be influenced by the results of the computer. Sophisticated interfaces will be established whereby men and machines will be able to enter into, and sustain, meaningful dialogues.

But these and many others like them will remain merely technological innovations unless we are willing and ready to dedicate ourselves during this next decade to a total rethinking and re-evaluation of our goals. Such an insistence on the requirement to first define the exact nature of the problem and then to decide how best to solve it, is fundamental to our very existence. It is now clear that this industry inherently is moving toward self-destruction. Any radical rethinking must start from the premise that its manifest destructiveness will not be stopped by a wider distribution of the values or a more intensive application of the methods and processes which constitute and sustain the problem itself. If the corporations within this technological society dedicate themselves to this rethinking, then they will not only serve the society in the most valuable way possible, but they might even save themselves. ■

THE ONSLAUGHT OF THE NEXT GENERATION

like the wolf on the fold

by Philip A. Dorn

As the new decade opens, there are rumors of massive battalions of salesmen gathering in the peaceful hills of lower Westchester County, preparing to attack the milling, defenseless user community. If there was a slaughter of the innocents in the 1964 battle of System/360, the predictable carnage this time will be even bloodier. This time the bad guys in the blue suits will triumph in spite of the early warnings, the lessons of the past, and the far more difficult sales terrain.

Sometime early in this decade the battle will be on. Perhaps it has already begun and nobody even knows it; last summer's announcement of System/3 sent cold chills down the backs of many installation managers. But whether System/3 is the last shot of the old battle or the preliminary skirmishing for a new engagement is really immaterial, since it is apparent that the marketing lifespan of today's systems is almost over.

The user community reaction to a new hardware generation will be a worthy subject for a PhD dissertation in applied psychology. Will the 1965 mass hysteria set in again? Will there be a stubborn reaction against change? Will there be reason or emotion, logic or panic in the marketplace? The answers, friends, to these and other questions are still in the future, but perhaps we can at least peek at some of the questions and guess at a few answers.

camouflage for the sales attack

Let's assume that there will be a clear-cut next generation of hardware (which may be the third, fourth, or fifth, depending on how you count). If the manufacturers are really smart, they will evade the whole generation-labeling process by carefully sliding the new gear into open spots in existing lines. Of course the systems will have so-called compatible operating systems, foolproof microcoded emulators, and performance promises that will stagger the imagination. Enough angry words have been spoken about "resetting to zero" to forewarn manufacturers to exercise skill in public relations and avoid such connotations at all costs.

It seems fairly clear that whatever the revolution of the next generation will really provide, it will initially be carefully concealed behind an evolutionary cloak. Nobody is apt to get out on a limb and tell the cash customers to junk five years of work. Even if the gear is totally incompatible, such well-known phrases as "recognized industry standards" and "will run any FORTRAN or COBOL program from the Buzzfire 5000" will be disseminated. Even if the machines resemble their predecessors the way that Orville and Wilbur's kite resembles the SST, the differences will be carefully con-

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cealed behind a propaganda screen.

But let's say, for the sake of argument, that the next generation will contain totally new architecture, built around a new word and byte size, internal arithmetic in ASCII, and external data storage using laser beams. That could be a pretty incompatible machine. If, for fun, all existing data formats are instantly ruled out of date, the sales situation should get interesting.

Now to sell this mythical beast, a good salesman would first have to invent some rather fantastic numbers to justify the product. If the marketplace was the large-scale, number-crunching crowd, the claim would probably be that the machine does a quadruple-precision floating-point add in near-zero nsec (neglecting to mention that a single-character mode move takes several milliseconds). If the newly emerging minicomputer market was the target, the ads would say that the machine will run for seven years without a failure, and is no larger than your car radio (forgetting to mention that it has no I/O gear or indexing capabilities). Looking at the rich commercial data processing market, the capability for reading from 16 on-line storage files simultaneously would be pitched (casually omitting the detail that rewriting each updated record takes 10 *sec*). Now if all these things could be said, then the system would surely wind up with 70% of the market.

retrenching and conversion logistics

Let's take a look at the cost of a total "reset to zero": the almost legendary situation in which an installation dumps every program and data file it possesses and starts all over again. You say impossible? Well, it happened today. If you asked many users what the cost of such a disaster would be, they couldn't tell you. A wild guess, that it would take a typical medium-sized organization 150 man-years of effort to record everything in the house, may be off by an order of magnitude. But, even if accurate, this doesn't come anywhere near the true costs. Just think for a moment of the hidden price of stopping all development for a couple of years while converting and rewriting a mass of code.

If a large installation dared the restart route, and even assuming that all the programmers didn't quit, it is doubtful that a no-charge computer could begin to compensate for the lack of forward-going development. A two-year hiatus would bring most installations to the brink of ruin. The costs aside, could a serious installation stand this sort of shock? Having seen and experienced the third generation, it is not clear that the answer is "no." Somewhere in the world an installation is going to scrap everything and start all over again. Maybe, if they are lucky, this installation will have skipped the third generation, and is now preparing for a quantum jump. Few users who experienced the late 60's are likely to go through it again voluntarily.

Surely, at least some segment of this industry now understands that the economics of conversion are brutal. There are known techniques for minimizing conversion costs: using standard languages in standard ways, avoiding time-dependencies, prohibiting use of machine languages, etc. The techniques are known, even if ignored when writing the program. Only afterwards, when it is time to pay the conversion price, does anyone worry about getting from here to there.

But this is all a pleasant digression from the real point at issue—how the user community might react to a totally new next generation. The question is, *"Will the industry fall for the salesman's blandishments, or will they be stronger this time around?"*

To try to answer this key question, it becomes necessary to consider the many categories of users. Installation philosophies range from a completely do-it-yourself attitude to a completely dependent situation of reliance on the manufacturer for everything from applications programming to hardware planning. Most are somewhere in the middle, taking some the the manufacturer's services (at least before unbundling), but by no means totally dependent upon them.

Curiously enough, it is the people who elected to go it alone that are apt to have the least difficulty with new hardware. If all the software is home-grown (and is done properly) then it is feasible to simply prop up the system and slide new hardware underneath. It has been done before and will be done again, but the decision is decidedly non-trivial. If one elects to define a framework, an outline within which the applications live, then disturbing the externals has little relevance to the working applications programmers. This approach has been taken by a number of insurance companies, airlines, and universities, where the initial investment can be written off against a long term operation.

It is hard to decide if these installations are the smart ones or not. In many cases, the initial decision to go this route was caused by special circumstances, difficult personnel problems, special applications, unusual management approaches, etc. Certainly there is a large potential for gain if they can recreate their private worlds cheaply enough. The price being paid is technical and intellectual isolation from the main stream of industry development; the potential gain is solid performance within a limited application.

At the other end of the scale, the user who has been totally dependent on his vendor is apt to get hurt very badly by new hardware. If an installation has forfeited its technical competence, if it relies on the dubious wisdom of the salesman, if it accepts concepts without examination, if it believes without measurements, then it surely will be sold the proverbial bill of goods.

If an installation really has sold out, then it ought not to be surprised when it is sold new hardware that it may neither want nor need. At least this class of installation will get its work done—all that it will cost is lots of money. With the obviously rising cost curve, this may be expensive, but at least they will get answers to their problems.

It is to be hoped that the age of the totally dependent installation is over but, regrettably, most of us know several shops that even now exist only at the sufferance of their vendor. Sometimes the reasons are obvious; a rich potential market caused the vendor to go whole hog with a competitive bid or, more commonly, the vendor had to throw in his troops to save a bad situation and wound up running the place.

countermeasures

Fortunately, the recent growth of facilities management companies, prepared to take over an inept customer's operation (for a not inconsiderable fee), may be a solution. More than one installation has gone this route after a good deal of not overly gentle pressure from a vendor attempting to get out from under.

For the management that is paying the bills there can be sympathy, but very little real help. Data processing has become a tough business, and some bad mistakes in the past have now come due. The best thing that can be done is to hire a good consultant or facilities manager, make sure that all work is done on a reasonably standard computer with widely accepted languages, and try to avoid making the same mistake again. If this kind of shop gets through the

next generation unscathed, it will be lucky. Hopefully, it will only cost money.

The vast bulk of all installations are in the middle. They use mostly standard tools, buy some software outside, try to write in higher level languages, and generally seek, to some degree, to impose programming and documentation standards on their work. What will a new generation do to these cheerfully abused average customers?

what type of leadership?

The answer lies pretty much in the personal psychology of the installation manager. If he is a panic-prone type, wanting for one reason or another to be the firstest with the newest, he may be in for serious problems. After all, the classic reward for pioneers is to be the target for a large number of arrows in a very sensitive portion of the intellectual anatomy. An earlier DATAMATION symposium (January, 1969) mentioned the panic of the late sixties—the type of manager who hits the panic button once is apt to do it again, even if the battle scars haven't fully healed.

Those managers—skeptical by nature; bitten once and determined not to repeat the experience; having discovered that there are lots of vendors and not just one—those may just come out of the new generation fad alive and kicking. If they can simply avoid the new machines and continue to make a profit on still essentially unexploited third-generation technology, they will be ahead of the game.

Now what is really going to happen? Fred Gruenberger notwithstanding (DATAMATION, October, 1969), some predictions for the 70's seem to be in order. In spite of some slightly more optimistic words earlier, it is totally clear that any new hardware built can be sold to a large part of the data processing community rather easily. There appears to be a great myth spreading across the land. This strange fantasy (which may have been generated by the vendors) suggests that the problems with the third generation will be corrected by better hardware in the next go-around.

Now it takes a vast lack of insight not to see what's happening. The psychology of crowd control is well known. To prepare a mob for later action, first spread some high-sounding words to their waiting ears. Then at the appropriate time, when you want the mob to move, all that is needed is a slight nudge.

So, up and away, reset to zero, junk everything in sight, and let's start all over again. Of course those users who do it may get precisely what they deserve. First, already uneasy top corporate managements will get sick and tired of the whole thing. Second, a lot of data processing managers will suddenly be looking for employment. And third, the control over computing will depart from the hands of technical people and land in the lap of general management, where it will become just another profit and loss activity.

It appears that a stampede is building, regardless of the problems and the cost. The costs are so high as to be incalculable, but that never stopped a salesman from selling or a user from buying. Not a pretty picture, but this is for the record so let's not hedge. Let's predict that the next generation will be along soon, that it will be incompatible, that the users will snap it up, that the errors of 1965 will be repeated and magnified, and that you read it here first! ■

AN/FSQ-7—1954-197?

no brochure, only performance

by Douglas L. Jordan

"It has been determined that this property is no longer needed:

1. Miscellaneous Metals, Scrap: Consisting of electrical power and control cable, and cable support items including the following:
   . . . Estimated quantity 93,200 pounds.
2. Miscellaneous Metals, Scrap: Ferrous and non-ferrous. Consisting of cannibalized components of AN-FSQ-7 computer.
   . . . Estimated total weight 180,000 pounds."

GSA announcement of surplus materials

The AN/FSQ-7's were fantastic machines before they became nearly 300,000 pounds of scrap metal. They occupied nearly 20,000 square feet of floor space, with another 12,000 square feet for display consoles, and nearly 10,000 square feet for telephone input equipment. Nearly 30 of the duplex monsters were built, but their day is now passing. Already one-half of the number have been scrapped, and the others are showing their age. In their prime, however, these beasts required an army to feed them, and perhaps some of that departed army would like to recall for a moment the early days of SAGE and the SAGE computer.

"Where do I find the computer?" were often the first words of the new programmer trainee as he stood in the midst of the AN/FSQ-7 computer frames (Fig. 1). These were trainees in the purest sense—formerly teachers, farmers, machinists, preachers, professional cardplayers, professional ballplayers, draftsmen, draft dodgers, and a few, a very few, programmers. They came, learned basic programming, and went on to other activities in and out of the programming profession. Today it would be surprising to find a programming concern that had no one who had worked on the Q-7 at some time.

The army was assembled rapidly. In the summer of 1955 it numbered barely 100. A year later it was approaching 1000. During 1957, it increased at the rate of nearly 50 per week with predictable dislocation to management organizations. The popular phrase of the day was, "If my boss calls, get his name."

In those early days, it was not difficult to become an expert. The story that comes to mind is that of the ex-teacher who completed the basic IBM class in coding and reported to his new supervisor. He was handed the specification for the digital display package with the words, "If you have any problems just come ask." The value of the proffered help became questionable the next week when the supervisor came in to ask for clarification on the makeup of a particular display.

It was the practice to load the entire system from cards, a seemingly endless task, given the tendency of the card reader to drop bits. Because of this, all computer users were ordered never to write or erase the Aux Memory drums which held the program. Programmers being what they are, the Aux Memory was regularly destroyed, until a manual interlock switch was placed on the drums. At about the same time, the program went onto tape and the problem ceased to exist; but the interlock is there today, unused and nearly forgotten—a monument to the unwillingness of programmers to conform.

The genealogy of the Q-7 has a Biblical ring: Whirlwind begat XD-1, begat Q-7 (8K), begat Q-7 (69K).[1] The XD-1 was an experimental prototype used during the early development of the SAGE programs. Like it, the early Q-7's were built with 8K of memory, but this soon proved too small in relation to the 150K of drum storage, and by 1960 all Q-7's had been retrofitted with 69K of core memory. With this modification, and the inactivity and I/O interrupt circuits which were added later, the Q-7 was complete. Its statistics were almost unbelievable in 1957 and they remain impressive even today: 69K of core memory all directly addressable; 150K of drum storage; add four 16-bit numbers in two memory cycles; multiply in three memory cycles; divide in nine memory cycles; I/O operations proceeding independently of the central processor. The Q-7 was the heart of the first real-time command and control system. Designed to accept, process, and display large quantities of digital data, it was capable of simultaneously driving 100 display consoles, while accepting data from 100 on-line operators and 30 remote computers, and providing output data and commands to these same computers, and up to 25 Teletypes.

Like its contemporaries, the 704 and 709, the Q-7 was designed using vacuum-tube technology (Fig. 2). Its thousands of vacuum tubes forced speeds which are now surpassed by an order of magnitude. However, a memory cycle of 6 usec was twice as fast as the 704, and nearly up to that of the 709. Basic to the Q-7 design was a division of labor so that no one system would be overloaded. This is best illustrated by its method of interfacing with the external world—during Air Defense operations, all input and output messages were routed via the buffer drums so that the

[1] The line continued on to the AN/FSQ-8, a near twin of the Q-7 used in SAGE Combat Centers; the AN/FSQ-31, used by SAC; and the AN/FSQ-32, the original SDC time-sharing machine.

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independent input and output systems could process them without interfering with the central computer. Similarly, all displays were placed on drums so that both the central computer and the display system had access on a noninterfering basis. Thus the Q-7 was unchallenged at its own game.

On the other hand, its capabilities as a general purpose processor had certain limitations. The on-line printer ran at 150 lines per minute (Fig. 3) and the tapes at 3000 words per second. These Q-7 capabilities were found both interesting and confusing by the programmers. For example, many programmers learned by experience that the Q-7 was perfectly capable of clearing a print image in the time that

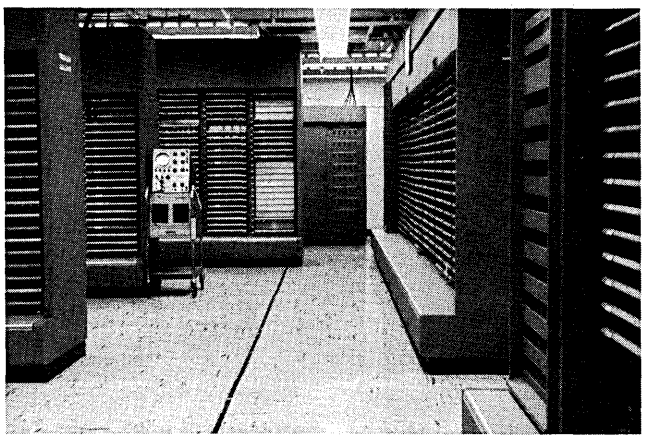

Fig. 1. One corner of the AN-FSQ-7 main frame.

elapsed after the print command was executed but before the data were transferred to the printer. These same programmers often "processed" data that had yet to be stored in memory by the tape, drum, or card input operations. The results of such processing were often remarkable, but never useful.

The tape drives on the Q-7 were, by design, secondary storage devices. Their reliability was below that of other parts of the machine, and their capabilities had some nota-

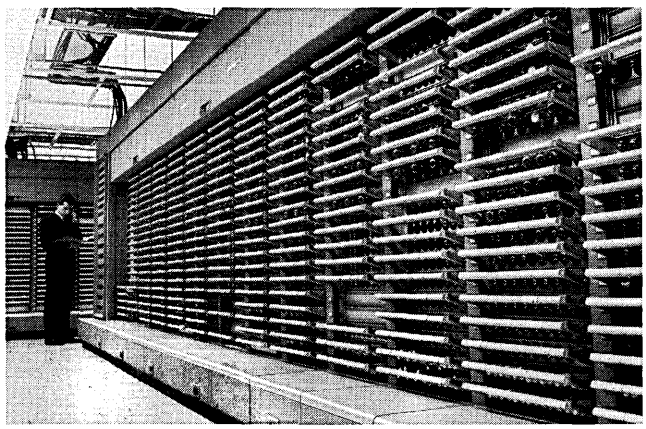

Fig. 2. A sample of the AN-FSQ-7's vacuum tubes.

ble consequences. During the early years, many tapes were snapped by programmers who forgot that a tape backspace command would be executed even if the tape were moving forward. This problem no longer exists, but only because mylar tape will stretch rather than snap.

The secondary character of the tape drives came to light most frequently during the operation of the simulation system. The sim system design required that there be five records for each five seconds of time which was simulated. All the required data was placed in only two records, and the sequence was completed by three dummy records. The chant "KIS, TDS, Dummy, Dummy, Dummy" was always good for a laugh. It also represented a rhythmic sequence of short records which created endless problems for the tape drives and, on at least one occasion, caused a side panel to fall off.

The Q-7 had some data characteristics which set it apart from the rest of the world of computers. Being designed to solve problems involving coordinates, its data word was always considered to be two signed half-words. This made the problem of calculating with positional data a relatively rapid one, since both the X and Y coordinates could be processed simultaneously. On the other hand, it caused a large number of unused bits to ride along during the majority of data processing. Of more concern and consternation to the Q-7 programmer was its use of one's complement arithmetic. Most of the neophyte programmers who first met the machine had never heard of the existence of a negative zero—the majority of the old-timers often wish they had never heard of it. Many programmers have built a reputation for trouble-shooting solely on their constant search for instances in which the coder forgot that a few bits taken from the middle of a negative zero will look nothing at all like zero. The behavior of negative zero has undoubtedly caused more testing and error correction than any other single characteristic of the machine.

The testing of computer programs was even more of an unknown art in 1958 than it is today. Everyone had his own ideas, and everyone's ideas were tried. One mathematician felt that it would be possible to enter random inputs and then to verify performance by predicting the outputs on a statistical basis. His effort bore no fruit; however, the basic

Fig. 3. The lethargic printer and a view of the AN-FSQ-7 console.

idea was implemented by a programmer to test out the switch programs. He labored for several weeks producing an input tape which contained randomly selected combinations of all possible switch actions, legal and illegal. His test was finally run (at midnight naturally), and a huge stack of computer printout was delivered to him the next morning. It was only then that he learned that his first, randomly selected, switch action had turned off the simulation input tape!

If testing was an area of individuality, documentation was even more so. Everyone had his pet way for showing the operation of a program. Register reference diagrams, branch diagrams, functional flow diagrams, and dynamic flow diagrams were only a few of the methods which were tried. All had their uses, and most have passed into history. Now the machine that spawned the diagrams—and also had its uses—must follow them. ■

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CIRCLE 64 ON READER CARD

FROM IDOL TO COMPUTER

by William H. Desmonde

It is amusing to note that computers are being used extensively today both for landing men on the moon and for the casting of horoscopes. A psychologist might adduce from this curious combination that, even in a highly rational society, part of the human psyche tends to cling to archaic, magical ideas.

Perhaps further light can be shed on this atavism by glancing back into the origins of man's ideas about automata. Historians of science trace the beginnings of machines to the worship of idols. It will be recalled that the Ten Commandments forbids idolatry. This prohibition is related to the thought that, if man can fashion a god, then in some sense man can control God, or even be God. A human (who is finite, as opposed to God, who is assumed to be infinite) caught up in the worship of idols may hence become swollen with self-delusion and accept no boundaries on his wishes. This is one way of defining a psychotic. And a psychotic society tends ultimately to stunt its own growth or to destroy itself. The moral of this sermon, applied to modern technology, is that a computer is basically merely a very useful tool, not a way of attaining megalomaniacal control over the universe.

The fact is that science is rooted in primitive magical and mystical conceptions of man and his environment. Newton, for example, conducted experiments in alchemy, Kepler cast horoscopes, and Copernicus cited the lengendary Egyptian priest Hermes Trismegistus to support his heliocentric hypothesis.

The computer, too, has a long and bizarre history. The origins of the automatic data processing machine appear to be related to early man's desire to imitate the creator by simulating the universe around him, an urge first appearing in primitive art and persisting into the Turing machine which inspired John von Neumann to develop the stored-program calculator. From the earliest times, man has sculptured, carved, or painted images on stone, wood, bone, or on the walls of caves. Primitives are believed to have used many representations of animals for magical purposes; these images were thought to facilitate hunting or to insure the growth of herds. The talisman, fetish, and idol, found throughout primitive cultures, were symbols of the gods. Many of the earliest of these images were simply stones or natural objects which were believed to possess marvelous properties because of their shape. Later, with the development of magic, men thought that gods or supernatural beings could be drawn into things by means of appropriate charms and rituals. The fashioning of natural objects into images very likely was a consequence of this belief.

The first objects of worship seem to have been representations of mother goddesses. This form of veneration of creativity stretches far back into the prehistory of our species. Statuettes of nude women with huge breasts and bulging abdomens have been found in Aurignacian deposits dating thirty to forty thousand years ago. These figurines, which represent females in an advanced stage of pregnancy, are generally termed Paleolithic Venuses. Later finds in Mesopotamia and Syria go back to the fifth millenium B.C. It is believed that these statuettes magically insured fertility and the safe delivery of children. The goddess was originally a mother image who cast her mysterious and magical qualities upon her devotees. Many of man's oldest conceptions of the nature of the universe start with a primal goddess. Sometimes it was believed that the world was generated from an egg emerging from a great mother goddess. In other primitive cosmologies the universe was born, or was constructed from the body of a primal maternal divinity. These ideas persist in the everyday expression, "Mother Nature."

A variant of the idol is the mask, an artifact found throughout the world by ethnologists. Simulated heads and animal costumes were employed extensively in primitive dramatic presentations, which were in the nature of religious rituals. Masks were also frequently used in dances, puberty ceremonials, and in fertility and funeral rites. In donning a mask, primitive man believed himself magically to be transformed into another being, often of a supernatural nature.

According to authorities, automata originated in the articulated idol or mask. Masks were sometimes constructed so that facial gestures would increase their expressiveness. Moving jaws or ears also enhanced their effectiveness. Fig-

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urines with articulated heads, arms, legs, or hands, dating back to early periods of man's history, have been discovered in many corners of the world. In Mexico, for instance, where archaeologists have uncovered numerous remains of pre-Columbian cultures, large numbers of such idols have been found. The doll, which today is simply a child's toy, can be traced back to statuettes constructed by primitive man. Similarly the marionette or puppet, found in numerous early societies, was first used in ritual practices. Articulated statuettes have been found in Greece, around the Bosphoros, in Asia Minor, in Cyrenaica, in Italy, and in Gaul. These figurines usually had joints at the shoulders and haunches.

speaking, moving statues

The ancient Egyptians believed that statues could be brought to life by inducing the spirits of the gods to enter these images through magical ceremonies. These idols possessed powers to do good and evil, and to affect the lives of men. In ancient Thebes statues spoke and made gestures with their heads and arms. Oracles in Rome were delivered by mechanically operated figures called *neuropastes*. On exhibit at the Louvre is a terra cotta Greek idol with articulated legs, as well as a talking statue of the Egyptian god Re-Harmakis. The latter was operated by a speaking tube leading behind the statue to a hidden priest who identified himself with the god and who uttered words in moments of divine inspiration.

The age-old desire to create life probably is related to man's yearning to imitate God or to be godlike. The long history of robots begins with this urge. Numerous myths of animated statues have come down to us from the Graeco-Roman culture. The image of Hera at Sybaris streamed blood and turned on its pedestal in a flash of anger. Roman historians tell of statues which bled or collapsed at critical moments, or which moved when necessary. For example, at the time of the invasions of Rome, it was often thought that certain statues came to life and fought the enemy. Homer's Iliad recounts moving statues built by Vulcan. It will be remembered that in Shakespeare's *Julius Caesar* Mark Anthony sought to inflame the mob by relating that Pompeii's statue ran blood when Caesar was assassinated.

It is difficult to say whether many of the early automata were toys or were magical devices used in religious rituals. According to legend, the ancient Greek Daedalus devised flying birds and walking statues. Archytas of Tarentum in the fourth century B.C. was reputed to have made a mechanical wooden flying dove operated by counterweights and air pressure. But it is from the city of Alexandria, in its time the cultural center of the world, that we have the first exact details of how to construct a mechanical automaton. The ancient technician Ctesibus made a moving statue. He also described the workings of a mechanical theater and a water powered pipe organ. Archimedes is well known as the inventor of numerous mechanical devices. Philo the Byzantian constructed numerous gadgets in which water, acting on floats, furnished the motive power for mechanical movements. Heron of Alexandria, who lived about the second century B.C., is famous for his numerous steam and water powered automata. He constructed an automatic theater with dancing bacchantes revolving and pivoting on a turntable serving as a stage. Another of his gadgets was what we would now call a coin-operated slot machine. This was designed for use in temples: the coin caused holy water to flow, thereby enabling the worshipper to wash his hands before sacrificing to the god. Heron also constructed a working steam boiler, but this was never put to practical use.

A turning point in the development of the technological skills required for the construction of automata occurred when man began to construct models of the heavens. Ancient man was dominated by astrological ideas. God had created the heavens and set the stars and planets in motion as part of a divine plan. Hence these early celestial models were built for meditational purposes or for controlling earthly events in accordance with God's will. Among the first types of astronomical simulacra were maps of stars on the ceilings of Egyptian tombs. The Babylonians also made simple visual models of the cosmos, and achieved outstanding success in the prediction of heavenly events through arithmetic techniques. The principles of the rationality of astronomical motions and the orderliness of number greatly influenced the Greeks. Pythagorean mystical notions that the universe could be explained by number, plus Babylonian theory translated into geometric representation, led to the development of Greek astronomy and mathematics. There are indications that by the time of Plato simple animated cosmological simulacra had been developed. Indeed, this philosopher may have based much of his imagery upon these devices. It is know that by 370 B.C. there existed a geometric model of planetary motion.

Instruments for telling time were intimately connected with the invention of astronomical simulacra. What is remarkable about the early water clocks, as well as the sundials with which they were associated, is that their prime function was religious, not keeping track of the time. The basic mechanisms of water clocks appear to extend back to the period 300-270 B.C. Excavations reveal that as far back as the third century B. C. there was a water clock edifice in the public square in Athens. These devices were constructed to simulate the glory and magnificence of the gods. Early water clocks developed in Chinese culture appear to have been imbedded in a similar metaphysical conception. Throughout ancient cultures the fundamental purpose of the calendar was to ascertain when holy days were to be celebrated.

automatic water clocks

A close relationship existed between the clepsydra (water-flowing) principles used in celestial clock-simulators and the numerous automata associated with Heron of Alexandria. Evidence indicates that the technology employed in these devices was at a much higher level than is indicated by literary sources. A recently discovered complex astronomical calculator, built about 65 A.D., possessed gear trains which turned indicators at speeds comparable to the motions of the planets.

It would appear that the ancient mechanical craft tradition was preserved in Islamic automatic water clocks. These devices were celestial simulators with associated manikins such as singing birds. (These were the ancestors of the modern cuckoo clock.) Gadgets, operated through the motive power of a clock (such as moving or articulated figurines) are referred to as "jackwork." In the Islamic clocks, dripping water supplied the basic motion. The energy was transmitted either through a block pulled by string or chain, through string wound around a pulley, or by a gearing device. This motion was used to trip levers consecutively, thus opening doors, activating statuettes, causing balls to fall on gongs, moving eyes, heads, or bodies of figurines, or turning globes or models of the heavens. Water was also used to force air in such a way as to blow whistles and to sound pipes.

This body of knowledge concerning clockwork and jackwork arrived in Euope in the thirteenth century, associated with ideas about perpetual motion machines. By 1320 the

water clock was adapted to the working of complex automata simulating the Ptolemaic universe. The famous de Dondi astrarium or planetarium, completed in Padua in 1364, had the primary purpose of depicting the motions of the sun, moon, and the five planets according to the geocentric theory. A series of edifice clocks were constructed at Strasbourg and throughout Europe during the sixteenth to eighteenth centuries. These large showpieces were often a major feature of the great cathedrals. London's Big Ben belongs to this tradition. The association of jackwork with clock continued with mechanical clocks, carillons, and innumerable other figurines serving as part of these monumental automata.

clocks to computers

The clock is the technological ancestor of the modern computer, and is the prototype of the complex scientific instrument. Probably the development of the clock was vital to the rise of experimental physics. But the mechanical clock, like its ancient predecessors, seems not originally to have had the primary purpose of telling time. The early monumental clocks in Europe were showpieces depicting eclipses and the motions of the heavenly bodies, and computing the church calendar. The keeping of time and the ringing of bells at intervals was a by-product of their main function of enhancing an awareness of the greatness of God in his orderly creation.

Myths and legends of fantastic automata were rampant during the Middle Ages. The philosopher Albertus Magnus (1204-1282) was reputed to have constructed a mobile robot. Oracular heads were common: Pope Sylvester II devised a speaking head which made prophesies, and Roger Bacon (1214-1292), who had a reputation as a magician, constructed a similar device. Stories of man-made creatures of flesh and blood made by alchemists and occultists go back at least to the beginnings of the Christian Era. Hebrew mysticism contained formulas for making an artificial man. These cabbalistic procedures had to be carried out during an ecstatic state by combining sacred letters representing the basic attributes of the deity. The famous robot called the *golem* was reputed to have been constructed in 1580 by Rabbi Loew of Prague. Tales of these types survived into modern times in such works of fiction as Goethe's *Faust* and the horror story *Frankenstein*. The latter book, by Mary Shelley, was influenced not only by the golem legend, but also by discussions between the poets Byron and Shelley on the implications of the work of Erasmus Darwin and Galvani on the chemical and electrical characteristics of protoplasm.

Descartes (1596-1650), the philosopher who invented analytical geometry, extended the idea of the machine to the bodies of living beings. It seems likely that he was influenced by jackwork or other automata which he had seen in Europe. There is a story that Descartes himself long considered the construction of a human automaton. According to one tale, he actually built a gorgeous blonde robot named Francine. However, during a sea voyage her packing case was accidentally opened, and the captain of the ship, thinking she was the work of a sorcerer, threw her overboard.

During the Renaissance another line of technological development took the form of devices in grottoes in the fancy gardens of the aristocracy. Elaborate fountains and waterfalls were built, following ancient Greek hydraulic principles, with complex automata which moved and sang. In the royal chateau of Henry IV of France (1698) a number of connected grottoes and fountains depicted famous mythological characters in action. In the largest of these chambers the legendary hero Perseus, fully armed, descended from the ceiling with a sword and killed a dragon rising from the water.

Still another branch in the evolution of machines was the production of musical automata. These gadgets, which survive in our little modern music boxes, were very popular for centuries. Numerous automata called androids were constructed, perhaps as early as the fifteenth century, in which human figures played the piano and other instruments. In 1599 Queen Elizabeth of England made a gift of an organ clock to the Sultan of Turkey. The mechanical organ was first described in the seventeenth century. During the eighteenth century a large variety of androids and other automata, such as singing birds enclosed in snuff boxes, were manufactured and sold all over the world.

The skill of the clockmaker gradually combined with the craft of the jeweler, resulting in the production of numerous fine works of mechanical art. As has been stated, the art of making complex and delicate instruments, a development indispensable to the rise of science, is traceable to the clockmaker. The Pascaline, the digital computer built by Pascal in 1645, made use of the same type of technology as the elaborate musical automata which were built during this period.

early logic

The idea of a calculus to explain all natural phenomena stemmed from the "Art" of Ramon Lull (about 1272). Lull conceived of a device, which can be thought of as an early type of logic machine, embodying a universal algorithm. This Art became one of the major intellectual forces in the Renaissance, and is known to have had an important influence upon both Descartes and Leibnitz.

Lull developed his Art as the result of an ecstatic vision (just as Descartes conceived of analytical geometry in a dream). The conception behind his idea was that the entire universe stemmed from basic archetypes or principles preexisting in the mind of God. These were the fundamental exemplars of all created material things, and consisted of such divine attributes as Goodness, Greatness, Eternity, Power, Wisdom, Will, Virtue, Truth, and Glory. These principles expanded into all of the levels of the natural world. Thus, Goodness initially emanated into the goodness of angels, next into the goodness of heavenly bodies, then into the goodness of man, etc.

In its simplest form, the Art of Ramon Lull consisted of a set of concentric revolving wheels, on each of which was inscribed the names of the archetypes. By turning the wheels, it would be possible to form every possible combination of the basic factors. In this way, the characteristics of any created thing could be calculated. Since Lull thought within a Ptolemaic world view, his technique could be applied to astrology to predict all earthly events.

In a certain sense, it might be stated that Ramon Lull sought to create an idol. For if his Art had really worked, it would have been possible to simulate completely the workings of God in his creation. But Gödel and Turing have proved that Lull's dream cannot be attained, for no axiom system or Turing machine can comprehend all of reality. It could be said that, although Turing helped provide the idea for the modern computer, he also showed that it is idolatry to overestimate its capabilities.

(For further information on Lull the reader is referred to the work of Frances A. Yates. Some of the leading historians of automata are Derek J. de Solla Price, Alfred Chapuis, Silvio Bedini, and Robert Brumbaugh.) ■

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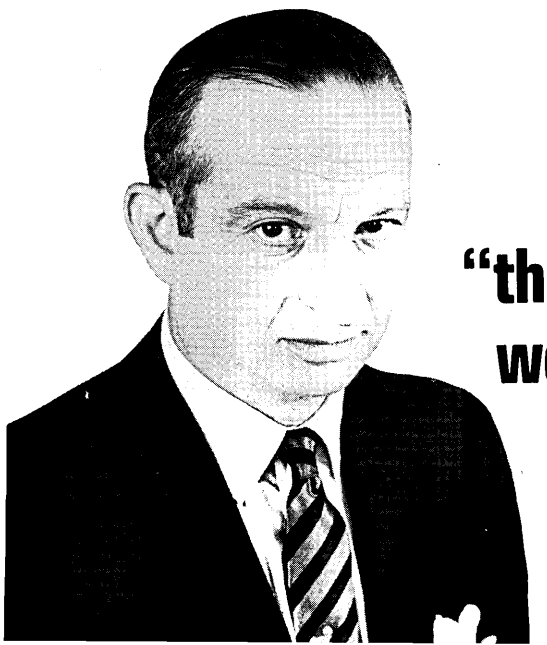

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Some plain talk about communications processing

Historically, computers have been viewed as automatic devices for numeric computation or volume data processing, and advances in computer technology have almost exclusively involved increases in these capabilities.

Today digital computers are faster and more powerful than ever. But the technology of data collection and dissemination has not kept pace.

Because of the urgency of much of the information processed by the computer it is essential that it respond within a time frame that its results can be meaningfully utilized. And so it has become vital to transmit input data directly from its source to the computer and output data directly to its destination. Furthermore, in order to ecnomically distribute the power of a large scale computing system, or to effectively utilize the inherent value of a centralized data bank, it has become necessary to communicate directly and simultaneously with many geographically remote areas.

To meet these demands the computer came to be used not only as a computational device in the traditional sense, but as a device for the control of the communications network itself.

In order to perform this function, of course, a portion of the computer's time was required. But to the extent that a computer performs communications and control processing, its capacity to perform its conventional computation and data handling tasks is diminished. More importantly, the real loss in having the central computer handle communications and control processing is that it was not designed for these purposes; often its capabilities can be adapted to such uses only in a cumbersome manner (for instance, it may not have the proper character handling instructions), or it has expensive capabilities which cannot be effectively utilized (floating point instructions, for example).

Here's what it means in dollars and cents . . . if you have a $1 million computer, and 30% of its capacity is taken up with communications processing (in many systems the percentage is much higher), you really have a $300,000 communications processor.

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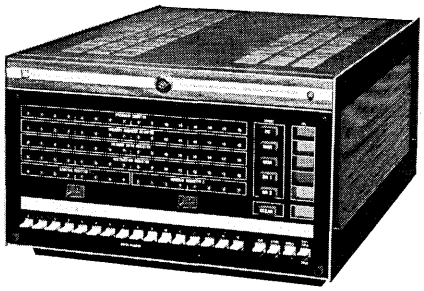

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Photo and Carol, courtesy Wells Fargo Bank

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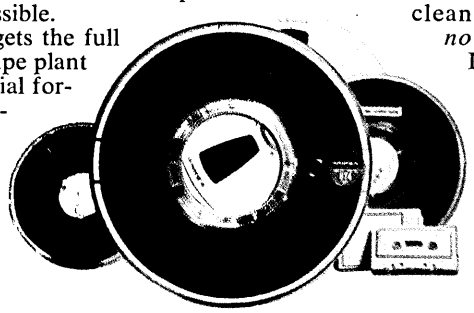

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1969: AN OVERVIEW OF THE NEWS

by Aubrey Dahl, Associate Editor

The 60's have passed, a political and social decade for the ages, a time when the computer took its place in the function of society, when it became the tool of man in the most mundane and most magnificent of enterprises: It continued to keep track of invoices, and it landed men on the surface of the moon.

It would seem fitting that the last year of a decade should be focal, should be the culmination of 10 years of events, should provide some answers—but this seldom is the case.

1969 was, however, the impossible year of the Jets and the Mets.

It was not, lamentably, the year that trends and directions became clear, although trends and directions seemed to abound. To call it an explosive year for the industry would be tiresome and iterative, because explosiveness has been a continuing phenomenon of the decade for the computer. It was, instead, a year for taking stock (including options and profits), and watching the industry expand instead of explode.

And it was the year of the lawsuit and the announcement of the unbundling.

Control Data Corp. was the first to file suit against IBM, in the last month of 1968, charging violation of the Sherman Antitrust Act. The second legal action against IBM was instituted early in January by a leasing firm, Data Processing Financial & General, which charged violation of the antitrust laws, the Consent Decree of 1956, and state unfair competition laws. (Allusions to the Consent Decree were later ordered stricken from the complaints by Federal District Court Judge Phillip Neville in St. Paul, Minn., ultimate site of the firms' antitrust proceedings. He did, however, reject IBM's plan that would have required the plaintiffs to prove market damages before they would be allowed to look over IBM's books. They now will be entitled to go over the books in "simultaneous discovery" proceedings.)

The Dept. of Justice shortly followed suit with a suit of its own, filed the day before Lyndon Johnson left the Presidency in January.

Applied Data Research, Inc., Princeton, N.J. software firm, was the third commercial company to file an antitrust action (in April), to be followed by Programmatics, Inc., an L.A. based software firm (which ADR later acquired) that followed a different tack by seeking an injunction to prevent IBM from distributing without charge its 483 Sort program, a successor to the 450 Sort, with which Programmatics proprietary package, Pi Sort, operates. Programmatics contended that IBM developed the new program (Pi Sort isn't compatible with it) to shut the software house out of the market. The injunction was denied and Programmatics is appealing.

The four firms' suits will be heard on a consolidated basis, and speculation is that IBM will attempt to negotiate for another consent decree, which could take around four years to establish.

Lots of people sued lots of people in 1969. Scientific Control Corp., Dallas, sued CDC and its subsidiary, Commercial Credit Corp. (the complaint since dropped), for allegedly reneging on a $4.5 million loan. SSC badly needed the money, as was evidenced in November when the firm filed a petition for protection from its creditors under the provisions of Chapter 11 of the National Bankruptcy Act. For the first FY quarter ending July 31, SCC had a net loss of $1.6 million on sales of $2.5 million. The loss was blamed on expenses incurred in product development and the more than $1 million spent on organizing and staffing a national marketing team. The company reportedly has a $40 million backlog and expects to attract the necessary financing to stay in business.

CDC already was fighting a suit for patent infringement, charged by Potter Instrument Co., Inc., in Plainview, N.Y. IBM sued Cogar Corp. for allegedly misusing trade secrets. Itek Corp. sued RCA for allegedly infringing a patent on an electronic photocomposition system in the construction of the RCA Videocomp. Motor Replacements, Inc., sued IBM for $5 billion (it was a "class" suit, in which all IBM computer users were represented by MRI) charging that because of unbundling IBM would not follow through on an agreement to provide "lifetime programming services" without charge. As in all suits against IBM, the defendant denied all, and promised to defend itself vigorously.

In still another suit, Greyhound Computer Corp. filed against IBM for unbundling, declaring that the policy would drive them out of business, and that the 3% cut in hardware prices would make it impossible for them to get back their investment in the required period of time. IBM retorted that Greyhound was the only leasing company that agreed to provide equipment at a guaranteed level below IBM's pricing, thus making it mandatory for Greyhound to cut its own prices.

Aside from the suits against IBM aimed at breaking up the empire, the raft of other legal actions that continued to float over the industry seemed to indicate a widespread case of the jitters in a business that is beginning to shake out and is not yet keyed to the rest of the nation's economy. An atmosphere of self-protection and perhaps even a form of professional paranoia seems to be replacing the excitement and good will that personified the early days.

And in 1969, the heretofore esoteric world of the computer found itself in the real world as some of its constituents made themselves heard on such controversial issues as the antiballistic missile system and the war in Vietnam. Raucous but concerned voices were raised at the SJCC panel titled "URGENT—Increased Dialogue With Society" as a group called the Computer Professionals for Peace vocally protested what seemed to them the bland nature of the panel proceedings in vocabulary that included Anglo-Saxon expletives (four-letter and otherwise) normally reserved for more private verbal punctuation. The gathering was upset,

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which certainly must have been one of the intentions of the CCP, but the import was clear: a significant segment of computer people, primarily young people, is, like the young everywhere, challenging the traditional concepts of its elders and demanding that attention be paid to the social implications of the machines that enable men to shoot at the moon and at each other with ever-increasing efficiency.

And it was the year of the announcement of the unbundling. On June 23, possibly in reaction to the antitrust suits, although IBM insisted the move had been in the works for some time, the dominant computer manufacturer told an expectant industry (IBM had announced in Dec. '68 that it was going to make an announcement) that effective Jan. 1, 1970, it would separate hardware and software prices and also would charge for theretofore "free" programming maintenance by field engineers and systems engineering help. IBM also put a price tag on professional-level edp education courses.

Reaction to the unbundling was varied, optimistic, diverse, pessimistic, dissimilar, and cautious. Software entrepreneurs generally were hopeful that IBM's separate pricing of software would enable them to compete more formidably than in the past, but there also were those who feared that IBM would establish such low prices on programs that competition would be difficult.

Much the same hesitant stance could be found among the mainframe manufacturers, most of whom dithered a lot before making their own unbundling decisions, which, for the greater part, were equivocal. Control Data, perhaps in an effort to come to court with clean hands, went even further than IBM in unbundling by not only separating

"It was the year of the lawsuit and the unbundling announcement."

prices for the same goods and services as its opponent, but also separating maintenance support. Also unbundling in varying degrees were General Electric, Burroughs, National Cash Register, and Xerox Data Systems. Electing to absorb the costs of services and software were RCA, Univac and Honeywell.

The full impact of the lawsuits and the unbundling could only be speculated on as 1969 ended and the separate pricing went into effect. IBM might be split up into four $25 billion corporations; its fees might be high enough to force users to seek outside services, or be so competitive that competitors might wish for the good old days, or none or a combination of the foregoing. Some results will be forthcoming when users receive their second-quarter bills in 1970. On to the wailing wall.

1969 was the year a quarter of a million antiwar demonstrators walked the streets of Washington, D.C., one day calling for peace in Vietnam. And it was the year another quarter million gathered in Woodstock, N.Y., to groove in a farmer's pasture.

One of the more pressing matters facing the industry, the people and their Congress was the issue of personal privacy. As credit, banking and insurance firms continued to amass large data banks of their own, the Congress toyed with the idea of a federal data bank and considered a bill that would give credit customers the right of access to their personal files. Many state legislatures also were trying to determine the proper procedures necessary to protect the consumer from invasion of privacy. The census questionnaire, due to be distributed in 1970, is sure to provoke further agitation over the rights of government to inquire into the private affairs of its citizens.

The struggle for standards in the industry continued as slow, inching strides were made toward a desired conformity. The Army, Navy and Air Force all settled on the USASI standard for COBOL compilers, effective Jan. 1, '70, but nothing was said about nonstandard extensions. PL/I was given new life as an X3 committee was formed to evaluate it once more, and then late in the year BEMA voted to dissolve X3.4, the Subcommittee on Common Programming Languages, and the future of PL/I will probably rest with SPARC (Standards Planning and Requirements Committee), which will cooperate with ECMA (European Computer Manufacturers Association) on an international basis. X3.4 was only the first of all the X.3 committees that will be phased out. ASCII was finally approved as a federal standard, but the battle between OCR-A and OCR-B continues as machine-readable and human-readable proponents remain

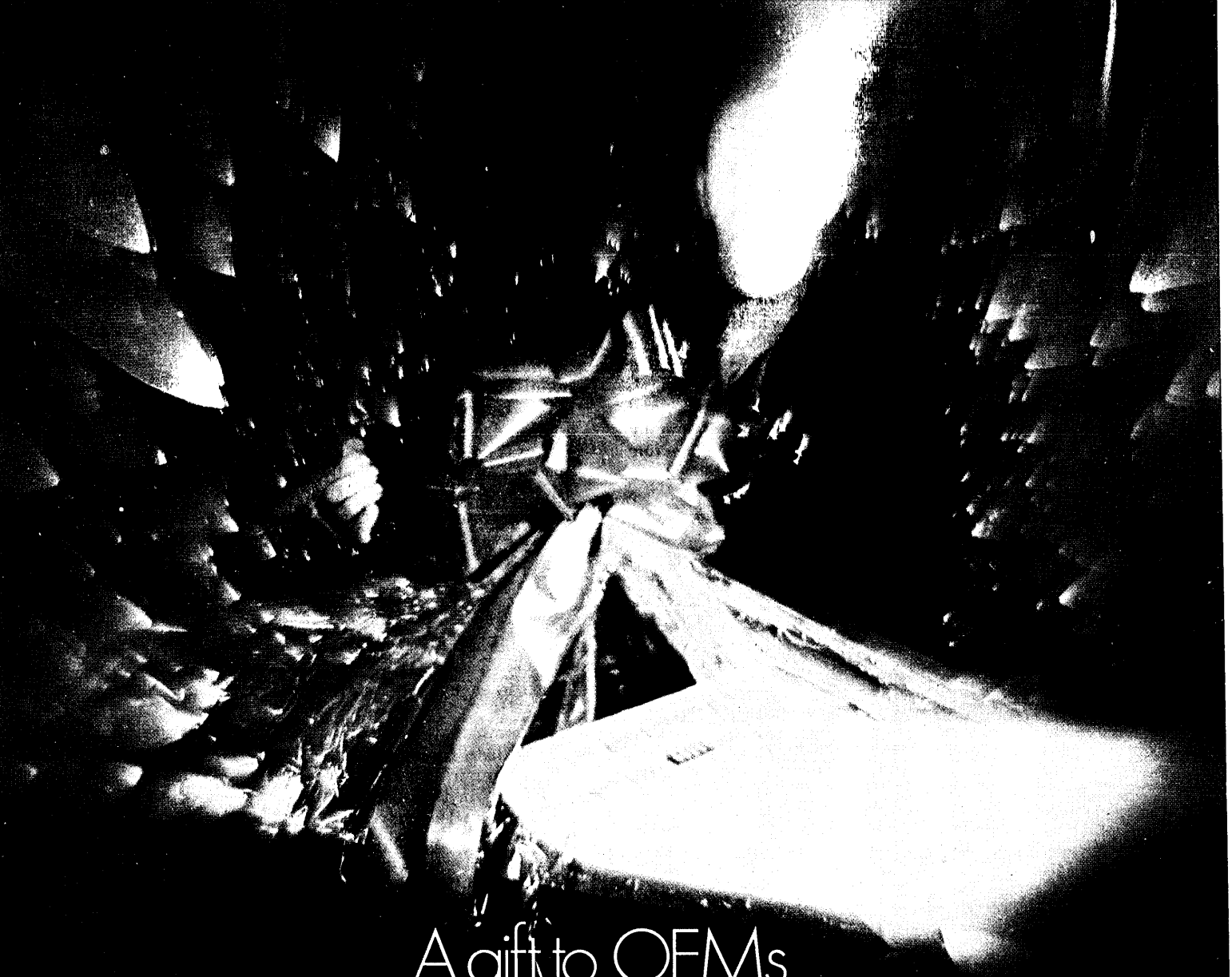
"Personal privacy was one of the pressing matters facing the industry."

locked in contention. Delay in standards has become standard.

In terms of delay, one involved observer's view of the year is that "In 1969 we delivered what we promised in 1967 for use in 1968. In 1964, we ordered third-generation equipment, in 1965-66 we installed it. 1966 and 1967 were totally devoted to converting and learning (in that order). By 1967 we had fulfilled the promises we had allowed the salesmen to goad us into, and so that year we made promises all by ourselves and delivered the big on-line systems with integrated files, the network of terminals, etc., just one year late—in 1969. In addition, many users (quite a few in government) finally got their third-generation equipment and started the conversion cycle themselves. There was even some price-cutting, since the third-generation machine is almost at the end of its manufacturing life. Finally, in 1969 some shops at last received reliable third-generation software and began practical exploitation of multiprogramming."

Beginning its manufacturing life in 1969 was System/3, IBM's new low-end accounting system for the small business user. System/3, with its small 96-character card, model programming packages, and special peripherals, did several things to the market place. It picked up thousands of new users (although there reportedly is slippage in delivery), signaled more specifically how IBM would be pricing under unbundling, and temporarily barred outside peripheral makers from that market because of the unique peripherals. One observer noted that System/3 psychologically primed the small business user for computer use and, consequently, he is thinking computer and may also look at other manufacturers, opening up new markets for them.

The stock market flattened out during the year. It was in 1967 and '68 that the front offices of brokerage firms shamelessly pushed the glamour computer stocks to undreamed of price/earnings and price/no earnings multiples, while the back offices suffered from the ills of nonexistent or shamefully poor computer operations. Hundreds of new companies and stock issues appeared. By mid-1969, however, world events, inflation, and the accompanying high interest rates eroded stock market optimism and the availability of venture capital. Though new firms continued to



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proliferate and go public, hundreds more appeared in the merger and acquisition column. Some had never received their "second money" from original investors; others, though sound, sought the greater financial stability afforded by older, more established firms in and outside the industry; and still others had overestimated their markets, product, and business sense.

One of the noteworthiest acquisitions was that of profitable, "old-line" Scientific Data Systems (which became XDS) by Xerox Corp., and the kind of copier that will emerge from that merger remains to be seen. In other developments, Electronic Data Systems tried to acquire Collins Radio and was rebuffed, and System Development Corp., longtime semisubsidiary of the Air Force, evolved a plan to convert itself into a profit-making firm and ultimately to go public.

And another company was heard from in uncertain terms in 1969. Viatron Computer Systems, Inc., continued its barrage of advertising to sell its System 21, the $39-a-month "computer station" that uses LSI, and even announced two new "low cost general purpose" computers at $99 and $199 a month to operate with System 21. Viatron racked up losses of $5 million in the first nine months of the year, but it made its first two deliveries in November (won't say where or to whom . . . it doesn't want the initial users inundated with inquiries as to how it does or doesn't work) and is said to have a tremendous backlog. It also has adopted a novel marketing approach, is now selling and leasing its gear through regional companies, most of them software houses.

It was the year California was supposed to sink slowly in the West and disappear as the result of an earthquake, according to sayers of sooth, but it didn't.

It isn't known whether the moon quakes but the world did as Armstrong and Aldrin in Eagle settled slowly to touch down on the lunar surface. The navigation and guidance computer on board became overloaded because the rendezvous radar was inputting redundant (at that time) navigation data on the position of the circling command module, Columbia. The issue was whether to abort the landing and it was two groundling heroes, guidance

"In 1969 we delivered what we promised in '67 for use in '68."

officer Stephen Bales and astronaut Charlie Duke, who resolved it. They told the crew to keep the onboard computer loading to a minimum by not interrogating the processor about the status of the landing radar unit and letting ground monitor take over the job, directing the information to the crew as the module descended. Bales then called out the landing radar information, which was relayed immediately by Duke, and the Eagle settled to its perch on the moon. The giant step soon followed.

Another computer-related government effort was President Nixon's job data bank program, which is now in operation in over 20 major U.S. cities. Secretary of Labor George P. Schultz estimates that more than 100,000 jobs will have been filled by this method by mid-1970. It will be installed in over 55 cities by June '70.

And in 1969 Lana Turner headed for her seventh divorce. One more and she'll be octal.

Then there are the trends. Facilities management, minicomputers, and key-to-rotary memory seem to have been the most apparent during the year. With the unbundling, there suddenly appeared numberless former IBMers and others who can manage your facility better than you or IBM can. And maybe they can.

The minicomputer story was the 16-bit machines, the PDP-11, just announced, the Supernova, the PDC-816 from Computer Automation, the General Automation 18-30, Varian's 620i, etc. The future story revolves on which of the minicomputer companies will develop into full fledged marketing entities—contenders are Varian, Data General, Computer Automation and General Automation, with DEC and Hewlett-Packard already there. Redcor and Interdata are after it, too. And prices are dropping.

Keyboard-to-rotary memory data entry was a new development in 1969 and most of the companies in the market are less than a year old, with only a few having systems in actual operation. Computer Machinery Corp., the first to announce entry, seemingly has the lead in the field, with Realtronics and Logic Corp. following. Since then, Consolidated Computer Services of Canada, Systems Engineering Labs, Penta Computer Associates, Inc., and Inforex have

"Penta's pigeons perched precariously."

joined the group. Essentially, the keyboard-to-rotary memory data entry system comprises a number of keyboard terminals (usually 16 or 32), a supervisory terminal, a small computer, a mag disc or drum and a tape drive, and it's all to optimize input.

Penta figured one way to publicize its product was to send homing pigeons to key computer executives with an interest card attached for the exec to fill out and return with the pigeon to a Penta hq somewhere. Only trouble was, the pigeons were not trained to home anywhere (they were simply obtained from a bird farm in Ohio) and, at last report, many of them roost atop the execs' office buildings, from where at least they might be able to wreak some kind of revenge.

And there were computer applications just as frivolous (or pertinent and meaningful, depending . . .), such as personality analysis by computer utilizing those ever-popular sciences of astrology and graphology. Or rating football teams (was Namath programmed?) and baseball teams (Ron Swoboda?) and a date reminder service (your mother-in-law's dental appointment) and somewhere, someone was trying to determine the probability of the Creation.

Serious applications were being developed and effected covering the range of national activity. The computer loomed increasingly important in the operations of the stock market, hospitals, education, ticket reservation systems, and retailing, with predictions that its use in credit operations and purchasing would become the biggest factor in the continued growth of the industry.

Many events occurred during the year that deserved and were given headline stories, but we'll deal with them here in the "Shortlines" format borrowed from the News Briefs section: Leasco attempted to acquire Britain's Pergamon Press in another effort to diversify, bought 38% of the stock, and then sued for the $22 million purchase price, claiming misrepresentation, and was countersued . . . New firms and mergers and acquisitions climbed steadily in numbers, and, after stock profits were realized, nonmergers became daily announcements . . . the proliferation of similar company names caused confusion and will continue to do so . . . More

2 ways to design a CRT terminal into a system:

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(2) On the other hand, yours may be a special-purpose system which calls for a special terminal design.

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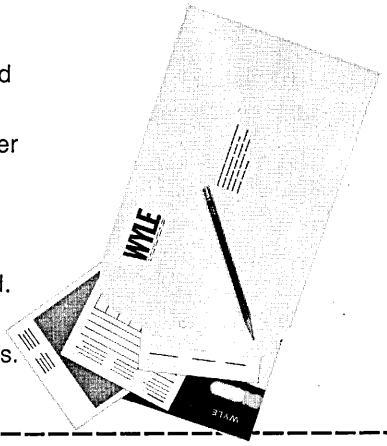

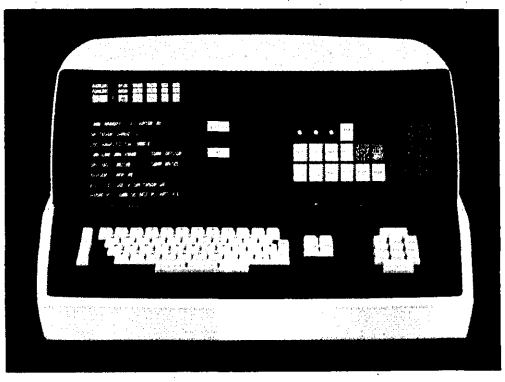

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service centers sprang up but things don't seem to be going well for them . . . The ACM was in financial trouble and AFIPS will run ACM's 1970 convention . . . SICSIC, ACM's committee on social implications, was killed in a flurry of misunderstanding and then was reborn at the ACM San Francisco meeting . . . There was a riot at Montreal University over suspected racial slurs and several computers were destroyed, perhaps indicating the need for off-campus duplicate protection . . . The Department of Defense is still the world's biggest computer user, with 14,000 computers of one kind or another spread throughout its domain . . . West-to-East export tariffs were eased slightly . . . And Commander Grace Hopper was named DPMA's Man of the Year.

And the industry lost three gifted and beloved pioneers: Ascher Opler, whose contributions were legion and legendary; John W. Haanstra, vice president and general manager of GE's Systems Equipment Division, who was a moving force in the development of IBM's 1401; and Warren S. McCulloch, one of the earliest theoreticians, who collaborated with Norbert Weiner and Walter Pitts in the development of the concept of cybernetics.

The industry matures.

The 70's are with us. What they might bring is forecast elsewhere in this issue for us by predictors who are ever fearless. But if we are not to ignore the past, it would seem that all but the most outrageous predictions will be outstripped by the coming realities. And even the most outrageous may come to pass.

There were men on the moon in 1969. ■

the changing emphases

HARDWARE, SOFTWARE TRENDS: 1969

by R. A. McLaughlin, Assoc. Editor

Several new or continuing trends were evident in 1969's proliferation of computer products. Among them were the selective lowering of many prices, a greater emphasis on input/output processing, and the expansion of new markets for specialized peripherals and dedicated processors.

The prices of computer components and subsystems from core stacks to minicomputers have dropped dramatically over the past 12-18 months. Computer related products are now being produced in such quantities that they are vended as from a retail store catalog. Certain common core stacks, for example, can be bought in quantities for 50% of what they sold for 18 months ago. On a tiny component level, the gallium arsenide diode used in optical memories, infrared-sending data set replacements, and photosensing card readers has fallen in price from $10 to $2 in the same time span. The end user saw this volume buying and building reflected in such things as price cuts from 19% to 38% in the sale price of some minicomputers, and in stiffer competition on the part of the manufacturers for his hardware dollar.

Part of the higher volume sales of the minicomputers can be explained by the increased application of the mini as a building block in a dedicated, specialized processing system. As an example, several years ago Fourier transforms were something for Cooley and Tukey to write a thesis on. Last year, a half dozen manufacturers constructed special processors around the transformations for use in vibration analysis and seismic data processing. Similarly, many minicomputer or midicomputer manufacturers constructed communications concentrators and front end processors from their devices.

While the processing element has found itself being used increasingly as a building block, the communications, I/O, and even digital control aspects of computer systems have been receiving special attention. This trend has been most apparent in large scale systems, but even a minicomputer must have sophisticated architecture to get by in today's marketplace. That wasn't always true.

The market for specialized processing and control systems was not the only one to come in for additional attention. Two kinds of peripherals shared in the interest. First, there was a rush to build plug-to-plug compatible full-size peripherals like IBM-compatible tape handlers and disc drives. This may have been precipitated in part by an increased willingness on the part of the government and some sophisticated users to consider buying these items from a vendor other than the mainframe supplier.

Second, at the other end of the size scale, a new family of peripherals may have been quietly gathering. Desk-top or table-top magnetic tape units, disc drives, printers, and card equipment are already commonplace, but the introduction of a digital magnetic tape cassette drive may have signaled something new. The cassette could be the front-runner of a whole family of really tiny peripherals for minicomputers and terminals, and that family might extend in the 70's to include multiple-spindle disc storage subsystems and other imaginative miniatures.

Probably the most important product development of the year was IBM's System/3. Although the figures have not been officially released, rumor has it that the small business machines have already been spoken for in twice the quantity that IBM expected. The small scale processor reached a very broad and relatively untapped audience by offering in-house data processing capabilities of a high order at a relatively low price. The system did not meet with complete acceptance, however, because IBM chose to give the machine a new card format—the 96-column mini card—and a 6-bit BCD character code rather than ASCII.

At the super-scale end of the computer business there were two developments that may portend future architectural changes in all machines. One development was the use of an intermediate computer memory, a small fast core or LST cache that interfaced the cpu with main core and

made the larger core look like it had a much faster access time. The second development was the implementation of an elegant set of logic referred to as Tomasulo's algorithm, a hardware/software strategem that makes it possible for a single processor machine to overlap arithmetic instructions as if it had redundant arithmetic processors. Applying these two lessons to smaller computers could result in significantly faster machines at a relatively low hardware cost.

If any single hardware technology stands out in 1969's products, it is optics. That sounds like a strange statement, but new products like remote optical character recognition terminals, optical read-only memories, infrared-sending transceivers, and laser-based tape memories all came into prominence during the year. Computer output microfilmers, which are also optical devices, broke through at least one price/performance barrier during the year. One of these even used fiber optics to form its characters. In addition, laser displays and a photosensitive data cell memory were also introduced.

The software side has had different problems. It seems to be still gearing up for a bigger push. A thousand vendors are out there, many of them selling similar packages. To help them sell against each other, software marketing firms have come into existence. To help the user buy, a couple of vendor rating services and software encyclopaedias have sprung up. There are even services that do almost the entire job of contracting for software, including helping to write the program specifications, taking bids, determining if the software produced meets the specifications, and comparing software products.

One unexpected source for programs turned up, too. Big companies that have traditionally written a good deal of their own programs decided to market them. If many aerospace firms and big businesses get involved in this, a vast software reservoir may be opened. Price competition may be hurt a little, because the big firms have already absorbed the program development costs and anything they make on a package will be gravy.

Finally, as if to prove the economy of buying software package goods, one vendor wrote and sold a program for computing the efficiency of in-house analysts. That ought to be enough to jolt almost anyone.

The biggest problems that result from all this hardware and software growth are not really hardware or software related. As a processor gets smaller, and less expensive, and maybe more job-oriented, the most critical question becomes: "What do you do with it?" Large scale circuit integration holds the promise of a nearly-expendable processor on a wafer. Expected this year is the delivery of a $1000 processor on a card, limited in power admittedly but not in application. When the computer thus becomes a building block and its program is a plug-in too, what application do you plug it into? The choices are waiting to be found. ■

WASHINGTON REVIEW AND FORECAST

bell baiting

by Phil Hirsch, Washington Editor

The top Washington story of 1969 was Ma Bell's battle with the dp industry for control of the national telecommunications network. Troops on both sides slogged through an ever-deepening swamp of paperwork as the year progressed but, despite much action, there was little progress.

When the year began, AT&T was on the defensive as a result of the FCC's Carterfone decision in the summer of 1968. Basically, the decision directed the company to let telecommunications users connect independently made modems and acoustic/inductive terminals to the switched telephone network. Bell had been the exclusive supplier of this equipment previously. AT&T responded to the order by filing new tariffs permitting the use of foreign attachments, provided they were connected to the telephone system through interfaces supplied exclusively by Bell.

Most users, together with the Department of Justice, indicated this arrangement would leave AT&T with as much power as it had before to control telecommunications services and prices, and to keep out competing terminal equipment suppliers. Some critics thought the tariff should be rejected; others felt it should be accepted temporarily while FCC explored the monopoly question in a formal hearing. The commission ultimately decided to accept the tariff and hold an informal conference.

Commissioner Nicholas Johnson dissented, and the Justice Department protested, arguing that these conferences would only prolong the controversy without resolving it. But the FCC majority refused to be swayed. Several users said privately that Ma Bell had won a major victory.

The conferences didn't get started until last fall. They will continue throughout much if not all of 1970. The key question facing the conferees is the same one presented to the FCC in the Carterfone case: does AT&T (and the other established communication carriers) have too much power over telecommunication services and prices?

There were several other developments at the FCC during 1969 which may affect the ultimate answer to that question:

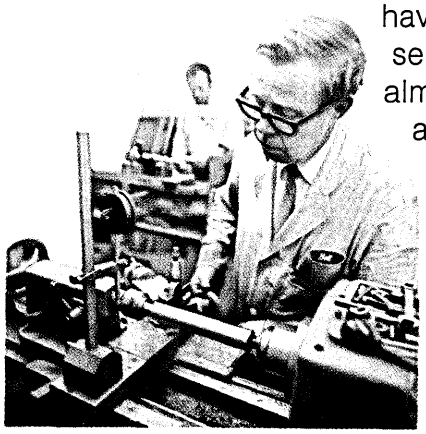
In August, Microwave Communications, Inc., after a six-

WHY WE STOCK PARTS FOR A VANISHING BUSINESS.

The unit record business is in such a state that it produces only about $500,000,000 in annual revenues in this country. Maybe only $600,000,000.

If that seems like a lot of money for a vanishing business, consider the fact that there are an estimated 600,000 punched card machines now in use at more than 40,000 installations.

A lot of equipment for a vanishing business. And it takes a lot to maintain our share of it. That's why we stock 16,000 parts, why we reconditioned over 3,000 machines during the past fiscal year, and that's why we have a customer service force of almost 1,000 men and more than 50 service offices.



Sometimes we wonder what it would be like in a business that wasn't vanishing. But after all this time we're used to it. People started waving handkerchiefs at the unit record business fifteen years ago when IBM brought out the 650. Then it was the 705. Now it's System/3 and we're getting the senior citizen treatment again.

Not that the unit record business hasn't changed. But changed is not gone. Punched card consumption keeps going up every year. Walk into just about any office and you'll find some familiar tabs and sorters and verifiers still churning away. Still doing the same jobs. Or doing new jobs, such as low-cost computer editing and back-up. Much as the IBM 1401 (remember when that vanished?) is now being used in support of more sophisticated computers.

And if you think the only people left in the unit record business are the brokers, you are invited to contact one of our sales representatives. He will assess your data processing needs and recommend the right machines for you. You can buy them outright, or you can rent them short or long term. Or both. However you choose to do it, you will probably end up saving money.

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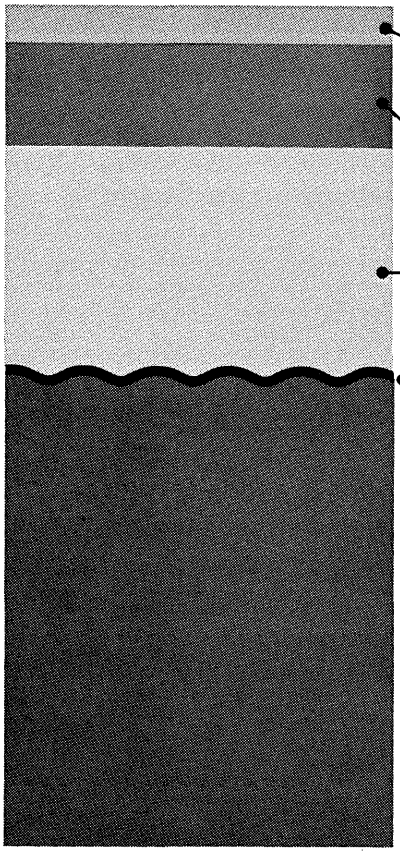

Even the color is different. The whole concept is different. From the surface to the substrate.

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A precision electroplated nickel-cobalt magnetic film. Our exclusive Polar Plating process, done under Class-10,000 clean room conditions.

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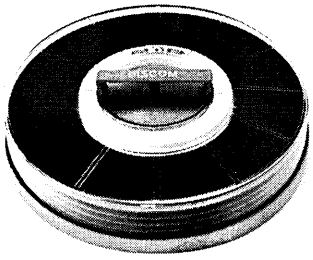

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year fight, won permission to operate a for-hire microwave communication service between Chicago and St. Louis. MCI's rates will be far lower than Ma Bell's, and MCI customers will have a far wider choice of line capacities, terminal configurations, and sharing arrangements, which should reduce their costs further. The major significance of the MCI decision is that it opens the door to creation of a nationwide communications network capable of competing with the existing data transmission services offered by the established carriers. MCI has already asked the commission

"With the FCC decision, Ma Bell had won a major victory."

for permission to extend its Chicago-St. Louis link, and University Computing Co. has applied for a license to operate a competing microwave system.

In the course of considering these applications, the FCC is going to have to decide whether it has the power to control interconnection among the systems of different carriers. Historically, such arrangements have been beyond government regulation, and Ma Bell, in an effort to limit the competitive threat posed by MCI and other commercial microwave system operators, is trying hard to maintain the status quo. But the commission, in its MCI decision, clearly indicated that Bell would either agree voluntarily to connect with MCI or face the prospect of being ordered to do so.

Another threat to AT&T's monopoly was implicit in the Stanford Research Institute's analysis of the growing interrelationship of computers and communications. This interrelationship was the subject of a lengthy FCC inquiry in 1968. The seven-volume SRI report summarized the responses and made several recommendations. One was that any responsible company wanting to offer data communication services should be allowed to do so. Government restraints should be designed only to prevent market cream-skimming and promote system interconnection. SRI also thought that no common carrier, except for Western Union and possibly GT&E, should be allowed to sell commercial dp services.

While the FCC was trying to convert the war between Ma Bell and the dp industry into a symbiotic relationship, the

"Computer programs can be patented, the court ruled."

