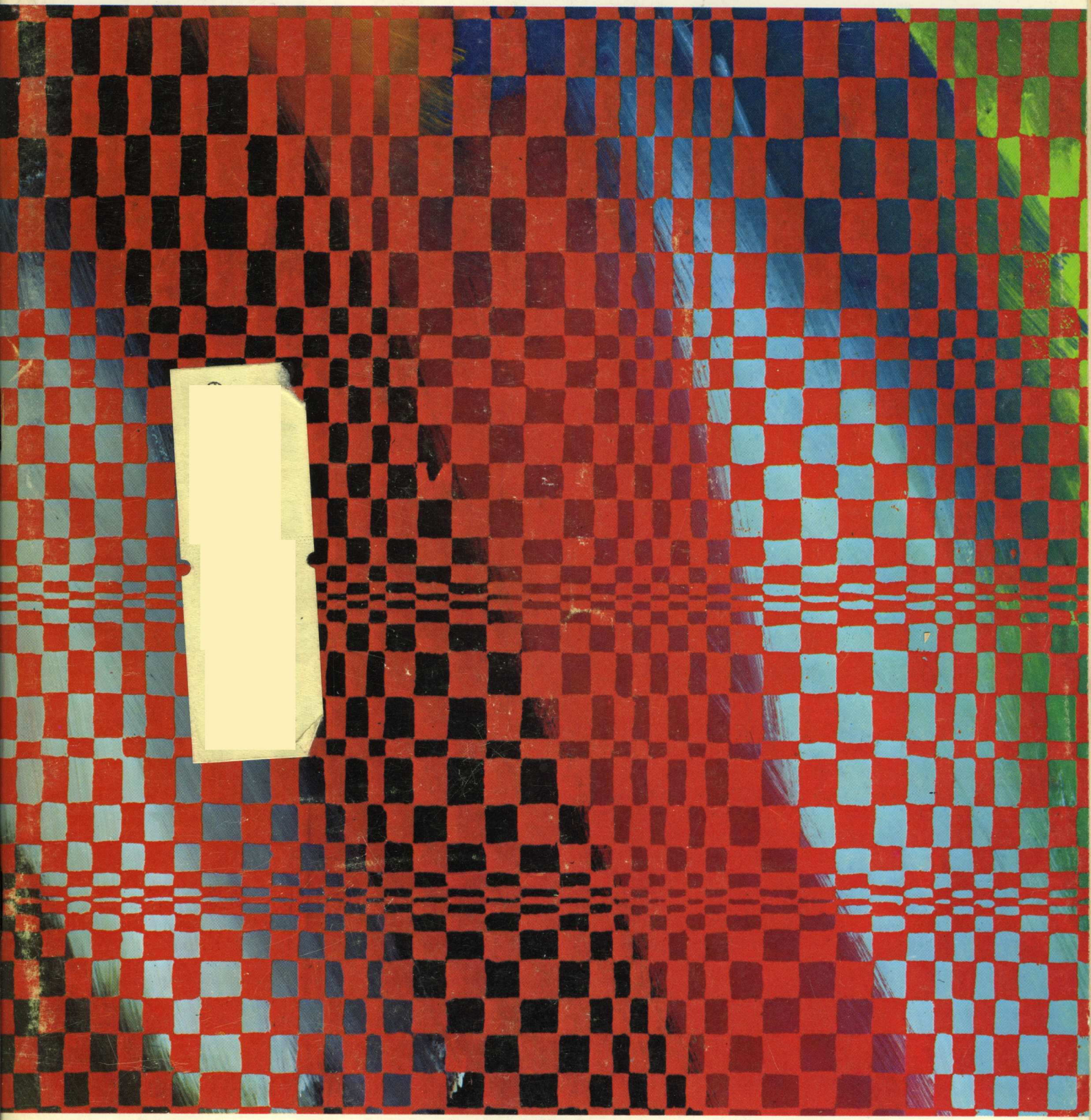
DATAMATION®

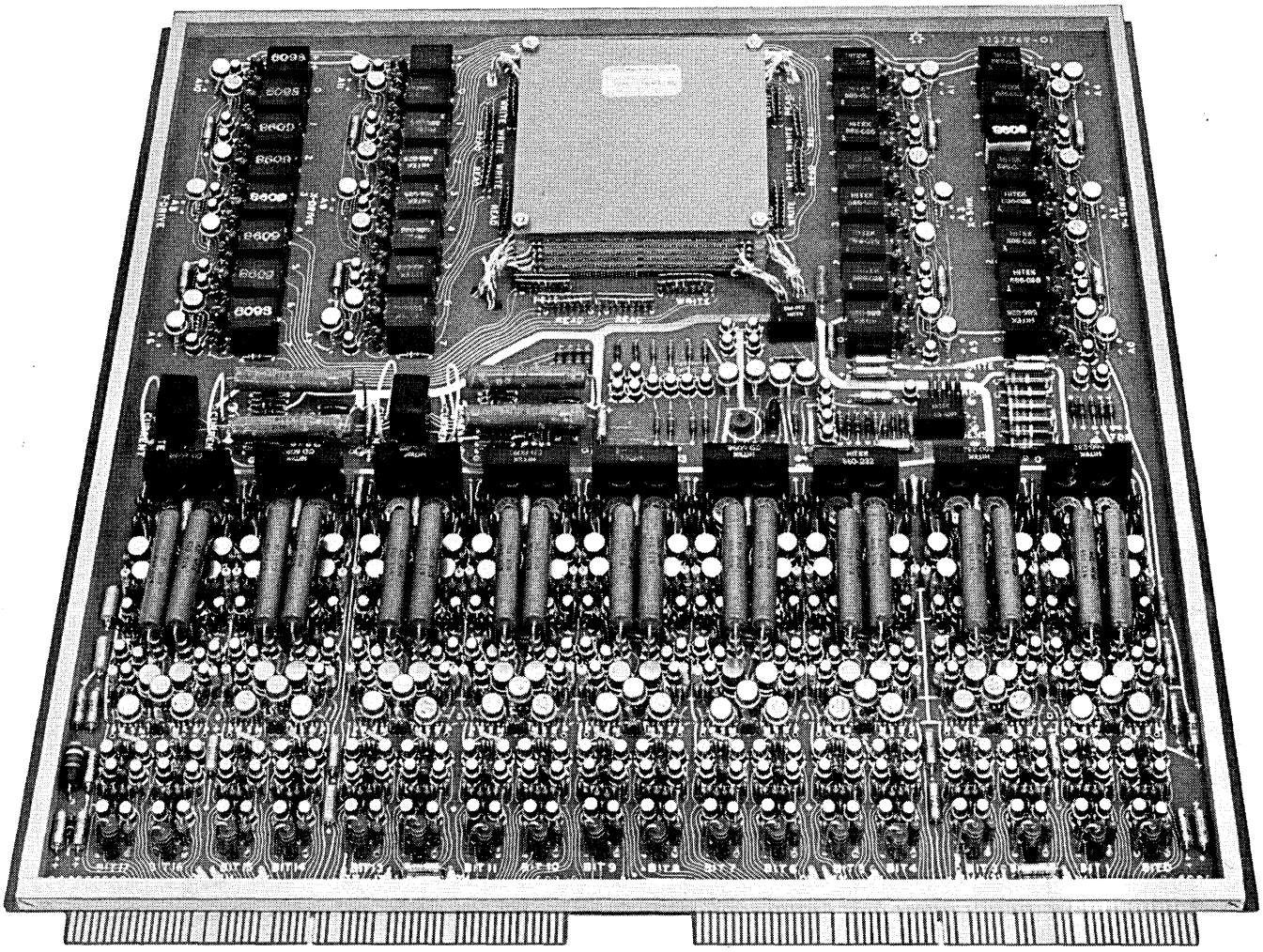
66

November



COMMUNICATIONS . . . the picture is confused

The best new idea in core memory packaging is a big one:



...and you can access it in 500 nanoseconds, full cycle it in 1.5 microseconds.

If you're designing digital systems for computing, automatic control, data communications or the like, you'll be glad to hear we've found a way to make your life easier. And your equipment more reliable.

Ampex RF core memories have improved the whole concept of memory system packaging. The large PCBA board you see above, dotted with all-silicon discrete and integrated circuits, is the nucleus of this new family of memory systems.

Peak performance and reliability at minimal cost are the major benefits you receive. MTBF for several sizes of the RF, for example, exceeds 5000 hours. Maintenance is simple on this wide-open PCBA.

The Ampex RF family offers a range of capacities from 2,000 to 590,000 bits, word lengths from 4 to 72 bits. Commonality of the three basic systems minimizes your training and spares logistics. The RF's modular packaging brings additional benefits: compactness—and a capability for expanding capacity.

The extra plus you receive is speed.

Access time is 500 nanoseconds; half-cycle, 850 nanoseconds; full cycle, 1.5 microseconds.

All units of the RF family are rack-mountable. Prices are low. We'll be glad to send you complete information.

Write Ampex Corporation, 401 Broadway, Redwood City, California 94063.

AMPEX

CIRCLE 1 ON READER CARD

Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't make time on company time. Or use the office for intimate tete-a-tetes. Or be a social butterfly. But it *can* read. And gobble data at the rate of 2400 typewritten characters a second. And compute while it reads. And reduce errors from a keypunch operator's one in a thousand to an efficient one in a *hundred* thousand.

Our machine reads upper and lower case characters in intermixed, standard type fonts. It handles intermixed sizes and weights of paper, including carbon-backed sheets.

An ordinary computer program tells our reader what to do . . . to add, subtract, edit, check, or verify as it reads. Lets you forget format restrictions, leading and trailing zeros, skipped fields, and fixed record lengths. And our reader won't obsolete any of your present hardware because it speaks the same output language as your computer.

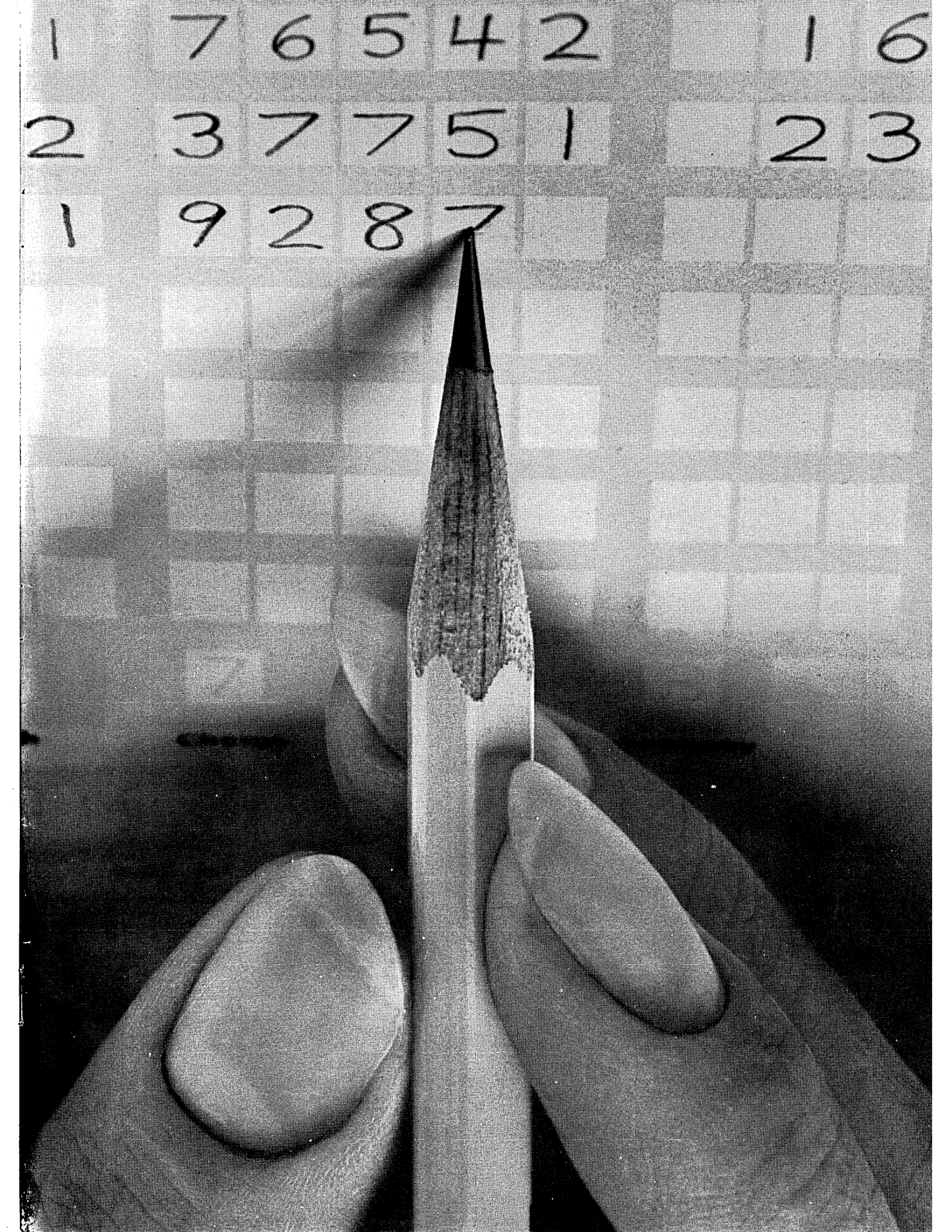
Our Electronic Retina Computing Reader can replace all—or almost all—of your keypunch operators. At least that's what it is doing for American Airlines.

If you have a volume input application, it can do the same for you. Tell us your problem and we'll tell you how.

RECOGNITION EQUIPMENT Incorporated

U.S. Headquarters: Dallas, Texas 214-637-2210 Offices in principal U.S. cities and Frankfurt, London, Milan, Paris and Stockholm

CIRCLE 4 ON READER CARD


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

IBM introduces a machine that reads handwritten numbers for direct input to a computer.

The IBM 1287 Optical Reader.
Until now, handwritten numbers had to be converted to machine-readable form before a computer could process them.

That's all changed.

Now handwritten numbers are machine-readable. You can forget about conversion steps because the new IBM 1287 Optical Reader speeds handwritten numbers directly into an IBM SYSTEM/360.

That means you can process data faster and cheaper than ever before.

Reads printed numbers, too.
The IBM 1287 also reads numbers from pre-printed forms... and numbers from computer print-outs ...and typed numbers. It reads imprints from credit cards.

The 1287 even reads numbers from cash register and adding machine journal tapes.

Lots of jobs for the 1287.
For example, retail clerks can write up sales on saleschecks and imprint customer account numbers. The 1287 reads all those numbers into the computer.

Utility meter readers can record customer usage on computer-printed forms.

The 1287 reads the data.

Telephone operators can record toll calls. The 1287 reads the data.

Isn't there a job it can do for you?

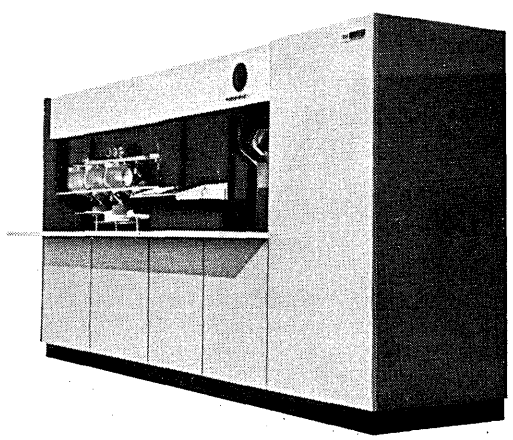
New but proven technique.
The 1287 uses a high-speed beam of light to trace the numbers. This curve-following technique is new to commercial data processing.

Even so, you won't be the first to use it. It's been in test since 1962.

It's been tested in business environments and at IBM's Pavilion at the New York World's Fair where it read the birth dates of some 350,000 people.

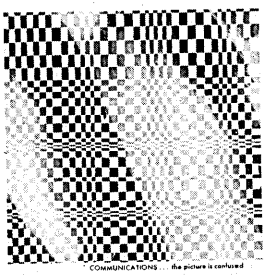
So add an IBM 1287 Optical Reader to your SYSTEM/360.

Then people can write numbers by hand for direct computer input. Let their sharp pencils help cut your data processing costs. IBM®



CIRCLE 5 ON READER CARD

DATAMATION



november 1966

volume 12 number 11

EDITORIAL OFFICES
1830 WEST OLYMPIC BLVD.
LOS ANGELES, CALIF. 90006

BPA
Circulation audited by Business Publications Audit

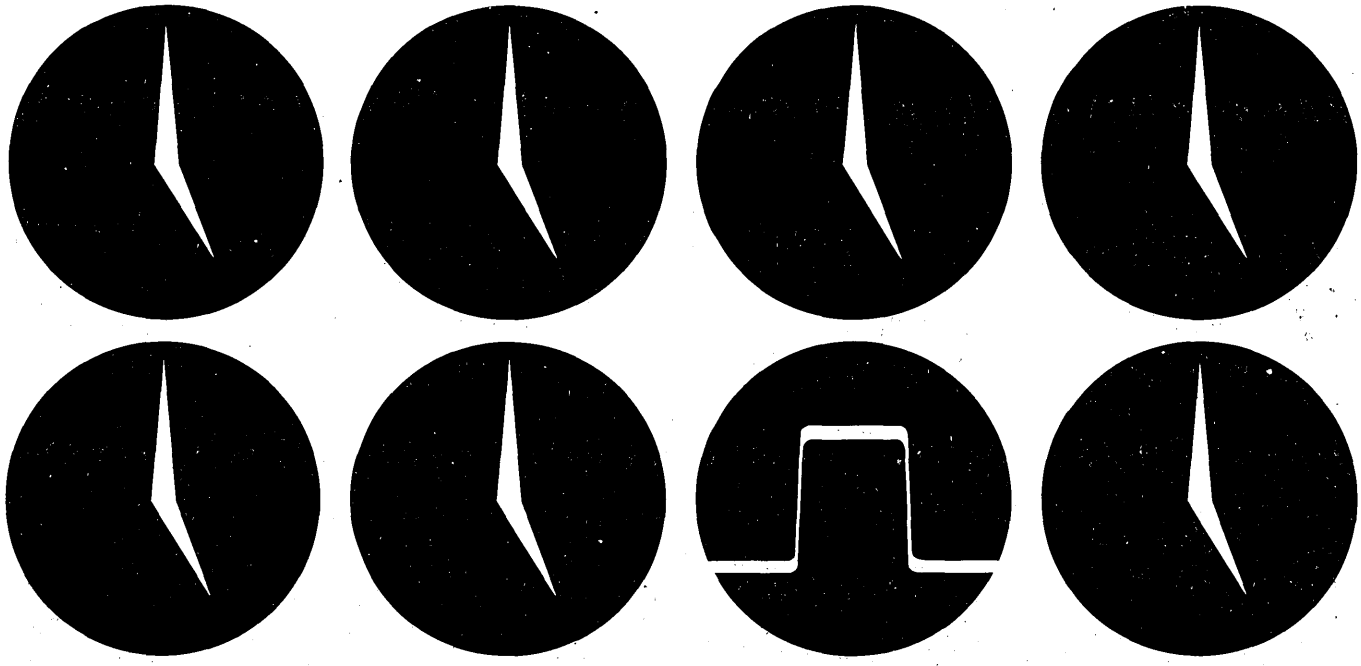
ABP
Member, American Business Press, Inc.

DATAMATION is published monthly on or about the tenth day of every month by F. D. Thompson Publications, Inc., Frank D. Thompson, Chairman; Gardner F. Landon, President; Gilbert Thayer, Senior Vice President. Executive, Circulation and Advertising offices, 35 Mason Street, Greenwich, Conn. 06830 (203) 661-5400. Editorial offices, 1830 W. Olympic Blvd., Los Angeles, California 90006. Published at Chicago, Ill.
DATAMATION is circulated without charge by name and title to individuals who qualify by our standards and are employed by manufacturers or users of automatic information-handling equipment in all branches of business, industry, government and the military. Available to others by subscription at the rate of $15.00 annually; single issues (when available) $1.50. Reduced rate for qualified students. Foreign subscriptions are on a paid basis only at a rate of $25.00 annually. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulation paid at Columbus, O. and Chicago, Ill. Form 3579 to be sent to F. D. Thompson Publications, Inc. Microfilm copies of **DATAMATION** may be obtained from University Microfilms, Inc., 313 No. First St., Ann Arbor, Michigan.

Printed by Beslow Associates, Inc.

This issue 70,214 copies

A real-time, time-sharing systems computer



And a way to digitize 5 nanosecond signals.

Using a new disc-oriented, real-time monitor, the Raytheon 520 can simultaneously acquire and process real-time data, control a data system from up to 20 remote display-control stations and compile, assemble and execute FORTRAN IV and FLEXTRAN programs on a job or batch basis.

And the new NANOVERTER™ input device for high speed data systems includes a remarkable 5-nanosecond sampling device, and a 12-bit analog-to-digital converter for ± 2% accuracy at 45KC throughput.

With the monitor the 520 can respond to real-time interrupts, transfer data to core or disc via a direct memory access channel, transfer programs from disc to main memory and then shunt processed data to disc, magnetic tape, printer or other storage or output device.

The 520 monitor makes use of two unique features—direct memory access and dynamic memory protect including a memory map.

Direct memory access switches main memory in four microseconds between external devices—either peripheral equipment or another computer—without interrupting the 520 central processor.

Memory protect prevents inadvertent loss or output of stored real-time or batch processing data during interrupt program runs or job program compiling, assembly or execution. A special memory map keeps track of occupied and available memory locations in 2000-word segments and automatically assigns available memory to new programs.

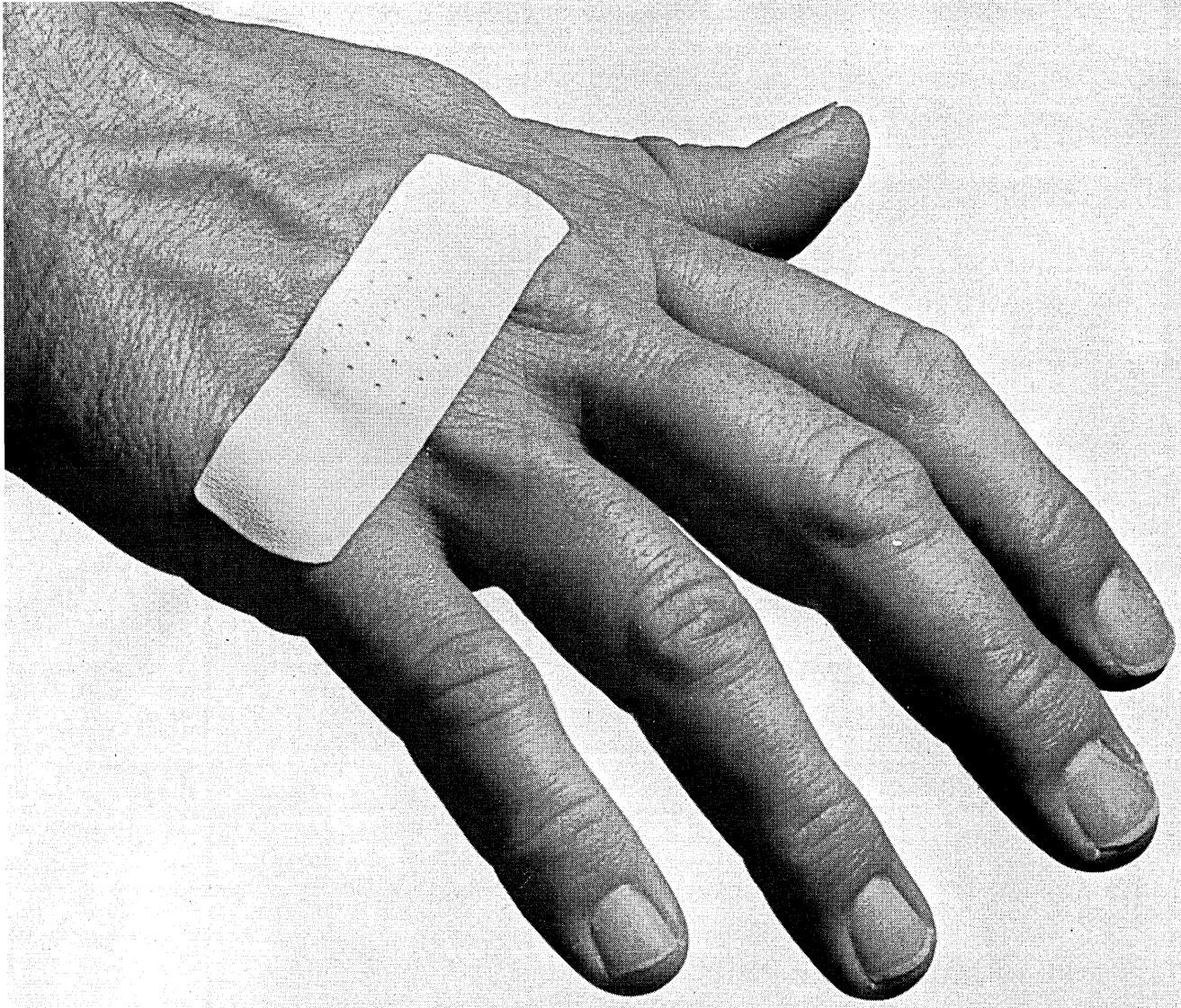
Besides FORTRAN IV and FLEXTRAN, 520 software includes Real-Time FORTRAN IV. This separate and distinct processor is based on Raytheon's exclusive one-pass FORTRAN IV which is language compatible with the widely-used FORTRAN IV (version 13). Real-time FORTRAN IV simplifies the programmer's handling of real-time problems with features like RECURSIVE, PROTECT, CONNECT AND COUNT TIME Statements, and useful debugging aids like TRACE mode, Memory Map and DUMP.