U.S. Court of Customs and Patent Appeals made somewhat more progress in settling another dispute. In August, CCPA overturned a long-established government policy by ruling that computer programs can be patented, provided they encompass "unobvious" machine processes and clearly exclude operations performed manually (by pencil and paper, for example). But it remains to be seen whether patents will solve the software developer's problem. Distinguishing among competing claims is going to be difficult. Also, it usually takes quite a while to obtain a patent; many programs will become obsolete before this exercise can be completed.

Most software developers applauded the CCPA decision. Soon afterward, they received more good news when the IRS decided that software development costs can be either expensed or capitalized. Computer users who purchase software separately are given the same basic options, while those who buy on a bundled basis must capitalize their investment over the operating life of the hardware. One likely effect of the IRS ukase is that software purchasers will be encouraged to buy separately priced programs.

The Budget Bureau apparently has decided to give similar encouragement to federal dp users. This is one result of a three-day meeting BOB convened last September in Charlottesville, Va., at which federal dp users and industry representatives discussed the pros and cons of separately priced hardware and software. Federal development of standard interfaces that would allow independently manufactured peripherals to be mated with a greater variety of cpu's is another possible result of the Charlottesville meeting. These moves are part of a continuing effort by BOB—the chief dp policymaker within the executive branch—to promote standardization. A major accomplishment in that area during the year was adoption of ASCII as the federal government's information interchange code.

As the year ended, there were several other developments pregnant with significant possibilities:

It seems likely that, early this year, the FCC will authorize development of a multipurpose domestic satellite system capable of handling data.

GE and Com-Share are embroiled in a fight with Ohio Bell over charges for "information service access lines" (ISAL's) that may affect similar rates throughout the coun-

"Adoption of ASCII by the government was a major accomplishment."

try. Another possibility is that the ISAL fight will prod the FCC into assuming greater jurisdiction over this service. Operators of multistate commercial on-line t-s service centers say this move will get them out from under the thumb of state public utility commissions, whose competence and objectivity often leave much to be desired. Greater federal jurisdiction, add the service center operators, will also enable them to offer the same services to all customers. They can't do so now because of the different rates and terminal equipment configurations offered by various local telephone companies.

Late in 1969, DOD, after months of delay, decided to go ahead with procurement of the World Wide Military Command and Control System. Initially, 34 systems will be acquired. Ultimately, Wimmix could be the biggest general purpose computer buy ever undertaken anywhere. It is likely to affect IBM's dominance of the dp market, future development of transferable software, and standardization of other hardware and software within the federal government.

On Capitol Hill, the House Judiciary Committee is investigating the acquisition practices of Leasco, Litton, and ITT, among other firms; legislation aimed at curbing conglomeration is a possible result. A related effort was launched in the House Banking Committee last year, when it considered legislation curbing one-bank holding companies. Late in the year, the House passed a bill that contains a number of restrictions desired by the dp service industry.

The House also passed and sent to the Senate a bill that would permit greater trade with the Iron Curtain countries. The Senate, meanwhile, approved another measure that would give consumers greater access to their credit bureau dossiers. And a computerized information retrieval system for the House was being considered. ■

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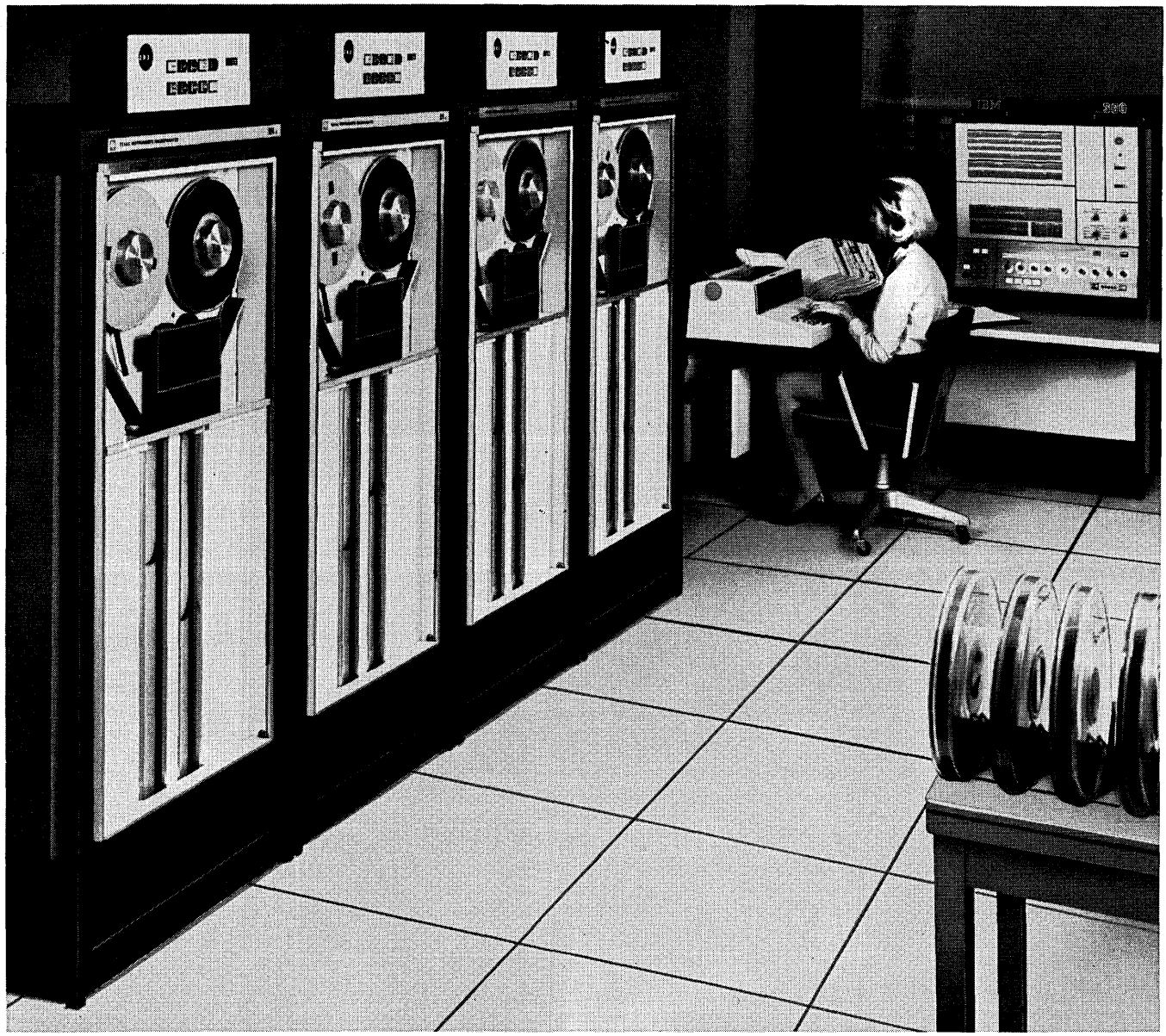

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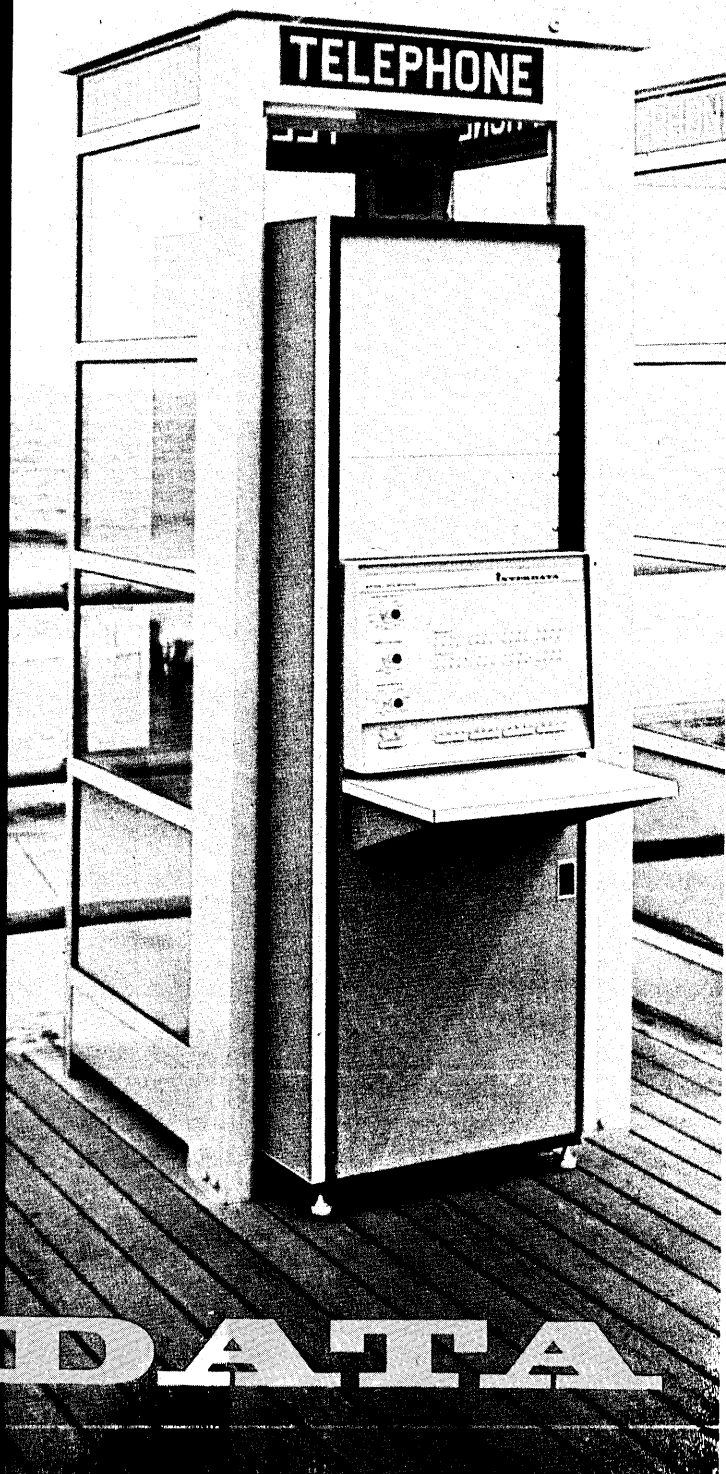

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COGAR: The Mind Joggers©

ALSO SPRACH VON NEUMANN

by Eric Blodax
with illustrations
by
Stew Burgess

PROLOGUE: When the editor of DATAMATION suggested that I write a nostalgic series on the early days of digital computing, I thought it was a dumb idea. In fact, I was insulted. After all, the editor referred to me as a "genuine old-timer." I know I'm genuine, but I'm not that old.

However, after honest contemplation, I must admit that I have been around "computing," whatever that may be, for a long time. I've been in the machine room, and the keypunch room, and the programming room, and the logic design room. I've been in the circuit board room and the solder dip room, and in just about every other room with occasionally too little time to make the bathroom.

I did not work on the Harvard Mark I, as some of my friends did. But I did work with some of the squirreliest contraptions ever called computers. It may be, in fact, that a cross section recounting of how it used to be may help put some of today's wet-eared, callow kids in their proper place. They may even realize how soft they have it with their preprinted coding forms and their big paychecks.

This is *apologia in toto,* if any be required or excusable, for what follows.

It all began by accident. There is no sensible reason that I should have been swept up into the computing business. I might have had a perfectly respectable job in used car sales or in burglary, but it was not to be. I was actually enjoying a perfectly fine job as a junior engineer, grade B, in the Airship Foundry. I was in full charge of a small group of sweaty ladies who did engineering calculations by poking at a room full of rickety Marchants[1].

Then Old Robert came along. I call him old because he must have been nearly 30 at the time. Besides, I change his name as I frequently do in this opus in order to protect the guilty.

Old Robert was a new, hot-rock hire out of the Competing Aircraft Corporation of America. Competing Aircraft exercised its advertised leadership by being way out front in the application of computing to new design glitches. Robert had become disgruntled when some ten-dollar-a-day administrator misplaced his parking pass, and he had to walk into the plant from Glendale. Robert was thus gleeful when he was hired into our Way-Out-Research Staff by Dr. Attenuator, our beloved and fearless old leader. Robert arrived at the Airship Foundry in due time to teach all us clods how it really was out in the modern world.

Robert promptly recruited me to become the first "programmer" in the place. This was an obvious wise move on

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So every day we launder 500 dacron cleanroom uniforms. And we do it in a special cleanroom on our own premises, where automatic particle counters keep track of airborne contaminants down to 1/2 micron.

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CIRCLE 209 ON READER CARD

Robert's part, since it promptly got him out of the programmer class and made him a supervisor.

The scientific equipment, most of which we "borrowed" from the accounting people, was overwhelming. We had a machine called the "IBM 603 Calculating Punch." It looked like a suitcase cabled to a coffee grinder, or, possibly, a milking machine. You could see giant tubes glowing through the slits in the suitcase.

The opcode set of the 603 was a trifle limited. It could add and subtract and multiply, but it couldn't divide. We had to go back to the Marchant to calculate reciprocals, then keypunch these into cards so the 603 could read them. The necessity of doing this made engineering use of the 603 somewhat difficult.

Memory capacity of the 603 was also a bit small, since it had exactly zero memory locations. Programs were held in the wires of a tiny, enigmatic IBM plugboard.

Since mean time between failures of the 603 was very short, we were never able to complete a problem with it; thus it is difficult to assess, in retrospect, exactly what we might have been able to do with it.

Mostly we ran our tiny but important problems on the IBM 602A. To use this machine, one had to be a competent keypuncher, board wirer, and control-bar set-up man. However, the 602A was a massively engineered, highly reliable, electromechanical machine, and therefore it does not count among the computers. Everybody knows you cannot build a mechanical computer. It must be electronic.

The full dawn of the electronic age arrived in our little shop with delivery of our IBM 604. This machine represented a truly remarkable advance in the computing art. While it had no memory, it was magnificently programmable in three-address mode, provided one limited the program to no more than 60 instructions and plugged these into a plastic board in a metal frame. There was, however, a trivial I/O restriction: All input *and* all output had to be punched into a single 80-column card.

In spite of the minor limitations of the 604, we did a good deal of vital work with it. We waded into structures problems, solved the world of trajectories in at least two dimensions, and sailed easily through long equations in applied physics, like:

$$f = ma$$

Without question there were earth-shaking events in those days. Reaching into my bookshelf I take down my dusty copy of the proceedings of the Computation Seminar of December, 1949, held in the IBM Department of Education, Endicott, N. Y. One hundred and seven research engineers and scientists attended this seminar. It was staged by Dr. Cuthbert C. Hurd, director of the IBM Applied Science Department.

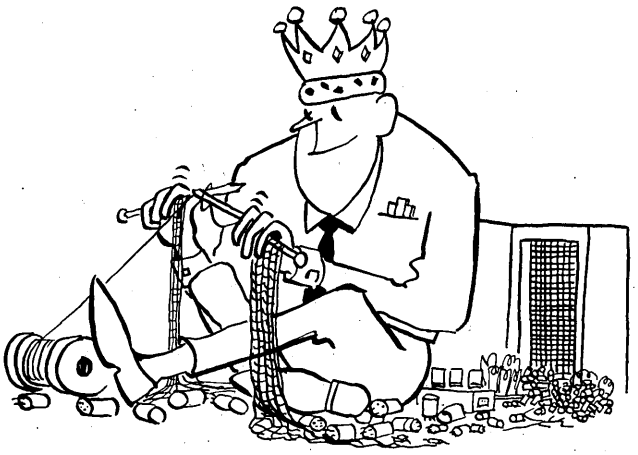
The keynote speaker was Dr. John von Neumann, who spoke on "The Future of High-Speed Computing." Dr. von Neumann addressed himself to a major concern of the day: the worry that computing machines would become so fast that they would rapidly make themselves obsolete, having solved all possible problems. Dr. von Neumann did not believe this fear to be based on fact. He admitted that, for problems then current, planning and coding required much more time than the actual solution of the problem. Yet, with clear vision, he foresaw the day when, since problem size was, in a very real sense, dictated by machine speed, the magnitude of problems would automatically increase so that problem solution time would become longer than planning and coding time.

At this same seminar, Dr. Richard W. Hamming of the Bell Telephone Laboratories spoke regarding some methods of solving hyperbolic and parabolic differential equations.

There were learned papers on sundry topics, including "Inversion of an Alternate Matrix," "The Construction of Tables," "An Algorithm for Fitting a Polynomial Through N Given Points," "A Punched Card Application of Monte Carlo Method," and "Remarks on the IBM Relay Calculator."

Doubtless all 107 attendees went home convinced of the secure future of their new-found profession. After all, the world had never before seen such an overwhelming attendance at a meeting set up for the discussion of digital computing.

Meanwhile, back at the Airship Foundry, word kept leaking in to us that out at Northrop a bright engineer named King Barley had spread the innards of his 604 all over the floor while he tried to substitute wires for the physical act of walking with cards in hand from the 604 to



the tabulator to the sorter to the interpreter to the sorter to the collator to the tabulator to the 604, *ad infinitum.*

Of course, we thought, this was a pretty silly idea.

Shortly thereafter, IBM announced the CPC, the aboriginal three-letter mnemonic, standing for Card Programmed Calculator. We ordered several.

This impressive collection of cabled-together boxes included a 604, a tabulator, and a bunch of electromechanical storage devices which looked suspiciously like hastily re-

worked "accumulators" from inside a tabulator. These memory locations came twelve in a box, and the customer could select up to three boxes, giving him the unheard-of capacity of 36 memory locations, each consisting of 10 decimal digits, plus sign. To access these memory locations one had, however, to endure a computing delay of one or more cycles (tabulator turns) of time.

A great breakthrough had been accomplished. No longer was the sole input and output capability found in the delayed passage of one card through the reader-punch of the 604. Now we had a *real* I/O machine: the 402 tabulator. At least the number of cards was unlimited. The 402 would read them all day at some high percentage of its rated speed. With each reading the magnificent type bars rose and fell, some alphanumeric and some numeric. They looked like the tide ebbing and advancing with the phases of the moon, and they were damn near as fast.

The CPC shortly became the only machine of importance to people in a hurry.

By people in a hurry, we mean those up tight to see Dr. von Neumann's predictions fulfilled, not those anxious to make a buck on their fulfillment.

totus mundis histrioniam agit

While our daily work of calculating engineering structures, strictures, and sutures went on at the Airship Foundry, massive rumblings began to be heard in our new world of computerdom. The U.S. federal government, in a vast, precedent-setting move, acting through its duly constituted, knowledgeable, and contemplative authorities, had caused to be negotiated a contract with the Eckert-Mauchly Corp. of Philadelphia—a contract to supply a really big computer to the Bureau of the Census. Not since the decreee of Caesar Augustus that the world should be numbered was there government action triggering off such a monumental series of events.

The government had financed computing machines before, and has done so many times after, but there was something about the genesis of Univac I that marked the dawn of a new age. No doubt the contract for the first Univac, like many contracts negotiated by well-meaning government committees, was optimistic in delivery and performance schedules, and deficient in price, for federal government procurement is marked by errors that a housewife knows how to avoid. Yet this was a beginning.

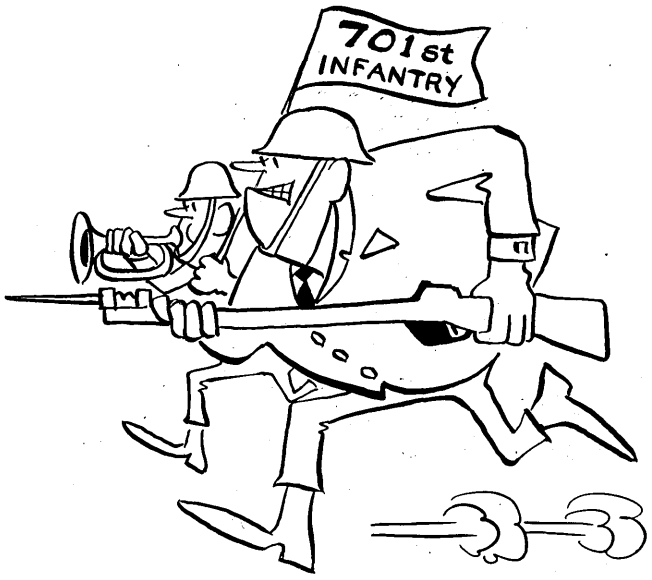
Ere long the small Eckert-Mauchly Corp. had become the Univac Division of the (then) Remington Rand Corp. Progress went on apace, and Remington Rand loomed as the only American company with a big, high-performance electronic computer on the boards and with production scheduled. High-quota adding machine, shaver, and tab equipment salesmen boned up to sell Univacs to the world.

IBM, which had sold Hollerith (square-hole) card systems to almost the level of a national standard, was nearly caught napping, but not quite. It was the time of the Korean War and reimposed priorities, and the Defense Calculator project (later the IBM 701) got into high gear in a hurry.

Well-trained teams of IBM Applied Science men and marketeers (all IBM representatives are, by definition, well-trained) covered the country, making their pitch particularly to the engineering/scientific types. Though they ran behind in timing, there was no deficiency in their push or pitch.

Whatever the reasons, lease vs. sale or you-name-it, the Univac troops were repeatedly able to snatch defeat from the jaws of victory. They made some impressive sales, particularly to such customers as insurance companies, but somehow still managed to end up in second place when the dust settled. At the Airship Foundry we ordered a Defense Calculator, and proceeded to prepare a building just to house it.

The contrasts between the two computers are interesting, and even ludicrous from today's point of view. The Univac was a decimal, serial machine with dual, voting circuitry. The 701 was binary and parallel. I/O was copious and varied on the Univac and limited to cards on the 701 (since no one of that day had any way to prepare a 701 tape off-



line). The Univac was pitched as a "business-oriented" machine, while the 701 was alleged to be "engineering/scientific oriented."

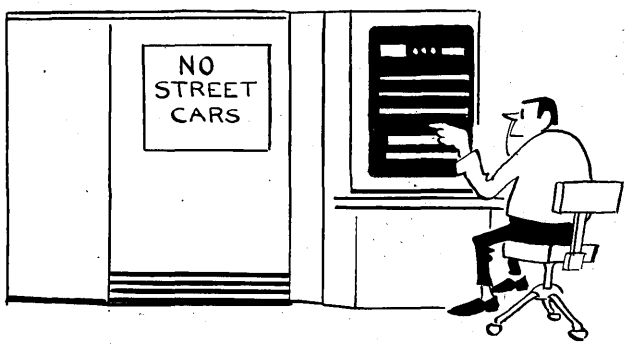
The main memory systems of the two computers presented one of the most fascinating of the contrasts. Univac memory consisted of a set of cylindrical tanks studded with mountings for piezo-electric crystals. The write crystal put a never-ending string of sound pulses into the mercury which filled the tank. The read crystal opposite read this string and sent it to the amplifier to be reshaped and rewritten by the write crystal. Thus memory was a vast assemblage of acoustic delay lines. Univac I memory was therefore susceptible to interference from such effects as loud door slams. IBM 701 memory, on the other hand, was electrostatic. It wrote bit patterns on Williams tubes (3-inch cathode ray tubes) and thus had continually to regenerate as the electrostatic charges faded. This memory was susceptible to interference from opening circuit breakers and passing streetcars. Both memories in their original installations exhibited a mean time between failures so short as to be barely measurable.

Actually the Univac I suffered from being ahead of its time. Its I/O devices were elegant, magnificent in concept, expensive, and unreliable. They offered the user capabilities that were unheard of then but commonplace today.

When our 701 (Defense Calculator) was delivered to the Airship Foundry we were ready for it. We had read the installation instructions carefully, and had become expert in the care and feeding of a big computer. Working hand-in-foot with our brilliant plant engineering crew, we had procured a giant motor generator set to power the computer. This machine was approximately the size of the left bank powerhouse at Grand Coulee Dam. The plant engineers had tenderly hung a great ice machine in the building overhead, and had designed a perforated ceiling that would let the cold air extrude gently down over the entire 701.

The computing room ceiling thus looked like the world's largest spaghetti die, but it did spill frosty, filtered air at a great rate.

It took a week or so to get the 701 set in place on its brand new false floor, and to string the subterranean cables that hooked all its brains together. This task was completed on a Friday and, after a long coordinating session with the IBM field engineers, we determined that it would be a good idea to turn on the great ice machine to cool the computer



over the week end so it would be ready to turn on Monday morning in a blaze of glory.

As fortune would have it, the week end proved to be a long and exceptionally rainy one. When we came into the new computer facility on Monday morning the rain was still pouring down.

The great ice machine was still humming smoothly, and the Coulee Dam generator looked ready to spring into action. But a miracle had been wrought over the weekend. The 701 room had turned into a Christmas scene. Snow was gently falling from the spaghetti extruders in the ceiling, and it blanketed the computer, the false floor, and the entire 701 to a depth of, say, half an inch.

It took the IBM engineers about a week to dismantle the 701, dry it out thoroughly, and put it back together. This interval gave the plant engineering crew time to redesign the control system of the ice machine.

And so the great day came when the Coulee Dam generator was turned on to fill the world with its 60-cycle hum. The Williams tubes ignited with a glowing pattern of confused blue dots, and the card reader went pockety-gleep. The 701 was on the air.

We spent several weeks learning how to keypunch in binary, and trying to find out why a mag tape written on one servo would not read on any other, but gradually we learned to live with our new, magnificent computer. It was time to invent software systems.

For nearly a year we had a study team assigned to play with and design a "programming system" for the 701. The machine was delivered in a most virgin state, understanding only its own opcode set and nothing else. There was a "machine manual," since systems manuals had not been thought of yet. This was written by Sid Lida of IBM, and it was a beautiful job, possibly the finest such manual ever written. The writing of manuals by committee had not yet been invented.

In spite of our year of software planning, getting the 701 on the air proved to be equivalent to enticing a sick camel to stand up under a two-ton load. We worked under the "clean machine" concept in which no software was ever resident, but the entire facilities of the computer were available to the next clod trying to add two and two.

Our thinking, however, was surely not backward. I was assigned for a time to the construction effort of a very pre-FORTRAN compiler which we called ASAIC for Airship Algebraic Interpretive Coding. As time passed we actually got ASAIC on the air, and it did succeed in reordering and compiling code from statements written in "plain" algebra.

Meanwhile, out in the great world, things were progressing at a rapid pace. Edmund C. Berkeley had published in 1948 his famous epic, "*Giant Brains, or Machines That Think*," and he followed this by beginning regular publication in 1951 of "Computers and Automation," the first journal devoted exclusively to computing.

Berkeley was also among those instrumental in organizing the first Joint Computer Conference. This was held in Philadelphia in December, 1951, and it was actually called the "Joint AIEE-IRE Computer Conference," though Berkeley represented the ACM on the conference committee.

The keynote address was presented by W. H. MacWilliams of the Bell Telephone Laboratories, and he spoke rather more briefly than any subsequent keynoter. A multi-authored paper by J. Presper Eckert, Jr., James R. Weiner, H. Frazer Welsh, and Dr. Herbert F. Mitchell described the inner glories of Univac I, which had passed its formal acceptance tests in March of 1951 at the Bureau of the Census. The best IBM seemed able to counter with was a paper entitled "The IBM Card-Programmed Calculator," by John W. Sheldon and Liston Tatum. There were papers on various extinct, one-of-a-kind machines, including the ORDVAC, the EDSAC, the SEAC and Whirlwind I. The papers on The Burroughs Laboratory Computer, by G. C. Hoberg of the Burroughs Adding Machine Co., and on the ERA 1101 by Frank C. Mullaney of Engineering Research Associates, Inc., gave promise that new competition might enter the fray.

The conference was heavily dominated by hardware papers, and the final comment of the proceedings, stem-

ming from the discussion group on "Universal Instruction Codes," seems to summarize the then-current view. This comment was: ". . . the problems of programming at this point appear as yet mostly unsolved."

As these great events took place in the world, and as time wore on, life at the Airship Foundry began to grate on my nerves. The perennial programming and running of other people's problems is not calculated to fulfill the artistic soul. After politely asking for a transfer to empennage engineering or to the human foibles staff, I resigned to become a high-ranking analyst with the Intelligible Assurance Society of America, the noted insurance cartel. In this move I was about to enter an entirely new world.

(Chapter II will appear in an early issue.) ■

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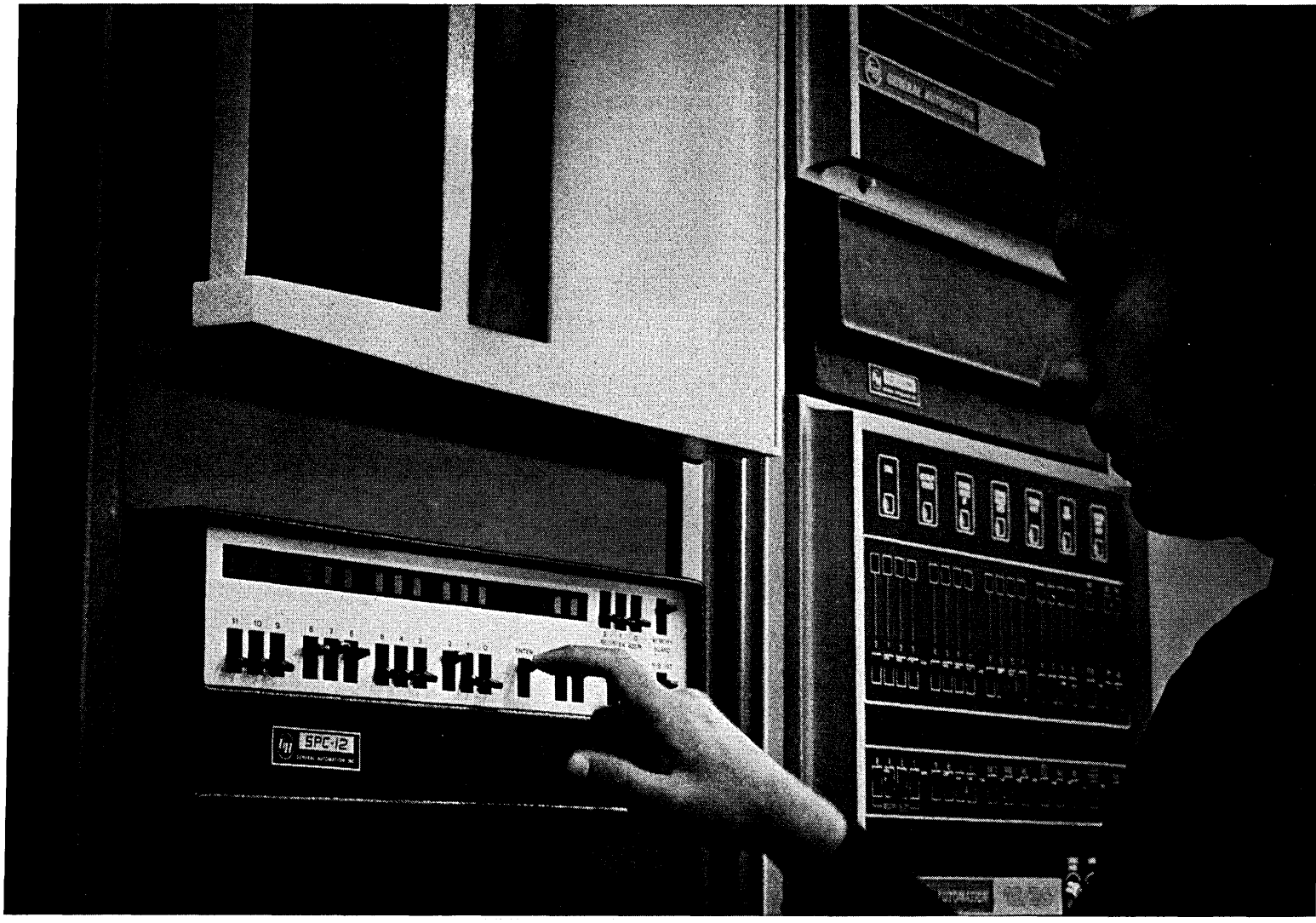

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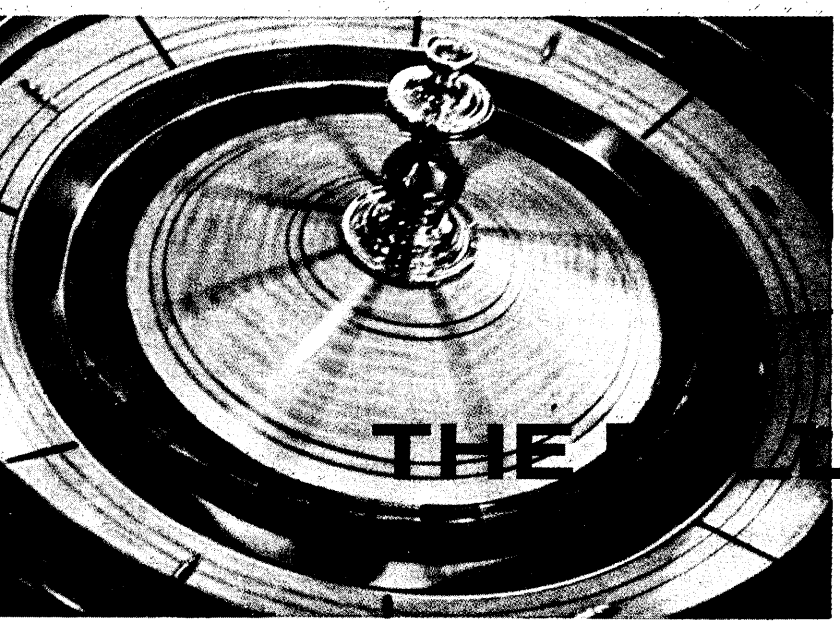


conference capers

THE [illegible] JOINT

RESIDENTS OF LAS VEGAS said they'd never seen such congestion, and wanted only to know when "you computer people" were leaving. Those attending the Fall Joint Computer Conference, unsure of the status of their flight reservations, were asking the same question, for some 25,000 risked the brisk, smogless air of Nevada. They overtaxed the desert community's telephone lines, created a run on taxi service, and caused the airlines to put on extra flights.

In return for their patience, they were rewarded with the largest agglomeration of giveaway pins ever seen at a JCC, along with the usual array of miniskirted girls and highly imaginative exhibits. The colorful displays flashed or moved, vying for attention; about the only passive devices were the slot machines. When the convention center's displays needed more power, a residential section of the town was blacked out. Finally, when the show was over and everyone started heading home, the exhibitors were asked to unplug from the electrical system in sequence so the entire power plant wouldn't go down.

Some new products came to light there, but not the Univac 1109, or the GE 655, or the DEC PDP-11, or the General Automation 16-bit mini-computer. Instead, as a general observation, there was a growing number of exhibitors peddling services; even omitting those offering time-sharing services, there was an appreciable number in the education, software, and facilities management arenas. Coming as no surprise was the legion of manufacturers with terminals, minicomputers, and miniperipherals in their product lines, although the latter is the latest biggie activity. It follows the plethora of key-to-tape and key-to-disc systems now on the market, and which were also demonstrated at the show. One wouldn't have thought there was such vengeance to be wrought on the lowly keypunch.

Presumably, products like these or the technologies that make them possible indicate the way things will be in the 1970's. At least, that was the theme of the conference, "Threshold of the Seventies," which featured several technical sessions on malingering problems yet to be overcome. Panelist Paul Armer's confrontation with the

local fuzz (see December, p. 264) was a fitting opener to the session, "Computer- Related Social Problems: Effective Action Alternatives." The difficulty Armer encountered in entering the hall showed dramatically that the problems are immediate and omnipresent.

looking for answers

Solutions to those problems are much more remote, however, judging from the subsequent discussion. It may be true, as panelist Max Palevsky said, that it is logically possible to change the social structure gradually, yet fast enough to prevent social protest. But as Palevsky also pointed out, the problem is political, not technical, which implies that it isn't amenable to logic.

The presence on the panel of Ed Elkind, cochairman of the Computer Professionals for Peace, could be taken as a sign of progress. By putting him there, the conference management recognized the existence of legitimate opposition to the conventional wisdom. At the last SJCC, by comparison, Elkind and his associates had to protest from the audience.

But Elkind's prescription for making modern technology more socially-responsible didn't seem to be any more viable than Palevsky's. "The only way to bring about change is to organize large numbers of people to act in concert," he said. At a press conference preceding the formal session, Elkind was asked how this organization could occur if most of the people to be involved are not basically dissatisfied with the status quo. His answer, in effect, was that the organizers would have to keep trying.

One outcome of such striving was suggested by Herb Grosch when he predicted that Elkind's organization would have to get their heads bloodied before they could attract wider support. And even then, added Grosch, their effort to create a more humane, livable society might fail because "intellectuals expect a depth of concern on the part of the rest of society that just isn't there. Our . . . culture [will continue] to be driven by an overstimulated demand for goodies, by inept education and trashy entertainment. I don't think the man in the street will sacrifice easy credit for privacy — he'll choose easy credit every time."

Armer seemed more hopeful, but like the others he didn't talk very much about the "effective action alternatives" mentioned in the session title.

For the 70's, the development of a software engineering discipline was also urged. There are many problems impeding the transformation of software design from an art to a science, according to Dr. Julius Tou of the University of Florida. Among them: the lack of a firm theoretical base, nonuniformity of terminology, and a sensitivity to change in software. Studies to overcome these might be delegated to universities, the academician observed, but industry must also participate.

One of the big problems, noted panel chairman Ken Kolence of Boole & Babbage Inc., is that natural laws of software engineering are being ignored. Averring that "There are natural laws of software," Kolence said software could be viewed as a set of transformations (and other relationships) operating over a set of data and container structures. Software physics, then, is a study of these elements and relationships. The basic technology of software measurement exists now, he continued, and a set of measurement tools and techniques is becoming available. Thus one might start by observing and measuring the data and container structures. He closed the session by saying that the objective of the panelists was to jog the thoughts of the attendees. Judging by the number who congregated around the stage after the close (past 10 p.m.), they succeeded.

Lest the reader feel that the new decade is surfeited with problems, he can take comfort from the conference keynote speaker. Albert V. Casey, president of the Times Mirror Co. in Los Angeles, paraphrased John Gardner, who said the 1970's will be characterized by great opportunities disguised as problems. Underlying these problems/opportunities are what Casey calls the most important forces for the 70's: international cooperation, social demands, the new population, technological progress, and the advent of planning.

He then elaborated on these, tracing the move toward world integration, the awakening of a national social consciousness, and the experiences and affluence of the new generation; he also noted those experiences common to the older generation but lacking in the young, such as the big depression. With technological progress, he continued, the stress even more will be on the skill of the population, rather than natural wealth.

Casey — who said his talk "Can America Survive the Exacting Years Ahead?" might be alternatively titled "Can a Patched-Up 1401 Program Achieve Happiness in a 360 Environment?" — also had some words in favor of his listeners. He said, "No other group in America better combines the characteristics of which I spoke today

than that present here. Your business leadership can provide the pointing up of the large problems in your community and the solution to them." He added: "You are the establishment of tomorrow."

education lives

After the presentation of three rather dull but necessary papers, the "Using Computers in Education" session really got moving when four panelists read their position papers and the lively debate that followed lasted long after the discussion period was scheduled to end.

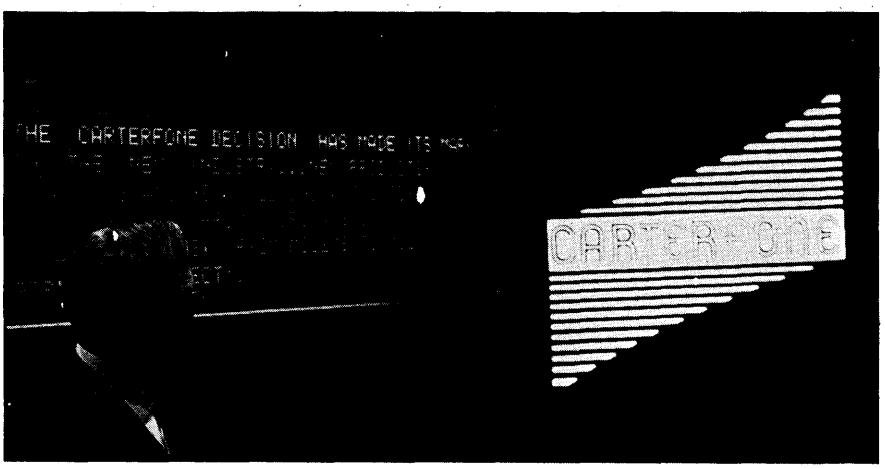
The first panelist, John W. Hamblen, of the Southern Regional Education Board (Atlanta), presented some interesting statistics on computers in higher education. According to National Science Foundation estimates as of last June, there are $263 million worth of digital computers being used in higher education; yet half of the colleges and universities do not have computers, and 1.2 million college students have no access to a computer. A reasonable cost/student for computers in small colleges should be $60/year, according to another report, but only $20 a year is being spent. With minicomputers, the reasonable cost could be lowered to $10. But, he added, these estimates were made B.U. (Before Unbundling).

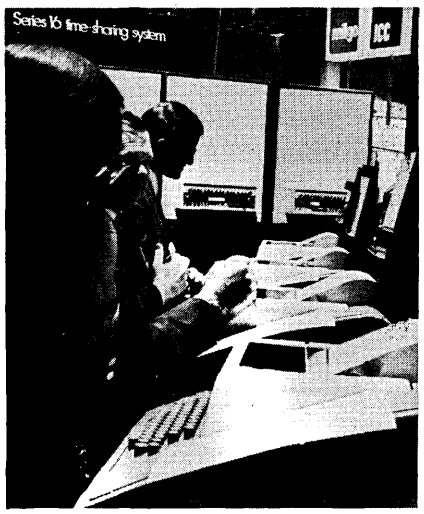
The position paper that seemed to arouse the greatest interest was that presented by Roger Levien of the RAND Corp. He predicted that it is possible that off-campus computers will replace on-campus facilities for instructional purposes. (This thesis will be part of a report to be issued late this spring resulting from a RAND-Carnegie study on the instructional use of computers.) He said the system would be analogous to that for which textbooks are now needed. The commercial time-sharing services would be specialized, with many campuses using several services. The programs would be faculty-written and commercially distributed, with royalties and prestige for the authors, as in the present system. These programs would go into a bank of materials, so the universities would not have to consider hardware or software standards; terminal interface would be a minor problem.

The advantages of such a system are many — no administrative worry about acquiring hardware (just rent terminals); materials would be prepared by faculty peers and selected and individualized by faculty teaching the course; and small initial use would be possible. For instructional use, the quality and variety of courses would be improved without adding cost. Computers can be used effectively now in some areas and will become more economical as the cost of alternatives (i.e., additional faculty) rises.

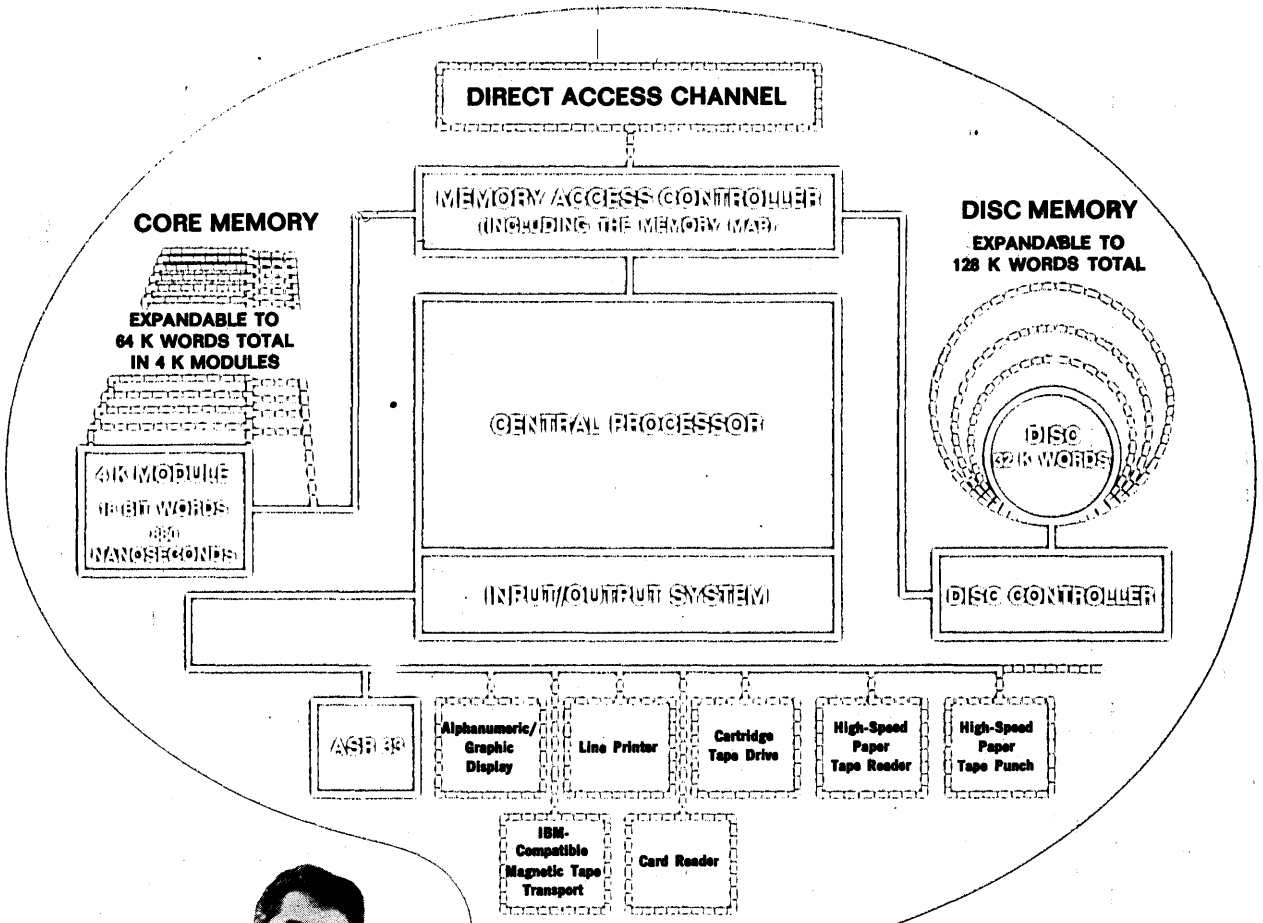
flogging the phone company

Then it started. How can colleges afford the line costs? And, indeed, is AT&T prepared to provide the necessary services to accommodate all this time-sharing? A prophet of doom, who became known simply as "the consultant from Minneapolis," rose and addressed those gathered. He said that readers in the 75th and above percentiles become bored to death with the 10-character-per-second rate of current terminals used in CAI, and all but the top 2% need at least 50 cps, while the top 2% need 200 cps. Time-sharing channels will be the problem, and what is needed cannot be had from the currently financed AT&T. By 1975 an additional $45 billion, plus the $8 billion that AT&T is putting in, will be needed to prevent the whole system from breaking down. Right now, he said, the necessary lines have a 40% chance of being down 15 minutes out of any given three hours, and 40% of the time they are down the full three hours — and it's getting worse. He predicted that in three years 300 bps will be the maximum possible transmission rate.





A representative from the Bell System asked if the public would be willing to pay for the capabilities they want. He said that a store and forward message system looks promising — the switched network takes much more money and equipment. One solution might be the use of more small computers with secondary storage, not more time-sharing. In other words, connect a lot of minicomputers in a distributed network. And Levien admitted that he would not be opposed



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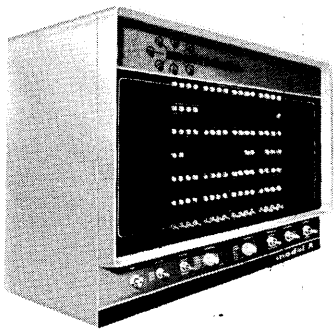

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to this type of arrangement.

The question of whether or not computers could be used in teaching the unstructured subjects (like history) was also raised in the discussion. Robert J. Seidel, of the Human Resources Research Office, one of the panelists, said that this certainly was possible. Although the student-teacher relationship is traditional, it is deteriorating anyway, so a complete revision and restructuring of these subjects is not necessarily undesirable. Further, the students would get the contribution of a number of faculty, not just one. And Thomas J. McConnell, Jr., a panelist representing the Atlanta public schools, said that the Atlanta system is in the process of doing away with textbooks presently used and will implement a completely unstructured system, one that could actually be used to teach all subjects via CAI.

Possibly the dullest event of the FJCC was the movie presented at Panel Session 3, on "Computers for Congress," in which six Congressmen explained why they favored the idea. Rather than six different views, the film presented one view six times, each delivered in a wooden monotone which suggested that the speakers had made the mistake of reading their material before getting in front of the camera.

Panelist Bob Chartrand, of the Library of Congress, provided one of the few comments worth noting when he said that if and when Congress establishes a computerized information retrieval system, the organization that manages the operation will seek data bases and software from outside suppliers rather than developing its own, in-house. This statement is particularly significant since the Library of Congress seems likely to become the manager.

John Horty, head of Aspen Systems Corp., which provides computerized information retrieval services to some 20 state governments, suggested that "individual Congressional committees are individual fiefdoms," and indicated that individual information retrieval systems, tailored to the needs of individual committees or Congressmen, might be a better way of closing the Congressional information gap than the centralized setup now being contemplated.

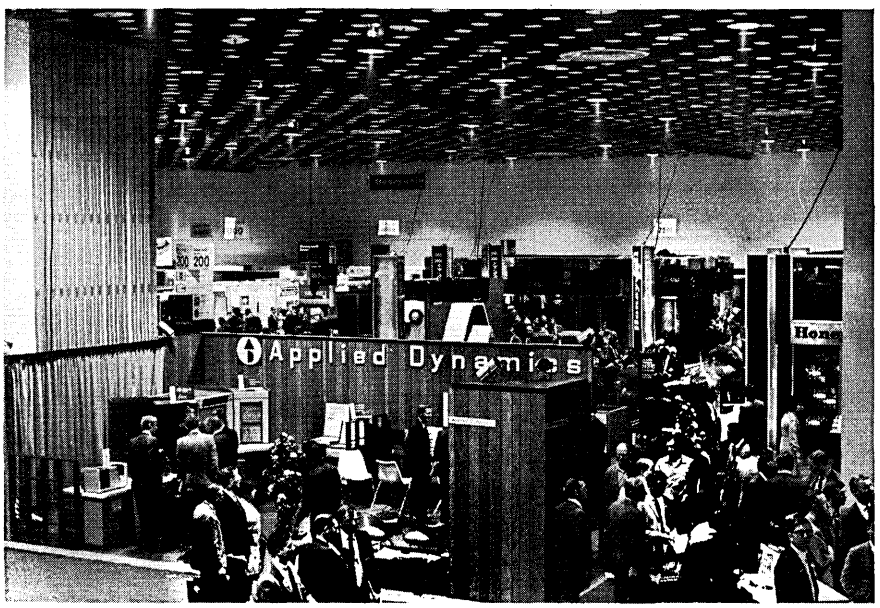
Someone else in the audience suggested that installing a computer on Capitol Hill might give incumbents an advantage at election time. His point was that the system could provide the incumbent with useful information about his constituency that an outside challenger couldn't obtain. Also, since the system planned for Congress will provide mass-mailing, as well as information services, it could reduce the incumbent's campaign costs and give him another advantage over an outside challenger. Greenberger said there is a need for "an equal time rule," like the one adopted by radio-tv broadcasters, to prevent such misuse of any computer system developed for Congress.

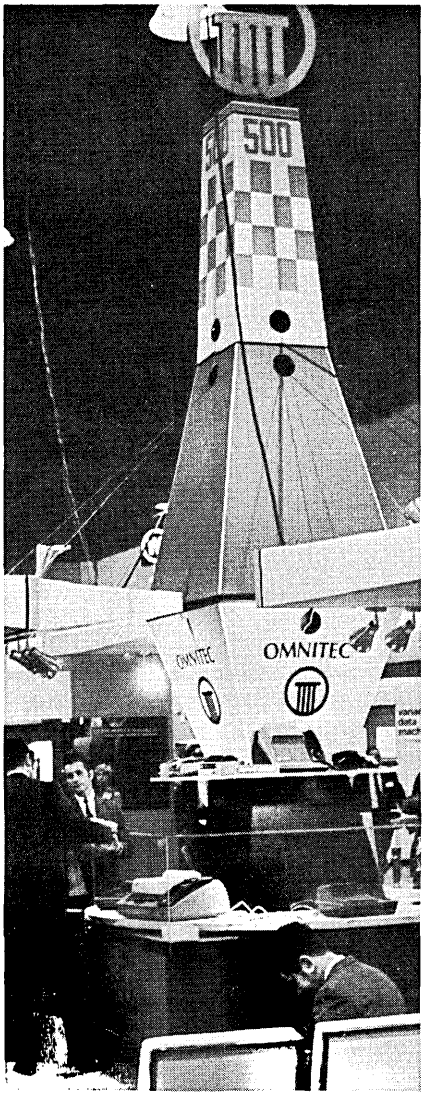
grosch strikes again

Although another session was titled "The Impact of Standardization for the 70's," much of the discussion concerned the immediate problem of reducing manufacturer dominance. Herb Grosch, the federal government's chief dp standardizer, was in the audience and, as expected, enlivened the proceeding.

He suggested that if the Association of Independent Software Companies "spent 10% less to entertain security analysts," they'd have enough money to hire a qualified technician who could participate full time in standards development work. Grosch added that relying on "well-intentioned dilettantes from ACM is better than nothing, but not much better." His basic point was that the standards effort needs to be staffed by full-time standards experts who aren't beholden to equipment manufacturers, that industry trade associations are the logical source of this talent, and that they can finance the effort by reducing their expenditures for less important activities.

Jan Lee, chairman of ACM's standards committee, who was also in the audience, replied that the fault lay, not with the industry associations, but rather with the prevailing notion that standards work is not research, and thus doesn't justify more investment. "If this need for standards exists," he added, "somebody has to recognize the research relationship." Lee also disagreed with Grosch's proposal that industry associations supply full-time experts to develop new standards. He





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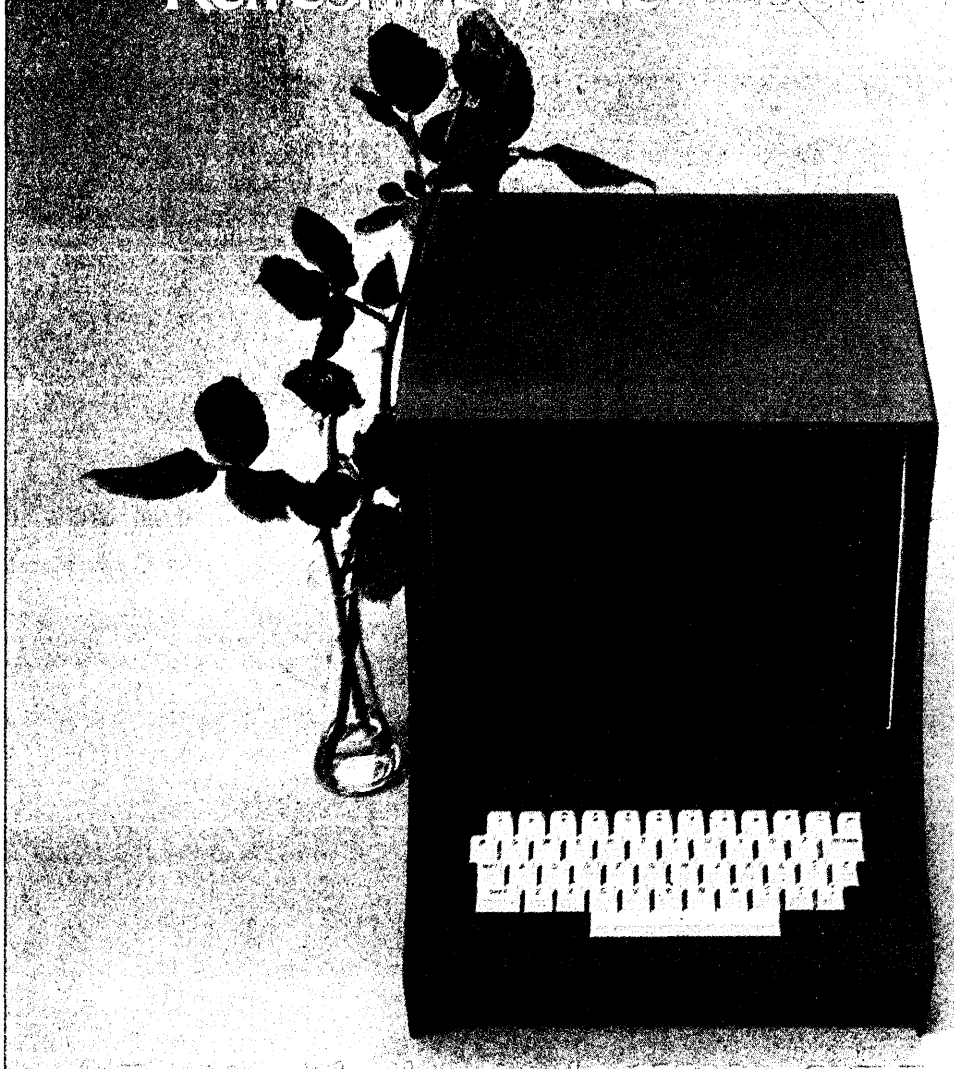

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thought the task groups working on dp standards should be given technical advisers who would do the research needed to develop the bases for new standards. Some of this advisory work, Lee added, could be handled by contract.

Harrison predicted that, during the 70's, the federal government will emphasize I/O interface standardization. Later in the session, one controversial issue relating to that development came to the surface when Bob Bemer contended that the interface should be located in the cpu controller channel, and Grosch argued that it should be put between the controller and the peripherals.

money talks

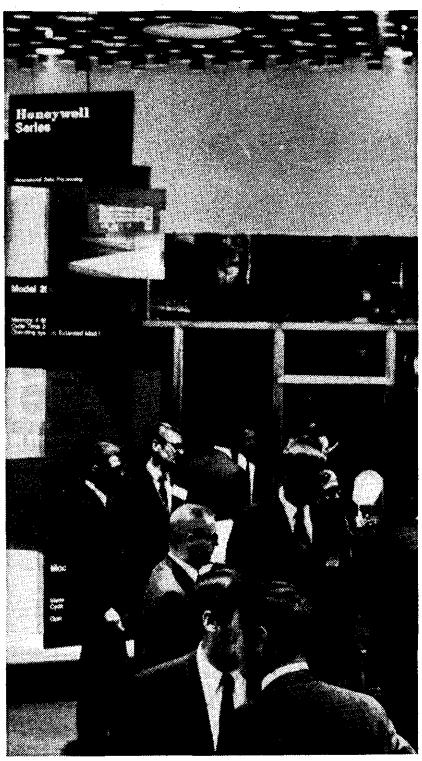
Also concerned with the 70's was a panel session on "Managing Money with Computers," which had nothing to do with Las Vegas betting strategies. Panelist Les Goldberg, a vp at Valley National Bank in Phoenix, Ariz., described an interesting — or, perhaps, appalling — plan for the bank to take over the complete fiscal life of consumers. The bank would consolidate all credit for a customer, use descriptive billing to show categories of expenses, and provide an early warning notice when the consumer is getting in too deep. With all this information, the bank would be able to keep one posted on his net financial position regularly and provide a money management plan that could include investment policy suited to his means and objectives. Simplicity (plus profits for the bank) is the main selling point: "If you're in the red, you pay the bank; if you're in the black, the bank pays you."

Asked about the privacy issue in the proposed bank all-purpose credit plan, Goldberg said a survey of customers of one bank showed that only about 10% were bothered by the idea. He agreed that the customer must have access to credit information that affects him, but pointed out that making it available can be difficult and expensive, especially in an on-line system.

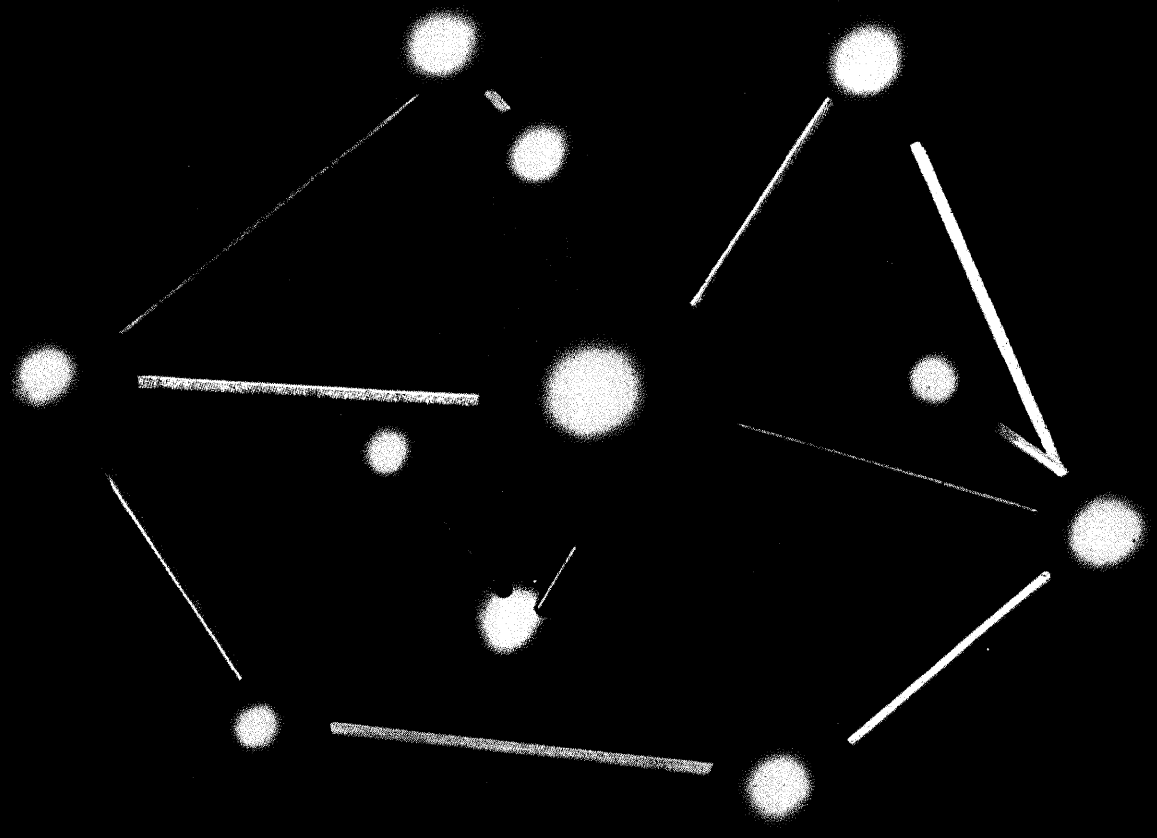
With the unfolding of all the plans for the 70's, combined with the disclosure of problems hopefully disguised as opportunities, it seemed fitting that the conference sponsors, AFIPS, also engage in catharsis. Speaking to members of the press, president Dick Tanaka explained that AFIPS was trying to avoid having the JCC's mammoth size become its chief characteristic, and didn't want them to become shows, rather than conferences. Technical papers given at each are making up the archives of the industry, he said, and the desire was to continue emphasizing the importance of the sessions. Still, it's the exhibitors who provide the revenue that made the conferences possible — or, at least, highly profitable — and AFIPS's decision to limit the size of the exhibition to 1,000 booths (single booths, not exhibitors) comes in the midst of a veritable blizzard of new companies. Somehow, they'll have to satisfy both perennial exhibitors and the newcomers. It's not an enviable task.

But as it is, the show is so large as to almost preclude someone meeting another by prearrangement. What with the crowd, one didn't attempt this in the exhibit halls; even a couple of the meeting rooms had accommodations for 2,000 people — and were nearly filled.

Breakfast followed immediately after the lounge shows, and the sessions right after breakfast. Still, one masochist was heard to say, "They really should stretch this out to five days." No thanks. ■



General Electric announces the United Systems



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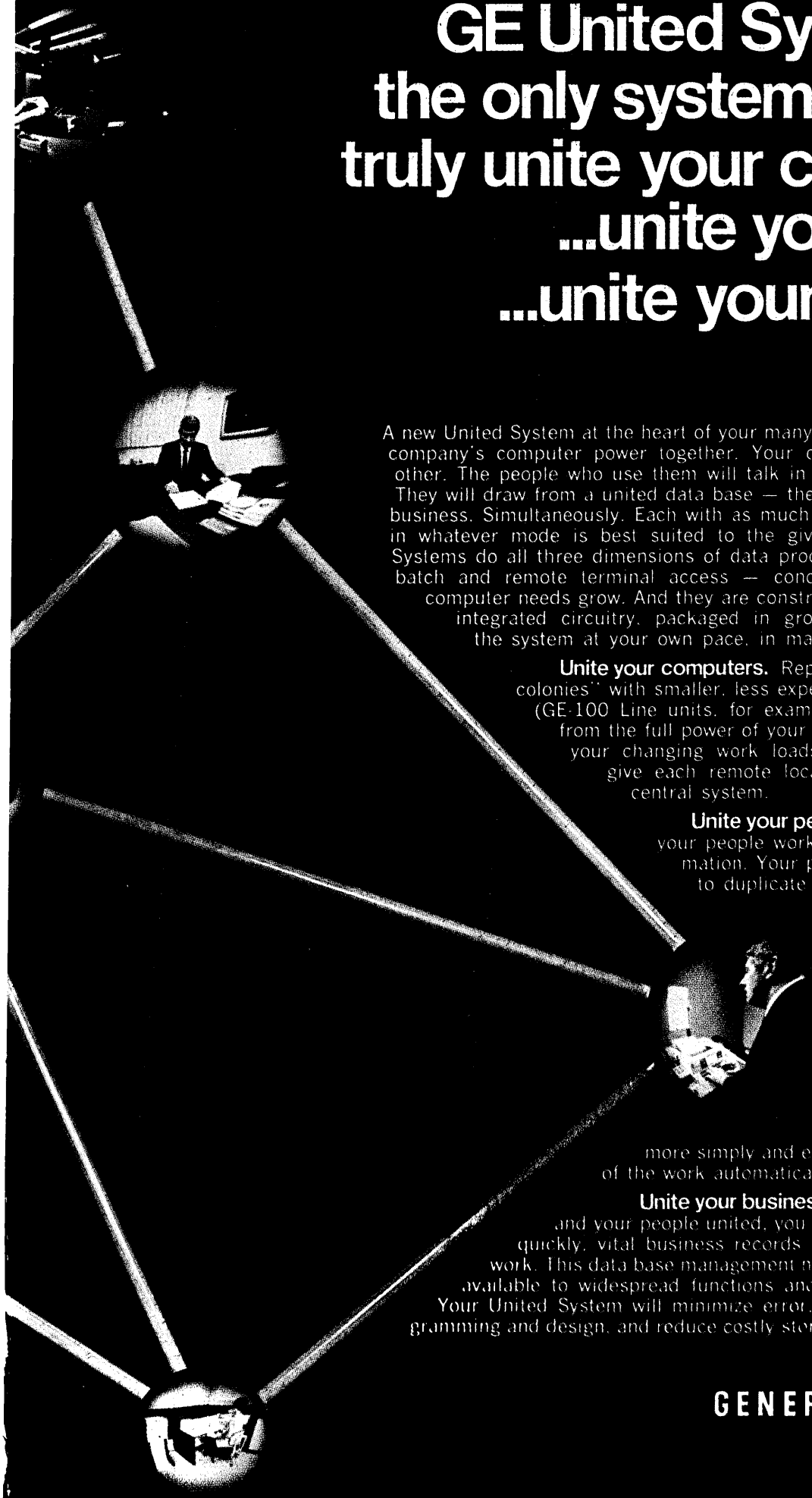

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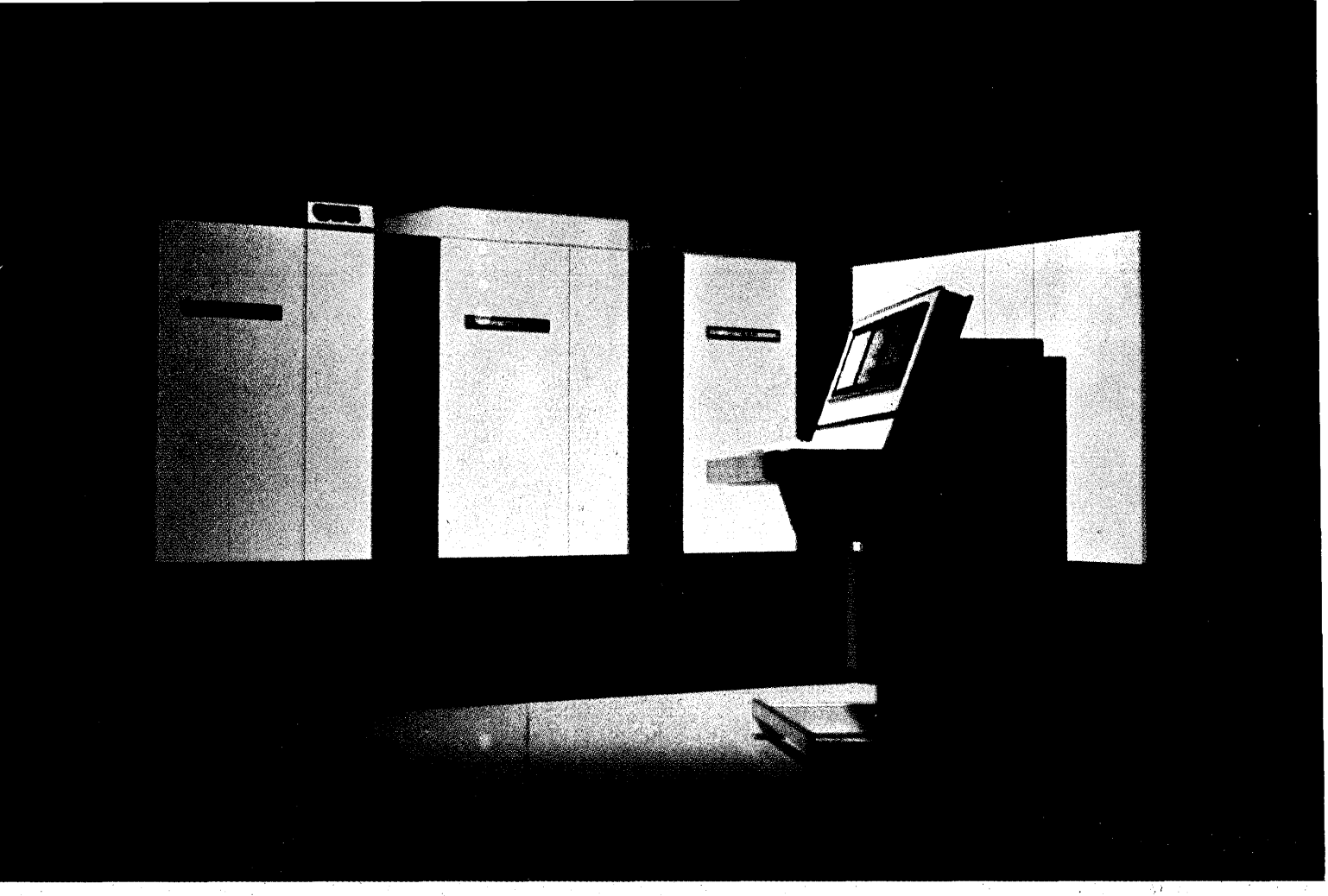

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AN OPTICAL DATA LINK FOR REMOTE COMPUTER TERMINALS

by Jack R. Baird

The increased usage of remote terminals for large computers has created a demand for a short range, medium bandwidth communication system or data link. A laser communication system[1] can easily accomplish this objective but the cost of such a system is usually prohibitive.

The object of this article is to describe an optical data link which is in use at the University of Colorado, Boulder, which is both highly reliable and extremely economical.

The system has been in continuous operation for over two months and in that time has required absolutely no maintenance and has provided reliable communication over the one kilometer path length through both heavy rain and fog. The only observed failure of the system was during a heavy snow storm when 13 inches of snow fell and visibility was reduced to a few hundred feet at times.

The basic transmitter element is a gallium-arsenide infrared light emitter costing approximately $15 and the basic element of the receiver is a $9 phototransistor. The most expensive components in the communications link are the condensing lenses which are five inches in diameter and cost $40 each.

The entire system is illustrated in the block diagram of Fig. 1. The main computer is a Control Data Corp. Model 6400 with a normal complement of local terminal equipment. The main computer is interfaced to the General Electric Data Set through a CDC-6673 Data Set Controller.

The remote terminal is a CDC Model 8231 terminal using one 1200 cpm card reader, a typewriter and one 1000 lpm line printer. The system is operated in a half-duplex mode but the data link itself is capable of full duplex operation. The 40.8 kilobit data rate is sufficiently high that a second 1000 lpm line printer can be added to the remote terminal.

This is a completely normal high speed remote terminal system with the exception of the manner in which the two GE Data Sets are interconnected. In a normal installation the data sets are interconnected by two "baseband grade" telephone lines. Ordinary "voice grade" telephone lines are not sufficient because the bandwidth on such lines is less than 4 kilohertz. A baseband grade line has a usable bandwidth of 50 kilohertz and normally could be used by the phone company to carry 12 individual phone lines. Most installations require two baseband lines from the main computer to the telephone switchboard where they bypass the switchboard and are permanently connected to two other baseband lines from the switchboard to the remote terminal. Such an installation would consume line capacity which could normally be used to provide service to 48 individual business phones; thus it is not surprising that the cost for such service is approximately 48 times the rate for an individual business phone. Rates will vary considerably from one installation to the next, but a cost in excess of

[1] Ross, *Laser Receivers*, 1966, Wiley & Sons.

Dr. Baird is an associate professor of electrical engineering at the University of Colorado, Boulder, Colorado. He received his BS, MS, and PhD degrees from the University of Illinois. His research interests have been in the general area of physical electronics including solid state devices, microwaves, and optics.

$5000 per year is quite common.

In the system described here, the telephone lines have been replaced by a two-way optical data link at a considerable savings in installation and operating cost. In this system the path length between transmitter and receiver is approximately one kilometer and a direct line of sight is obtainable from the tops of the two buildings housing the computer and the remote terminal. At least 300 feet of

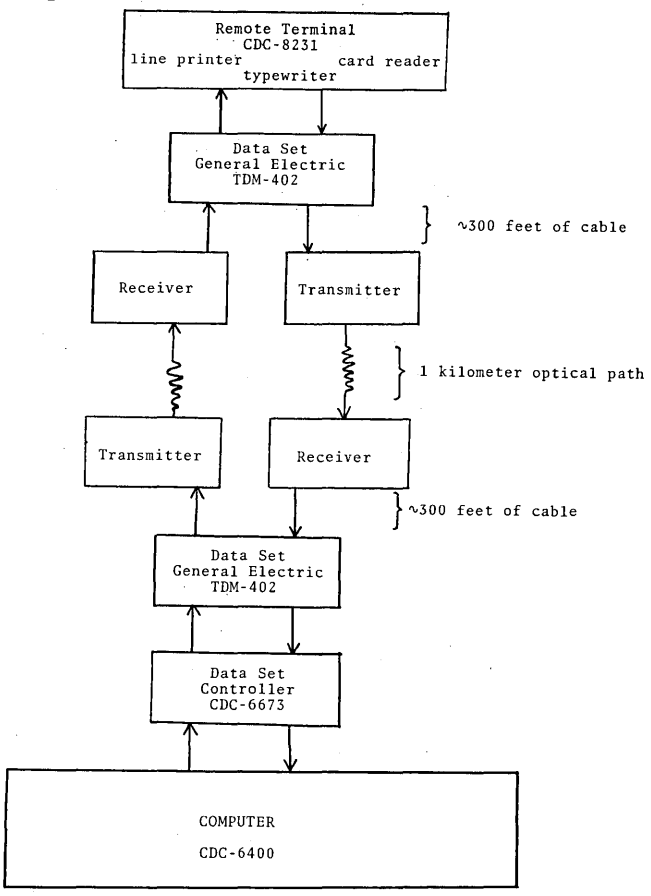


Fig. 1. Block diagram of the system.

cable is used between the data sets and the optical transmitter-receiver installations. A considerably longer cable could be used without serious problems.

A photograph of one of the two transmitter-receiver installations is shown in Fig. 2. Both units are completely within the building and the infrared signals are transmitted through ordinary window glass. Each of the two six-inch-diameter tubes is used to support the focusing lenses, each of which is 146 millimeters in diameter with a focal length of 410 millimeters.

The transmitting element, located near the focal point of the transmitting lens, is a GE infrared solid state lamp Type SSL-5C. This lamp is a gallium-arsenide light-emitting junction mounted in a TO-18 transistor case with a glass lens in the top. The diode has a rated continuous wave power output of seven milliwatts in a 300 angstrom bandwidth centered at about 9400 angstroms. The radiation pattern of the SSL-5C has a half power beam width of approximately 18° total angle. Typically, there is but 1 to 2 milliwatts of power within this beam width, the remaining power being in side lobes and skirts outside of the main beam.

The input to the light emitter is 500 milliamps at 1.8 volts and is easily controlled and modulated by a two-stage transistor amplifier operating from a 10 volt power supply.

The receiving element, located near the focal point of the receiving lens, is a Motorola phototransistor Type MRD300. This is a silicon transistor also mounted in a TO-18 transistor case with a glass lens on top. The receiving amplifier consists of some eight transistors and one integrated circuit. The amplifier contains automatic gain control to provide a constant output signal voltage while the input voltage varies over a range of 100 to 1. This wide range of AGC is to compensate for the variations in the path loss due to adverse weather conditions. Additional AGC is available in the GE data sets but it is not used in this installation. There were several other minor modifications made in the data sets to make them compatible with this system.

range and bandwidth

At the present time it is difficult to predict the maximum range and maximum bandwidth of such a system. The ultimate range or bandwidth of such a system will likely not be limited by transmitter power or receiver sensitivity but instead will be limited by the AGC range which can be incorporated into the receiver amplifier. The best information available today indicates that the received power can be expected to fluctuate by more than 20 db for every kilometer of path length. With present technology, it would appear that a 2 kilometer path length may be the maximum range for reliable communications. However, repeater stations are very economical and could be used to considerably extend the range.

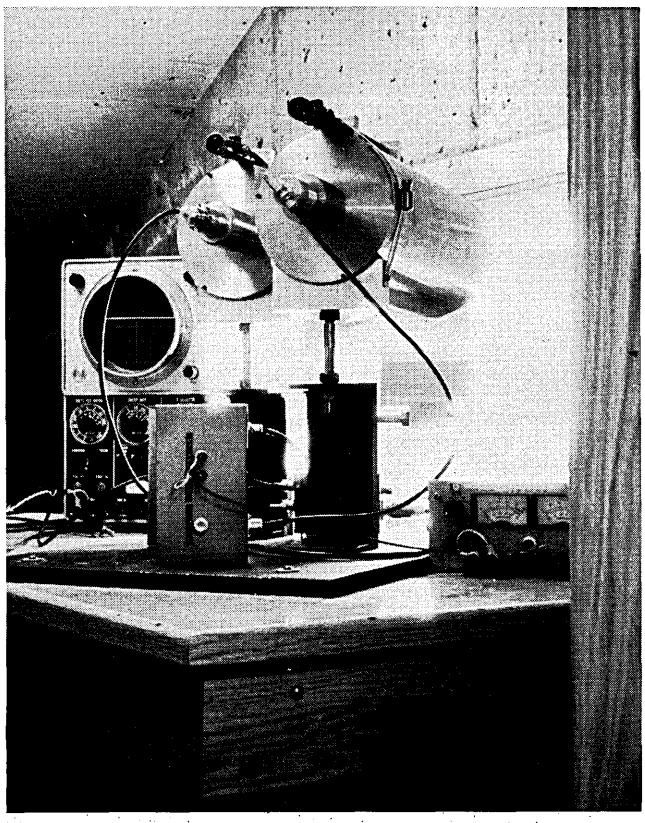
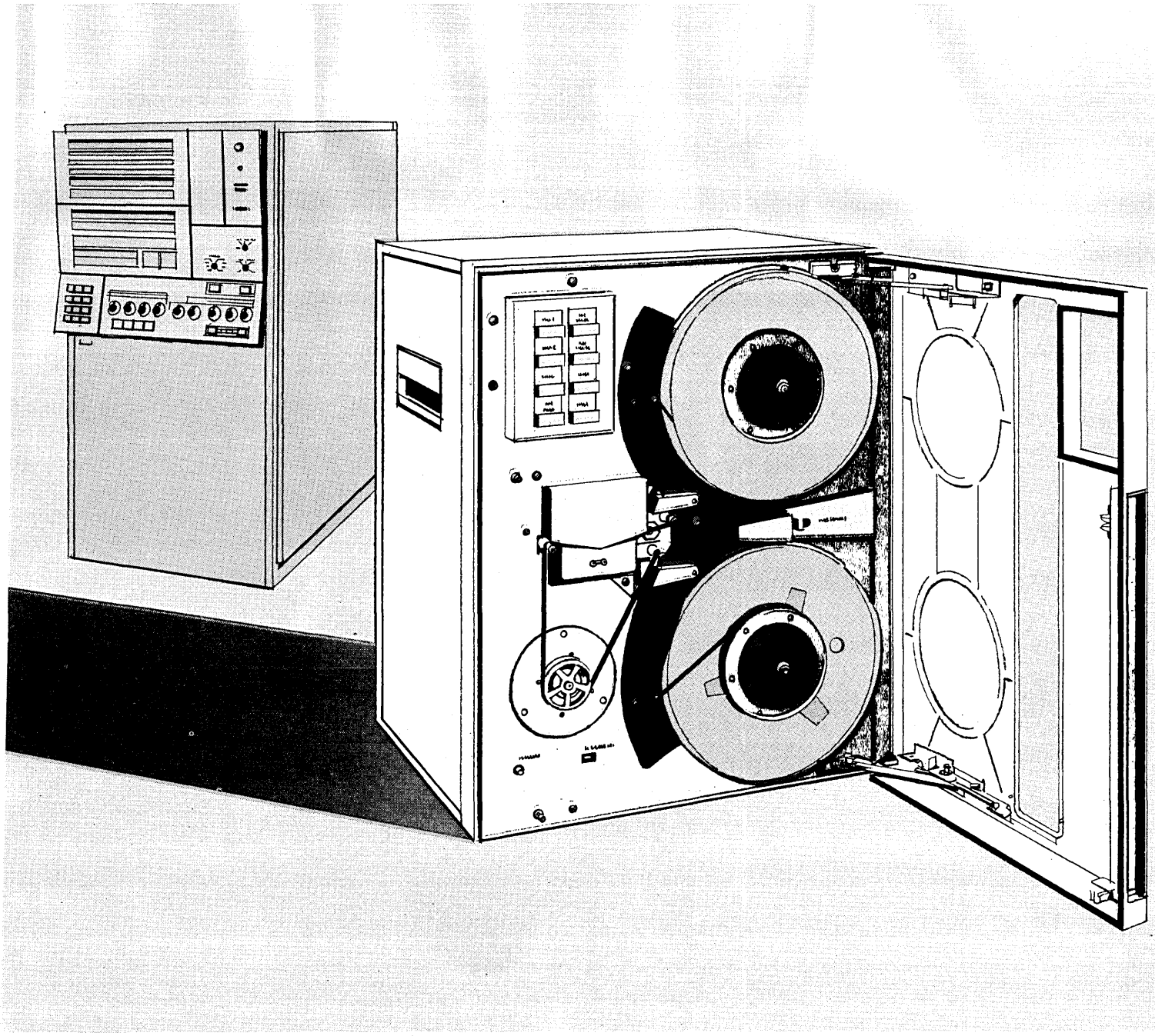


Fig. 2. One of the two transmitter-receiver stations.

(The author would like to acknowledge Professors Russell Hayes and Rex Krueger and students Larry Potter and William Stout for their assistance in the design, construction, and testing of this system.) ■

Computer's little helper.



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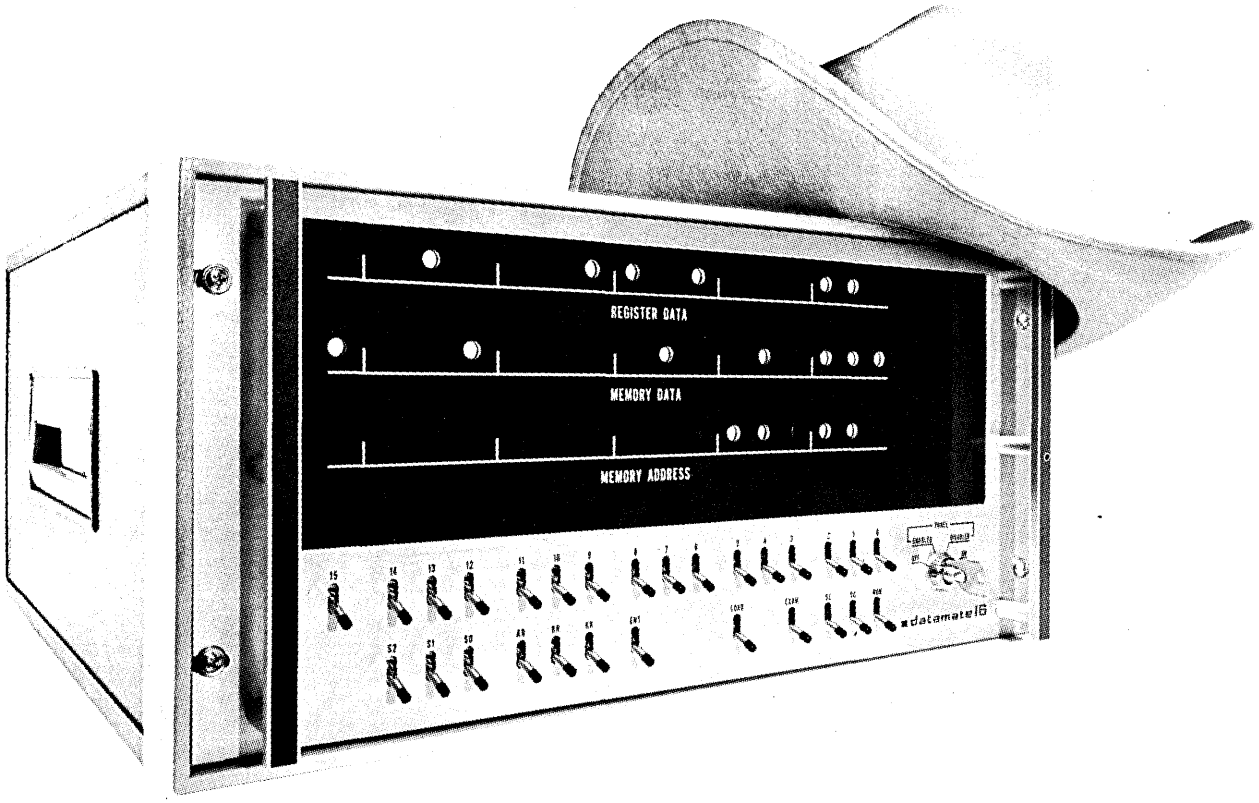

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CIRCLE 51 ON READER CARD

a tutorial

INCREMENTAL COMPILERS

by Wesley J. Rishel

One of the advantages of an on-line system is the short compile-debug-edit-compile cycle permitted by the fast turnaround time characteristic of time-sharing systems. To shorten the debugging cycle, a special type of language processor has evolved. I refer to the incremental compilers and interpreters now offered on most t-s systems. Some of the special problems of incremental compilers and their possible solutions are discussed in this paper. This discussion is illustrated by a review of some actual commercial implementations. Since incremental compilers have a reputation for generating slow code, the article concludes with some arguments for attacking that problem.

The defining characteristic of the incremental processor is that each line of source language is translated at the time it is received from the on-line terminal. This allows immediate reporting of syntax errors. Since each line is compiled as it is entered, the whole program need not be recompiled and rerun to change only a few lines. Incremental processors always translate directly to core, eliminating the loading pass. As a result the debug cycle consists only of "type in statement; begin trial run."

Unless noted differently, I make no distinction between compilers which generate machine language and those which produce a translated form of the program suitable for interpretation. While a clear distinction may be possible, I choose to blur it by noting that almost every compiler generates a subroutine jump to handle some operation. Such a compiler's code can be said to be partly interpretive. It will be convenient to speak below of compilers as generating "more" or "less" interpretive code.

processor characteristics

Several satellite characteristics are usually associated with incremental processors:

(1) When the execution phase terminates, the state of variable storage is preserved as well as the object code. It is then possible to change statements in the program and continue its run without restarting the program from the beginning.

(2) Many statements may be typed into the processor for immediate execution, as opposed to statements which are typed in for addition to a program (deferred execution). This feature, usually billed as a "desk calculator" or direct mode, allows the user to enter complicated arithmetic expressions for immediate execution.

(3) When the direct execution mode is available in a system which preserves storage after a run, the processor becomes a powerful debugging tool. Direct I/O and assignment statements are used to examine and modify the state of the variables. Lines of text are changed very quickly. Direct subroutine jump statements are used to allow parts of a program to be debugged. In this mode the user has at least as much debugging freedom as nostalgic old-timers report they had "at the console." Further, the user has, in the language processor, the capability for very selective dumps and the conceptual ability to deal with a "FORTRAN machine" or a "BASIC machine," rather than having to maintain simul-

Mr. Rishel, as senior systems programmer at Com-Share in Ann Arbor, is responsible for the design and implementation of interactive compilers for their t-s system. He also serves as their software integration coordinator. Previously, he did the layout for the t-s system at the Fulton National Bank in Georgia. He majored in math at Dartmouth and worked on their EDIT package and various background - mode support programs.

taneous mental views of his program's source and machine language representations.

The concept of the incremental compiler is deceptively simple—like so many good ideas—but the simplicity of its mode of operation is more in the eyes of the ultimate user than the system programmer. It is the system programmer who must consider problems like: maintaining two parallel copies of the program, object-code linking, remote-line references, loop-defining statements, declarations, and asynchronous interrupts. This section takes up these problems in some detail.

the parallel version problem

A source language version of the program must be maintained and updated to show changes. At the end of a debugging session, the updated copy of the program reflects the programmer's progress. This usually entails keeping *two parallel copies of the program,* source and object. Entering a line causes new object code to appear and also causes the source line to be placed in its logical position in the symbolic program.

Maintaining two parallel copies of the program places extra demands on the supporting operating system. For each entry of a line of program the system must swap in roughly twice as much information as would be needed if only the source were required. On a machine with a relatively small amount of core available to a single user, the designer of the incremental system may choose to address one version of the program at a time. This shows itself to the operating system as extra drum or disc interactions for each teletype interaction.

If the amount of space available in high-speed secondary storage is small, relative to the amount of core available to the program, or, if the secondary storage is slow enough to make accesses costly, the parallel version problem manifests itself in the form of the incremental processor handling smaller programs than it otherwise might, since both versions must be kept in core.

This problem can be largely circumvented by accumulating lines of text in chronological order until some command requires a sorted version of the source text. The source lines pile up a buffer which, when full, spills to secondary storage. The bigger the buffer, compared to the average line of source, the more pleasant for the operating system will be the ratio of drum or disc interaction with teletype interaction.

Another solution to the parallel version problem has been in use for some years now. Some systems which are highly interpretive keep only the translated version of the code. Upon request for the symbolic version, the processor reconstitutes the source language from the translated code. Redundant parentheses are often lost, and constants come back out in uniform format. This solution rivals the precedence-arithmetic scan for its pleasing elegance. However, it has the disadvantage of being psychologically somewhat unsettling to the user since, when he lists his program, some lines are sufficiently different from the way he typed them, so that he suspects that the compiler erred. The scheme also is somewhat more costly in terms of cpu time than others, and one can imagine that there will be areas where the translator output will be less neat than it might be, due to the necessity of generating reconstitutable code.

the object code linking problem

During repeated trips through the compile-run cycle, the same line may be entered many times, and lines may be inserted between other lines. This creates problems of object code linking and object time core management. Since the lines are received chronologically in an order different from their logical order, it is necessary to provide some mechanism for getting from one statement to the next.

Fig. 1a illustrates one scheme for handling the linking problem. Each statement is compiled as a unit. The first word of the statement is a code for where the statement

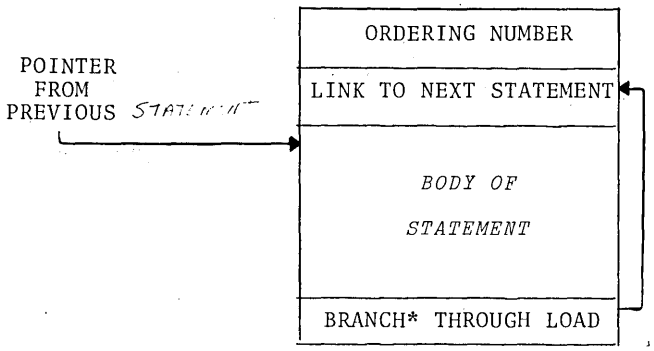


Fig. 1-a thru 1-c Object code linking by threaded lists.

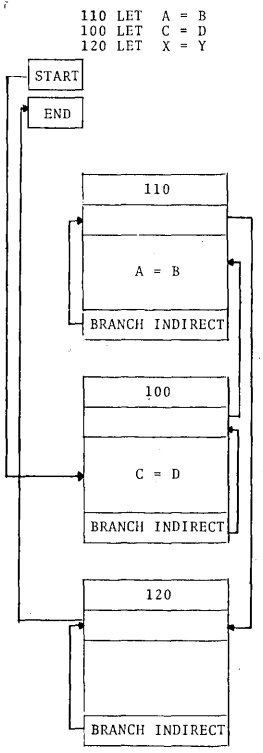


Fig. 1-b

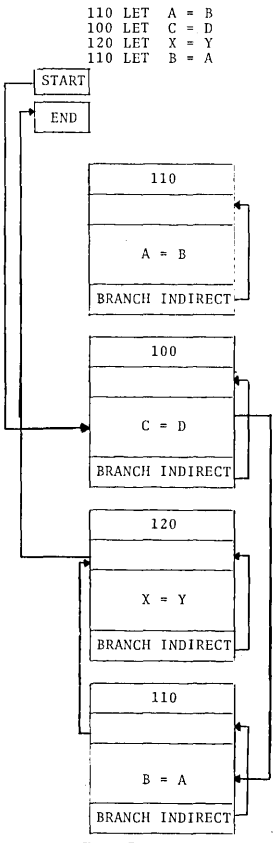


Fig. 1-c

belongs logically in the program. For BASIC, the binary representation of the line number suits this purpose admirably. The last word of each statement is compiled into an indirect branch through the second word. The second word is left empty until compilation completes, at which time this statement of object code is threaded through the existing linked list of statements. When it is so threaded, the second word points to the first executable instruction of the logically next statement in the program.

Figs. 1b and 1c illustrate with simple BASIC statements how the threaded list forms as statements are entered. In Fig. 1c, a corrected statement 110 is typed in. The thread-

ing is reorganized and the object code for the previous version of 110 is left out in the cold.

Note that replacing a line in this (and most) incremental processors is the same as inserting a new line and then deleting an old one. This is because the processor cannot discard the old version of the line until it is finished compiling the new one and knows it to be correct. The problems of inserting and deleting lines are the same as those associated with changing lines.

It is fairly difficult to recover the core discarded by deletion under this scheme. One problem is that object code is often not relocatable. It might be possible to recompile new statements into old holes if one knew in advance how many words would be required. A good upper bound for most BASIC implementations is one word per (non blank) character of source text. I know of no one who has tried such a scheme. Attempts to recover discarded core will be discussed below in more detail.

inverted-list method

Another scheme for organizing the object code is shown in Figs. 2a and 2b. This inverted-list method is analogous to the threaded list of statements used in the previous scheme. Object code is compiled into available core, and the linkage information is kept in a separate table. The last word of code for each statement is a jump to a routine which advances a pointer into the table and jumps indirectly through the second word of the table.

The inverted list uses core no more efficiently than the threaded list, since each requires three overhead words per statement. However, if the output from the compiler fits

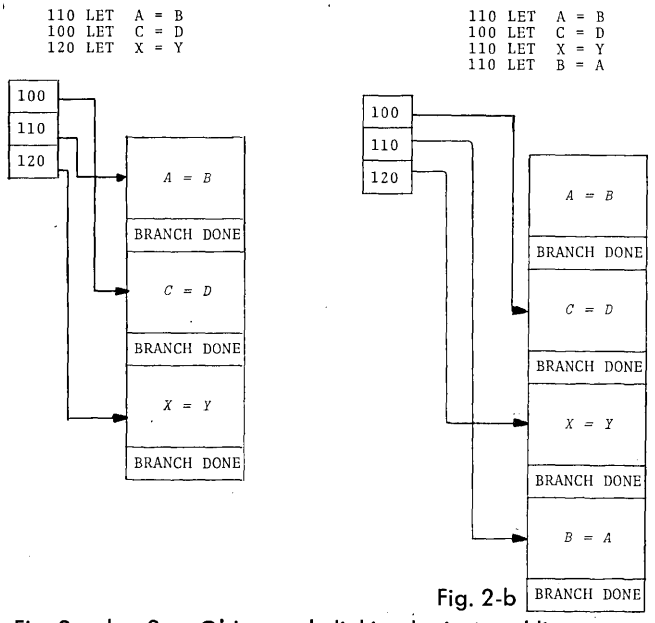


Fig. 2-b

Fig. 2-a thru 2-c Object code linking by inverted lists.

certain requirements, the inverted list can be a significant help in core management. One requirement is that the executable (or interpretable) output be relocatable. This is not as tough as it seems, since variable storage need not be relocated. On most machines any stream of pure arithmetic instructions can be moved around with no modification. It is a branch which causes trouble.

If a processor can move its executable code around, then storage can be reclaimed as statements are deleted or replaced. The inverted list makes it easier to shuffle core to close up gaps created by deleting lines. It is easier to use a block-move operation to close up core (and then scan the table, relocating all entries which reside in core above a given address) than it is to perform analogous operations on a threaded list. See Fig. 2c.

Another major problem related to core management is the use of external functions. There is no clearly defined time at which compiling stops and running begins. Indeed, the two states alternate indefinitely. The set of functions required for program execution can contract and expand as lines are changed. Ideally, a processor would like to evaluate the set of required functions just as execution begins and load them all in zero time. Computer speeds being finite, some compromises have to be made. The time constraint generally dominates. Incremental processors typically have a fixed library of externals which permanently occupy an area of run-time core. The disadvantage to this scheme is that all subroutines in the system library are

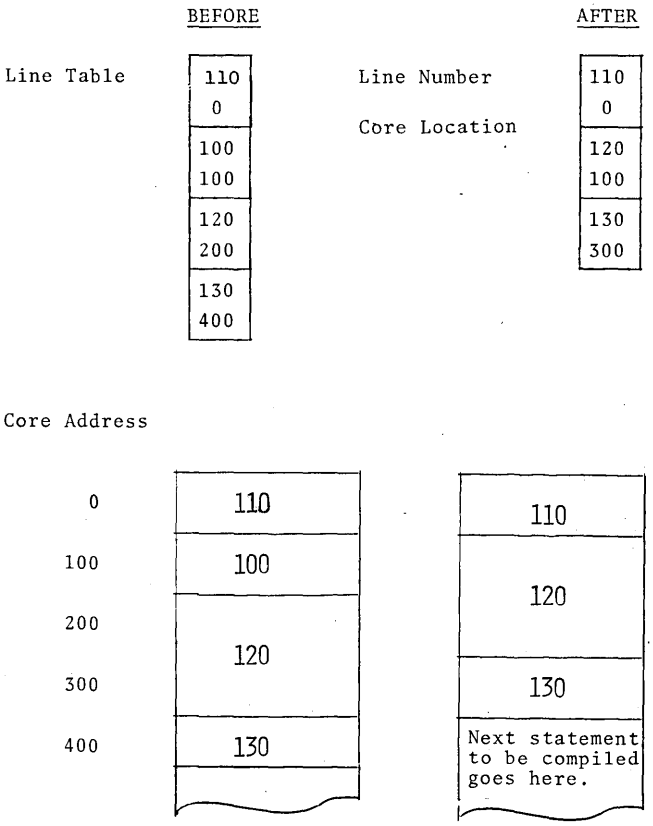


Fig. 2-c

always competing with the object code for space in core. New entries in the library must be carefully considered on a space-vs.-utility basis.

There is an alternate scheme for handling externals. Its practicality is based on the premise that the set of required external functions does not often change as the user runs through the debugging cycle. The scheme involves making changes to the function region of core only when execution is requested, and there have been additions to the set of required functions. At that time the functions are all reloaded.

Note that for this scheme to avoid filling core with unnecessary functions, the processor must be able to determine that subroutines which were once required are no longer needed because of the deletion or modification of lines in the program. One straightforward way of achieving this requires little overhead in processing time. Function references are enabled in an array which contains the name of the function, an access count, and a cell reserved

for the location of the function when it is loaded into core. When the compiler finds a reference to an external function it sets the function name in the table, if it is not already there. Function calls in the object code are compiled indirectly through the table, and the access count is bumped. The compiler appends to the statement's object code a list of indexes into the table, one index for each different function referenced. When a line is deleted, this list of indexes is used to reduce access counts in the function table. Then, when a run is finally requested, all entries in the function table with nonzero access counts are checked for being currently loaded. If any are not in core, they are all reloaded, compacting the core required for function references. See Figs. 3a through 3c for a chronological example of how this scheme works out.

the remote line reference problem

Another major problem in incremental implementations is the fact that most higher level languages have statements which depend for meaning on other statements in the program. The most obvious of such examples is a GOTO statement. When the BASIC statement "100 GOTO 10" is entered, statement 10 may not yet have been provided, or it may have been entered but subsequent changes may move

```
      100   A = SIN (B)
      110   B = SOR (A) + SIN (A) + TAN (B)
      120   C = SQR (A) + CØS (A)
(b)   RUN   (loading of functions required)
      120   C = SQR (A)
(c)   RUN   (loading of functions not required)
      120   C =TAN (A)
(d)   RUN   (loading still not required)
      120   C = ATN (A)
(e)   RUN   (loading required, un-needed functions flushed)
```

Fig. 3-a thru 3-c Sample session using external functions.

its location. The same problem exists for computed GOTO's, FORTRAN format references, or any statement which refers to another line.

One solution to the GOTO problem is to interpret all remote line references at run-time. If this solution is chosen there is significant reason to choose the inverted-list core organization discussed above. In the inverted-list scheme one can search the line table with a binary search. If statements are threaded together, only a linear search is possible.

An alternate method of handling remote line references is to associate symbolic names with real-core addresses each time execution begins. When a remote reference is compiled, only the symbolic name is put in the object code. When the program is started, all such references are analyzed and a true core address is located for each one. Note that this must be done *each* time the job is started up, since a previously fixed remote reference may need to be refixed if its target statement has moved.

Finding each remote reference at run-time presents a problem. If the object code is sufficiently restricted to avoid ambiguities, a linear search over the object code can be performed by threading all remote line references together as they are compiled. As before, the symbolic address of the remote line is saved in the object code. Along with the code for the jump, and the symbolic address, is a link to the next such reference. Just before an execution phase begins, the initialization routine traces down the list of line references, looking each up in the line table, and filling in the missing real core addresses for the jumps. This is more sparing of cpu time than interpretation, since each line is looked up only once per run. The threaded list must be modified to close up gaps caused by deleting object code. This is considerably easier than fixing up a threaded object code. Since the threading of remote line references does not have to be in any special order, new references can simply be added to the end of the list as they are generated. Because the references will be in the chronological order in which the lines were generated, they will also be in ascending order by real core address. Before closing the gap left by a deleted line, one need only run through the list of remote references, deleting all those within the area to be closed up, and relocating downwards all pointers to remote line references which are above the area to be closed in.

Wherever there is a threaded list it is natural to consider the analogous inverted list. Removing the pointer to each remote reference and the symbolic name of the line sought allows the compiler to generate only one word of code in line for each reference. This may help the compiler generate "neat" code.

Aside from this largely aesthetic advantage, inversion of the list of remote references has no profound impact. There is one disadvantage which I will mention here as a bit of philosophy. All other things being equal, it is preferable not to create tables because, generally, when any one table fills up, the compiler quits. I believe it is preferable to tell a user

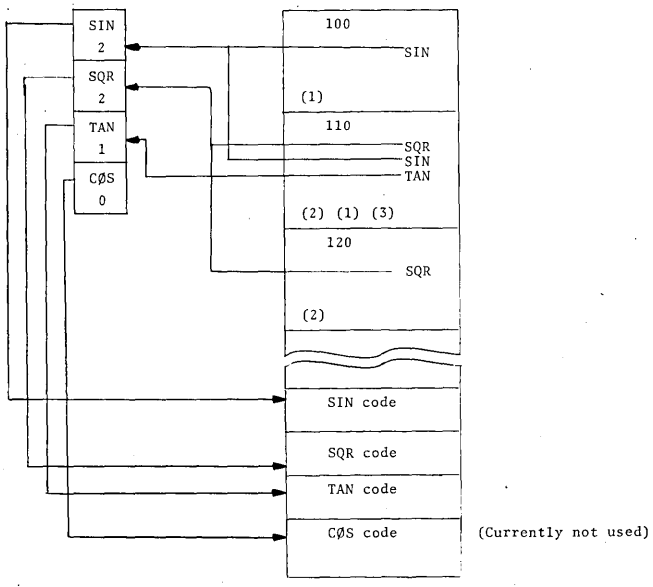


Fig. 3-b

that "the total number of your widgets, flammerjams, and object codes must be less than 100," rather than saying that "you may have no more than 10 widgets, no more than 5 flammerjams, and at most 985 object codes."

the loop analysis problem

Another case where the whole program state must be analyzed before execution begins is the analysis of loop-defining statements. The problems vary considerably with the form of the language. In BASIC a loop is defined by a pair of statements:

FOR <variable> = <expression> TO <expression>
.
.
.
NEXT <variable>

Whatever falls between the two statements is the body of the loop. The body will not be executed at all if the first expression is greater than the second. Mentioning the index variable in the NEXT statement is redundant, but the convention is very natural and aids the user in debugging. Since a test must be made before the loop is entered for the first time, most compilers like to compile the code for incrementing the loop in the FOR statement.

Just before execution begins the BASIC processor must: (1) link all FOR statements to the statement following the corresponding NEXT, (2) link each NEXT statement into the body of the FOR where the index is stepped and tested, and (3) verify the redundance of the NEXT statement.

One way of handling the problems is to build two separate tables for FOR and NEXT statements. Both tables will be kept sorted on line numbers and each will also contain the name of the index variable. In addition, the FOR

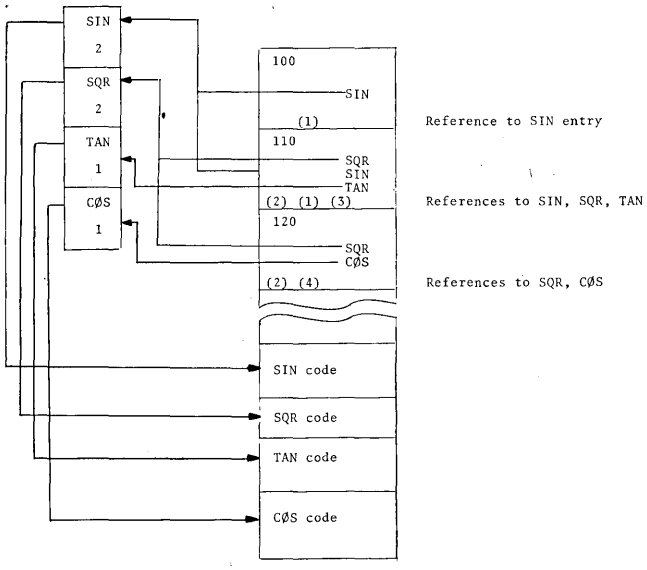


Fig. 3-c

table will contain the real core address of the body of the FOR statement. The evaluation of the NEXT statement will require this entry. Whenever any line is deleted it is checked for being in either table. If it is, the entry is deleted and the table closed up. The analysis of the table before running is straightforward.

The table scheme suffers from my flammerjam objection and is wasteful of code. Since the object code is so organized that it can be accessed in logical order, we can eliminate that word which specifies line number in the FOR and NEXT tables. Then, instead of having a separate table, the object code for each loop-defining statement starts with a special code indicating "I am a FOR" or "I am a NEXT." If the object code is organized on an inverted-list basis, spare bits in the line table can be used. The start of the code for the FOR and NEXT statements contains the name of the variable, and in the case of FOR, the entry point.

As execution begins, the object code is scanned and a pushdown is built in temporary storage. When a FOR statement is discovered, the name of the index and entry point address is pushed. When a NEXT is discovered, the index name must match the newest one in the pushdown.

it does do too

FORTRAN DO loops are really tough. The problem is that, when the incremental compiler translates a statement, it has no way of knowing that the statement may be made into the terminator for a loop by a line inserted later. The user can, for example, type

```
10 A=A+I
```

and later insert

```
DO 10 I=1, 10
```

Most incremental FORTRANS are heavily interpretive in this area. This is unfortunate since the DO statement is generally used to define the innermost loop of any program.

If the line table which keeps track of the logical order of the object code has some spare bits, a fairly efficient interpretive scheme can be set up. Just before execution begins, a scan is made for all DO statements. The code for the DO contains the symbolic name of the last statement in the loop. When a DO statement is discovered, a link word describing the entry point in the DO statement is tacked onto the end of the object code. The offset between the end of the object code and the link word is stored in a field in the line table entry which points to the end of the loop. As execution proceeds the linkage routine, which gets from one line to the next, checks that field to see if the statement just executed was the end of a loop. If so, special action is taken. At the end of the run the scratch core used for link words is recovered.

In the analysis phase, just before execution, the DO loop processor checks for inconsistent loop structure in the following manner. While searching down through the table for the line number of the terminator, it checks the "I am a loop termination" field of every intervening entry. If any entry has bits on it, indicating that it is a terminator of a previous loop, the loop structure is an illegal one:

```
DO 10 . . .
.
.
.
DO 20 . . .
.
.
.
10 . . .
20 . . .
```

the declaration problem

The toughest problem associated with incremental compilers is declarations. Most compilers generate context-dependent code based on declarations which logically precede the affected statements. Variable type and dimension are the most obvious examples. It is impossible to know whether to compile an integer add or a complex add when processing the statement A=B+C. In the statement X=ZAP (Y), is ZAP an array name or an external function? In BASIC, how must the code for statement 100 below be modified for the addition of statement 90?

```
100 LET A=B+C+D*E
 90 DEF FNF (B,E)
```

In some compilers there is a more subtle problem associated with defining a statement into a function than the fact that some variables have become formal parameters. If the temporary storage cells which the compiler generates during the evaluation of an expression are reused from line to line, and the above statement is used in a formula like

```
190 LET X=X*Y+Z*FNF (X,Y),
```

the same temporary cell would likely be used in statements 190 and 100. That is a bug. If there is a spare B or index register around, all temporary references can be generated to small integers modified by X. When a function call is executed, the value of X is saved on a pushdown and is bumped by the maximum amount of temporary cells used. Function return resets X.

There are some conceptual difficulties as well as the

implementation problems associated with inserting declaratives. What does the user want when his program has been running for a while, and he stops it, equivalences two arrays together, and resumes execution? Suppose he redefines the number of dimensions in an array?

Declaratives are considerably more of a problem in FORTRAN than BASIC. One way to handle some declaratives is to make them executable statements and handle them at run-time, which is a very good way of handling BASIC's DIM statement. At the time the DIM statement is executed, space is grabbed from a pool of available storage and zeroed. If an array is redimensioned, the old storage is returned to available storage. Using this scheme the DIM statement may contain formulae. MAT (matrix) operations use only the storage currently required, leaving more storage in the pool.

A reference to a subscripted variable is compiled as a jump to a closed subroutine. One argument to the subscript routine is a pointer to a table describing the array. Redimensioning changes the contents but not the location of the table.

declaratives in fortran

The problem of declaratives in FORTRAN is generally solved in one of three ways:

(1) Heavily interpretive execution.
(2) Requiring the user to enter all declaratives first, chronologically.
(3) Recompiling the whole program if declaratives are changed or added.

If the arithmetic is being interpreted, the operands in the code can contain pointers into a symbol table instead of the address of data. The symbol table holds type information. The subroutines called when operators are interpreted check the types of both operands and perform accordingly.

On a system where floating-point arithmetic is really slow—say 15 to 20 times slower than integer—the extra overhead for interpretation can be fairly well buried in the floating-point time. This occurs where floating point is being done with software. Such implementations are relatively expensive for programs which rely heavily on integer arithmetic.

Consider the gains in efficiency if the user must type in all declarations first. While this makes the requirement seem not nearly so unattractive, the real disadvantage becomes apparent only when the user finds that he has made a mistake in his declaratives. To change them, he must go through the rigamarole of saving his symbolic on a scratch file, modifying it, and starting a fresh session with the processor.

The third alternative is just the second one automated. When the user enters a declarative into an existing program, the processor automatically initializes itself and produces a clean object code. I believe that, where execution speed is important, this scheme is the best of the three. Its disadvantage is that the user must accept much longer response times to changes of declaratives than to other statements.

asynchronous interrupt problem

One other problem area in the design of incremental processors is the handling of asynchronous interrupts. The user needs some way to tell the processor to stop what it is doing. Typically, he presses a designated key on his terminal, and the operating system simulates a hardware trap in user core. The user may then want to examine his storage, make changes to it, and resume execution. In order to avoid bewildering events, it is crucial that the interrupt be honored between statements rather than during the execution of one.

For example, suppose the following sequence of events occurs. The object code for the statement "I=I+1" is being executed. Just before the "store accumulator in I" instruction is executed, an interrupt occurs. Working in direct mode the user changes the value of I to a totally different number, then resumes execution. The "store accumulator" is executed and I returns to the old value.

The normal way of handling interrupts is to have the interrupt routine set a flag saying the trap occurred. The interstatement linkage routine checks the flag before beginning a new statement.

examples of incremental processors

To illustrate some working solutions to the problems discussed in the previous section, let us examine five commercial implementations of incremental compilers.

QUIKTRAN. The oldest commercial incremental interpreter is QUIKTRAN I, with which we are all familiar. QUIKTRAN accepts statements and immediately compiles them to an interpretable form. Operand references in the compiled code point into a table which contains symbolic names, type information, and pointers to values. Statement labels are also in the symbol table. The code to be interpreted is in a big pot and is in no way dependent on real core location. Source language is reconstituted from the execution code when required.

Execution under QUIKTRAN I is slow.

RUSH. One very modern time-sharing system shares some common characteristics with QUIKTRAN. The Allen-Babcok RUSH system runs on a modified 360/50 under OS. The language is essentially PL/I, although there are some incompatabilities with the IBM compilers.

Source language is translated as it is entered into Polish strings. The string corresponding to each statement is kept in a threaded list in a section of core assigned to the user. The source language is reconstituted from the Polish when required for a listing.

The Polish contains pointers into a symbol table for the operands. Dimension and type information is kept in the symbol table along with pointers to the data. There are only two data types: short, floating-point decimal and long, floating-point decimal (6 and 14 digits, respectively). Special hardware allows the mantissa to be kept in packed-decimal format. This eliminates the rounding problems that necessitate the integer data type on binary machines.

Execution is considerably more rapid than under QUIKTRAN because the special hardware interprets the Polish string and the symbol table directly. Mixed data types are also handled automatically. The deletion of the integer data type is a significant improvement in execution efficiency.

Information describing the block and loop structure of the program is kept in separate tables.

External functions are in a fixed library which permanently occupies part of the system region of memory. The program and data are always kept in bulk core (there is no swapping). This means that the fixed library does not compete with the user program for space. Since the library size does affect the size of the partition required to run RUSH under OS, this will tend to inhibit the growth of a vast machine language library.

FIV. Another example of an incremental FORTRAN is Com-Share's FIV (FORTRAN IV). Other versions of the processor, stemming from the same origins, are available from most vendors offering time-sharing on the SDS 940. While the language is full FORTRAN IV, the system was originally

conceived to support other languages with a common command processor, text-handling routines, and execution monitor.

When the FIV compiler processes a semantically acceptable line, it passes the source to text-handling routines and their object code to the structuring routines. The object code is completely relocatable here. The execution routines will physically move the code into a "hole" in the existing object code and thread the statement into logical order. Declaratives which generate type or dimension information are executable. Symbolic variables are linked to data locations the first time a statement is executed. GOTO's and DO-loop structure are interpreted during execution.

To understand the mode of interpretation, one must know a little about the 940. The machine has a set of subroutine jumps called Programmed Operators (POP's) which allow the user to define up to 64 pseudo-instructions which may be intermixed with hardware instruction in the object code.

The object code for FIV consists entirely of POP's. The POP's and their associated subroutines define a "pseudo-machine" with an especially good instruction set for the type of execution required from the processor. It is because of the existence of interpretation mechanisms like these that I claim that the distinction between interpretation and execution is unclear.

CAL. Com-Share's CAL, a language very similar to JOSS and TelComp, also uses the idealized machine concept. CAL compiles a statement to POP's—and the POP's and the text of the source version of the statement are combined in a block which is threaded in logical order with other statements.

Since CAL is one of the few languages specifically defined for incremental processors, many of the problems discussed in the preceding section are not present in it.

There are no declaratives in CAL. Variables are all of type real. Arrays are kept as threaded lists of elements. Each entry in the list contains the subscripts associated with it and the value. Array elements which have not been used are not on the list.

The FOR construct used to define a loop in CAL is a suffix modifier which operates only on the single statement in which it is contained. Multiple statement loops may be created by iteratively executing a subroutine jump under the control of the FOR modifier.

Remote line references are the only case in CAL where the operation of one statement is effected by the presence or contents of any other statement in the program. These are handled at runtime by linear searches of the threaded list of statements.

BASIC. Com-Share's BASIC generates machine code for each statement as it is entered. The source language corresponding to the object code is added onto the end of a drum file, which may be accessed randomly. A pointer into the source file is saved with the object code. The object code is threaded together, with the last word being an indirect jump through the first word which points to the next statement in sequence. A POP is used to perform the jump rather than the hardware branch instruction. This allows the processor to check a flag for the processing of interrupts.

Just before execution begins FOR-NEXT loops are analyzed, building a pushdown in temporary storage, as discussed previously.

Remote line references are maintained in a threaded list through the object code. All such references are linked each time execution begins.

The only time a clean copy of the source program is needed is during the execution of commands which require source to be output sequentially to the file system (LIST, SAVE). A subroutine runs down the object code thread, using the pointers into the source file to address the drum in a random fashion. The buffer size for the drum file is big enough (6144 characters) to ensure high probability that the next line required will be in the same buffer load as the last, eliminating the need for extensive drum interaction.

slow execution—a distinct disadvantage

The many solutions to incremental processing problems lead to the one problem which is usually considered a generic characteristic of incremental processors, i.e., slow execution. In comparisons recently made between Com-Share's FIV and our XTRAN (a nonincremental FORTRAN IV), XTRAN executed the same cpu-bound program 11 times faster, in cpu time, than FIV.

In a similar comparison BASIC fared much better than FIV; it executed only about 15% slower than XTRAN. This is due to the form of the BASIC language, which allows the compiler to generate mostly machine language code. Certain features in other implementations of BASIC, however, like multiple line functions and complex data declaration, make BASIC seem an unlikely candidate for future noninterpretive incremental implementation.

Slow execution has been traditionally regarded as the tradeoff made in exchange for the convenience of incremental processors.

How important is execution speed? Some often-presented arguments tend to belittle the importance of efficiency at execution time. I take issue with several of these arguments.

It is said that a program written on a time-sharing system is usually written to be run only once, so who cares if it takes twice (or 11 times) as long to execute? The facts are that it simply isn't so. In the commercial time-sharing business, a very small number of programs are written for one-time execution. Most customers use time-sharing to automate repetitive calculations.

The argument has somewhat more validity in a university environment where a good deal of the school's computer resources are devoted to class homework. However, when a time-shared system is available within a university, the general level of sophistication in computing rises all across the campus. It is reasonable, therefore to expect the growth of a body of users who will develop programs for repeated execution. Also, programs now being developed for class work in areas other than computer science are very often very complex, causing a considerable amount of cpu time to be spent in checkout of a class project.

The statement is also made that "all time-sharing jobs are I/O bound because of the low data rates associated with terminals in use today, so cpu time is not critical." It can be pointed out that the data rates of terminals will go up before they go down. A more pertinent point is that the relevance of the I/O-bound argument in systems analysis is strictly limited to batch. On any time-sharing system, where the processor is a scarce resource, unnecessarily slow execution degrades response time and reduces the number of people who can make simultaneous use of the computer. This is very strongly related to the revenue-producing capability of the system.

In a noncommercial environment, a processor-bound system with uneconomical execution speed raises the cost per terminal hour of the system. Most time-sharing systems are processor bound. This can be true even on a system which is, on the average, I/O bound, since backlogs of computation will often accumulate during heavy load conditions.

It is my contention, then, that slow execution is a significant disadvantage in incremental implementations.

In some languages, the only major problem associated

with incremental compiling is that of mode declarations which are received after code referring to the variable being declared has been generated. I believe that, for these processors, it would be better to recompile the whole program upon receipt of such a declaration than to generate "flexible," slow code which examines data modes at run time.

alternatives to incremental processors

Where a language has features which make the output of an incremental compiler execute slowly (other than mixed data types), it is appropriate to consider alternative schemes for on-line programming.

The chief value contributed by an incremental processor to a time-sharing system is that program development costs are sharply reduced by the short debugging cycle. Which of the characteristics of incremental processors contribute most to reducing the debug cycle? Perhaps less critical features can be pared out in exchange for increased execution speed.

The first idea which springs to mind is that of supporting essentially two compilers, one for debugging and another for generating a "production" version of a program. The hard part of such a scheme is doing it well; systems programmers would have to exercise tremendous restraint to avoid adding subtle differences in execution under the two systems—differences that would permit bugs to pass undetected through the debug system and show up only in production. Could we ever find good systems programmers who would be really willing to try to keep the two systems identical?

Another objection to the two compiler scheme is that, as time-sharing users become more experienced, they often develop complex systems of programs for on-line use. Checkout of these systems may involve great amounts of execution time. It would be nice to concoct a scheme which gives the benefit of quick execution to the person who is developing programs as well as to the end user.

even better

I believe that the defining characteristic of incremental compilers (immediate processing of source) contributes less to the value of the system than do the satellite characteristics, i.e., editing programs without switching processors, and being able to resume execution after examining and changing the state of the program.

The value of true "incrementability" is based on the contention that the overhead involved in recompiling the program each time it is changed is a burden to the user (in terms of response time). It is better, the argument proceeds, that the cpu time required to compile be spread over many terminal interactions than to give it in one lump at the time execution is requested.

There do exist time-sharing systems which compile to core at the time execution is requested, such as the Dartmouth 235 system marketed by GE as its MARK I service. When the system design allocates relatively large quanta of time to each user, a system can be built in which the entire program is recompiled if any statements are changed.

If such a processor were constructed in such a manner as to allow the program to be recompiled while variable storage was preserved, the user could be allowed to stop his program, examine, and change variables with direct statements, and even resume execution in a modified program. The user would sacrifice only instant diagnostic messages in exchange for speedier execution. I believe that such a system is an attractive compromise between the flexibility of an incremental processor and run-time efficiency. ■

THE
E-655

R. A. McLaughlin, Assc. Editor

Although the GE-655 has been assigned a model number taken in regular progression from the GE-635 and -645, it is called by the manufacturer the "first of the United Systems," and in some ways represents a significant departure from the older machines in the 600 series. The single processor computer is referred to as two to three times as fast as the GE-635. It is not compared with the relatively rare 645, since that machine is considered by GE to be a kind of design exercise and not a regular part of the 600 series.

Unlike either of its predecessors, the GE-655 is built with integrated circuitry rather than from discrete components, admits to the need of an informed computer operator, and has been packaged by designers rather than by technicians.

Glamorous styling for a large-scale computer system should be about as important as glamorous pipe fittings, but since so many computers are encased in fishbowls and treated as prestige items, General Electric apparently felt that the customer should get something he is proud to have his picture taken with. The technicians did not lose out entirely, though, for in addition to stuffing IC's behind the color accented and walnut grained exterior panels, several new test and maintenance working panels have been built, and deep within the hardware lurk 32 (74-bit) history registers whose purpose is to provide traces of cpu activities for diagnostic purposes.

The cpu is asynchronous, so it has no clearly definable cycle time, but performs Gibson mix instructions at a rate of better than one million per second (about twice as fast as the GE-635). A full-word fixed-point add is executed in 600 nsec (compared to 1.9 usec on the 635), a multiply in 3.0 usec (versus 7.6 usec), and a divide in 7.3 usec (against 15.1 usec).

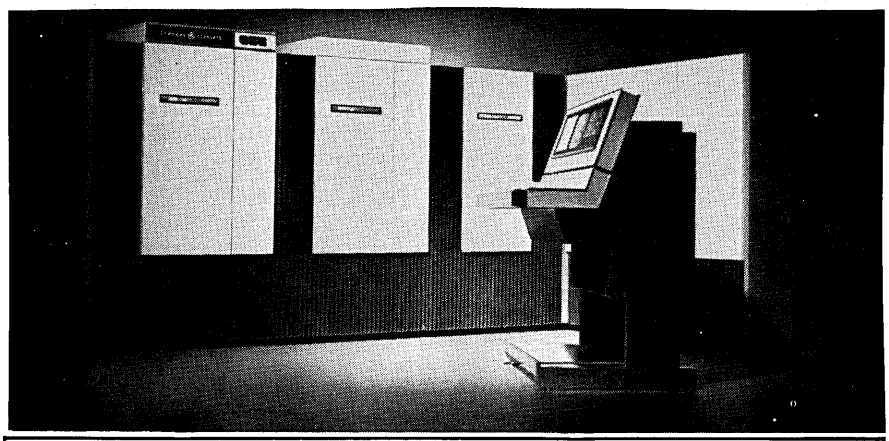
The machine performs binary, two's-complement arithmetic, and can give up to 64 bits of precision on floating-point numbers. Digits and characters can be represented in six or nine bits, and one character space corresponds to one digit space. Character handling has been enhanced with provisions for a sequence character reverse tally.

There are 185 instructions in the machine's repertoire, some 10 more than the 635 now handles. Three slave mode instructions providing for more floating-point rounding, including double precision floating rounds, three load and clear's, plus four master mode register manipulating instructions are included in the 10.

The machine has more than 49 programmable hardware registers, including eight index registers, 32 history registers, an exponent register, base address register, indicator register, timer register, instruction counter, and accumulator. The 500 nsec core memory does double word fetches from each 64K memory bank it accesses. There may be up to four 64K banks connected, when two system controllers are used, and interleaving thus makes it possible to pull up to eight words at a time.

The I/O architecture calls for up to four Input Output Controllers per system, 16 channels per IOC (six at 400KC each, 10 at 25KC), for a maximum of 64 channels. The top aggregate data rate is given as 450 KC.

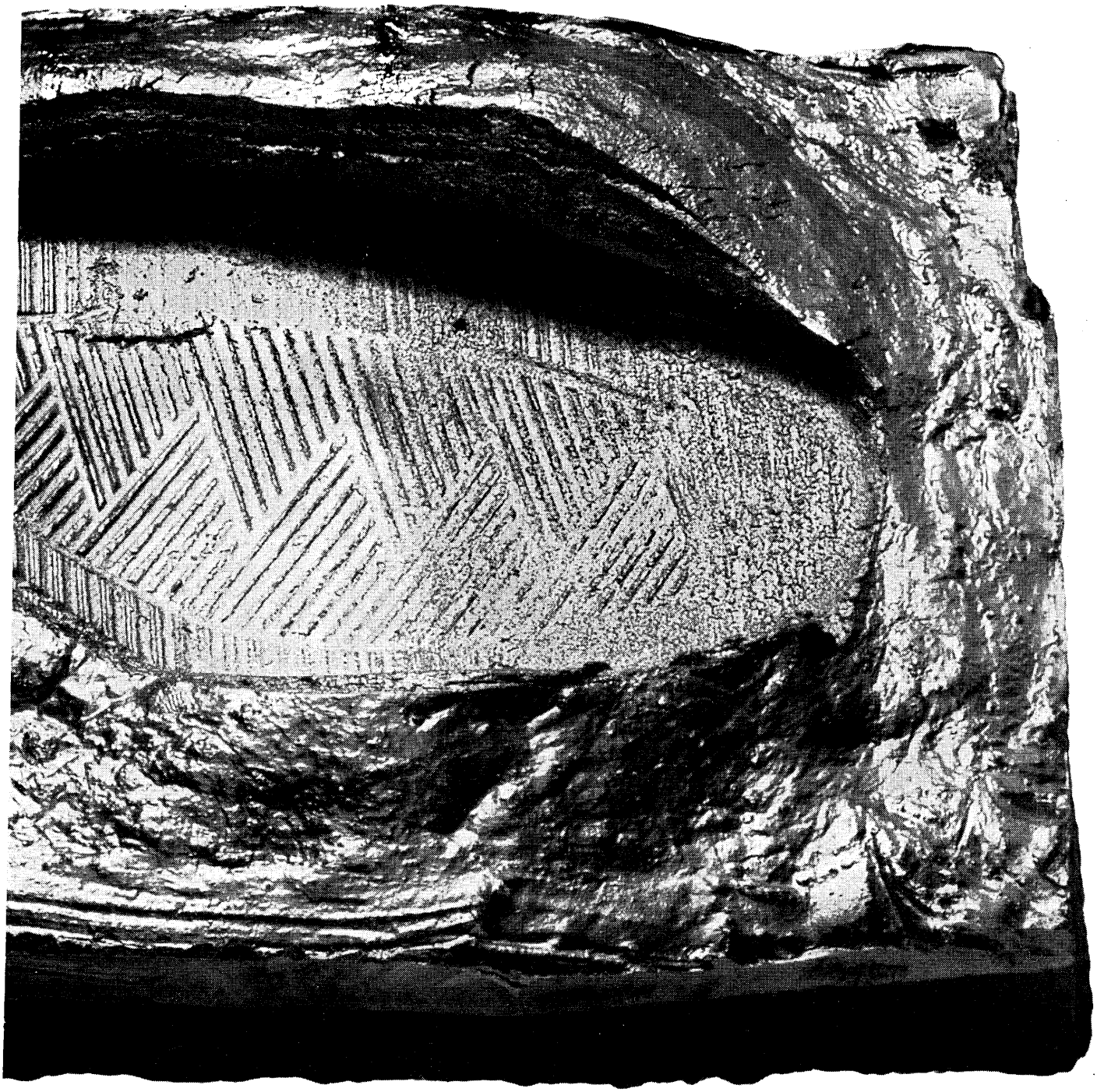
Communications are also a big 600 series design factor. General Electric claims that 70% of its systems are shipped with communications capabilities, and that the industry average — including GE's contribution — is only about 35%. Up to 192 active communications lines are handled by the Datanet 355, a communications box which connects directly to a memory port, at speeds from five bps to 50,000. In all, the channel and communications power make for a talkative machine, and the GECOS III supervisor (batch, remote batch, and time-sharing) should be able to make use of all the hardware power available. GECOS (General Comprehensive Operating Supervisor) also is capable



GE-655 SPECIFICATIONS

CPU	cycle time	asynchronous, but effective time of less than 500 nsec
	word size	36 bits (plus one parity bit)
	arithmetic	fixed-point (36 bit), or floating-point (36 or 72 bits)
	registers	more than 49, including eight index registers
MEMORY	cycle time	500 nsec
	size	64K - 256K 36 bit words
I/O	Input Output Controllers	
	number per system	up to four
	channels per IOC	16
	channel rates	six at 400KC each ten at 25KC each
	number of channels	up to 64
	aggregate data rate	450KC
	Datanet-355 number/system	one
	communications lines	up to 192 active
	line speeds	5bps - 50,000bps

3M takes the next step.



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of taking care of multiprogramming, dynamic core reallocation, job swapping, etc.

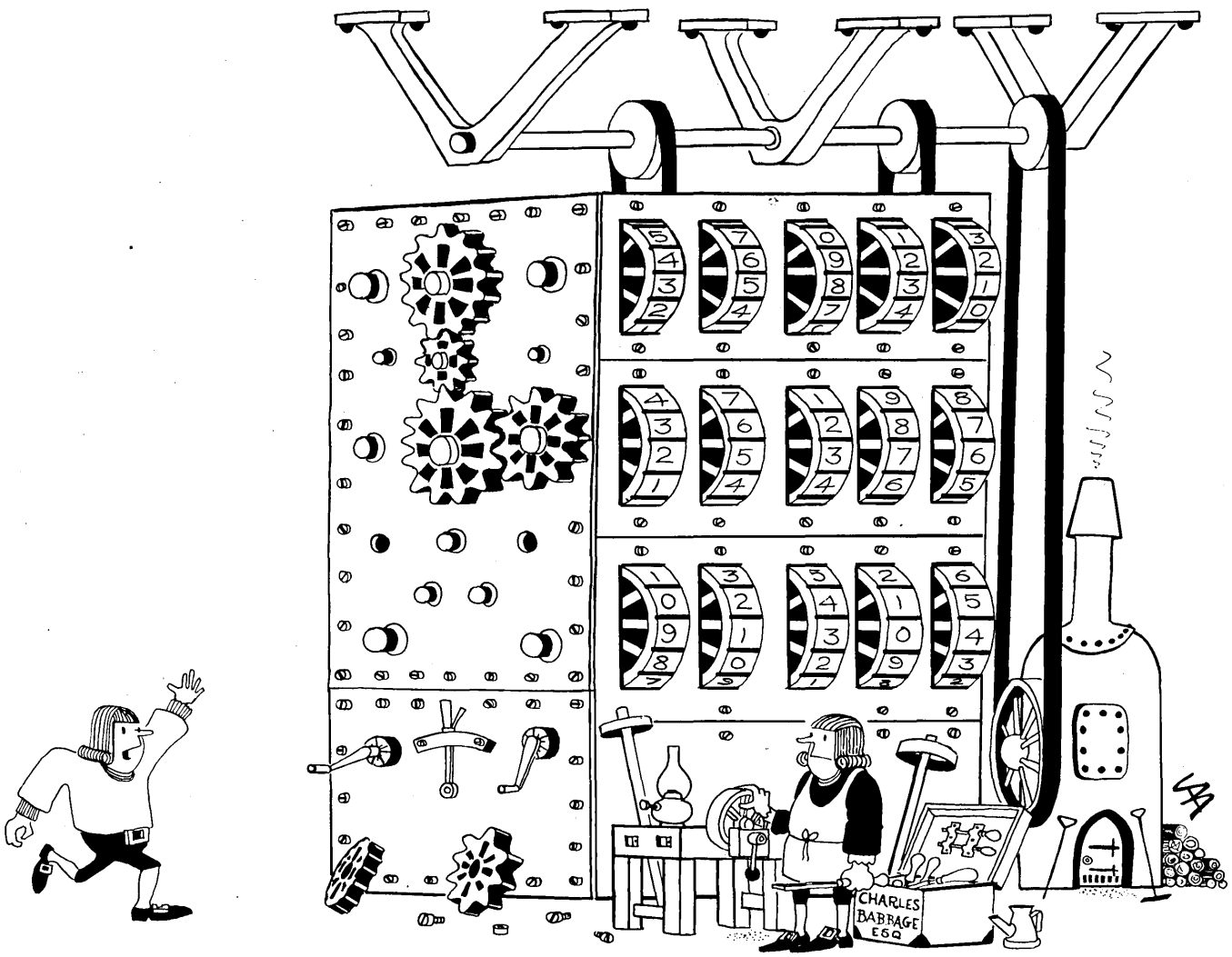
Of course, multiplying cpu cycle time by channel speeds or the number of memory banks will not yield a figure for throughput. Such figures are hard to come by, and everyone's job mix is different, but GE claims more efficient use of the hardware is realized through built-in self-optimizing features. By making the 600 systems memory oriented, then assigning priorities to memory ports and introducing "anti-hog" algorithms to the routines that service those ports, GE claims better throughput than cpu-oriented systems can deliver. The difference, and the advantage supposedly, lies in the fact that the memory is a passive device, the cpu active.

In comparison to the GE-635, the 655 should be an operator's delight. The 635 used a console typewriter for operator-machine communications. The typing speed was slow, and much of what the operator wanted to know in problem situations had to be found on maintenance panels or wasn't available at all. The 655 console still has the hard copy printout (which may be from a small line printer in delivered machines rather than a 10-15 cps typewriter), but adds a crt and a bank of display lights. The crt alone can give the operator in a glance such things as a memory map, memory usage (% batch, % t-s, % GECOS, %IDLE), processor usage, channel usage, job statuses, etc.

The operator's console was one of the boxes that came in for some styling changes, too — walnut grain, color accents, special stand — and at no "extra" cost. But to get one an installation must be willing to part with something like $80K per month. In comparable 128K configurations, the 655 leases for about $6000/month more than the 635. Prices go as follows: for the cpu, $540,000 or $13,000/ month; for each system controller (a box that's associated with the memory), $190,000 or $4500/month; for each 64K word memory bank, $435,000 or $10,500/month. Figuring on two core banks, these numbers add up to $38,500/month before peripherals.

The peripherals are the same as those offered for the rest of the 600 line, and all existing 600's are upward-compatible. Should a 600 user choose to upgrade, he will be glad to find that the 655 is downward program compatible. All existing 600-series programs will run on the 655 as is, GE claims, without recompiling.

The machine's price and performance put it squarely in the IBM 360/75 class, but the machine, as offered, is a uniprocessor. If a user could add on another cpu as he can with a 635, for the same $13,000/month, he might have a machine more nearly equal in performance to a CDC 6600 for the price of a /75. That would be a whole new league for GE. ■



"Charlie, there's a Japanese peddler down the road selling little things called transistors!"

A TECHNIQUE FOR SELECTING SMALL COMPUTERS

by Robin T. Ollivier

Computer salesmen have multiplied nearly as fast as the machines they sell. The systems engineer selecting a giant number cruncher probably doesn't recall any selection problems—he never drew a sober breath. On the other hand, I've been installing minicomputers. The salesman takes *me* to the automat—I have to contend with dyspepsia, as well as headaches from reading fine print.

The marketing principle implied in this little story demonstrates the necessity of having a quick, analytical method for comparing small computers. It has to be quick. One can't spend $20,000 worth of engineering time to buy a $10,000 computer. It has to be effective. Different applications demand different approaches. As a matter of fact, each of the more than 30 cpu manufacturers thinks his uniquely designed product is the best for most tasks.[1]

terms and conditions

A selection technique is proposed in this paper that has proved both quick and effective. The assumptions on which this technique is based are listed below:

1. Qualified vendors will make competitive proposals.
2. Vendor proposals are factual.
3. The system designer has analyzed the problem to be solved.
4. Evaluators are capable of relating computer characteristics to a detailed task description.

The procedure may be summed up in the following definitions:

Basis. Cpu selection will be based on performance and on effective cost.

Performance. Performance (P) is defined to be the weighted sum of equipment and vendor capability.

Effective cost. Effective cost ($) consists of quoted price plus the software and engineering costs of implementing a given computer.

Equipment capability. The weighted sum of discrete computer characteristics. Each characteristic is evaluated on a 0-4 point basis.

Vendor ability. The weighted sum of discrete vendor performance factors, each rated on a 0-4 point basis.

Quoted price. The number of dollars the buyer sees on the contract.

Software costs. The number of dollars worth of programming service required for this task plus hardware add-ons or deletions to the quoted equipment required by software.

Engineering costs. The number of dollars worth of engineer-

Mr. Ollivier is vice president of Digital Data Engineering in Pasadena, Cal., a systems and software house specializing in computer-based real-time applications. Mr. Ollivier is widely known for his bonhommie as well as for his data systems designs. He was formerly with the Jet Propulsion Laboratory, MESA, and with Burroughs Corp. He has a BS in engineering physics from the Univ. of Michigan.

1. For a current survey of processors see one of the following:
   D.J. Theis and L.C. Hobbs, "Mini-Computers for Real-Time Applications," Datamation, v. 15, no. 3, 1969.
   R. Ollivier, "Revolt Within the Rack" *EDN*, v. 14, 1969.
   J. Cohen, "Mini-computers," Modern Data, v. 2, no. 8, 1969.

ing services such as design, fabrication, and documentation plus hardware add-ons or deletions to the quoted equipment.

Weighted sum. The relative importance of one factor to another is determined by assigning each factor a multiplier. The score for a given factor is multiplied by its weight and then added to the scores of other factors.