The 520's one microsecond main memory boosts data acquisition word transfer rates to IMC. Besides the NANOVERTER, other real-time systems hardware includes the Multidevice Controller for interfacing as many as 512 external data systems devices and establishing up to 1024 levels of priority interrupt, and the unique Multiverter,™ which combines up to 96 channels of IC multiplexing, a 50-nanosecond sample and hold amplifier and analog-to-digital conversion in a single 5¼ inch chassis.

The Raytheon 520 is currently being specified and delivered for real-time and hybrid systems in the $100,000 class and up. Find out why by writing today for Data File C-134. Raytheon Computer, 2700 S. Fairview Street, Santa Ana, California, 92704.

RAYTHEON

Trademark of the Raytheon Company for its data system.



Not Tape is tape

When it comes to wrapping a package or patching a cut or recording a symphony there is usually one brand of tape that does the job a little better than anything else . . . but people being what they are, not everyone uses it.

Likewise, in critical data processing applications, there is one precision tape that stands above the rest in terms of value . . . but not everyone uses Computape either.

There are still tape users who have not discovered that, if they buy Computape, they get far more than a certified reel of reliable, quality recording tape. They still haven't found that the tape itself is only half the story . . . that unlike many other tape manufacturers, *Computron follows through.*

Those who *do* use Computape, of course, are familiar, not only with the quick delivery, the fine performance, and the convenience features, but also with extras such as Computron's unique applications engineering service — available without charge, on short notice, in all parts of the country.

Perhaps you should be using Computape. Find out. Write today for the complete story.

COMPUTRON INC

122 CALVARY STREET, WALTHAM, MASSACHUSETTS 02154

CIRCLE 8 ON READER CARD

DATAMATION 66®

november

Donald G. McBrien 1966

volume 12 number 11

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79 THE PATENT OFFICE EXAMINES SOFTWARE, by *Phil Hirsch.* *At an all-day hearing last month, diverse opinions were heard on the question, "Are computer programs patentable?"*

automatic information processing for business industry & science

datamation departments

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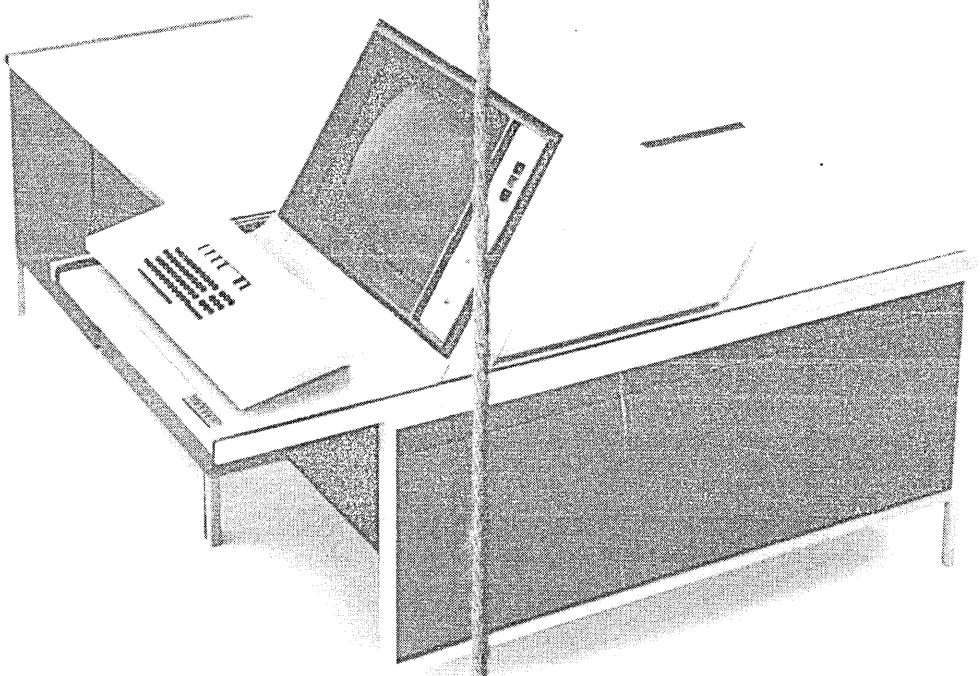
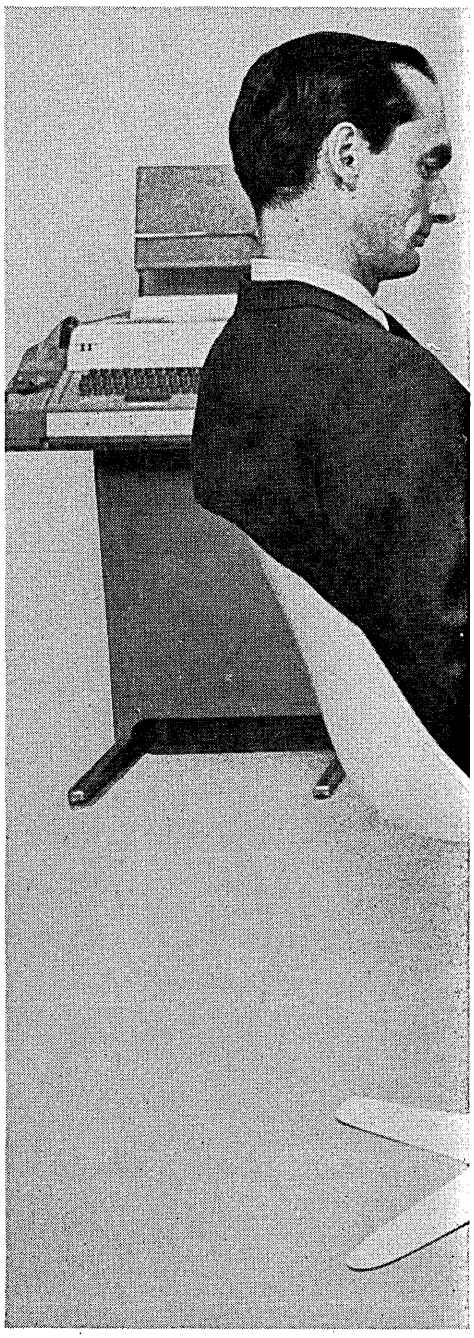
The first off-the-shelf custom display package



New Tasker 9000

calendar

DATE	TITLE	LOCATION	SPONSORS
Nov. 28-30	Users' Meeting	Jung Hotel New Orleans, La.	COMMON
Dec. 5-6	Users' Exchange Meeting	Room 158 Matomic Bldg. Washington, D.C.	Transportation Planning Computer Users' Group
Dec. 12-15	Course: Computer in Hospital Management $175	Twin Bridges Marriott Washington, D. C.	American Univ.
Dec. 15-16	Colloquium: Computer Applications in Earth Sciences	Univ. of Kansas Lawrence, Kansas	Kansas Geological Survey & Dept. of Entomology & Dept. of Chemical & Petroleum Engr.
Dec. 31	Summary Deadline: Symposium on Automation of Population Registration Systems	IFIP Israel P. O. Box 3009 Jerusalem, Israel	
Jan. 4-7	Meeting: Professional Engineers	Americana Hotel San Juan, Puerto Rico	American Society Professional Engrs.
Jan. 15	Deadline: Papers for Colloquium on Information Retrieval	To: Lawrence Berul Auerbach Corp. 121 N. Broad Philadelphia, Pa.	
Jan. 16-19	Course: Printing and Publishing — The Management of Automation $175	Twin Bridges Marriott Washington, D. C.	American Univ.
Jan. 17-18	Symposium: Simulation in Biomedicine	Mayo Clinic Rochester, Minn.	Central and Midwestern Simulation Councils
Jan. 23-27	Course: Methods of Operations Research $225	Univ. of Miami Coral Gables, Fla.	Univ. of Miami
Jan. 27-28	Workshop: Simulation	College of Engineering Univ. of Missouri Columbia, Mo.	Univ. of Missouri
Feb. 1	Symposium: Computer Science and Statistics	Univ. of California Los Angeles, Calif.	UCLA, L.A. ACM & American Statistical Assn.
Feb. 13-17	SHARE XXVIII	Hilton Hotel San Francisco, Calif.	IBM Users' Group



ONLY HONEYWELL OFFERS

THE SMALLEST ...FASTEST ...MOST POWERFUL 16-BIT I/C COMPUTER AVAILABLE TODAY!

THE μ-COMP DDP-516

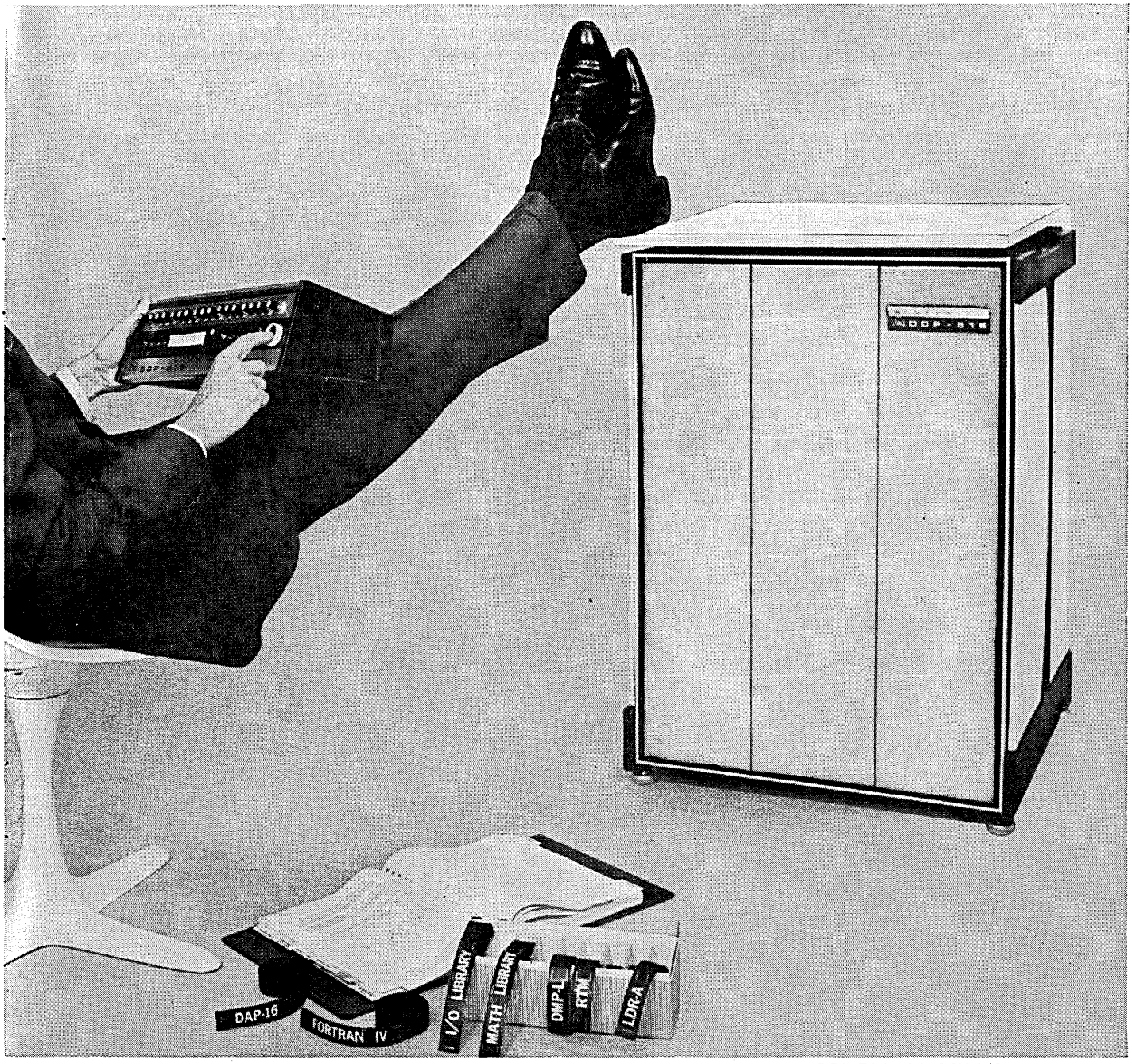
SPECIFICATION SUMMARY

Type	16-bit parallel binary
Console	Movable
Addressing	Indirect/indexing
Memory Size	Up to 32,768 words
Cycle Time	960 nanoseconds
Add	1.92 μsecs
Single Word I/O Transfer	1.92 μsecs
Automatic (Cycle Stealing) I/O Transfer	Over 1 mc (16-bit words)
Weight	250 lbs.
Temperature	0°-45°C
Hardware Index Register	

THE NEW μ-COMP DDP-516 . . . is being manufactured and delivered today — complete with an extensive software package.

It's no surprise that the DDP-516 from Honeywell, Computer Control Division is the most advanced commercial I/C compact computer you can find today . . . a natural third generation machine from the house that built the first 16-bit compact and the first I/C computer.

SPEED . . . YOU GET 520,000 COMPUTATIONS PER SECOND. Memory protection and power failure interrupt are standard. High performance arithmetic unit includes high speed multiply (5.28 μsec), divide (10.56 μsec) and double precision add (2.88 μsec). The 4K μ-STORE ICM-40 core memory (expandable to 32K) features 960 nanosecond cycle time. This is the same field-proven



Above: DDP-516 with 16K I/C core memory.

memory used in the DDP-124 I/C general purpose computer . . . the same memory unit that's the favorite of many systems' builders.

And that's not all . . . the DDP-516 is ideal for on-line real-time applications because of its unusually flexible I/O. Priority interrupt (individually maskable) is standard. DMC allows economical multiplexing of up to 16 devices, all simultaneously time sharing the I/O bus. Megacycle I/O rates are duck-soup for cycle stealing DMA.

DDP-516 HIGH PERFORMANCE HARDWARE IS ALL I/C. μ-PAC logic modules are used throughout. They are packaged in a 24" x 24" x 38" mainframe that features front access to both modules and interwiring. You'll also find that field expansion and plug-in option additions are easy because of basic hardware modular construction.

RELIABILITY SPECIFICATIONS CAN'T BE TOUCHED. MTBF: about two years under normal 40-hour week operation. That's I/C for you — and 3C.

SOFTWARE INCLUDES 250 FIELD-PROVEN PROGRAMS . . . including a complete library of subroutines plus additional software from 3C's active users' group. The compiler is ASA FORTRAN IV. The assembler operates in a selectable one- or two-pass mode and features a unique DESECTORIZING technique that lets you ignore memory addressing restrictions.

That's a lot of software. Best of all, this software kit is ready to use. 3C delivered more than 125 16-bit computers during the past two years. Since our 16-bit programs are compatible with the DDP-516, you get field-proven software ready to go on line.

CIRCLE 11 ON READER CARD

PRICE: $25,000 including total software package.

DELIVERY: software immediately, hardware in as few as 90 days. Units are now being built for use in control applications, data acquisition, message communications and laboratory work.

WRITE TODAY! Get our new μ-COMP DDP-516 summary brochure. It gives you all the facts and it's yours for the asking. HONEYWELL, Computer Control Division, Old Connecticut Path, Framingham, Mass. 01701.

Honeywell

3C COMPUTER CONTROL DIVISION

Illuminates the blind spot.

Lack of continuous and instantaneous altitude information has gone the way of the biplane.

An electronic Alpha-Numeric Generator system, developed by the Hazeltine Corporation and built around a Bryant Magnetic Memory Drum, enables air traffic control to "visually" pinpoint the altitude of every aircraft in their sector.

"Personalized" transponders in the aircraft continuously transmit a stream of vital information to the airport electronic control center. As it's processed, synchronization pulses in the drum release it in the form of a luminous block of reports—updated every 1½ seconds on the radar screen.

Because of the drum's large capacity, several radar screens, in many different locations, can be served simultaneously. Which means that a controller can literally "pass the airplane" to other controllers as the flight continues across country.

Hazeltine Corporation chose the Bryant drum for its reliability, dependable interfacing capability and low cost per bit. To find out how Bryant solves tough jobs in other fields write to 850 Ladd Rd., Walled Lake, Michigan 48088.

BRYANT COMPUTER PRODUCTS

XLO

EX-CELL-O CORPORATION

CIRCLE 12 ON READER CARD

letters

european edp

Sir:

I was very interested in the September issue, which covered dp developments in Europe. In the article, "European EDP" by Charles White, reference was made to airline developments, but the author overlooked the Irish International Airlines. In Dublin, we have two IBM 1440's working with a Teleregister availability and inventory system, linking sales offices in the United Kingdom and Ireland. We are planning a move to third-generation computers with full on-line passenger name records in 1968.

J. F. DONOVAN
Irish International Airlines
Dublin, Ireland

Sir:

The titles of the two figures in my article ("Automation in Europe," Sept.) were reversed, possibly confusing some readers. Fig. 1 should read "Computers and computer centers in banking" and Fig. 2 should be "Computers installed in U.S. and Europe."

W. K. DE BRUIJN
Amsterdam, The Netherlands

Sir:

Most of the articles in the September issue degenerated into a monotonous, chauvinistic theme: The Europeans are destined to failure because they are not like the U.S., or like the U.S. thinks they should be. Surely you don't really believe this.

PHILIP BAUMEISTER
Rochester, New York

You've oversimplified somewhat the message of the theme articles, but what you identify as the theme is one part of it. We probably did not make it clear that we feel Europe need not be exactly like the U.S.—or like the U.S. conception of what it ought to be—in order to make better use of information processing equipment and techniques. Perhaps there is some way for European countries to maintain their own character *and* make faster progress. We hope so.

Sir:

A Dutchman enjoying very much the hospitality of this country, I was somewhat shocked by the Editor's Readout in the September issue, which in my opinion, generalized too much about Europe when you really had only one country in mind. As you stated so correctly, Europe is a fantastic maze of international, intranational, linguistic and cultural barriers. Realizing this you might as well not try to understand its cause; find yourself a real European, if there is one, to safeguard you from pitfalls.

B. AKKER
Bellingham, Washington

Contrary to Mr. Akker's reading, the editorial specifically made reference to French and English situations. And the barriers mentioned are real, although not mortared in place. We hope someday to be able to publish something about Europe of a more positive nature.

compilers & assemblers

Sir:

Regarding C. J. Shaw's article, "Assemble or Compile," (Sept., p. 59) I would like to make three comments.

I object to the use of COBOL as a commercial language. COBOL may stand for *CO*mmon *B*usiness *O*riented *L*anguage, but through its evolution has without a doubt become the most dynamic data processing language available today, besides being as machine independent as we can define such a classification. We are currently proving COBOL's versatility, using it to write efficient programs for models in logistic simulation.

To quote Phil Cramer of SDC, "It still takes good COBOL programmers to write good COBOL programs," (or any other procedural language).

"Object-code efficiency is often not an important factor . . ." leads one to believe an untruth that a good compiler means good programs. Since Mr. Shaw used JOVIAL to illustrate his conclusions, I will take the same liberty using COBOL. In adding a variable array option to a COBOL program, the option took 27 minutes to run, which was inefficient and unsatisfactory. By modifying the option with standard COBOL language elements, time was reduced to a tolerable four-plus minutes execution time including loading of program.

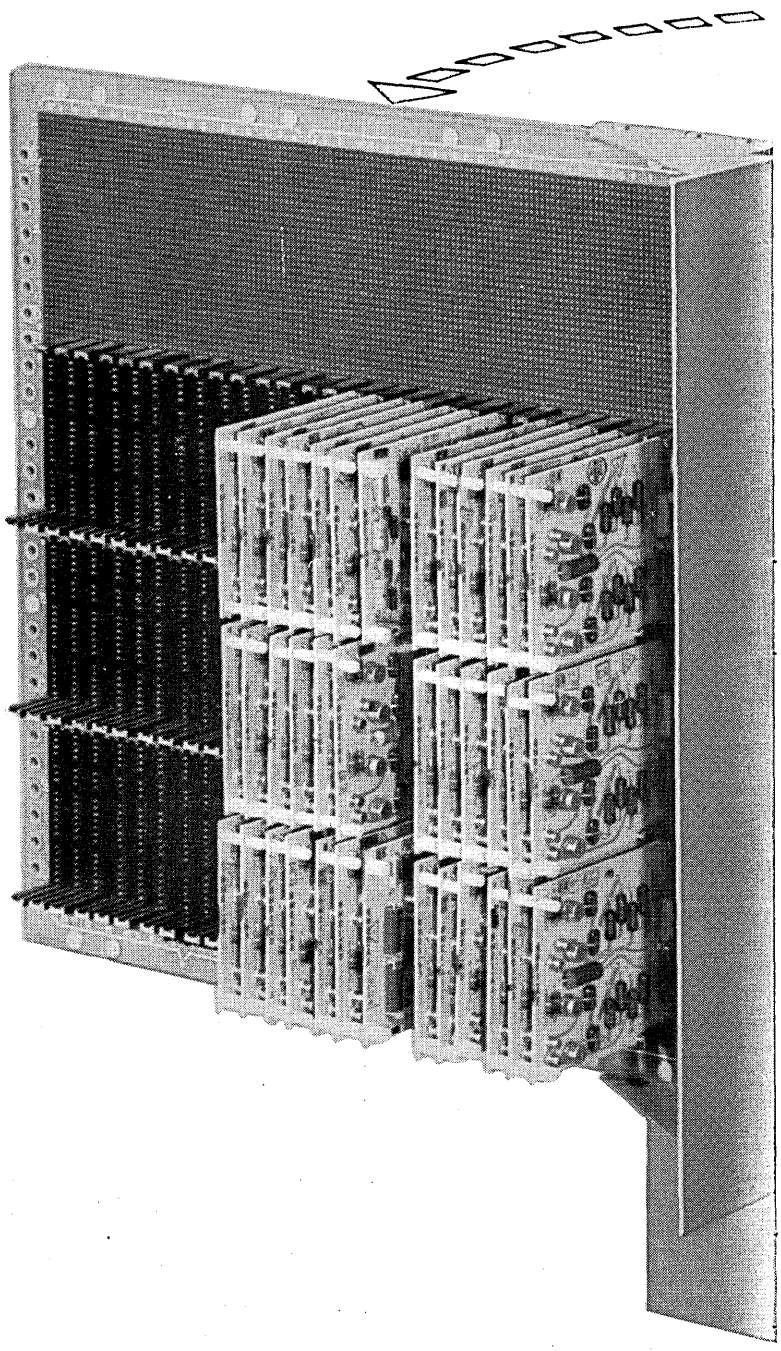
SY BERLIN
McLean, Virginia

Mr. Shaw replies: COBOL is indeed being used for an amazing variety of applications, far removed from business data processing. Solving of ordinary differential equations and processing decision table programming languages are examples of this. Nevertheless, COBOL is not the best language for every application, and there probably even exist applications for which an assembly language would be a better choice. Which is really all I said.

A poor programmer is going to write lousy code in any language, and any code optimization done by the compiler will affect program quality no more than a blowtorch will affect the Greenland icecap. And I should, of course, have said this in my article.

It is true that "object-code efficiency is often not an important factor." And it is not true that "a good compiler (always) means good programs." But I find it incredible that anyone could infer the latter from the former.