Factor. A discrete, measurable characteristic of some importance to the task at hand.

the method

Computer procurement (of machine, not by machine) proceeds in four distinct stages:

Design. The task is analyzed and one solution (from among many) is chosen. An envelope of constraints is defined. Minimum specs and maximum dollars are established for the computer. Initial hardware/software tradeoffs are made. A list of qualified vendors is developed.

Solicitation. A problem description, minimum specs, and approximate job-scope information is supplied to vendors. Proposals are requested. Two to four weeks should be allowed for preparation. (Shorter times restrict competition; longer periods suggest larger systems and more extensive selection procedures.) Prior to receipt of proposals, the evaluators must complete the list of evaluation criteria and assign weights to factors. System design should be reviewed and refined during this period.

Evaluation. Scoring of proposals proceeds quickly. Impartiality is guaranteed by the objective requirements of the weighted factors.

Greater care must be taken in developing effective costs. Software kernel routines for key processes must be flowcharted or otherwise designed to provide a basis for estimating I/O timing, memory requirements, and manpower resources. Engineering and fabrication costs may be highly vendor dependent. The task should be broken down to the cost of each logical function or identifiable module.

The evaluation procedure succeeds in ranking proposed equipments according to their performance and cost. This data may be presented in two ordered lists or plotted as cost vs. performance. This completes the objective evaluation of competitive equipments.

Negotiation. Competing proposals have been analyzed and fairly evaluated. The analytical data forms the basis for final selection. The thought processes that effect this decision are subjective in nature. Only some of the more obvious considerations will be reviewed here.

Guidelines may have been established in the solicitation phase for a maximum effective cost and minimum performance score. Using these guidelines one might choose any of the following:

1. The best performer whose effective cost is less than the maximum.
2. The lowest cost equipment whose performance exceeds the minimum standard.
3. The equipment that satisfies cost and performance standards and has the highest performance/cost ratio.

a sample recipe

The method has been briefly sketched in preceding paragraphs. It is intended that this technique can be applied almost directly from the cookbook. An example of minicomputer selection is given in this section as a means of further defining the technique.

Task Definition. The dynamics of an object falling through a tube will be studied by analyzing time and pressure information. The data is generated by eight pressure ports located along the tube and as many as 16 presence sensors. Enough data will be taken to adequately define the pressure vs. time plot. Event-timing resolution to 5 usec is required. Placement of the pressure sensors, sampling strategy, number and relation of timing events, and extent of postexperiment analysis was (and is) still under discussion. The maximum number of samples for any run should be in the range of 1000 to 2000.

data acquisition

This description by the scientist resulted in the data acquisition system specification shown in Fig. 1. A programmed digital computer provides on-site control and calibration functions. Run data is buffered in core memory. Those runs requiring more analysis than that provided at the site are transferred serially by phone line to a data center computer. System design was undertaken. The approach was to develop a multi-application data logger with limited processing and display capabilities. The computer was required to provide for independent calibration runs and to permit rapid modification of sampling strategies. Analog multiplexing schemes were keyed to the occurrence of digital events, bit rates, order of channels. Number of channels, time offsets, etc. are selected by the experimenter. These options are selected by English language commands from a teletypewriter. This method of control provides a hard-copy record of each run.

1. Digital Inputs
   - 16 Channels
   - Pulse width 1 usec. minimum
   - Provision for electrical signal conditioning
2. Digital Outputs (number of bits in parentheses)
   - Enable/disable acquisition (1)
   - Start/stop A/D scan (1)
   - Set end scan channel (3)
   - Select sampling rate (3-7)
   - Select timer rate (4-9)
   - Set submultiplex channel (3)
3. Analog Inputs
   - 7 primary scan channels
   - 8 submultiplex channels
   - Scan rate to 50 KHZ maximum
   - Input impedance > 10 megohms
   - Input voltage ± 10 v full scale
   - Conversion to 10-bit digital
   - All channels single ended
4. Timing Measurements
   - Clock increments 8-16-bit register
   - Interrupt on overflow
   - Parallel read on command

Fig. 1 Data acquisition specification.

weighting the factors

Evaluation criteria for the computer were developed and weighted. The same was done for manufacturing aspects of the procurement. The results are shown in Figs. 2 and 3. Note that specifications are firmly tied to objective quantities.

Since we intended to build a single system—or at most two—we felt that the quality of the vendor was relatively important. We therefore assigned an over-all weight of two to the computer and one to the manufacturing criteria. Put

another way, the sum of the computer weights was twice as large as vendor weights. No attempt was made to get "neat" numbers for the sum of weights; only to see that the factors be reasonably related to each other. An agreeable way to start is by assigning a weight of one to the least important factor and proceeding comparatively up an intuitively known ladder of significance. Computer characteristics were weighted first. Then half the total of the computer

FACTOR	WEIGHT	SCORING BASES
Word Size	10	4: 16 bits or more; 2: 12 bits 0: 8 bits or less
Cycle time	6	4: 1 usec; 3-1: 1-2 usec 0: 2 usec
Instruction set	5	4,3: Extensive; 2: Adequate; 1-0: Primitive
Arithmetic	2	4: Hardware multiply/divide; double precision and floating point options; good precision 3-1: Adequate capability; hardware mul/div or fast subroutines 0: Very little arithmetic capability
Addressing	4	4-0: Score one for each of the following: indirect, relative, indexed, direct to greater than 4096, or by addressing
Programmable registers	6	4: Many; 3-1: More than one; 0: One
Interrupts	7	4: 3 or more priority, no identification necessary; 3-1: Adequate for 3 devices 0: None quoted
Input/Output	8	4: 2 or more automatic channels at rates to 1.3 megabits/sec; 3-1: At least one 1.0 megabits/sec with good accumulator I/O; 0: Marginal I/O capability
Physical size	1	4-0: Subtract one point for each 5 inches over 11 inches
Console	3	4-0: Sense switches, displays, debugging aids

Fig. 2 Computer criteria.

FACTOR	WEIGHT	SCORING BASES
Delivery time	7	4,3: Less than 45 days ARO; 2,1: 45-75 days ARO 0: Over 75 days ARO
Past performance	4	4-2: Many reports of on-time delivery and good service 1-0: Known for late delivery, poor service
Maintenance	3	4-2: 24-hour turnaround on cpu, on-call maintenance; 2-0: No experience, remote or difficult corporate interface
Location	2	4: Southern California 2: Within 500 miles 0: Distant
Alternative sites	1	4: Same computer installed at JPL 3-1: Locally available 0: No Alternative site
Number installed	4	4: Over 100; 3-1: 10-100 installed 0: Less than 10 in field
Documentation & training	5	4: Excellent hardware and software manuals, or training provided 3-1: Adequate interface and programming manuals 0: Little or no documentation

Fig. 3 Manufacturer criteria.

weights were distributed among the vendor characteristics.

Factors are also rated as to their significance to the project. The following statements illustrate what I mean:

1. Most factors are significant to the project and *must* be scored whether or not the vendor supplies adequate information to do so in his proposal.
2. Some factors are peripheral in nature and need not be scored (changing the basis), or may be given a nominal score if insufficient data exists.
3. A few factors have critical limits. A zero score on any one of these factors would result in disqualification of that proposal.

In this example, three factors—interrupts, I/O capability, and timely delivery—had critical limits. A score of zero on delivery eliminated two machines, and redefined the model number of a third.

A vendor list of eight was prepared and proposals solicited. In due course the evaluation was completed. The results are summarized in Figs. 4, 5, and 6. The euphemism of numbered rather than named computers was used to spare the editors. However, the discerning eye may distinguish the "made in" Orange County, Framingham, or Maynard features.

For this particular task, characterized by few, but high rate, data sources, some interesting observations result.

1. Eight-bit machines were disappointing. I/O characteristics were not adequate or were relatively expensive.
2. An 8K memory was required for all machines with less

FACTOR/CPU	A	B	C	D	E	F	G	H
Computer								
Word	40	20	0	0	40	40	0	40
Cycle time	6	12	18	6	12	12	0	24
Instruction	15	0	10	10	15	15	15	15
Arithmetic	4	2	0	2	4	4	0	4
Addressing	12	8	16	16	8	12	4	16
Registers	12	0	24	18	18	12	0	18
Interrupts	28	7	21	7	21	14	28	28
Input/output	32	24	8	16	24	24	8	8
Physical size	4	4	4	4	4	3	4	2
Console	6	6	9	6	9	6	6	9
Subtotal	159	83	110	85	155	142	65	164
Vendor								
Delivery time	14	21	28	28	28	0	28	21
Past performance	12	12	8*	8*	16	4	8*	8*
Maintenance	9	6	3	12	9	6	9	9
Location	4	0	8	8	8	0	8	8
Alternative	2	4	2	2	2	4	2	2
Number installed	12	16	4	16	16	8	4	8
Training	20	15	5	10	15	15	10	10
Subtotal	73	74	58	84	94	37	79	76
TOTAL	232	157	168	169	249	179	144	240

*Nominal value; no data

Fig. 4 Evaluation results.

ITEM/CPU	A	B	C	D	E	F	G	H
Quoted	11.9	6.4	8.1	12.7	16.2	11.4	8.8	12.0
Software								
Programming	5.0	5.0	7.5	7.0	6.0	5.5	6.5	5.5
Modifications*	0	4.0	2.5	2.5	0.5	0	3.0	0
Hardware								
Interfacing	1.5	0.5	2.4	0.4	0	0.3	1.6	0.6
Modifications**	4.5	0	2.0	(1.5)	1.7	2.0	0	0
	22.9	15.9	22.5	21.1	24.4	19.2	19.9	18.1

*Modifications are for additional 4096 core memory, except E, additional level of interrupt.

**Addition of I/O channel, except D, deletion of special interface hardware. A represents upgrade to next model computer to get required I/O performance.

Fig. 5 Effective costs.

than 16-bit word length. Shorter words meant longer programs and double length buffers.

3. Programming costs were relatively tightly grouped.

Cost (1000's $)	
B	15.9
H	18.1
F	19.2
G	19.9
D	21.1
C	22.5
A	22.9
E	24.4

Performance	
E	249
H	240
A	232
F	179
D	169
C	168
B	157
G	144

Cost Maximum	Performance Minimum
22.0	150

Fig. 6 Data summary.

The nature of the job and the size of the computer dictated assembly language coding. Better instruction sets required longer learning curves.

4. Interface costs were difficult to estimate unless the vendor provided literature treating this issue in depth.

The cost vs. performance plot in Fig. 7 provides a good visual presentation of analytical results. Processors H and B

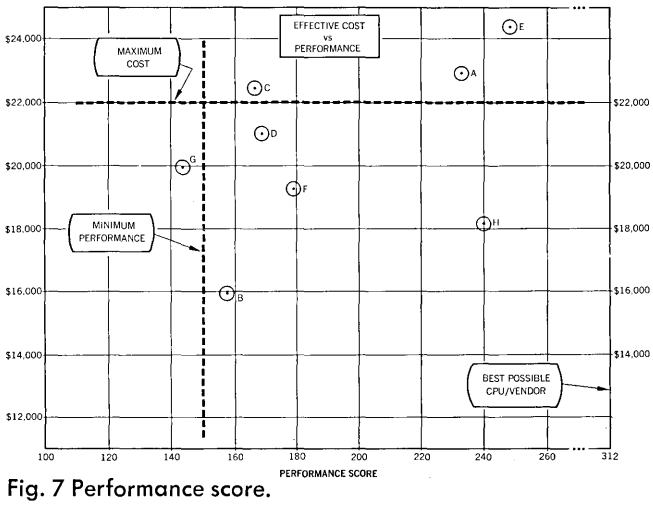


Fig. 7 Performance score.

are the most likely choices. Computer F is a possible but unlikely candidate. Note that the 8-bit computers C, D, and G deliver less bang per buck than the 16-bit cpu's E, A, and F. It is clear from this data that this task is not suitable for an 8-bit processor.[2]

The results in this case were relatively straightforward. The technical group selected the best performer within the cost envelope. There was a sufficient dollar pad to allow for contingencies. Should some unforeseen fiscal calamity befall the project, management can quickly and reliably shift to a lower-priced computer.[3] ■

2. A line of constant performance/dollar can be drawn for items C, D, and G and for items E, A, and F. This represents a de facto standard for this particular evaluation. It can be seen that such lines are roughly parallel and that the vertical separation is about $3,200. Thus even a 4K 8-bit machine is found to be a poorer performer per dollar than a 16-bit processor.
3. Several additional 16-bit machines received a cursory evaluation during and after the example procurement. One could quickly determine whether further evaluation was desirable.

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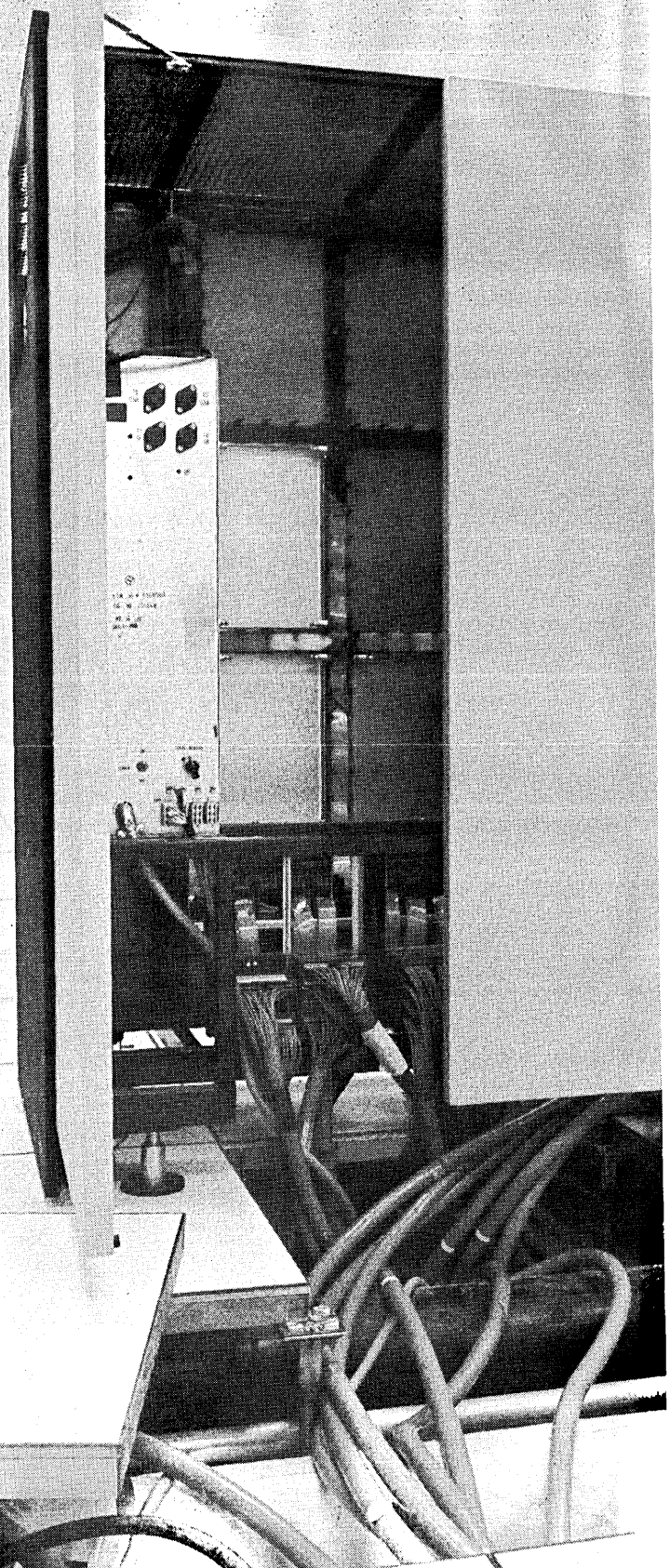

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CIRCLE 87 ON READER CARD

a survey

COMPUTERS IN JAPAN - 1969

by James K. Imai

The Japanese computer environment continues to boom, both in output and in installations. In 1967, when DATAMATION last reviewed the scene, the total number of computers delivered in Japan was 2978. As of March, 1969, 5735 had been delivered, an increase of 90% in two years.

In the period from April, 1968, to March, 1969 (Japanese fiscal year 1968), a total of 1585 computers were installed in Japan. Their value was $449 million. These figures represent about a 40% increase in the number of installations and a 50% increase in value over the previous year.

The major Japanese computer makers are Fujitsu, Hitachi, Mitsubishi, Nippon Electric Co., Oki, and Toshiba. For the fiscal year 1968, NEC led the Japanese manufacturing group with a 20% share of the total market. Fujitsu followed with 17% but showed the most dynamic market growth, increasing its share from 12% the previous year.

IBM computers, even those assembled in Japan, are listed by the Japanese as foreign. IBM's market share was 31% over the same period. Table 1 shows the breakdown on new computers installed in Japan during fiscal year 1968 by Japanese and foreign makers, tabulated in order of their market share.

Table 2 shows the same breakdown on total computer installations, cumulative through March, 1969. Nippon Electric Co. leads the Japanese makers with 16% of the total market. Fujitsu follows with 12%, and Hitachi with 11% of the total market share.

Table 3 tabulated both Japanese and foreign computers in operation, by size of computer system, for the fiscal year 1968. Table 4 lists the same data cumulative through March, 1969.

rental

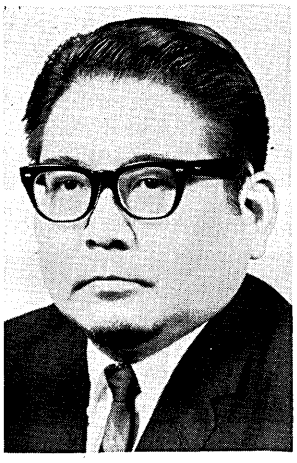
Approximately 70% of the computers manufactured by Japanese makers are rented as compared to about 74% of the foreign makes. The computer rental trend appears to be dropping for Japanese makers with 76.5% posted for fiscal year 1967. The trend had been upward in prior years with a high of 80% in fiscal year 1966. Rentals of the foreign-make computers have oscillated between 90% and 74% over the last five years with a downward tendency.

The Japanese divide their computer systems into four size categories according to the price of the specific installations.

CATEGORY	AVERAGE SYSTEM PRICE	APPROX. MONTHLY RENTAL
Large	Over $700,000	Over $17,500
Medium	$110,000-$700,000	$2750-$17,500
Small	$28,000-$110,000	$700-$2750
Supersmall	Under $28,000	Under $700

computer usage

Computer usage is divided by industries into 35 categories in Japan. Banks and electrical/electronic equipment manufacturers have, respectively, 358 computers valued at $153 million and 420 computers valued at $147 million. The greatest number of computers were installed in retail



Mr. Imai is vice president of Mentor Japan, a subsidiary of Mentor International. He has had extended contacts with the Japanese data processing and electronics industry as a Mentor consultant. Before joining Mentor, he was manager of Far East Business Operations, Microelectronics Div., Philco-Ford. He has a BS in physics.

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and distributive organizations, totaling 728 with an average system price of $119,875. Computer systems with the highest average price were installed in public utilities and securities industries. The average prices are $510,000 and $470,000 respectively.

Table 5 lists the industries in Japan with computer installations valued at over $7 million.

Total installation value in each industry was tabulated and the number of industries by total value are listed in Table 6. Forestry was the only industry in the 35 categories that did not list any computer installation. Since 1967 the agricultural, fishery, and hospital industries joined the ranks

MAKER	COMPUTERS INSTALLED	VALUE ($ Million)	MARKET SHARE (%)
Japanese Total	1,206	253.45	56
Nippon Electric Co.	369	87.86	20
Fujitsu	367	75.47	17
Hitachi	127	52.50	12
Oki Electric	85	15.06	3
Toshiba	47	13.28	3
Mitsubishi	97	6.14	1
Others	114	3.14	—
Foreign Total	379	195.41	44
IBM	242	136.81	31
Sperry Rand	11	37.47	8
NCR	38	11.69	3
Others	88	9.44	2
Total	1,585	448.86	100

Note: Includes gross deliveries during period, whether by rental or direct sale.

Table 1 Computers installed in Japan—April, 1968, to March, 1969.

MARKET	COMPUTERS INSTALLED	SHARE (%)	VALUE ($ Million)	MARKET SHARE (%)
Japanese total	3,861	67	689.48	48
Nippon Electric Co.	1,502	26	216.56	15
Fujitsu	877	15	182.78	13
Hitachi	469	8	162.22	11
Oki Electric	298	5	49.56	3
Toshiba	196	3	49.36	3
Mitsubishi	157	3	20.47	2
Others	362	7	8.53	1
Foreign Total	1,874	33	753.31	52
IBM	1,074	19	506.36	35
Sperry Rand	419	7	165.81	11
NCR	180	3	37.53	3
Others	201	4	43.61	3
Total	5,735	100	1,442.78	100

Note: After deduction of return of older models to their makers, a balance of 4,900 computers were operative in Japan as of March, 1969

Table 2 Total of computers installed in Japan, cumulative through March, 1969.

COMPUTER SIZE	TOTAL NUMBER	FOREIGN SHARE (%)	TOTAL VALUE ($1,000)	FOREIGN SHARE (%)
Large	178	48.9	$236,575	54
Medium	425	17.2	116,578	21
Small	538	21.2	32,489	24
Supersmall	200	5.5	4,033	4.6
Total	1,341	21.2	389,677	41

Table 3 Net increase in number and value of computers placed in operation in Japan, year ending March 31, 1968.

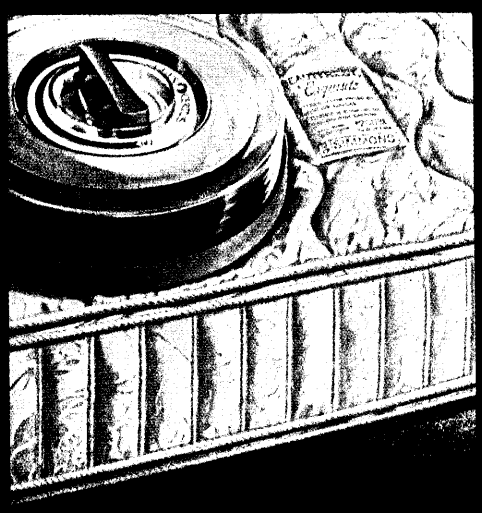
COMPUTER SIZE	TOTAL NUMBER	FOREIGN SHARE (%)	TOTAL VALUE ($1,000)	FOREIGN SHARE (%)
Large	454	59.0	$355,822	63.2
Medium	1,813	34.8	207,042	38.8
Small	1,755	25.3	33,555	29.3
Supersmall	878	2.1	271	1.7
Total	4,900	27.7	596,691	48.6

Table 4 Number and value of computers in operation in Japan as of March 31, 1969.


Armstrong
CORK


Coca-Cola


20
MULE TEAM
BORAX



Some of America's finest companies have one thing in common

CÆLUS MEMORIES, INC.

CIRCLE 231 ON READER CARD

of computer users.

Even more dramatic than the hardware makers' growth has been that of the new Japanese software companies. Two years ago there was no independent software industry in Japan. Computer makers relied on their own efforts, with a rare assist from a U.S. software firm. In all of their developments their customers expected all software free as part of the purchase price of a computer.

All of this has now changed. Software still is a limiting factor, but as many as 20 independent organizations have blossomed. The Japanese government is actively supporting software development. Special incentives, such as tax reductions and credit facilities, are expected in 1970.

Non-Japanese software companies are beginning to probe actively in Japan. Two years ago such ventures would have been welcomed by the Japanese government, but this may no longer be true.

An example of the Japanese approach to resolving the software shortage was the formation of Nippon Software Co. Owned jointly by the three major hardware makers—Nippon Electric, Hitachi, and Fujitsu—the company has a distinguished board and executive staff. It has extensive, direct, government support.

Nippon Software Co. was established three years ago

INDUSTRY	NO. OF COMPUTER INSTALLATIONS	VALUE ($1,000)	AVERAGE VALUE PER INSTALLATION
Banking	358	$152,935	$427,194
Electrical Mach:	420	147,389	350,925
Commerce (Retail & Distrib.)	728	87,270	119,875
Transportation	246	81,598	331,700
Government Agencies	181	73,671	407,025
Services	365	71,450	195,755

Table 5 Industries with computer installations totaling more than $7 million.

INSTALLED VALUE ($ Million)	NUMBER OF INDUSTRIES 1967	1968	1969
Over 110	0	0	2
55-110	2	3	7
28-55	8	9	6
14-28	6	6	6
2.8-14	9	8	5
Under 2.8	7	6	8
Total categories	32	32	34

Table 6 Installation value by industry.

COMPUTER	TYPICAL MONTHLY RENTAL[1]	ANNOUNCEMENT	FIRST DELIVERY	DELIVERY THROUGH MARCH, 1969
Superlarge Size				
NEAC-SERIES 2200 Model 700	$41,700	Nov. '68	Jan. '70	—
Large Size				
NEAC-SERIES 2200 Model 500	15,400	May '65	Nov. '66	26
NEAC-SERIES 2200 Model 400	11,300	May '65	Sept. '66	37
Medium Size				
NEAC-SERIES 2200 Model 300	7,700	May '65	Aug. '67	3
NEAC-SERIES 2200 Model 250	7,000	Mar. '69	Sept. '69	—
NEAC-SERIES 2200 Model 200	5,500	May '64	Jan. '65	211
Small Size				
NEAC-SERIES 2200 Model 150	4,100	Mar. '69	Sept. '69	—
NEAC-SERIES 2200 Model 100	3,000	May '65	Nov. '66	36
NEAC-SERIES 2200 Model 50	2,000	Aug. '66	Sept. '67	71
NEAC-3200		Aug. '68	Aug. '68	11
NEAC-3100		Mar. '67	May '67	
Supersmall Size				
NEAC-1240	700	Feb. '67	Feb. '67	342
NEAC-1210	400	Oct. '64	Oct. '64	619
NEAC-1201		May '61	May '61	
Minicomputer				
NEAC-M4		July '69	Nov. '69	—

[1]Note: Typical rental for a system with basic peripherals and magnetic tape.

Table 7 Announcement and first delivery of each model.

with 20 people. In this autumn, 1969, it has more than 200 people. Last year's sales volume of $1.6 million was profitable and erased the loss of initial years. This year it is expected that $2.8 million of operating revenues—and more net profit—will be realized. Major activities are devoted to the government project for development by 1971 of an LSI-based, 50-nanosecond-add-time, large-scale computer. Nippon Software's responsibilities include file control programs, FORTRAN, time-sharing interfaces, and I/O interfaces.

On the other hand, private contracts have also been made between Nippon Software Co. and customers in very wide-ranging fields. This year two more computers have been installed in the firm; one is a FACOM-230 Model 60, the largest available Japanese-made computer. The other one is a NEAC-2200 Model 400. Common software concepts and machine-independent software are developed by Nippon Software.

a leading manufacturer

For those who are trying to understand the Japanese data processing industry, a look in depth at one of the leading companies is instructive.

Nippon Electric Co., a member of the Sumitoma Group, had sales in fiscal 1968 of $458 million. About $75 million of this total was in 369 data processing installations. The balance was concentrated heavily in telecommunications gear and industrial investments, though NEC also makes some consumer products. NEC's $88 million of data processing sales included $56 million value of rental, and the balance of $19 million as direct sales. The company produces a very wide range of central processors, as indicated in Table 7.

NEC's data processing sales have more than doubled in the past two years. Their growth rate is comparable to that of Scientific Data Systems in the United States and, in fact, NEC sales are now at about the same level achieved by SDS in 1968.

Like most Japanese companies, NEC is vertically integrated to a very high degree, including component manufacture. Furthermore, almost all of the peripherals offered are made by them.

Some characteristics of the newer models listed in Table 7 are:

NEAC-2200 Model 700. This computer, largest in the series, is due for first delivery in January, 1970. It is designed for large-scale time-sharing, on-line real time, and management information systems. It is considered by NEC to be competitive to the IBM 360/65 and 75.

NEAC-M4. This minicomputer, at the other size extreme, is to be delivered in November, 1969. It is intended to be a system component and has a priority interrupt function. It is most similar to the DEC PDP 8/I. It will sell in Japan for $9720, and has a 4-32K, 8-bit memory. Add time is 4.5 usec and memory cycle time is 1.5 usec. An associated drum memory with 65 K words and 8.3 msec access time is available as well as paper tape units.

NEAC-2200 Model 150 and NEAC-2200 Model 250. Two other new models delivered in September, 1969, are in the small/medium range. ■

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With the 3300 Magnetic Tape unit, the Datapoint 3300 becomes a much more useful tool for "interactive" time sharing users who must work with large masses of data. Availability of the 3300T will greatly expand the number of commercial and business organizations which can effectively utilize commercial time sharing services. The large masses of data normally associated with commercial data processing can be readily stored on the 3300T's replaceable cassettes, and then displayed on the Datapoint's CRT screen, edited locally and transmitted to the central computer.

The 3300T is essentially a cartridge tape transport with storage buffer and the controls needed to provide 1.) on-line data storage, 2.) off-line message preparation, 3.) high speed off-line message retrieval (with lines displayed on the screen in either "Forward" or "Reverse" directions), and 5.) editing capability.

In use the 3300T is located immediately adjacent to the Datapoint. The two-unit system retains all the other features associated with the Datapoint alone, which includes complete interchangeability with standard teletypewriter equipment, totally self-contained (no control unit required), high speed data transmission capabilities, a high capacity and flexible CRT display, easy to read characters, solid state construction throughout, modern styling, and a 64-character keyboard set. Ten key numerical keyboard and speed buffer above 600 BPS remain optionally available.

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Computer Terminal Corporation
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THE NEREM MEETING

Pouring rain held down attendance at the Northeast Electronic Research & Engineering Meeting (NEREM) in Boston, on Nov. 5 through 7. Held it down, that is, to only 23,000 —2000 under target, but still a record. The attendance from California (over 500) did support the show's organizers in their claim that NEREM is now a national, rather than a regional, meeting. So did the number of exhibitors (332) and the quality of the technical papers. They were all invited ones—which probably helped with the quality.

The treatment of computers in the meeting was somewhat ambiguous. On the one hand, great and grandiose successes were talked about in the special supplement on the meeting (computers solving the problems of decaying cities were given the full treatment) as were those that help run a "Dial-A-Bus" service that solves the problems of suburbs by abolishing commuting by car. So were systems for earth surveillance, to handle problems like whether California was about to drop into the Pacific, etc.

But little of the grandiose remained in the meeting itself. Few even went so far ahead as N. S. Zimbel of Arthur D. Little, Inc., who, in discussing the next five years, said that the development of small computers would be limited not by the computers themselves, but by outside circumstances. And, just to take the computer down another peg or two, he went on to comment that savings in computers might not mean much, because it was now quite common to find that a $15,000 processor could power a $150,000 system—so what was the importance of knocking it down to $10,000?

Zimbel's crystal ball showed that sales of small (under $25,000) computers would increase by between 35% to 50% per year for the next few years, so that as many small computers would be manufactured as big ones by 1974. He also said that the market would change, with the laboratory market, which was 70% only four years ago, continuing its decline and falling below both the growing industrial and communication markets.

He also saw an increase in the importance of software, and the development of business languages as well as FORTRAN; system simulation of small-computer programs on larger computers, and much more application programming. Faster computer speeds, by a factor of five to ten, would emerge as semiconductor memories became available, while costs would drop by factors of two or three.

Fairly clearly his audience—about 500—agreed with him about the trend to greatly increased business uses. Every single question from this gathering of research engineers dealt with the business market for small computers.

Many of those attending were apparently considering going into business for themselves. The great success of the meeting was a series of talks on the life cycles of new enterprises, with Nicholas DeWolf asking why anyone would start his own company and giving solid advice in a humorous presentation. One of the solutions offered to them by Malcolm Hecht, Jr., of Unitrode, was to encourage the start of small new businesses under the corporate roof, by providing the tools and the excitement and letting the new entrepreneurs go to it under some shelter. That raised quite some discussion among the overflow crowds.

New firms and new products were to be found on the exhibition floor, of course. Infoton was probably the most noticeable—with its yellow Infomaniac buttons drawing as much attention as the display of its first KDT Display Terminals, priced from $1500. These are aimed for industry, and even home markets, and act as replacement for Teletypes on time-sharing systems.

Another interesting Teletype replacement was shown by Syner-Data, a Beverley, Mass., firm. This is a printer that can handle full-width sprocketed paper—just the same as a normal computer printer—and produce copies at the time-share terminal. Basis of its low price ($3100 in single units, dropping to $2300 when a thousand or so are ordered) is a single print wheel that moves along the front of the page at 30 character-positions/second and produces some of the cleanest printing around. It is designed to be an input

system through the use of a keyboard, and in fact has a range of "peripherals" that makes the meaning of "peripheral" rather dubious.

More printers were shown by Shepard Division of Vogue, both for terminal and computer-room use, but these were in many ways in the standard price brackets. Here the attraction was the degree with which the conditions at today's and tomorrow's terminals had been accounted for in the design—with memory buffering the lines, speeds up to 3000 baud, and minimum controls installation.

In the computer area itself, attention was again on the small computers. BIT had a colorful display of its 350 nsec 483 computer used to support time-sharing. BIT made a bow to some of its competition, the desk calculators, by showing CALC, a desk calculator system, in action.

The price reductions in small computers seemed to be raising questions as to where desk calculators ended and computers should start. Wang showed its powerful systems, which verge on computers, while Olivetti Underwood continued with the best-selling Programma 101 unaltered, arguing that by the time many advances beyond stored programming were added to a calculator, it became just as cheap to buy a computer!

The same questions were in fact discussed also at a preconference meeting of the Boston Section of the IEEE, which pitted Lou Clapp of Dial Data in defense of his time-sharing systems against Adrian Staffers of Wang Labs, Roy Reach of Mathatron and Ken Olsen of Digital Equipment to help bring the present and the future into focus. General opinion afterwards seemed to be that the ideal was a small desk-top computer with calculator ease of use, and with access to a larger computer when overloaded. Sounded nice—but some attendees characterized it as being a typical committee design that simply included everything.

To summarize, the meeting was an undoubted success, and left the engineers telling computer users that there were developments in the low end of the scale that would both greatly increase the amount of computing done in business and would utilize a number of different techniques, depending upon circumstances of the particular case. If that means that systems analysts have got to learn the ins and outs of a number of types of computing services—well, that appears to be the way that it was seen at NEREM 69.

—ALAN TAYLOR

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CIRCLE 73 ON READER CARD

news scene

an interpretive review of recent important developments in information processing

WIMMIX FACES A COMPREHENSIVE REVIEW AS A RESULT OF DOD ADP BUDGET CUTS

DOD's dp managers were spanked by the House Appropriations committee last month, but the bruises probably will heal quickly. Specifically, the House committee lopped roughly $150 million — about 12% — off DOD's FY'70 appropriation request for adp activities. Also, the committee carped about, but didn't explicitly ban, further implementation of several computer system projects currently underway.

With the possible exception of the World Wide Military Command and Control System, these criticisms are likely to have all the impact of a snowflake falling on the broad bosom of the Potomac, to quote the late Everett McKinley Dirksen's immortal phrase.

budget cuts

DOD's total request for adp operations, for all budget categories, was $1.25 billion, about half of which is chargeable to "operations and maintenance activities" (O&MA). This encompasses equipment rental and maintenance, civilian personnel salaries, contract support, and supplies. The table shows a breakdown of O&MA adp requests of the three major services, together with the reductions made by the committee.

Service	FY'70 Request (in millions)	Reduction (in millions)	Reduction (%)
Army	$259.27	$25	10
Navy	145.2	30	21
Air Force	226.05	23	10

The House committee also reduced DOD appropriation requests for management studies, many of which are dp-related. The Army's request — $4.9 million — was cut $2 million, while the Navy's — $10.22 million — was reduced by $4 million. The Air Force didn't ask for any management study money in FY'70.

The Defense Communications Agency requested approximately $12.35 million to finance support contracts related to the National Military Command System. This item was reduced $1.35 million by the House committee.

According to knowledgeable Pentagon sources, the cuts won't produce any big retrenchments because the services anticipated some trouble and planned their activities accordingly. Also, FY'70 is half over, and until now actual expenditures have been held to the FY'69 level. Basically, the appropriations committee reduced the FY'70 requests to the prior-year level, and so on-going programs will be able to proceed generally at about their current rates.

The appropriations bill had not been finally enacted at press time, but our sources said they thought there wouldn't be any substantial changes in the figures quoted above.

wimmix, phase 2 re-evaluations

In a report accompanying the bill, the House Appropriations committee directed the Air Force to take "a hard look" at the Phase II program and try to utilize existing second-generation gear wherever possible. The committee also directed the Air Force to re-evaluate the need for a third- generation computer to support the LITE legal information retrieval system. It called upon DOD to proceed with Wimmix (World Wide Military Command and Control System) "with caution," and ordered the General Accounting Office to "immediately commence a comprehensive review of the need, requirements, and implementation features" of this system. The Air Force was given a similar warning regarding its Advanced Logistics System, and GAO was told to study that one, too.

The House committee complained about the spiraling cost of DOD adp operations in general, management studies and service support contracts in particular, and indicated that it would give all three close scrutiny when the services submit their FY'71 appropriation requests.

A Pentagon source predicts that GAO will criticize Wimmix planners for inadequately integrating the system's applications and for not giving more management authority to the Joint Technical Support Agency, the group that will control overall implementation. He thinks the AF logistics system will fare better because "it's better-planned."

This prediction seems reasonable. GAO has studied several functionally related military computer systems in recent years, and almost invariably has complained about their lack of compatibility. The latest case involves the Army's COSMOS system (Centralization of Supply Management Operations). The COSMOS study, done at the request of the House Appropriations committee, was completed last January. The findings weren't released; however, it isn't hard to guess what GAO said from subsequent events. Soon after it received the COSMOS report, the House Appropriations committee pressured the Army into establishing a computer systems command at Ft. Belvoir, Va., and gave this group centralized planning responsibility for all multi-command Army adp systems. Implementation of COSMOS, meanwhile, was "deferred pending further study and development," and DOD set up an in-house group to develop a blueprint for integrating functionally related supply systems in all the services.

The upcoming GAO study of Wimmix could lead to similar results, and possibly, to further delay in the procurement process to allow time for additional planning and management reorganization. The House Appropriations committee will be in a strategic position to force such changes this year, because it is likely that DOD's FY'71 budget will contain a hefty request for funds to support the Wimmix update.

Much of the House committee's unhappiness with DOD adp activities seems to be based on misunderstanding born largely of technical ignorance.

The following dialogue is typical of several scattered through the printed record of the committee hearings. It concerns a contract awarded by the Navy to the Stanwick Corp., Arlington, Va., for analysis of ship maintenance data. The principals are Rep. George Andrews, of Alabama, and Vice Admiral R. L. Shifley, deputy chief of naval operations.

Andrews: "We note that you are requesting $5 million for the Stanwick Corp. to continue development of the Navy's ADP products for analysis by The Fleet Commands System. This is an increase of $1,592,000 over the amount requested for this study in 1969. Why are you increasing the amount . . ."

Shifley: ". . . we collect quite a lot of information on the maintenance of

ships; that is, how often and which parts fail, personnel utilization, and so forth ... This contract is to assist the type commanders in analyzing this information in order that they might better manage the maintenance and support of their ships ..."

Andrews: "... Why is it necessary to get (Stanwick) to point out the defects in ships?"

Shifley: "We don't use them to point out the defects in our ships. We use them to process and analyze information reported by our officers and men so that our Navy engineers can determine the action necessary to improve maintainability, reliability, supply support, training personnel allocations, and so forth ..."

Andrews: "Just what do these people do?"

Shifley: "They perform three kinds of services. They work on the systems, the information systems; they also ..."

Andrews: "Explain information systems for us."

Shifley: "The information that we get from the operation and maintenance of our ships."

Andrews: "Who gets the information?"

Shifley: "It comes from the ships; the bluejackets and the officers on the ships ..."

Andrews: "You mean they notice the defects in the ships?"

Shifley: "They make reports."

Andrews: "They make a report to their commanding officer?"

This discussion rambles on for several pages in the printed hearings without noticeably lessening the communications gap between the committee and the Pentagon. But if the Congressmen seemed to be confused, DOD witnesses did little to help them. When the Army was before the committee, Rep. Glenn Davis of Wisconsin asked "What does COSMOS do that is not being done or capable of being done under the other ongoing systems (that the Army has) in operation?" This is the answer given by Maj. Gen. J. J. Hayes, Assistant Deputy Chief of Staff for Logistics:

"I think we have the contrast here between a multi-purpose, multi-functional computer system for a base and a dedicated system for a complete Army area. If I could compare the COSMOS system, the COSMOS establishment in the 6th Army area is more closely parallel to the ICP operation in the AMC area, in its commodity commands ... The COCOAS system is a local installation, computerized setup which will take care, on a computer, of all of the information that an installation commander needs ... The proposed extension of COSMOS has solely been to extend it to the five Army areas and possibly to CONARC headquarters so that we will have something in CONUS which compares to our situation in the overseas theaters or to the major NICP's at the wholesale level."

— PHIL HIRSCH

INDUSTRY SEERS LOOK TO THE FUTURE AND SEE GREAT PROSPECTS BEFORE THEM

Predictions are the order of the month as the sachems of the industry struggle to extricate possible fact from probable fancy in an effort to forecast what profit lies in the future, what action can be taken for the benefit of man, and just where everybody's going.

Many spokesmen were willing to be quoted as the end of the year and a decade of implausible growth were reached. Not all of them agreed, which is hopeful, but most were more or less optimistic regarding the future of data processing machinery and its related functions and services in the U.S. and everywhere else.

Robert B. Muchmore, vp and general manager of TRW's software and information systems div., stated during a series of seminars for magazine editors and reporters (who need all the help they're offered) that he expected the computer industry will represent a dollar volume well in "excess of $200 billion by the year 2000" and will equal or surpass the auto industry in that time. He stated that in the U.S. there is one computer for every 4,000 persons, "which is at least twice as many per capita than any other nation." That would mean there are about 50,000 computers in operation in the U.S.

However, according to a census conducted by the latest Diebold Computer Census, "as many as 70,000 computers will be installed in the U.S. by the end of 1969," but only if 8,000 units in the second half of the year are delivered to equal the 15,000 units delivered in 1968. It is assumed that this happened, because "in the second half of the year, deliveries usually increase."

As an afterthought, Diebold adds that: 3000 minicomputers were installed in 1968 and that 4500 more were delivered by the end of 1969. There seems to be no rebuttal to this.

Quantum Science Corp., however (however will be used a lot in this piece), came up with some figures stated by James Stone, director of its computer technology div., in a speech before the Western Electronic Manufacturers Association that seems rebuttable (if predictions are rebuttable before the fact). He made a five-year forecast in an overview of the somewhat frenetic situation and decided that the nation is at present spending some $16 billion a year for data processing: a third of that for hardware, another third for software and the rest for "operations." This means services, "which are directly tied to the amount of equipment in use," will increase from the present $20 billion to $40 billion by 1975. "In the same period, total domestic hardware shipments will grow from the present $5 billion annual sales volume to $10 billion, while services from all sources including hardware vendors will grow from the present $3 billion to $9 billion and subsequently will overtake hardware."

However (there it is), take the prognostications advanced by University Computing Co.'s Sam Wyly before WEMA's meeting. Quoting various sources, he estimated that "the total cost of equipment and people producing computer services should reach $80 billion in 1975. By that time, the U.S. market for computer equipment should reach $16 billion." And he stated that software expenditures will increase from the present $7 billion to over $21 billion in 1975. (He also stated that the industry has a way of making most growth projection conservative.)

It would seem that firms selling proprietary software packages are going to have only a small piece of that projected software pie, according to Thomas T. Fleming, president of Scientific Resources Corp., who said in a speech to the New York Society of Security Analysts that sales for proprietary software will increase by $170 million to reach $200 million by 1973. He noted that software firms are trending toward becoming total systems suppliers and information utilities and that expenditures for these services would rise from the current $2 billion a year to $5 billion by 1973.

John F. Keane, of Keane Associates, Inc., Weston, Mass., stated in a seminar conducted by his firm that spending by users for outside software and services would go from the present $2.5 billion to $8.5 billion by 1975, and that a new breed of edp man is needed to help evaluate, design and implement the new breed of systems

that will result from unbundling. The hopeful Mr. Keane outlined the kinds of activities he thought his "information architect" should be involved in and they included: Systems design and planning; be a management "sounding board" for new ideas; hardware and software evaluations; be a source of current information on systems work within his client's industry; be a corporate "free spirit" able to roam throughout the client organization to gather data on attitudes and activities affecting systems designs.

A corporate free spirit is a blithe idea, indeed.

Never at a loss for predictions, Dick Brandon, of Brandon Applied Systems, Inc., N.Y., told the Chicago Science Analysts that the current $2.8 billion market for data processing support services will grow to between $16 and $20 billion by 1980. This potential, he suggested, may have been a factor in IBM's unbundling decision. He said that intense competition in this field will eventually cause a major shakeout among the 2,500 companies in the market.

At present, Brandon said, approximately 70 support service firms have annual revenues of more than $1 million each. "This could shrink to fewer than 40 by 1975, including some four to eight companies with annual revenues of $250 million plus, and 10 to 20 with revenues over $50 million." Brandon Applied Systems' revenues for the current year are projected at approximately $7 million.

However, no such rosy revenue expectations were forecast for the time-sharing business by Ronald M. Poppe, another speaker at the TRW seminars. He estimated that sales for the t-s industry will grow from today's $120 million annually to about $1.75 billion in 1975, not the $2.5 billion that has been "commonly projected." He cited several problem areas that will have to be resolved before time-sharing will achieve its potential: the development of simplified computer languages; development of low-cost applications packages tailored to the needs of the business community; education (coddling?) of users who are not technically oriented; reduction in the cost of communications.

But, according to Wyly, a recent Honeywell study states that by 1975 50% of all computers installed will be used for time-sharing and on the basis of that projection, said Wyly, the Honeywell study raises the value of the remote-access market in 1975 to about $5 billion.

On a more modulated British key, the Hoskyns Group, Ltd., has published an analysis and forecast of the British computer industry through the seventies, and predicts an annual value of $1.5 billion for the total edp market in the U.K. in 1970, increasing to $3.36 billion by 1975 and $5.04 billion by 1980. Curiously, the report sees a downtrend in percentile growth of the market, which currently is running at 26% a year, and projects an average of 17% for 1970-75, and 8% for 1975-80. However, the service bureau market will increase from $92 million in 1970 to $336 million in 1975, with the percentage of the users' budget increasing from 6% in 1970, 10% in 1975 and 23% in 1980.

Quantum Science Corp. predicts that U.S. computer equipment production will continue to grow at the rate of 16% annually. Its Maptek Information Services data base tells us so.

Finally, a couple of prejudiced predictions by two more company heads. Alan I. Frank, of Scan Data Corp., said at the FJCC that there will be a $2 billion market for ocr equipment by mid-1970, and that by the mid-1970's, ocr gear will have replaced about 25% of current keypunch equipment (200,000 of 800,000 keypunch machines now in use). And Stuart Rubenstein, of I.O.A. Data Corp., which is engaged in the buying, leasing and selling of used edp equipment, predicted that total sales of used computers should rise from its 1968 level of $10 to $15 million to the $1 to $1.5 billion range by 1975.

We wonder what the Blue Book value will be on a 7600 in 1980.

— AUBREY DAHL

CENTURY SEEN LEADING NCR GROWTH AS THE FIRM RINGS UP INCREASING SALES

With a name like National Cash Register Company, it should be obvious what the company makes. After all, IBM makes business machines, and XDS makes Xerox machines. Seemingly evident, too, is the marketing emphasis at NCR, which had been identified for many years with the financial and retail industries.

With the addition of computers to the product line, however, NCR has changed all this. Now accounting for 60% of sales at the Dayton-based firm are commercial/industrial accounts, which include manufacturers, medical and educational fields, and the government. And by 1973, computer sales are expected to be larger than the combined sales of the other three divisions — terminals, cash registers, and accounting machines. Second in growth rate: terminals. Spokesmen for the company, however, refuse to say whether NCR has any plans to make and market its own graphic terminals, or to get into the minicomputer battle. They would only say, "We are dedicated to being in the edp business."

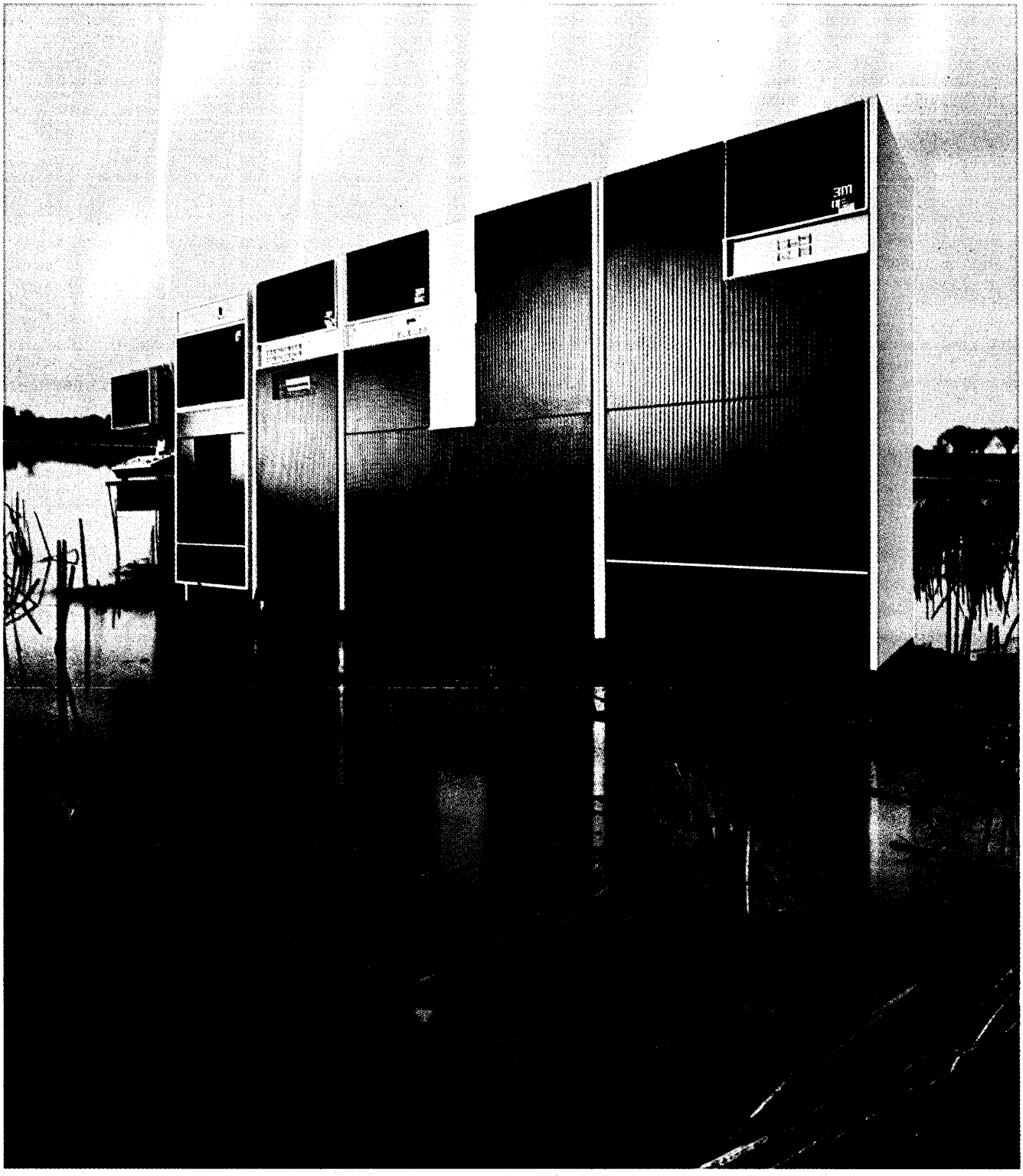
Behind this optimism is the firm's Century series, introduced early in 1968. Domestic and international orders for this line exceed 2,000, according to G.P. Williamson, assistant vp for EDP Products, who adds: "We have delivered over 400 Century 100's and 100 Century 200's." Nearly all orders are for leased systems with the majority on long-term contracts. For example, 95% of the 100's are to be leased — 63% for five years, 16% for two years, and 21% for one year. Average monthly rental for these systems is reportedly $2,564. For the Century 200's, some 93% are to be leased, 55% on five-year pacts, 25% on two-year contracts, and 20% on one-year. Average monthly rental: $7,688.

Approximately 50% of the orders are from new computer users, another 20% from NCR users (the 315 and 500), and 31% had "competitive equipment." In this latter category, 90% of which are said to be IBM gear, there is reportedly a 50-50 split between the 360 and 1400 series. Credited with this is the Century's simulation and translation capability. Comments Williamson, "We have developed a higher speed emulator-simulator to be delivered next April."

According to W.P. Keating, assistant vp for Software Development, the B-3 multiprogramming exec, first shipped in August, is operational but "stilted." The only user of a 200 with the B-3 exec is the University of Bridgeport in Connecticut. The B-2 real-time exec is being operated in-house and under field trial in conjunction with an on-line savings application. And for banks there's the Central Information File package, whose five applications are being released in stages. Demand deposit, installment loans, and general ledger have been released; savings is scheduled for release this month, and mortgage loans is still in the pilot stage.

"This was our one much-publicized problem area in applications systems," admits Keating. The CIF program was originally planned for a 16K system, but was found to require 32K, and this change made. Noting that some 20 banks are now using this package, Keating says, "We feel we're completely out of the woods now."

The first Century on-line savings system, being installed this month, has



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been in test at NCR's Rancho Bernardo plant in California. Supporting 10 teller sets feeding live data has been a 64K mod 200 with two Cram units and two twin-disc drives.

In addition to software, hardware problems are also acknowledged by the firm. Delivery schedules were fouled up by memory unreliability, reportedly overcome through a redesign of the control circuitry, and there were also problems with the plated discs. By redesigning the disc, this too is said to be eliminated.

During last September and October, Century sales were 30% above forecasts and triple the sales for the same period in '68. Accordingly, the 18-month-old Rancho Bernardo plant north of San Diego, where the mainframes are built, is being expanded from 300,000 square feet to 525,000. By the end of '70, employment there is expected to grow from the current 1,200 to 2,500. Not bad for a company that started out by selling cash registers.

— ED YASAKI

GE LAUNCHES TIME-SHARING VIA SATELLITE, PLANS SOFTWARE PUSH

By next April or before, GE plans to begin offering its Mark II-AX time-sharing service, via satellite, to customers in the London area.

The recent reorganization of the Information Services Division, headquartered in Bethesda, was partly the result of over-optimistic market forecasting, but largely it was aimed at eliminating duplicate effort and interdepartmental competition created by earlier organizational changes.

to stay in computer biz

GE's information service business is growing. Employment, monthly billings, and the weekly volume of new service orders are all up considerably over year-ago levels. Contrary to market rumors, GE apparently is not trying to get out of the computer business, either partly or completely. There has been some top-level discussion of the idea, and possibly some tentative exploration of it with potential buyers, but a strong feeling exists within the company that computers represent a major sales growth area for GE.

The Information Services Division's plans for 1970 will put relatively greater stress on expanding business with existing customers, and relatively less on further growth in new business. It is expected that Datanet Software Services — a recently launched effort involving the acquisition and marketing of user-developed software — will grow considerably this year. GE is also looking at data base marketing. The company is modifying an economic data base, developed in-house, so that it can support a commercial query-response service. GE also hopes that its Datanet software scouts can find some marketable data bases developed by users.

These are the main outputs from a long interview we had last month with Paul Sage, general manager of GE's Information Services Division. He commented directly on only a few of the points. The other conclusions, particularly the one about the possible unloading of GE's computer business, are based on our interpretation of his remarks concerning related matters.

The interview was precipitated by GE's appointment, a short time earlier, of Art Peltosalo, vp of the International Information Systems Division, as acting general manager of the Information Services Division. Sage, however, retains his general manager's hat. "Art's assignment here is to help the division get a business plan together and help us meet it," Sage explained. "It has already been announced that he'll be here approximately six months. During this period, I'm acting as his deputy."

Shortly after the Peltosalo appointment, GE merged one of the division's departments — international information services (IISD) — with another, information services (ISD), and consolidated product planning responsibilities in the information network department (IND). Previously, they had been split between ISD and IND. Paul Leadley, IISD general manager, became head of information services — because "he had prior experience in both domestic and international operations," according to Sage. Bill Eaton, the previous head of ISD, is now on special assignment to Peltosalo. "Eaton wants to stay with GE, and GE wants him to," Sage added.

He said the information network and information services departments had been set up separately last January on the assumption that GE's domestic time-sharing business would grow at a certain rate. It did grow, but not as fast as anticipated. Some sales and technical reps hired in anticipation of the predicted growth have since been let go, but many of them have been, or will be, absorbed by other GE operations.

The reorganization is also intended to eliminate friction between the information services and information network departments. They frequently approached new product specifications from different viewpoints, and sometimes competed for customers, under the old setup. Assigning sales quotas was difficult as a result. International information services and information services were merged to eliminate additional duplication in product planning effort.

The projected Mark II satellite service to England will utilize GE's Cleveland kludge for processing. The Mark II-AX system installed there is now accessible nationally. It offers faster access and greater storage than the earlier version of Mark II. This added capability comes from the use of Burroughs-supplied Model 270 discs, in place of GE Mod 204's. Sage said that the satellite channel GE plans to use between the U.S. and England will permit 20-30 overseas customers to interact with Mark II-AX simultaneously. He added that extending the service to the rest of England "would not be difficult" and that expansion to other countries is feasible. However, he indicated that the governments involved have some reservations about allowing data to be sent out of their countries, and this problem will have to be resolved first.

The Information Services Division is employing "about a third more people now than in December, 1968," Sage added. Monthly billings at the end of '69 for the division were double the January '69 level, and new order volume is currently 2½ times that base. GE currently supplies 15-18% of the information network's business, said Sage, and he expects this to drop, percentagewise.

GE has completed negotiations with five outside program authors to market their software, and is negotiating with about a dozen others. The user-developed programs acquired to date are oriented to banking-financial, petrochemical, and electronic-electrical engineering applications. The company is now studying additional areas where it can profitably develop software in-house and/or acquire programs from outsiders. Sage added that GE is planning changes to its Mark II system which will give the user "a reliable estimate in advance of what his expenditures are going to be, and provide him with a means of setting a limit on the number of terminals and the amount of time he uses."

— PHIL HIRSCH

"With seven 2314's on line to a 360 time-sharing system, BASF disk-packs give the reliability essential to our business"

W. Porter Stone, president of U.S. Time-Sharing, Inc., one of the country's fastest growing and most unique computer service organizations, tells us why his company is now using BASF Disk-Packs exclusively.

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Mr. Stone is one of many EDP professionals who are determining, on the job, (in this case with a coupled System/360 50/65 installation) that BASF Disk-Packs actually do offer substantial long-term advantages over other units. Reason? Very simply, greater care and precision in assembly and coating for better performance and surface characteristics.

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news briefs

FCC TO HOLD MEETING ON BELL/T-S SB TARIFF DISPUTE

FCC's Common Carrier Bureau has been directed by Commissioner Kenneth Cox to take a hand in a dispute between the communications carriers and their customers which directly affects line charges paid by operators of many t-s service bureaus.

Basically the dispute is whether data transmitted to or from a terminal in one state, through a customer-supplied multiplexer in the same state, to a computer in another state is partly or completely interstate communications. The carriers insist the terminal-multiplexer link is intrastate; the service bureaus insist the whole communications path should be subject to interstate tariffs.

The dispute is particularly significant right now because rates for analogous "intrastate" service have been substantially increased recently in Ohio and some other states. These increases apply to Information System Access Lines, some of which connect service bureau customers to concentrators within the same state through telephone switching centers; each concentrator is tied by leased foreign exchange line to a computer in another state.

In Ohio, GE and Com-Share are fighting the increase. (Com-Share's Ohio lines are linked to a computer in Michigan.) Service bureau operators object not only to paying higher rates, but also to the fact that they have to deal with at least two carriers — AT&T and the state telephone company. This leads to divided maintenance responsibilities and differences in the types of terminal equipment that can be used.

The Common Carrier Bureau entered the picture last summer, after the commission received a complaint from Shearson, Hamill & Co., a New York securities firm.

The company has a 360/40 in New York, which is linked through a 2703 communications controller to a multiplexer in Chicago; this device, in turn, is connected to several terminals within Illinois by 75-baud telegraph lines. The 2703 is also linked to terminals in New York state through lines supplied by New York Bell. Shearson, Hamill has to deal with three carriers — New York Bell, Illinois Bell, and AT&T. Vice President Nicholas Costanza wanted to know why he couldn't acquire the entire service from AT&T.

He received a letter from Commissioner Cox which explained that Ma Bell regards a customer-supplied communications device as the termination point for a particular type of service. So if an interstate line connects with the device on one side, and an intrastate line connects on the other side, the corresponding line charges are levied on the basis of different tariffs.

"These practices are not based on specific tariff provisions ... but upon Bell's own interpretation ..." Cox added.

Cox asked Costanza whether the intelligence carried by the Shearson, Hamill network was altered in form or content en route. Costanza answered that "messages processed by the computer are altered only to the extent of determining their address location." This is significant because in 1968, the U. S. Court of Appeals decided, in a CATV case involving the same sort of communications path, that the entire transmission circuit was interstate for tariff purposes if the message content wasn't altered.

The Common Carrier Bureau recently contacted AT&T officials, who asked to meet with representatives of the Bureau and of Shearson, Hamill. At press time, no meeting had yet been held, but it was considered likely that one would occur shortly.

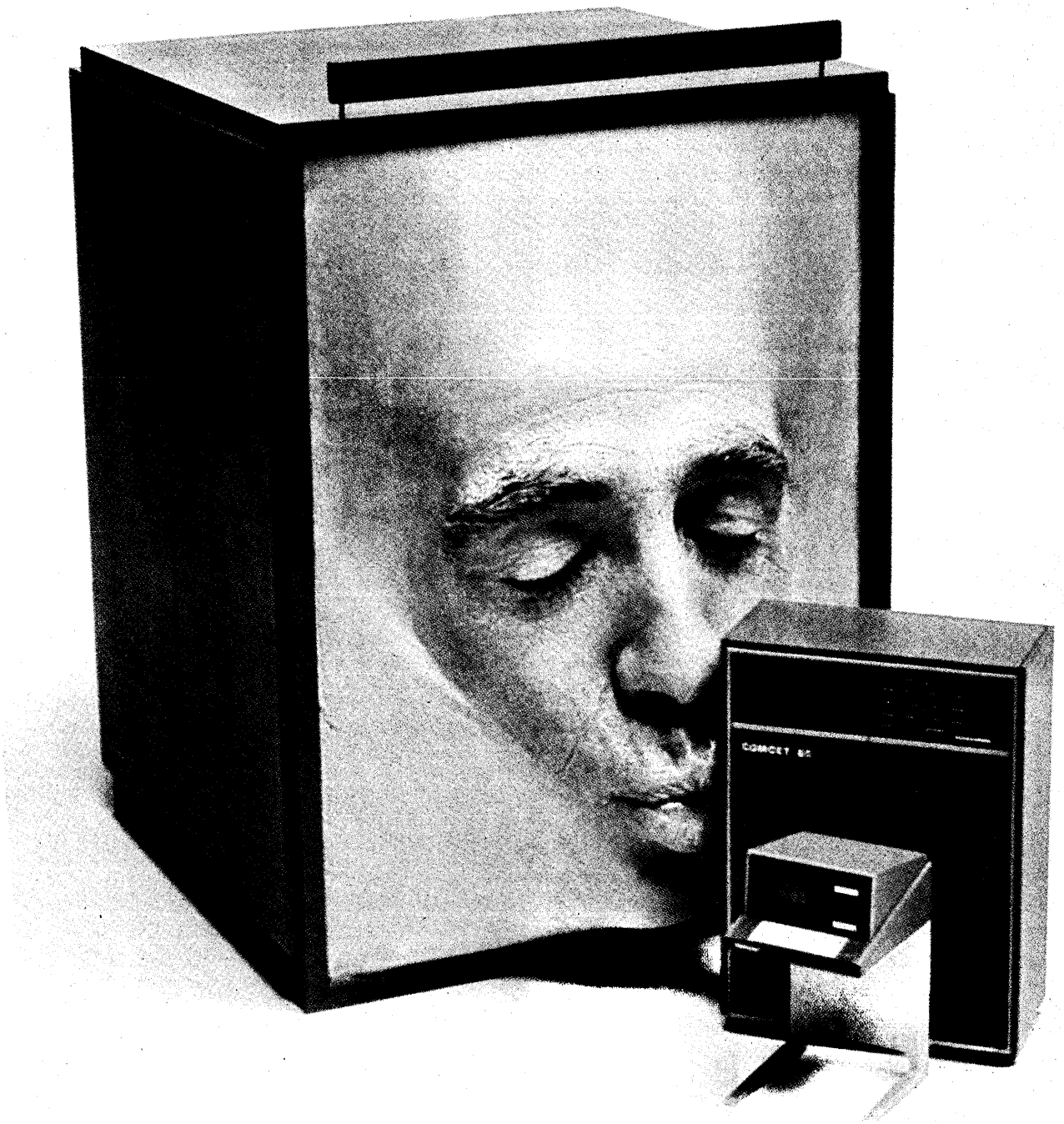
UNIVAC 9200-II HELPS TO HOUND DOGNAPPERS

The National Pet Registration Center in Gillette, N.J., is trying to foil dognappers by tattooing canine pets with their owner's social security number, which is then registered in the memory of a Univac 9200-II at the Capitol Data Processing Corp., a Montclair, N.J., service bureau. Ownership information on over 10,000 dogs has been stored for retrieval, as needed, since the system was established in 1968.

The need for such information occurs when a dog becomes lost, strayed, or stolen and a matchup with its owner is desired. Sal La Manna, head of the registration center, is primarily concerned with preventing theft. Of the two million dogs that disappeared last year, La Manna estimates that 50% were taken by dognappers, who sell them to each other at secret out-of-state auctions for small sums, and then sell them to laboratories far from their homes at a going rate of about $40 apiece. There are about 1,500 laboratories engaged in experimental research requiring the use of dogs, but no reputable laboratory, says La Manna, will purchase a dog marked with a permanent identification number.

A further deterrent to theft is the decal given to each owner for display at his home, indicating that his dog has been marked with a permanent identification number. The dog also wears a tag with the same information. And then there's a Federal deterrent of a $5000 fine and/or five years in prison for transporting a stolen marked dog across state lines. Something like the Mann Act for Doggs.

And they lived



happily ever after.

Our Comcet family of computer communications systems has been living happily together with big multi-terminal computer installations like the IBM 360/40, 360/50 and 360/65 for quite a while now.

Ask Information Network Corporation and Computer Network Corporation—two time-sharing companies who installed Comcet systems to relieve most of their computers' communications overload.

Ask Trans World Airlines—who is installing two Comcet systems to handle the entire communications processing for an IBM 360/50, IBM 360/40, and inter-computer communications with two IBM 360/65's.

Ask the City and County of San Francisco—who are installing a Comcet system to front-end their IBM/360 computer in their communications network used for taxation and finance, law enforcement, public health, hospital administration, social services and personnel administration.

Or ask Optimum Systems, Inc.—their Comcet 60 System will enable their computer center to communicate with the widest possible variety of remote terminal installations giving nationwide service and access to users of the computer utility from anywhere in the United States.

And ask Alcoa Management Information Services Company who chose Comcet Systems to process international communications traffic for 120 sales offices, manufacturing plants and warehouses.

And ask Computer Response Corporation—who after evaluating many alternatives will install a Comcet communications system for use with their IBM 360/40.

They all chose Comcet because Comcet alone had the most complete, original and economical approach to their computer's communications problems.

There's little wonder these firms feel like they do. Just by adding a low cost Comcet System, you can almost double your on-line computer's available capacity. Or by combining a Comcet 60 or 40 System with Comcet peripherals, you can have an extremely low cost free-standing computer system for store-and-forward and message-switching applications. And if you want to tie several systems together, there is no solution that even comes close to the Comcet solution, technically or economically.

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One of the reasons that Comcet Systems can offer solutions to your communications problems that surpass those of the giant computer companies is that we've built a company staffed by the experts of the computer communications field. And, together, we've produced the special new hardware and software needed for designing efficient communications networks.

Ask us to arrange for a technical seminar meeting at your office followed by a demonstration at the Comcet installation nearest you. Write or call Comcet, Inc., Two Research Court, Rockville, Md. 20850. Phone (301) 948-8700.

Or call: Minneapolis-St. Paul (612) 633-8130, Boston (617) 969-3070, Los Angeles (213) 641-3655, N.Y.C. (212) 594-9080, Chicago (312) 298-6180, San Francisco (415) 392-7741, Dallas (214) 357-6557, Houston (713) 524-8119. **COMCET**

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ICES/360 USERS MAY SEEK BIDS FROM OTHER SOURCES

When members of the Integrated Civil Engineering Systems (ICES) users group met December 8-9 at the Chicago campus of the University of Illinois, they studied an IBM response to a question they had posed last February: Would IBM continue to make available the ICES/360? The response? "Maybe."

Developed by Massachusetts Institute of Technology, the system of programs for engineers, architects and construction men was turned over to its users when in 1968 MIT quit distributing and maintaining it. ICES users formed a group to exchange information. Right now it numbers 203 companies, though it is said that around the world some 500 plus companies are now using these programs.

Of concern to members is what they regard as IBM's ambiguous position as to whether the system will continue to be available from its Type 4 library. A formal reply, received only a week before the ICES conference began, indicates that IBM is considering an "enhanced version of the ICES/360 System as a program product." On the other hand, continues the reply, "there is always a possibility that IBM will decide not to announce this program."

"It took only 11 months," said one member of the users group executive committee, "for IBM to give us a definite 'maybe.'"

The IBM non-position left the ICES users group with only one way to go. It took that road in a formal statement: ". . . the group must take the necessary steps on its own, to insure the future availability of ICES." That means it will invite bids on doing for any company using any equipment for a fee what IBM now does for IBM users without a fee.

"We'll look for an alternative system," says McDonnell Automation's Barry Flachsbart, "even if IBM decides to continue." Flachsbart is the group's immediate past director.

Elected at the mid-December meeting to succeed him was Neil McEachern, Systems Dimensions, Ltd., Ottawa. William D. Tabachnik, Mobil Oil Corp., was elected co-director and next year will automatically assume the directorship. The group's next meeting has been planned for Boston in June.

AIR TRAFFIC CONTROL SYSTEM STILL SNARLED

"Unresolved technical problems" and "possible management deficiencies" related to updating of the U.S. air traffic control system will be the subject of a hearing to be held this month by Congressman Jack Brooks' gov ops subcommittee.

Raytheon and IBM are the chief suppliers involved in the technical problems, reports a non-subcommittee source. Raytheon is said to be months behind in delivering a sophisticated crt display needed by en route traffic control centers. The status of software for an IBM 360/67 (designated the 9020-E), which is to be linked to the Raytheon unit, is also in doubt.

The reference to management problems in the subcommittee's announcement probably involves FAA's failure to develop an automated terminal air traffic control system quickly enough during a period when airport congestion has been increasing rapidly. An automation program is now under way, but constant changes in contract specs are said to have stretched it out. Reportedly, the agency still doesn't have a workable prototype of the air traffic control system it wants to use at most airports, even after spending several million dollars on development.

Some of this money went into development of a radar surveillance system called ARTS II — a joint effort with the Air Force and Navy. AF is now installing ARTS II's, but FAA apparently hasn't made up its mind.

Brooks, in announcing the January hearing, commented that "our purpose will be to determine the reasons for the delays in developing and installing the new automated air traffic control system, as outlined in the so-called 'Project Beacon' report, issued in September, 1961. On the tenth anniversary of the Project Beacon report, no significant elements of the new air traffic control system that this report recommended will have been installed."

He added that "the failure of the Bureau of the Budget to request adequate funds from Congress ... has seriously complicated the problem." A reliable source estimates that between now and 1976, "at least one billion dollars" will be needed, above and beyond the amounts Congress has already appropriated to provide an adequate, automated air traffic control system. The investment needed to meet current needs is almost that high. But, reportedly, even if the money were available, it couldn't be spent because of delays in developing final specs for some system components and suppliers' slippages.

GAO-DOD PROCUREMENT BATTLE ESCALATES

The General Accounting Office criticized Pentagon procurement practices last month — again. Previous chapters in this seemingly-endless morality play have produced a number of changes in Armed Services Procurement Regulations (ASPRs); considering the current critical Congressional mood, the new report (B-39995) could produce further changes.

Under a "Truth in Negotiation" Act passed several years ago, DOD suppliers who bid on negotiated contracts or subcontracts worth more than $100K must certify that their prices are accurate. An exception to that rule permits the Pentagon to accept prices without certification if they are based on an established catalog or market price of a commercial item sold in substantial quantities to the general public. GAO, after analyzing 68 contracts which — according to DOD — qualified for the exception, found that in 45 of them, the contracting officers did not make sure that the prices were

based on substantial commercial sales. In the other 23 cases, this information had been obtained but not sufficiently verified.

GAO's own analysis revealed that several of the contracts in the first group had very low, or non-existent, commercial sales. Included in this first group were two computer system contracts, and two others for computer components.

In the second group were two more computer system contracts. One of them involved a scientific installation valued at about $600K. The contracting officer, according to GAO, based his decision that there had been substantial commercial sales on a statement by the contractor that 65% of his sales were commercial and 35% were to the government. "However, there was no indication as to the length of the period involved for the claimed commercial/government sales ratio or the percentages for the previous 12 months." GAO recommended changes in the ASPR regulations aimed at defining quantitatively what constitutes "substantial commercial sales."

Existing regulations tell the contracting officer what kind of data he should collect from the contractor to make this determination, but as GAO points out, the officer has complete power to determine that **any** volume of non-government business over **any** time period meets the "substantial commercial sales" requirement of the law.

The GAO study also said that contractors should be required to certify their catalog and market prices, and the government should be able to check contractors' books to verify this certification.

DOD, which saw an advance copy of the GAO report, objected to all of these recommendations — basically because "there is no basis (for concluding that) a specific percentage of commercial sales establishes an appropriate ground rule" for determining what constitutes substantial commercial sales. "We firmly believe this is a matter of judgment, and establishing specific criteria would not be beneficial in achieving reasonable prices." The Pentagon objected to the certification recommendation because "awards based on catalog pricing" do not constitute "a large or significant problem" and "there is no general indication that contractors submit false facts when asked for facts."

According to GAO, about 9% of all firm fixed-price negotiated contracts worth more than $100K apiece are awarded on the basis of catalog or market prices. "We estimate that the dollar value of these contracts probably amounted to about $1.3 billion a year for the past three years."

Related development: President Nixon has signed a bill establishing a commission to study federal procurement laws and regulations. The group is to recommend changes aimed at reducing costs, making better use of competitive bid procedures, eliminating gaps and inconsistencies in present regulations, achieving greater uniformity and simplicity in procurement procedures, and coordinating procurement policies of federal departments and agencies. The commission is composed of 12 members, including five from outside the government. The others are two Senators, two Congressmen, two members of the Executive Branch, and the Comptroller General, who heads GAO. The commission's final report is due at the end of 1971. It is empowered to issue subpoenas, and can go to court to win the cooperation of a balky witness.

ATTENTIVE CROWD RAPT BY DPMA UNBUNDLING SPEAKERS

Over 150 registrants jammed a smallish banquet room at Philadelphia's Franklin Hotel on December 4 to hear three DPMA speakers issue somber warnings to dp management to prepare for "an unbundled environment." The audience was inordinately attentive, and the speakers disarmingly straightforward and unaffected.

First speaker was ex-IBM training expert George J. Ravazzolo, now president of Advanced Systems, Inc. "The IBM move has forced all of us to grow up in a hurry," he said. "There will be a period of sloshing around, but the impact will be disastrous for those dp managers who are not prepared. And, from what I can see, few are!"

Budgeting for education is now as important as budgeting for hardware and people, he warned. "You should add about 10 per cent to your present budgets for education to survive in an unbundled environment."

Mr. Ravazzolo outlined a basic rationale for dp education, a plan for systematic education of "entry level" personnel, and training programs for systems analysts and management personnel. He said attrition in the '70s will be an acute problem, and "... training will be the key to retaining good people."

Second to speak was Ronald L. Lowe, ex-Univac on-line real-time systems executive, now manager of administrative services for Arthur Andersen & Co. His topic was systems engineering, with particular emphasis on the revised role of systems engineers (SE's), customer engineers (CE's) and field engineers (FE's) in an unbundled environment.

His essential theme: it would be a dandy idea, indeed, for dp managers to quickly learn what to expect from SE's, CE's and FE's, how much these services should cost, and who might be good sources for such critical services. He outlined the approximate extent of IBM's service responsibilities after January 1, and the billings which users can anticipate for these unbundled services.

Last to speak was Al Marchi, vice president of Bresnahan Computer Leasing Co., substituting for previously scheduled company president W. J. Bresnahan. Mr. Marchi, most intent and soft-spoken of the three, commanded a rapt audience. His topic was programming software. He treated the legal antecedents of unbundling, offered specific insights into the unbundled world of software pricing and availability, and brushed against a few topics which caused most to fall into a state of far-off pensiveness.

"IBM has created a whole new environment for the computing industry. All dp costs should be viewed separately now: hardware, software, service, education. We should also bear in mind that programs can not only be bought; they can be sold as well. Programs are now being patented and copyrighted."

Mr. Marchi even suggested a possible "association" which might facilitate the pooling of software resources to help absorb rising costs, and pointed to the fact that these costs can now be "expensed," according to the IRS. He also warned that software salaries will probably spiral even higher in the '70s, with intensified pirating.

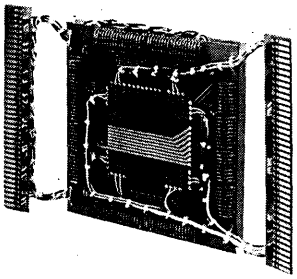
In all, there was a conspicuous absence of fidgeting, pencil-chewing and lint-picking at this briefing. It would appear that dp management has a keen interest in bundling up for what may be a chilly interim of adjustment to the new world of separate pricing.

NBS ACTION ON ASCII, OCR, I/O, COBOL STANDARDS

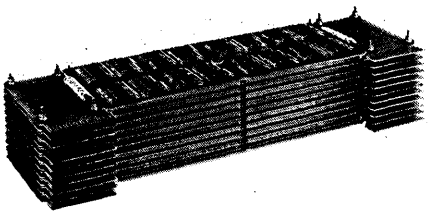
A major test of the federal government's ASCII standard seemed to be developing last month, when the National Bureau of Standards objected to Navy plans for using non-standard characters and bit configurations in a system being acquired for its Ship Parts Control Center in Mechanicsburg, Pa.

NBS wants the Navy to acquire a system that can transmit and receive an ASCII subset of 64 characters in standard bit format, in addition to handling the non-standard characters and non-standard codes required for the ap-

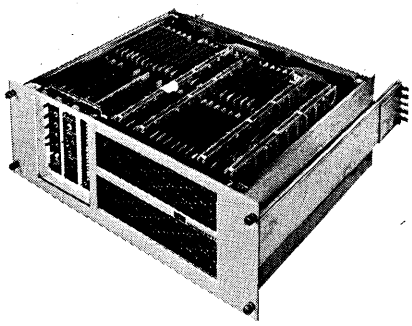
Who else but Electronic Memories



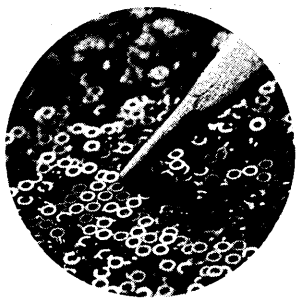
Rugged design for ground based mobile equipment, **NANOSTAK 020** commercial memory stack. High speed 850-nanosecond full cycle time for 4K memories. Features 3W, 3D organization with word capacities to 16K by 40. Built-in reliability and dependability. Available with wide temperature range cores for operation in severe environments.



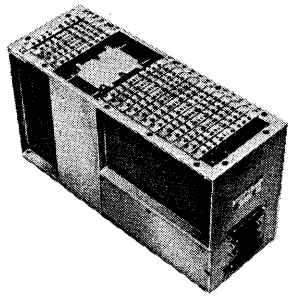
Perfect for high speed, large capacity mainframe memory systems... **NANOSTAK 3020**...technology breakthrough in 3W, 2-1/2D stacks. Stackable, compact size is an amazing 25% of competitive planar stacks and offers a significant advantage in form factor for system packaging. Extremely fast 650 nanosecond cycle time for 8K or 16K by 40, or 32K by 20 word memories.



High speed commercial memory system —**NANOMEMORY 2600**. Full cycle time of 600 nanoseconds, and word capacities of 16K by 18 or 8K by 36. It's all done with a second-generation 2-1/2D drive system with efficient circuit and logic design, for reduced component count and high MTBF, and wide operating margins—the real feature of the 2-1/2D configuration. It is easily expandable in the field, and comes in a standard 19" rack.



Five new memory cores for your next stack or system. All are medium or high drive, all coincident current, and all are fast switching for your high speed applications. Four new cores available in 18 mil, 20 mil, and two types of 30 mil sizes for use from 0° to 70°C. Also, a new wide temperature range 18 mil core for severe environments of −55° to +100°C.



Compact, ATR compatible memory system **SEMS-6** for use in military and rugged commercial aircraft applications. Reliable performer is optimized around 8K or 16K with maximum capacities of 8K by 40 or 16K by 20. Full cycle time of 2 microseconds, with access time of 700 nanoseconds. Meets MIL-E-5400, low power consumption and lightweight.

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plication. In a letter sent to the Navy's dp director last month, Dr. Herbert R. G. Grosch, the Bureau's standards chief, asked the Navy to revise an RFP encompassing the Mechanicsburg procurement so that vendors would include this additional capability, and the related extra costs, in their bids.

The NBS-Navy disagreement could be significant because the outcome may show how effectively NBS can use the rather limited powers it has been given to enforce ASCII standardization throughout the federal government.

Elsewhere on the standards front:

ECMA has agreed to re-structure the upper-case B, E, O, and Z in its OCR-B type font, as a concession to U. S. OCR equipment makers who say the existing shapes are too difficult to read electronically. The ECMA changes probably will be sent to ANSI's X3.1 committee "early next Spring," says a knowledgeable source. If the committee accepts them, OCR-B could subsequently be promulgated as a U. S. standard for all applications where humans must read the output; OCR-A, already standardized as an upper-case font, would then be used for all other applications. This, at least, is what the National Bureau of Standards is pushing for.

The more likely result is that X3.1 will ask for further concessions from ECMA, and meanwhile try to get a lower case A font worked into the existing standard. A proposed lowercase standard was under consideration by X3.1 as we went to press. The proposal seemed likely to be approved by that group. It would then go to X3's SPARC committee and if OK'd there, to X3 for a virtually-final approval.

NBS is also butting heads with the industry on another proposed standard; this one involves a common I/O interface.

Most computer makers want the interface located in the communication channel between the cpu and controller. NBS wants it between the controller and the peripherals — partly because of a conviction that this location would promote use of independent peripherals (i.e., the user wouldn't have to get a separate controller to utilize independently made peripherals, so costs would be reduced; he probably *would* need a different controller, on the other hand, if the interface were in the communication channel).

NBS officials also complain that the industry hasn't come up with a firm implementation schedule for a channel interface; our sources suggest this may be a ploy by system manufacturers designed to maintain their present monopoly on the supply of system peripherals. The dispute could come to a head this month when X3 meets in New York. Two proposals are on the agenda: One calls for proceeding with development of a channel interface; while the other authorizes parallel development of device and channel interfaces.

A proposed federal COBOL standard was undergoing final evaluation within NBS at press time. It would require COBOL compilers acquired by Uncle Sam to conform to one of the three levels, each encompassing specified modules in the USASI COBOL standard. Extra features could be offered, but the supplier would have to provide a pre-processor, at no extra cost, able to flag the extras automatically. Use of these additional features would be restricted to programs that were not interchanged among federal users.

The "low level" compiler specified in the proposed federal standard would contain the following modules in the USASI standard: Nucleus (low level); Table Handling (low level); Sequential Access (low level); Random Access (low level), and Segmentation (low level).

The intermediate level compiler specified in the proposed standard would encompass Nucleus (high level); Table Handling (intermediate level); Sequential Access (high level); Random Access (high level); Sort (low level), and Segmentation (low level).

The proposed high-level compiler would encompass the Nucleus module (high level); Table Handling (high level); Sequential Access (high level); Random Access (high level); Sort (high level); Report Writer; Segmentation (high level), and Library.

After NBS officials agree on the proposed COBOL standard, it will be circulated to other federal agencies, and to industry, for comment before being finally adopted.

STANDARDS DIRECTOR ALEXANDER GROVE DIES

Alexander C. Grove, BEMA director of standards, died November 25, in the New Rochelle Hospital. He suffered a heart attack. The 47-year-old Mr. Grove joined BEMA as director of standards in February 1968. He had been involved in standards work since working at General Precision Equipment Co. While at General Precision he was appointed chief delegate and head of delegation for the American Electronics Industry in its international technical negotiations in 1959.

He joined the United States of America Standards Institute (now ANCI) as director of information services, marketing and program manager in 1964. He was nominated the American candidate for the secretary generalship of the International Organization for Standardization in 1966. In 1967 he became secretary of the Information Processing Standards Board with responsiblity for the X3 and X4 committees, which set standards for computers and office machines, and for their international counterparts ISO/TC 97 and 95.

At BEMA Mr. Grove held primary responsibility for the operations of the Data Processing Group Standards Program, the American National Standards Committee X3 and U.S. participation in ISO/TC 97. He was also vice chairman of X3 and chairman of the X3 International Advisor Committee.

Funeral services were held November 28. Mr. Grove is survived by his widow.

ACM'S DR. WALTER HOFFMAN DIES AT 47

Dr. Walter Hoffman, treasurer for both the Association for Computing Machinery (1963-69) and the American Federation of Information Processing Societies (since 1968), is dead at the age of 47, after a short illness that left him unable to attend the FJCC.

His regular duties were as director of the Data Processing Center at Wayne State University in Detroit, where he had been a member of the faculty since 1949, when he joined as an instructor in mathematics. He had a full professorship at his death. Dr. Hoffman also received his college education from Wayne State, after coming to the U.S. from his Vienna birthplace in his teens, just before the outbreak of World War II. He obtained his PhD from the University of Michigan in 1956.

A scholarship for Computer Science with Medical Application is being set up in memory of Dr. Hoffman, and contributions may be sent to Wayne State Fund, Wayne State University, Detroit, Mich. 48202.

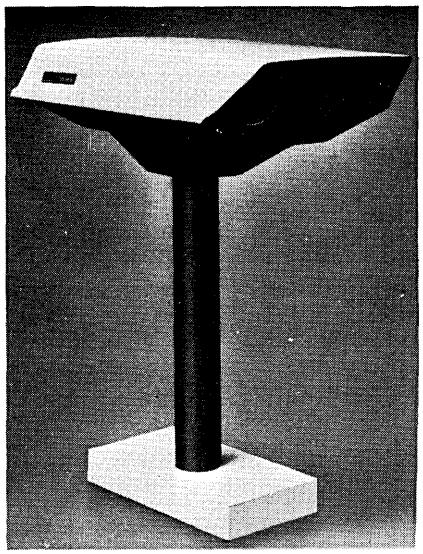
THE "EYES" HAVE IT FOR CHEAP DATA COMMUNICATIONS

Computer Transmission Corp., a small new Los Angeles firm, is out to make data communications faster and cheaper at the same time. To do this they will sometimes take to the air — with optical and microwave transmissions.

The company started operations last March with a charter that dedicated their dozen employees to building turnkey, high-speed, local data communications networks. Its princi-

pals, president Ray Sanders, vp Andrew Meyer, and staff member Neil Keyes (all most recently of ITT Gilfillan) have had experience in radar, digital interfacing, and computing.

The firm's first product is already out, operating, and proven. It is called OPTRAN, looks like a two-eyed mailbox, and uses infrared light for duplexed serial data transmissions from 1200 bps to 250,000 bps. The unit replaces data sets and cables in installations where several local buildings are each to be connected to a central site computer, or, as in an L.A. airport terminal office, where many terminals are situated too far from each other for cabling and really too close to need phone line tie-ins.



Look at me when I'm talking to you!

OPTRAN is a line of sight device good for up to 3,000 feet under almost all conditions, and to over a mile in clear weather. Two models of the data set replacement are sold, 1815A with a standard EIA RS 232C low speed (1,200-20,000 baud) interface, and 1815B for the de facto standard AT&T series 300 data set (to 250,000 bps). Either unit will quickly pay for itself For instance, a 300 series data set can go for well over $200 per month plus line costs and installation. In fact, the rental on the data set alone can go to $3000/year, while the OPTRAN replacement runs $2950.

High reliability is claimed for the unit. In a test at UCLA which saw an IBM 360/91 linked to a 360/20, 5800 blocks (18,460,000 bits) were sent at 4800 baud without a single error. This compares, reportedly, with an experienced error rate there of three to five bits per 100 blocks using phone lines.

The people at CTC are aware that their ambitious goals call for more than a single solution. Other products, however, are being kept under wraps. One of them is a universal digital communications interface which will hook to OPTRAN, to a phone line, or to another medium to transmit digital information at high rates. Billed as "much more than just a communications concentrator," the device replaces concentrators, multiplexors, and data sets. A trial unit is now being secretly worked out on-line to an eight-mile microwave facility. If it has passed its tests, it will be introduced as a product next month. For information:

CIRCLE 357 ON READER CARD

DOOR OPENED FOR EUROPEAN COMPUTER COOPERATION

Britain has accepted proposals from the European Economic Community that it should join with eight other countries to cooperate in key scientific and technological research. One result should be the green light for the super computer system talked about for the past six months — something along the line of joint Anglo-French Concorde supersonic aircraft, but involving more nations. This could bring the French state mainframe maker CII, Britain's government backed ICL, the Dutch Philips organization, and Italian Olivetti, together for collaboration.

The acceptance of the idea for joint work was handed to the Council of European Ministers by the British Foreign Secretary, Michael Stewart. Ideas are for a wider spread of cooperation than just computers, and they include bringing in Norway, Denmark, Sweden, Austria and Spain. Seven fields of activity in which countries could join with the members of the European Common Market involve data processing, telecommunications, oceanography, metallurgy, meteorology, transport, and control of air and water pollution.

Proposals will be drafted at a meeting of the ministers of the six members of the Common Market. But the computer field is the strong candidate for project number one, because talks have been going on in this field longer than any other. However, the scheme is fundamentally politically based, and even the optimistic logic designers of Europe have difficulty in saying, with hand on heart, that this is the most viable way to attempt to build a system envisaged as 10 times bigger than the 7600. Though they don't doubt the strength of the argument for spreading the commercial risks of such a development, there just is no existing development which points out anywhere near the competence or experience needed to take such a jump. And this is undoubtedly a proposal based on ideas of trying to leapfrog a generation gap of practice that exists between America and Europe.

AUTOCODE & AUTOCOMP MERGE, SHARE PROFITS & A COMPUTER

Autocode, Inc., which booked $700K in contracts last year during its first seven months of marketing effort, recently merged with Autocomp, Inc., a supplier of computerized photocomposition services. Although Autocomp is the survivor, officials of Autocode will exercise substantial management control.

Total sales of the two Washington-area companies for 1969 were "approximately $350K," reports John C. Lyons, Autocomp's president and board chairman. About two-thirds of this total came from Autocomp. He looks for a two- to three-fold increase in '70, with Autocode contributing "most" of the gain. For 1969, each company expects to report a "small" profit. Autocomp netted $33K in 1968.

Autocomp has been purchasing time on outside photocomposition equipment until now. Next July 1, it expects delivery of a dedicated Fototronic system from Harris Intertype.

Autocode started out codifying and searching local government statutes for $50/search. Since then, the company has branched into assembly and retrieval of court decisions relating to state and "sub-state" governments, and design of governmental management information systems. It offers a service known as FAM (Federal Aid to Municipalities), which enables prospective local government applicants for federal grants to search a computerized data base and find out the terms under which they can qualify for money to finance specific projects. After the application is submitted, Autocode monitors its progress through the federal pipeline. The company is working on a regional government information data bank in Arizona, and — jointly with Killeen, Texas and a local university — has submitted a bid to the Department of Housing and Urban Development covering design of a model municipal management information system (see Nov. '69, p. 383). Another Autocode activity consists of building a data base containing all court decisions relating to local and state government. About 15K decisions have been cranked in so far, and the ultimate store will contain 40K. A KWIC system is the retrieval tool.

This and other Autocode data bases are stored and massaged on the 128K 360/40 which Autocomp uses to support its photocomposition operation.

Autocode's principals are Ed

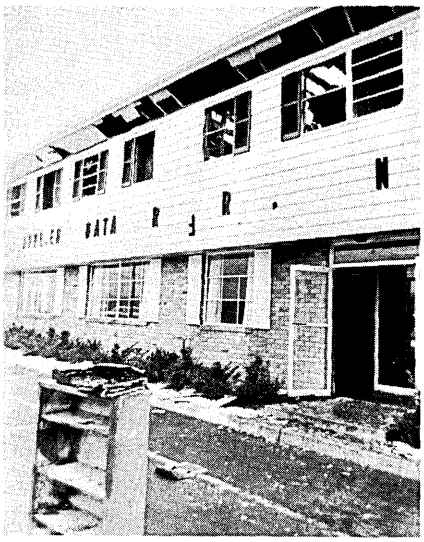
Coxen, president; Lloyd Kendall, exec vp; Carl Fisher and Lew Vovakis, vps. All of them formerly worked on a computerized codification and information retrieval project at the National Institute of Municipal Law Officers. Coxen, Kendall, Fisher, and Vovakis will each be Autocomp directors under the new organizational setup.

LIGHT PLANE LIGHTS ADR'S FIRE

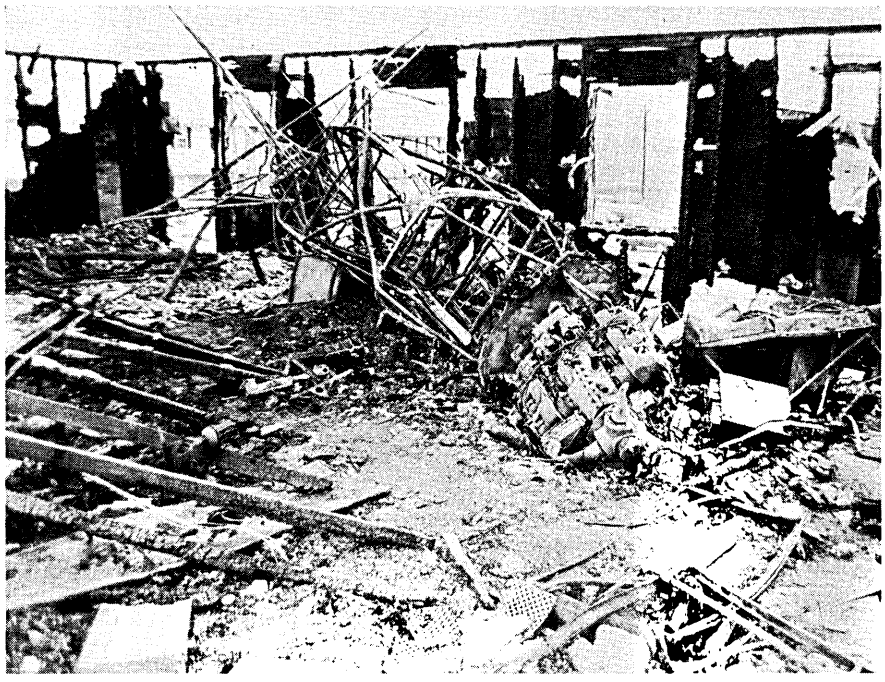
Fire struck Applied Data Research, Inc., on November 13th when the president of an exterminating firm landed his out-of-gas light plane on the roof of the ADR building in Princeton, N.J. The plane caught fire, but some 100 ADR personnel and the pilot escaped without serious injury. The upper two stories of the three-story building burned, however, destroying the card files and some tapes, while the first floor, housing most of the tapes plus the 360/50 and PDP-10 computers, was flooded by water from firemen's hoses. Since all ADR programs are stored on tape with additional back-up reels, no programs were lost despite the loss of the second floor tapes.

The morning after, ADR employees sifted through the rubble and managed to occupy space in a nearby building where temporary offices were established. Within a week, the hardware had been dried out, relocated, and was functioning.

The firm attributes its success in recovering from the disaster largely to its own software packages, notably Autoflow and Librarian. Autoflow permitted flowcharts of the rescued programs to be regenerated immediately. All major source programs were stored on tape in the Librarian master file, which was removed from the burning building unharmed. ADR approximates that the equivalent of over 250K punched cards had been placed on Librarian tapes, and would have required four twenty-drawer filing cabinets for storage; these certainly could not have escaped damage. Thus, ADR may have snatched a promotional victory from the flames. It's fortunate they used their own products.



Remains of Applied Data Research building after applied fire and water



Skeleton of light plane and top floor of ADR building

HONEYWELL TO CURE BLUE CROSS COMMUNICATIONS ILLS

Blue Cross and its affiliate Blue Shield are building a 40,000 mile private wire communications network which will be one of the largest in the country. At one end of the communication lines are 75 Blue Cross and 73 Blue Shield offices. At the other end is the Chicago home office and computer center. Honeywell picked up a plum by selling the communications and computer gear for both ends of the lines.

In 40 of the local offices Honeywell has contracted to place key-to-tape units and message traffic devices called Selectors. The key-to-tape units are from Honeywell's standard keypunch replacement line, but in the message applications they are used as store and forward devices. The selectors act as traffic monitors to identify, send, and receive data, and also do parallel to serial conversions, block records, and check parities. With these stations the local offices will be able to access home office files for individual health plan records, or the Baltimore Medicare files, or the Washington, D.C., federal employee health benefit files for answers to questions on Medicare and federal health programs. For this part of the system Honeywell gets $739,000.

The home office is equipped with two medium-scale H-2200 computers and two small H-516's (which act as front-end systems for the larger machines). For this part of the system, Honeywell banks $2.5 million.

The two health plans provide coverage for some 86 million Americans, and process 30 million characters of data daily right now. Business transactions are expected to increase 800% by 1974.

TIME-SHARING FOR PORTFOLIO MANAGEMENT

Princeton Time Sharing Services, Inc., has negotiated an over $500K contract with DHR Systems, Inc., Paoli, Pa., covering systems programming, installation, and facility operation of a 360/50 time-sharing system for stock portfolio management over the next two years. DHR, a subsidiary of the Drexel, Harriman, Ripley brokerage in Philadelphia, will provide a service to customers with the facility managed by PTSS. The 360/50, previously used by PTSS to provide its own time-sharing services, has been relocated to a DHR facility, while PTSS has acquired a 360/65 for its own use.

The service provided by DHR will be the Computer Assisted Management of Portfolios system, which the

firm designed and developed. It is scheduled for customer release early this year. CAMP evaluates portfolios for: closing prices of previous trading day, unrealized appreciations and current tax status, distribution of assets by industry classification, relative price action of the portfolio, data on specific stocks or industry groups, etc.

COMPUTER SCIENCE'S 3R'S — RESTAFF, REGROUP, RETAIL

Last month's announcement of the formation within Computer Sciences Corp. of a Development Division should have marked the wrap-up of a move started there last March to reorganize into two basic branches — one for contract services, in which the company is already big, and one for proprietary services, in which the company plans to get big. The move was preceded by several personnel changes, including the formal designation of Wm. R. Hoover as president and chief operating officer.

Hoover will work directly under Fletcher Jones as chairman and chief executive, but this actually reflects no change in the status he has held since becoming executive vp in charge of operational management last March.

Other personnel movements saw Norman Carter, general manager of the Computer Science Institute — the educational arm — go to Information Management Facilities, Inc., of New York as, reasonably enough, vp/gm of that firm's new Education Systems Div. With him went W. Blake Gibbs, Carter's assistant, who will manage operations and planning, under Carter. In an apparently unrelated move, CSC's vp Ed Kearns left to head up an amalgamation of three maintenance organizations at University Computing Co.

Meanwhile, back at CSC, Dr. John F. O'Toole, Jr., stepped into the education gap left by Carter, and Roger Fisher in the package marketing group found himself minus one level of upper management.

As CSC's structure now stands, the bulk of its resources and revenues are tied up in the contract services section called the Systems Group.

The past year's restructuring has been aimed at readying an attack on the more profitable proprietary package and proprietary services markets. Proprietary services will be taken care of by the existing Information Network Div. The package end will be handled by the new Development Div. in conjunction with Fisher's marketing department.

Hoover announced the appointment of Donald A. Jackson, ex-ass't. to the pres., as president of the Development Div. He will handle administrative affairs while Roy Nutt, vp and CSC co-founder, heads up the R&D work. The organization here is reminiscent of the Fletcher Jones/Roy Nutt pairing, and CSC will be hoping that this dynamic duo is just as successful in its run for the high money markets.

HOUSEHOLDER CHOSEN FOR HARRY GOODE AWARD

Undoubtedly the shortest and most gracious speech delivered at the FJCC was that of Dr. Alston Scott Householder upon receiving the 1969

Dr. Alston Scott Householder

Harry Goode Memorial Award from AFIPS. In fact, his acceptance speech was shorter than the presentation.

The presentation:

"For his impact and influence on computer science in general and particularly for his contributions to the methods and techniques for obtaining numerical solutions to very large problems through the use of digital computers.

"For his many publications, including books, which have provided guidance and help to workers in the field of numerical analysis.

"For his contributions to professional activities and societies as committee member, paper referee, conference organizer, and society president."

His acceptance:

"I am deeply grateful. Whatever I have accomplished in this field or others has been accomplished only with the able and generous cooperation of many people. Thank you."

NEW KIND OF MEMORY ANNOUNCED BY CMI

Cambridge Memories, Inc., has developed a magnetic domain memory. The technology, called DOT (Domain Tip), stores data in magnetic spots moving in channels etched on an aluminum film. The domain is generated by application of a magnetic field at a point on the channel. The direction of magnetism of the spot determines whether it represents a binary zero or one. Conductors passing over the channel sense the stored information and move the domains through a predetermined pattern.

Initially, CMI will use the technology in shift registers, which are expected to be available early in 1970. Joseph F. Kruy, CMI president, believes a mass memory storing up to 16 billion bits of data should be available by 1972.

The CMI technology is similar to Bell Laboratories' "bubble memory" (DATAMATION, Sept., p. 162), but it uses ferromagnetic materials rather than the ortho-ferrites which Bell plans to develop. CMI will use a nickel iron compound, vacuum deposition and printed circuit techniques to produce its domain memories. Mr. Kruy said the DOT shift registers will be fast enough to satisfy 95% of the buffer memory applications which currently use MOS memories. The advantages of DOT, he said, are its ability to have data read in and out at many points and its nonvolatility.

CMI has placed 2,000 bits on a one-inch square chip and expects to have 4,000-bit chips for use in shift registers. Mr. Kruy said development would continue and should increase chip density to 8,000 and 16,000 bits. A mass storage device could combine 1,000 chips and associated electronics.

CMS CONSOLIDATES TECHNICAL SERVICES

Computer Microfilm Systems, a one-year-old company based in Glendale, Calif., has put together a package of services that offers companies a chance to avoid the horrors of in-house technical publications and documentation. Such companies as XDS, Data Products, DatagraphiX, and 3M have signed on as customers, according to president C. J. Taylor.

The firm was called Graphicomp Systems until October of this year and that name has been retained for one of the divisions. A variety of services is offered — software, short-run printing, standard microfilming, and computer-output microfilming — but the central theme is a computer-based documentation system. Using a 65K 360/30 (with a second to be added soon), CMS has built up a data base of military and commercial specifications for technical support documents, such as parts analysis, provisioning, and operating manuals. When a customer signs up, his requirements are

programmed and the applicable specs are pulled out accordingly. Lists and descriptions are then ground out by line printer, combined and published in one or more media as required. It takes one full-time programmer just to keep the publication specs up to date.

Taylor, formerly manager of technical publications for GE's computer department in Phoenix and in the same business for General Dynamics, says CMS is in the black with $750K sales in the first fiscal year just completed. He's predicting $3 million for the coming year.

A San Diego office was opened this year and San Francisco is the next target, with the expansions planned through acquisition of companies offering any one of the services. Business is so good, according to Taylor, that "we're having trouble getting our internal accounting on the computer."

COMPUTER UNCOVERS NEW NUCLEAR INTERACTION

Scientists at the Space Radiation Effects Laboratory, Newport News, Va., have linked an IBM 360/44 with an atom smasher to study nature's strongest force, the attraction of the nucleus and a nuclear particle known as a pi-meson, or pion.

The experiment begins at the cyclotron, which shoots a stream of energy at a target, usually a piece of metal; 50,000 pions a second stream through a detection system toward a bank of five targets, emitting x-rays as they slip from one energy level to another, drawn by the nucleus of the target in their path. The pions themselves are too small and their life spans too short for them to be seen, but their effects can be observed. The computer system performs as a three-dimensional analyzer. It identifies the target struck, the energy of the x-rays, and the times the x-rays occurred. The computer is connected to the detection system, which converts the data to machine-compatible language and sends it to the computer's memory at the rate of 800K cps. So far, the computer has compiled a record of 50 million measurements. The results indicate that pions do not do what physicists generally thought they did. Instead of the attraction growing stronger as the pions move closer to the nucleus, the force levels off. The next task is to find out why this happens. Once the fundamental properties in nature are understood, man will have the potential of absolute control of his environment with nuclear energy.

According to Dr. Richard J. Powers, the experiment wouldn't have been practical without the computer — the lab would have needed 5,000 electronic counters to record the results and at least a thousand people to watch the counters. And even if that had been possible, the accuracy of the information would be questionable.

To help introduce its new line of cars at the annual auto show in Paris, Renault used Bull-General Electric's time-sharing service and set up terminals in such places as the metro (subway) to inform the buying public. The prospective buyer listed his requirements, and the computer sent back printed recommendations, including the monthly payment necessary and the name and address of the customer's nearest Renault dealer.

THE BRITISH ARE COMING

International Computers, Ltd., second computer producer in the world (after IBM) and premier computer maker in the UK, has penetrated the U.S. market. It will make the first U.S. installation of an ICL computer in late 1970.

The machine, an ICL 1902A, has been ordered by Barclays Bank DCO (Dominion Colonial Organization) for use in its New York City offices. The 1902A is a 360/30 size machine that rents for $6K to $8K monthly. Barclays will use it for processing now handled by tabulating equipment and a service bureau.

ICL looks upon the installation as a showcase for presenting its equipment to the U.S. business community. The company isn't organizing a national sales effort, however; it is more interested in influencing U.S. company decisions on computer purchases for overseas operations.

ICL's major U.S. effort is in OEM sales of computer peripherals. It reports its OEM business, which produced about $5 million in revenues last year, to be growing at the rate of 60% annually with 90% of the business coming from the U.S.

Support for Barclays' 1902A will come from ICL's New York office and from International Computers of Canada Ltd., in Toronto.

DATA BASE LANGUAGES REPORT READY FOR PUBLICATION

Proposals for two data base languages have been prepared by the Data Base Task Group of CODASYL. The group, established three years ago, was charged with development of concepts and language specifications for data base handling. The results of the effort are the Data Description Language, which provides for declaration of data bases independently of the languages used to process them, and the Data Manipulation Language which is associated with a host language — COBOL, FORTRAN, etc. — and is used by programmers to interface with the data base. The languages would permit the building and maintenance of large integrated and shared data bases.

The Task Group is composed of representatives of GE, Honeywell, Univac, RCA, NCR, IBM, General Motors, U.S. Steel and Bell Telephone Laboratories. It is currently preparing to publish the report and solicit comments and proposals from the data processing community. Publication is expected sometime this month. Proposals will be assessed by the group and a final proposal for the language specifications will be presented for CODASYL approval.

XDS MAKES ITS MARK IN EUROPE AND LAS VEGAS

Following the trend, XDS has announced a major price slash on its CF16 minicomputer from $12,890 to $7,990. The CF16 is a 16-bitter with a cycle time of 2.67 usec, an I/O transfer rate of 250K words per second, and a memory expandable in 4K-word increments to 32K words. The firm is also offering two new peripheral device couplers that allow the minicomputer to function with analog digitizers, high-and low-level multiplexing equipment, and D/A converters.

In another XDS development, par-

ent Xerox Corp. and the Rank Organisation, Ltd., announced an expansion of the business of Rank Xerox, Ltd., in which they are partners, to include the "manufacture, sale, and distribution of computers and related electronic data processing equipment and services," which means an added thrust for XDS in the European market. In addition, the Rank Organisation will provide advisory and consulting services to XDS "concerning the design, development, and marketing of products suitable to the needs of customers in the Eastern Hemisphere, for which Rank will receive a fee of $5 million over the next five years."

On the Las Vegas front, XDS alluded to its name change from Scientific Data Systems to XDS as a result of its recent acquisition by Xerox with a battery of billboards around the town showing the S x'd out (see photo). Rumors that the x'ing was the work of vandals or opponents of the Students for a Democratic Society were quickly scotched in the various bars around town.

XDS billboard vies with every Phil, Vic and Harry in Las Vegas

new companies ...

Big corporations continue to revamp their setups to adjust to the changing technological scene: **The Bunker-Ramo Corp.** has formed a Government Systems Group which will include its Defense Systems, Micromega and Applied Time Sharing divisions in a concerted effort to produce for state and local governments as well as federal. The group will hq in Canoga Park, Calif. ... **Motorola** has established an Applied Systems Unit for dealing with "the more pressing social problems of our day," like air and water pollution. Carl P. Nierzwicki, formerly market director of the government electronics division, will stay in Washington to head the unit. First accomplishment is a flood control and hurricane protection system for New England, originally designed for the Army ... **Univac** has formed the Communications and Terminals division, hq'd in Salt Lake City, to increase penetration of "the fastest growing segment of the computer hardware industry." It will operate within Univac's dp division, but have separate responsibility to reach all users, including non-Univac, with compatible equipment ... **Boeing** has initiated an Experimental and Production Manufacturing organization, with "emphasis on production of electronic and information systems products." One of its first jobs will be putting together guidance and navigation systems for NASA'S Lunar Rover, better known as the moon buggy ... In turn, **Technology, Inc.**, Dayton, O., R & D firm, has started a Commercial Applications Section, for business and educational dp ... And **Quantum Sciences Corp.** has opened a center in Hartsdale, N. Y., to establish its Computer Technology Div., which will conduct multiclient studies, forecasting, marketing, and technological trends in hardware, software and services ... Microfiche information processing will be the specialty of **Data Bank Corp.**, directed from a penthouse in New York City. They call their system MARS ... In Burlington, Mass., **Geosystems, Inc.**, is engaged in developing process control systems, and computer-aid laser-based measurement, as well as regular dp and software consulting ... Computer components will be manufactured and marketed by **Unicom, Inc.**, in Fairfield, N.J. Plans are to start the new year right with a desk-top dp system for small insurance, engineering and banking offices ... **Logic Simulation Co.** has been founded in Kent, Wash., as a division of Computer Graphics, will provide services for both scientific and commercial operations ... **Computer Facilities Corp.** will service 14 western states in data entry problems ("the forgotten stepchild of the industry") and facilities management from its L.A. base ... **Systems Management, Inc.**, Des Plaines, Ill., will cope with day-to-day operations problems (of others) ... Another facilities management and consulting entry is **Advanced Management Systems, Inc.**, formed in Houston, which will specialize in inventory reporting and control systems using t-s ... In Arlington (outside Dallas), **NHA Data Tex., Inc.**, will furnish task force teams to originate and apply systems for manufacturing, procurement and inventory, mainly in the aerospace, oil and petrochemical industries ... **Westat Research, Inc.**, Washington, D.C., area firm which specializes in processing data from the Census Bureau and other federal agencies, has started a Data Services Div. for guidance and technical assistance in obtaining government data. Westat also furnishes surveys and summaries for use in urban planning, transportation, housing studies and marketing research ... **Computer System Architects, Inc.**, in Cambridge, Mass., will assist in developing computer-based products ... Partial exodus to the Caribbean, where the labor and economy are cheaper and the air freight is speedy, has been undertaken by **Fimaco, Inc.**, which has started a dp facility in Kingston, Jamaica, and United Telecontrol Electronics, Inc., which has started **UTE Trinidad Ltd.** in Port of Spain to produce memory core stacks and planes for its own use. Both firms are happy to retain internal control of their operations ... **Alphanumeric, Inc.**, has joined hands across the ocean with a couple of French companies to start its own brand of computerized photocomposition at service centers "in Europe." It picked its partners well: Compagnie Bancaire, with $1.8 billion in diverse pockets, and Compagnie Generale d'Automatisme, a subsidiary of one of France's five largest industrial corporations ... **Intech Australia Ltd.**, located in Melbourne, is the latest subsidiary of the same-named U.S. company, which heretofore has not ventured farther than Kansas City and St. Louis. Its managers were formerly Control Data Australians ... **Vector General** has been organized in the L.A. area, to produce a crt terminal "allowing as many as 5,000 vectors to be displayed" ... There has been a spate of name-

Can CMC keep delivering its systems faster than other companies keep announcing theirs?

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The first systems have been at work since July. The advantages of computer-controlled keyboard input—lower cost, higher efficiency, simple operation—are clear by now to our customers (bless them). And to our competitors (count them).

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The CMC KeyProcessing System for computer-controlled keyboard input

system's computer and written on a magnetic disk.

After verification, batches of data may be transferred automatically, in any sequence, from the disk onto a single reel of magnetic tape. Done! This one tape then becomes clean input to your computer.

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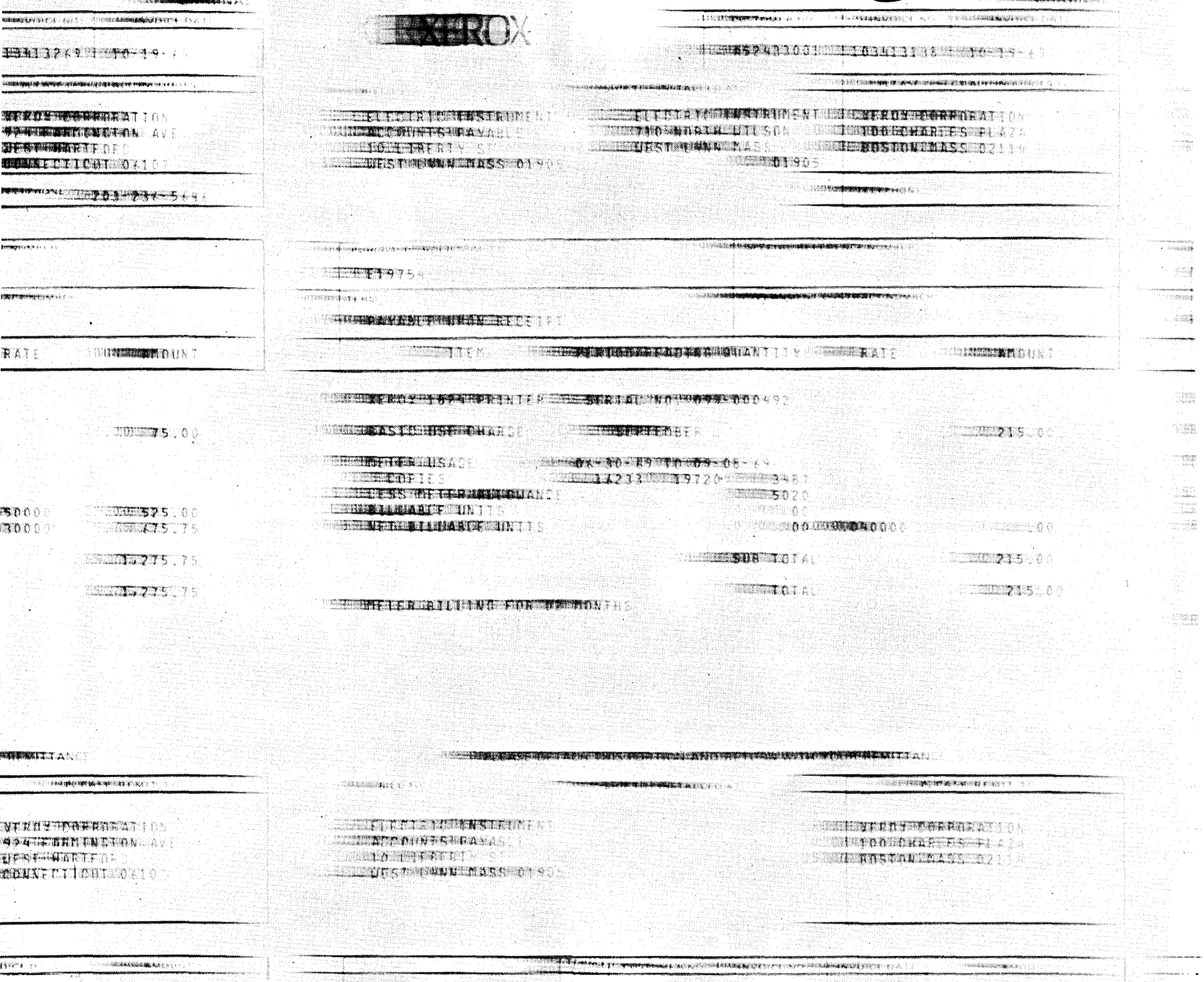

Print-out from electronically-generated microfilm at 50 to 60 pages a minute.

Sound too fast to be true? Not for the Xerox Copyflo 11 Continuous Printer.

Now you can take your microfilm data and turn it into sharp, clear positive enlargements—at 40 feet per minute.

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CIRCLE 141 ON READER CARD

XEROX

changing of late among computer companies: Access Systems, Inc., t-s service company of Paramus, N. J., has changed its name to **Axicom Systems, Inc.** . . . I.R.A. Systems, Inc., is now **Spiras Systems, Inc.,** still making peripherals in Waltham, Mass. In Newton, **GRI Computer Corp.** hasn't changed much from its former name of G-R Industries, but says it will not now be confused with another Massachusetts company. Construction Products, Inc., in Natick, is now **data-site inc.** (sic), the better to reflect the company's business, which is site preparation for computer facilities. In Santa Ana, Calif, **Microdata Corp.** used to be System Design Associates, and the company's software operations will still go under that name. The company's minicomputer manufacturing will be done by another newly designated subsidiary, **Micro Systems, Inc.** . . . And in N.Y.C., Strategic Time-Sharing, Inc., is now **The Comsonic Corp.,** encompassing both hardware and software development, on-line systems services, consulting and software design . . . National Data Processing Corp. is not only becoming **Network Data Processing Corp.,** but is moving its hq from Cedar Rapids, Ia., to the Chicago suburb of Oak Brook . . . **Quadra Data, Inc.,** is the new name chosen by Professional Data Systems in Mountain View, Calif., with a service center offering third generation systems.

mergers, acquisitions . . .

Enlightened caution seemed to be the prevailing attitude when it came to mergers, in view of money rates and the stock market. After backing off and circling on their original agreement, **Varian Associates** in the West and **Electronic Associates, Inc.,** in the East decided the twain could not meet after all, in spite of merger and reconciliation announcements . . . **Sears, Roebuck** first suspended, then terminated talks on its supposedly all-set takeover of **Computer Usage Co.** . . . **Schlumberger, Ltd.,** however, apparently was quite willing to bid $87 million for a big overseas acquisition, **Compagnie des Compteurs,** a French electrical company making automation equipment. Schlumberger has extensive U.S. interests in the same field (including Weston Instruments) for oil-well service applications . . . **Raytheon** agreed to sell its electronic learning systems company to **Visual Electronics,** of N.Y.C., to enable a "separate approach" to markets, but Raytheon is scheduled to keep a 14% interest in its former Michigan City, Ind., operation; also ownership of its new plant there . . . Susquehanna Corp. has sold controlling interest in **Xebec Corp.,** a profitable Kansas City peripheral equipment maker, to **National General Corp.** in L. A. for a "substantial" capital gain to offset loss elsewhere . . . Maintaining that **University Computing Co.** now is structured to operate primarily in large metropolitan areas, Karl F. Young, president of UCC's Data-Link Div., announced sale of its Shreveport, La., center to **Computer Information Systems,** but is acquiring an equity in CIS . . . **HF Image Systems, Inc.,** is merging into its subsidiary, plain **Image Systems, Inc.,** which has already announced a further merger that will absorb the original parent company, **Houston Fearless Corp.** — a tail-swallowing-the-head phenomenon . . . The emergent IMI will be hq'd in the L.A. area, producing microfilm retrieval and storage systems . . . **Washington Engineering Services Co., Inc.,** a dp service organization in the D.C. area since 1951, has agreed to take over the batch computer operations of **Telecomputations, Inc.** . . . **The Computer Exchange, Inc.,** used computer dealer, is negotiating acquisition of a holding company, **Capital Corporate Resources, Inc.,** which also owns and operates **Capital Computer Corp.** as a subsidiary in Philadelphia . . . **The Multiple Science Corp.,** Asbury Park, N. J., with its two subsidiaries, **Universal Programming & Systems, Inc.,** and **Commercial Computer & Mailing Services, Inc.,** in the Washington, D.C., area, have been acquired by **Photo Magnetic Systems, Inc.,** which has a guaranteed check cashing (Comput-A-Credit) and trading (Comput-A-Car) service there . . . **Alphameric Data Corp.,** Boston, designer of an I/O terminal for use with both fourth generation t-s systems and small computers, has been opted for purchase by **Dataram Corp.,** Princeton, N. J., memory manufacturer, which wants the terminal for use in info management and accounting systems . . . **URS Systems,** which previously purchased **Matrix Corp.**'s Professional Services Group, with an option to buy the rest of Matrix by February, has gone ahead with its plan, and will acquire that company's two dp centers in Los Angeles and Boston. They will "complement the software technology and marketing strength" of URS, according to president Richard De Lancie, whose company plans to enter network information services in a big way . . . A company that is simultaneously enlarging its staff for facilities management and merging into another company is **Drexel Data Systems,** which will become a part of **Venture-Data Corp.,** both in the Philadelphia area . . . **Recognition Equipment Corp.,** Dallas OCR firm, has agreed to acquire a major interest in **Datacraft Corp.,** of Ft. Lauderdale, Fla. Datacraft makes digital computers and magnetic core memories . . . In the meantime, an affiliate of REI, **Corporation S,** goes along making deals for optimation ("optical input automation") centers. Nationally, the latest are with the **Maryland National Bank,** for a center in Baltimore; **Security Pacific Bank,** for one in L.A., and **Northwest Computer Services,** for Minneapolis. Overseas, **Credito Italiano** has agreed to go for one in Milan, and Stockholm's **Enskilda Bank** will help launch one in Sweden . . . **Systems Engineering Laboratories, Inc.,** Ft. Lauderdale, and **Spectral Dynamics Corp.** of San Diego have agreed to an exchange of stock. Systems makes and markets digital computers; Spectral designs and manufactures electronic instruments used in data acquisition, and will operate as a subsidiary . . . In another Florida-California linkage, **Micro-Tenna Corp.** of Miami not only has acquired **Data Computer Systems, Inc.,** but is in the process of changing its name to same and moving corporate hq to Santa Ana. DCSI recently introduced a fourth generation remote terminal.

• Two large time-sharing networks, embodied in Com-Share, Inc. and Computer Complex, Inc., have agreed to unite their centers in four distinct national areas to form a more widespread whole. Com-Share, headquartered in the Detroit area with other centers in Los Angeles and New Jersey and servicing 34 U.S. and Canadian cities, will take over the t-s operations of Computer Complex, headquartered in Houston and servicing 18 cities. Com-Share, however, will operate as a wholly-owned subsidiary of Computer Complex, calling for issuance of 1.5 shares of its stock for each share of CSI. Computer Complex also has subsidiaries involved in computer equipment design, manufacture, and leasing. Richard L. Crandall, who was promoted to chief operating officer of CSI last October, will continue with that subsidiary as president. Robert F. Guise, Jr., CSI president to date, will become chairman of the board of Computer Complex, and Robert A. Westerhouse will continue in his previous post as president and chief executive officer of *that* company.

• Honeywell Aerospace Div. is developing a "Mini-Wire" aerospace-computer memory element expected to have reliability, speed, power, and

That's the way we are. About everything.

First we went overboard on the computer itself and came up with the best you can buy. A high speed, low cost unit with microprogramming, available off-the-shelf for only $3200. You get the basic processor with 16 multipurpose registers, 256 words of read-only store, basic console, enclosure and power supply to function as a microprogrammed controller. When you add up to 32K bytes of core memory, you also get the fastest computer in its class with a 1.1 μs memory cycle time and a 220 ns micro command execution time.

Then we went overboard on options so more of you could buy the 800. Take a good look at our selection. Chances are you'll find the board you need right here. If not, give us a call anyway. We can provide special options within 90 days for volume users. In the meantime, write for details on the Micro 800 and its microprogrammed general purpose partner, the 810.

Central Processor Option Boards

POWER FAIL AND AUTOMATIC RESTART. Provides interrupt when loss of power is imminent and when power is turned on.

MEMORY PARITY. Includes the memory parity generator and checker logic and an interrupt when an error is detected.

REAL TIME CLOCK. Provides an internal interrupt at a crystal controlled timing rate.

SPARE MEMORY BIT CONTROL. Provides a spare memory bit by expanding the memory byte length and I/O bus to 9 bits.

OPTION BOARD. Includes all of the above processor option items.

Utility Interfaces

INPUT/OUTPUT LINE DRIVER AND RECEIVER BOARD. Expands the internal I/O bus to an external bus allowing integration of up to 10 peripheral interfaces under program control, or concurrent data transfer with interrupt.

PARALLEL TELETYPE CONTROLLER. Assembles and disassembles serial information to and from the teletype for parallel transfer to and from the computer under program control or concurrent block transfer.

We've gone overboard on options

GENERAL PURPOSE I/O BOARD — WIRE WRAP. Accommodates 14, 16, or 24 pin integrated circuit sockets in the following quantities: 135 units—14 or 16 pin sockets. 24 units —24 pin sockets.

PRIORITY INTERRUPT BOARD. Allows interfacing of 8 external interrupt lines with expansion capability to 64 lines using 8 boards.

DIRECT MEMORY ACCESS SELECTOR CHANNEL. Provides for transfer of 8 bit bytes directly between external devices and core memory.

32 x 32 DISCRETE I/O. Expands the 8 bit I/O bus into multiple (4) byte I/O and operates with standard DTL or TTL logic levels.

Communications Options

SYNCHRONOUS MODEM CONTROLLER. Interfaces a Western Electric 201 or equivalent data set and operates with point to point or switched networks with optional automatic calling-answering for either 2-wire or 4-wire service.

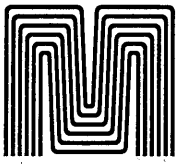
LOW-SPEED ASYNCHRONOUS MODEM INTERFACE. Accommodates up to sixteen 103 type modems and operates with point-to-point or on switched networks.

MULTIPLE TELETYPE INTERFACE. Accommodates up to 24 locally connected teletypes and functions as a 4-wire full duplex with 20 ma currents.

Device Interfaces

CARD READER. Provides control of an 80 column card reader, 12 lines per column in Hollerith or two binary bytes, at reading rates of 225 or 400 cards per minute.

PAPER TAPE READER/PUNCH. Consists of two separate functions which can be mounted on the same board.



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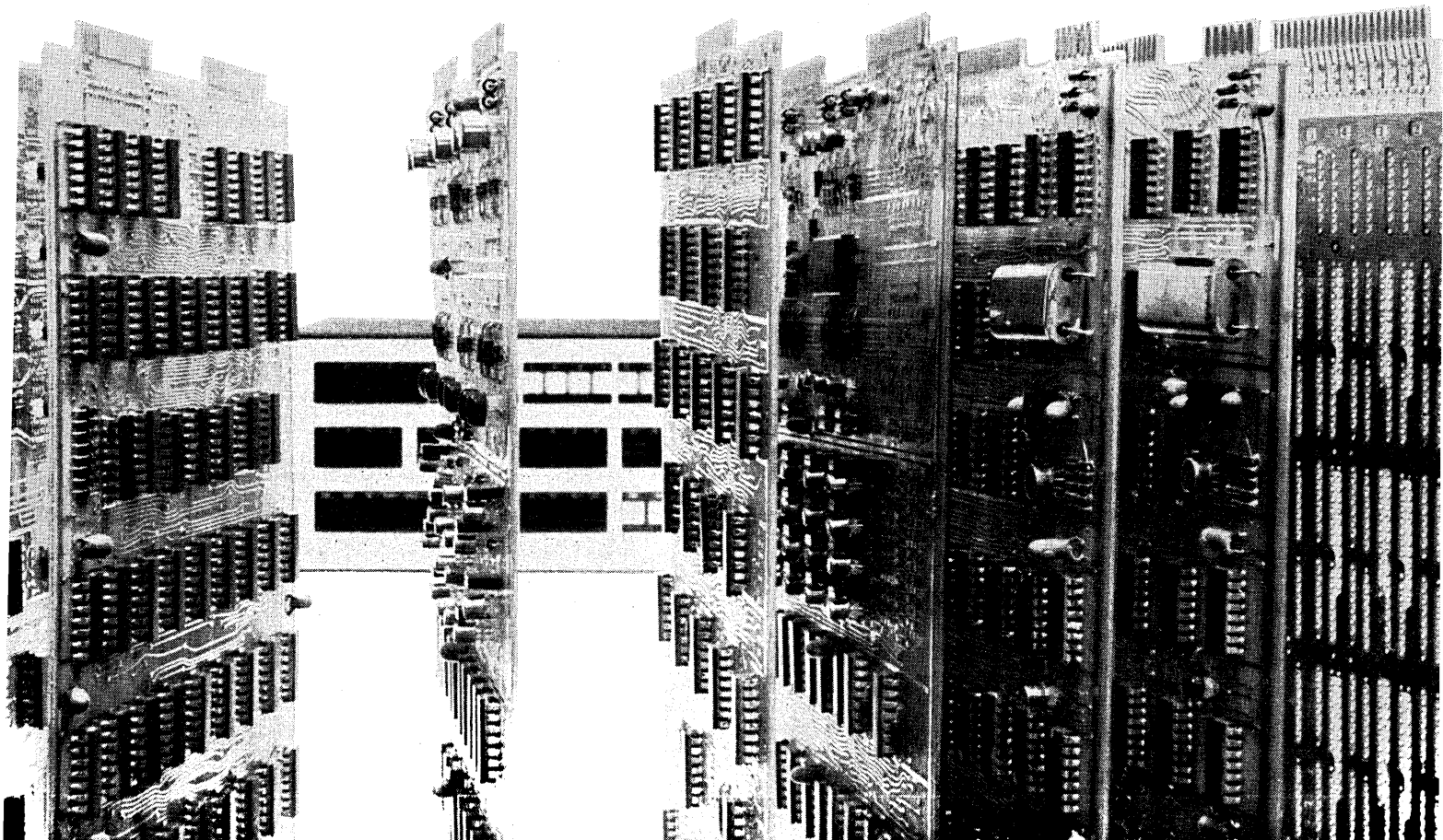
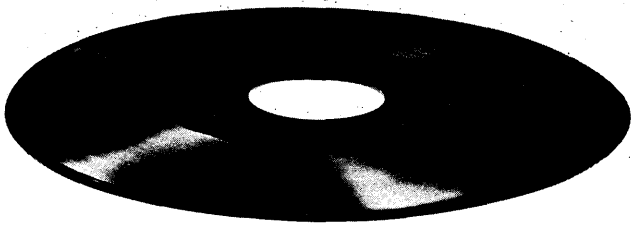
CIRCLE 16 ON READER CARD

for the Micro 800 mini computer.



ON A PLATTER



New "juke-box" digital data input/output puts your data on records-for pennies a copy.

You can now get your digital data on records! Sturdy. Compact. Tamper-proof. And for only pennies a copy.

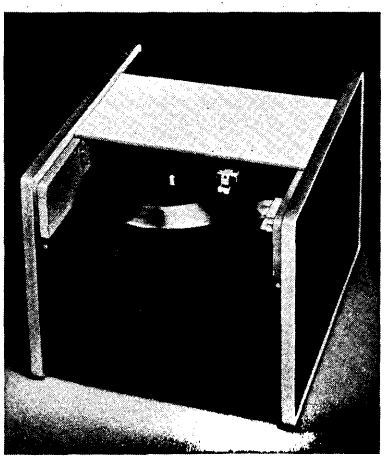
Pressed into a vinyl base like an ordinary "hit" record, data on a platter is part of a new concept in data distribution, storage and retrieval – the first of a new generation of low-cost digital data products from EG&G.

As a random access mass-storage peripheral to CRT terminals and small computers, the DATAPLAYER* Terminal gives you on-line random access to alphanumeric or digitized graphic data stored on DATAPLATTER* Digital Records in any machine readable language. Capabilities include standard data bases, subroutines, instructions and complete computer programs.

*Trademarks of EG&G, Inc.

A 7-inch DATAPLATTER record can store up to 5 million bits per side, accessible in seconds. On-line random access to a hundred or more records in a "juke-box" type changer could provide billions of data bits for CRT display, computer memory transfer, or hard-copy printout in 15 to 30 seconds. Data transfer rate is nominally 16 Kilobits per second (2,000 bytes).

Look into this new, low-cost subsystem for your data processing. A free sample of the DATAPLATTER *record mailed to you in an informative "booklet album", is yours for the asking. Write EG&G, Inc., Systems Development Division, Crosby Drive, Bedford, Mass. 01730.*



DATAPLAYER Terminal is a compact, solid-state, stand-alone peripheral. Individual plug-in boards contain stylus assembly and turntable, power supply, input and output interfaces, and control electronics.

EG&G
SYSTEMS DEVELOPMENT DIVISION

size advantages over standard 20-mil core memories while remaining price competitive. A production version of the memory, believed to be the first of its kind to combine 2-mil plated wire and LSI circuitry, is scheduled to be completed by mid-year. Development began in 1968 and is presently in the prototype stage. The firm sees Mini-Wire as a "natural technological progression" from the division's 5-mil plated wire memory element. Using a 2-mil Mini-Wire memory of 8K 25-bit words and a 20-mil core memory of corresponding capacity as a basis for comparison, the former is said to offer the following advantages: five-to-one improvement in reliability; four-to-one increase in speed; three-to-one decrease in power requirement; and two-to-one decrease in size.

• The winner of the Best Presentation Award for a paper at the Fall Joint Computer Conference has been announced by program chairman Dr. E. M. Grabbe, of TRW Systems. The award will be presented at the Spring Joint Computer Conference to J. P. Considine, IBM, Yorktown Heights, for his talk on "Establishment and Maintenance of a Storage Hierarchy for an On-Line Data Base Under TSS/360." The FJCC is the first major conference to video tape all speakers to determine the most outstanding contribution to speaker/audience communications. Assistance to speakers was provided at preconference presentation seminars organized by the program committee and instructed by Bob Perry of Hughes Aircraft. Nearly half of the speakers participated in this program. Announced at FJCC was the Best Paper Award, given to Clark Weissman, System Development Corp., for "Security Controls in the ADEPT-50 Time-Sharing System."

• Euratom (European Atomic Energy Community) has signed a contract with IAEA, the United Nations' International Atomic Energy Agency, to provide IAEA with technical assistance in setting up an international nuclear information system (INIS). The 102 member states in the INIS venture are preparing descriptions of available nuclear information that will be given to IAEA to be put into a master file which will be distributed as a source of information for individual nuclear programs. Essential data will be in computer-compatible form. Euratom's Center of Information and Documentation already has in operation a mechanized nuclear documentation system and has developed the linguistic tools and methods which, with a few adjustments, will meet IAEA requirements. Under the six-month contract, Euratom will deliver a dictionary of descriptive terms that will be used for identifying the items of information reported to INIS, a manual of instructions on how to use the dictionary, and a set of computer programs for processing the terms.

• IBM's Field Engineering Div. has opened a teleprocessing test center in Raleigh, N.C., to test customer's terminal and control equipment with a series of diagnostics which indicate whether or not the equipment is operating properly. Using a data set connected to the regular phone network, the customer engineer dials the test center from the customer's teleprocessing terminal. When the call is accepted by the center's modified System/360 Model 2030 computer, the customer engineer requests a systems test via the terminal. If the customer's system is not operating properly, the CE is informed by terminal printout of the probable location of the malfunction. The whole process usually takes about 10 minutes. Meanwhile, the customer can continue to use his computer for jobs other than teleprocessing. If the CE needs additional help, he can press a button on the data set and talk with a test center specialist for technical assistance. Once a problem is corrected, verification is made through additional tests. The test center can receive calls from all parts of the continental U.S. and is capable of handling incoming calls from several locations simultaneously.

• Honeywell's program of fee education (Oct., p. 148) is being expanded nationally with the start of classes in Long Beach, Calif., Chicago, and Atlanta. Initially, courses at the new locations will be aimed at high school and junior college graduates, with the program for college graduates scheduled for implementation within the next six months, as well as the Tailored Education Programs, aimed at satisfying specific needs of customer firms.

• Potter Instrument Co., Inc., is marketing a line of magnetic tape drives which were previously distributed by Management Assistance Inc. The units involved are compatible with IBM System/360, 1400, and 7000 systems, and feature single capstan operation with vacuum tensioning of the tape. Potter is currently expanding sales and service offices and is aiming at becoming a "full-service" supplier of peripherals.

• A commercial time-sharing operating system for the Control Data 6000 computer series has been jointly developed by CDC and United Computing Systems of Kansas City, Mo. UCS will use the monitor in its t-s service, and CDC will market it to machine owners. Called KRONOS, the system accommodates interactive time-sharing, batch, and remote batch processing. In a t-s environment KRONOS can handle up to 384 terminal lines along with local batch jobs; for remote batch-oriented usage, it can handle 16 user terminals and 256 t-s lines. File management facilities provide for line-by-line editing, multiple simultaneous accesses to a file, and password protection. Batch-only compilers include COBOL, SORT/MERGE, PERT/TIME, APT, and OPTIMA. Conversational/batch compilers include FORTRAN, BASIC, TEXT EDITOR, and ALGOL. For information:

CIRCLE 358 ON READER CARD

• Seeking professional status is a group of operators of time-sharing terminals, primarily Datatext and ATS-type operators. They want to be known as more than typists or keyboard artists, and so a group of Southern Californians in the aerospace industry has formed the National Association of Computer Assisted Analysts. Late next month, the NACAA has scheduled a communications conference at the Biltmore Hotel in L.A. Inquiries on the organization and its conference should go to Mary Bragg, P.O. Box 2802, Fullerton, Calif. 92633.

• Proving once again he's a Good Guy, George R. Cogar, mild-mannered president of Cogar Corp. and target of an IBM suit, has established the Cogar Foundation Inc., Herkimer, N.Y. Goal of the organization, for which Mr. Cogar has provided an initial $500K endowment, is to sponsor research on the sociological implications of rapid advances in technology. The foundation will fund in-depth studies "which might reveal long term and far-reaching implications of the rapid and intense advances in science and technology in the years ahead." Foundation activities are governed by a board of five trustees from the business and educational communities. No grants have been made as yet, but the trustees are currently evaluating several possible projects. The foundation's activities will be nationwide.

• The Computer Exchange, Inc., a New York used-computer firm, has entered the facilities management arena with Economation, a plan to provide complete service for firms using 360/30's or larger. The service will include complete responsibility for the operation of client data processing on a contract basis, with CEI providing hardware, personnel, and software. In most cases, CEI will purchase the user's hardware and hire his personnel. The firm claims it has amassed a library of programs from the purchase of used computers with software, and that it will be in a unique position to supply clients with the most economic and efficient hardware for their operations, since CEI is a hardware-oriented firm. At writing, Economation had no customers, but CEI looked forward to unbundling as an impetus for users to look for their new bundle.

• DPA, Inc., a 10-year-old Dallas firm engaged in such diverse activities as leasing tab equipment and discs, marketing lubricants, manufacturing textbook covers, and building tug boats, has formed a subsidiary to enter facilities management: DPA Management Systems, Inc. The new firm, armed with a 360/30 and five employees, hopes to serve companies that spend $10-25K/mo. for edp, rather than the large users being tackled by most facilities management ventures. DPA will offer contracts as short as one year and will specialize in firms with five or less years of experience with edp. If the venture is successful, they will expand nationally and move up to facilities management for larger firms.