RCA's new 1-μs Integrated Circuit Memory System is expandable up to 32,768 words X 36 bits

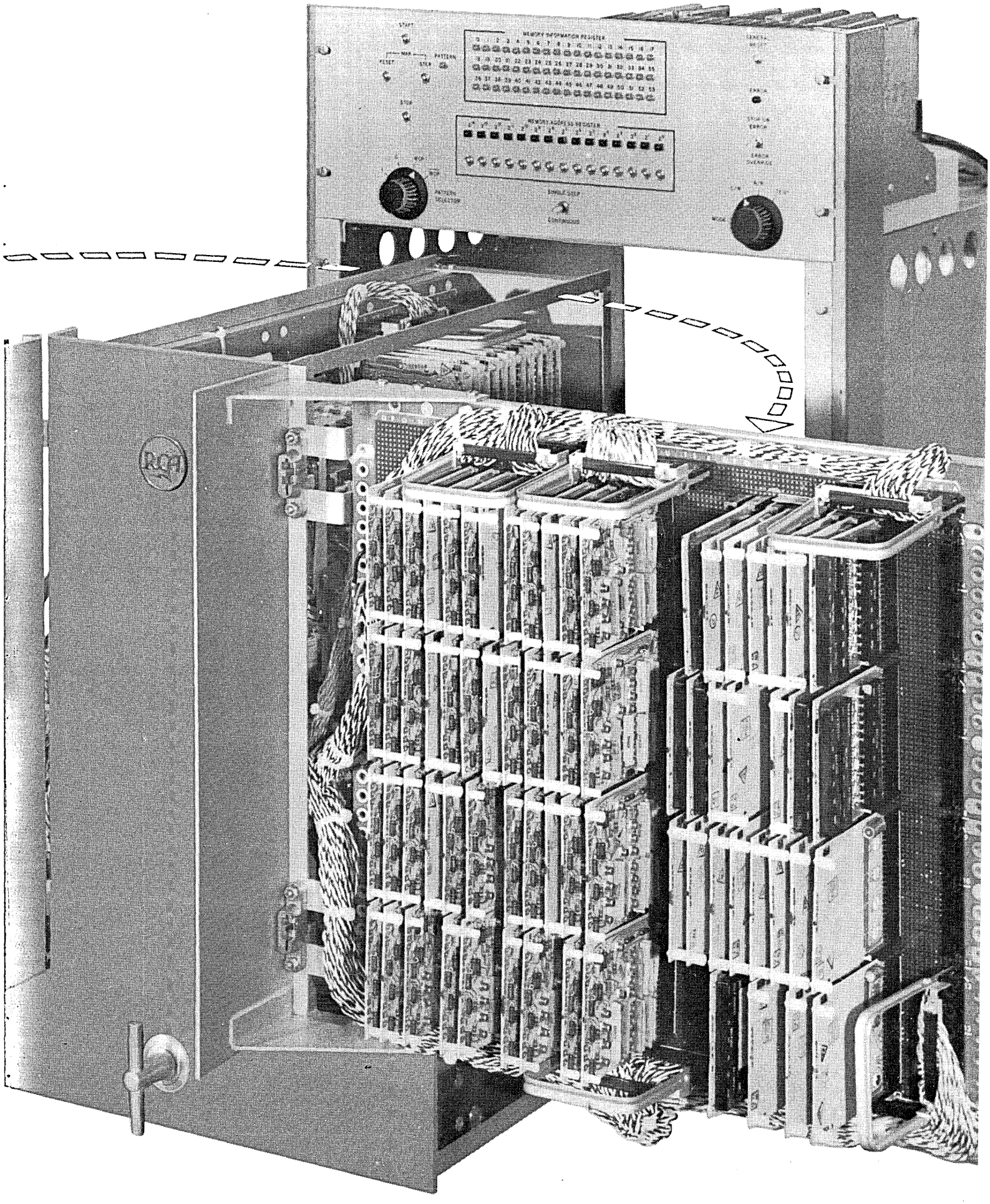


Integrated circuits in this new RCA memory system increase speed, reduce size, and lower power needs. Complete front-panel accessibility provides easy maintenance... panels slide out and open like a book. Field-proved RCA circuit modules assure high reliability. And you have maximum flexibility with such optional features as: expandable memory size, a self-tester, Read/Modify/Write operation, and easy interfacing. Ask about the new RCA 30/18 high-speed cores that make this system unique... and reduce the cost to you. A new 2-μs system is also available. Call, write or wire your RCA Field Representative today for price and delivery information. For a technical data brochure, write RCA Electronic Components & Devices, Commercial Engineering, Section FD 11, Harrison, N. J. 07029.

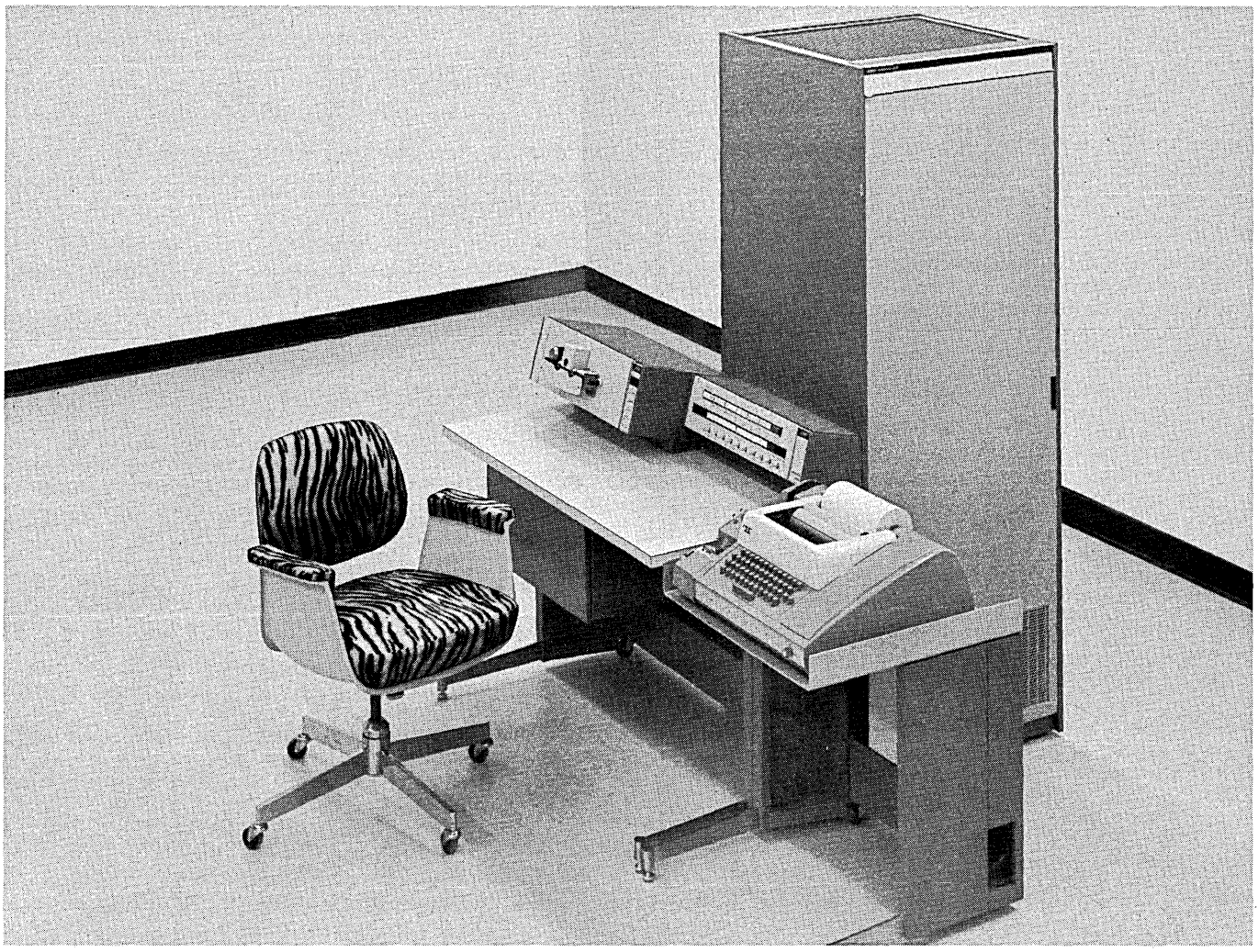
RCA ELECTRONIC COMPONENTS AND DEVICES

The Most Trusted Name in Electronics

CIRCLE 14 ON READER CARD


START
RESET
MAR
STEP
PATTERN
STOP
MEMORY INFORMATION REGISTER
MEMORY ADDRESS REGISTER
PATTERN SELECTOR
SINGLE STEP
CONTINUOUS
RUN
RCA

The new ADVANCE 6130, ready for delivery at $34,500...



...we used to call it the "paper tiger"

Last July we announced the *ADVANCE* 6130, specially designed for real-time data acquisition and control applications.

At that time we couldn't promise immediate delivery and frankly called it our "paper tiger".

Right now our tiger is all hardware and purring smoothly. Software is also ready with FORTRAN, symbolic translator, and a real-time and batch processing monitor.

With a 900 nanosecond memory cycle time and 16-bit data word (plus parity and memory protect bits), the all integrated circuit 6130 computer can show its teeth in outperforming all competitive machines, including those most recently announced.

The *ADVANCE* 6130 will be uncaged for the first time at the Fall Joint Computer Conference, San Francisco, November 8-10, Booths 119-121. Should you like more information beforehand, please call or write: Computer Division, Electro-Mechanical Research, Inc. 8001 Bloomington Freeway, Minneapolis, Minn. 55420. Phone: (612) 888-9581.

COMPUTER DIVISION EMR

look ahead

NBS CENTER STANDARDS
JOB RUNS INTO OBSTACLES

It looks as if a deep crack has developed in one of the three columns (BuBudget, General Services Administration, National Bureau of Standards) designed by chief architect Congressman Jack Brooks to support coordinated control of the federal government's massive edp investment.

The BOB efforts -- essentially policy setting -- seem sound enough, and the GSA activity was hopefully strengthened recently by moving key man Ed Dwyer to a higher level.

But a comprehensive and intensive program outlined by the director and staff of the NBS Center for Computer Science and Technology to coordinate standards/compatibility techniques may be seriously hampered. The Center's budget has been heavily slashed, according to the latest Congressional appropriation hearings, key people required to get the program moving have waited several months for approval ... other slots have not been made available.

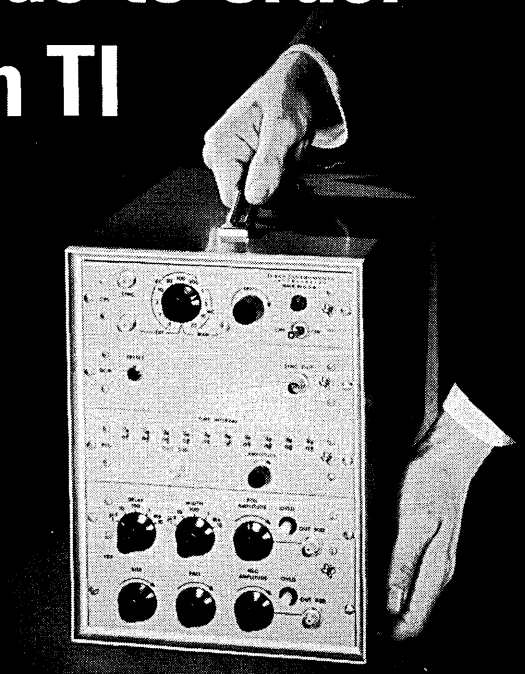
All of which makes some critics feel that responsible government officials don't understand the NBS mission as outlined in the Brooks Bill ... don't understand the complexity and severity of the industry's standards problems. Other evidence supporting this belief is the fact that one NBS faction obtained reversal of a recent decision to abandon the Pilot project to build a computer. Begun in 1956, the machine reportedly incorporates vacuum tubes, one I/O channel, features which would not seem to qualify it as a startling advancement in the state of the art.

The NBS ruckus has already attracted the attention of Representative Brooks, who, we understand, has asked the GAO to review the Pilot project and who has discussed the problem with Dept. of Commerce officials. Brooks, on record as opposing hardware R&D as a legitimate part of NBS work, and an outspoken advocate of accelerated attacks on the compatibility problem, can be expected to watch NBS activity closely.

BONUS GIFTS -- A BONUS
FOR EQUIPMENT MAKERS

The Bonus Gifts program at the Service Industries Group of Rexall Drug and Chemical Co. is shaping up as a massive data processing application -- a 4-to-5-year potential of handling more pieces of paper than the Federal Reserve clearing house operation -- requiring multiple computers and character recognition equipment. It's an extension of trading stamp and coupon promotions, with the consumer being offered a choice of redemption plans -- her favorite kind of trading stamps or cash. Manufacturers who sign up to take part will include the Bonus Gifts coupons with their products, using them in some cases instead of "cents-off" promotion plans. Buyers send these coupons to the processing center which returns certificates redeemable for stamps or money. Big incentive for the manufacturer to use the plan is that

how to get your Pulse Generator "made to order" from TI



"Special" Pulse Generators are made to order at TI. Modular construction allows assembly of the right building blocks to meet your requirements. Now, "specials" cost you no more, frequently cost less than conventional pulse generators.

For example, the 6613 is an economical general-purpose unit with PRF from 15 cps to 15 mc, priced at only $950. Another model, the 6325, is a ten-channel, word-bit programmable unit operating up to 25 mc. The single unit does the job of ten discrete generators, at half the cost, and fits in a cabinet 23 in. wide, 38 in. high, 18 in. deep.

TI Pulse Generators give you outstanding performance: PRF's to 100 mc, fast rise and fall times, variable pulse width and delay, variable rise and fall times, plus and minus outputs, pulse mixing, programmed and random word generation. You have your choice of portable or rack-mounting cases.

When you need special pulse generator performance, choose one of the thousands of standard pulse generator combinations from Texas Instruments. For more information, contact your nearest TI Authorized Representative or write to the Industrial Products Group in Houston.

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CIRCLE 16 ON READER CARD

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If you're going to have a new business address, please fill out the form at the right now and return it to us. We'll make sure that DATAMATION keeps up with you. To save time, we need your old address, just as it's printed on the mailing label, (or the whole label is better yet) as well as your new address.

define your terms, please

Whatever your work in information processing, you'll communicate better with the help of this authoritative glossary.

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City

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it improves control of redemption. With present coupon promotions, the fickle consumer may persuade the corner grocer to redeem the coupon on a competitor's product. Burroughs is likely to get the order for a B5500 system with more to follow. Recognition Equipment will supply custom-designed coupon readers and a standard OCR document reader to start. Project planning is well under way now, including recruiting of systems analysis and programmers.

A MULTI-PROCESSOR FROM SEL

Systems Engineering Labs will soon announce a multi-processing version of medium-scale 840A. The 840MP can have a configuration of up to three cpu's with 32K core each and share a 65K core bank. I/O processors are also available (up to four with one or two cpu's, two with three cpu's), each with three fully buffered channels handling up to 16 controllers. The system will use 840A software and peripherals. Deliveries begin in second-quarter '67.

TECHNOMICS TAKES NEW APPROACH TO CAI

About to complete its first year in business, Technomics Inc. of Santa Monica, Calif., now has 22 people, a good-sized contract with the U.S. Office of Education, and strong opinions about the right approach to Computer-Assisted Instruction. The company is headed by some well-known alumni of RAND and SDC. Dr. Norton Kristy, from RAND, is president and ex-SDC training director Dr. Warren Pelton a vice president. Other management members from the same organizations: Robert B. Parks and Burton R. Wolin.

The USOE contract involves an investigation of 12 school districts to determine the characteristics of successful programs in improving education results. Findings will affect the distribution of Title I money for aid to education.

As for CAI, Technomics takes the view that special-purpose devices are the way to go -- to be used in small doses where the subject matter is applicable and the student needs intensive, short-term training. To this end they are developing the Simutech Trainer, an outgrowth of the trainers at RAND used for Gemini and Apollo mission simulation. First application expected is technician training in military organizations and retraining for industry.

AIM OFFERS MIS IN MINNEAPOLIS

A new information management firm -- AIM, Inc. -- has been set up in Minneapolis by Richard Sherman (ex-IBM, Univac, RCA marketing man) to do MIS planning, consulting, contract-management of computer installations; provide applications packages and processing; sponsor schools and seminars (initially for Twin Cities firms); develop a service-bureau operation; and just grow -- nationwide. AIM emphasizes it's acquisition-minded. Besides renting computer time, the 16-man firm will start with a B-300, to go into on-line processing in February. Depending on the number of acquisitions and mergers in the next year, AIM will also add either a time-sharing RCA 70/45 or a Univac 490 series system. Optical scanning services will also be provided on either Farrington or CDC units.

3M INTRODUCES FAST, PAPERLESS PRINTER

Three M dipped a toe into the murky waters of edp early this year (Datamation, Jan. '66, p. 19) and now intends to make a splash. The company has been

(Continued on page 135)

Just as we expected, Sigma 7 is 30% faster than we promised.

When we put the first Sigma 7 together, we found that its cycle time was 850 nanoseconds.

So why had we promised 1.2 microseconds?

Because we wanted to wait and be sure. And 1.2 microseconds is impressive enough.

So much for cycle time. Sigma 7 is an integrated system of hardware and software, and raw speed is a poor way to describe how fast it gets the jobs done.

Take input/output. Most computers have to take time to do it. Sigma 7 doesn't. It has two processors — one for computing, another for input/output.

Sigma 7 was designed from the beginning to do real-time on-line control, conversational time sharing, batch processing, and high-speed input/output all at the same time. With full protection for everybody. And every job done as fast as the user wants it done.

We're delivering both hardware and software a little ahead of schedule. Two Sigma 7's in our plant are busy full time checking out software. When you get your software packages you know they'll run.

So far we're keeping all our promises. Except the one about the cycle time.

Sorry about that.

SDS

Scientific Data Systems,
Santa Monica, California

CIRCLE 17 ON READER CARD

editor's readout

COMMUNICATIONS: THE PICTURE IS CONFUSED

I can tell you *exactly* when the headaches started, Doctor.

It was one hour after I decided that I would write an editorial about communications and information processing—yeah, computers—and how things are *really*. What communications services are available to computer users, and how the tariffs—no, not like duties. Like rates—are set and . . . Maybe if I try to explain it to you, it will help me clarify things and ease the nervous tension? Well, I doubt it, but it's worth a try.

Well, let's see. First of all, there are these common carriers. . . . I don't know why they're called that. No, I don't think there's such a thing as an uncommon common carrier. They are the companies authorized by the FCC—Federal Communications Commission—to transmit voice and record information. . . . Record information is data, I think.

Now there are also dedicated networks. . . . Dedicated is like private. Some companies have their own communications equipment. And there are people who apply for a license to provide a communications service between two points, and they say they can do it cheaper, but the common carrier points out that their rates are based on all sorts of terrains and populations and they spend lots of dollars on research. There are a lot of FCC hearings and sometimes it goes to court. Companies and industry associations also try to bypass the common carriers. Sometimes they want their own microwave network, and sometimes they want their own satellite or they want to deal directly with Comsat . . . That's the Communications Satellite Corp., which was authorized by Congress, and it's publicly held.

Well, the public holds half the common stock; the other half is held by 163 common carriers, one of whom—AT&T—is the largest single stockholder, with 29%. Thus AT&T is an owner, a customer and a competitor of Comsat. The public elects six members of the 15-man Board of Directors; six are appointed by the common carriers, and three by the President of the U.S. with Senate confirmation. Let's see. There are 46 foreign countries which also share in the direction and profits of Comsat, and their votes and shares of the profits are weighted. Comsat's share now is 56.2%, but it can't get below 50.6%. Great Britain has 7.7%, Germany and France 5.6% each. Policy matters are decided by Comsat's voting strength plus 12.5%. If there's no decision on an issue within two months after it's brought to vote, it takes Comsat plus 8.5%. The FCC decides matters not specifically covered by the Congressional dictum which established Comsat. Like whom Comsat will serve. The latest ruling is that users must go through the common carriers to make use of Comsat's international transmission network, unless it's a "unique and exceptional" circumstance.

Where was I? Have I told you yet about AT&T and Western Union and TWX? About the Telpak rate investigations? About the question of who owns the ground stations which capture and transmit the national network information abroad? Oh. And I forgot to explain about the other international carriers competing with Comsat. And I think Comsat might be eligible to be a common carrier inside this country.

You probably already know about the squabble between AT&T and Bunker-Ramo over just what B-R is allowed to do with the information it offers the users of its stock quotation network. And there's the question of whether or not Western Union qualifies as a common carrier to offer its national computing "utility." Should computing services be regulated? If, so, by whom?

Maybe we ought to go back to the services offered by the major common carriers. AT&T, whose services range from 0 to 4 megacycles. . . . A cycle is like a bit per second, I think. Most of these services fall in the 150-2400 range, and that includes Dataphone, which offers 30 different data sets or modems . . . a modem is a unit which converts and transmits computer data. The ASA vocabularly says it's a "MOdulator-DEModulator." . . . Now AT&T won't guarantee rates above 2400 bps over its common user lines, except you can move data 3600 or 4800 bps if you use modems made by other communications firms, only you can't use them unless you have a dedicated system. . . . Dedicated is like private. I told you that earlier. Then there's Telpak. . . . What? You say you have a splitting headache?

Why don't you just lie down, and tell me all about it. Maybe if you try to explain it to me, it will clarify things and ease the nervous tension.

THE COMPUTER UTILITY

a public policy overview

by MANLEY R. IRWIN

Within the next decade electronic data centers are expected to sell computational power to the general public in a way somewhat analogous to today's distribution of electricity. These systems will cover the U.S., establishing an informational grid to permit the mass storage, processing and consumption of a variety of data services: computer-aided instruction, medical information, marketing research, stock quotations, airline and hotel reservations, banking by phone—to mention only a few. Many of these services exist today in embryonic form, and the reality of computer networks linked by high-speed communication circuits has generated considerable interest in the potential of a new industry —the information, computer, or data utility.

This paper will concentrate on the competitive problems of the computer utility as an industry. We will sketch the market potential of the industry, focus on two candidates who seek entry into the industry, outline problem areas of market rivalry, and consider competition vs. regulated monopoly as policy options. We will conclude that, with few exceptions, the computer utility is unlikely to exhibit the traits of a "natural monopoly" and that the industry is capable of vigorous market competition.

the idea

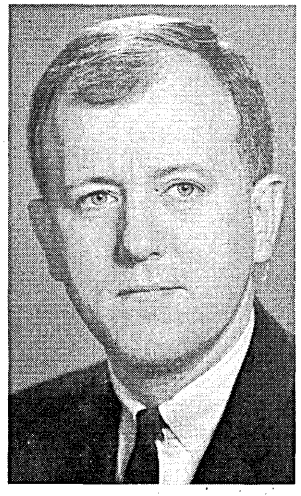
The concept of the data utility is a product of technical advances in computer programming and the realization that batch processing does not exploit the full potential of the computer. Some of the most complex scientific problems use less than 10% of the computer's capacity—a fact that results in high costs, high prices and therefore, limited availability of computer usage. Multiple access processing, on the other hand, permits several users to interact or communicate with a central computer. This development gives impetus to a host of new services now largely unavailable to the public.

Two examples point up the potential of data utility services. IBM's market information service combines an industrial data base with an input-output model of the U.S. economy. The business information service consists of financial data on 400,000 firms gathered under license from Dun & Bradstreet. The input-output classifies U. S. industries on the basis of their purchases and sales. This information is then made available to IBM's customers. The customer keys in the relevant input and receives marketing estimates or profiles in terms of geographic size and location. Clearly, this service attempts to reduce the hazards of market projections as well as making such projects available to smaller-sized firms currently priced out of marketing surveys.

The commercial possibilities of a time-shared service are also illustrated by the operations of KEYDATA Corporation. Firms store their stock inventories and customers in KEYDATA's computer; the subscriber can then direct the computer to record the customer's orders, prices and delivery data. In turn, the user receives information on the customer order, credit, invoice, inventory—all without the use of punched cards or paper tape. KEYDATA insists that even larger companies as well as small firms can effect economies through its time-shared service.

In addition to these examples, several trends lend an air of inevitability to the computer utility concept. General Electric contends that by 1970 75% of all computers will possess time-sharing capability. Informatics argues that by 1975 nearly all computer usage will be on-line. Western Union estimates that within five years some 60% of all computers will be tied into the nation's communication networks. The Bell System predicts that eventually half of the information transmitted over its network will be data. And finally, *Business Week* projects that time-shared services will grow from an estimated volume of $20 million to some $2.5 billion within five years. Whether these estimates are inflated by optimism

Research for this study was partially funded by a grant from the Office of Naval Research.



Dr. Irwin has formerly been a staff economist for the Select Committee on Small Business for the U.S. Senate, and an industry economist for the Common Carrier Bureau of the FCC. Holder of a Ph.D. from Michigan State Univ., he is presently associate professor of economics, Whittemore School of Business & Economics, Univ. of New Hampshire.

or exaggeration, the concept of the data utility has attracted the interest of two major industries—the data processing industry and the communication industry.

market entry

Although the data processing industry and the communications common carriers are prime candidates to supply data utility services, each industry differs in market environment and structure. Consider first the data processing industry.

Data processing firms can be classified as: (1) integrated firms that manufacture computers and peripheral devices and also offer data processing services; (2) nonintegrated firms that manufacture a variety of terminal equipment; (3) nonintegrated firms offering only data processing (service bureaus); and (4) corporations that sell data processing services as a sideline because of excess computer capacity. The first group, computer manufacturers, includes some dozen hardware fabricators; most also operate data processing centers or service bureau affiliates.

A second market related to the supplying of data processing equipment consists of peripheral hardware such as desk-size computers, video display devices, printers, readers, modems, tape drives, etc. This market is occupied by main-frame manufacturers as well as scores of firms that manufacture only peripheral equipment, such as terminal devices.

The service bureau market includes firms that buy and lease computer hardware, in turn selling machine time or data processing to their subscribers. In contrast to about a dozen major integrated computer suppliers, nearly 800 firms engage in service bureau activities, suggesting that market entry into this phase of data processing is relatively easy. Many of these firms operate on local levels, others are regional.

Finally, the data processing field includes firms whose activities are ancillary to data processing per se. These firms have computerized their in-house data requirements and have experienced either excess computer capacity or excess communications capacity, and attempt to reduce overhead by expanding into commercial data processing. The banking and aerospace industry typify this type of diversification.