• Army chief of staff Gen. Wm. C. Westmoreland has predicted that within 10 years computers may replace the foot soldier. In computer-assisted war (CAW?), enemy forces will be electronically located, tracked, and targeted almost instantaneously with first round kill probabilities approaching certainty. Isn't that wonderful?

• TransNet Corp., a fledgling Red Bank, N.J., time-sharing vendor, has announced a royalty plan for the acquisition of programs, patterned after the plan used for the payment of royalties for records played on radio stations. Authors of programs used by TransNet will be paid royalties on a flat rate basis, dependent upon the amount of time the program is in use on the TransNet PDP-8 t-s system. Business, scientific, and engineering programs written in FOCAL, BASIC, FORTRAN, or assembly language are eligible for submission. The firm will make free time available to programmers for debugging programs that have been approved for the royalty plan. Prior to the announcement of the royalty program last month, the company had a library of some 100 programs conventionally acquired.

• A new name and a new game to go with its cute program names are the latest developments at Economatics, Pasadena, Calif., software firm. The new name is Economatics Computer Systems, Inc., and the new game is called FAME (Financial and Management Expertise), which is a consultant service Economatics has developed to guide potential users in their selection of Economatics packages — PEAC (Program Establishment and Control), MAID (Merger-Acquisition Improved Decision), and ISIS (Instant Sales Indicator System). Economatics offers other packages named Elope, Cupid and Flirt.

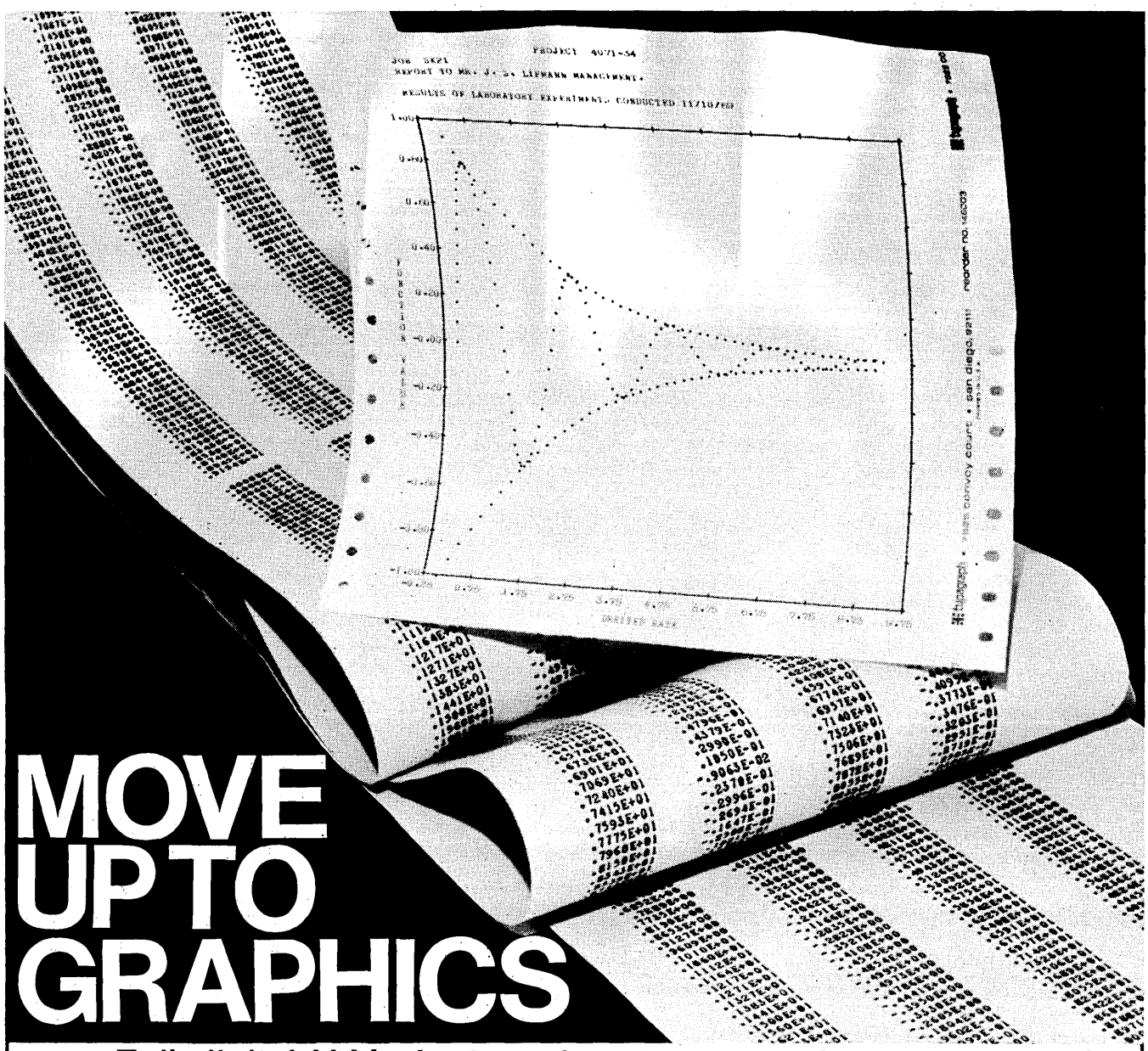
shortlines ...

Computer-controlled instruments for the chemical industry will be engineered, manufactured and marketed from a new plant being built in Waltham, Mass., by Problematics, Inc. Dr. Joseph D. Grandine, II, company president, says that "with the advent of the minicomputer, it is now economically possible to automatically control chemical testing, reduce analysis time, and improve measure- about 100 people will have to move over into a new Honeywell facility (a renovated mill) to make way for that company's expanded manufacture of printed-circuit boards at the main Lowell plant. The Veterans Administration in Los Angeles is cooperating in a Honeywell study seeking ways to link clinical labs in satellite hospitals with a central computer... Richard B. Blue, Sr., has received ACM's Outstanding Service award for his dedicated effort on behalf of the Los Angeles chapter while chairman. He is manager of TRW's Scientific Data Processing lab ... Arabic and Farsi (Iranian) language printouts combined with the usual numeric and English are being furnished on some of National Cash Register's 640-300 printers destined for shipment to the Middle East ... The single drum has 164 characters rather than 64. "Katakana," a simplified script based on Japanese calligraphy, has also been integrated into printers delivered to Nipponese clients... Development of a display tube capable of generating the Japanese characters has enabled the establishment of a computer-to-microfilm center in Tokyo, using Stromberg DatagraphiX 4360 recorder/printers. Several banks in Tokyo and Osaka are transferring their present systems to COM... New data centers are blossoming all over the northeastern U.S.: Data Power, Inc., has opened three franchise centers in New York City, Union, N. J., and lately in Boston, with ones to come in Philadelphia and Washington ... Westinghouse has added Boston and NYC. to its Tel-Computer center locations, as well as Buffalo, Cincinnati and Detroit. It already has centers in Chicago, Philadelphia and Pittsburgh ... Protesters invaded Dow Chemical Co. and erased more than 1,000 tapes at the company's Midland, Mich., plant. The machines were not harmed; the demonstrators evidently knew when to turn off ... North Carolina Educational Computer Service, outgrowth of a project which started one of the first intercollegiate computer networks in the U.S., will be able to continue advance work by grants totalling $475,000 from the National Science Foundation. The NCECS network currently includes 32 public and private universities, colleges and high schools ... American Computer Accountants, L.A., announced a new insurance software package for independent insurance agents that features 32 breakouts from two source documents input. It gives info on expenses and sales, account aging, renewals, etc. Became available the first of the year at $275 a month.

call for papers ...

Summer Computer Simulation Conference, Denver, Colo., June 10-12. Simulation aspect themes are sought on continuous and discrete languages, hybrid applications, process industry applications, aerospace and mechanical industries, earth environment and civil systems. Informal abstracts of about 500 words should be submitted by February 6 to Takeshi Itsumi, Stone and Webster Engineering Corp., 225 Franklin St., Boston, Mass. 02107.

25th Annual ISA Conference & Exhibit, Philadelphia, Pa., October 26-29. Silver Jubilee conference will look back on past technological progress and will forecast the future decade. All major sectors of instrumentation and automatic control should be represented. Abstracts of representative papers should be submitted by March 16, on special forms that may be obtained by writing to Sal F. Luna, Conference Program Coordinator, ISA, 530 William Penn Place, Pittsburgh, Pa. 15219. ■



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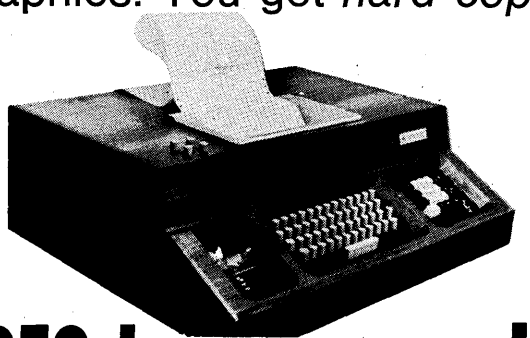


typagraph tm

typagraph corporation 7525 convoy court
san diego, california 92111 (714) 279-5690

new software

1401 simulator

ARMsim was originally intended for simulating an IBM 1401 computer on a Digital Equip. Corp. PDP-8, but has been extended to work on a DEC PDP-12 with its crt capability. The program operates by dividing the small computer's core into 2K ARMsim space and a virtual image of the 1401 and its program. With disc buffering, a 4K PDP-X can be made to look like a 16,000 (decimal) character 1401. The IBM machine's registers are kept in memory except for those which are to be manually set by the operator, and these are replaced by teleprinter keys.

All 1401 arithmetic codes, hardware multiply/divide, indexing, high-low-equal compare, store address, sense switches, move record, and address modification instructions have all been implemented. The package sells for $3500, if you need your 1401 back, and all those old Autocoder jobs can be run if you have four DECtapes or their equivalent. Additional copies of the program go for $1500. AUTOMATION RESEARCH MECHANISMS, INC., Livermore, Calif. For information:

CIRCLE 269 ON READER CARD

nova basic t-s

A BASIC time-sharing capability is now available for the Nova and Supernova minicomputers. Single-user BASIC runs on any Nova or Supernova with at least 4K core, but the new time-sharing BASIC will require 8K. It can support eight users. The software includes the matrix extension for the construction of matrices, and the string extension, which permits the manipulation of alphanumeric data. DATA GENERAL CORP., Southboro, Mass. For information:

CIRCLE 270 ON READER CARD

modeling

Continuous systems are modeled on a digital computer using SYSMOD by emulating the operation of an analog computer. The object system must be expressed to the program in block form, where each block represents an element of the analog machine and is arbitrarily assigned a number up to 75. Start-up cards or terminal inputs specify the configuration diagram, initial conditions, function generators, and timing and print control specifications. Once started into operation, SYSMOD can be batched or run interactively. It will ask for changes and directions, run or halt instructions, etc.

Up to three function generators, 25 integrators, and 25 delay elements can be programmed. The output may include plots insofar as a Teletype is capable of them. Written in FORTRAN IV for a 64K-byte machine or larger, SYSMOD is currently operational on a time-shared basis on a Burroughs 5500, but can be configured for other machines in short order. It sells for $2500. ANCOM SYSTEMS, Los Angeles, Calif. For information:

CIRCLE 271 ON READER CARD

interactive cpm/pert

A new interactive CPM/PERT system is designed to improve total project management. It provides segmented data for evaluation during any stage of the project progress. New cost factors, personnel deployment, and interim scheduling can be achieved through the segmented evaluation process. Features include: data input that can be edited before being entered into the calculating portion of the system; network error analysis including loop detection; on-line or off-line reporting; and preparation of updated network files to be used for input to the next CPM/PERT system run. The system, written in FORTRAN G, is available in a 32K size (500 events), and 128K (6,000 events). Price is about $25K. DIALOG COMPUTING, INC., Fairfield, Conn. For information:

CIRCLE 272 ON READER CARD

spectra 70 utility package

Pronounced "scoop," the Spectra Composite Utility Program is designed to enhance the normal tape/card/printer and card/tape/printer functions which are required for debugging and as an operations aid. Features of SCUP include: selective record extraction; tape positioning capabilities; techniques for building test files; and flexible reblocking. Features may be used either independently or in conjunction with any other option in the same pass. The system, written in assembly language, requires minimum 8K core. Price is $3K, with a 15-day trial period available at no cost. It's the first software package offered by a 35-man consulting firm founded by ex-RCA personnel. CGA COMPUTER ASSOCIATES, INC., E. Orange, N.J. For information:

CIRCLE 276 ON READER CARD

machine utilization accounting

Version 2 of DOS MURS (Machine Utilization Reporting System) provides an automatic accounting of all programs run under DOS on an IBM S/360 computer. All program executions in each partition are accounted for, whether they are run in batch or in single program initiation mode. Machine utilization records created for each program are wait time, supervisor time, and problem partition time. A time capturing method accumulates supervisor time separately for each program based on the partition being serviced. A daily log of all program executions and four production and testing summary reports are provided by MURS. For use on a single computer, the base price for the system is $3000. Pricing for multiple 360 users is based on the number of computers used by the customer. WEBSTER COMPUTER CORP., Danbury, Conn. For information.

CIRCLE 274 ON READER CARD

1400 programs to cobol

A conversion system known as CASPER will translate your IBM 1400 programs to COBOL from either source decks or magnetic tape. CASPER itself is written in COBOL. The pricing of this service depends on the volume of work and degree of completion required by clients. A 100% translation on small orders will be handled for 59¢ per Autocoder or SPS source statement where the client assumes responsibility for file conversions, system integration, and final checkout. The service is now available in the San Francisco area and will be offered in Los Angeles, Chicago, and New York early this year. COMPUTER ADVISORY SERVICES, INC., Los Angeles, Calif. For information:

CIRCLE 275 ON READER CARD

byte manipulating

A Univac 1106/1107/1108 version of BEEF2, a bit string and byte manipulation package, has been developed to complement this vendor's similar products for the IBM 360 and Spectra 70 series. Like the earlier offerings, BEEF2/1108 gives a higher level language user the ability to mess with characters and strings with the ease of PL/I coding. But along with the word moving, searching, decision making, and data conversion instructions given earlier BEEF2 users, the 1100 series program also offers the ability to work with 7-, 8-, or even 9-bit character

codes as well as the 1100's 6-bit FIELDATA code. That capability gives the Univac user an effective bridge to other machines.

Two models of the program are offered, a straight 6-bit version for users not experiencing compatibility problems, and the 7-, 8-, or 9-bit code version. Both allow the user to ignore word and byte boundaries and can handle strings of any length. Each sells for $4750, and the pair is offered for $5250. Leases cost $100/month for one, $110 for two. Installation runs $750 for one, $900 for two, but is included in the purchase price, along with three years of maintenance. COMPUTATION PLANNING, INC., Bethesda, Md. For information:

CIRCLE 279 ON READER CARD

mis

A management information system for professional firms (named CEMIS, for Client Employee Management System) is designed for franchising to information network services companies at $2000 plus residuals. The CEMIS program, written in COBOL, furnishes detailed business operating data in the form of six reports produced periodically, usually monthly. They are: accounts receivable detail, accounts receivable summary, client fee analysis, employee performance, employee time study, and client billing statements. The program will operate on an IBM 360 under DOS or OS, a GE 635 or similar-sized machine. WESTERN DATA SCIENCES, INC., Phoenix, Ariz. For information:

CIRCLE 280 ON READER CARD

data compression

CRAM/360 is a software package for compression, retrieval, and maintenance of data, said to be capable of increasing external storage capacity in most hardware by about 40%. The system provides the capability of retrieving and updating source data stored in a special direct access library. In addition to a unique compress and decompress technique, a new fragmented data set concept is utilized for access and retrieval.

The compress routine scans each input source record and eliminates all blank columns; only the valid characters remaining are compressed. The decompress routines restore each compressed image to the original 80 columns. Each source member is compressed before it is stored in the library and decompressed as it is retrieved from the library. The decompressed version may be updated and/or used as input to processing programs. The direct access library consists of a directory of index pointers and a preallocated member area for source data. There are a maximum of 1125 reusable index entries, and a predetermined number of reusable member tracks for the source data. Once a source member has been deleted from the library, the index entry and the member tracks become immediately available for reuse.

CRAM/360 was designed for use in the following application areas: name and address files; stock inventory; and source language files containing programs written in assembly language, COBOL, FORTRAN, RPG, and PL/I. The system is written in assembly language for the System/360, but will be adapted and implemented without charge for other hardware, including Univac, Spectra, GE et al. It is presently available only for OS, but a DOS version is being developed. Minimum core is less than 14K. Purchase price is $6200, including implementation. Rental is $300/mo. for the first two years, $200/mo. thereafter. COMPUTER INTERACTIONS, INC., Great Neck, N.Y. For information:

CIRCLE 278 ON READER CARD

plant capacity planning

System/360 Capacity Planning is the latest major module of IBM's Production Information and Control System, which includes Bill of Material Processor, Inventory Control, and Requirements Planning. Linked with the other programs in the system, Capacity Planning balances production requirements against available resources, such as manpower, machines, and materials. It then computes long-range production schedules for each work center in the plant.

One version of Capacity Planning, called Infinite Loading, assumes that the plant has unlimited resources. It produces reports that help flag potential bottlenecks in the manufacturing cycle. However, this version does not direct the computer to re-schedule production to match available capacity. A second version, called Finite Loading, takes into account the actual capacity as well as availability of materials. It then calculates schedules for each work center to solve potential overload and underload conditions.

Capacity Planning/Infinite Loading rents for $75/mo.; Finite Loading is $225/mo. plus $25/mo. for an interface program needed as a link to Requirements Planning. The two versions and the interface—which run on 360/25's and up—are scheduled to be available in the third quarter. The packages are written in PL/I. Earlier programs in the series were announced before unbundling. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 277 ON READER CARD

automated report programming

SYSARO, a system for automated report programming, utilizes only the report layout as input, and produces a printed image of the report and a COBOL data division for the report. This should help eliminate the tedious coding of the data division of the COBOL program for each report and provide a faster throughput from the initial report layout to a workable program. The system runs on the 360/30 or larger, the Univac 1108, and Honeywell 200. Rental is $100/mo. and up, depending on the size of the installation, for a minimum one-year lease. GENASYS CORP., Washington, D.C. For information:

CIRCLE 281 ON READER CARD

cobol cross-reference

REF-BACK is billed as a "mini-program" which provides a COBOL (DOS) cross-reference listing. It uses one card to call a subprogram off the core image during compilation, generating a COBOL cross-reference list of all data names and procedure names, giving all page and line references used by data and procedure division names. The list indicates any fields which are used as subscripts, qualifiers, or data files. REF-BACK operates on a 360/30 or larger. Price is $750. COMMUNICATION DYNAMICS SYSTEMS, INC., Westchester, Ill. For information:

CIRCLE 282 ON READER CARD

accounts receivable

The key feature of this accounts receivable system is its ability to process both on an open item and a balance forward basis within the same company. The system, consisting of 22 programs and sorts, is written in COBOL and will run on an IBM 360/30 or up in tape or disc configuration, as well as on Honeywell 200 series and Burroughs B-3500 computers. It is available to private users at $10K, to service bureaus at $15K, and is designed to interface with the vendor's general ledger system. Additional system features include multi-company processing, automatic calculation of trade discounts, net amounts and service charges, and automatic aging of accounts receivable. A variety of reports may be produced, including validation reports for both product file and account master file update data, product

file and account master file maintenance reports, product file code book, account master listing and preliminary transaction validation. In addition, several daily transaction reports, trial balance reports, credit overrun and delinquent account reports may be generated. EXECUTIVE COMPUTER SYSTEMS, Oak Brook, Ill. For information:

CIRCLE 283 ON READER CARD

circuit simulation

Conversational Circuit Analysis Program (CCAP) is being sold to time-sharing service bureaus for $28,500—including installation, documentation, courses for resale, technical training, user's guide, sales brochures, and maintenance for three years. The system consists of something over 15,000 FORTRAN statements but uses as little as 30K characters of core if 8-10 overlays are used. The engineer need not code information in a particular format in order to use the program. It will accept just about any standard engineering terms, and will let the user know if his statement is not understood. CCAP features AC, DC and Transient analyses, plotted and tabular output, and two levels of help functions. The engineer may store circuits and elements of circuits for use as the design and testing of a system progresses. CTC COMPUTER CORP., Palo Alto, Calif. For information:

CIRCLE 284 ON READER CARD

shareholder accounting

This automated accounting system for shareholder records uses a share-holder's name and address to store and control his record, rather than an account number. If the user desires, inquiries may be made directly against specified accounts or certificates or by multiple variable characteristics associated with any group of shareholders. The program allows the computer to make all routine decisions instead of clerks. The system is written in COBOL and runs on a 256K (minimum) IBM 360/40 or larger with disc storage. The $20K purchase price includes one man-week of system and programming support, user's manual, operator's manual, test data, tape source deck, and complete documentation of systems and programs. The company will process shareholder data for any firm that cannot justify independent processing of its own programs. McDonnell Douglas has been using the system since last May to keep historical, operational and statistical data on its 64,000 shareholders with only four clerks keeping track of all stock transfer activity. The system is said to be cost-effective for banks and corporations with active shareholders files. McDONNELL AUTOMATION CO., St. Louis, Mo. For information:

CIRCLE 285 ON READER CARD

economic evaluation

The Computer Utilization Economics System (CUES) provides the information necessary to evaluate an investment proposal, including present value, internal rate of return, payout period, and number of times investment returned. The user provides cost estimates and income projections and the system calculates depreciation, tax credits, federal corporate income tax, cash flows, etc. The system is written in FORTRAN and requires about 128K of core (any 360). It is currently overlaid on an RCA Spectra 70/35 with 65K and on a Burroughs B-5500 in the time-sharing mode. The time-sharing version contains a rerun option with conversational mode data modifications that allows the user to ask "what if?" questions. A risk analysis option provides the user with a graph or tabular output response to a question such as "What chance does this investment have of achieving a 20% return?" Installation of an operable system will cost $12,500; the addition of the risk analysis option brings the purchase price to $15K. COMPUTER UTILIZATION INC., Austin, Texas. For information:

CIRCLE 286 ON READER CARD

pdp-15 focal

A single user version of DEC's mathematically oriented language, FOCAL, is now available for the PDP-15 medium-scale computer. FORmula CALculator's 12 functions include trigonometric, logarithmic, device controls and sign part, integer part, absolute value, square root, and random number. Individual character editing eliminates the need to correct an entire line because of a single typographic error. A trace feature allows the operator to determine what the error is and where it is located. FOCAL can be operated from the Teletype keyboard alone, eliminating the possibility of program destruction by accidentally engaging one of the computer keys. A multi-user version of FOCAL for the PDP-15 is now in the works. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 288 ON READER CARD

information management

A compiler-like program, INMAREX can operate on an IBM 360 system under DOS or OS, on an RCA Spectra 70 under TDOS or TOS, or on a Univac 9300. Its core requirement is 32K bytes. Inputs to the FORTRAN-based information management system can come from an optical scanner, card reader, or other type of conventional I/O device.

Control of INMAREX is gained through a dictionary of file descriptions, editing criteria, and print format data. In addition to the control module that works on the dictionary entries, the system contains index generator, edit, update, extract, and print modules.

Two versions of the program are offered. One, referred to as INMAREX JR., works on single files, and sells for $15,000. An advanced version called Level II offers multi-file capability for updating and extracting, and matrix reporting. Level II sells for $30,000, and will be upgraded later with crt functions, management gaming, and graphics at no extra cost to the customer. GULTON SYSTEMS RESEARCH GROUP, INC., Arlington, Va. For information:

CIRCLE 289 ON READER CARD

analysis

Six applications packages are now available for the EAI 640, IBM 360, and other machines with FORTRAN IV compilers. Kinetic Data Analysis estimates unknown rate constants and other kinetic parameters from experimental data. It handles up to 45 unknown parameters. Memory required is 32K. Price: $10K. OPTRAN, for analysis of linear or non-linear parameter optimization problems, obtains complete solutions from initial data specifications to final parameter output summaries. It obtains estimates of the parameter values that minimize or maximize the function. Price is $13K, memory 32K. HEATRAN, a general-purpose thermal analyzer, sells for about $2K. GEPOL, a generalized processor for command-oriented languages, is $3K. PARTRAN, a parallel tangents optimization program, is $1K. And DYDAT, a basic FORTRAN dynamic data allocator, is $2K. ELECTRONIC ASSOCIATES, INC., W. Long Branch, N.J. For information:

CIRCLE 290 ON READER CARD

med billing, posting

Comput-A-Bill is an integrated medical billing, posting, and claims system for use in private practices, group practices, and hospitals. The system, offered both as a service and on a franchise basis to service bureaus, includes the monthly statement to the patient based on family billing rather than individual patient billing, with a service charge per bill rather than per transaction. Included in this charge are all payment entries and automatic aging of accounts receivable, plus reports on weekly transactions and

monthly aged trial balances by patient. Comput-A-Bill also provides practice-wide messages, automatic recalls, collection messages, color-keyed overdue account statements, postage paid computer mailings, and a weekly billing register giving day sheet listing of total debits and credits and a monthly aged trial balance for all patients.

The package includes Comput-A-Claim for insurance claims, a forms generator which provides completed claims for Medicare, Medicaid, Blue Shield, and Health Insurance Council forms for insurance companies. The doctor merely fills in the diagnosis and signs the form. The system, written in COBOL, requires a minimum 360/30 with 64K core, two discs, and at least two other peripherals—either tapes or discs. Price for franchise to use all 12 programs is $15K plus 6% of gross billing and 1¢ per statement form or claim form used. COMMUNICATION DYNAMICS SYSTEMS, INC., Westchester, Ill. For information:

CIRCLE 291 ON READER CARD

cobol program generator

MIRACL/CPG generates COBOL programs. More than 30 COBOL statements may be replaced by one MIRACL statement, allowing the programmer to spend more time programming and less writing. Other features include the ability to utilize 10 I/O files, full compatibility with COBOL, and the ability to operate as a "load and go" system whereby a completely bug-free COBOL object program is generated for execution. The package includes a file description library and dictionary and a system documentation feature which provides documentation automatically. It runs on the Honeywell 200 with minimum 12K, or System/360 with 32K; versions for other hardware are planned. Price is $1280 under license. REPUBLIC SOFTWARE PRODUCTS, INC., E. Orange, N.J. For information:

CIRCLE 292 ON READER CARD

ibm videocomp

RCA has developed a programming language that enables IBM 360 computers to operate Videocomp electronic typesetters. The language is a special version of RCA's Page-1 composition language and gives users of IBM systems an ability to use Videocomp equipment to produce catalogues, parts manuals, directories, etc. Page-1 (PAge GEnerator) is a higher-level language that is used to prepare full-page graphic arts composition on Spectra 70 computers, and is specifically designed to make the computer capable of directing Videocomp systems for typesetting. The new IBM version of the language will run on 360 Models 30, 40, and 50. RCA, New York, N.Y. For information:

CIRCLE 293 ON READER CARD

selembler/1130

The SELEMBLER/1130 is a SEL 810A/810B assembler that will run on the IBM 1130. It accepts all SEL mnemonic instructions and pseudo-ops as described in the SEL 810A/810B Reference Manual, plus five additional specifications which describe and format SELEMBLER/1130 output. Program input is punched cards in SEL format. Output options include: object paper tape acceptable to the SEL Relocating Loader; a listing almost identical to the SEL two-pass assembler (MNEMBLER) listing; and an alphabetized symbol table. A typical 500-card source deck takes approximately fifteen minutes to assemble, punch object tape, and generate a listing with symbol table. Price is about $2K. DATANETICS, Pittsburgh, Pa. For information:

CIRCLE 294 ON READER CARD

process control

PROSPRO II is an improved "fill-in-the-blanks" process control program from IBM, intended to make it easy for process engineers to prepare direct digital control (DDC) instructions. The program can be used with the IBM 1800 to help direct continuous industrial processes such as paper manufacturing and oil refining. PROSPRO II includes a DDC capability that provides second-by-second, on-line control of the instruments regulating an industrial process. The DDC capability, which bypasses individual instrument controllers, could control 150 different instruments in a typical system. PROSPRO II also improves the supervisory control function. For example, it can update the computer files as often as once a minute. The program directs the computer to monitor process variables that may call for initiating such actions as closing valves, altering another variable, or flashing an alarm signal to the operator.

Both the second-by-second and minute-by-minute control levels can be implemented with the "fill-in-the-blanks" technique of the original PROSPRO/1800 program, introduced two years ago. The technique allows an engineer with little knowledge of programming to describe the industrial process and develop a control scheme. He fills in special forms specifying the frequency at which a process variable is to be read by the computer, its alarm limits, the alarm actions, and control strategies. This information is then entered into the 1800 using punched cards. PROSPRO II is written in FORTRAN and assembly language, and requires 32K core. It will be available next month at $285/mo. under license. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 295 ON READER CARD

hospital lab monitor

The Clinical Laboratory Data Acquisition System is a program that runs on the 1800 data acquisition and control system. The package collects, analyzes, and verifies data extracted from specimens by instruments such as automatic blood testing devices. At the same time, it monitors the operation of the instruments to assure that they are functioning properly. At the end of each test run, the system prints results for verification and submission to the patients' physicians. The results are also available for lab records and reports. The system operates under the IBM 1800 Time Sharing Executive and requires minimum 16K core. It is written in FORTRAN. Price is $100/mo. under license agreement. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 296 ON READER CARD

expanded dec editor

An improved and expanded version of DEC's Symbolic Editor package operates on a line number or context basis and permits intra-line character string editing. It can search for a character string within a line or group of lines, and delete, insert, replace, or list the character string; list file contents with or without line numbers; and can terminate a logical string at whatever point is specified by the user. These features are in addition to those already included in DEC's program, such as the ability to create new files, delete files, and add, delete, insert, replace, or list lines. The package is being offered through the vendor's Comdac-8 time-sharing service and is also for sale at $1500. COMSONIC CORP., New York, N.Y. For information:

CIRCLE 297 ON READER CARD

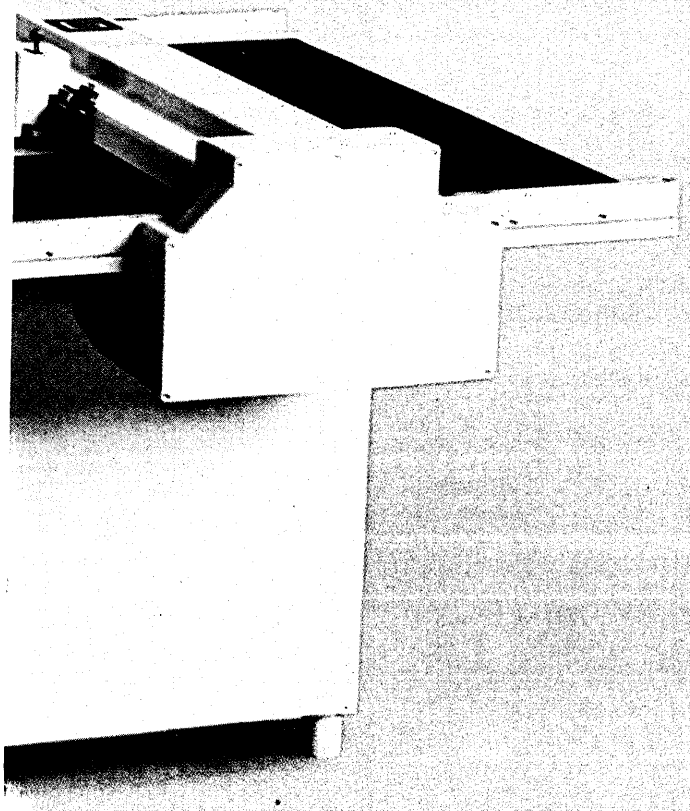
$10 utility program

JUDY is probably the cheapest program around. Billed as Just a Useful Device for You, the program performs 14 common utility functions for the Univac 9200/9300, and is available for a $10 "postage/handling" charge. Minimum memory required is 16K. The program executes all of the data conversion functions associated with card, tape, and printer; e.g., card to tape, tape to printer, tape to tape, etc. DATA USAGE CORP., Ft. Lee, N.J. For information:

CIRCLE 273 ON READER CARD

GOWN / TIFFEAU & BUSCH / JEWELRY / K.J.L. / PHOTO / TED CROMER

original Gerber creation ...the system 723 plotter



1970 model / Gerber's new low cost high speed plotter / all digital / stored program control included / price $84,900 with magnetic and paper tape inputs / leasing arrangements / drafting software packages available / speed 600 ipm / accuracy ± .004 / obsoletes incremental plotters / call 203-644-1551 extension 723 for quick answers, quick action /

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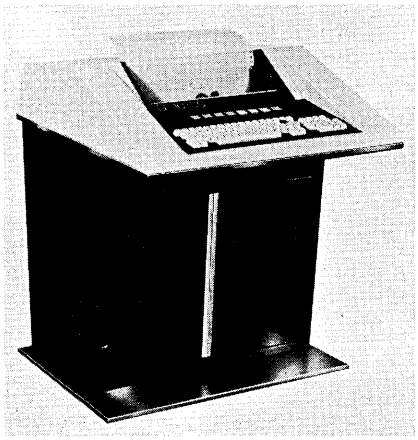
CIRCLE 124 ON READER CARD

new products

30 cps remote printer

The 10 cps input speed of a Teletype terminal probably does not hold back many programmers but waiting for a printout that is being received at 10 cps can send many users to the coffee machine. The slow speed printing can restrict a TTY's usefulness as a text editing terminal or as a remote printing terminal. The LC 10/30, by that kind of measure, may be as much as three times as useful, given that its print speed can go to 30 cps.

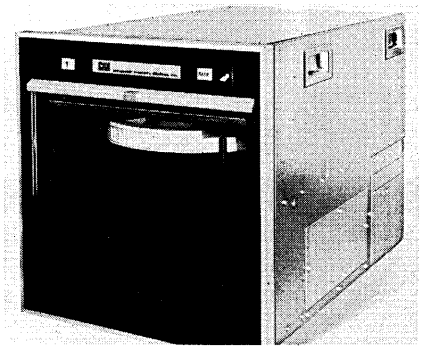


Somewhere under the 10/30's skins is a Univac DCT-500, so the device is not just a printer, but an I/O terminal with a full keyboard and even, optionally, a cassette tape buffer—something not mentioned in the Univac offering. The 10/30 operates with a 64-character slice of a drum and an ink roller to hammer out its 132-character lines. It interfaces with a 110, 150, or 300 baud line through standard EIA RS232B connections, understands USASCII code, runs full or half duplex, and prints 10 characters per inch, six lines per inch. The 150-mil cassette (at $1200 extra) can store up to 100,000 characters. Pin-fed, the printer mechanism will handle six-part forms. The end-user unit price is given as $4900 (will lease for $150/month) and deliveries begin this month. Quantity and open OEM pricing is available. GULTON INDUSTRIES, INC., Hawthorne, Calif. For information:

CIRCLE 302 ON READER CARD

single disc drive

One of the more recent entries in the single-disc cartridge drive business that has lately seen the introduction of Iomec and Caelus units, among others,

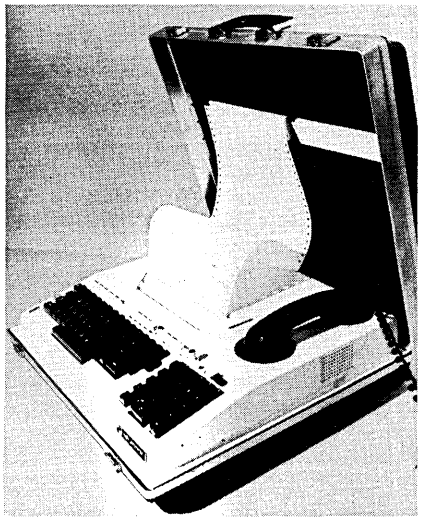


is the MD-2101. Aimed at the OEM market for use with mini-to-medium size computers, the 2101 features a detentless electromechanical head positioner, an average access time of 115 msec, a transfer rate of 720 kilo-bps, and complete media compatibility with the IBM 2310 drive. Storage is provided, on each disc, for over 11 million bits. The rack-mounting unit comes with air filtration and cooling equipment built in for under $3000 in OEM quantities. A power supply and sequencing circuitry are listed as options. COMPUTER MEMORY DEVICES, INC., Glendale, Ariz. For information:

CIRCLE 303 ON READER CARD

portable terminal

The PortaCom portable computer-communications terminal produces full page computer printout with carbon copies. It has its own built-in acoustic coupler and standard ASCII keyboard.



Teletype compatible, the PortaCom needs only a standard power outlet and a telephone to begin operating. The terminal weighs 26 pounds and can be hand carried in a custom briefcase. The PortaCom will lease for $80 a month. Quantity purchase price will be around $2400. DATA PRODUCTS CORP., Woodland Hills, Calif. For information:

CIRCLE 304 ON READER CARD

operator trainer

Training a computer operator to run an IBM 360/30 by giving over to him a real 360/30 is an expensive teaching method. Similarly, any mistakes a trainee might make in trying to operate alongside a supervisor are expensive. Both methods, though they must eventually be used for advanced training, are slow, too. Enter the Eduputer, a sort of a "Link" trainer for the computer operator. Designed to simulate the console of an IBM 360/30, the Eduputer has almost the same complement of dials, decals, lights, and switches. It won't compute; its only logic functions act to turn on and off the console displays. It does, however, react as a 2030 to operator entries, and that is its sole function.

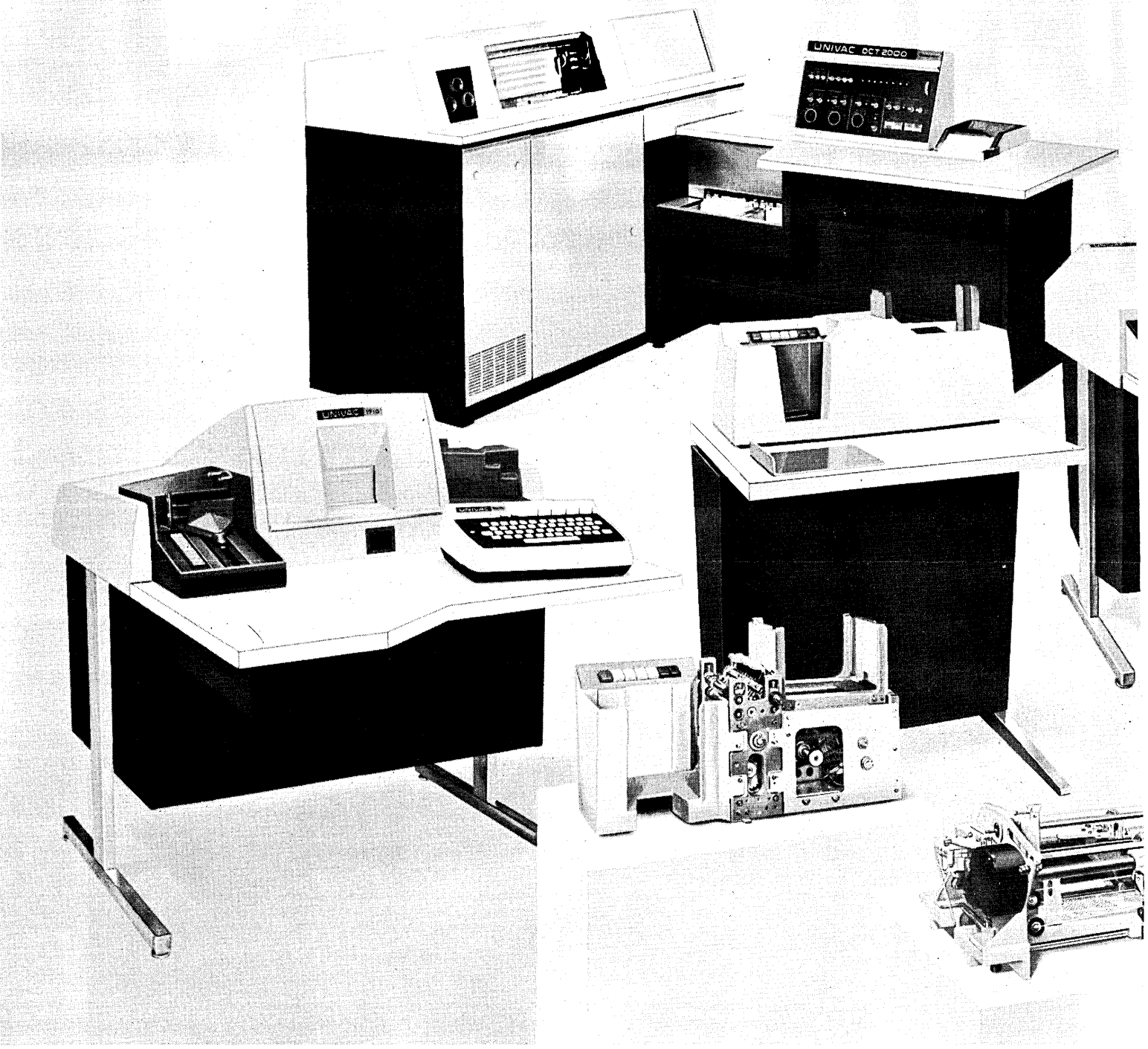
The training device is complemented by 16 taped lessons, a playback-only audio cassette tape drive, a four-volume, 16-lesson text, a student guide containing tests, and an instructor's guide which contains, among other things, the answers to the test questions. With the system, the novice can have as much hands-on time on the portable console as he wishes, and can come into the computer shop for the first time with a confidence in his own ability and basic knowledge, and without a fear of the machine.

The market for the under $3000 device is given as 6,500 business and government installations using the Model 30, plus all computer oriented vocational schools. PROGRAMMING SCIENCES CORP., New York, N.Y. For information:

CIRCLE 307 ON READER CARD

(Continued on p. 200)

Build your business around



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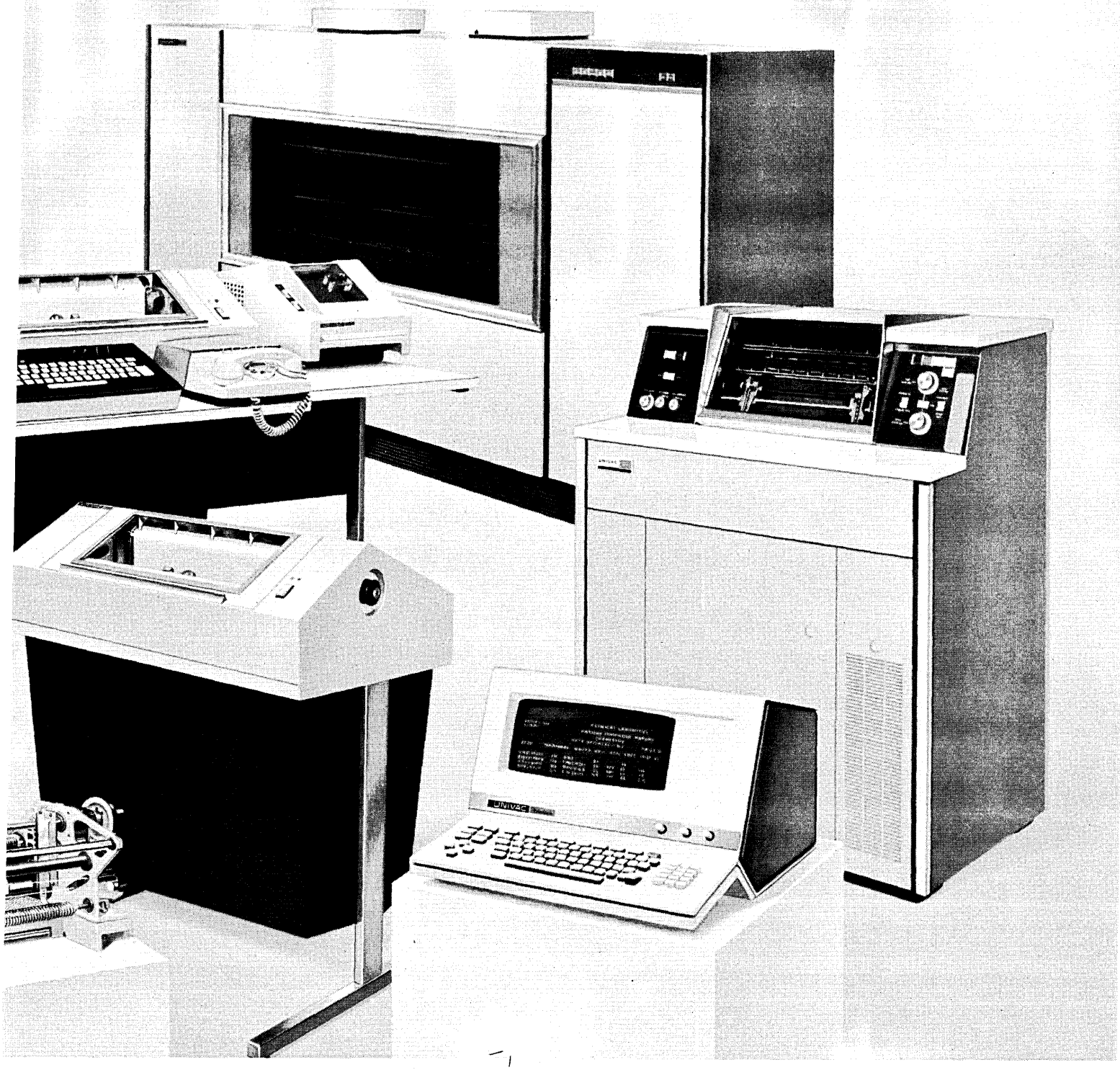

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new products ...

16-bit computer

Hewlett-Packard is big in the instrumentation end of minicomputer applications, and has added direct memory access channels to their cpu's to develop configurations which are adapted to batch processing, too. The 2114B, for instance, adds a dma channel option which was not available on the "A" model. The processor comes with seven I/O channels (or "slots" in HP terminology) but reserves an eighth slot for the dma or for an optional high-speed channel. Both the dma and the high-speed slot are rated at 500,000 words/sec.

The 2114B has, as did the 2114A, a 4K 2-usec cycle time core which is expandable to 8K. Its processor can do an add in four usec, or a subtract in six, but multiply and divide instructions are implemented through software routines—a multiply takes something like 150 usec. The machine comes with two 16-bit accumulators, three memory control registers, and two one-bit registers labelled "overflo" and "extend." The instruction repertoire has 70 entries.

Software includes a basic control system, FORTRAN, ALGOL, BASIC, a symbolic editor, extended assembler and utilities, and is "bundled" into the $8500 sales price. HEWLETT-PACKARD CO., Palo Alto, Calif. For information:

CIRCLE 308 ON READER CARD

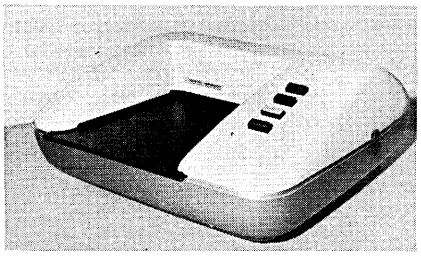
memorex 1603 correction

In the November issue, we reported the maximum input data rate of the Memorex 1603 Computer Output Microfilmer as 1,320KC, when that figure should have been 500KC. We also reported its character code as ASCII rather than EBCDIC. Fortunately the most meaningful numbers of the write-up, the 10,000 lpm printing speed and the $895/month rental (including maintenance) were correctly stated.

table-top ocr

The term "optical character reader" brings to mind large peripherals and high prices, a false impression when considering the Dataflow Optical Reading System, a table-top ocr unit priced under $10K. The first product of a two-year-old Florida firm, the reader digests 8½x11 pages at a rate of about one every 80 seconds—slower if the information read is being sent over Teletype lines. The secret behind the size and cost lies in an ASCII bar code printed under each character on the sheet. The code is read and translated in the reader through the use of read only memory to whatever digital code the user requires.

Printing for the device is done on a Selectric typewriter specially configured to add the bar code as it types. The system allows for formatting mag tape records from a typewriter since special characters can be used to designate tape marks, end of record marks, etc. Editing capabilities are also provided through special characters. For instance, the user may choose to have all data enclosed in parentheses automatically dropped from records being sent or recorded on tape. Deliveries start in June, and service offices are planned for New York City and the West Coast. End users can buy single units for $9,850, but with a



quantity OEM discount bringing the price as low as $5500, most units will probably be placed by "middle men." DATATYPE CORP., Miami, Fla. For information:

CIRCLE 310 ON READER CARD

1200 lpm printer

The Path 1200 electrostatic drum printer operates so quietly that the manufacturer built in a "hum" so that the user can tell when it is powered up. The peripheral uses 2000-foot rolls of paper cut to 80-, 132-, or 160-column widths, and lays down up to 1200 lpm using a 96-character set. Like most line printers, the characters are placed 10 to the inch horizontally and six lines per inch vertically.

The printer's standard seven-level ASCII font allows for upper and lower case alpha, numerics, and symbols, but the user can change the shape of the characters himself by simply changing a mask.

The supplier is a small firm, without service centers as yet, so most of the Path 1200's that find their way into the world will probably come from OEM's. The OEM price, in small quantities, for the 80-column model will be about $10,000, for the 132-column model figure $12,000, and for the 160-column model, $140,000. Today's orders will be filled this summer. PATH, Stamford, Conn. For information:

CIRCLE 305 ON READER CARD

laser scanner

The Laser Document Translator Model 8511-1 looks at an 8½x11 page as an 8500x11,000 element matrix and can digitize its contents in less than a minute. The page is scanned with a resolution of .001 inch, and the manufacturer claims a high signal to noise ratio as a result of using the helium-neon laser instead of a regular light beam.

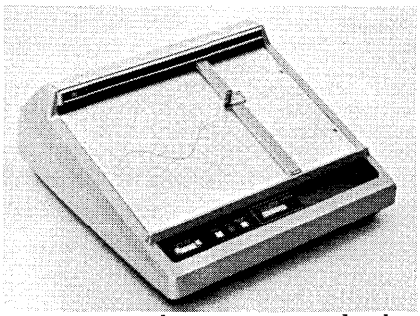
The scanner is merchandized with a Model 900 translator, which accepts the video data and translates it into 16 bit digital, and a Model 840 graphic generator for going from the digital back to video on the receiving end of a transmission system. The three-component package will sell for $1500, less on volume orders.

The vendor offers the system for process control field scanning, computer graphics, information storage and retrieval, photo mask making, and military reconnaissance and surveillance. MC COWN LABORATORIES, Tempe, Ariz. For information:

CIRCLE 309 ON READER CARD

remote plotter

The HP 7200A Graphic Plotter is a little slow—at one increment per 1.1 sec.—to be used for on-line plotting, but runs at about the right speed for connection to a 10 cps Teletype. Its biggest claim to fame is that it does



not require plotting commands that give it a direction and plot increment, but takes coordinate data specifying the end point of a line. Because of this feature, fewer plot commands need be generated, and this makes the unit more attractive for time-sharers.

The software drivers designed to work with the plotter feed the device

coordinate data scaled to the 11x17 inch paper size. All the plotter really needs to know is that it must go to a position between one and 999 on the X-axis and between one and 999 on the ordinate. Routines are included which provide for curve generation, curve synthesis, curve fitting, scaling, etc., and repeatability is kept to seven mils, accuracy to 15. The 7200A sells for $3300 and can be delivered in 90 days. HEWLETT-PACKARD CO., Palo Alto, Calif. For information:

CIRCLE 313 ON READER CARD

fast fast plotter

Two figures tell an impressive story about the Model 1000 Automated Drafting System. They refer to the flat-bed plotter's line or arc drawing speed (70 ips) and pen-up time (one msec). The rest of the story is not unimpressive either. For instance, the line drawing repeatability is .001 inch and the accuracy over the full table is .005 inch. The table comes standard as a 5x8 foot slab, but can be increased in either direction in increments of two feet.

The four-pen drawing head floats over the slab on a cushion of air, and pen positioning is actually done through a series of magnets in the head assembly which act on a waffle iron pattern in the drawing table surface. (For an explanation of the process, see June, p. 123.)

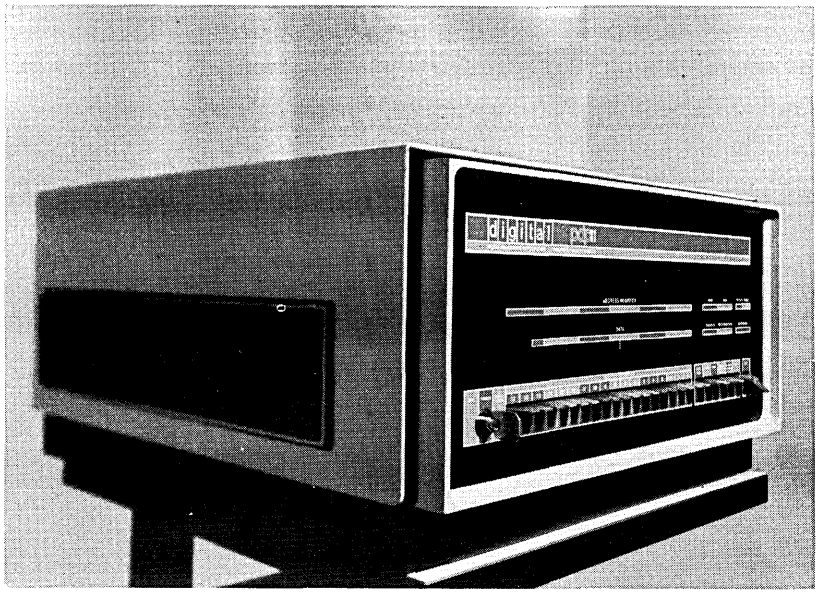
Starting with a magnetic tape (7- or 9-track, 800 bpi, 10½ inch reels) produced on a user's computer, the end points of the lines to be plotted are manipulated by built-in MAC 16 computer (16-bit word length, 1 usec cycle time, 4K expandable to 64K) and fed to the drafting system's own control logic, which determines the on and off states of the head's magnets, which in turn determine the direction of travel. With this system, arcs are drawn directly, not as approximations.

Also sold with the table are a built-in ASR 33 Teletype and a joy stick for positioning the head manually. The keyboard and paper tape gear of the 33 are to be used only in inserting corrections, since neither can efficiently utilize the plotting system's inherent speed. The MAC 16 is a powerful enough computer to assemble its own FORTRAN programs, so the 1000 may be the first drafting system which does not require an outside computer. (In fact, the computer becomes a peripheral if used to generate the drawings, right?) The whole ball of wax comes delivered with a price tag in the $100,000 range. XYNETICS, INC., Canoga Park, Calif. For information:

CIRCLE 306 ON READER CARD

(Continued on p. 204)

PRODUCT OF THE MONTH



the pdp-8's big brother

The box above may one day be the most common of minicomputers. It is a 16-bit big brother to the Digital Equip. Corp. PDP-8 12-bit computer, a device which undoubtedly now holds the world's record for "number installed" with a figure above 6200 units. The vendor is estimated to have 70%-80% of the minicomputer market, and that fact alone would sell the new machine.

The device now offered has an I/O architecture centered around a single bus called, appropriately, the Unibus. The central processor, the memory, and all peripherals attach to the 56 bi-directional lines of the bus to send address, data, and control information.

DEC worked on the idea of producing a 16-bit machine for over two years, and determined long ago that the machine would have to be more than another fast box. Using the bus, system modules and peripherals can communicate with each other without the intervention of the central processor, at an aggregate data rate of 1.3 million words/sec.

The cpu has a 70 nsec clock time, and performs some instructions in 1.2 usec (an add takes 2.3 usec). It does two's-complement airthmetic and uses an instruction repertoire of 60-70 functional types implemented in 400 hardwired specifics, including double-operand instructions. There are six 16-bit general purpose registers which may be used as index registers, accumulators or stack pointers, another which is reserved as a program counter and one used as a processor stack pointer.

The memory can be addressed as up to 32K 16-bit words or as 64K bytes, and byte addressing does not imply using right and left word halves. Read/write core is provided in 4K increments, has a cycle time of 1.2 usec and an access time of 500 nsec. Read-only memory (modified U-core with a wire braid) is available in 1K word segments and has a 1.0 usec cycle time. Read/-write memory is also available in 128 word segments with a 2.0 usec cycle. The vendor claims, however, that because of the large number of hardwired instructions, the double-operanding, and the I/O and interrupt schemes, the system will run 50%-100% faster than other mini's using the same speed memory.

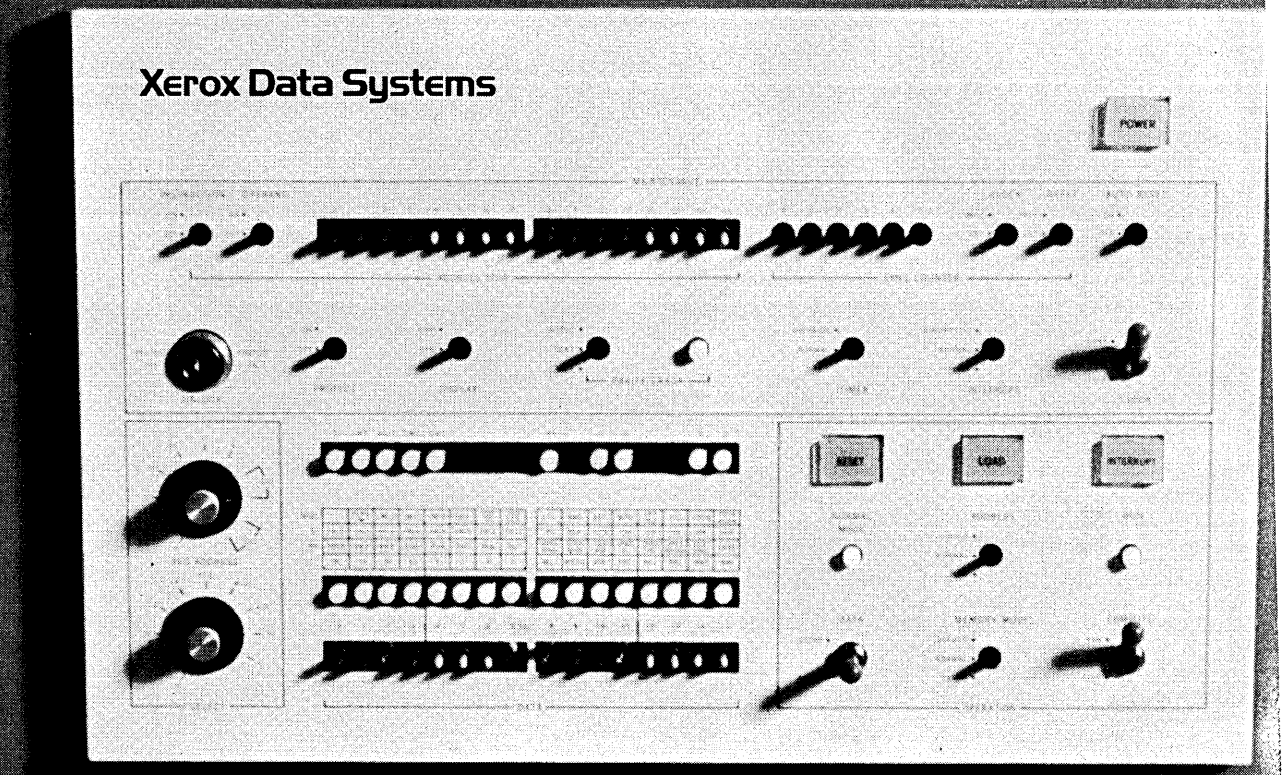
The 11 recognizes four primary levels of interrupt, but each peripheral is assigned its own interrupt level within that scheme, and interrupts can be infinitely nested.

The computer is available in two basic configurations. The PDP-11/10 comes with 1K of read-only memory, 128 words of the slower read/write core, a turnkey console and a direct memory access channel for $7700. Apparently this will be the process control configuration. The PDP-11/20 has the same processor, a 4K core, an operator's console, and a Teletype and sells for $10,800. First deliveries are scheduled for early summer.

Software will at first be minimal, with an assembler, an I/O editor, on-line debug facilities, and utilities; but editors, compilers, interpreters, and monitors are all promised. DIGITAL EQUIP. CORP., Maynard, Mass. For information:

CIRCLE 300 ON READER CARD

XDS SIGMA 3



new products...

imported office computers

Close on the heels of Victor Comptometer's importation of the Nixdorfer computers is North American Philips Corp. with its own series of computerized accounting machines. Fresh from success on the British market, the machines—the P-350 series—range in price from $7,900 to $50,000 and in power from 300 to 1200 16-digit words of core storage. The P-351, P-352, P-353 machines can handle invoicing, accounts receivable, payroll, inventory control, general ledger and related reports. The total hardware and software packages come with Philips Assembler Language (PAL) for programming. Two keyboards are supplied, the standard alphanumeric one and a standard 10 key numeric unit. The P-350 series can work with punched cards (270 cards a minute), paper tape (50 cps), or magnetic card (72 80-column cards a minute) input. Up to four peripheral devices can be attached to each of the system's four I/O channels. Rental for the P-350's start at $175 a month. NORTH AMERICAN PHILIPS CORP., New York, N.Y. For information:

CIRCLE 312 ON READER CARD

japanese computer

The face of the Facom R 16-bit computer—and a marking somewhere on the bottom that says "Made in Japan"—are almost the only features that distinguish it from similar American products. It has a 17-bit 1.5 usec cycle time core (the extra bit for parity) which can be ordered in sizes ranging from 1K-32K. Its processor performs binary two's-complement arithmetic, recognizes 28 basic instruction types and has a 6 usec adder. The unit has 11 registers, five of which are hardware and a maximum data transfer rate of 800 KB.

Software provided includes a two-pass assembler, a mini-FORTRAN, a desk calculator language, plus utilities. The end user price of a 4K model, with a built-in Teletype controller but without the TTY, is given as $13,800; but since the firm has no service offices in this country yet, the principal market will be OEM's. FUJITSU LTD., New York, N.Y. For information:

CIRCLE 314 ON READER CARD

business mini

First product of a firm rich in ex-Univac and CDC personnel is the System D-110, a stand-alone minicomputer designed for business use. It consists of a cpu and crt display, with alphanumeric, function, and programmer's keyboards. The machine is byte-oriented, with 4K-word core and 123K-word internal *disc* memory. Access time for core is .75 msec, and 8 msec for disc. Core is expandable to 16K words in 4K increments. The total memory system is directly addressable, with a single or double address system. Up to eight crt's, directly referenced to memory, can be located up to 1000 feet from the cpu. In addition, any combination of up to 32 perhiperals can be operated by one cpu. A repertoire of 44 instructions is used.

The firm intends to provide "total system support," including conversions of existing tab card systems, training, service, system expansion, and software. A basic operating system in an incompatible machine language is furnished with D-110 without charge, but everything else will be unbundled. Applications software will be available on a contractual basis, and higher level languages, such as COBOL, will be available at extra charge as soon as they are available. First system availability is scheduled for next month, with the firm planning to manufacture a minimum of 150 units this year. A range of peripherals, including card readers, punches, paper tape handlers, printers, disc files, etc., are available, using Mohawk equipment at present. Monthly rental will start at $675; purchase price at $20K. DATAC COMPUTER CORP., Minneapolis, Minn. For information:

CIRCLE 315 ON READER CARD

mag tape terminal

The model 4210 Magnetic Tape Data Terminal has a send/receive transmission capacity of up to 2400 wpm, twice as fast as most available punched paper tape equipment. The device was designed to add high-speed on-line capability to existing low-speed terminals. Data can be entered from the keyboard of a Model 33, 35, or 37 or Inktronic (1200 wpm printer) I/O terminal, which use the ASCII code, or on-line from a remote station or computer. The 3″ x 3″ x 1″ cartridge of re-usable magnetic tape has a storage capacity of approximately 150K words.

Features include a Forward/Reverse Search mechanism that can search for specific data at a rate of 400 cps, stopping automatically, and a Forward/Reverse Fast Access feature that allows the operator to locate a particular area on the tape at an approximate speed of 4K cps. Up to seven characters may be used for search purposes. Corrections are made manually using an overwriting technique.

The unit may be left unattended, arranged to answer calls automatically and either send or receive, depending on the mode selected. After transmission, the terminal automatically goes into the receive mode. Low tape and end tape alarms, indicated on the control panel, will disconnect a call so that no data is lost.

The Bell System will lease the terminal for about $120 a month as part of its Dataspeed services. Teletype will sell the unit for about $2200. (Neither price includes Teletypewriter or DataPhone. Photograph shows the 4210 with the Inktronic terminal.) TELETYPE CORP., Skokie, Ill. For information:

CIRCLE 311 ON READER CARD

small cpu's

There are several ways to make a small computer fast, including making the basic circuitry fast, implementing instructions through hardware, and making the software efficient. Although the CSI-16 and CSI-24 computers do not have unusually fast circuitry (2.0 usec are required for an add on both machines), they are constructed with hardware algorithms for all of the basic compiler language functions, the manufacturer claims. The one-pass compilers—ALGOL-60, BASIC, and extended FORTRAN IV (less double precision and complex data forms)—are written to take full advantage of the hardware instructions. For example, the execution time given for 100 passes of a "typical" FORTRAN DO loop (multiply included), counting time needed for loop initiation and termination, is given as 4 msec.

Both the 16-bit CSI-16 and the 24-bit machine have basic cycle times of 1 usec, come with 4K of core (expandable to 32K in the smaller machine and to over eight million words in the larger), with 16 levels of interrupt (expandable to 256), 13 hardware registers, and with a hardware list processor attached to a direct memory access channel for I/O (and up to 256 list processors can be attached, each theoretically capable of handling 256 I/O devices).

In standard trim the small machine sells for $10,750 and the 24-bit version for $14,950. COMPILER SYSTEMS INC., Ridgefield, Conn. For information:

CIRCLE 318 ON READER CARD

disc drives

The Telex 5311 disc drive is compatible in all aspects with the IBM 2311 disc pack drive and features 30 msec average access time (compared to IBM's 75 msec) and a start-up time of 15 seconds (compared to 60 seconds for the IBM drive). Lease prices for one year, including maintenance, are $525/month for the Telex 5311 vs. about $570 for the 2311.

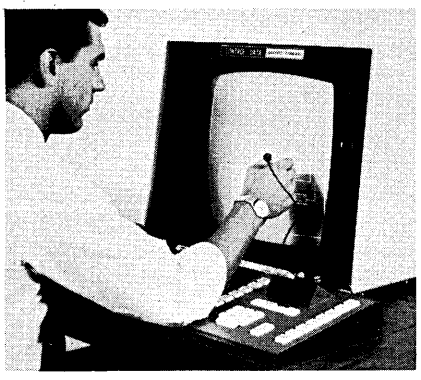
Telex is also offering the Model 5312 disc drive, plug-to-plug compatible with IBM's 2314, as part of its 5314 disc storage drive system which also includes the Telex 5328 file control unit. A major feature of both Telex drives is the use of an electromagnetic actuator and an electronic position control system which eliminates mechanical detents.

Average access time of the 5312 is 32 msec, compared to 75 msec for the IBM 2314-1 and 60 msec for the IBM 2313-A1. Start-up is 20 seconds vs. 60 seconds for the IBM 2314. The full instruction set of the IBM 2841 control unit is included in the Telex 5328, which is plug-to-plug compatible with the IBM 360 selector channel. A full 9-spindle 2314-A1 system, including the controller, rents for $5220/month and sells for $210,000. Comparable IBM prices are $5505/month and $248,710. TELEX COMPUTER PRODUCTS DIV., Tulsa, Okla. For information:

CIRCLE 317 ON READER CARD

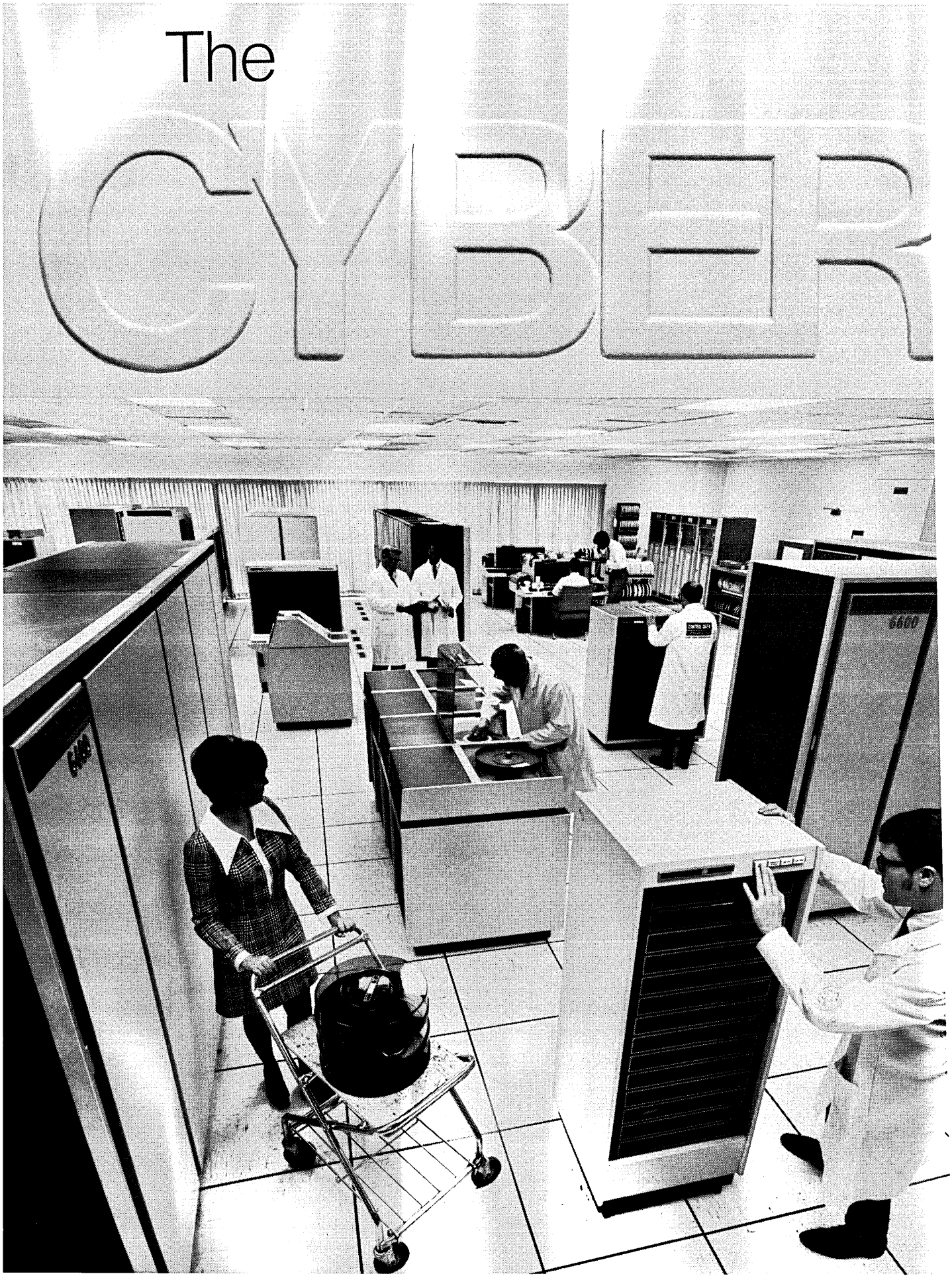
graphics terminal

Although it isn't always apparent, more and more computers are becoming peripherals to peripherals. A certain amount of "control logic" has al-



ways been found in more complicated peripheral gear, but the processor in the GRID 240 Series Graphics System sounds like a computer. It has a 4K memory of 12-bit words that can be expanded to 8K or 12K. Its cycle time

The CYBER



CYBERNET™ system

The main problem with having an efficient, economical terminal like the MARC™-II is that you don't have an impressive mainframe to show visitors. And you probably wouldn't have the MARC-II in a special room either. Just another office.