Whatever the members of the data processing industry may possess in variety, they lack an element essential to a national information system—communications circuits. Data transmission lines thrust the common carriers to the forefront as prime candidates for entry into the information utility field.

the communications industry

Two domestic communications carriers, Western Union and AT&T, supply the nation's long distance communications channels and services. Of the two, Western Union has been the most emphatic in committing its future to the information utility concept. To date, Western Union has initiated several steps in this direction: it provides customized business information systems, it has embarked on setting up dp service centers, it has undertaken a program to computerize its switching net, and it has announced a job-finding service and a legal reference service. (Western Union also provides communications circuits to business and commercial subscribers on a private lease basis.) The result is that the company expects to offer computerized information services in the near future that include credit rating, market securities, library bibliographies, and medical data. In short, Western Union has no hesitancy in identifying itself as an information utility.

AT&T, by contrast, has not expressed any direct interest in a computer utility system such as that outlined by Western Union. Although AT&T has been content so far to lease communication lines to the dp industry, it is clear that it would be a formidable candidate if it elected to enter the data utility market. AT&T has a nationwide network of communications circuits; it is embarking on electronic switching exchanges with memory and switching capability; and it provides a host of devices — e.g., the touchtone telephone or Teletypewriter adaptable as terminal units for transmitting and receiving data. Moreover, the telephone company's management information system represents a vast effort to computerize a host of internal management functions including customer accounts, records, credit, payroll, etc. What the telephone company has not done to date is introduce a digital information service comparable to that of Western Union.

problems in competition

As the data processing and communication carriers embark on data utility services, the very nature of their candidacy poses competitive issues that are as intriguing as they are complex. We will first consider competition within each industry and then competition between the two industries.

If we postpone consideration of IBM as a special case, the remaining major computer manufacturers generally occupy two markets, manufacturing computer hardware and operating dp centers competitive with those of independent service bureau firms. In this integrated-nonintegrated environment, the line between economic efficiency and market power may be obscured. The hardware suppliers, for example, might find it tempting to raise prices on leasing or selling computers while at the same time indulging in selective price reductions in data processing.

Caught in a cost-price squeeze, the non-affiliated service firm may choose several options not all of equal attraction: they could merge with a hardware supplier and become similarly integrated, play-off one supplier's price against another; merge into larger service bureau units in order to establish countervailing power; or get out of the industry altogether.

IBM is, of course, unique—not only because of its predominance as an integrated supplier but because it must live within the constraints of an antitrust consent decree. The 1956 decree ruled that the parent manufacturing firm could not engage in service bureau activities in which customer data is manipulated or otherwise changed. The decree sought to drive a wedge between IBM as a manufacturer and IBM as a service bureau. To this end, the Justice Department required IBM to form a separate data processing affiliate, the Service Bureau Corporation. The affiliate was permitted to do what IBM as a manufacturer was precluded from doing—the direct handling and processing of customer-owned data used in such applications as payroll, accounts receivable, job costs, invoicing, etc.

Apparently, the decree does not condemn IBM's own machines to idleness. Today, subscribers may bring their data to IBM's own data centers, process it, and be billed for the appropriate machine time. Because IBM does not "touch" customer data, the sale of raw machine time is ostensibly a legitimate activity under the consent judgment.

IBM has not only joined the move to manufacturing time-shared computers, the parent corporation operates time-shared data centers as well. With the QUIKTRAN service, for example, IBM computer centers will offer facilities for solution of engineering and scientific problems by subscribers who are located at remote stations. In addition to its market information service, IBM recently inaugurated a time-shared service that edits, updates, and

justifies correspondence, reports and other business documents. Again the user gains computer access via a remote terminal.

These new developments in technology and services raise the question, once again, of the status of IBM's consent decree. Does time-sharing merely permit IBM to sell computer time over telephone lines, or is IBM processing customer data for a fee? What is legitimate activity for IBM as a manufacturer and IBM as a service bureau? The answers to these questions are not clear, but as if to hedge its short term anti-trust bet, both the Service Bureau Corporation and IBM, the parent corporation, have recently introduced nationwide systems of time-shared computer centers. In the long run, however, IBM may find it necessary to convince the Justice Department that new technology has invalidated major premises of its 1956 judgment.

competition within the communications industry

The common carriers represent a second candidate for data utility services, and living with the constraints of consent decrees is not alien to these regulated firms. Since 1956, the Bell Telephone System, the nation's largest communications carrier, has been subject to certain limitations as an outgrowth of an antitrust suit in 1949. The consent judgment precludes Bell's operating carriers from engaging in services that are not subject to public regulation. Inasmuch as data processing is presumably not such a service, Bell may be prohibited from engaging in this activity.

Western Union is, of course, under no antitrust burden. As the telegraph company advances further into data processing, it has been conspicuously reluctant to file tariffs for these services. Such tariffs, once accepted by the Federal Communications Commission, carry a double edge. They would disclose rates on services which competitors in the computer industry could easily underbid; they would also extend data processing as a legitimate common carrier activity, thereby possibly opening the door for AT&T to engage in similar services. Indeed, Bell recently acknowledged before a House subcommittee that its entry into computerized services rested on the FCC's acceptance or rejection of a filed tariff.

As with IBM, it is conceivable that in the long run, Bell may seek some accommodation with the Justice Department by pleading that changes in information technology have rendered the decree's sanctions obsolete. Bell may find it necessary to seek a redefinition of "communications" to include data processing on grounds that the two are inseparable—a view reminiscent of its position that communication technology has blurred the distinction between voice and nonvoice messages.

In either short or long run context, the organization of the Bell System gives it dual leverage within the communications industry. Consider the vertical or supplier-customer aspect of this leverage. The Bell System's position as a wholesaler of communications lines creates a condition that increases Western Union's vulnerability to a cost-price squeeze somewhat analogous to the computer-service bureau rivalry. The wholesaling carrier may rent circuits to a competing carrier and at the same time make circuits available to commercial users on more advantageous terms (an allegation made by Western Union during the FCC's telegraph investigation). Whether this will ever manifest itself as a major problem in the future is of course speculative. In any event, the FCC has declared that carrier-to-carrier leasing agreements fall outside their jurisdiction, and attempts by the commission to secure such authority from Congress have thus far proved notably unsuccessful.

The horizontal or supplier-supplier aspect of market leverage is also a distinct possibility. If Bell occupies two markets, one competitive (nonvoice service) and the other noncompetitive (voice service), then due and undue price discrimination may be difficult to disentangle, much less expose. The carrier may not be above setting full cost prices in its monopoly market but less than full cost prices in its competitive market. As long as regulating authorities concentrate their attention on the rate of return rather than rate structure, undue price discrimination will remain largely undetected.

This strategy of pricing is not without precedent. A study, undertaken by the Bell System at FCC request, assigned full cost to seven of Bell's interstate services. The study concluded that Bell's competitive services earned in excess of reasonable returns. All of this suggests that the FCC will hear more of the merits — or infirmities — of marginal cost as a pricing philosophy within the confines of the communications industry.

competition between regulated and nonregulated firms

Market rivalry is and will be muddied by the fact that the communication industry is regulated but the data processing industry experiences varying degrees of market competition. As the two industries move on a collision course, several problems are likely to arise. Four come to mind: (1) the availability of communications circuits; (2) the cost of communications circuits; (3) the costing of terminal equipment; and (4) the pricing of digital data services.

Since the carriers own the nation's communications circuits, they enjoy considerable influence as to who can and who cannot enter the data utility market. An example of this phenomenon erupted before the FCC this year in a dispute between the Bunker-Ramo Corporation and the common carriers. Bunker-Ramo provides a computerized stock quotation service to brokers and financial houses throughout the brokerage community.

Recently Bunker-Ramo initiated a new service called Telequote IV. Under this new service, Bunker-Ramo's computer functions not only as a bank of assorted information on securities, but it serves as a message forwarding device as well. This capability permits brokers in different locations to key into Bunker-Ramo's computer and virtually negotiate a stock transaction. In short, the computer skirts the analogy of a "switchboard."

At first the carriers were reluctant to lease circuits for Bunker-Ramo's new service. Indeed, the telegraph company refused on the grounds that Bunker-Ramo's Telequote IV violated Western Union's authorized user section of the tariff, a provision whereby the carriers permit customers to resell communication circuits.

For example, if customer A leases circuits in order to resell them to customer B, then user B acquires "authorized user status" if the carrier decides that both A and B are in the same line of business. Once the carrier makes this determination, Bunker-Ramo or any other similar firm can act as a communications broker between the carrier and investment security houses.

The Bell System expressed similar concern that Bunker-Ramo's Telequote IV impinged upon common carrier activity. After several rounds of discussion and some give and take between the parties, the telephone company agreed to provide circuits under its "authorized user" practice.

In the main, Bunker-Ramo was successful in this skirmish. However, the confrontation between the data proc-

essing industry and the communications carriers points to a very real and fundamental question—the control over market entry exercised by the communications industry. The carriers, in determining who qualify as authorized users, literally decide customer eligibility to Bunker-Ramo's service. It is important to note that at least in the short term this control appears to reside within the communications carriers rather than with any regulatory body.

Furthermore, the question of availability of communication lines is vital to Western Union's combination of data processing and message forwarding capability. The telegraph company will lease communications circuits to computer firms who apparently limit their activities to data processing alone. If, however, the edp firm incorporates message forwarding as part of its service, then the telegraph company holds that such service is one restricted to the communications carriers. This position hardly eases the FCC's dilemma: it may find the telegraph company refusing to tariff a data processing service because of market competition, while simultaneously refusing to lease circuits for switching because this activity is subject to the Communications Act. To repeat, the carriers command an enviable position because of their control of communication circuits and switching.

cost of communication circuits

The costing of communication circuits will play a strategic role in the evolution of the computer utility. The fact that carriers possess data links has implications that affect not only rival data utility services but the equipment market as well.

On the data service side, the carrier supplies circuits to itself and to computer customers. In the authorized user case, both the carrier and the firm selling to such users compete directly in the data/communications package. It is conceivable that the carrier will accord itself cost discounts denied to its competitor. Quite clearly these discounts would translate into a price advantage in selling computerized information services to the ultimate consumer.

The same costing advantage holds true if one shifts to the non-authorized user case. The computer firm sells only its data processing service; the subscriber to this service must turn to the carrier for necessary data circuits. In this case, the subscriber leases only channels at retail rates, but he might be able to purchase the complete data/communications package from the carriers. The internal discounting of the communication component side of this package again holds competitive advantages in the services market.

The implication of communication line charges cannot be ignored in the peripheral equipment market either. The Bell System not only supplies communication circuits, it has an important stake in manufacturing and leasing station equipment, notably Teletypewriter sets. If competition intensifies in the peripheral market, the tie-in of circuits and equipment accords the carrier additional flexibility in costing terminal equipment. The carrier may lower circuit cost (which would raise equipment cost), raise circuit cost, lower equipment cost, or manipulate both together. In practice, the latter two options may not be unattractive since competition is minimal in providing communication circuits. High revenues at this end of the equation could subsidize loss leader pricing in Teletype equipment. Indeed, there is some indication that the price of both circuits and terminal gear may be depressed sufficiently to place a burden on the carrier's customers in other markets. The FCC's telegraph investigation disclosed that Bell's TWX, which includes circuits and Teletypewriter sets, generated a 2.9% return—a profit level generally regarded as unsatisfactory by regulatory authorities.

It would be misleading on the other hand, to suggest that the dependence of data processing firms upon common carrier facilities is absolute. Computer firms may turn to private microwave systems as links between data centers; recently, the FCC has ruled that shared or cooperative use of privately-owned radio relay systems is permissible. But even this option, however attractive in terms of reducing costs per circuit mile, is not without its price: the capital investment to get such systems into being and the prohibition of interconnecting private circuits to the nation's public exchange network (not to mention Bell's Telpak tariff).

pricing of data utility services

The data processing industry and the communications common carriers possess mutual advantages in the pricing of time-shared data services—a fourth area of competition. Both industries may be able to split the data/communications package and assign price discounts on the basis of market conditions. Dp firms selling to authorized users, for example, cannot resell communication circuits at a markup over common carrier charges. Tariff schedules act, in short, as a price ceiling. There is no price floor in reselling communications circuits. The dp firm could skip the charge for communications circuits, bill its customers only the dp charge, thus relegating line costs as an overhead covered by some markets, but not in others. The ability to survive such loss leader pricing is as dependent on "deep pocket money" as on the ability to tap other profitable markets.

Even without the authorized user case, price flexibility of the data/communications package is within the realm of the possible. The dp firm may lease circuits to customer premises in order to give users access to a central computer. Again, the user may happily find communication links subsidized by the firm selling the time-shared service. Apparently, this is the policy of General Electric's Medinet division: namely, that it will absorb line charges in tying hospitals to its computerized medical information centers.

The converse is also true. A communications common carrier may absorb the dp component of the data/communications service while charging its subscribers full communications costs. Or the carrier may offer such severe price reductions to volume circuit users that this service, of necessity, must be carried by the firm's subscribers in other markets insulated from competition.

An additional windfall accompanies a carrier's move from a regulated market to a competitive one. If tariffs are filed on the former but not on the latter, then the potential of cross-subsidization becomes real, with the carrier underwriting short term losses in its unregulated market. Western Union's diversification efforts carry with it this latent possibility.

In summary, it would be an understatement to assert that the issues we have discussed relative to the computer utility concept are simple. On the contrary, the problems are intricate and complicated. This is particularly true in terms of competition between the two industry candidates for such services; for it cannot be forgotten that one industry, the communications industry, consists of private utilities subject to public regulation. As the carriers move increasingly closer to national information systems, the mere fact of their regulated status may well shape the status of all computer utility services. This brings us to the next issue: the possible avenues to public regulation.

public regulation

Regulation of time-shared data services may come about directly or indirectly. In either case, the question of defini-

tion is likely to be crucial. What is the nature of data information transmitted between two points? Does such information constitute common carrier communications as defined in the Communications Act? What precisely is the nature of time-shared computer systems which incorporate message switching capability as well? Is this activity akin to public telephone or telegraph service?

If the FCC regards these activities as falling under its responsibility, then it follows that the commission will request that common carriers offering a data service file appropriate tariffs or explain why they should not do so. This decision would meet head-on the question of whether the computer utility is to be a regulated industry, and the computer industry may find itself pleading that message processing and message switching stand as polar extremes, the former clearly outside FCC interest.

Regulation via the indirect route is a more subtle process. The FCC could eventually find itself regulating data utility services through the following sequence. First, a common carrier files a tariff on its computer switching operation as a legitimate step in plant automation. Second, once computers are in place, memory units of stored information are grafted to the switching system. A tariff is then filed and accepted on this service as a natural extension of computer capacity.

Lest the indirect route appear academic, a recent tariff filed by an international carrier embodies at least the first step. ITT World Com, an international record (non-voice) carrier, has recently submitted a tariff on a computer switching service. Customers are billed for a service which routes messages to designated locations. The tariff does not include communication circuits. It does not include terminal apparatus. It does not embrace communications as a total service. Rather ITT World Com has submitted a tariff solely on the computer and its switching capability.

What are the implications of FCC approval of ITT's new tariff? Does it mean that a computer manufacturer can no longer provide this service because it now falls into the common carrier bailiwick? Does it mean that any subsequent data processing service is a "natural" extension of the computer system and requires FCC approval? Will the carriers modify their foreign attachments rule? And do these decisions establish precedents that irretrievably lead to public regulation of the computer utility industry? Again, the problem elicits more questions than answers.

Perhaps a more fundamental question pervades the ITT World Com tariff. Does the computer utility as an industry fit the "natural monopoly" format that ultimately calls for regulation by the FCC? The answer to this question usually depends on whether the computer utility satisfies several conditions which include: a necessary and essential service to the community, a decreasing cost industry, and a high capital requirement incident to making such services available to the public. Although the evidence is at the best tentative, some observations are nevertheless appropriate.

services offered

If one posits a spectrum of information services, then presumably some services fall into the format of "natural monopoly", while others approach market diversity. For example, a medical information network consisting of hospital time-shared systems may not necessarily lend itself to duplication because of the feasibility of several medical units sharing only one system. Although several geographic regions might well accommodate different systems within each location, operating economies could limit the system to one firm, thereby approaching the analogy of the electric power industry.

At the other end of the data service spectrum, stock quotations, airline reservations, credit ratings, legal services, marketing services, etc., are proliferating to the extent that diversity, specialization, and rivalry appears the rule. That scores of firms are entering the industry offering competitive services, indicates the computer utility possesses none of the traits inherent in a regulated utility service. Although both monopoly and competitive characteristics exist, the latter appears the dominant trend.

The nature of operating costs will also be decisive in structuring the data utility industry. If a high ratio of fixed to variable costs proves the case, then lower unit costs will be realized if output is concentrated within the confines of a single firm. The information utility may experience decreasing cost, a condition that could lead to limited competition and eventual public regulation.

There is no guarantee, however, that data utility services as presently constituted will encounter decreasing operating cost despite the potential of sharing computer overhead. The reason is that (1) communications circuit costs vary directly with distance and (2) communication costs are assuming a greater proportion of total operating cost. Recent testimony before Congress indicated that beyond 75-100 miles firms operating on-line, time-shared services cannot compete with customers who purchase business machines and operate data processing in-house. The limiting factor was declared to be the cost of leasing communications circuits.

Here then is one irony. High communications costs suggest that the computer utility service will be local or parochial in operation and lead to market diversity; low communications costs permit larger and more centralized computer centers.

Furthermore, there is little likelihood, at least in the short run, that the existing carriers can introduce substantial reductions in communications line cost given their investments in switching and transmission facilities — an investment that exceeds $30 billion. Two discount pricing attempts have been rejected by the FCC and the courts either on grounds of price discrimination, inadequate cost justification or non-existent competitive necessity (the multiple channel and Telpak tariff). Even the introduction of communications satellites will probably be priced to average the cost of terrestrial and satellite circuits — as appears to be the case in international traffic — unless the FCC sees fit to encourage private non-common-carrier satellite systems for domestic use. In this context it would be remiss not to mention the carriers' sensitivity to communication circuits outside their ownership or control. Witness AT&T's tepid reception to the Ford Foundation's satellite proposal. Thus, communication line charges may rule that the limits of economies of operation give the data utility a bias toward an increasing cost, and hence a competitive industry.

capital costs

The magnitude of capital outlays will be a third factor that will affect the choice between competition or regulated monopoly. This outlay is crucial, for the number of firms eligible to provide data utility services will tend to be inversely related to the size of capital investment. These investment requirements can be categorized into hardware and software costs.

If we divide hardware into computer and terminal equipment, then a first question is whether the cost of large time-shared computer systems on the order of $6 million

automatically prevents market entry by the small or medium size firm. Two trends suggest that it may not. First, a service bureau company may lease instead of buying a computer, thereby spreading investment costs into a monthly stream of payments. (Leasing rather than outright purchase of computers may persist if the obsolescence of data processing equipment continues.) Second, service bureau firms as well as others may rent machines indirectly from computer leasing firms whose monthly rates substantially undercut IBM's rates. (The temporary rescinding of the investment tax credit may alter this advantage for 16 months.) Thus, the ability to lease shifts the burden of capital requirements back to the computer manufacturer and hence tends to remove a major deterrent to market entry for the small or medium size firm.

Station equipment such as Teletype printers is something else. Here leasing may work to the detriment of market entry. If the information utility is to own both central computer and satellite terminal apparatus, as well as data transmission lines, then obviously the capital requirements of this investment effectively limit market participation to only the large firm. Indeed, the addition of manufacturing capability to leasing computers, lines and terminal apparatus, approximates the organizational format of the Bell System. The policy implications of the computer utility adhering to this pattern are obvious.

On the other hand, there is no compelling reason why the customer must lease terminal input-output devices from the data utility. If the electric power industry is to be the borrowed model, then the subscriber will own his own terminal apparatus, plugging his devices into sockets for connection with the data center. This choice shifts a major investment burden to the subscriber and hence, lowers the barriers to market entry to the data utility firm. In short, capital costs, whether for main-frame or terminal devices, although large, do not appear to be prohibitive.

software costs

Software costs may be another matter, however; here, costs range from minimal to prohibitive outlays depending on the nature of the service contemplated. On the low side, for example, "canned" programs can be purchased at rates that enable service bureau firms to handle computation, inventory control, invoicing, etc.

A more expensive programming expenditure is typified by IBM's marketing service and input/output model. Although IBM used Department of Commerce data, conversion into computer language is estimated to have cost the firm in excess of two million dollars — an investment that would necessarily enjoin some firms from market entry.

Conceivably, capital outlays in computer programming such as a national document retrieval system could exceed not only the resources of a single firm but of the entire data processing industry. In this case, the government would likely bear the research and development cost — a possibility that has prompted the President's Office of Science and Technology to include a Comsat type entity as a possible option.

All of this deals with the present accessibility of software. The rash of mergers between the electronics industry and the publishing industry may temper one's optimism with respect to the future. IBM's acquisition of Scientific Research Associates, Raytheon's purchase of D. C. Heath, Xerox and Wesleyan Press, RCA and Random House, to mention a few, suggest that the scurry to establish data bases is gaining momentum. The ultimate impact on market entry resulting from the fusion of software and hardware firms remains to be seen.

conclusion

That the facts are scarce in an industry just now moving from concept to reality is to state the obvious. Nor have we catalogued all of the variables that could bear on the final decision to regulate the computer utility (eavesdropping, disclosure and potential abuse of proprietary information for example.) There is much to be said, however, for competition as a policy choice for the computer utility at least in the foreseeable future: most data services as they now unfold are characterized by diverse, specialized competitive services and it is by no means clear that the industry will exhibit traits of overwhelming economies of scale; capital expenditures, although potentially large, do not appear to be a prohibitive factor in market entry. Nor is it suggested that the combined ownership of computer manufacturing, computer programming or communication circuits is essential to the efficient operation or development of the computer utility. Computers can be leased, terminal devices can be purchased by the user, software can be acquired, circuits can be leased, and buildings can be rented.

Above all, competitition is particularly attractive as a policy alternative because it is a trusted vehicle that promotes diffusion of information technology in our economy. This innovative process is as delicate as it is vital. It can be impeded, delayed, or thwarted by market power, market structure, pricing practices and ill-considered regulatory decisions. By electing to keep the competitive game open and by choosing to enforce its rules, public policy could well play a key role in the development of the computer utility. ■

ELECTRICAL COMMUNICATIONS IN THE FUTURE

planning for the changes

by HARVEY J. McMAINS

The one word that best describes the prospects for communications in the next two decades is *change*. There will be change in the way we use the existing communication capabilities. There will be change in the pattern and advance in the use of communications which is not the result of expanding and improving the existing and available communications services. Rather, these changes will be the result of scientific discovery and invention, and the application of this discovery to the needs of particular situations.

The rapid rates of technological innovation and its importance to the national economy and financial soundness of corporations has put a premium on effective communications and intelligence systems. Management decisions based on history alone are seldom as useful as those based on the present or on accurate forecasts of the future. This means increased pressure on speed and presentation of data.

One of my favorite stories is one often told by the late Alben Barkley. The former Vice President used to tell of a poor old mongrel dog in his home town that was plagued by kids tying tin cans to his tail. According to the story the dog got so used to this treatment that every time it saw a tin can it would back up to it.

I think that many of us concerned with the future of management information systems often back up to the tin can embodied in the accusation that future systems will relegate man to the role of a non-thinker. I personally don't believe this. However, there have been many thousands of words addressed to this point and I don't propose to belabor it with verbiage. One point I will venture. There is something unacceptable and even revolting to me in the suggestion that man will allow himself to be stifled and lose his ever-restless and fertile imagination. Knowledge does not lend itself to an ethical classification as good or evil; it is, rather, the manner in which this knowledge is exploited with the society that introduces problems of an ethical or moral nature. In fact, the best intelligence system must be vigorously pursued and the most advanced techniques and hardware applied if we are to keep pace with the needs of a dynamic, advancing economy which may some day provide a self dignity for all mankind . . . if that be man's desire.

What change, then, can be expected in the communications art over the next 20 years that will affect systems planning? The major change will probably be digital transmission replacing or supplementing analogue. The new digital art will allow all forms of electrical communications to take place over the same facilities with a high degree of economic efficiency. For instance, we can expect:

- Microwave systems for linking suburbs and rural areas to cities.
- Economical cable circuits which can be used to distribute 20 or more TV channels throughout a community.
- Millimeter wave guide systems which provide 200 one-way TV circuits across our continent.
- Synchronous satellites with the capacity of 80,000 voice telephone channels or 160 one-way television channels, available to and from rooftop antennas without complex switching arrangements.

Also the electronics art has unexploited tools which are just about ready for widespread application. Microelectronics will soon make it possible to put in your home, in your car, or even on your person, compact and reliable apparatus with the complexity of a small digital computer. Coherent light from lasers will provide a revolutionary increase in the volume of communication that can be sent over a single pathway.

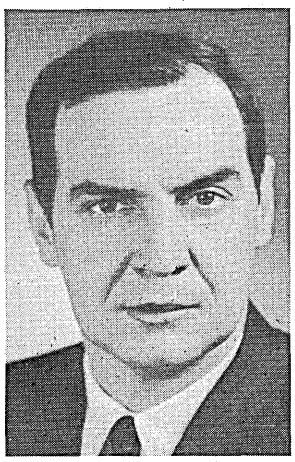
These potentialities, when put into play, will not merely expand or refine what we now can do; they will alter the way we communicate and even our habits of life in a revolutionary way. However, even the most informed man can not predict in what ways—or, with certainty, the useful and profitable forms—such changes can or will take.