Well, to avoid the problem of underestimating the MARC-II, we've outlined a briefing procedure for tours of this data processing facility.

STEP ONE — Point to the cable leading to the telephone outlet and state that at the other end of that cable (a millisecond away) is the world's most powerful computer complex — the CYBERNET System. Control Data's CYBERNET System is a network of computer centers located in 29 cities across the United States and worldwide. With CDC® 6600 and 3300 computer systems, these centers provide a perfect combination of computing power and high capacity data processing capability.

The tremendous speed of the CDC 6600 computer and its multiprocessing capability mean that, when you operate your MARC-II terminal, it's as if the total computer system at the center were dedicated to your particular problem. And that speed also means that problems that would take hours or days on other computers are solved in seconds or minutes with the 6600 supercomputer — a factor that means substantial savings in time and costs.

STEP TWO — Point out that the MARC-II, with its CYBERNET System tie-in, can handle any data processing problem that can be solved with a free-standing computer. It has both batch-job and interactive capabilities. The MARC-II has an entry keyboard, CRT display, 300 card-per-minute reader, and 300 line-per-minute printer. Data can be entered by the keyboard or card reader, edited on the display screen, and transmitted in blocks or a line at a time. Transmission speed between the terminal and the center is up to 300 bytes-per-second with the MARC-II, and up to 6000 bytes-per-second with other terminals in the MARC-Series and wideband communications.

MARC-II

STEP THREE—Be sure to mention that your choice of access to the CDC 6600 and the 3300 systems provides you with a one-two punch of computing power and high-capacity data processing for increased problem solving efficiency. Your cost per computation is lower *and* you pay only for the resources you use as you use them.

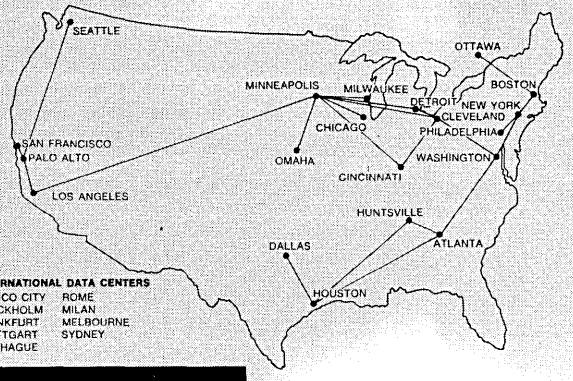
STEP FOUR—Stress the point that alternate centers throughout the CYBERNET System are always available to perform your processing. You are no longer dependent on a single facility where being "down" can seriously hamper your operation.

STEP FIVE—Note the fact that the MARC-II doesn't require air conditioning or a raised floor . . . that it uses a low-cost dial-up voice-grade phone line.

STEP SIX — Demonstrate how easy it is to search, change or update your files (which are stored at the CYBERNET Center) with CDC's new software system, SHADE. And how its companion system, SHADOW, provides you with the command and control features to designate which CYBERNET 6600 or 3300 (or combination of both) you want to use to solve your problem.

THAT'S THE BRIEFING. It's really *too* brief to tell you all the impressive things about the CYBERNET System and the MARC-Series of remote terminals from the MARC-I to the MARC-V.

Get the *full* briefing by calling your nearest CDC Data Center. Or contact us directly. You'll be impressed.



CONTROL DATA
CORPORATION

For further information, call or write:

In the United States:
Data Services Division
Dept. 211
Control Data Corporation
4550 West 77th Street
Minneapolis, Minnesota 55435
Phone: 612/920-8600, Ext. 5091

In Europe:
CDC Data Services, Dept. 211
Control Data GmbH
6 Frankfurt am Main 16
Niddastrasse 40
West Germany
Phone: 71-231

is 2.4 usec, and it is competent enough to relieve the central processor of routine tasks such as the generation and manipulation of display lists.

Other parts of the 240 are a light pen and keyboard, an interface for communications lines or, in the case of the CDC 3000 or 6000 computers, a direct channel interface. The 12x12-inch screen is divided by a 1Kx1K raster matrix, and inputs to the screen can come from a function keyboard (with edit keys, function keys and status switches) in addition to the 64 or 128-character alpha keyboard. The terminal is base priced at $70,000. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 316 ON READER CARD

coupler/modem

The ADAC 1200 acoustic direct access coupler may be used in an acoustic coupler mode when portability is desired or with a Bell System Data Access Arrangement in permanent installations. It is compatible with the Bell 202C and D Data-Phones. A high speed channel provides for data rates up to 1200 bps, and the low speed channel is for rates up to 10 bps. Both channels are half duplex. When the 1200 is transmitting on the high speed channel, it may be receiving on the low speed channel and vice-versa. Serial binary DC data is accepted and transmitted. The data is then converted to FSK signals. Interface signals conform to the EIA RS-223B standard. The unit is available for $985. The ADAC 1210, which is the same as the 1200 except that the high speed channel can be used in the transmit mode only, costs $795. ANDERSON JACOBSON, INC., Mountain View, Calif. For information:

CIRCLE 320 ON READER CARD

mag tape units

The series 924 magnetic tape units, plug-for-plug replacements for use with IBM 360's, are said to offer operational savings and prices substantially lower than original equipment. The TI units feature a single-capstan drive which is directly driven from a special PC motor, eliminating the maintenance problems associated with the mechanical drive components in the "older" mag tape units. Other features minimize skew and protect the tape edges and recording surface. Convenience features include a power window and quick-release reel hubs. As a pricing example, the company is offering their 924-6 (replacement for the IBM 2401 Model 6), a 112.5 ips, 1600 bpi, phase-encoded unit, for around $16K. Delivery is 120 days ARO. TEXAS INSTRUMENTS INC., Houston, Texas. For information:

CIRCLE 321 ON READER CARD

miniprinter

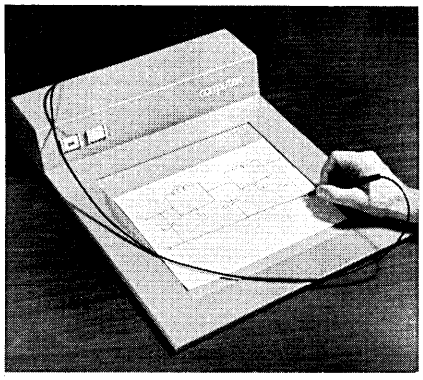
It's a buyer's market in the miniprinter field, with manufacturers falling all over each other to present another technology, a smaller size, or a better price. For instance, the Series A-1000 Line Printer goes to 132 columns at speeds of at least 163 lpm, and forms its characters electrostatically. The 1000 uses a continuous roll of chemically treated paper which is brushed by a wire eight times per line creating dot matrix characters at a spacing of 12 to the inch horizontally and six lines per inch vertically.

The characters can actually be of a variety of forms, as they are constructed by a software driver. The standard set contains 64 elements which are held in a buffer area in the host computer's memory. The printer can be interfaced to any computer, the manufacturer says, and sells for less than $6000 ($5965 for a PDP-8). APPLICON COMPUTER SYSTEMS, LTD., Ottawa, Canada. For information:

CIRCLE 325 ON READER CARD

graphic tablet

A new graphic tablet for converting hand-drawn data to digital form uses an electromagnetic sensing technique incorporating a proprietary printed digital pattern. Pattern accuracy of .005-inch and linearity of .05% of full scale are claimed. Writing area is 11¼



inches square. It can be used with graphics terminals or as a stand-alone unit. Applications include positional control of display cursors, on-line interaction with graphic displays for computer-aided design, curve tracing, conversion of rough drawings to exact drawings, and marking on standard forms. Two models are offered: The 50/10 provides resolution of 10 bits (91 lines/inch or .011 inches/line), and the 50/8 provides resolution of 8 bits (23 lines/inch or .044 inches/line). Prices are $2800 and $2400, respectively. OEM discounts available in quantity. COMPUTEK, INC., Cambridge, Mass. For information:

CIRCLE 319 ON READER CARD

voice answer-back

Credit checking, inventory inquiry, and bank account balance verification were some of the applications this vendor mentioned where a voice answer-back unit could do a useful job. Called "Audikon," the device can respond with a 15-word vocabulary simultaneously over up to 13 connected phone lines. Options can expand the number of connectable phone lines from 16 to 1,024 and increment the vocabulary with mass storage device units of up to 2000 words. Claiming a big price advantage over competitors, the supplier claims that a 15-word version of Audikon can be placed for as little as $20,000 (but this figure was quoted for a system interfacing with one of the vendor's own computer systems and might be higher using another interface). SYNERGISTICS, INC., Natick, Mass. For information:

CIRCLE 322 ON READER CARD

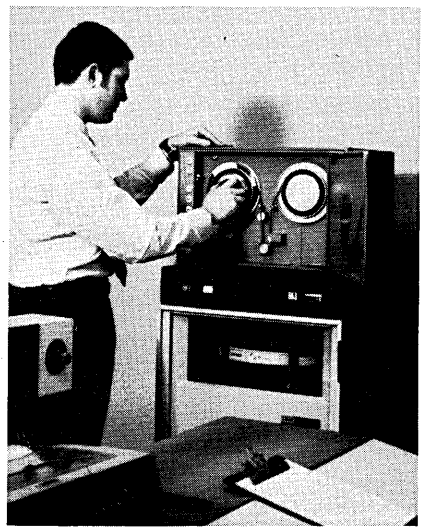
hardware monitor

Dynaprobe/Dynapar is a hardware/software package designed to monitor computer installation efficiency. The hardware portion, Dynaprobe, is a solid state portable device, consisting of three logical elements: probe lines which convey statistical data input from the computer being monitored, accumulators which temporarily store count or timing signals, and a tape transport to record data for later analysis. Dynapar, the software, performs an analysis of systems performance data accumulated during monitoring. Reports produced by Dynapar include measurements of cpu and peripherals utilization and operating system overhead directly related to individual application program execution. Dynapar is written in FORTRAN IV and requires minimum 44K. The complete Dynaprobe/Dynapar package sells for about $35K and requires 30-45 days ARO for delivery. Price includes installation, consulting support, and access to monthly 2½-day training courses at the vendor's headquarters. COMRESS, Rockville, Md. For information:

CIRCLE 329 ON READER CARD

mtu's for small computers

Independent manufacturers of peripherals are making calculated moves into the small system market. A recent foray into the field makes available magnetic tape systems for the PDP-8 computers, the 8, 8I and 8L, and the



IBM 1130. The units read and write at the rate of 20,000 cps on ½-inch tape, either 7 or 9 track. They feature a read-after-write head, separate erase head, and can calculate LRC and CRC.

The PDP-8 system, Model TS-8C, has an IBM-compatible tape format and allows tape functions to be initiated with one IOT instruction. Data is transferred as a background operation, and the main program proceeds without interruption until the function is completed. TS-8C has a tape input/output control system using PAL III assembly language that performs all basic tape functions.

Model TS-1130C, the system for the 1130, has individual LRC and CRC registers which can be accessed to correct flawed records. It uses cycle steal and direct memory access to initiate tape functions and transfer data. Operating subroutines can be accessed with read/write statements in FORTRAN, or call statements in 1130 assembly language.

Single unit price for the TS-8C is $11,300. Additional units cost around $5,200. The price for a single TS-1130C is $11,720 and additional units cost $6,000. Rental terms are available. INFOTEC, INC., Plainview, N.Y. For information:

CIRCLE 323 ON READER CARD

in-house t-s

The Interplex System I is an in-house time-sharing system which provides both the BASIC language and calculator functions, using from 4 to 16 terminals and a Honeywell 316 mini-computer with 12K core. The terminals are of a unique design with keys arranged in three functional groupings: the left-hand group contains the BASIC instruction repertoire and the major mathematical functions; the center keys, alphabetic, represent 23 variable storage registers; and the keys of the right-hand group are for numeric data entry and caclulator operation. Printout is provided on a narrow roll of paper more like that of an adding machine than a computer printer. Rental of a 16-terminal system complete with cpu and software is $1803/mo. under 4-year lease. Initial deliveries are expected this spring. INTERPLEX CORP., Waltham, Mass. For information:

CIRCLE 324 ON READER CARD

communications controller

Two points that differentiate the Interactive L-64 Communications Controller are the fact that its basic data element is the character rather than a bit, and that it is capable of dynamically allocating lines of varying speeds without being previously hardware or software limited to "X lines of 110 baud and Y lines of 1200 baud, etc."

The L-64 is marketed as a communications controller with line adapters multiplexing local terminals and data sets, or as a front end communications processor, in which case it is beefed up by the addition of a Lockheed Mac 16 minicomputer. A minimum system configuration for the controller (not including the mini) would be able to handle 16 lines and cost $16,000, but the cost per line falls dramatically for larger systems. A single unit price for a "typical" 32 line controller would be $19,000 without the processor, and $36,000 with it. The single-controller

new products...

model is the bottom of the line, and is expandable to up to four controllers with 64 adaptive line adapters each. INTERACTIVE DATA SYSTEMS, Irvine, Calif. For information:

CIRCLE 326 ON READER CARD

programmable crt terminal

The Series 100 crt Infoterminal is microprogrammed to improve the performance-to-cost ratio, and most of these microprograms are in firmware as opposed to magnetic core memory. The microprograms become part of the hardware and can be physically changed without changing any of the unit's logic circuitry when reprogramming for new tasks becomes necessary. The terminal also has a read only memory (maximum 1K 16-bit words) and a delay line buffer memory for refreshing the crt.

The display is 14 inches diagonally, the equal of the standard 8½ x 11 inch sheet of paper. The microprograms allow for any amount of protected data on the screen. Up to 1000 7x9 dot matrix characters may be displayed. The three character formats include 50 characters/line by 20 lines, 73 characters/line by 15 lines (Teletype compatible), and 80 characters/line by 13 lines (punched card compatible). The cursor is a blinking symbol whose position is controlled either locally or by the channel. The keyboard is compatible with the Mod 33 Teletype layout and functions plus some additional control keys.

Maximum communications rate is 1 million bps, with worst-case latency at 8.33 msec. Standard interfaces include ASCII 8-bit parallel output and input, with control flags, and both full and half duplex serial. Options include cassettes, hard copy, hardware edit, parity check. Unit base price of the standalone configuration is $5200. OEM pricing is available. COMPUTEK INC., Cambridge, Mass. For information:

CIRCLE 330 ON READER CARD

teleprinter controller

For high seas marine communications networks and other applications where an inexpensive alternate to long distance telephone service seems desirable, the Teleprinter Automatic Control Terminal can perform automatic start/stop, polling, acknowledge response, tape reader start and audible call functions for a five level Model 32 Teletype or its equivalent. The first product of a communications oriented firm, TACT converts an HF radio transceiver and teleprinter into an attended

or unattended communications terminal at a cost that ranges from $1440-$2489. Models are offered for receive only, or receive and transmit for either single or dual channel operation. A single channel receive and transmit model with address detection and parity detection/generation sells for $1764. RYDAX, INC., San Rafael, Calif. For information:

CIRCLE 328 ON READER CARD

tape recorder

First of a product-line series of digital tape recorders by this vendor is the TCC 1701, which is capable of writing incrementally at 1000 steps/second and above, and reading and writing synchronously from 4 to 37½ ips. The unit generates IBM-compatible 7- or 9-channel tapes in either 556 or 800 bpi densities. Reel size is 8½ inches (1200 foot capacity). The recorder uses a single direct-drive capstan for tape movement, driven by a DC motor-tachometer-optical encoder assembly which is common-shaft coupled to the capstan. Price of the unit ranges from $3000 to $6500, depending on features, options, and quantities.

Future 1700 series recorders will provide several operating modes: incremental write/synchronous write; synchronous read; incremental write; synchronous write; and an OEM synchronous write/synchronous read version stripped of gap generation, file mark generation, etc. All, except the OEM series, will be available optionally with parity generation and checking, echo checking, read-after-write cyclic redundancy check generation and checking. TRACOR COMPUTING CORP., Austin, Texas. For information:

CIRCLE 334 ON READER CARD

cassette tape drive

The Model 6200 Cartridge Magnetic Tape Unit was originally built for use by the vendor in its larger systems, but apparently the lure of the OEM market was too much to resist, for it is being offered separately now. Using twin reels of ¼-inch tape (as opposed to the more standard 150 mil variety commonly referred to as ⅛ inch), the 6200 is capable of reading or writing at rates to 3750 bps or 375 ASCII cps. With a packing density of 250 bpi nominally, each 300-foot tape is good for 900,000 bits, and the 1.5 mil mylar tape has been certified to four times this packing density.

Both single tape deck and dual deck models are offered (at approximately $2200 and $4000) with three kinds of interfaces—serial, parallel, and parallel with a controller. Tape motion is through a pinch roller and reel motors, and a rewind time of less than 60 seconds is quoted. RJ COMMUNICATIONS PRODUCTS, INC., Phoenix, Ariz. For information:

CIRCLE 332 ON READER CARD

crt terminals

The KDT series of desk-top crt display terminals consists of the KDT-1, designed as a substitute for teletypewriters, and the KDT-2, which is primarily a data entry terminal and features editing capabilities, including character and line insertion and deletion, format protection, and tab features. Each has a 12″ diagonal display and is available in four models—5 x 7 dot matrix characters by 10 lines, 32 by 20, 64 by 10, and 64 by 2. The prices range from $1490-$2495 for the KDT-1 and $1995-$2995 for the KDT-2, again depending on the number of characters shown in each display frame.

The basic interface is to standard data sets or acoustic couplers of up to 2400 baud using the 64-character ASCII set. Optionally, higher speed serial or parallel data transfer rates of up to 8600 baud are available. The terminals can also be interfaced with hard copy devices. Both include a blinking character capability that permits callout of significant information and

new products...

scroll mode operation that permits information of more than one display frame to be shown consecutively. INFOTON INC., Burlington, Mass. For information:

CIRCLE 336 ON READER CARD

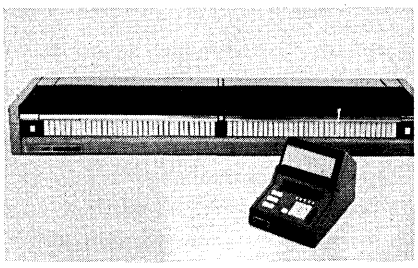
rapid mini disc

The Models ADN-10128 and ADP-10128 are disc memory systems for the Nova and PDP-8 computers, respectively. Each system consists of an Alpha Data disc and a controller/interface. The claimed average access time is only 8.4 msec. The ADN has a storage capacity of 250K 8-bit characters and a transfer rate of 62.5K words per second. The ADP stores 512K 6-bit characters, and transfers 128K words per second. Fast access is said to be obtained through a unique head per track construction and a high disc rotation speed. A buffered interface is employed and MSI implementation is used. A diagnostic program is included. Price of either model is $9K, delivery requires 45 days ARO. OEM discounts available. COMPUTER SYSTEMS & SOFTWARE, INC., Orlando, Fla. For information:

CIRCLE 333 ON READER CARD

random card store

The System 4000 automatically retrieves cards or other items of the size of tabulating cards. With a controller keyboard and any number of retriever files (each holds 4000 cards or items) data can be found and filed without concern for file placement. The storage item may be microfiche, microfilm aperture, magnetic faced or address tab cards, even documents in tab card size envelopes. All are coded. The



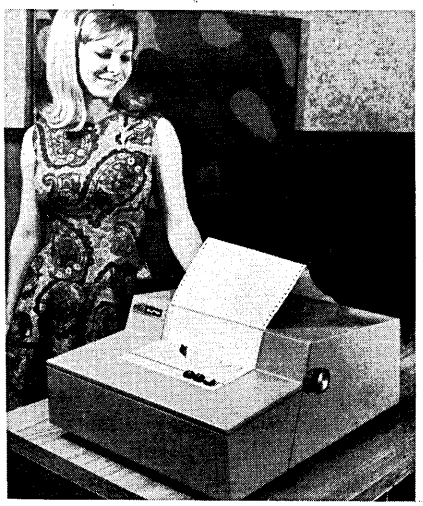
operator keys the code and the system searches and produces the item or items. System 4000 is priced at about $7,500. MOHAWK INDUSTRIAL LABORATORIES, INC., Vernon, N.Y. For information:

CIRCLE 331 ON READER CARD

300 lpm printer

Many small, 80-column, medium speed printers are electrostatic or thermal devices and as such cannot produce multiple copy output or position with the accuracy of a pin-fed printer. The Alpha is small (10x18x24 inches), and prints 80 columns at 300 lpm, but uses a drum and impact hammer mechanism that allows for up to six copies and uses pin-fed paper.

The printer accepts ASCII code and is expected to see service alongside remote terminals and with minicomputers. A serial EIA interface should make it acceptable to most existing



systems. Prices start at $6600. SYNERDATA, Beverly, Mass. For information:

CIRCLE 327 ON READER CARD

acoustic coupler

The Model 3040 acoustic coupler is used for serial binary data transmission at 300 baud over public telephone lines. The dual interface capability enables it to perform interchangeably with Teletype Models 33, 35, 37 or with other printing mechanisms using the EIA RS-232B standards. Transmission mode is selectable, either full or half duplex. Unit price is $495. BECKMAN INSTRUMENTS, INC., Fullerton, Calif. For information:

CIRCLE 337 ON READER CARD

communications controller

The MLC104 multi-line communications controller for the GE-100 line of computers supplements the single-line controllers announced a few months ago for the GE-105, 115, 120 and 130 systems. As many as 16 asynchronous transmissions can be handled at any four of 10 line speeds, ranging from 45.5 to 1200 bps. Up to four MLC104's may be used in a system, with a memory capacity of 32K, bringing the total capacity to 64 lines. Transmission lines may be half or full duplex. A new buffer on the controller (4K capacity, subdivided by program control according to the number of lines) facilitates sorting and assembling of messages for processing. A unit capable of handling

four lines leases for $700 a month and sells for $28,655. Line adapters, one for each line, lease for between $25 and $50 a month and sell for between $1,010 and $2065, depending on transmission speed and whether the line is half or full duplex. Additional modules, each capable of handling four lines, lease for $80 monthly and can be purchased for $3265. Deliveries begin in June if you order this month. GENERAL ELECTRIC CO., Phoenix, Ariz. For information:

CIRCLE 339 ON READER CARD

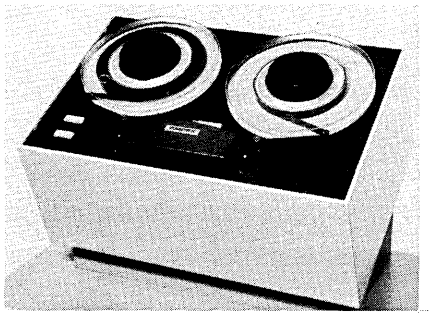
mark sense reader

The GDI 100-MS Mark Sense Card Reader, intended for OEM's, is designed to read pencil marked or punched hole data, column by column, at demand rates up to 300 cpm. The reader accepts 3¼- x 7⅜-inch Hollerith mark sense cards of various formats up to 80 columns. The unit includes data amplifiers, control logic, and power supply. The mechanical deck of the GDI-200 is used for the card transport mechanism. The 100-MS is designed for use with small computers, communications terminals, and off-line devices. Price is under $4K in small quantities. Delivery is 60 days ARO. GDI INC., Melbourne, Fla. For information:

CIRCLE 338 ON READER CARD

small tape deck

Ampex has claimed that its TMZ 25 ips tape drive is the Volkswagen of the industry. If being slow and cheap and small has proven good for their sales, then they must feel that being slower and smaller and cheaper will be even better, for the TMX is in some ways half a TMZ. The TMX uses 8½-inch tape



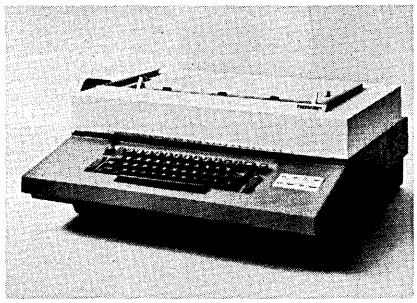
reels instead of 10½-inch and has a read/write speed of 12½ ips instead of 24 ips. A dual capstan drive mechanism moves the tape, and bit densities can be 200, 556, or 800 bpi.

The unit measures 12x18x19 inches and is expected to find uses alongside minicomputers in tape-to-printer and keyboard-to-tape applications. Prices range from $2000-$2500 and deliveries begin this quarter. AMPEX CORP., Culver City, Calif. For information:

CIRCLE 335 ON READER CARD

selectric terminal

By wrapping an IBM 2741 terminal in fiberglass, this vendor has arrived at a Selectric terminal with full keyboard and printing capabilities which weighs in at less than 50 pounds. Called the 5-41, I/O speed is still up to 15 cps and 2741-compatibility is maintained throughout. A two-character buffer is included which prevents the terminal from falling behind when receiving from a central computer. This feature



reportedly eliminates keyboard lockup and the associated loss of data. The unit sends and receives in ASCII when on-line, and can be used as a standard office typewriter off-line. It is priced at $4,050 and may be rented for $99/month on a 12-month basis. NOVAR CORP., Mountain View, Calif. For information:

CIRCLE 340 ON READER CARD

on-line microfiche

The Micro-Interactive Retrieval System is a microfiche retrieval system designed to operate on-line to a computer. Equipped with an electronic pen and a keyboard for access purposes, the system also has an audio unit to supplement displayed data or provide instructions to the user. Pages of data stored on microfiche are displayed in an average access time of 1.5 seconds; maximum access time is 3 seconds. Up to 62,720 pages can be displayed either in color or black-and-white. A modular electronic control unit, MCU, permits up to 32 display terminals to communicate with a computer through a single channel, using either a direct link or voice grade phone lines. The MCU can accommodate up to eight other peripherals, including printers, crt's, etc. Software includes terminal support programs, a general user language for use by non-programmers, and proprietary application programs. The audio unit handles 16 stored voice messages, each of 5 seconds duration. Optional features include a crt, special function keyboards, a badge reader, strip or line printer, and hardcopy printout of microfilmed information. A basic systems sells for $7.5K, rents for $200/mo. CYTEK INFORMATION SYSTEMS CORP., New York, N.Y. For information:

CIRCLE 348 ON READER CARD

crt terminals

The model 265 terminals feature a 64-character ASCII keyboard and a 9" diagonal crt that can display up to 2400 9x14 filled stroke characters. Standard interface is to tty or data set. The terminal can interface with a tape cassette, be used on-line in the time-sharing mode, and hard copy capability is available. Transmission rates are from 75 to 9600 baud, full or half duplex, synchronous or asynchronous, parallel or serial (parallel optional for output). Standard editing features include full-control non-destructive cursor, page erase, character erase, carriage return, tab, line feed, and scroll. Page and line separate and condense and other features are optional. Other options include lower case alphabet character set, split screen capability, and memory expandable to 64 lines. Single quantity base price (4 line by 32 character display format) is $1790. The 260 series is also available in the read only controller (261) and read only display (262) models. AMERICAN TERMINAL SYSTEMS, Chatsworth, Calif. For information:

CIRCLE 341 ON READER CARD

tty coupler

The DH-100 data coupler is for use with the Models 33 or 35 Teletype under the telephone Data Access Arrangement. The coupler is designed to be mounted in the base of the TTY using existing mounting holes. It may also be used as a desk set. Complete interconnecting cables and connections are provided. The coupler, modular in design, is available in a variety of configurations, including automatic answer modes. Transmission of accurate data is aided by fully filtered transmitter and receiver circuits, hardwire connected to any telephone. Price is $395. DATA ACCESS SYSTEMS, INC., Dover, N.J. For information:

CIRCLE 342 ON READER CARD

breakpoint generator

The Hardware Breakpoint Generator, designed for the PDP-8/L, requires no storage space for diagnostic routines and eliminates the need for modifications or "patches" to a program under test. Features include: an automatic stop or interrupt at any address; control switch to execute breakpoint at either a program (control) address or an operand (arithmetic) address; elimination of need for software diagnosis; interpretive routines eliminated, debugging accomplished in real-time; real-time expended in various program branches can be measured; and signal output at exact time breakpoint address is detected giving sync pulses for scope interrogation. The generator is small enough to allow it to be positioned on top of or adjacent to the

new products...

computer. Price is $590 with 60-90 days ARO delivery. CUSTOM COMPUTER SYSTEMS, INC., Plainview, N.Y. For information:

CIRCLE 343 ON READER CARD

multiplexer on a card

A 5½ x 8½ display packed pc board produced by this vendor contains eight three-wire analog multiplexer channels. Switching at rates to 100 KHZ, the model 2005 can use a signal range of from one mv to 10 volts. For multichannel applications which use several multiplexer cards, a "card select" logic level input is provided to simplify channel selection logic circuits. All this for $350. DATUM INC., Anaheim, Calif. For information:

CIRCLE 464 ON READER CARD

disc drives

The models Dø85, 86, and 87 are compatible disc drive controllers for IBM 2314 disc storage units. The Dø85 is said to provide the minimum hardware/cost method for removable disc pack storage on a non-IBM system through use of software and the direct memory access feature of the host computer to eliminate buffers and much of the control unit logic. The Dø86 is fully buffered and contains all checking and searching logic plus a full-record buffer; it requires virtually no software and uses any I/O facility. The Dø87 allows minimum hardware control of either the 2311 or 2314 using one control unit. Prices are $10K for the 85, $22K for the 86, and $12K for the 87. BCD COMPUTING CORP., Deer Park, N.Y. For information:

CIRCLE 350 ON READER CARD

channel access module

The CAM/360-2 is a channel access module designed to simplify the task of attaching I/O devices to the channels of a System/360 computer, models 30 through 195. It attaches to either a selector or multiplexor channel of the 360, and operates in single-byte, multi-byte, or burst mode. The input to the CAM is adaptable to either 8- or 16-bit parallel data sources and will move data at rates up to 1 million bytes per second. The CAM features dynamic device addressing on the 360 channel and provides a means of passing a sub-multiplex address on to the attached equipment. Price is $3000 in quantities of one to nine, with 90 days ARO for delivery. It's the first product of CAPITAL COMPUTER CORP., Dayton, Ohio. For information:

CIRCLE 346 ON READER CARD

mtu for minis

The DA-G60 is a block addressable tape cartridge for use with small computers to provide mass storage (up to 4-million-plus words) at approximately cassette cost (end-user price for a controller and two tape units is $7600). OEM prices will run about $5800 for the controller and two tape units. Word transfer rate is 16.6KC, and its average access time is 7.7 seconds. Block access time averages 19 seconds. The system in its maximum capacity consists of the controller and eight tape units. Each cartridge can hold 528,384 (12-bit) words in up to 4K blocks. Tape speed is 90 ips and recording density is 2400 bps. SYSTEM INDUSTRIES, INC., Sunnyvale, Calif. For information:

CIRCLE 347 ON READER CARD

data pooler, terminal

Sangamo has made two new products out of its basic 7100/9100 key-to-tape data entry station (7000 models use 7-track tape and 9000 models use 9-track tape). First is a data pooler known as the 7200/9200. This allows a data entry station to consolidate multiple input tapes from other data stations to full 10½-inch, 2400-foot reels before processing. It features a 240-character selectable memory which allows upblocking to expanded record sizes to increase transfer rate of data

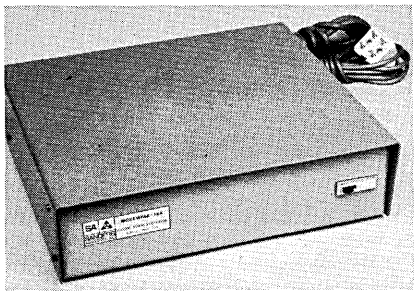
input to the computer. When other data entry stations are interfaced into a 7200/9200, they become known as 7120's, and this costs the user $10 a month or can be purchased for $300. The 7200/9200 station leases for $235/$247 and sells for $8560/$9360. The data stations themselves can still be used for data entry when desired.

Or the 7100/9100 can become a communications terminal as well as the key-to-tape unit, in which case it is called the 7300/9300. It will transmit or receive asynchronously at up to 1200 bps over the DDD network or 1600 bps over private lines using a Bell or Sangamodem 202C data set. Complete error check during transmission is automatically provided. Full 2400-foot reel transmission is available, with densities up to 800 bpi. Standard 64-character set or any of 256 characters may be transmitted. The 7300/9300 leases for $232/$255 a month and sells for $9510/$10,310. SANGAMO ELECTRIC CO., Springfield, Ill. For information:

CIRCLE 351 ON READER CARD

data set

The Modempak-18A is built for digital transmissions up to 1800 baud using two- or four-wire conditioned phone lines or direct dial-up lines (in which case it needs a Data Access Arrangement supplied by the phone company). In addition, it can operate over privately owned voice grade lines up to several miles. Its frequency shift



keying is meant for use with other Modempaks or with 202D data sets. One special feature is an 8 msec on/off time built in for fast polling applications. The unit price for the 18A is about $750. SANDERS ASSOC., INC., Nashua, N.H. For information:

CIRCLE 345 ON READER CARD

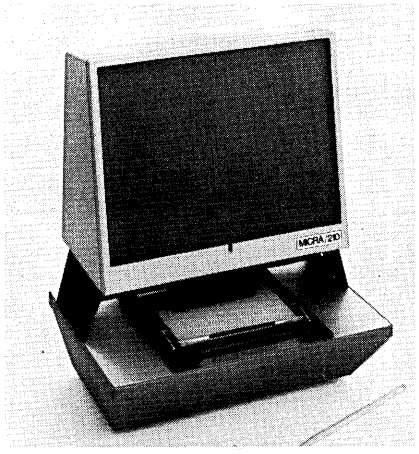
tv to crt

The S/R 1000 is a digital scanner which converts any TV set into a medium for the display of computer information. A Micro Switch keyboard provides the conversational link. The unit attaches neatly to the TV set through the antenna terminal posts, and automatically blanks out programs being televised. An acoustic coupler is used for attachment to a phone. Price is under $3K, with delivery requiring 60-90 days ARO. MEGADATA, Deer Park, N.Y. For information:

CIRCLE 352 ON READER CARD

microfiche viewer

The first product of this Stromberg-DatagraphiX spin-off is the Micra 210, a microfiche reader which can be ordered with lenses for reading 18X,



24X, or 40X reductions. The screen displays images to 75% of full size in blue, and the entire unit is only 9x13x16 inches. It uses normal wall current, sells in the $80-$100 range, and comes with a six-month warranty. MICRO IMAGE CORP., San Diego, Calif. For information:

CIRCLE 349 ON READER CARD

crt to tv

The Execuport 220TV displays the I/O of a data terminal on any conventional TV set. Designed for use with the firm's Execuport 300, it will also operate with any other Teletype-compatible unit. A total of 800 characters may be displayed, at 40 characters per each of 20 lines. Features include page roll capability and a cursor. Price is under $1500, with deliveries scheduled to begin in April. COMPUTER TRANSCEIVER SYSTEMS INC., Upper Saddle River, N.J. For information:

CIRCLE 353 ON READER CARD

core planes

Using a single plane for assembling a core module—with 22 or 18-mil cores laced on one or both sides—reduces the manufacturing costs by eliminating cabling, connectors, and stacking hardware, this supplier claims. In addition, the core planes have many times fewer soldered joints and therefore greater reliability than conventional core stacks do. They also have shorter leads and are capable of higher speed operation—between 1500 and 650 nsec. The cost savings will be passed on to the user, too. For instance, a 4K by 18 stack will cost $812 in production quantities. AMPEX CORP., Culver City, Calif. For information:

CIRCLE 354 ON READER CARD

order/inventory

Order-Flow is an order processing and inventory control system which utilizes a PDP-8/L computer. It is designed to automate the flow of information from order entry, through distribution and credit check, to shipping and billing procedures. O-F is a dedicated real-time on-line system which is installed with the equipment and programming tailored to the workflow requirements of the customer. Service support, training, conversion, and maintenance are provided.

Operation is said to be simple enough to reduce cost of operations and labor. As orders are received, an account number is attached to the order, along with any special pricing or billing instructions. This information is then entered into the system through a teletypewriter, using a question and answer format. The computer will then automatically process a credit check on the purchaser and alert the credit department if a marginal situation exists. If credit is approved, a check is made of inventory availability. A back order is made if the product is not available. If available, the stock is subtracted from the finished goods inventory and the shipping room is notified. After the shipping room has "picked" the order, confirmation is made so that billing reflects what is actually sent.

As many as 20 terminals can be used for input. The PDP-8/L has 8 to 12K core, discs expandable to 524K words, high-speed printer, magnetic tape, I/O interfacing. Price of $168,-250 includes hardware, software, installation, and training. DATA ARCHITECTS, INC., Waltham, Mass. For information:

CIRCLE 355 ON READER CARD

a/d on a card

The Model 310 microverter is a complete analog to digital conversion system contained on a 6″x5¼″x1″ card. Especially suited for minicomputers, the system accepts an 8 to 12 bit a/d converter sample-and-hold amplifier precision reference supply clock and timing circuit, buffered output storage, solid state display drivers and up to 32 channels of multiplexing (expandable to 128 channels). Base price is under $1K, delivery in 30 days. DYNAMIC SYSTEM ELECTRONICS, Phoenix, Ariz. For information:

CIRCLE 356 ON READER CARD

system spotlight

information for this series is invited applications submitted must be installed and operational

STOCK MARKET SYSTEM

message switching

The stock market's data handling problems are no secret. Shorter trading hours and even shorter work weeks have been tried in a forced attempt to make Wall Street's outdated manual order processing methods work in spite of an ever-increasing trading volume. Various computer-based order matching systems have been proposed. The ORDERMATIC system, developed in conjunction with Hornblower & Weeks-Hemphill, Noyes, is one of the working alternatives.

computer and peripherals

Two CDC 3300 processors with 32K words of core storage each; 1.25 usec cycle time
One 266 million character disc storage unit
Eight disc pack drives
plus eight crt terminals, printers, card readers, a card punch, magnetic tape handlers, and remote Teletypes

application

Hornblower & Weeks - Hemphill, Noyes has over 1000 registered security representatives in 64 offices across the nation. These agents generate thousands of buy and sell orders daily which must be communicated to the floor of the appropriate exchange. Transactions that result from the orders must be matched with the customer's original order, verified for accuracy, and communicated back to the originating office. ORDERMATIC is billed as the first computerized system that performs these functions for all securities listed on the NYSE and AMEX boards, and for trades in both odd lots and round lots. In addition, as an on-line real-time by-product of this processing, the system prepares and updates trade data for the analysts. After hours, the 3300 performs many more conventional data processing functions, such as margin accounting, recap reporting, and figuring broker commissions.

Both 3300's are located at Hornblower's Automation Center in New York's financial district. One of the processors is kept as an off-line back-up. The second processor, with its expansive configuration of discs and other peripherals, is linked by a private communications network to the major exchanges and to other areas where mutual funds and over-the-counter securities are traded, and to all of the firm's branch offices.

Each order transmitted to the on-line cpu is checked for proper format, condensed, and stored. Orders that flunk the format test are immediately displayed on a CDC 211 crt terminal and corrected. The computer establishes a routing pattern for each order based on the context of the message and on stored information on each security, including the exchange where it is traded. After the routing path has been established, the order is transmitted to the Hornblower booth closest to the post where the stock is traded. The average message transmission time, from branch to floor, is 11 seconds.

After the execution of the order, the communications process is reversed. The data is sent to the 3300 where it is matched with the original order and a confirmation is prepared. As a part of this preparation the security symbol on the original order is expanded to the full security name, and the customer account file is checked. (The customer file contains personal data regarding whether the account is kept on a cash or margin basis, whether the securities are to be held in trust or joint ownership, and where the certificates are to

The on-line CDC 3300 processor stands back to back with another as one of the precautionary measures taken by Hornblower.

be sent.) Both the customer name and address data and the security master file data are pulled from the 266 million character CDC 814 disc storage system.

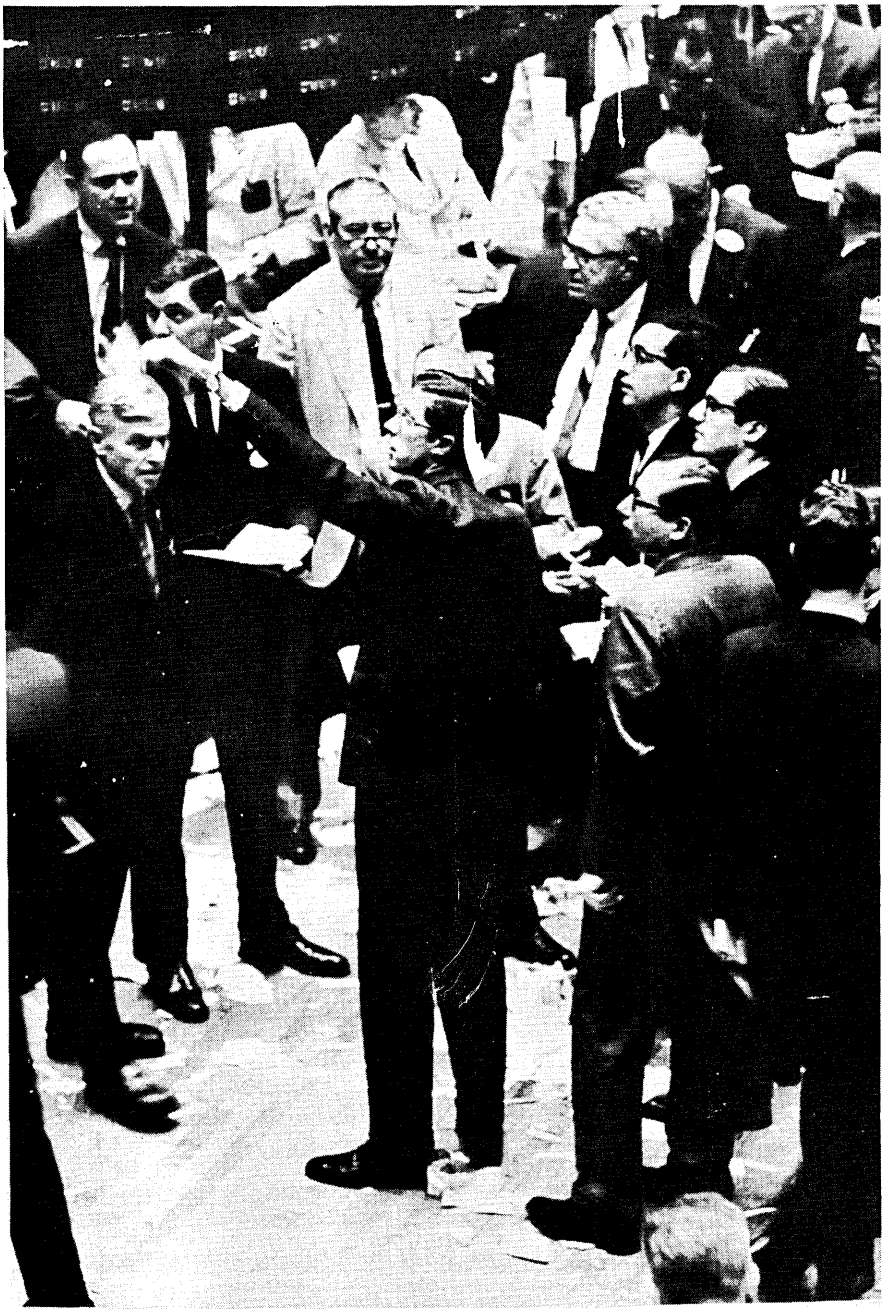
The customer confirmation is expanded with customer name and address, Social Security number, price per share, taxes, commissions, trade and due dates, gross amount, registration fee, and net amount, and printed at the branch office Teletype. This document is the final product of all of ORDERMATIC's cross-country machinations, and serves as the customer invoice.

The information for the expansion comes from several of the discs, and like the redundancy built into the hardware configuration by having two processors, the disc files are repeated, too. One of the six on-line CDC 854 disc pack drives contains only the primary copy of the order file; another is dedicated to a back-up copy. One file is shared by the primary copy of the message switching account information and back-up copies of an expanded order file index, money balances, message switching data, an absolute copy of the program library, etc. Another will be shared by the back-up copy of the message switching account data and a primary copy of something else.

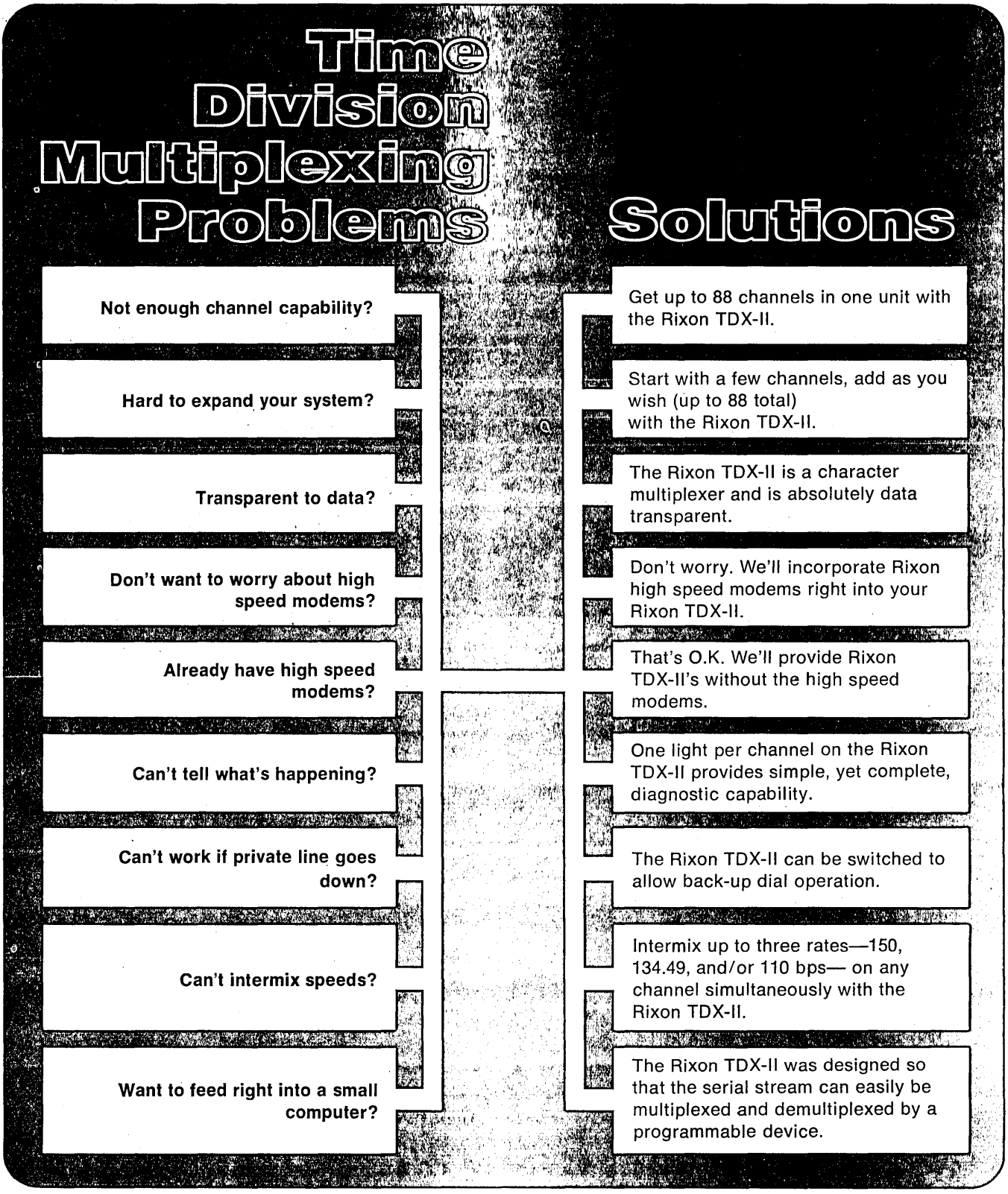
The crt displays are also redundant and dedicated. Two are for supervisory control, two for order correction, two for report correction, and two for manual matching. Even the private communications network is duplicated with a back-up copy.

This may seem complicated, but not when compared to the manual system that the computer replaces. Not long ago, each order received from the branch offices was printed, sent down a conveyor or pneumatic tube to a bank of telephone operators and relayed to the floor of the exchange. There it was handwritten and given to a messenger to be carried to a floor trader.

Putting the process in reverse to deliver a confirmation was more difficult, for the transaction data had to be handwritten, messengered, phoned in, recopied and sent down the conveyor or tube to a teletypist pool to be transmitted to the branch office. The hand matching of a transaction document with the original order had to be done at night, along with the preparation of the invoice and the generation of reports. As the time required to finish this back office work became longer, the trading day was shortened, and the process might have continued indefinitely for Hornblower had the firm not opted to get out of that loop and into an automated system. ■



Some aspects of the exchange, like the flurry of activity on the trading floor, have not yet been altered by computerized systems.



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Experience counts. It means you can count on Rixon. The Data Communications People.

RIXON

Rixon Electronics, Inc./a subsidiary of United Utilities, Incorporated, 2120 Industrial Parkway, Silver Spring, Maryland 20904/(301) 622-2121

CIRCLE 74 ON READER CARD

new literature

ALL THE JOINTS: The American Federation of Information Processing Societies (AFIPS) now has made available on microfilm all the proceedings from all spring and fall joint computer conferences, since 1951. This includes the latest one in Las Vegas last November. The complete set of 35 volumes costs $150. Or three separate sets can be ordered: Spring 1951 through Fall 1961 (Vols. 1-20); Spring 1962 through Spring 1967 (Vols. 21-30), and Fall 1967 through Fall 1969 (Vols. 31-35). These each will cost $50. *Or,* the latter volumes (31-35) may be had on microfiche (usable with all standard microfiche readers) for $10 per volume (each volume represents a single conference). These prices include all charges for postage and handling. AFIPS PRESS, 210 Summit Ave., Montvale, N.J.

BRITISH COMPUTING: Six-page brochure lists publications of interest from The National Computing Centre, nonprofit company sponsored by Britain's Ministry of Technology. Included are such titles as *International Computer Bibliography,* containing almost 6000 abstracts of books and technical reports from 1960-68, *Computers in Distribution, Systems Analysis/Design Working Party Report,* and an NCC Newsletter. SCIENCE ASSOCIATES / INTERNATIONAL, INC., New York, N.Y. For copy:

CIRCLE 251 ON READER CARD

PORTFOLIOS WITHOUT PAIN: Folder itemizes stock market data available and explains operations of a computerized investment portfolio monitor service offered monthly to subscribers, costing an average of 17¢ per security analyzed. Analysis for each stock includes 13 months price history, performance since purchase date, average monthly performance, updated price/earning ratio, percentage of annual yield, and original and current dollar value. A sample monitor sheet is illustrated, with space to record new purchases, sales, and other changes. Monitor services include mutual funds. COMPU-DATA REPORTING, INC., Chicago, Ill. For copy:

CIRCLE 252 ON READER CARD

INSIDE INFORMATION: Eight-page brochure describes the CPA computer efficiency analyzer, a combination control module and counter module equipped with a set of universal high impedance differential amplifier probes. The analyzer can examine up to 18 different computer functions and determine which can be corrected to upgrade the computer's efficiency. All functions can be monitored without disrupting normal operations. Analysis information includes wait and search times, extent of supervisory functions, and which units are overworked. Specs on six models are given, with illustrative photos. COMPUTER AND PROGRAMMING ANALYSIS, INC., Cherry Hill, N.J. For copy:

CIRCLE 253 ON READER CARD

UNFAIL SAFE: Four-page folder gives ratings and specifications of 90% of protection paraphernalia (safes, insulated record containers) used in the U.S. Standards are according to Underwriters Laboratories and the Safe Manufacturers National Association. The listing includes two-hour and four-hour edp safes (as per fire resistance tests) for guarding computer records. The other hazards of burglary and robbery are also safe-rated. All are charted according to a defined code used nationally by insurance companies. SMNA, INC., New York, N.Y. For copy:

CIRCLE 254 ON READER CARD

DISC STORAGE: RAD (for Rapid Access Disc) series of fixed-head rotating magnetic memories are described in four-page brochure. Up to 51.3 megabits are stored in a single unit; units may be combined to store up to 410 megabits. Data can be grouped for interface convenience. Self-testing is provided by 7901 Peripheral Equipment Tester, without requiring com-

"I'm just bustin' to tell somebody."

new literature ...

puter or other control. All is summed up with a spec table. XEROX DATA SYSTEMS, El Segundo, Calif. For copy:

CIRCLE 256 ON READER CARD

DIGITAL-TO-ANALOG: Forty models of Series DA-035 converters are described in six-page bulletin. Selection is comprised of 8, 10, and 12-bit binary and BCD modules, with or without input data storage, available in six output voltage ranges. Part of the bulletin also gives packaging accessories and power supplies necessary for conversion. The converters can drive up to 300 feet of cable. COMPUTER PRODUCTS, Ft. Lauderdale, Fla. For copy:

CIRCLE 257 ON READER CARD

MORE REPORTS, MORE OFTEN: Another volume has been added to *Data Communications Reports,* a standard, loose-leaf reference compilation on the dp industry, which was initiated in 1965. More than 400 pieces of equipment are included in the reports. Updates have also been increased from quarterly to every two months. Besides reports, the compilation also includes charts in system design, common-carrier facilities, and terminal, processing and facsimile equipment, furnished on a subscription basis. AUERBACH INFO, INC., Philadelphia, Pa. For information:

CIRCLE 258 ON READER CARD

DATA ACQUISITION: 20-page brochure advocates the general-purpose approach to data acquisition, citing its flexibility, reliability, reduction of turnaround time and costs, and expansibility. The two acquisition systems described both use the RC70 midi computer, with a 16-bit memory which can be expanded to 16,384 words without additional power supplies or mounting hardware. Specs are included: hardware, physical, programming and I/O capabilities, as well as a computer block diagram. Front end equipment is also detailed for both systems. REDCOR CORP., Canoga Park, Calif. For copy:

CIRCLE 259 ON READER CARD

NO MISSING LINKS: Communications processors that furnish interconnecting links for both host computers and remote terminals are detailed in 12-page brochure. The remote processor can handle a group of terminals in the same building or coupled through data sets and line control units over longer distances. A front-end processor can accommodate both low speed and voice grade lines, combining the advantages of "firmware" and software. A remote batch terminal controller combines the capability of remote job entry with local processing. The resulting system is programmable, accepting a variety of protocol requirements from party line to switched network. Interfacing hardware and the available software library are summarized, and a standard instruction repertoire is given. INTERDATA, Oceanport, N.J. For copy:

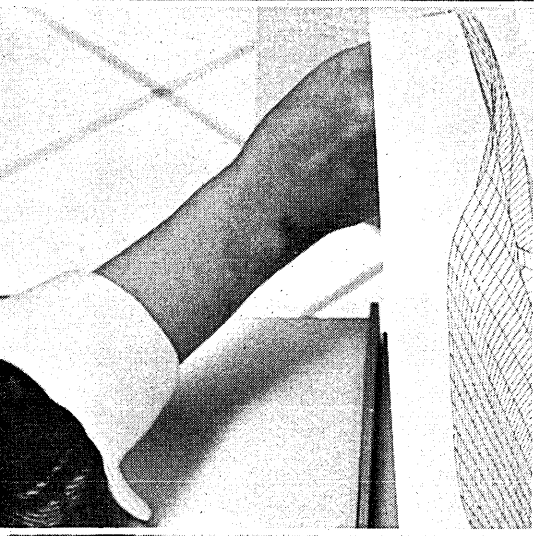
CIRCLE 255 ON READER CARD

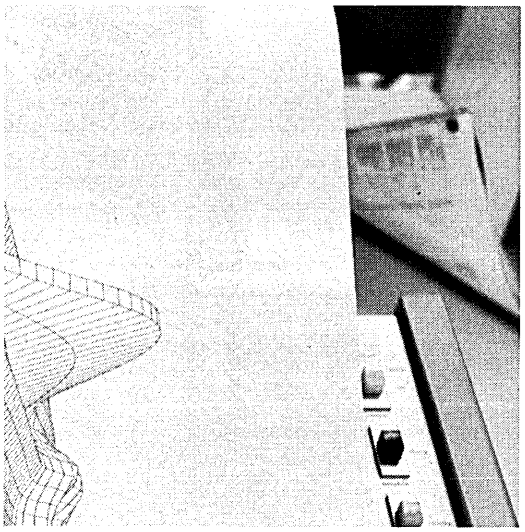
WHITHER COMMUNICATIONS?: 44-page booklet furnishes proceedings of IEEE conference, titled "Where Is Technology Leading Communications?" held last February. Special emphasis was placed on computer and automation techniques in various communications fields. Proceedings cover 15 papers in four sessions: applications to setting text; nonprint media for technical communications; applications to setting formulae and tabulations, and the next five years in editing technology. Volume EWS-12, Number 2. Cost:

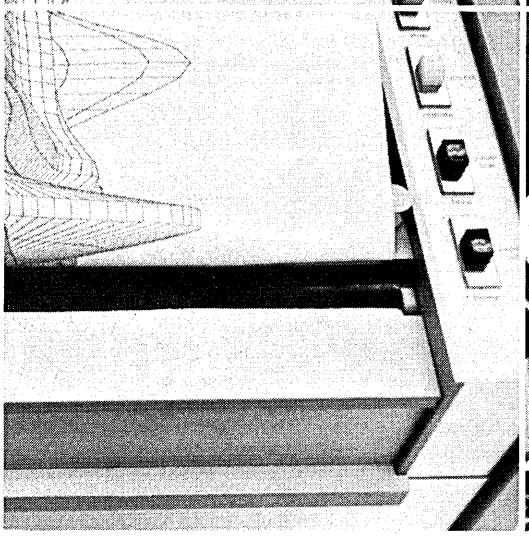
$2.50 for IEEE members; $3.75 for public libraries and colleges; $5 for others. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 345 E. 47th St., New York, N.Y. 10017.

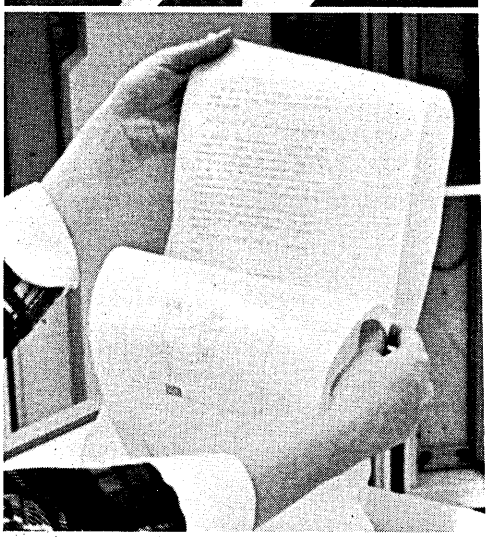
AUTOMATED PUBLISHING: More than 80 papers primarily concerned with typographic computer applications in printing and publishing are summarized in 120-page book. They were originally given at a seminar on automated publishing systems last September at Newcastle-upon-Tyne, England. Subjects range from computer-oriented editing to high-speed photocomposition output. Emphasis is on basic design and economic implications of total systems. The affiliations and mailing addresses of the speakers are also included. Price: $5. COMPOSITION INFORMATION SERVICES, INC., 1605 North Cahuenga Blvd., Los Angeles, Calif. 90028.

DISPLAY FUTURES: Report gives predictions, facts and figures on the crt market. Created as a planning tool for companies developing and producing display terminals, it details market growth and technological advances. It also lists potential markets for display










UNIVAC 1108

"The Clevite electrostatic printer increases our printout capability anywhere from eight to two hundred times."

That's how Mr. Stanley Y. Curry, President of Chi Corporation sums up their experience with the Clevite 4800 hardcopy printer.

A Cleveland-based computer service firm founded by Case Western Reserve University, Chi wanted a fast, versatile printer to complement its third generation Univac 1108. Chi uses its Clevite 4800 printer to perform a wide variety of highly sophisticated scientific and engineering computations, for both the university and over 100 customers currently using the firm's many services.

Here are some more of Mr. Curry's observations . . .

"We use the Clevite 4800 in three principle areas . . . text editing; intermixing text and pictures; circuit diagrams, plotting and perspective drawings. Currently, we're experimenting with applying it to our billing procedures and are exploring its use for high-speed label printing. It looks as if the printer is useful for just about any output.

"Take text, for example. The 4800 is ideal because of the speed with which it provides copies. Change, delete, add, then program the computer accordingly. Almost instantly the electrostatic printer provides a clean copy of the edited material.

"Our experience with core dump has been quite impressive. Here is an area where the printer's diagnostic ability really comes to play. Our computer stores some four million binary bits of information, and core dumping used to take around twenty minutes. With the Clevite Printer, we're now completing a core dump in just two minutes," Mr. Curry concludes.

MORE FACTS ON THE CLEVITE 4800

Clevite 4800 reproduces signals from any source of digital input or data transmission by telemetry, radio microwave, and/or land line. It produces accurate printouts of both alphanumerics and graphics almost as fast as the computer supplies them.

A productivity rate of 412,000 characters per minute means fast-acting computers are no longer hampered by mechanical equipment, noisely hammering out a few hundred lines per minute.

No other printer gets as much out of your computer as fast as Clevite 4800. And no other printer is so economical. The Clevite 4800 reduces capital investment, because conventional equipment costs more per unit. Also, there are few moving parts, reducing the need for constant maintenance and servicing.

Clevite 4800. It's faster, more versatile, quieter, and more dependable than anything else you can buy.

Drop us a line to find out how it fits into your computer room. Graphics Division, Gould Inc., 3631 Perkins Ave., Cleveland, Ohio 44114.

GOULD **CLEVITE**

Clevite 4800. The next generation of high-speed printers.

CIRCLE 174 ON READER CARD

new literature ...

and 230 potential large customers, and examines eight display manufacturers considered to have the greatest growth potential. FROST & SULLIVAN, INC., New York, N.Y. For information:

CIRCLE 260 ON READER CARD

AUDIO/VISUAL CONTROLS: Application of small computer techniques to audio/visual systems is described in four-page brochure. Called Local Lesson Control, the system uses computer-type circuitry to make every A/V device in an educational or other information center instantly available. The system can be operated by grade school students, and their possible pranks won't interrupt the controls or other monitors—the same for other classes or centers using the facility. There is two-way signalling between control stations and the A/V devices; signals are in computer language, and the system can be interfaced with mag tapes or cards. New stations and devices can be added by plugging in circuit boards. VALTEC CORP., Irvine, Calif. For copy:

CIRCLE 261 ON READER CARD

GET SET: Four-page folder gives round-up information on seven types of data sets, from limits of 300 to 9600 bps, for transmission over telephone, cable, microwave, UHF, VHF or other 3Khz voice frequency communications circuits. The modems are compatible with all dp equipment with standard RS-232 B or C interfaces. Three modulation techniques may be used: AM vestigial sideband, frequency shift keyed, and phase shift. Specifications are charted on the back page. RIXON ELECTRONICS, INC., Silver Spring, Md. For copy:

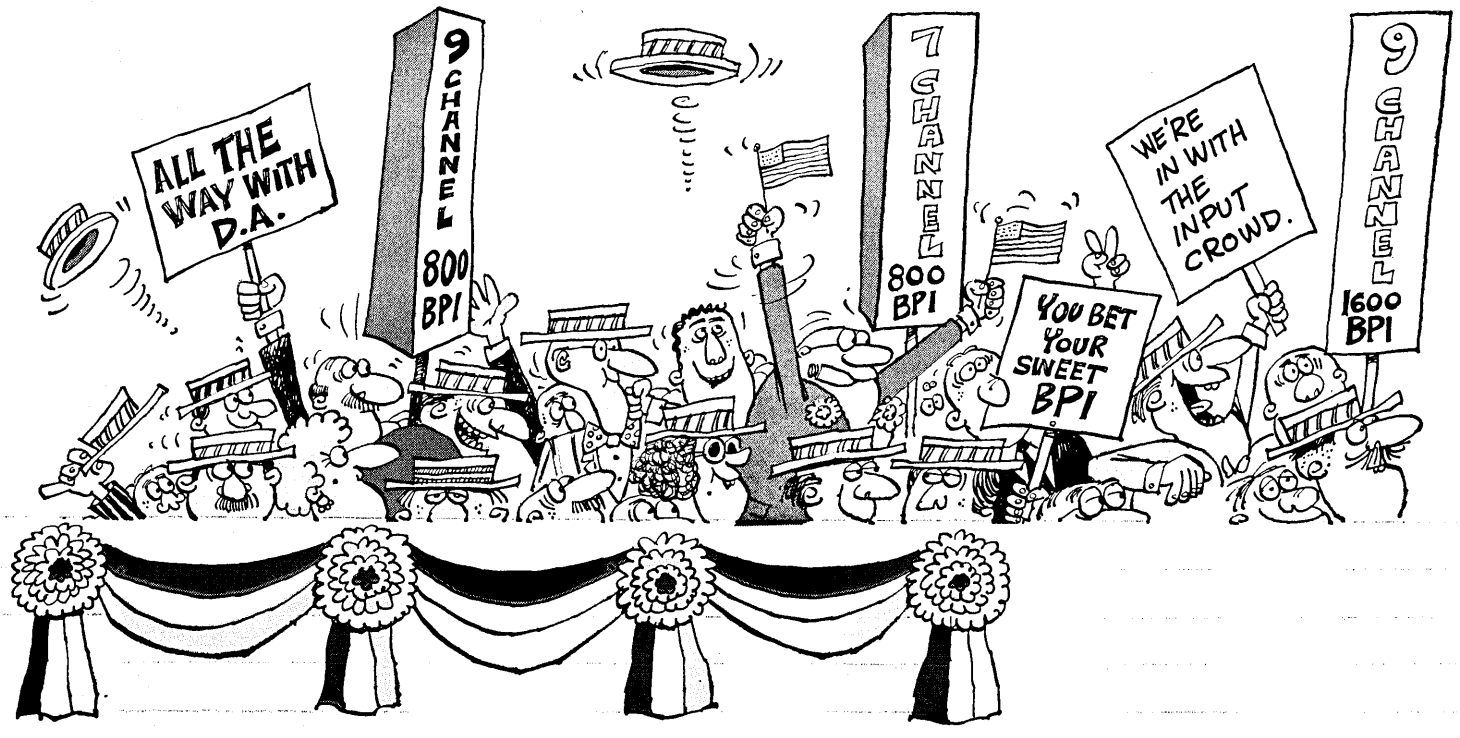
CIRCLE 262 ON READER CARD

GOOD FOR THE SYSTEMS: A detailed summary of the GRI-909 computer is given in 12-page booklet. The 909 was designed and developed as a direct function processor for system control, i.e., as applied to metalworking, chemical, aircraft and printing equipment. The language it uses is oriented functionally, not arithmetically. Every device in the system, both inside and outside the computer, is directly addressable by programmed instructions. Since the 909's structure is open-ended, other functional modules can be added. Basic elements of the computer are itemized in detail in a special pullout section. Software routines are itemized, with instruction examples. Physical, electrical, functional and environmental specs are rounded up on the back page. GRI COMPUTER CORP., Newton, Mass. For copy:

CIRCLE 263 ON READER CARD

MEASURE FOR MEASURE: 45-page illustrated booklet, *Measuring Systems and Standards Organizations,* covers the history of measurement, as well as present information about its diverse forms and efforts to standardize them, mainly through the metric system, the growth of which is followed in detail. The long-range effects of standardization for industry are discussed, with the status of present commercial and industrial standards, both in the U.S. and overseas. The organizations concerned with this work are noted, as are recent changes in metric units of measure. Price: $1.25. AMERICAN NATIONAL STANDARDS INSTITUTE, INC., 1430 Broadway, New York, N.Y. 10018.

DATA ENTRY: Six-page folder ticks off the main features of KeyTran keyboard data entry system. One of them is that information can be entered simultaneously from up to 48 keyboard data terminals onto a disc. Cards and individual tape reels are eliminated, and the end product is a single consolidated tape reel ready for input to any computer. A supervisor's console al-



lows coordination of all the work that goes through the system, and provides a way to suspend, reassign or erase jobs from the disc file. Data can be collected, compiled and verified. SYSTEMS ENGINEERING LABORATORIES, Fort Lauderdale, Fla. For copy:

CIRCLE 264 ON READER CARD

COMPUTER CONTRIBUTIONS: First of a series of "Computer Contribution" reports to be released by the U.S. Geological Survey is on weighted triangulation adjustment (52 pages). Future open-file reports will include computer program descriptions and computer related material which in addition to mathematics will encompass earth sciences, engineering, accounting, and the administrative field. COMPUTER CENTER DIVISION, U.S. GEOLOGICAL SURVEY, Washington, D.C. For copy:

CIRCLE 266 ON READER CARD

PSYCHOLOGICAL EXPERIMENTS: Eight-page brochure explains INTERACT, an interface control system to monitor sequences of events in both human and animal response testing. Designed mainly for lab experimenters, it operates with the ACT language, and can be used with virtually any 4, 12 or 16-bit general purpose digital computer. The investigator can write his own program of procedural and data recording requirements without special training. Significant raw data is printed out on an ASR33 Teletype. A systems block diagram takes up the middle spread. System hardware is numbered and described. Software functions are shown, with printout samples. LEHIGH VALLEY ELECTRONICS, INC., Fogelsville, Pa. 18051. For copy:

CIRCLE 265 ON READER CARD

DATA MANAGEMENT: A multi-terminal, on-line file management system with time-sharing capability is detailed in eight-page brochure. The Video Data Management System can be linked to 12 display terminals and nine teletypewriters. System applications in manufacturing, education, distribution, utilities and banks are given, with a description of the t-s language (BASIC), and the store-and-manipulate real-time operating system, SAM. GENERAL ELECTRIC INFORMATION SYSTEMS, Schenectady, N.Y. For copy:

CIRCLE 267 ON READER CARD

MINER'S MANUAL: 952-page hard cover book published by the Society of Mining Engineers is a guide to the use of digital computers in the mining industry, covers developments over the last 10 years. It also covers the proceedings of the International Computer Application symposium held in Salt Lake City last September. It is edited by Alfred Weiss, director of the Scientific and Engineering Computer Center of the Metal Mining Division of Kennecott Copper Co. Scope of the book is international—it explains techniques such as "Kriging," comparatively unused in the U.S. Illustrations, indices and a glossary are included. Cost: $23; $18 to AIME members. AIME, 345 E. 47th St., New York, N.Y. 10017.