If, then, we cannot predict the future, at least we can understand its possibilities and begin to develop and implement systems for test. For a given set of objectives, what we need is information and analysis that will reduce the risks inherent in decisions relating to our dynamic environment.

upcoming phone services

In our look ahead let's be more specific as to needs, possible desires and availability of communications without reference to the role of the supplier of the service.

Electronic switching of the types currently being installed provide a series of new features called memory services, which may very well be generally available in the next 10 to 20 years. These services include:



Mr. McMains currently heads up the Management Analytical Support Center at AT&T, where he has also been administrator of data communications planning and new services coordinator. He has also been with Bell Labs and Southwestern Bell, has held various positions including that of chief engineer. He holds degrees in engineering, physics and math, has attended Oklahoma, Georgia, Texas and Notre Dame.

Abbreviated Dialing. The customer can dial two or four digits instead of the normal seven to 10 digits to reach frequently called numbers.

Add-On. By dialing the appropriate code and then the number of the station desired, the customer can add a third party to an already established connection.

Present Automatic Transfer. By making prior arrangements with the telephone company, a customer can arrange to have the incoming calls routed to another number while he is away from his phone.

Variable Automatic Transfer. By dialing the appropriate code and the telephone number of the station to which he wishes his calls re-routed, the customer can have incoming calls diverted while he is away from his phone. The number to which the calls are diverted can be varied by the customer according to his needs.

Dial Conference. By dialing the appropriate code and the numbers of the stations desired, the customer can establish a conference with up to four additional stations without the aid of an operator.

Other communication services that I believe could be made available with modest additional development work if they are desired or needed:

Call Waiting. If a second call is directed to a customer's telephone while he is talking on the phone, an audible signal indicates to him that he has another incoming call. The customer can then, if he wishes, place the first call on hold and answer the second call. He can, if he wishes, then put the second call on hold and return to his first caller. Neither party can hear his conversation with the other caller.

Key Telephone Features. The various service features now provided through the use of multi-button station relay type key telephone equipment could be provided with non-button station sets and the memory capability of ESS (electronic switching system; for description, see Aug. '65, p. 31). These features would include: multiple line pickup and hold, dial intercom, etc.

Watchmen's Check In. With this feature a watchman making his rounds would use the regular telephone instrument to dial into memory, which would record the origin and time of his check.

Busy-Line Call Back. A customer reaching a busy line would hear a recorded announcement that the line was busy and asking him to leave his name and telephone number so that the busy party could call him back. When the busy line became idle the central office would automatically call it and the recording would pass the name and telephone number of the person who had called. This customer could now initiate a call to the person who had been attempting to reach him.

Automatic Answer and Recorded Message. With this feature, calls directed to a station would be automatically answered by the central office, and the calling party's message recorded, whenever the called party did not wish to answer the phone or was away from the phone.

Automatic Answer and Recorded Announcement. With this service the customer could dial an appropriate code and then dictate a recorded announcement. Subsequent calls directed to his number would then be given the recorded announcement.

Automated Wake-Up. A customer would dial an appropriate code and the time he wished to be called back. The central office would automatically remember these instructions and at the desired time would place a call back to the customer to awaken him as requested.

social changes

Social and economic forces now at work will affect communications needs of the future. In turn, communication services will have an effect upon the way we live and work.

For instance, the trend toward automation and automatic reporting, with its accompanying requirements for standardization of information and methods, will, for many people, restrict the freedom they have to do their job "in their own way." Advanced information systems will grow. These systems will be able to digest great volumes of data, instantaneously evaluate this data according to a well planned and complex process reflecting more pertinent factors than the human mind can handle systematically in a short period of time, and indicate appropriate and timely action. For many people these systems will similarly undermine their sense of importance. These developments, and others, are likely to cause people to search for new ways to express themselves.

Psychologists see a society striving to express itself in new ways oriented toward people rather than things. Such a society will tend to buy goods and services for their emotion fulfilling qualities and because they provide a sense of creative achievement.

The concurrent trend toward more leisure time will provide people with the time to devote to these emotion fulfilling pursuits. And the increasing affluence of our society will provide the means to pay for them. Spending which is today considered irrational will probably be more common . . . spending which, though irrational, is an individualistic means of expressing one's special self.

And so people, spending money for goods and services, will make their choices against a different set of criteria than in the past. Communication services which have heretofore been considered too expensive or unnecessary will come into demand.

Information and knowledge are more likely to be sought for the pure pleasure of knowing, not solely for the utility of knowledge, although many people will also feel an acute need for more knowledge to cope with the more complex problems of business and society. To satisfy this need, educational programs of many kinds will be directed toward the home and business. Some of these programs will, of course, be carried by broadcast television. However, the great variety of programs needed and the desirability of having two-way communication with the source of instruction, whether live instructor or teaching machine, will prompt the use of some sort of individual two-way communication channel capable of providing a visual display to the student.

The orientation toward people will stimulate greater usage of all modes of communication from person-to-person. Because of the additional personal satisfaction it provides, "See While You Talk" service will be popular.

communications instead of commuting?

There is every indication that the urban concentration of society will continue and that the present leading metropolitan areas will continue to account for a substantial part of the prospective population growth. Business and industry generally follow the labor markets, so the present metropolitan areas can expect to see a growth in business and industry.

Such metropolitan areas are already beset with transportation problems and problems resulting from continued building of additional office space. Municipal services are already severely strained in many places and further growth will intensify their problems.

The high social cost of workers commuting from longer and longer distances from their homes in the suburbs to their place of employment in the central city is becoming a severe burden. As the work day becomes shorter and

the amount of time spent commuting approaches it, many an employee will become dissatisfied.

Tomorrow's communications systems can provide at least a partial solution to many of these problems. For many employees, their physical presence in an office every day is not really essential so long as they can be tied to others with whom they do business by an adequate communication system.

Picture an appropriate work space in an employee's home equipped with a communication console. Through this console the employee is enabled to contact any person whom he would contact if he were at the office. Through this console he also has access to all sources of information which would be at his disposal if he were at the office. It is not unreasonable to imagine that this console would not only enable him to talk with others and see them but would also enable him to view documents and obtain graphic displays. It could also enable him to send and receive hard copy if desirable.

With such an arrangement it should not be necessary to physically go to the office more than one or two days a week. The saving in commuting costs alone would cover a large part of the cost. The elimination of 10 to 15 hours of commuting time is hard to evaluate in dollars but should have a beneficial effect upon family and community life. This arrangement would also relieve the transportation problem facing large cities and could postpone or eliminate large expenditures for highway expansion to relieve "rush hour" traffic and minimize the displacement of homes and businesses which always accompanies major highway construction in metropolitan areas. The reduction in travel would have the added advantage of reducing the number of people injured in accidents on the way to and from work. And such an advanced communication concept would produce savings for the employer. His office space requirements would be materially reduced, since only one-fifth to one-half of the employees of this type would be in the office at any one time. The advantages to the employee should also make it easier for the employer to attract and hold employees.

Communications and change are basic to a successful future. Communications technology and the potential services it can provide does not appear to restrict man's dreams. Instead, it appears more likely that the degree to which electrical communications will be employed will be a matter of balancing benefits against cost.

However, the prudent designer should be cautioned to consider this communications problems at an early stage to avoid the imposition of unbearable economic burdens by placing unnecessary requirements on communications. Some pitfalls to avoid are the use of a custom design when off-the-shelf gear will do, the use of real-time transmission when delay will suffice, the use of inefficient modes of communications such as video when motion is not important.

Communications of the proper type can do much to bring about a future of man's best dreams, but action and implementation are the keys to success. ■

HONEYWELL'S DDP-516

systems computer

Newcomers to computing who manage to get their hands on copies of DATAMATION would be justified in believing that "compact" computers —those with short word lengths—are introduced each month. November is no exception. Slated for its debut at the Fall Joint Computer Conference but formally announced late last month, the DDP-516 is a 16-bit systems computer that can also be used for stand-alone computation. And its parent is Honeywell's Computer Control Div. of Framingham, Mass., the former Computer Control Corp.

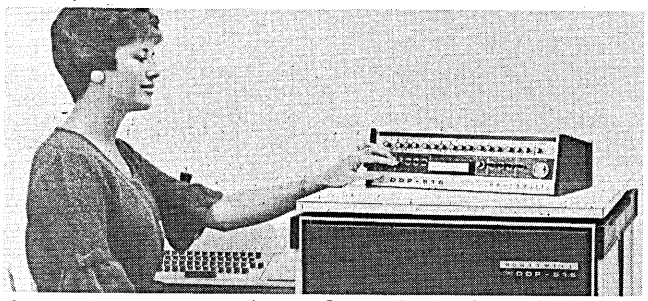
The 516, ASCII- and program-compatible with the DDP-116, joins battle with such recent mainframes as the EAI 640, PDP-9, ASI 6130, Sigma 2, and the IEC 1010. Other stalwarts, which have been around for awhile, are the CDC 1700 and IBM 1800. A feature of the newer machines—although not all of them—is a 960-nanosecond cycle time. The DDP-516 has it.

Other marketing adjectives currently in vogue and applicable to the DDP-516 include the use of integrated-circuit logic modules, a software package of 250 programs that have been operating in some 125 DDP-116 installations, direct memory access, and a direct multiplexed channel option for multi-access I/O capability. Also being trumpeted: delivery in 90 days, or soon thereafter. We also hear tell that the 516 is the first member of a family.

Before that gleam in the eye scares you, we'll tell you about Number One Son. The 516 features fully parallel organization, indexing, multi-level indirect addressing, and a 72-command instruction repertoire including byte manipulation capability. Memory is expandable from 4K to 32K words. Add time is 1.92 usec, and multiply time is 5.28 usec. The standard mainframe includes two full-word arithmetic registers, a hardware index register, priority interrupt, power failure protection, and individually buffered I/O channels.

The list of options, in addition to those already mentioned, include a high-speed arithmetic package including hardware double precision, memory lockout for program protection, memory parity, and a real-time clock.

There's also a line of peripherals featuring 36-80 ips tape drives, 100-600K word mass storage systems, 300-



1pm printer, paper tape reader and punch, and 200-cpm card punch.

The software package has an 8K one-pass FORTRAN IV, the DAP-16 assembly program, and the Desectorizing software that allows a programmer to directly address all of memory without regard for memory sector boundaries.

The price of a basic system, with 4K words of core and an ASR-33 teletype unit, is $25K. ■

CIRCLE 171 ON READER CARD

PL/I: AN EVALUATION

the people's choice?

by WALTER H. BURKHARDT

A new programming language becomes the concern of all computer professionals, especially if the scope of the new one supersedes the most-used of the current crop. There is no question of the need for new and better languages with wider applications potentials and with facets of modern programming techniques.

On the hardware side, no one would want to pay present-day prices for 10-year-old design features and technologies; but as far as software is concerned, the most-used programming language, FORTRAN, despite many relatively important though small additions, is still affected by the peculiarities and inadequacies of the initial design. FORTRAN has poor decision facilities, underdeveloped data structuring, and limits on subscripts and expressions. The most serious drawback, however, is certainly its very restricted expansion capability. Other high-level languages, like COBOL, are crippled by similar handicaps. The situation becomes alarming when we realize that in the near future the outlay for hardware may diminish to a rather small percentage of the overall cost of using computers.

Perhaps this situation prompted SHARE and IBM to develop the new programming language, PL/I, especially for introduction with the 360's. But if the full importance of the language problem has been realized, one questions why relatively so little effort and expense has been expended on the development of PL/I.

The following evaluation of the new language for the benefit of programmers in the field is based on recent IBM reports.[1,2] The PL/I report describes the features that a new and fairly universal procedural language should include. But the development of languages on this level seems to be rather redundant in view of their incompatibility with older languages.

Perhaps terminating the development of languages on the procedural level may be justified. Probably no committee will ever be able to develop a really useful language. In newer versions of PL/I, for example, too many special cases and features seem to be included in, but not integrated into, the language.

We can consider programming languages as tools for the definition of problems and solutions to computers. Obviously, too many specialties and compromises decrease efficiency and applicability. A final verdict on the language and the system will be demonstrated in their use by applications programmers.

The most interesting features of the language can be found in:

- Detailed block structuring of programs
- Versatile data description possibilities by attributes
- Powerful data organization and conversion
- Flexible input-output
- Controlled storage allocation (optional)
- Multi-task operators for time-sharing and multiprogramming
- Compile-time facilities for modifying the programs

design criteria

In the following, the design criteria for the language are explained. Then we will see how programs may be structured, followed by an outline of the choices for data declarations, data operations and conversions, and for input-output. Some of the novel features are detailed

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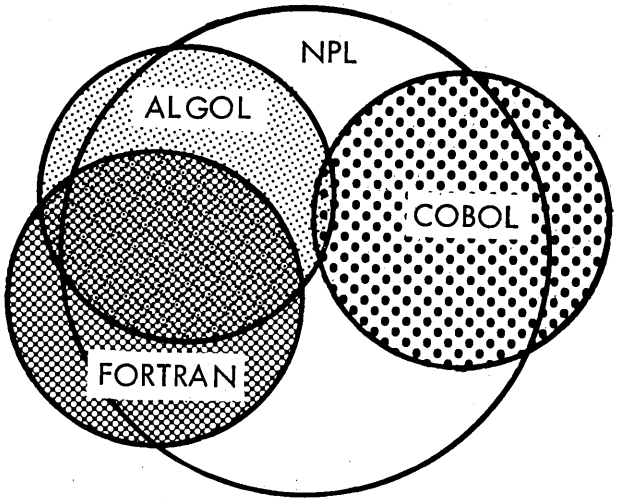
[1] IBM Operating System/360, PL/I: Language Specifications, IBM Reference Library, form C28-6571-3, (1966).

[2] Report II of the SHARE Advanced Language Development Committee, IBM Corporation (June 24, 1964). A better version is given in: NPL Technical Report, IBM World Trade Laboratories Ltd. form 320-0308, (December 1964).

in the section on multi-task operations and on compile-time facilities.

The most important characteristic is the move to combine all possible worthwhile features from algebraic, data processing, and control languages into one unified polyglot (Fig. 1). The reason is obviously to serve future installations of the 360 system with a facility for processing programs from different applications (scientific, commercial, and control) without swapping compilers—besides the inclusion of new programming techniques. Whereas the design point of universality for the 360 hardware might easily be justified by the small differences of basic computer functions for different applications, carelessness in programming with a complex language could rapidly lead to trouble.

Fig. 1



Two other essential design criteria are modularity and machine affiliation.

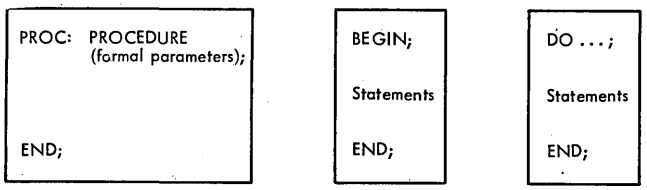
Modularity in this sense allows the programmer to ignore many of the features of the language without adverse effects on the programs. All attributes of variables, all options and all specifications were intended to have a default interpretation in case of omission to avoid ambiguities. The interpretation chosen is most likely to be wanted by the programmer who does not know the possible alternatives (if he follows the assumed pattern). In this manner, subsets of the language can easily be defined for programmers with different degrees of competence, for different applications, and for different levels of complexity in the language.

Machine affiliation means programmer access to all machine and operating system facilities. The programmer rarely needs to resort to machine-oriented assembly language as he does in FORTRAN for character and string-handling and ALGOL for input and output. (This feature is very necessary, for example, because of the difficulties in sector addressing in the 360. All the allocation must be done in the compiler—which does not especially contribute to the efficient use of the 360 systems.) On the other hand, the constraint for the language design was to keep the language relatively independent of machine peculiarities (not like ASA FORTRAN IV which still reflects the 704 machine features in the restrictions of identifiers to six characters and variables to three subscripts). Parameters reflecting a particular machine are not allowed to intrude into the language. A programmer can specify the precision of arithmetic variables in digits requested, instead of single, double, etc., precision (at cost of run-time efficiency). Similarly, the input and output is specified as device-independent.

program structuring

As usual, the programs are composed of statements (36 executable and eight nonexecutable). However, contrary to FORTRAN, the notation is in the superior free-field format (as in ALGOL) and the statements are grouped into subprograms and blocks. Program structuring, further developed than the block concept in ALGOL 60, has several purposes (see Fig. 2):

Fig. 2



1. Delimiting and defining a procedure (in FORTRAN: main-program, subroutine and function subprogram) which could be called from different places in a program with different arguments;
2. Indication of scope and range of definitions for the names locally;
3. Combination of statements into groups for control purposes (DO-loops);
4. Specifying the validity of a given method for storage allocation of the variables.

This structuring is done by procedures, blocks and groups of statements.

Procedures are defined by a procedure statement which is a name or label, the delimiter PROCEDURE followed by the formal parameters, and an END statement embracing the statements of the procedure body (like the ALGOL procedure, but with the declarator PROCEDURE acting for the *begin*). This is used for purposes (1) and (2) above. Multiple entry points are allowed in a procedure when the parameters of the different entries need not agree, and can be used very advantageously for initialization purposes in procedure calls (thus defining the *own* features from ALGOL). The old FORTRAN distinction between functions and subroutines is eliminated in favor of the procedure concept (ALGOL). A call for a procedure may be by a call statement or by the occurence of the procedure name. At the call point the correspondence of the actual with the formal parameters is established so that the simple names are called "by name" while expressions are called "by value." This is obviously intended to avoid the well known difficulties of calls in ALGOL procedures.

A procedure name may be considered GENERIC if it generates the facilities of generic functions. (The mode of the returned function value depends on the modes of the arguments). Many built-in functions are generic. The return from a procedure to the calling point is specified by a return statement; then a return may have a function value.

Blocks can be defined by BEGIN and END statements to delimit the scope of names. (Unlike ALGOL, the contents of store registers and return locations are never stacked automatically.) Thus, the procedure could be defined as a block with the means of handling arguments and returns.

Groups for control purposes are embraced by DO and END statements. In this definition the function of loop control is also treated.

Statements may have a prefix attached to the labels to enable the condition for an interrupt or non-interrupt during the execution of the statement. (Such conditions are

overflow, underflow, zero-divide, etc.). The list of possible statements includes the known types from FORTRAN, ALGOL and COBOL, some with slight, some with extensive alterations, together with a few new ones (e.g., two statements for control of data storage allocation; two statements for setup and put-back of procedures, ten statements for data transmission and seven for data transmission administration, etc). For labels, identifiers are used. In the go-to statements, the designated address may be a label constant, which is a simple label, or a label variable for a switch. (A label variable is declared in a LABEL attribute. So the control transfer facilities are very similar to the assigned GO TO in FORTRAN. In this respect, ALGOL is superior with its control transfer facilities in switches and designational expressions.)

Storage Allocation for variables may be dynamic instead of static. A variable can be defined by an EXTERNAL or INTERNAL attribute whether its name has to be known to other blocks or not and so side-effects are possible as in ALGOL. The allocation may be STATIC, AUTOMATIC or CONTROLLED.

AUTOMATIC allocation takes place at entry to a block and the storage is freed or unallocated at exit from the block (as in ALGOL). STATIC allocation is made once for the entire execution of the program (as in FORTRAN). The CONTROLLED allocation is a means for the programmer to define the allocation of storage according to his needs by an explicit ALLOCATE statement and to free by a FREE statement during execution time. The built-in procedure ALLOCATE (arg) returns the value 1 (true) only if there is storage for arg to be allocated. Storage allocation for AUTOMATIC and CONTROLLED is done by stacking and freeing previous allocations for the given variable. The default allocation attribute for EXTERNAL data is STATIC and for INTERNAL data AUTOMATIC (adapting the implied definitions of FORTRAN and ALGOL as standard).

One important feature of the new language is the possibility of data description by attributes. So, data for programs can be defined in the types of string and numeric data. String data may be given as a CHARACTER string or as a BIT string; both strings could be declared as VARYING or FIXED in length.

Other declaration possibilities for numeric data are concerned with the radix, scale, mode and size, and the location of the binary or decimal point. The radix variations are BINARY and DECIMAL; the scale may be given as FIXED or FLOATING POINT; and the mode can be defined as REAL or COMPLEX. The POINTER attribute facilitates some kind of list processing, and CELL permits equivalencing data storage. The size of numbers may be specified in BITS for binary and in DIGITS for decimal data. The data given by the variety of these definitions are stored internally in standard encoded representation.

For special occasions, where the standard representation is not sufficient, the programmer can specify a numeric significance to a string by means of a PICTURE construction. Such a picture specification might be used for input and output formatting as well. So zero suppression, insertion of blanks and other special characters and general editing is allowed for convenient specifications to the programmer (as in COBOL).

Data for programs may be combined into arrays or structures.

Array elements are represented in the conventional manner by subscripting. There is no limit on the number of subscripts for a name, but they are to be declared in DECLARE statements. For example, the statement:

```
DECLARE Q (8, 5);
```

defines Q to be an 8 *5 array. The designation Q (3,2) represents the element in the third row and second column of the Q array. Single vectors of the arrays can be addressed directly by the asterisk notation. For example, in the array declared above, the expression Q (3,*) denotes the third row of the matrix, while Q (*,4) refers to the fourth column. The asterisk indicates that the corresponding subscript is to be varied between the defined bounds. Therefore, Q (*,*) would be equivalent to the whole matrix.

Structures are defined by a level number similar to the notation in the Data Division of COBOL. The elements of the structures are represented by qualified names. For example,

```
DECLARE 1 PERSONAL
    2 NAME
      3 LAST CHARACTER (15),
      3 FIRST CHARACTER (10),
    2 ADDRESS,
      3 STREET CHARACTER (20),
      3 CITY CHARACTER (15),
      3 STATE CHARACTER (5),
    2 AGE CHARACTER (2);
```

defines a PERSONAL structure containing name, address, and age information with the name and address portion being further structured. The designation by the qualified name, PERSONAL.ADDRESS.STATE would describe the fifth element in the structured record.

data operations and conversions

Data in expressions may be declared with different attributes and therefore mixed expressions are allowed. For example, in

```
DECLARE INDEX FIXED, FRACTION FLOAT, WORD CHARACTER (10);
WORD = INDEX + FRACTION
```

the evaluation of the expression would be as follows:

1. INDEX is converted to floating-point representation.
2. The floating-point addition will be performed with FRACTION.
3. The result is to be converted to a character string of length 10 and assigned to WORD.

In addition to the usual operations on data (arithmetic, some logical, string-handling, and relational), of special interest will be the use of expressions containing data aggregates. Thus, arrays and structures are treated as variables in their own right. Whenever an operand is an expression in an array or structure, the expression is correspondingly an array or structure expression and returns an array or structure result. When several structures have elements with identical names, there may be specified operations on these structures to be applied to the corresponding elements only. For example, in the assignment statement:

```
RECORD = PERSONAL, BY NAME;
```

if we have defined the RECORD as

```
DECLARE 1 RECORD,
    2 ADDRESS,
      3 STATE CHARACTER (5),
      3 CITY CHARACTER (15),
      3 STREET CHARACTER (20),
    2 OCCUPATION CHARACTER (10),
    2 NAME,
      3 FIRST CHARACTER (10),
      3 LAST CHARACTER (15);
```

then the above assignment statement would cause the values of the elements of NAME and ADDRESS in PERSONAL to be rearranged and assigned to the corresponding ele-

ments of RECORD. AGE and OCCUPATION do not participate in the operation.

All operations handling arrays are performed on an element-by-element basis. All arrays in an array expression must therefore be treated as a string.

Included in the repertoire are built-in functions with string-handling capabilities. As described, BIT and CHAR allow data to be treated as a string.

SUBSTR (string, m, n,) designates the n bits (or characters) of string beginning with the m'th bit (or character).

INDEX (a,b) finds the first use of string b in string a.

UNSPEC (item) gives a bit string with the value of the internal representation of item.

When all elements of a structure are either bit or character strings, the whole structure may be handled as a string by the use of the STRING built-in function. Then, for example, unedited transfers of data collections are easily possible.

input-output specification

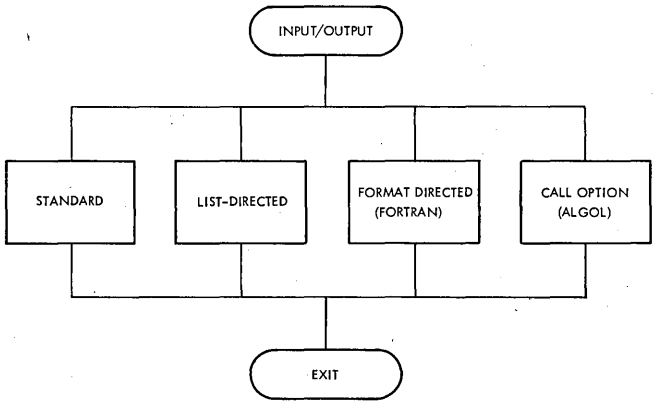
As already mentioned, the input-output activities can be controlled to any degree in a manner that is independent of the machine. Normal transmission and conversion can be specified rather simply; and for more sophisticated requirements the full capability of the language may be utilized.

Data transmission may be accomplished in standard, list-directed, format-directed, or in general form (see Fig. 3).

Standard input-output causes data-directed transmission without referring to format or file descriptions.

List-directed transmission uses a one-to-one correspon-

Fig. 3



dence between data names and data elements. Here element delimeters other than standard can be specified.

Format-directed input-output is the conventional method of FORTRAN by giving a list of data names and a corresponding format specification list.

The most general form of input-output specification may be accomplished by the CALL option (as intended on the lower assembly language level in ALGOL). Here a programmer can write his own transmission rules using the given language facilities. The only assumption is that a record or logical grouping of data has been read or written. With READ and WRITE statements an entire record is handled; but GET and PUT statements in the procedure permit the access or disposal of portions of a record.

Besides the conventional options in READ and WRITE statements, there are some new ones. For example, it is possible to specify by the PRINT option that data transmitted by the corresponding READ statement is also written out on the standard output file.

Also of special interest are the KEY and the SEARCH options. The KEY option serves to impose a sequence on a random file or may be used to override the implied sequence of a sequential file. The SEARCH statement enables the programmer to access a record from a random file by specifying either the logical key address or the content of the wanted record. In addition, the beginning and end of the search as well as the desired action on successful search may be specified.

The OPEN or CLOSE statement and the positioning to a specific point of a file is familiar from COBOL. In the absence of these statements a file is opened with the first READ or WRITE statement to be executed.

Other useful features, especially for the business application programmer, include report generation and input/output conversion facilities. For internal data transmission, a string name instead of a file name in the READ or WRITE statements can be specified so that data may be scattered or gathered together.

multi-task operation

Some of the most important new features are in this category, where the control commands for parallel processing and for trapping and recovery are adopted in a high-level language. Concurrent operation either by interrupts or by asynchronous operation is allowed; or there can be any combination of the two.

Asynchronous operation requires the definition of the TASK specifier. A task is defined as the execution sequence of a program. So, when several programs in multi-processing jobs are present, they can be specified for execution all at once or separately. For example, when program P1 is running as task A at the same moment that another one (program P2 as task B) should start, the CALL statement is:

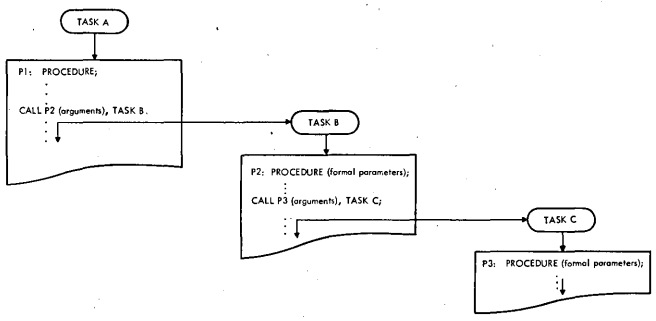
CALL P2 (arg 1, arg 2, . . .), TASK(B);

Then the new task will be started simultaneously (see Fig. 4). The form:

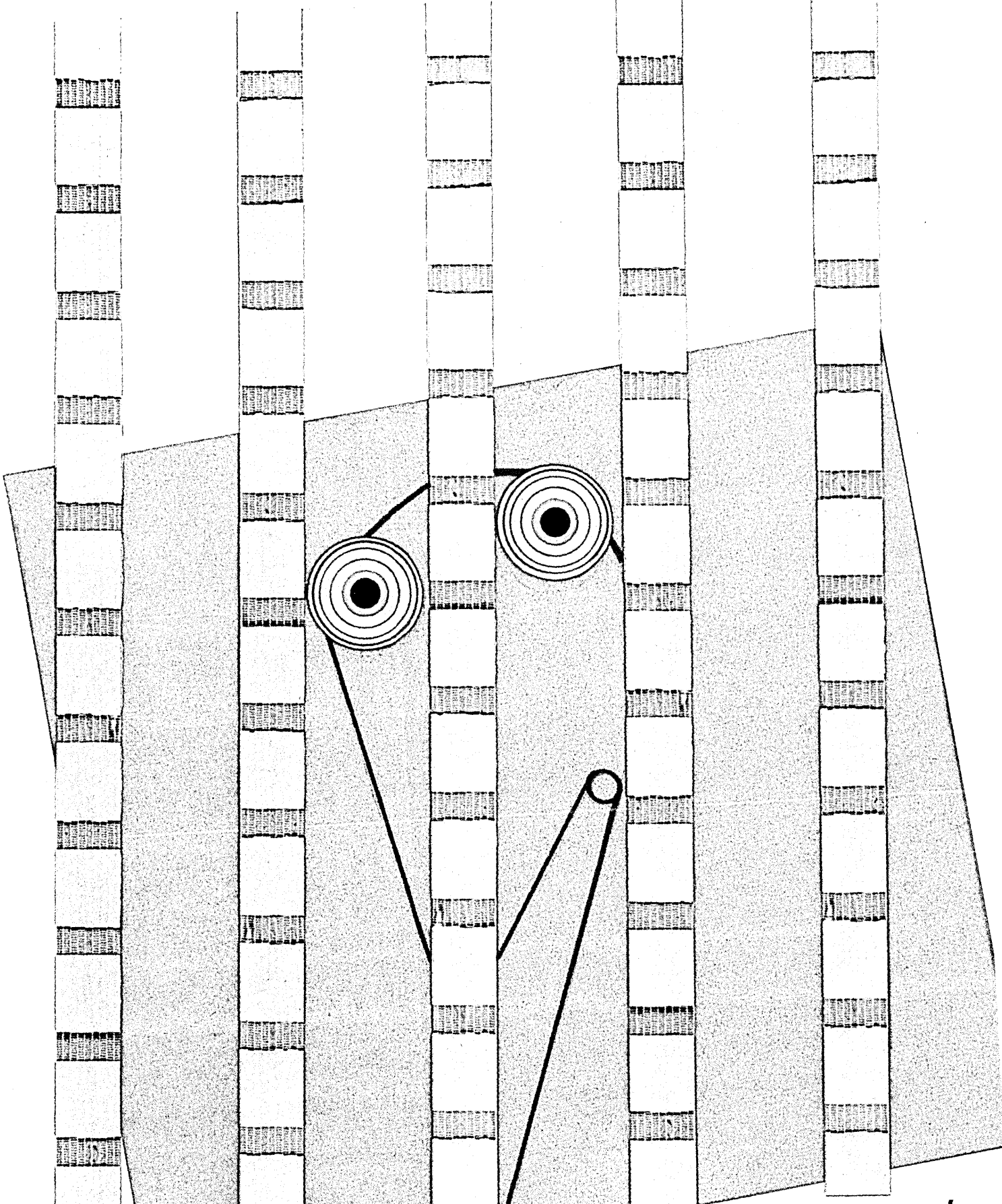
TASK (B): CALL P2 (arg 1, arg 2, . . .)

would be much better because the logical hierarchy of the task command in a program is higher than that of the call.

Fig. 4



As a second argument in the TASK specifier the declaration of a relative priority of B with respect to A can be included. (This is useful if only limited hardware is available). The communication between A and B is accomplished with the explicit arguments in the task call for B or through shared (common) storage. For the case where one program or subroutine (procedure) is called for several tasks, there are several attributes available to declare this condition. For example, the REENTRANT attribute could handle the situation, but this requires that the code must not modify its own instructions (the so-called read-only execution) and that all data areas are



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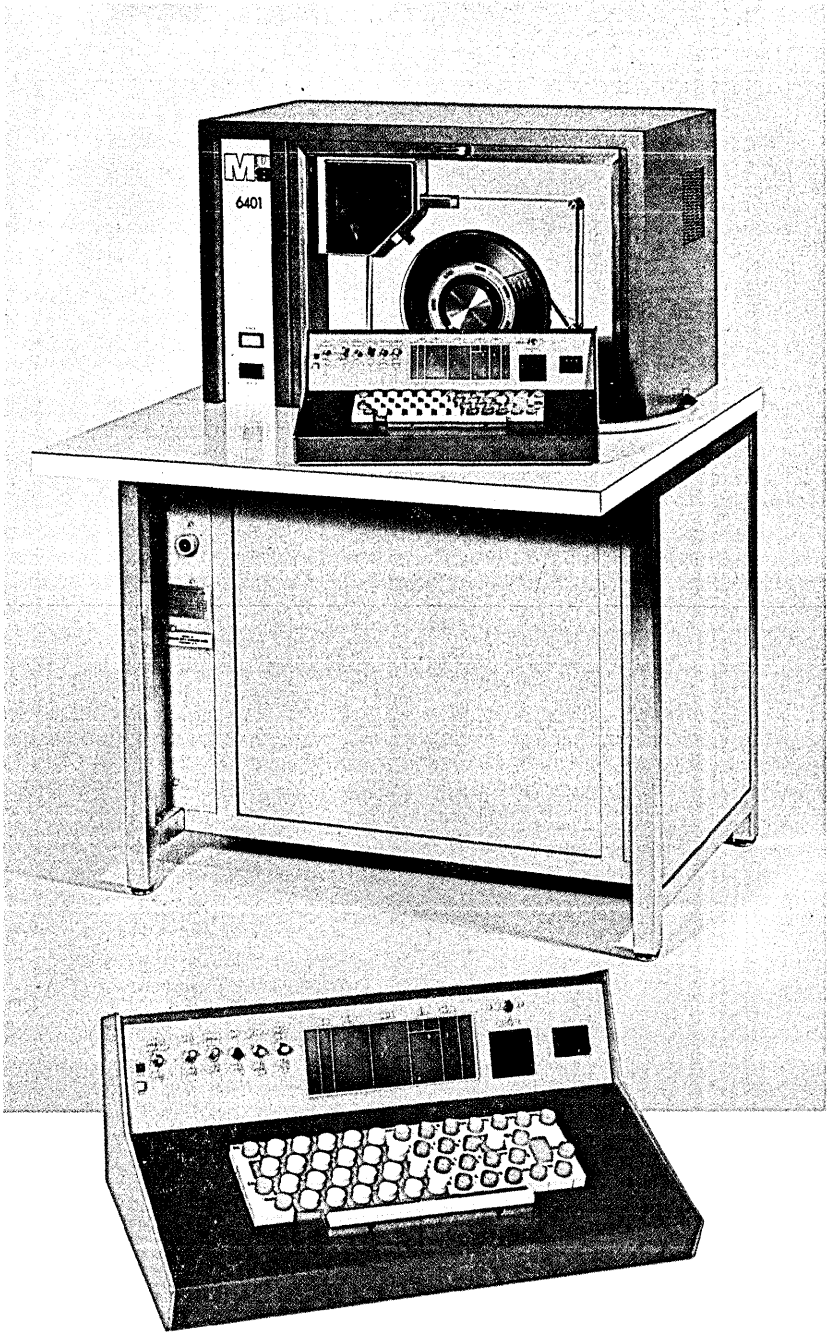

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referred to indirectly through the task which has control. Another possibility would be with the declaration RECURSIVE.

Control interaction between tasks can be done by the WAIT statements or the COMPLETE procedure, for example:

WAIT (B); or

COMPLETE (B)

WAIT (B) causes the execution of task A to be suspended until task B is completed. The COMPLETE procedure is built-in and returns the value 1 (true) if task B is complete. This procedure can, for example, be used in an IF statement.

Control within tasks has the operations for terminating one or all tasks and for a DELAY command. The statement

DELAY (n);

will put the current task into wait status for *n* milliseconds before proceeding.

A task can be terminated with either a RETURN or an EXIT statement. The RETURN terminates the concerned task by returning up past the main procedure for that task. A STOP statement encountered in one member of a family of tasks terminates the execution of the entire family.

Interrupt operations permit a tighter control of parallel operation and illegal conditions. While asynchronous operation enables subsequent tasks to be initiated and later in the main program, allows their completion status to be checked, the interrupt operations determine what code is to be executed or when some event occurs. The statement

ON interrupt-condition action;

automatically sets up the code sequence to be executed in case of the interrupt event. For example,

ON UNDERFLOW Y = 0

permits the asynchronous interruption of the concerned task when the overflow occurs and sets the value 0 for the illegal underflow value of Y.

The specified action may consist of a whole group of statements optionally preceded by the command SNAP (which demands the writing of machine status information for later inspection). A GO TO statement here would imply that control will never return to the point of interrupt.

The interrupt conditions are of three classes: debugging aids, unusual conditions, and parallel execution.

Debugging aids are programmed interrupts to check if subscripts are out of bounds, to document every possible change in the values of a set of variables, or to allow the tracing of every execution of a set of statements. For example,

ON SUBSCRIPT RANGE SNAP COUNT = COUNT +1;

would print out machine status information and add 1 to the variable count for each case of subscripts exceeding their range.

For the unusual condition interrupts, the programmer can override the system action on machine interrupts such as overflow, underflow, end-of-file, or transmission error, and on system interrupts such as conversion error or fixed-point overflow. The compiler contains built-in functions to help in the detection and correction of those errors. For concurrent execution of programs, the programmer may define an interrupt condition as a name. Then a machine interrupt will be simulated by the execution of the SIGNAL statement just as if machine interrupt had occurred.

The ON statements are restricted to the block in which they occur; therefore, they may be stacked as blocks and procedures are invoked or unstacked on returns. By the REVERT statement, conditions may be overridden or unstacked.

compile-time facilities*

The development of meta-assemblers[3] (and of SLANG[4]) has left its traces in the language. Included are commands to the compiler, the compile-time indicators, and the macro-variables and macro-procedures.

Compiler indicators and commands are special information aids to the compiler for faster compilations and better object code, documentation and diagnosis. The operation

OPTIONS (attribute$_1$, attribute$_2$ . . . .)

therefore conveys special information.

The characteristics of another procedure which is to be involved, can be described, such as the exact nature of each argument, what data is to be used (by the USES attribute), what data it will change (via SETS attribute), whether it has side effects or sometimes produces different results with the same set of arguments (via ABNORMAL attribute). This may also serve to indicate that a variable is changed from outside in a multiprocessing scheme, or due to asynchronous interrupts. Other attributes are SECONDARY, indicating the use of secondary addressable storage for a table or procedure if high-speed storage is unavailable, and LABEL, defining a list of statement labels to which control may transfer by GO TO's.

Compile time statements are ordinary statements preceded by a %-sign. They are immediately executed during compilation (interpretively) and are used to determine which are source statements and how they are compiled. The available statement types for compile-time statements are declarations, assignments, conditional compilations and transfers of control.

Variables and procedures may be declared as macro-variables and macro-procedures. By execution of compile-time assignments new values may be assigned to macro-variables during compilation. Conditional compilation can be performed during compilation with the compile-time IF statement.

% IF macro-boolean-expression THEN group
of statements;

causes the group of statements after the THEN to be compiled only if the macro-boolean-expression is true. As all compile-time statements may have labels, control may be transferred by compile-time GO TO's. For example

% GO TO label;

causes compilation to proceed at the compile-time label specified.

An example of generating a series of similar statements would be:

```
% DECLARE K FIXED INITIAL (3), LABEL CHARACTER (6);
% L:K = K + 1;
% LABEL = 'LABEL' / / K;
LABEL: V(K) = W (K) + K;
% IF K<5 THEN % GO TO L;
```

It would produce the following statements:

```
LABEL3 V(3) = W(3) + 3;
LABEL4: V(4) = W(4) +4;
LABEL5: V(5) = W(5) + 5;
```

Macro-variables and macro-procedures were included in the language to allow for a reasonably efficient, and easily specified development of many different problem-oriented dialects. With this feature, despite the difficulties in its use, practically any possible feature of other languages can be handled. It might be used to achieve compatibility with programming languages already in use. Very important examples are the programming aspects of COBOL. Macro-variables are declared in compile-time declarations, and

[3] Halpern, M.I., XPOP: A Meta-Language Without Metaphysics, Proc. Fall Joint Computer Conference 1964, pp. 57-68.

[4] Sibley, R. A., The SLANG System, Comm. ACM 4 (January 1961), pp. 75-84.

*These facilities are still undergoing considerable modification.

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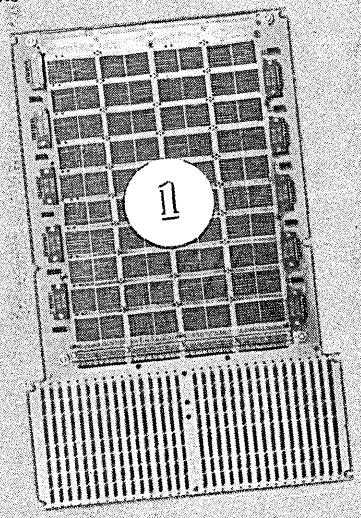

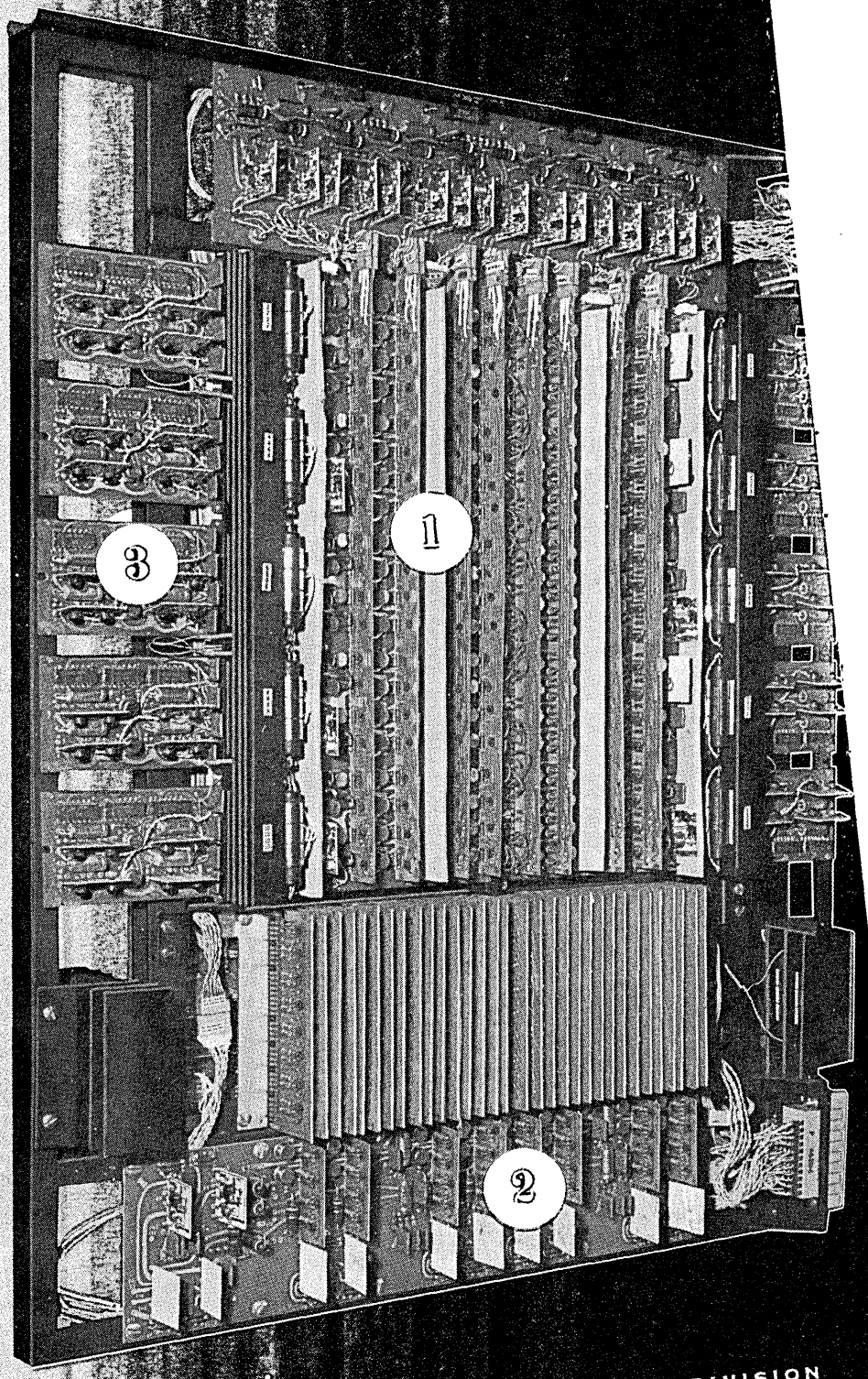

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are given an initial value. Other compile-time statements may assign new values to them. The current value of a macro-variable is always used. For example:

```
% DECLARE W FIXED INITIAL (1),
V CHARACTER (15) VARYING INITIAL ('TOM + ANN');
LAB: QUOT = V + W;
W = W + 1;
```

will produce:

LAB: QUOT = TOM + ANN + 1 for the first execution
LAB: QUOT = TOM + ANN + 1 + 1 for the second execution of the compile time statement

Macro-procedures can be declared in a compile-time statement with an argument list, if desired. When a reference to this procedure is encountered in a base language statement, then the procedure is called and its returned value is substituted for the appearance. (The values of all macro-procedures must be string values, because all data to the compiler are character strings). These macro-procedures allow the introduction of special-purpose statements into the language and thus its expansion for specific problem areas. The treatment in this form may be rather inelegant inasmuch as it imposes the burden in the development of special language features on the evaluation by the compiler; but it gives at least a working tool to tackle the problem of open-ended systems.

limitations on the 360

Several language features will be limited to a definite size, length, or order on the 360. These restrictions concern the program character set, data character set, length of identifiers, and the representation of data.

Two character sets for programs are available, one with 60 characters, the other using 48. The smaller set has as its basis the IBM character set H (used on the IBM 026, etc.). Therefore, some of the characters in the language have to be abolished or transliterated according to the following lists.

abolished:
- number sign #
- commercial at @
- question mark ?

transliterated:

	60-char. set	48-char. set	ALCOR
greater	>	GT	'GR'
greater or equal	>=	GE	'GQ'
not equal	¬=	NE	'NQ'
lower equal	<=	LE	'LQ'
less than	<	LT	'LS'
logical not	¬	NOT	'NOT'
logical or	|	OR	'OR'
logical and	&	AND	'AND'
concatenation	||	CAT	-
colon	:	. .	. .
percent	%	/ /	-
semicolon	;	, .	. ,

Besides the dubious restriction on a character set other than ASCII (the proposed set as an international standard), there seems to be an unfortunate divergence of the relational operators and of the semicolon against the ALCOR-SHARE character representation of ALGOL 60 as compared in the last column from above.

The data characters set contains any character that results in a defined pattern of the eight bits per byte of 360 storage. The use of characters other than those from the program character set is seen in character string constants, comments, and in SEQUENCE statement character strings.

For the length of identifiers, two limits exist on the 360. The limit of seven characters is pertinent to identifiers for EXTERNAL data identifiers, external PROCEDURE ENTRY labels, file names, and task identifiers as used in the TASK option, the WAIT statement, and in the COMPLETE built-in function. All other identifiers have an upper limit of 31 characters.

Data representation in the storage imposes various limitations on permitted precision and length of these data.

For FIXED BINARY data a maximum precision of 31 bits is given; the minimum precision will be assumed to be 15 bits when involved in expression evaluations. The internal representation is in binary fixed form. FIXED DECIMAL data has a maximum precision of 15 decimal digits; the assumed lower limit is five digits. These data are represented in packed decimal form.

For the FLOAT BINARY data the upper limit on precision is 53 bits. The assumed minimum precision is 21 when involved in expression evaluation. These data are internally represented in hexadecimal floating point with two different forms, long and short. The short form is used only when the specified precision is equal to or less than 21 bits.

FLOAT DECIMAL data have a maximum precision of 16 decimal digits, and a minimum assumed (if not specified) of six when involved in expression evaluation. The internal representation is also in hexadecimal floating-point form. If the specified precision is six or less, the short floating-point form is used; if it is seven or more decimal digits, the long floating-point form is used.

All CHARACTER data internally use one byte of storage per character. The maximum length for CHARACTER items of specified or VARYING length is 32,767 bits. If not specified, 1-bit length is assumed. In the evaluation of expressions involving FIXED data on the maximum field lengh for internal results is 31 for BINARY data and 15 for DECIMAL data.

The precision of not specified macro-variables up to now has only been determined for FIXED macro-variables with 31.

Arrays are limited in their dimensions. These dimensions are restricted to a lower bound of -32,768 and to an upper bound of 32,767.

outlook

The features of PL/I we have been examining are certainly very valuable tools for computer programming. We can understand the present demand for the language. Unfortunately, the whole set of language elements still seems to need further development, and a great deal more structuring of the language is required before it can be used. Compilers for the full language are now performing poorly, producing inefficient object code. But the most serious drawback is PL/I's incompatibility with the existing languages.