KEEP SUPPLIED: Fold-out brochure describes an entire line of dp supplies, including processing cards, stock and custom forms from long-run continuous to small volume snap sets, high speed printer and dp ribbons, binders and accessories, and specially imprinted as well as blank stock labels. Also carried are mag tape, disc packs, cartridges and cannisters, or wrap-around seals. A back-up card design center is available for rush jobs and special requirements. INFORMATION SUPPLIES CORP., Northbrook, Ill. For copy:

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CalComp finally steps out of line.

For years, friends of our CalComp plotters have been waiting for CalComp to make something else.

Well, friends, this is the day you've been waiting for.

Now CalComp brings you, in addition to the world's leading computer graphics systems, two major new product lines:

Disk drives.

And Punchmaster.

And we think you'll be pleased about both.

Our disk drives work twice as fast. For about half as much.

CalComp's first disk drive is called the CD-1. And it's available today.

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And because the CD-1 is utterly simple, it's a lot faster, too. With an average access time of just 30 milliseconds.

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Of course, if our CD-1 interests you, so will our bigger CalComp CD-12/14, an 11-disk drive system available early in 1970.

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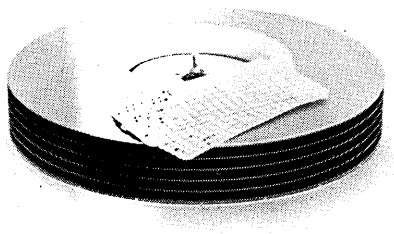

CIRCLE 151 ON READER CARD

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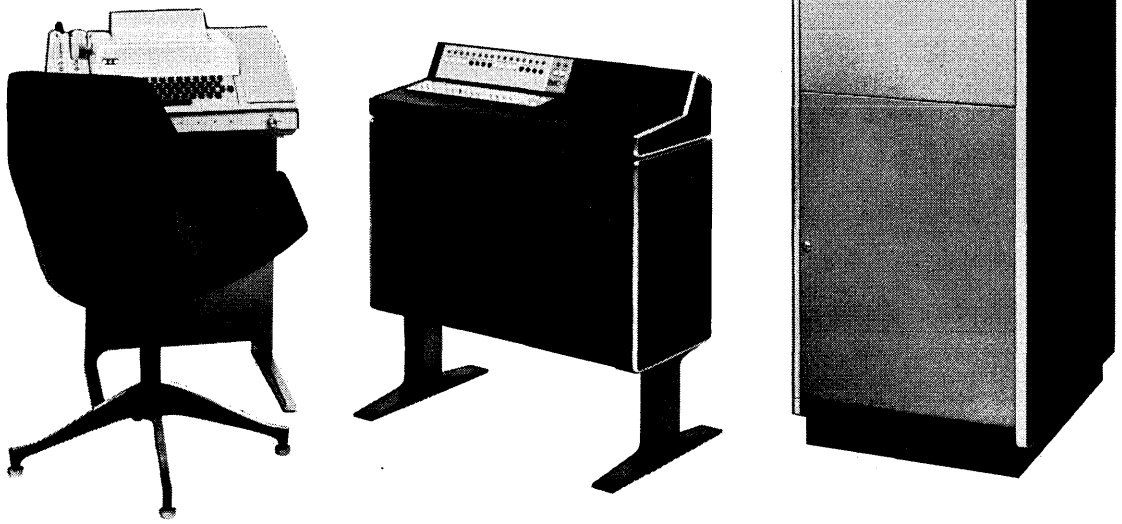

Tempo I's standard hardware priority interrupt system responds in 2.3 microseconds. Coupled with a 325 nanosecond access time, Tempo delivers speed that really means something. But, that's not all. For a basic price of $15,600, you get a real system that includes: 4K of memory, 900 nanosecond cycle time, 14 hardware registers (eight general purpose), register to register operation, hand-shaking I/O, 4 hardware priority interrupts, 14 addressing modes, more than 100 hardware instructions, complete software packages including USA Standard Fortran IV and a macro assembler, plus an ASR 33 teletype. Tempo I is available in a handsome console or a 60" high rack with room for over 12 peripheral controllers.

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TEMPO

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"concentrating on stabilizing the system" and hope to have an operational date set this month.

The costly results have been little but test use of 2200 crt's and a high speed communication system installed since early '68. Volume requirements have increased the number of 1108's from three to six, two being used as front ends until Univac delivers a new system in the works. Applications for the next few years have been cut back to major passenger-related jobs, and other tasks like materials control will go on a separate system. Cost? No one knows yet.

TWA? Rumor says that this month they will announce either a new system or a new vendor. American has finally given up trying to use OS, SABRE's 7090's are overworked, so PARS (IBM's airline package) will be installed.

BR continues to serve United and TWA, in there with those on-line solid-state Telefile computers since the early '60's. In fact, National still has two BR-335's, waiting to go 360, and Braniff, finally cut over to IBM, is serving smaller airlines with its 335's. And somewhere abroad, there's a vacuum tube Reservisor II in use . . .

ANOTHER USER GROUP VIEWS INCORPORATION

Although no lawsuit is foreseen, the threat of one has shaken up another IBM user group, COMMON. Last spring, the group of small-computer users published a comparison of the IBM PLAN (Problem Langage Analyzer) and PLT, two software packages with civil engineering applications. The latter is said by its developer, Aspen Computer Science (Aspen, Colo.), to be an improved version of PLAN.

Asserting the published comparison was inaccurate, ACS head Dick Taylor implied he was considering legal action and asked the group to publish his rebuttal. Taylor will probably achieve this without a suit, but he's also managed to scare COMMON into taking steps to incorporate, much as SHARE plans (see Dec., p. 264), to protect its officers. COMMON, seeking to fend off other legal action, has also been careful at its meetings to restrict software companies' presentations to technical info only--no prices, please, and no sales pitch.

ASK NOT WILL IT WORK, ASK ONLY HOW MANY YOU CAN GET

Viatron has indeed delivered System 21's. The firm may be running late due to all kinds of production problems ("You name it, they've had it," says one user), but a survey of four bonafide users elicited enthusiasm for the ten bare-bones systems they are testing. In fact, one thinks the 21 is the "greatest thing since night baseball." The systems, most delivered in November, include the basic terminal and card conversion units. The only problems encountered so far in the brief testing are a faulty tape recorder subassembly and the keyboard format--both being corrected.

New England Tel & Tel (the Bell System test facility for the 21), ordered and has installed four units and expects to take on more if the tests "continue so successfully." "Beautiful" and simple operation, ease of formatting, good training, and immediate response to maintenance calls are among the praises this user heaped on Viatron. Pepsico, which has one of the eight units ordered, is happy so far and intends to test them in numerous applications. But it awaits addition of: 512 of the 1024 words requested for the microprocessor, verification capability for the terminal ("sight verification just isn't enough") and communications and mag tape conversion equipment. The latter units are promised for January, but users expect this to slip to about March.

(Continued on page 231)


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look ahead

IS YOUR SOFTWARE TICKING SOFTLY?

You may get a time bomb with your proprietary package from On-Line Computer Corp. and Mandate Systems Inc., if you don't pay your bills. An illegal instruction planted in assembly language programs will cause them to self-destruct after a certain number of uses, says Jerry Wiener, founder of both firms.

On-Line, Stamford, Conn., was started last May and is the "east coast entry" into LSI-based time-sharing and communications systems. Quiet about the details of hardware plans (but actively looking for more financing), Wiener does note that the firm has a hardware technique for protecting against unauthorized use of packages in higher-level languages: Simple pre-wired instructions that go to supervisory status will be necessary to run COBOL, FORTRAN, etc.

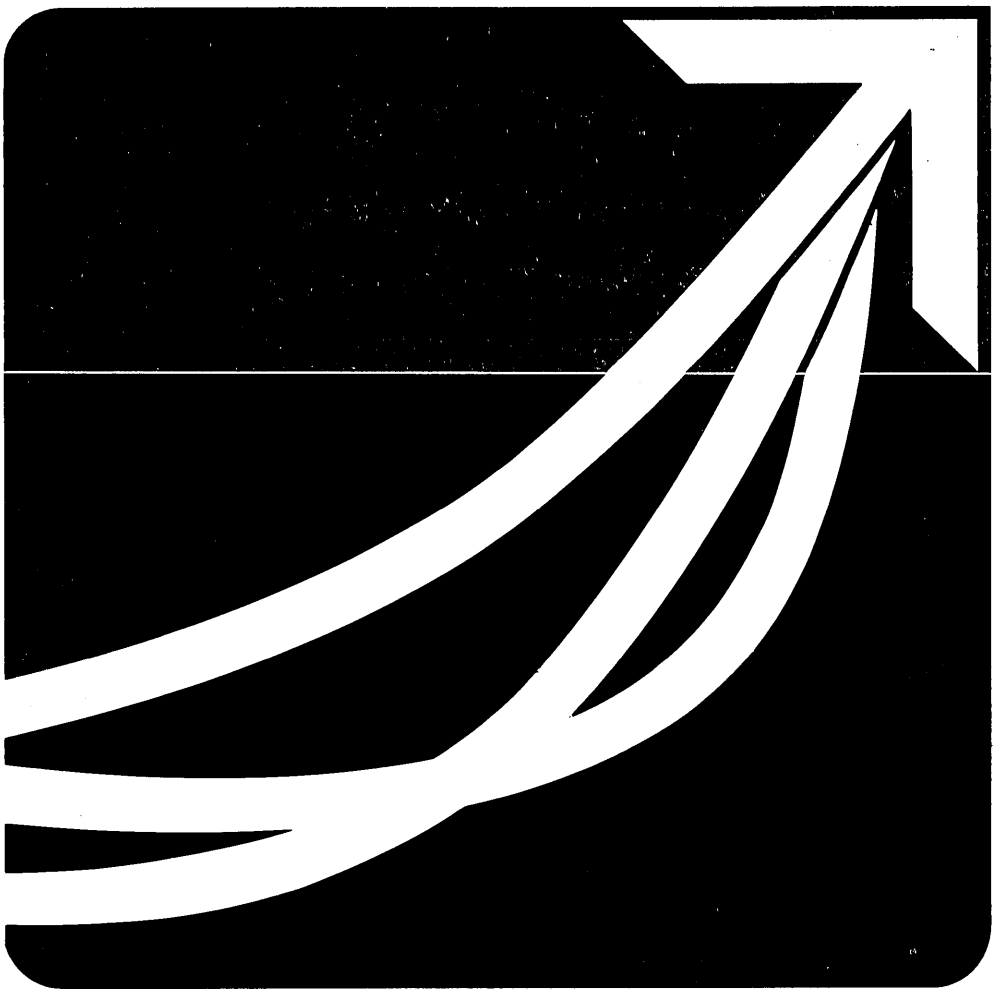
WHAT DOTH IT PROFIT SDC?

In one move toward becoming the profit-oriented firm it plans to be, Systems Development Corp. will drop its technical library setup, which doesn't please many SDC'ers who consider it a valuable adjunct. another unpleasant development is that SDC continues to lose middle-level people who don't know where they stand in the new structure as far as stock options, etc., are concerned. Matter of fact, neither do most in the upper level. Decisions continue to come slow, according to our source.

RUMORS AND RAW RANDOM DATA

In moving from DOS to OS, a user can expect his throughput to be improved by a factor of two to three, according to Boole & Babbage Inc., develpers of system measurement software. In OS, they find time spent in the program, while in DOS it's spent in the system . . . The State of Minnesota is determined not to pay IBM $100K in rent for two disastrous months of 360/40 failures during tax-return time last year . . . In great expectations that IBM will be forced to separate maintenance prices from rental, three maintenance companies are now in the planning stages, good sources say. Mixed vendor installations will be the target . . . Why is IBM underplaying APL? We hear it's spreading like a virus, but even IBM people are split into love and hate camps and promotion is nearly nil . . . There seems to be an inverse correlation between the latest equipment and making money. One example: Bunker-Ramo's Telequote system, said to have some 20,000 terminals installed bringing in a profitable $300 a month each, on the average. And it's all done with 10-year-old homemade computers. The system is being updated now--but with tried and true Univac 494's . . . At least some IBM branches are trying to sell SE services to non-IBM installations . . . Diablo Systems, Inc., Hayward, Cal., will unveil a portable removable disc cartridge this month. Aimed at the small computer market, the unit will permit replacement maintenance, requires no internal adjustments . . . Users are more than restless over CDC's "what's yours is ours" unbundling contract clause. The FOCUS user group is waiting answers to 28 pages of questions, has passed a resolution as well, stating that any software previously discussed by CDC reps at user meets should not be charged for on a brand new basis, since it had been anticipated as part of a package . . . Fallout from IBM unbundling: Computer Sciences has captured about six "time and material" systems engineering contracts from IBM users in New York, is negotiating for six more. CSC says New York will be fantastic market for independents.

SMIS



THE SOCIETY FOR MANAGEMENT INFORMATION SYSTEMS INVITES YOUR PARTICIPATION

Many management people and information systems professionals have strongly felt the need for a new society dedicated to continuing evaluation of the emerging art and science of MIS, development of meaningful informational programs and publications and the conduct of original research and development where needed. The Society for Management Information Systems has been formed by a group of leading executives and management information systems professionals who believe a void can be filled by an action-oriented MIS society. Your participation is invited.

Regular memberships are available for individuals. Corporations and institutions may wish institutional membership. Student memberships are also available.

Write to: Richard E. Dooley, Secretary
The Society for Management Information Systems
One First National Plaza, Chicago, Illinois 60670

world report

USUAL EXPLOSION PREDICTED

Market analysts of the European scene are predicting an explosive growth of the service industry as the big development over the next 12 months--which should mean megabuck business for the terminal makers and minicomputer specialists prepared to tailor multiplexors for extending existing cpu's for time-sharing. Many of the major users such as engineering and banks are expected to turn their surplus capacities onto the service bureau field. Rumours are strong that companies like Rolls Royce and Lloyds bank are preparing to take this step. These particular two are big IBM users, with the aerospace company having over 1,000 systems men and programmers behind its computer enterprise. Rolls Royce has IMIS, computer aided design and numerical control systems, running smoothly for its large aero-engine manufacturing plants. But the group is capital-short to go alone into the service business overnight. Lloyds is expected to produce finance and provide some marketing opening. Rolls recently ordered a batch of OCR readers, which has been taken as a sign of intent to capture commercial dp work.

Another big British engineering combine, Simon Carves, is also tipped to join up with one of the major banks in a similar way. Simon Carves' specialty is capital plant for the steel and chemical industries, and industrial automation systems. In the same vein, the German postal and telecommunications authority is to establish a computer network service similar to one built up by the British Post Office with its National Data Processing Service. France is expected to follow suit. Another prediction for France is a $1.3 billion turnover by the end of '71 with more than 80% in big systems and 60% still being manufactured by IBM.

CHALLENGE FRENCH MONOPOLY

French politicians have rarely been critical of the Plan Calcul under which the main manufacturing houses were brought together to form CII as the central main frame producer. But that was all under De Gaulle's reign. With a severely sagging economy, rumbling has turned to grumbling and a member of the French General Assembly, M. Michel Poniatowski, attacked the position of CII as a "de facto" monopoly supplier to government departments, thus raising the spectre that has haunted outsiders trying to sell to UK government departments. However, the French onslaught on CII pivoted on the slippage in the manufacturer's programme, which Poniatowski maintains is harming government administration because civil service departments are not being allowed to get on with modernisation.

But CII feels under no pressure to remedy the troubles because buy-French policies remove any competitive threat or possible stimulation that could come from either American or European competition. Even worse, according to M. Poniatowski, is that government departments are obliged to trade in foreign systems for French ones (which, believe it or not, are often foreigners themselves skulking under a new badge)

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ATI is an accredited member of the National Home Study Council. It was organized by the publishers of "Datamation," foremost magazine in the computer field. It is directed by a P.E.-author and a Doctor of Education-administrator, and guided by a board of college deans, engineers and EDP scientists.

and carry the cost in money and delay for reprogramming. The champion of the infidels believes France has less chance of winning its gamble with Plan Calcul than it did three years ago. And incentives must be applied to get the programme moving or it will become a dead weight on an already burdened economy. Over $150 million has been spent on the Plan in the past four years, but this is only about 2% of that committed to nuclear energy, which has been a disastrous flop.

RIDE THE METRA

The Metra consultancy's service group, SIA, is branching out into the time-sharing field in a big way, adding CDC 3300's in Paris and London to existing 6600's. SIA has also collected $4 million in contracts from CDC for software development. The major contract for $3 million is a joint CDC/SIA project for an advanced time-sharing system on the 6600 series, and to be known as the ATS 6400, for completion in '72. The the giant 7600, to be known as Orphelie III, and is an extension of a system developed earlier for SIA's own 6600. Other arrangements are for CDC to make the existing lp version available to users.

BITS AND PIECES

Honeywell has moved into South Africa in a jointly funded operation with National Fund Investments. There are about 400 installations in South Africa at present, split between the usual names like IBM, ICL, NCR, Burroughs, and CDC . . . A software protection conference at Brighton showed that programmers don't understand law and lawyers don't understand computing. Progress toward legal protection for software was minimal . . . Plessey company has taken over the numerical machine tool control interests of Ferranti . . . Compact, a computer assisted marine radar display introduced this year by the UK General Electric Company is being demonstrated in the States. Compact, for Computer Predicting and Automatic Course Tracking, is designed to prevent collision in poor visibility or crowded waters . . . The central research labs of the British Steel Corporation have designed a mobile process control system around a Con-Pac 4020 for testing out control models on rolling mills and strips mills before installation of a permanent system . . . Software house Polhemus Navigations has written the simulation software for the take-off and descent models of the supersonic Concorde airliner . . . U.S. Trade Centres in Europe are staging exhibitions of American data transmission equipment . . . Sweden's biggest merchant vessel, the 210,000-ton Sea Sovereign has put to sea with an ASEA 1700 computer on board for guidance and navigation . . . IBM's service centre in Rome is using a 360/40 to trace the Etruscans. Archaeologists from Rome to Bonn have devised a system by which they believe they have developed a field survey system that will point to sites inhabited by the forerunners of the Romans . . . Committee TC4 of IFIP is the organization's first user body and deals with medical computing. It is arranging a specialist conference at Lyon in April in medical record computing . . . IAG, the business data processing half of IFIP, held its first major meeting in the UK last month in Computer Management. Largely attended by the Dutch and Germans, it updated those not fortunate enough to go to places like the jcc's.

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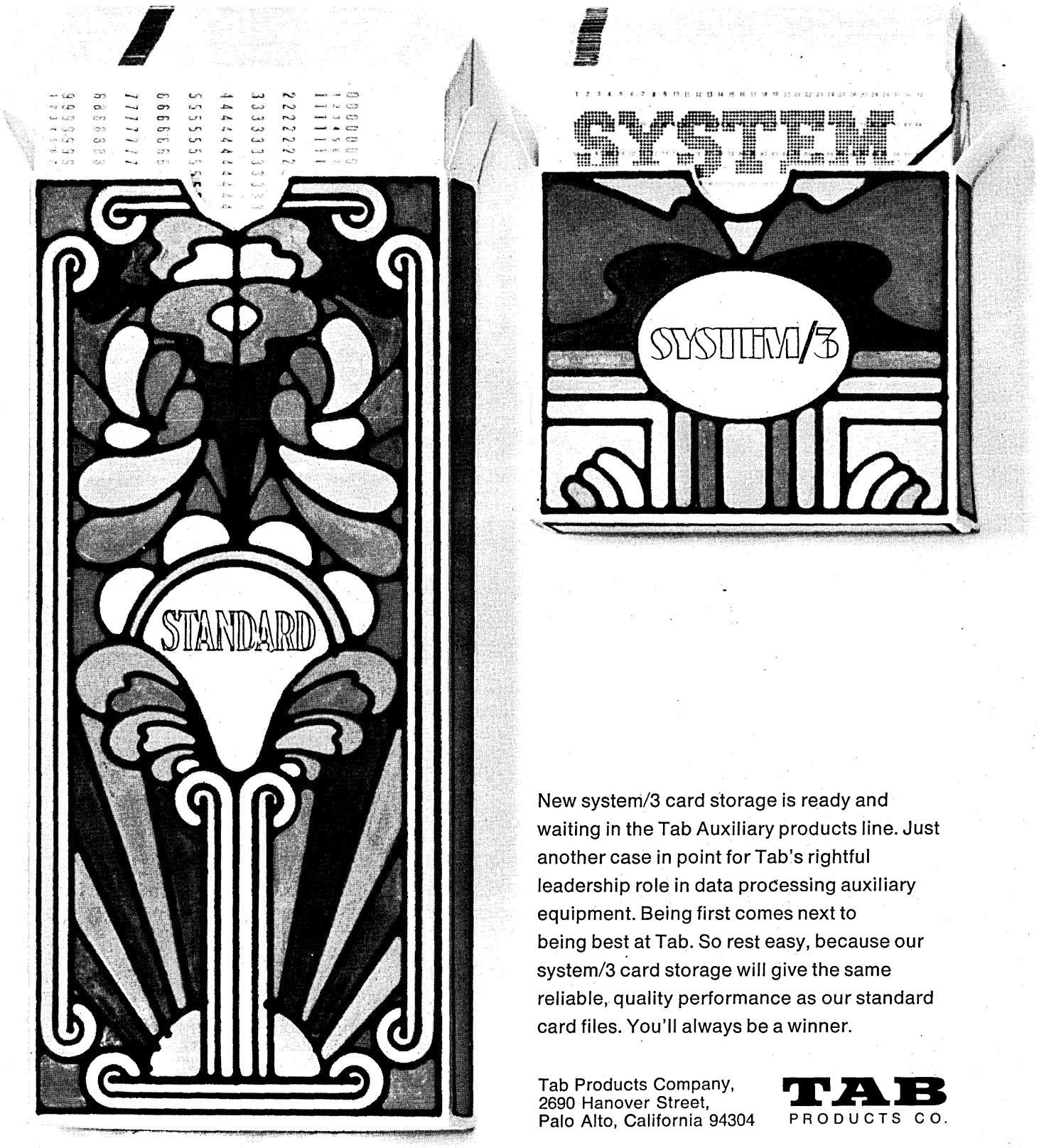

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CIRCLE 53 ON READER CARD

washington report

GSA TESTS T/S SERVICE TO OTHER FED USERS

GSA is scheduled to start an experimental, interactive t/s service for other federal agencies this month, using a GE 440 in Atlanta. The agency is aiming for a price "at least 15% below the lowest national rate." The experiment will last six months. If it works, service will be expanded "within the constraints of BOB Circular A-76"--i.e., wherever significant savings are attainable in comparison to commercial rates. GSA's Atlanta experiment will begin with 5-10 terminals, and can expand to 50. The break-even point reportedly is a load that soaks up "about 45%" of the 440's available machine time and I/O capacity. Six hours of prime time will be available to users of the new t/s system, 5 days/week. Users will be linked to the 440 via two dedicated, nationwide federal communication nets--Advanced Record System (ARS), which provides low-speed tty channels, and Federal Telecommunications System (FTS), a voicegrade network.

GSA wants to expand the present test to include remote batch applications, possibly at other sites.

SURF'S UP FOR MICROWAVERS

FCC was asked to license another data common carrier last month--New York-Penn Microwave Corp., which wants to compete directly with MCI-New York West between Chicago and NYC-Philadelphia by offering allegedly better service. Among the "unique features" of the New York-Penn offering are end-to-end service, "customized bandwidth" for handling slow- and medium-speed data, alternate and shared voice/data service, a max error rate of $1:10^7$ bits, transmit speeds of 50 bps "through all the commonly-used data speeds" to 80 megabits, and "substantially lower rates than domestic wireline carriers offer."

NY-Penn's local loop would consist of a "distribution center" near clusters of customers, to which each customer would be linked by channels obtained by NY-Penn from the local telephone company. NY-Penn is a subsidiary of the Newhouse Broadcasting chain, which already operates a CATV system in NY and Pa., and recently won an ETV system contract from the latter state. The license application stressed that maintenance and tower costs of the proposed common carrier network would be shared with these other activities.

COMMITTEE TO WRITE NEW COPYRIGHT LAW

New copyright legislation has been approved by a Senate Judiciary subcommittee. The bill establishes a 13-member commission to study new technological applications of copyrighted works for 3 years, then recommend changes in the copyright law. Applications involving adp and machine reproduction systems are explicitly mentioned. The bill would allow present uses of copyrighted materials in such systems to continue unaltered. The study commission would be composed of the Librarian of Congress, plus four members representing copyright owners, copyright users, and the public.

CAPITOL BRIEFS

GSA reportedly is thinking about buying Cobol compilers centrally for all federal agencies, to cut costs. A decision is "6-12 months away."

people

International Correspondence Schools, the 80-year-old organization that has been the way to promotion and pay for many who could not attend regular institutions of learning, has named **William C. Norris,** head of Control Data Corp., as its "Home Study Man of the Year." The award is not actually annual, since only nine have ever been given. ICS said it bestowed this one not only because of its ex-student's obvious success and self-determination, but because he "has gone further by making education and training available so that disadvantaged people can also exercise those attributes and break out of the grip of poverty". . . . Others have been honored by election to association posts: **Dr. John V. N. Granger** is president of the IEEE for 1970. Chairman of the board of Granger Associ-

ates, Palo Alto, Calif., the new president succeeds **Dr. F. Karl Willenbrock.** New vice president is **Dr. James H. Milligan, Jr.,** executive secretary of the National Academy of Engineering. . . . **C. W. Spangle,** of Honeywell, has been elected board chairman of BEMA; vice chairman is **R. H. Herzog** of 3M; the new chairman of BEMA's data processing group is **H. S. Forrest,** vice president of government relations at Control Data. . . . WEMA has elected **Harold R. Frank** as president, succeeding **Richard A. Campbell.** Frank is founder and president of Applied Magnetics Corp. in Santa Barbara, Calif. **Dr. John A. Jamieson,** manager of Aerojet-General Corp.'s electronics systems operations, has been named technical program chairman of WINCON '70, the 11th annual aerospace and electronics systems convention which will meet Feb. 10-12 in Los Angeles. . . . GUIDE, the users organization, has named as president **Herbert Seidenstickler** of Combustion Engineering, Inc., Windsor, Conn. . . . And UNIMED International, an organization of Univac computer users in medicine, has elected **Dr. Marvin Rosenberg** president. He is a medical coordinator of Travcom, The Travelers Corp. subsidiary. . . . *Law and Computer Technology,* the monthly publication (from Washington, D.C.) of The World Peace through Law Center, has two new editors: **Franklin E. Alan** and **Claudia R. Barquist,** associate. . . . The impressive title of Intercorporate Director of Urban Programs has been given to **Wilber E. Smith** at Planning Research Corp. He has held high-level urban management positions in Washington, D.C., and San Francisco, will be responsible for long-range urban programs and "specific large projects". . . . **William S. Wheeler,** new vp/gm of the commercial electronics division at Sylvania Electric Products, is responsible for introduction of new products to broaden that company's position in information electronics. **Frederick J. Anderson** has been appointed vp/gm of Sylvania's communications systems division. Both will be based in Waltham, Mass. . . . Also in Waltham, Honeywell has promoted **J. C. Chu** to be vp of planning and development for its computer and communications group, comprising five divisions. Chu has served since 1963 in a similar post for the electronic dp division, now is responsible for long-range planning and technical/design standards for the Computer Control, International Computer, Communications, Information Services, and Communication-Data Products divisions as well. He was associated with the historic ENIAC (first electronic computer) project back in '45. . . . **James P. Hynes** has left Teledyne, where he was group exec responsible for seven divisions, to become president of Standard Computer Corp. in Los Angeles. Former president **Fred J. Howden, Jr.** has be-

come chief executive officer as well as chairman; directives from both of them will be issued from the president's office. . . . **Richard F. Waid** has been named president of CompData Services Corp., Auerbach's joint venture with Comprehensive Designers to furnish manpower and contract programming. He's an Auerbach man, came from their federal systems division. . . . The new president of Systemetrics, Inc., **Paul M. Lewis,** comes from Washington, D.C., where he was president of Communications Analysis Corp., and a past Justice Dept. consultant and press director for the Office of Facts and Figures. Shortly after his arrival at the Mountainside, N.J., firm he announced the promotion of **James N. Ottobre,** who has been there since 1966, to executive vp. . . . Univac's data processing division has a new treasurer and controller: **Joseph J. Ciasullo,** who has come up through the ranks. . . . **C. B. Rogers, Jr.** has been named president and gm of IBM's new General Systems Div. Succeeding him in his previous post (vp of marketing for the Data Processing Div.) is **Howard G. Figueroa,** an IBMer since 1952. . . . **John R. Woodhull** has been elected president of Logicon, Inc., after serving five years with the company's L.A. division. Logicon went public last October, plans to place greater emphasis on growth and diversification. **Claude F. King,** previous president since 1961, has formulated no specific plans for a new venture as yet. . . . **David E. Ferguson,** who as president of Programmatics, Inc. retained his post when that firm was acquired by Applied Data Research, Inc., in L.A., has been elected to ADR's board of directors. . . . Tymshare's new national telecommunications network, TYMNET, will be directed by **Max Beere,** who has had 14 years of experience, including teleprocessing, with Ma Bell. The Palo Alto t-s organization also has announced three corporate promotions: **Edward J. Field,** to treasurer; **Ronald W. Braniff,** eastern vp, and **Alden Heintz,** marketing vp. . . . **Charles L. Eaton** has been shifted from managing General Electric's telecommunication and info processing operations in Schenectady, to Lynchburg, Va., where he will direct the design and manufacture of communications hardware sold to outside users. . . . **Chauncey W. Crandall,** of Fairfax, Va., has been elected president and board chairman of Pacemaker Automation, Inc., a software and management consulting firm. Before becoming a com-

people . . .

pletely Virginia gentleman, his experience was in the Washington area with Airtronics, CEIR and RCA. . . . **Edwin F. Kerr** will be responsible for systems development as vp of Synergistics, Inc., Boston area firm offering computer systems and peripheral equipment. He formerly handled both marketing and technical operations for Auerbach's Boston office. **Irwin D. Baumel** also has been appointed vp at Synergistics—for airline systems. He has 19 years experience, was with Sanders Associates the last six. . . . At Sanders, three divisions will be reporting to new group vp **Daniel R. Fisher**—Corporate Technical Development, Microwave, and Electronic Countermeasures. Fisher came from a vice presidency at Magnavox. . . . **Saul Hanges,** who helped develop dp systems for nursing homes and extended care facilities on behalf of Computer Dynamics Corp., has become president of that Cherry Hill, N.J., company. His programming experience includes stints with both

RCA and GE. . . . The newly created position of executive vp at Astrodata, Inc., has been filled by **Robert B. Baker,** who came to the Anaheim, Calif., firm as finance director from a similar post with ITT. **David F. Barnes** has been promoted to vp, still in charge of the data devices division. . . . **E. W. (Mac) McCain,** who left a vice presidency at Univac's Federal Systems Div. to join University Computing Co., has been appointed executive vp of operations, with five subsidiaries reporting to him, including the newly formed development division for special systems hardware. . . . Intercomp, a Cambridge, Mass., corporation producing turnkey systems and peripherals, has elected **John J. Donovan,** the founder of the company, its chief executive officer. He is also a professor of electrical engineering at MIT, where he has been involved in designing and

implementing an on-line simulation language. **Michael L. Mark** is vp of computer products, and chairman of the board and presumably financial benefactor is **John deKoven Alsop,** head of the Covenant Group in Hartford, Conn. . . . **Larry G. Hatfield** has become president of Intersystems, Inc., in Jackson, Miss., succeeding **J. W. Barksdale III,** who resigned. Hatfield was president of one of the companies that merged to form Intersystems last year. . . . And in Atlanta, Ga., **John McGinley** is now president and chairman of the board of General Software, Inc., computer programming and terminal sales company. He was formerly exec vp of Software Systems, Inc., in Washington, D.C. . . . Also in D.C., **William R. Sinkinson** has been named exec vp of Delta Data Systems, with complete authority over marketing, proprietary systems, facility management and management systems, as well as being acting president of Delta's two subsidiaries, Association Processing Corp. and Delta Caribe. **James M. Anderson** will continue as president and board chairman of the central company, but will concentrate on corporate development and expansion. . . . Computer Micro-Image Systems has secured **Robert M. Anderson** as vp, manufacturing. He was formerly director of management services with Harvey Aluminum, also in the L.A. area, has been a frequent speaker and author on computer technology. . . . Changes at Computer Planning Corp., Torrance, Calif.-based software house: **Howard Bedford** is now exec vp of operations; **Dr. Edward Brown** is vp in New York, and **Robert Miles** vp in L.A.; **Robert L. Homer** has joined the company as manager of program development, after 17 years of experience with Lockheed, North American (Rockwell) and IBM. . . . Two new positions have been created at Computer Learning and Systems Corp. in a reorganization: **William C. Thompson** will be president of the Software Products Div., and **Eugene Axelrod** will be president of the Computer Learning Div. Thompson is one of the founders of the company; Axelrod joined as assistant to the president, will be in charge of establishing new learning centers as well as ones already existing in the Washington area and L.A. . . . **John F. Kuemmerle** has been elected president of Installations and Research Corp. in N.Y.C., succeeding **Aaron Lieber,** who resigned to devote himself to other financial holdings. I&RC is a dp service company that includes a computer output microfilm system. ■

books

***Symbol Manipulation Languages and Techniques. Proceedings of the IFIP Working Conference on Symbol Manipulation Languages, Pisa, 1967,* edited by David G. Bobrow. North-Holland Publishing Co., Amsterdam. 1968. 487 pp. $19.50.**

The conference held in September, 1966 (not 1967, as indicated by the book jacket) presented papers on string processing, list processing, and formula manipulation. A vigorous exchange of ideas was desired; the papers and resulting discussions give a comprehensive picture of the techniques and attitudes prevalent at the time of the conference. However, many of the papers are not of great interest today.

An excellent survey of symbol manipulation languages is given in the paper "A Brief Survey of Computer Languages for Symbolic and Algebraic Manipulation" by Raphael, Bobrow, Fein, and Young. These languages are discussed in groups having common characteristics. Within each group, differences between languages are emphasized. Typical sections of code are shown which give the "feel" of the languages. The bulk of the paper is contained in three appendices: a summary chart, a comparison chart, and a set of annotated programs (with time and space costs wherever possible). The languages surveyed include COGENT, COMIT, FORMAC, FORMULA, ALGOL, IPL-V, LISP 1.5, LISP 2, SLIP, SNOBOL, and TRAC.

A second survey paper "Problems and Future Trends in Formal Algebraic Manipulation" by Sammet, suggests directions for future work. In particular, the paper stresses the desirability of communication with the computer in language as natural as possible, a viewpoint which was sharply contested in one of the panel discussions.

Most of the conference papers describe specific applications and techniques. One paper, "A Method Formula Manipulation in ALGOL 60 Applied to the Determination of Taylor Coefficients" by Van de Riet gives an ALGOL 60 program for formula manipulation; another "Sophisticated Algebra on a Computer: Derivation of Witt Vectors" by Duby shows the use of FORMAC; a third "Rational Functions in MATHLAB" by Manover, Bloom, and Engelman shows the use of the

MATHLAB system.

The most unusual language described at the conference is LOGOL ("LOGOL, a String Manipulation Language" by Mysior and Waligórski). In this language, strings are stored on cyclic symmetric lists, called tapes, on which finite automata are assumed to operate. Manipulators of the strings are then programmed directly as operations of the automata. In essence, a program in LOGOL directly constructs a Turing machine which performs the desired manipulation.

Possible extensions of ALGOL are described by Peck ("A List Processing Extension of ALGOL") and Hoare ("Record Handling"). The first paper describes an extension implemented in Calgary, while the second paper considers general methods for describing and handling structured data.

Two panel discussions were held during the conference. The record of the discussion "Basic Concepts in String Manipulation" shows lively disagreements. The chief controversies were the desirability of users being able to redefine languages, and the desirability of users communicating with computers in "natural" notations. The second panel "List and String Processing in General Programming Languages" for the most part discussed over-all objectives of language design. Most of the panelists agreed on the desirability of "illegal operations" and "loopholes" in general programming languages, and the desirability of having assembly language segments within programs. It was also felt that users should be able to experiment with and change machine order codes.

In addition to the conference proceedings, the book contains an extensive (127 pages) annotated descriptor-based bibliography, compiled by Sammet. The bibliography includes all articles in the field up to the end of 1966.

This reviewer feels that the book's usefulness will rest chiefly on its excellent survey articles and its extensive bibliography.

—PHILIP GILBERT

book briefs

(For further information on the books listed here, please write directly to the publisher mentioned.)

***Transmission Lines for Digital and Communications Networks*, by Richard E. Matick, McGraw-Hill Book Company, 330 W. 42nd St., New York, N.Y. 1969. 360 pp. $14.50.**

This book is intended to bring together all of the relevant information and important concepts necessary for an understanding of today's transmission lines. A broad range of fundamental subjects is presented for both novice and expert in the field. Particular emphasis is placed on high-frequency and fast rise time pulse behavior, but the results are generally applicable to low-frequency and power lines as well. Recent phenomena and devices are covered, such as anomalous skin effect, superconducting transmission lines, and pulse transformers.

***Computer Applications; Series II*, edited by Geoffrey Knight, Jr. Cambridge Communications Corp., Washington, D.C. 1969.**

This, the second volume of this series, is a collection of over 5000 abstracts on the applications of computers to various technical, scientific, and business problems. The references are arranged within the following main categories: artificial intelligence; linguistics; textural data processing and the liberal arts; life science and engineering; control engineering; and management, government, and education. This collection was compiled from *Computer and Information Systems*. Here again, although many topics are covered, some important references seem to be missing.

***BASIC Ideas*, by Robert E. Smith, International Timesharing Crop., 4620 W. 77 St., Minneapolis, Minn. 55435. 1969. 208 pp. $5.95 per copy with quantity discounts available. (Write to BASIC IDEAS, P.O. Box 4826, St. Paul, Minn. 55113.)**

A computer language called BASIC (Beginner's All purpose Symbolic Instruction Code) was developed at Darthmouth College for time-sharing computer users who had some or no knowledge of computers. It is a very easily learned and generally applicable language.

The book can be used as a self-teaching guide or a classroom text, and has been designed to "interact" with the reader and the computer. The pages are printed on heavy stock paper—about 5½" x 8"—and are held in a loose-leaf binder. Lesson pages can be removed and placed directly on the teletype stand.

Lessons consist of explanations and example problems. The reader is presented with a problem, a flow chart of the problem, and the correct answer. He is then expected to write a program using BASIC. The appendix gives the listings for each program. For classroom purposes the appendix can be removed and used as a teacher's guide.

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letters ...

(Continued from p. 47)

check, however, makes the present system more amenable to mechanization or automation.

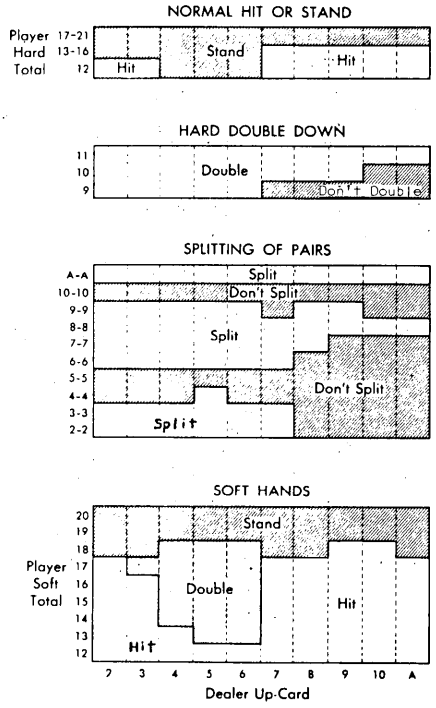
There is, of course, no reason to stop at the level of automated paper handling. Current techniques of data base management and communications suggest that the existence of 'paper' may be the principal shortcoming of the present system.

It is presently feasible to operate remote terminals on-line to large scale computers. Computers are being designed for no-fail reliability (e.g., WIMMIX), and data bases of ever-increasing size are being managed with ever-increasing facility. It is readily conceivable that a single data base containing the accounts of the entire nation might be created, and accessed through remotes wherever needed.

In conclusion, it would be well for the activists among us to consider the advice we so frequently give our activist young: It is better to improve upon a working system in small steps than to throw it out and start over!

L. Jonathan Kramer
Drexelbrook Engineering Co.
Glenside, Pennsylvania

Ed. note: The following Table 2 was inadvertently omitted from Dr. Allan Wilson's article "Casinos, Cards and Computers . . . Recompiled" on p. 167 of the November issue.



from the unknown

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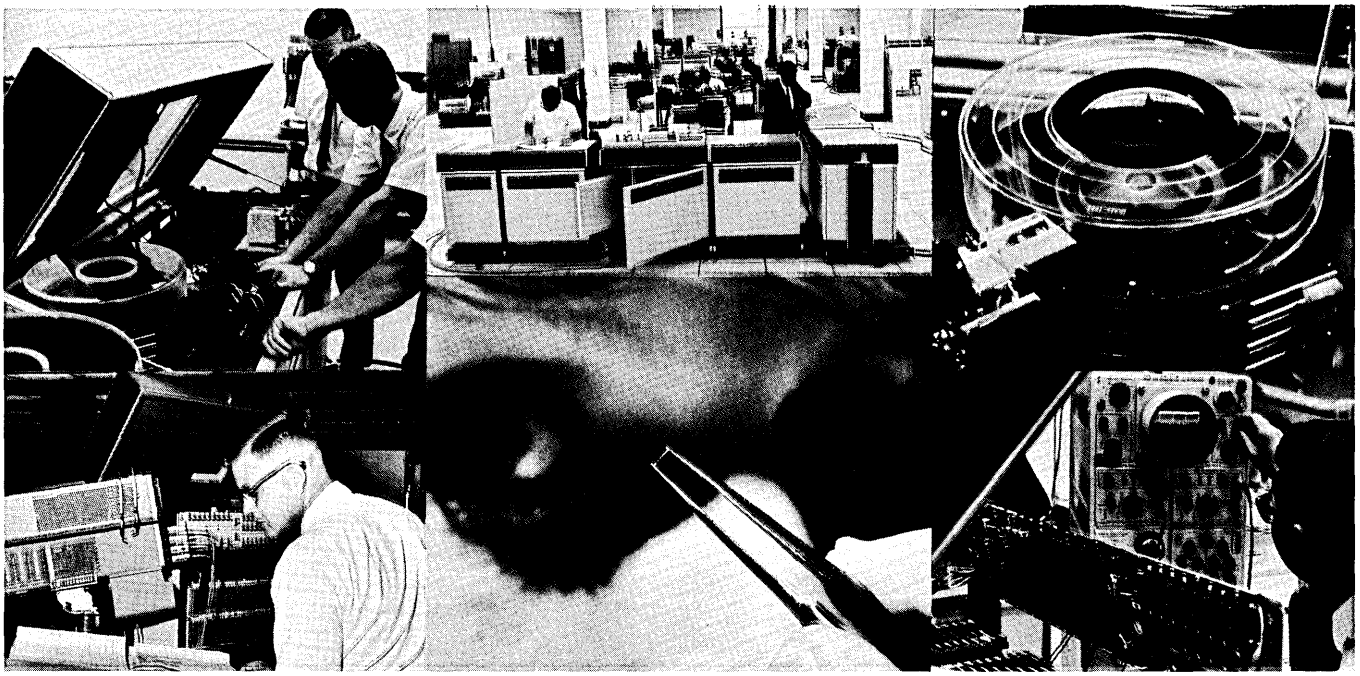

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letters . . .

ming" in restricting the entrance of new companies into the common carrier communications business, I would like to comment from a vantage point of some years of experience in this field.

There are some within the industry who do not share my faith in the innovative ability of the Bell System, and prefer to take a protectionist attitude before the FCC and other regulatory bodies which positively makes me ashamed. When these men present their argument that "cream skimming" by competition will leave the existing carrier with only the nonprofitable areas of the country to serve, I am impelled to review the history of the industry. If one examines the fifty largest cities of the United States, one is struck by the fact that only four of these are not served by the Bell System, and of the four, only one, Rochester, New York, is not in the second largest telephone company, General Telephone. If one were to examine the 50 *smallest* cities, I daresay these statistics would most probably be exactly reversed, with the majority being served by small independent companies.

The historical reason for this is well known . . . all of the large cities would have become part of the Bell System if Theodore Vail had not been prevented from buying them up by the threat of antitrust action in the days before World War I! On the other hand, Vail knew enough about "cream skimming" to express no interest in buying any rural areas with their scattered, hard-to-serve customers. Yet today, when we are grown old and have hardening of the corporate arteries, there are some in the industry who prefer to try the regulatory prevention of competition rather than to meet the new technical demands which motivate the competition! As the old saying goes, "What's sauce for the goose is sauce for the gander."

Unfortunately, corporate policy being against my point of view, I find it impossible to send you a letter identified with my name.

"INNOVARE"
Murray Hill, New Jersey

wake up and read

Sir:

In regard to reading DATAMATION, November, 1969, issue: 1, 2, 3, 4, 5, ... 438, 439, ... ZZZ . . . . . ZZZ . . . . . .

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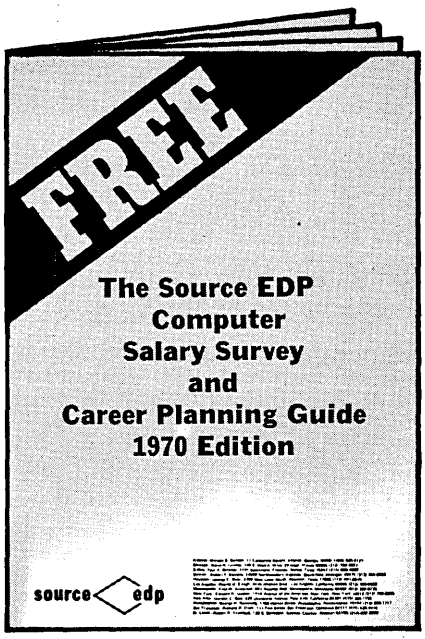

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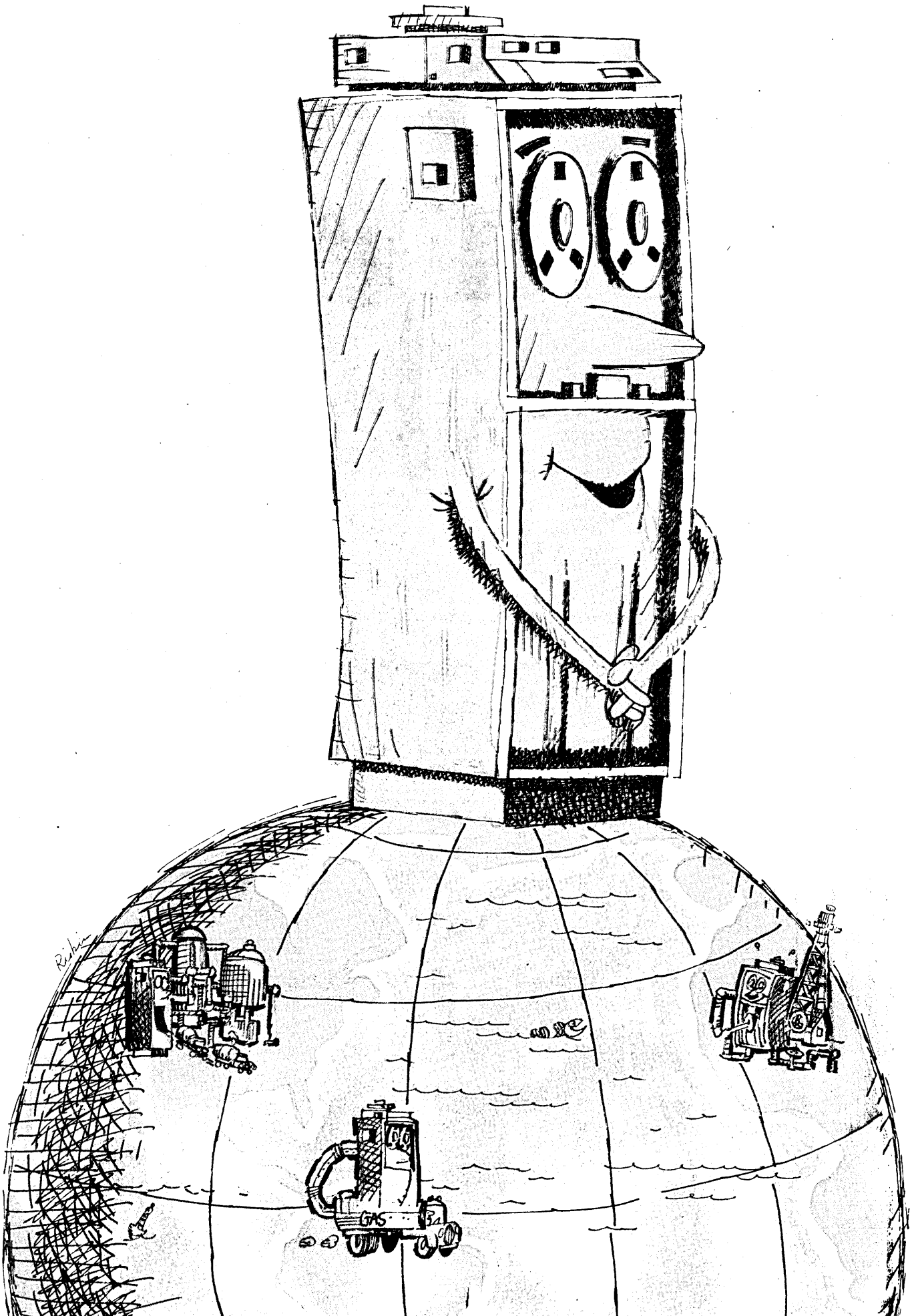
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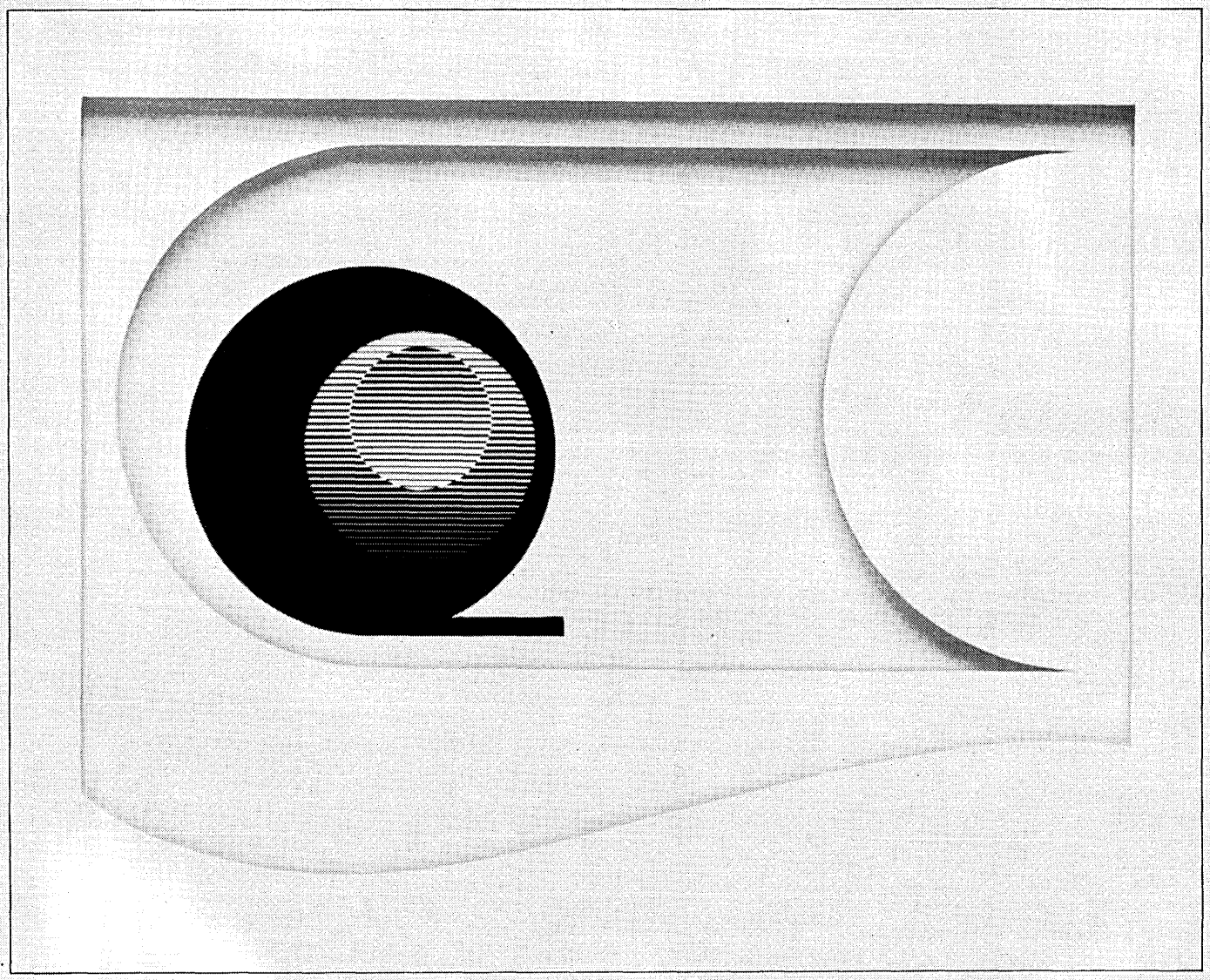

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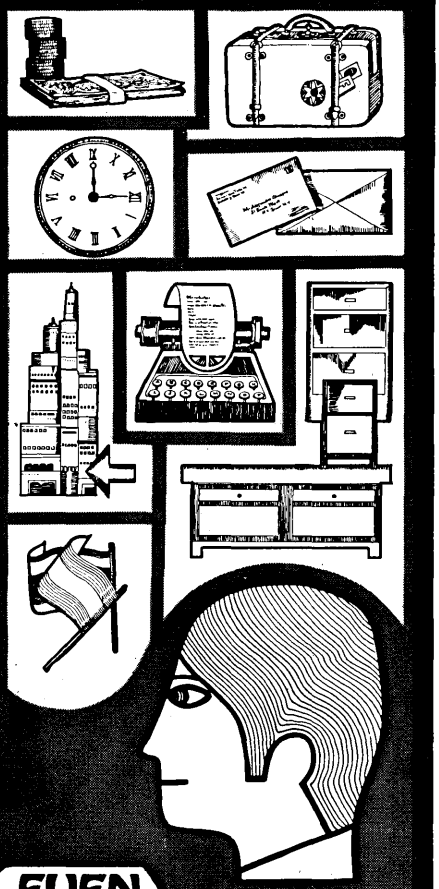
COMPUTERS



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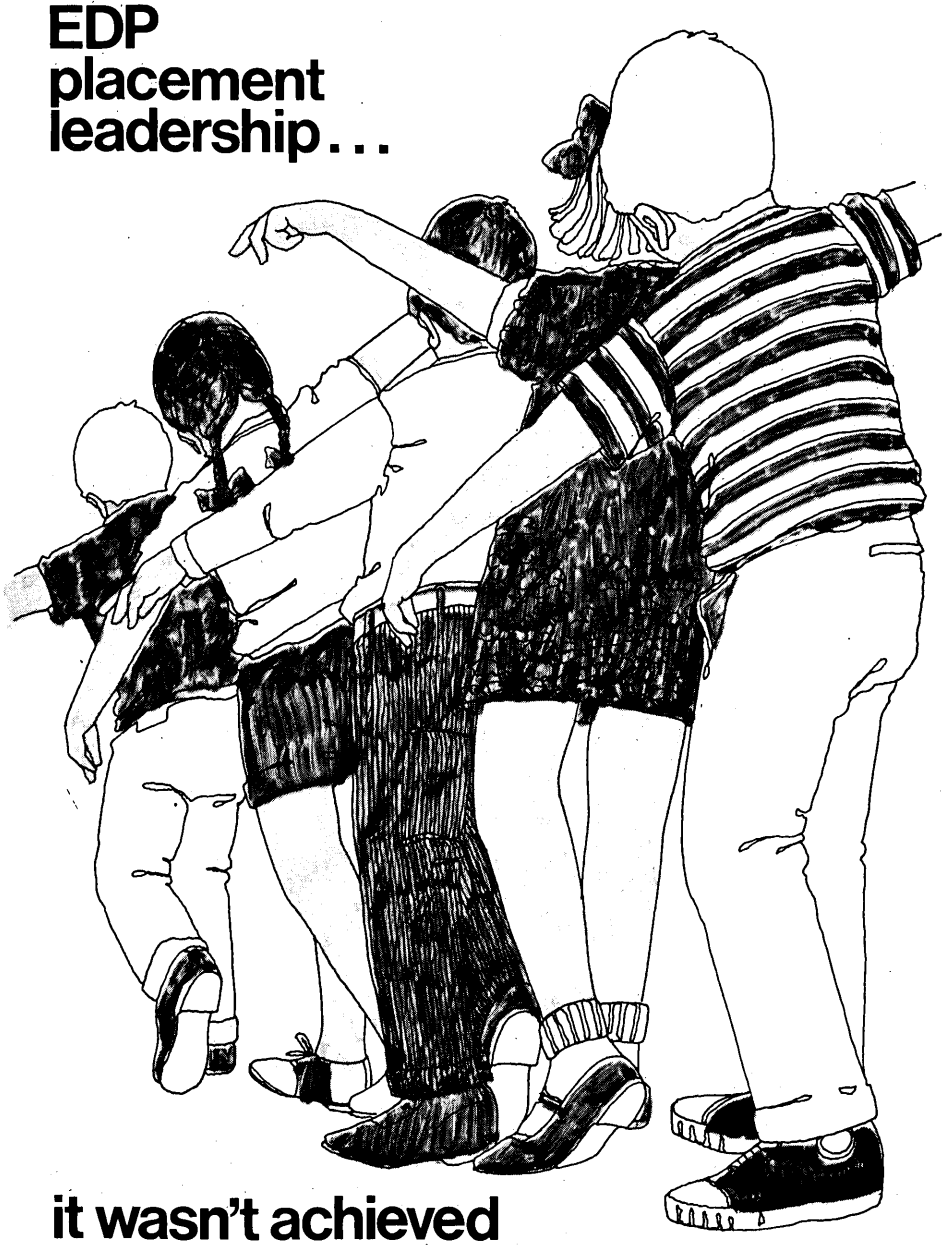

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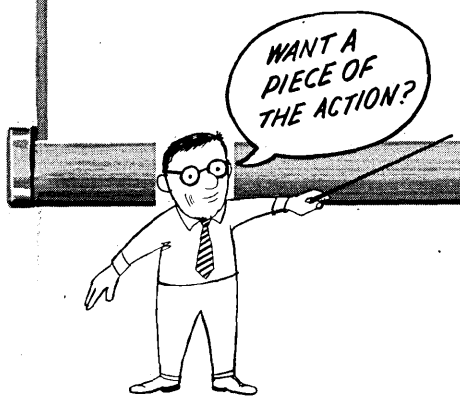

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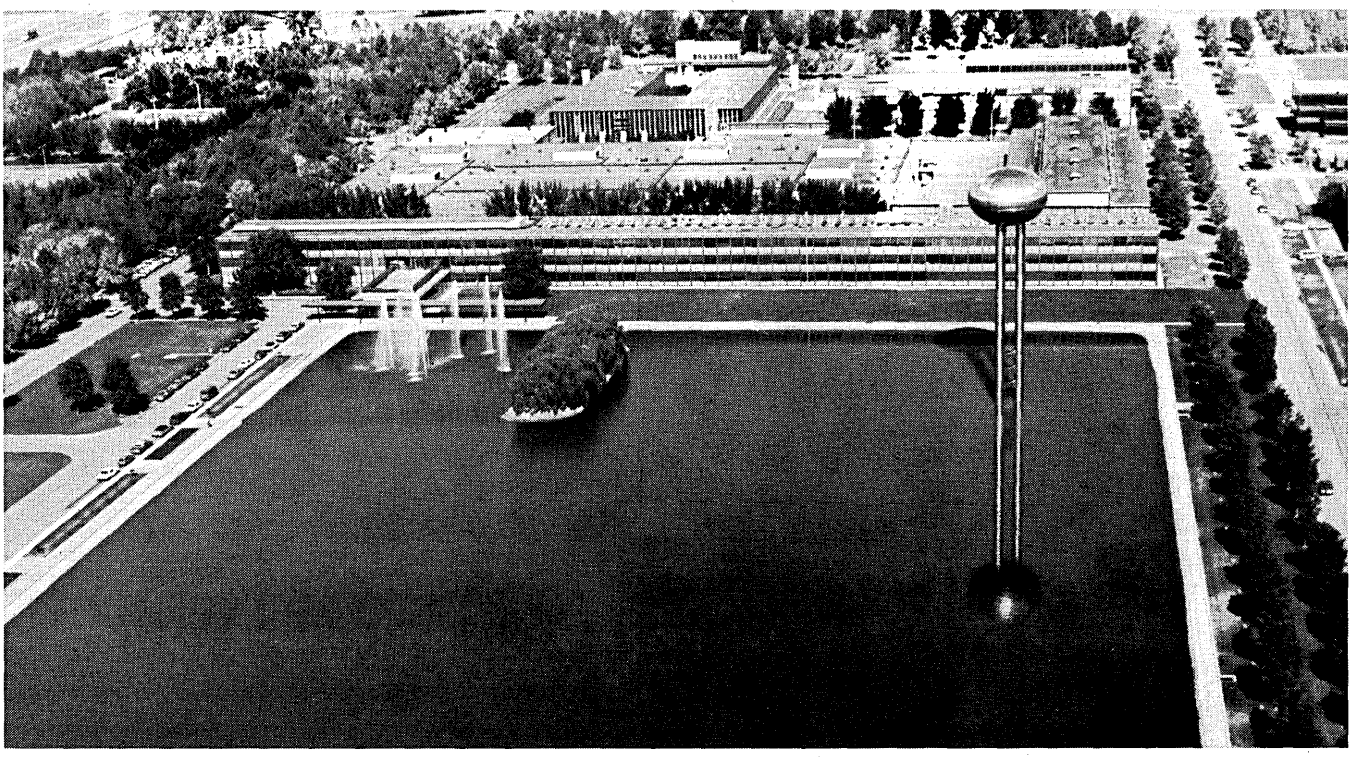

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the forum

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THE SIGNIFICANCE OF WIMMIX

The article entitled "WIMMIX: It's the Biggest, but Will It Be the Best?", (DATAMATION, Oct. '69, pp. 84-90), was recently read with great interest by the writers from two standpoints: as senior analysts with a leading computer manufacturer and as former Air Force officers associated with SPADATS (NORAD) and the Intelligence Data Handling System (IDHS).

It is encouraging from both our viewpoints to see that WWMCCS is stirring such interest among equipment manufacturers and ultimately warrants treatment at length in one of the industry's most popular trade magazines. There is certainly no argument that the effects of the WWMCCS selection will be felt throughout the industry in general, and may well pave the way for standardized machine-independent software for all government and civilian computer systems. The net result in terms of vendors' interests could be that the general market might become more truly competitive, rewarding price/performance excellence with purchase orders involving no hidden software conversion costs to the consumer.

The question could be posed, however, concerning the relevance of this point to the forthcoming WWMCCS buy. That is, if software compatibility were the pervasive consideration as the earlier article suggested, then a reasonable course of action might be for DOD to procure several hundred additional 1410 systems and color them "WWMCCS." We, however, interpret the situation somewhat differently. WWMCCS represents a new, refined and integrated approach to a much-needed world-wide force control and scientific computational capability within the Department of Defense. The ultimate effectiveness of WWMCCS depends on many factors—including a new operational concept for all major commands which is responsive to the C&C problems generated by advanced

weapons systems, real-time sensor systems, a myriad of weapon employment options and reduced decision times which did not apply at the time the present computer systems were installed. The new WWMCCS systems, at least at major command levels, are likely to be considerably different in function from the systems to be replaced. This point might explain why the WWMCCS planners appear to be more concerned with evolution of a new system than emulation of an older one.

This article will not fall prey to "speculating on remote contingencies" (courtesy Robert S. McNamara) such as predicting the outcome of the WWMCCS hardware procurement or listing reasons why one vendor should be considered more or less seriously than others. The referenced article has treated this subject in articulate detail, and any comments here would probably seem parochial and argumentative. We could point out, however, that it would be possible to divide WWMCCS into functional areas (e.g., scientific, intelligence, general dp, etc.) where little or no software transferability would be required. The WWMCCS procurement action could then be single-source in these categories without compromising the basic reasons for the World-Wide buy. (Single-source, contrary to the implications of "WIMMIX:", is not equivalent to sole source as a procurement action.)

As is accurately described in "WIMMIX:", the installation of these new computer systems is planned over some five years. With the adoption of JOVIAL J3 as the official USAF command and control language, those programs which will be transferred to the new computers could be converted to J3 in the intervening time. In fact, this process is presently under way in many military installations, and can be expected to begin in others—particularly those affected by the immediate WWMCCS buy—as soon as the approved option is released. Thus the "apparent decision to disregard system conversion costs" by DOD is not translatable into tremendous queues of unconverted and unusable programs, but rather means that much of the conversion which is necessary can be and is being gradually absorbed in the pre- and trans-WWMCCS acquisition period.

Therefore, the language standardization phase of WWMCCS can serve many more useful purposes than the alleged "sincere effort . . . to overcome IBM's bidding advantage" on the part of DOD. Evolution in command and control systems can be expected to continue beyond the 1969 WWMCCS concept, and software standardization costs at the present time could realistically be amortized over a longer period than the months until RFP date or the few years until full operational capability is realized. In any case, it is doubtful that the over-all cost of WWMCCS system development will be evaluated on a retroactive basis and consider the conversion of programs which could

have been written in (or converted to) a higher level language during the past two or three years.

The argument about long-term amortization of software conversion costs also applies to the intelligence data processing community, though the requirement for mass replacement is certainly decreased by the 40 or so sole source acquisitions permitted in the past two years. It would probably provoke little controversy to state that the Formatted File System (FFS) is not the latest word in information retrieval systems, or to point out that virtually all FFS installations have experienced difficulty in satisfying user requirements for intelligence data management. This is not intended as an argument that IBM, the developers of FFS, should be categorically deposed from intelligence. Rather, it is another example that requirements have changed in the past five or seven years, and that saving all programs developed for a particular machine is not and should not be the paramount consideration in determining the over-all cost of WWMCCS.

Future WWMCCS replacement will probably be on a three- to six-year cycle, and it seems eminently reasonable for DOD and the military commands to begin now to prepare for the eventuality that one vendor will not always have the most appropriate hardware for all future military command and control applications. Notable in this respect is the extensive reprogramming effort under way by personnel assigned to the Aerospace Defense Command (ADC). The Space Detection and Tracking System (SPADATS) software is being rewritten in JOVIAL to make better use of the existing Philco machines and to afford ADC and NORAD true flexibility in selecting the equipment best suited to the tremendous computational and data processing requirements of program 496L (SPADATS) and 425L. (The 496L workload, incidentally, is not handled adequately by a single Philco 2000/212, but is distributed over four such machines.) This programming effort is not aimed at unseating the present vendor, but is in consonance with a two-year-old AF directive which dictates that all new programs should be written in the JOVIAL language to simplify programmer training, program development and maintenance, as well as to achieve the desired machine independence.

Similarly, it is difficult to translate WWMCCS into an effort to depose the existing suppliers of DOD's computer systems. The World-Wide Military Command and Control System may force some advancements in hardware state-of-the-art and software transferability, but this can be considered incidental to the new DOD and JCS operational concepts which gave birth to WWMCCS itself. In short, WWMCCS appears to be a practicable solution to the compounding problems of present-day command and control within the Department of Defense. It will no doubt be the subject of many treatises on possible methods of development, management and support of large scale intercommunicating computer complexes using standardized languages.

If these subsequent articles can avoid the temptation to interpret WWMCCS strictly as cpu's, machine dependent software, or as a single-source opportunity for a particular vendor, then the industry and the DOD users together will profit from a greater understanding of what WWMCCS is and how its computer support can best be implemented.—L. K. GEISEL, B. L. HARRISON

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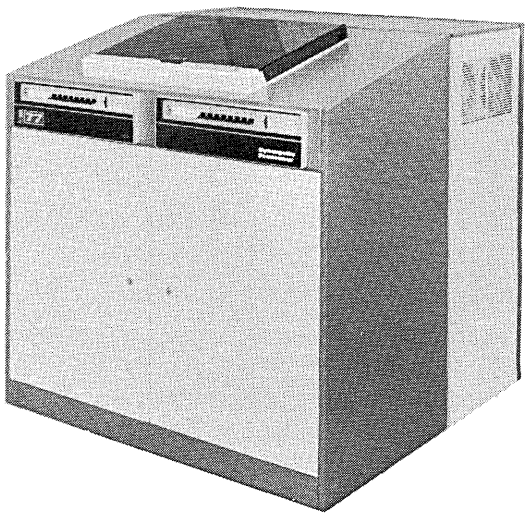

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