Additional effort can improve at least part of this situation; however, the scope of PL/I or its successor is such that it extends beyond the interests of one company or the developmental resources of even the largest. Similarly, one users group cannot be trusted to adequately handle the problem. The already proposed Programming Language Institute, which in turn might help form an Automation Institute, could carry the responsibility for design, specification, and possible implementation on a national—or, ideally, an international—basis. ■

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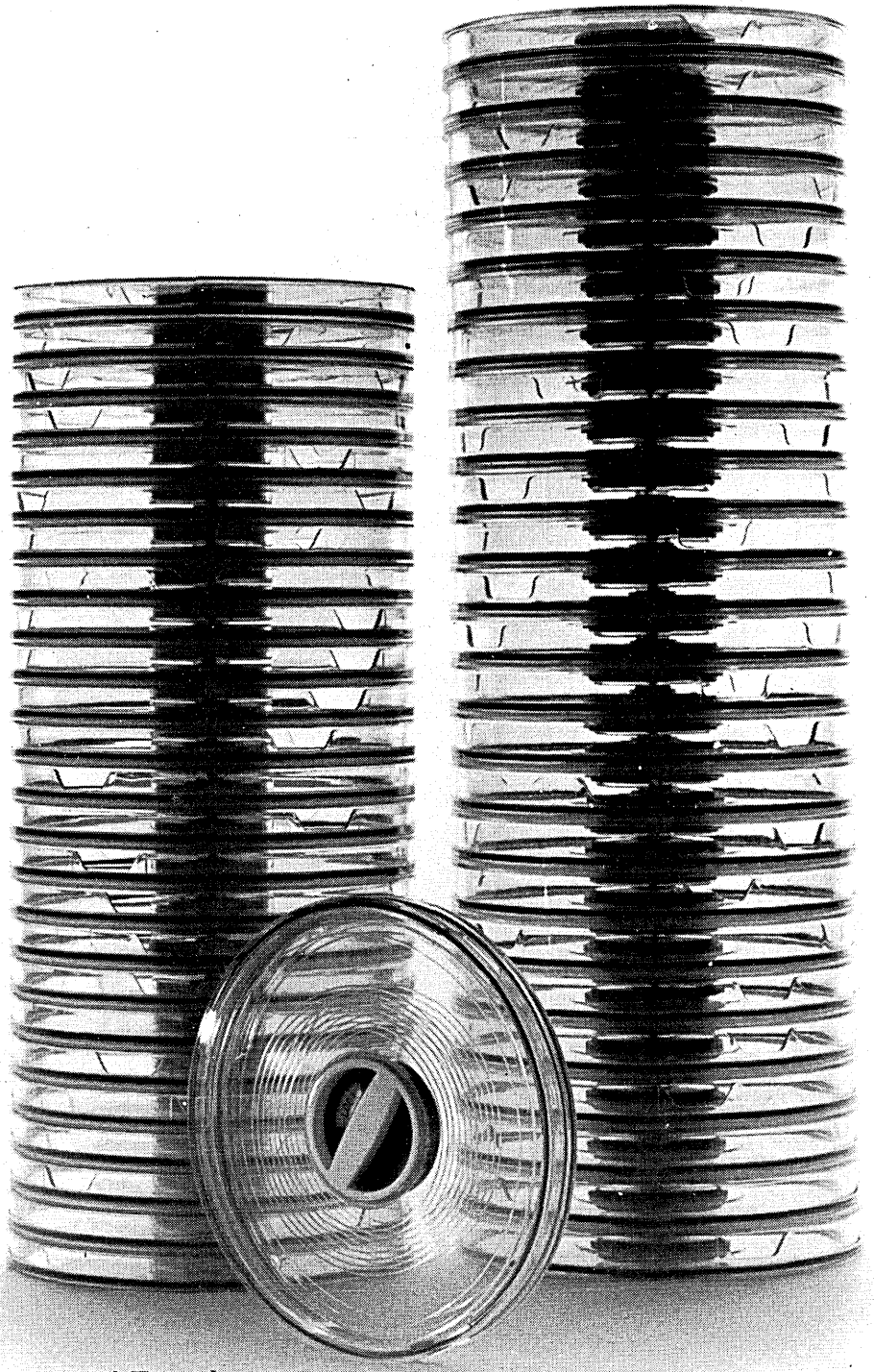

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COMPUTER SIMULATION OF WATER WAVES

hanging ten the hard way

by J. EDDIE WELCH

The many disasters of recent years caused by floods, tidal waves, and the collapse of dams prove the need for a deeper understanding of the destructive power exerted by the most common and most useful substance on earth, water. In an age when man can unleash the fury of the atom and put himself into space, it is surprising how little is really known about such a seemingly simple process as the flow of water. However, if we look into a sparkling mountain stream and watch the swirling turbulent eddies, we realize that perhaps the processes involved are not as simple as one would first imagine.

The small store of knowledge we have concerning the details of fluid flow has come primarily from laboratory experiments. These experiments are limited in scope by size, cost, and lack of dependable measuring devices. It is absurd to even consider experiments to study the flow of water from an 80-foot dam or to study the effects of a 20-foot tidal wave. Even in an experiment of a reasonable size, the internal details of the flow often cannot be measured because the measuring device itself (if, indeed, an appropriate one exists) will change the flow pattern when it is inserted into the water.

The only alternative way to add to our knowledge of fluid flow is to develop dependable techniques for calculating mathematically the details of the processes involved. These processes are the same for all fluids, but water and air are the ones of interest to most people. The mathematical equations of motion which describe the flow of a fluid have been known for several centuries, but because of the complexity of these equations it was possible to solve them for only a limited number of simple cases where special assumptions could be made. Then, with the advent of the high speed electronic computer, a completely new and fascinating approach was taken toward the solution of these differential equations of motion. Scientists began to develop mathematical models that could be solved on a computer by numerical techniques.

The first big success came in the field of compressible, i.e., high velocity, fluid dynamics. In the last 15 years a large number of successful methods have been developed for finding the time-dependent solutions of a wide variety of interesting problems in this field. Accurate solutions have been obtained for the supersonic flow of air past a nose cone, the hypervelocity impact of a meteor with a space vehicle, the rise of a fireball through the atmosphere, and many other physical processes.

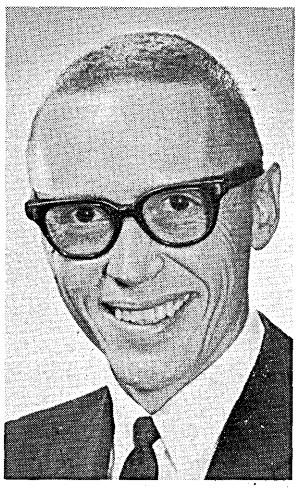
Techniques for solving incompressible, or low velocity, fluid flow problems were slower in coming. The first notable success was a method developed by Jacob Fromm[1] at the Los Alamos Scientific Laboratory. Fromm's method can be used to obtain the solution of problems involving a confined incompressible fluid. His success created a renewed interest in the field, and several hydrodynamicists have adapted his technique to their own investigations.

Now a new technique has been developed by us at Los Alamos for the full time-dependent solution of the flow of an incompressible fluid with a free surface. For the first time, it is now possible to study by computer such violent processes as the destructive surge of water from a broken dam and the crashing of a wave against a breakwater (*p. 42*). At the same time, the method has been applied to more gentle but equally interesting problems as, for example, the rise of an air bubble in water or the flow of water from a faucet into a sink. This technique is known as the "Marker-and-Cell" or MAC method. It is incorporated in a computer program which, for obvious reasons, we call SPLASH.

computer experiments

Using the SPLASH program, it is possible to set up computer experiments in much the same way that a scientist would set up a laboratory experiment. It is very easy, for example, to simulate a wind tunnel experiment for the

[1] Fromm, J. E. "A Method for Computing Nonsteady, Incompressible, Viscous Fluid Flows", Los Alamos Scientific Laboratory Report LA-2910 (1963).

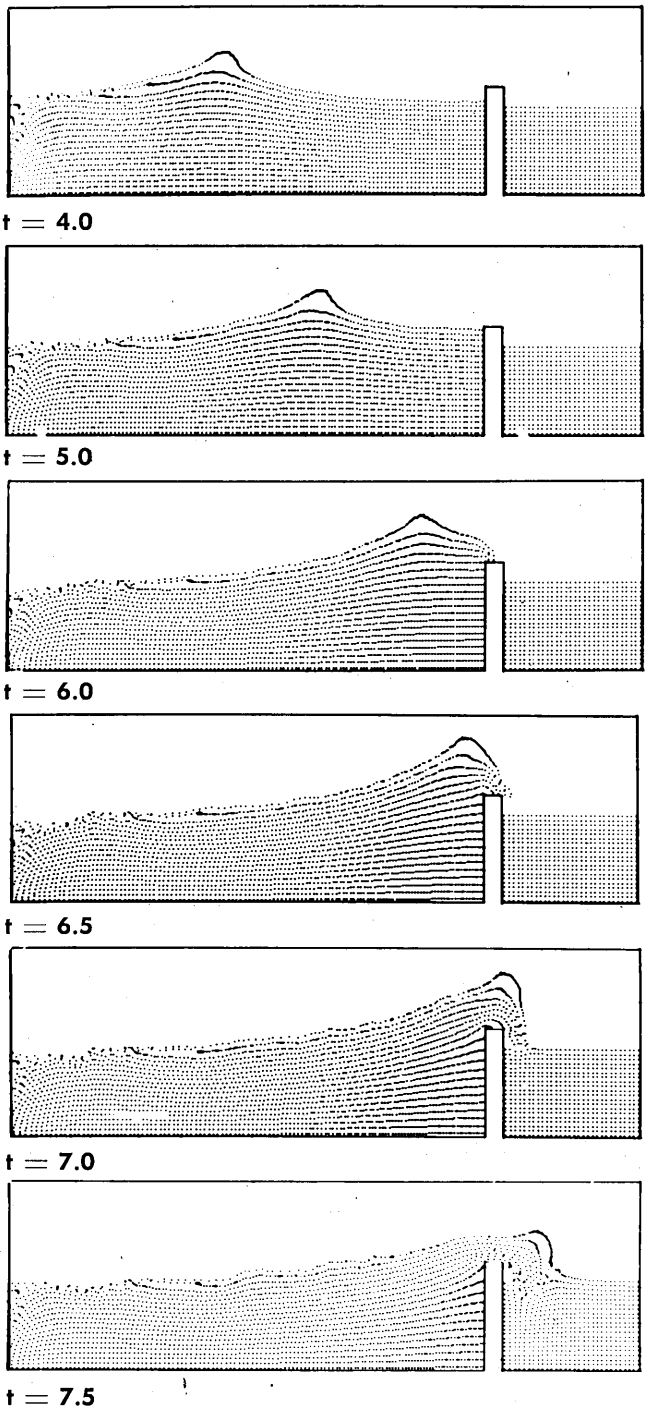


Mr. Welch is a scientific programmer in the theoretical div., Los Alamos (N.M.) Scientific Laboratory of the Univ. of Calif. Primarily concerned with the study of problems in fluid dynamics using numerical techniques on high speed computers, he has published several papers in this field. He holds a B.S. degree in math from Eastern New Mexico Univ.

study of low speed air flow past a rectangular obstruction. Fig. 2 shows just such a computer experiment. The top and bottom boundaries represent the walls of the wind tunnel, with the base of the obstruction at the left boundary. Fluid is injected into the system from the left, and flows out of the system through the right boundary. The lines of particles shown in the plots are analogous to smoke lines which would be injected into an actual wind tunnel to better enable us to visualize the flow.

The wake behind the obstruction has always attracted the greatest interest because early experiments showed the creation of a regular sequence of eddies shed from the base.

Fig. 1. Computer simulation of a wave crashing against a breakwater.



Not until the *computer* experiments, however, was it possible to see in detail exactly how the fluid was contorted into this strange and fascinating pattern.

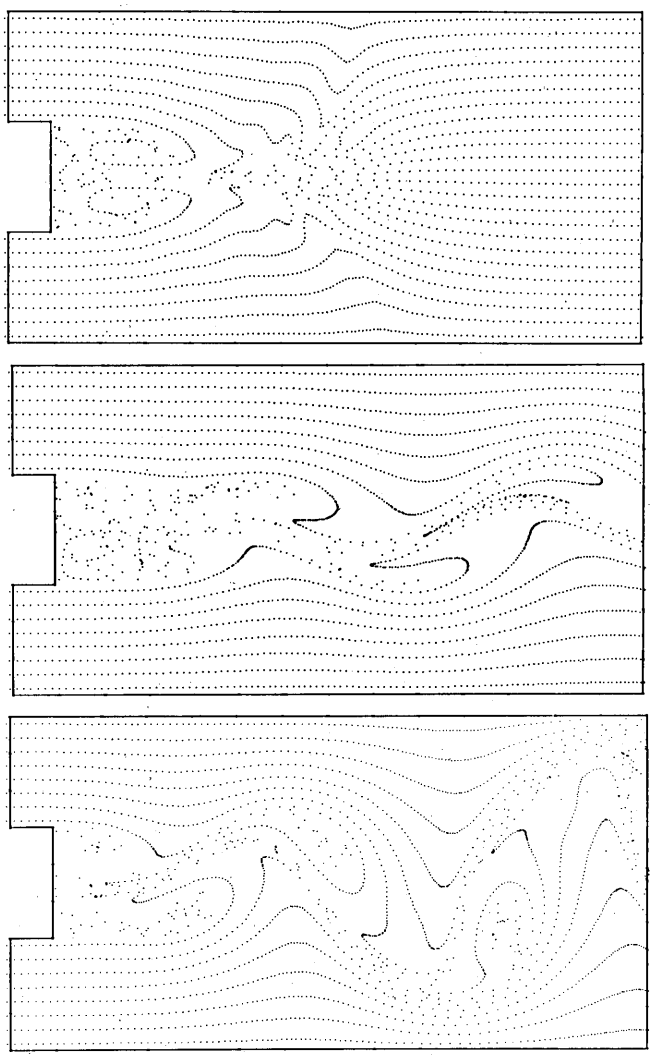
Computer experiments serve several useful purposes. By means of a computer experiment it is possible to set up an idealized physical situation, calculate the changes which take place with time, and then compare the results with true physical phenomena.

In any laboratory experiment it is impossible to have complete control of the environment. Small variations in the density, temperature, or other physical properties of the fluid, or imperfections in the apparatus used for the experiment are always present. The computer eliminates all of these problems, and allows for a completely idealized system.

Another important use for computer experiments is to help in the design of useful laboratory experiments. By means of a few computer runs, the engineer can gain much useful information that will help him decide exactly what kind of laboratory experiment is needed. This eliminates considerable trial and error in setting up the experiment, and often results in a great saving of both time and money.

Computers are also a useful aid in formulating analytical solutions. By carefully analyzing the data from a computer run, the theoretician can often see approximations which can be made, and can then develop dependable

Fig. 2. Computer simulation of the flow of air past an obstacle in a wind tunnel, and the development of the vortices behind the obstacle. Flow is from left to right.



by each computer run. If the data were merely printed, there would be stacks of listings to analyze for each problem. Our solution to this dilemma has been to use the old adage, "One picture is worth a thousand words." We, therefore, make extensive use of the Stromberg-Carlson SC-4020 microfilm recorder to display our results in a variety of ways, each of which illustrates particular aspects of the flow.

The easiest and perhaps the most useful display method is to make plots of particle configurations. Since each marker particle in the system has its coordinates stored in memory, it is a very simple matter to plot a point for each particle. This gives us a picture of the fluid very closely resembling a photograph taken of a laboratory experiment. Fig. 5, for example, shows particle configuration plots taken at four different times for the flow of water from a faucet into a sink. The first frame shows the water just before it hits the quiescent shallow water in the sink and subsequent frames show the flow at later times.

Although particle plots have the advantage of giving a nice visual effect and of being relatively easy to produce, they do not convey any information concerning the internal properties of the flow. A single particle plot, for example, does not show the direction of the flow or any information about the pressures.

For showing the direction and speed of the fluid we make velocity vector plots. This is accomplished by plotting one velocity vector for each cell in the system. Each velocity vector is given a direction which is the local flow direction, and a length which is proportional to the velocity of the fluid in the cell. The first three frames in Fig. 6 are velocity vector plots showing the flow of a liquid over an obstacle. The last frame is a particle configuration plot taken at the same time as the third velocity vector plot. Notice that the combination of the particle plot and the velocity plot give a picture of the flow that contains a considerable amount of useful information. The particle plot shows the shape and position of the fluid while the velocity plot shows the speed and direction of the flow. The only thing these plots fail to show is any information about the pressures.

The most useful techniques for visualizing the pressure field within the fluid is to plot lines of constant pressure. A given plot would contain lines for several different values of pressure, separated by a given pressure interval. This gives us a contour map very similar to geographical contour maps. As long as the pressure field is relatively smooth, the contour plots will provide us with a very useful and informative picture (see Fig. 7). However, a knowledge of the problem under consideration or printed information is necessary in order to decide whether the lines show increasing or decreasing values of pressure.

A given computer run will require several hundred advancements through time. If we take a particle plot, velocity vector plot, or contour plot at the end of each of these time steps, we have a short movie which will last for

Fig. 5. Flow of water from a faucet into a sink. These frames were chosen from among hundreds of plots which describe the complete development of the flow.

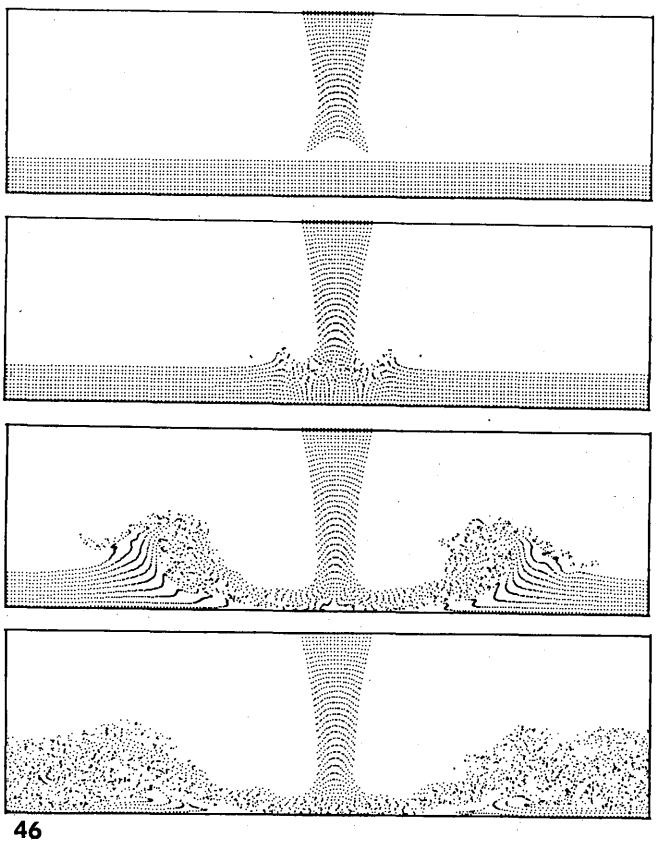
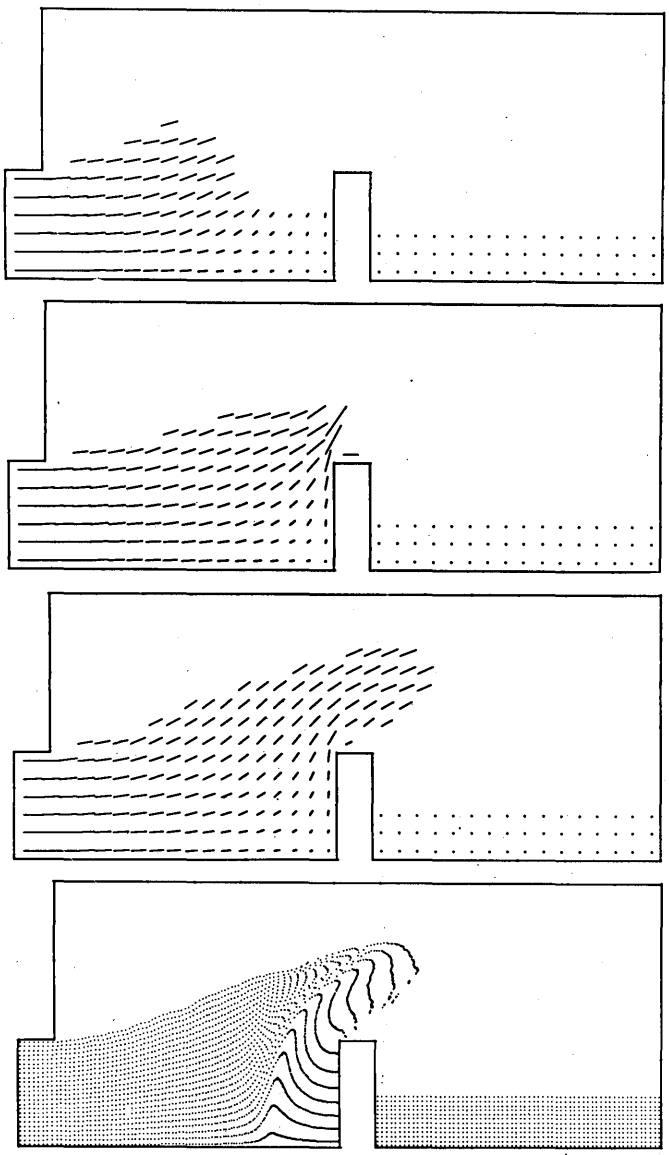
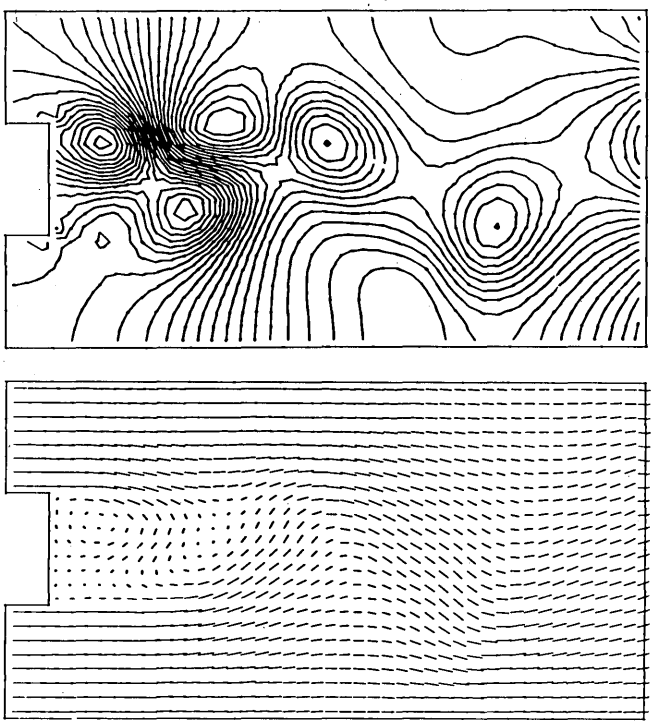


Fig. 6. Velocity vectors for the flow of fluid over an obstacle. The bottom frame is a particle plot corresponding to the third velocity plot.



several seconds.[5] Particle plot movies, in particular, give a visualization of the flow which is very close to a movie of the actual event. A short collection of these movies has been combined to form a silent film entitled "Computer Studies of Fluid Dynamics (Y-154)." This film is available on free short-term loan from the Report Library at the Los Alamos Scientific Laboratory.

Fig. 7. Pressure contour plot and velocity vector plot taken at a late time for the wind tunnel problem shown in Fig. 2.



The MAC method has a wide range of applicability, and has attracted world-wide attention in a variety of fields. The most obvious applications concern the study of waves on a beach, fluid flow through pipes, and other similar investigations. Enthusiastic responses have come from doctors interested in blood flow through the veins, engineers interested in using the method for ship design, and persons interested in solving problems involving liquid propellants in space craft.

additional applications

Further advancement in computer technology will open fascinating new possibilities for this method in the fields of oceanography and weather prediction. The method as applied to problems in these fields is limited now by the memory size and speed of the present generation of computers. Such advanced problems would require 10-20 times the memory available on the Stretch computer, and would run from 10-100 times as long as the problems now being run. Use of the disc solves the problem of space, but the time requirement can only be solved by future generations of computers. It should also be pointed out that the SPLASH program is merely a starting point for the MAC method. The method is being refined and expanded to solve even more complex problems than those to which it is now applied. A super computer of the future, and a sophisticated version of the MAC techniques will probably some day be able to accurately predict weather for many days in advance, or compute the changing currents for an entire ocean. The only limit is man's imagination. ■

[5] J. Eddie Welch, "Moving Picture Computer Ouput", Proceedings of the 4th Meeting of UAIDE, pp. XXI-1, XX-18, October, 1965.

DP FOR SMALL RETAILERS

without time-sharing

by BYRON L. CARTER

"In the club-management field, hand bookkeeping is obsolete and machine bookkeeping is obsolescent. The day of the computer is here." Joseph P. Meehan Jr., manager of Commissioned Officers' Open Mess, the Naval Air Station, Jacksonville, Fla.

"We are getting information on sales, inventory, and expenses soon enough to be used to make key operating decisions." Frank Hemphill, owner of Brill's Flower Shop, Ardmore, Pa.

"We previously had no inventory breakdown at all . . . This report gives us the information we need to improve our stock turns, guide our buying, and increase our net profit." Walter Mytinger, owner of Horney-Chapman, dealer in office equipment and supplies, Chillicothe, Ohio.

The people quoted above are all retailers. Although each is in a different business, they, and many other small retailers throughout the country, are confronted with similar critical problems: increased competition from new retailing concepts, shrinking margins of profit, and a growing amount of complex paperwork.

Ten years ago, they could rely on intuitive merchandising sense to meet the challenge of competition. Today, however, the small retailer needs more than just merchandising skill—he needs specific business information to support the decisions he makes every business day. Only in this way can he avoid making those errors in managerial judgment that dissipate profits.

But how can the small retailer hope to compete with the large corporation or discount house? How can he match the employee specialization brought about through the use of large computer systems? How can he afford the comprehensive information his larger competitor gets from a vast number of employees and elaborate business systems?

The three retailers quoted above are part of a growing number who are using electronic data processing as a managerial tool to solve these problems. Their remarks reflect the distinct advantages edp can now offer the small retailer.

But why this sudden change? Why, when as recently as several years ago data processing was considered too impractical and too expensive for most, is it now finding acceptance among a wide variety of retailers? Part of the answer lies in the fact that computer manufacturers have developed the four essential tools the retailer needs to effectively use a data processing system: input hardware, an integrated system, computer hardware and software.

four basic tools

Input Hardware. In the past, input hardware to capture detailed transaction data was a major obstacle for a majority of retailers. Punched card systems were available, of course, but the time and cost required to punch and verify cards was not practical for the many small retail transactions.

The development of punched paper tape brought dp within the economic reach of a few retailers by eliminating the cost of punching and verifying cards and making it possible for input media to go directly into the computer. But it was the development of optical scanning systems that made data processing an economic reality for the retailer. Now, point-of-sale information can be captured in optical type font as a byproduct of ringing up a sale on a conventional sales register. The register's optical font journal tape can be mailed directly to the data processing center. Processing costs are reduced because the tapes are used as direct input for the computer. In short, the functions of the conventional business system have been expanded, enabling the retailer to use it either in the conventional

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manner or in the applications of data processing methods to his business.

"The cost of processing varies with volume," reports Walter Mytinger, who is using an optical font sales register, "but never approaches the salary of a full time employee. The only investment required is in the sales register."

Integrated System. Economical input alone, however, does not justify a retailer's use of data processing. Any edp system for the retailer must, by the nature of his business, meet three prerequisites:

a. The system must control cash and merchandise by capturing the details of each transaction as a byproduct of recording the sale, purchase or expense.

b. The system must make the handling of all kinds of transactions simple and easy for the salesperson or bookkeeper without sacrifice of control.

c. The system must establish an audit trail from original entries to the final data processing reports.

Therefore, the retailer's system must be an integrated one requiring a merchant's knowledge of needed reports, an accountant's grasp of the retailer's needs, a specialist's knowledge of data processing costs and potential, and a thorough understanding of business machines.

Computer Hardware. Only a small minority of retailers can afford to rent or lease their own computer. The data processing center, however, has emerged to overcome the costly problem of computer hardware. They offer the retailer several distinct advantages:

a. Through the data processing center, the benefits of edp are obtained without investing in computer equipment.

b. Start-up costs are minimized. Further, the retailer's money is invested in original-entry equipment that would, in most cases, be purchased whether or not the business planned to use computer processing.

c. The retailer is provided with specialized programming aid without the expense of employing specialized personnel or developing training courses of his own.

d. Flexibility of the data processing center's services enables the retailer to experiment with and abandon systems that prove unsatisfactory. A larger competitor with more rigid restrictions would find such experimentation impossible.

e. A center can give the retailer an objective analysis of his data processing problems.

f. The data processing center provides the retailer with protection against obsolescence of purchased computer equipment.

Computer Software. Choosing the right center, of course, means choosing one that is programmed to do the retailer's particular job. However, writing a program is invariably time-consuming and expensive. A retailer taking his problems to a center sometimes takes it home with him, after learning how much programming will cost him.

Today, data processing centers counteract the expense of a custom-tailored group of programs by offering the retailer a "package" program, developed for a group of clients who have similar problems and requirements. Such programs help to lower the expense of programming by distributing the costs among individual retailers.

The major advantages of the data processing center and "program" packages are currently being realized by several national associations. Recently, the Smaller Stores Division of the National Retail Merchants Association, which has established standardized accounting procedures, distributed a edp manual to members. The manual sets forth the requirements of a standardized edp system, available to all members through group data processing. In order to make the system practical and to bring processing costs within the reach of the smallest member store, the committee incorporated two basic elements:

"First," the committee reported to members, "to minimize programming costs, a uniform format had to be designed to fulfill the needs of various types of retail stores, large and small, for effectively controlling their merchandising operations . . ."

"Second, to substantially reduce computer processing costs, a computer service center had to be retained, equipped to handle the entire group's processing on computers flexible enough to process data produced for a vast variety of electronic accounting equipment . . ."

"Through group effort, processing costs for the proposed systems were reduced to approximately one-third of what an individual store's cost would be attempting the same system on its own."

Similarly, the Menswear Retailers of America, through the efforts of the association's Financial and Operating Group, has developed a "chart of accounts and an accounting manual that would be good for manual, mechanical or electronic data processing." Through its manual, MRA is proposing that all men's wear shops develop a common schedule of merchandise "classifications" which will mean the same thing to all MRA members.

By adopting the system, MRA merchants will put themselves in a position to use low-cost data processing techniques to get the merchandising management information required "to stay competitive in today's business climate."

recording data

The procedure for recording input data on such a system is basically the same as under a conventional one. In recording a cash sale, for example, the salesperson performs the following steps: (1) records the department code; (2) indexes the salesperson's number; (3) indexes a three-digit classification code for each article of merchandise purchased; and (4) records price.

The same procedure is used to record a charge sale except that the customer's account number is also entered in the register's keyboard. Payments received on account are recorded by entering the customer's account number, the amount paid, the salesperson's identification number and depressing the received on account key.

Purchase information is recorded by first entering the item's classification number, the dollar amount of the item, and depressing the auditor debit key. On a second pass over the keyboard the operator enters a three-digit accounts payable code and depresses the auditor credit key. The auditor debit and credit keys insure that debits and credits are always in balance. Expense information, necessary for financial reports, is usually entered at the end of the month. A separate three-digit code identifies each expense account.

In installing his particular system, the retailer's primary job is to define the classification breakdown, a job that requires considerable thought, and is generally accomplished by working with his accountant. After taking a complete physical inventory, the assigning of classification codes should give the retailer a breakdown that fits his store and his clientele and allow room enough for later inventory expansion.

The recording of classification codes is enforced because the register has a sequence control. An item's classification code must be entered in sequence or the register automatically locks.

The system's flexibility allows for inter-departmental selling. The salesperson is no longer restricted to one sales register when recording a purchase. Since the salesperson's number and the item's classification code provide all the identification the computer needs, the system means greater customer convenience and permits personnel to do

better selling jobs. The customer may check out purchases at any register in the store, or the salesperson can follow the customer to other departments to sell merchandise.

the software package

Assuming that the retailer has all the necessary factors needed for an integrated system and has chosen a data processing center, what are the management reports he can receive? Among the most vital are the following:

Inventory Management Report. How much money is tied up in inventory? Which items of merchandise are moving fast and which are moving slowly? Which classification produces the greatest margin of profit? Where has the retailer had to take markdowns?

The answers to these questions can be found in the retailer's monthly inventory report. The inventory report should complement the retailer's current method of accounting: direct cost, retail, or cost. But whatever his method of accounting, the report will provide the retailer with a detailed profile of sales for the month and the present inventory status for all groups of merchandise.

One "program" package contains an inventory report which provides the following columns of information for as many as 800 separate merchandise classifications: the classification number, number of units sold, dollar sales at retail, percentage of total sales for the month, gross profit, margin percentage based on closing inventory, unit amount of opening inventory, opening inventory at cost, number of units purchased, purchases at cost, unit amount of closing inventory, and ending inventory at cost. As stated, the report is available regardless of whether the retailer is using the direct cost, the retail, or the cost method.

James Peterson, owner of Eckstrom's, a men's wear store in Superior, Wis., is typical of the retailer who has a need for current inventory information. Peterson, like many other small retailers is restricted by time. He is usually able to spend no more time on the selling floor than a part time employee. He does most of the store's buying and relies to a great extent on personal experience when making business decisions. Up until a year and a half ago, he had what he thought was an inadequate knowledge of his business. Now, after the installation of an optical font sales register, he receives an up-to-date retail inventory report from a data processing center.

With the inventory report he is able to base decisions on the total sales experience in the store, spelled in great detail even to the markdowns. The report is enabling him to stock the merchandise his customers want. But just as important as the immediate benefits an inventory report can provide, are the benefits it holds for the future.

Don Henes, owner of a marina in Painesville, Ohio, is using an optical font sales register to capture point-of-sale information needed for a monthly direct cost inventory report. He explains the added importance the report will assume in the near future: "The report will take on more significant value the longer our system is in operation. For intance, we will have a better idea of our inventory requirements for this year's busy season by checking the inventory reports covering the same period last year."

Similarly, Peterson, who is in a fashion business where customer preferences vary from one season to the next and from year to year, plans to use his inventory report for more sophisticated applications in the future. "Eventually," he says, "we will be using the report to test advertising media and display areas, to detect style changes and to plot variations in seasonal sales."

Financial Statements. A surprising number of small retailers are in the dark when it comes to the financial condition of their business. Most receive income statements and balance sheets only from one year to the next. And, in many cases, such reports are too late and lack the information necessary to take corrective measures.

A conventional business system equipped with optical type font or punched paper tape can capture all the necessary information needed for monthly computerized financial statements. Purchase and expense information can be recorded at any time convenient to the retailer and the machine's optical journal tapes or punched paper tapes mailed periodically to a data processing center.

A monthly income statement can present information as a dollar amount and as a percentage of sales for the month and for the year-to-date. The statement may be as detailed as the retailers wishes—providing a breakdown on as many as 200 categories. The statement also indicates the gross and net profit and total cost of sales for the month and year-to-date.

The balance sheet provides the standard information found in most balance sheets with an extra column of information telling the net amount of dollar change in each asset and liability that occurred during the reporting period. The report immediately alerts the retailer to changes he might not have learned about, until it is too late to act correctively.

not a substitute for retailer's experience

It should be emphasized that no system is a substitute for the retailer's merchandising skill or experience. He still has to interpret the resulting reports in the light of past experience and the immediate needs of his customer. Nor does the system reduce the value of the retailer's accountant. On the contrary, the system and the accompanying reports should help the accountant to quickly discern any upward or downward trends in the retailer's business.

What data processing can do for the retailer is transform his method of doing business from a skill to a science. It can provide him with the comprehensive and up-to-date management information he needs to meet an ever-increasing amount of competition. ■

"I can't help it if the computer has it in for me."

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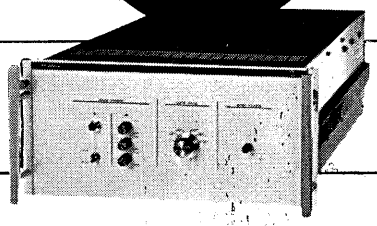

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CIRCLE 23 ON READER CARD

INCREMENTAL MAGNETIC TAPE RECORDERS

versatile and economic

by JOHN S. CRAVER

The incremental magnetic tape recorder is a device which can receive asynchronous, or randomly timed, digital signals and record them in block format on magnetic tape. This tape can later be read on conventional block reading digital tape transports. Incremental recorders are available for many special applications; however, in this paper we will examine only those designed specifically as data collection devices for digital computing systems and that produce output tapes that are usable by conventional computer tape transports.

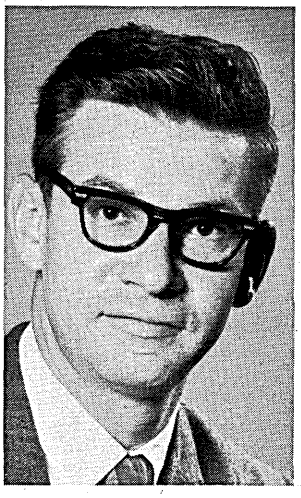
The computer-compatible incremental recorder is designed to accept standard-sized reels of ½" wide computer tape. The recorded tape is indistinguishable from a tape produced by a conventional computer transport in both its physical appearance and in its data format as it is recorded at densities of 200 and 556 bits per inch and includes normal beginning of block and end of block marks and inter-record gaps.

recording techniques

Recording techniques differ greatly between conventional tape transports and incremental recorders. Conventional tape transports read and record data only while the magnetic tape is traveling over the read/record head at a constant speed. It is therefore necessary to accelerate the tape until it reaches the desired constant speed, read or write the data at this speed, and decelerate the tape to a stop. Some tape must be moved during the period of acceleration and deceleration, thus it is necessary to leave small blank areas of tape between blocks of data so that it will not be necessary to skip data while the tape is accelerating or decelerating from read/write speed. These small blank areas are called inter-record gaps. In order to establish timing and aid in distinguishing the data from the inter-record gaps, beginning of block and end of block marks are added before and after the recording of the data.

The first magnetic tape transports developed for computer applications recorded data in fixed length blocks. As a constant number of characters were written each time, the tape transport passed a fixed length of tape between each start/stop cycle. When there was inadequate data to fill a complete block, the balance of the block was filled with zeroes or some other distinguishable symbol. When it was necessary to record more data than a block would hold, the data had to be recorded in two blocks and the balance of the second block filled with zeroes.

The concept of variable block length was later introduced and allowed the transport to record any number of characters in a block. Block length could be varied from several characters to a full reel of tape. In most applications, long block lengths are undesirable because there is inadequate central memory to store a full block of data. Short block lengths are also undesirable as they consume



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one start and one stop time for each block of data recorded and use the transport inefficiently. As an extreme example, if a tape transport with a start time of 7 milliseconds and a stop time of 13 msec requires something slightly in excess of 20 msec to record a character in one character blocks, the maximum recording rate for such a transport would be 50 characters per second—somewhat slower than the rate of many paper punches currently available. The conventional computer tape transport is not too efficient in those applications where data cannot be written in blocks of several hundred to several thousand characters.

In low speed applications and asynchronous digital data recording applications, paper tape is usually used as conventional tape transports are expensive; they are inefficient in this type of application, and frequently require buffering of data. Paper tape perforators can accept digital data and record it at rates that vary from less than one character per second to several hundred cps. However, the optimum performance of these units is in the range of 10-100 cps. When paper tape equipment must be designed to operate much faster than this, it becomes quite expensive and requires a substantial amount of power.

In low speed applications, paper tape perforators have a number of advantages over conventional computer magnetic tape transports. They do not require buffering because of their ability to punch characters asynchronously. They record data by punching holes in paper tape while it is standing still and are not hampered by a need to accelerate the tape prior to recording as are conventional magnetic tape transports. Tape movement in paper tape perforators takes place between recording of characters.

When operating with computing systems, paper tape units have a distinct disadvantage as it is necessary to provide not only the paper tape recorders but also paper tape readers so that the tape can be read by the computer. These readers are an added cost of the tape system and operate at considerably slower speeds than conventional computer mag tape transports as they must pass a much greater length of tape than the mag tape transports because of the difference in recording density. A computer tape is recorded at several hundred characters per inch while a paper tape is recorded at only 10 characters per inch.

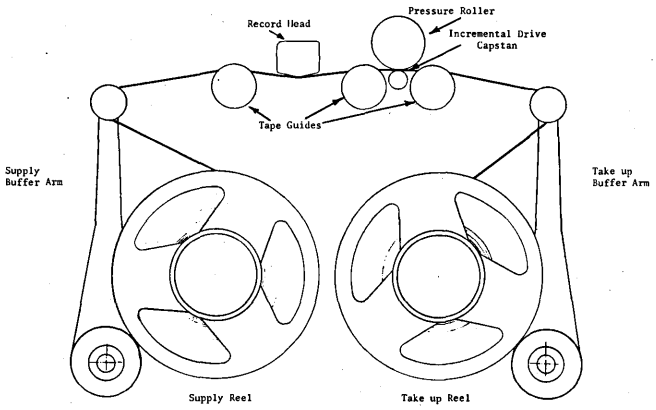
The incremental magnetic tape recorder combines many of the advantages of both paper tape recording and mag tape recordings. It uses conventional computer tape and records in the standard computer tape transport formats, e.g. 200 or 556 bits per inch. However, the incremental mag tape recorder, like the paper tape perforator, records on the tape while it is standing still. The result is that the incremental recorder can record randomly occurring data in a form suitable for synchronous reading.

operation of the incremental recorder

The configuration of the incremental recorder is like that of the conventional digital tape transport (see Fig. 1). It consists of a reel drive system containing two reel servos and a tape buffering system with some form of tape loop sensing. This tape servo system is designed to unwind tape from the supply reel into the input tape buffer as the tape becomes exhausted and take up tape from the output buffer as it becomes filled. Between the input and output tape buffers is a capstan drive and a read/record head. It is the function of the tape servo system to provide a fixed and constant tension on the tape so that it is held firmly in contact with the capstan drive and the record head. This is to allow close control of tape movement by the capstan and provide intimate contact between the record head and the magnetic material on the surface of the tape. Tape tension must be constant regardless of the relative position of the tapes in the tape buffers and regardless of the movement of the tape reel drives.

The record head used in an incremental transport is similar to that used in a conventional digital tape transport. For recording IBM 729 compatible tape, the record head has 7 write gaps spaced across the width of the tape to produce 7 bit parallel or character serial recording. The major difference is that the incremental recorder uses a head that is capable of recording only since reading is not usually required.

Fig. 1 Diagram of Typical Incremental Recorder



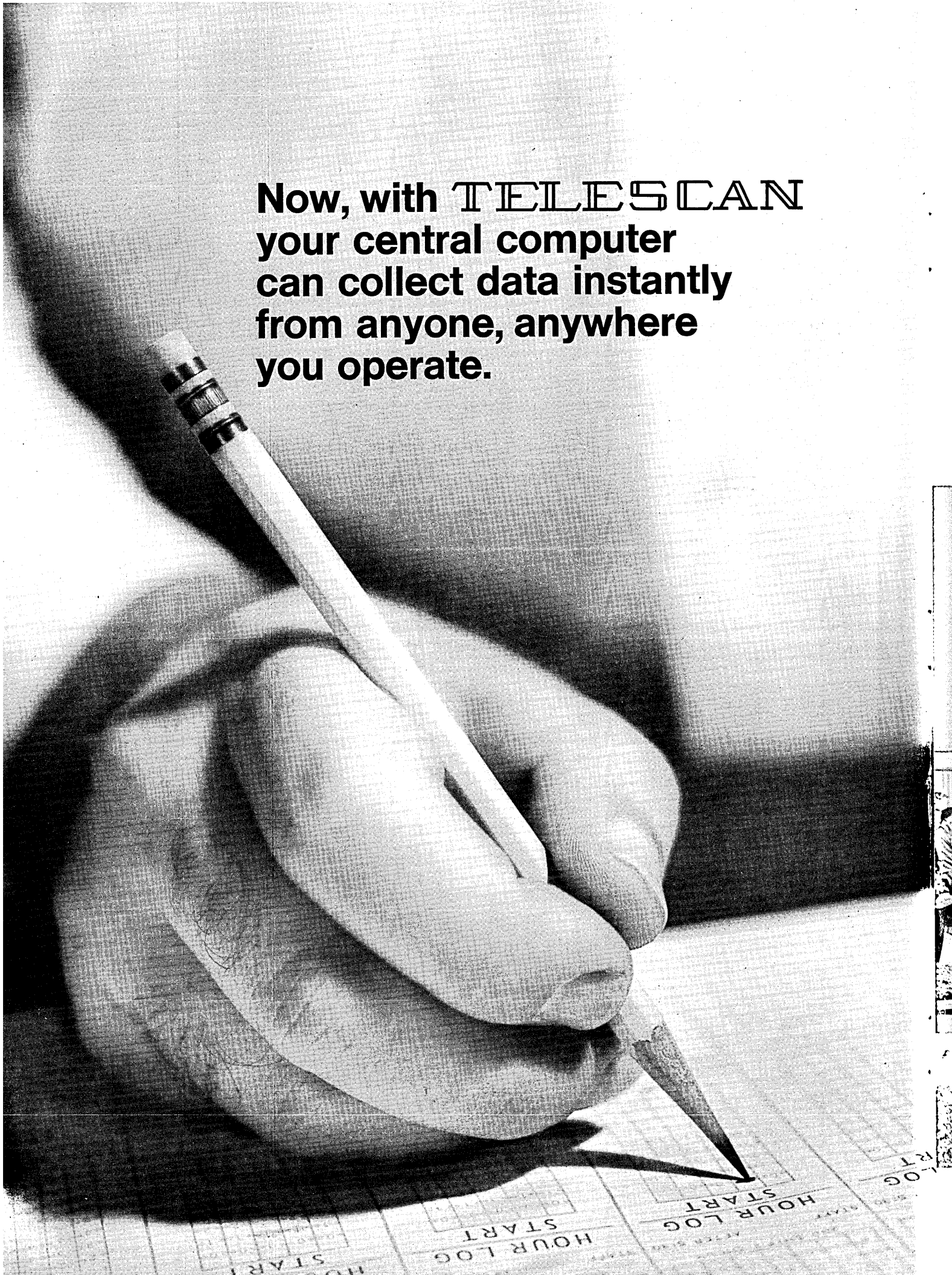
The tape drive system used in an incremental recorder is radically different from that provided with a conventional digital tape transport. Most conventional transports hold the tape away from a constantly rotating capstan when it is not in motion. The tape is forced against the capstan by a pinch roller, air pressure, a vacuum, or some equivalent means when motion is required. Some sliding of the tape occurs until it accelerates to the speed of the capstan when it is ready for recording.

Incremental recorders are designed to hold the tape firmly in contact with the capstan. Incremental movement is created by giving the capstan short controlled pulses of rotational movement that result in a fixed lineal movement of the tape. A single character is recorded in parallel on the tape while it is standing still. Between recording of characters the capstan is rotated slightly to move the tape to the next recording position. This movement is controlled to provide 1/200 or 1/556 of an inch lineal tape movement depending upon the recording density required.

Peak asynchronous recording rate of the transport is dependent upon how rapidly the transport can accurately space the tape to these close tolerances between recording of characters. Current state-of-the-art as indicated by presently marketed equipment is 650 steps per second representing a recording speed of 650 characters per second. It is important to recognize that this is the maximum speed that the incrementing mechanism can reach and is the speed at which the transport becomes synchronous. It may thus record characters that are spaced asynchronously as long as the closest timing of these characters is greater than 1/650 of a second.

Methods of incrementally driving the capstan vary; however, it is typically driven by using a light-weight capstan directly connected to the shaft of an incremental motor or to the shaft of a high torque motor in which motion is controlled by a feedback system and rotational sensing device. The system must be self-braking or provide some form of controlled braking to prevent excessive tape travel.

The typical computer-compatible incremental tape trans-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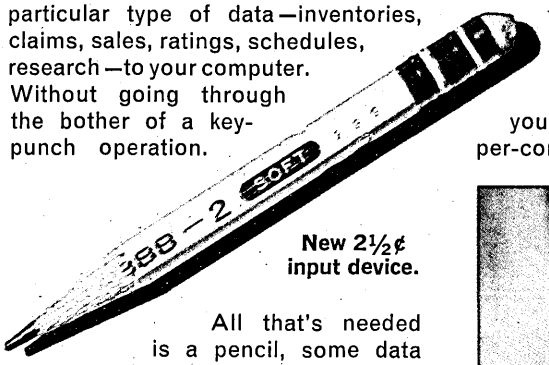

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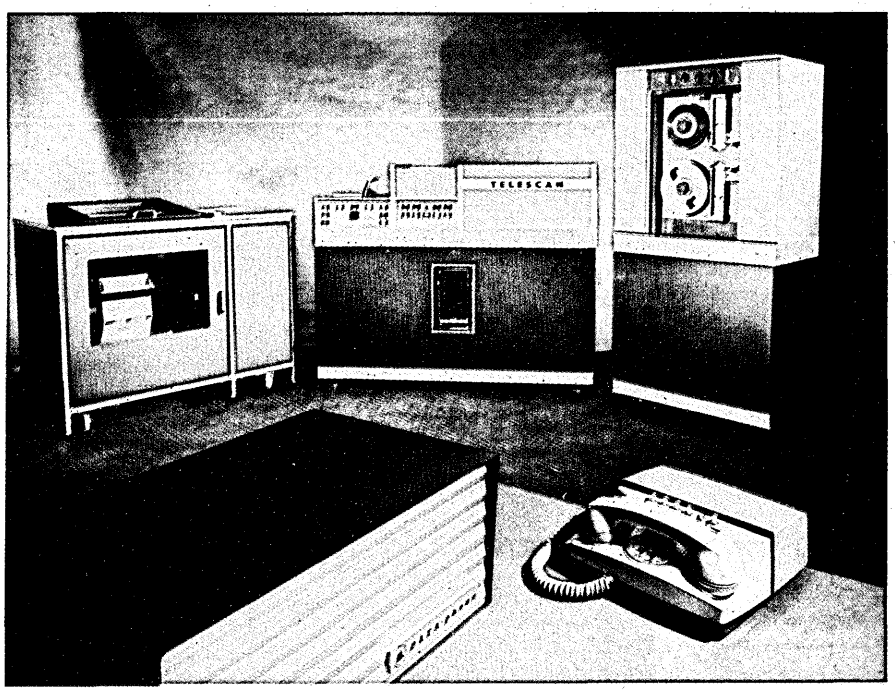

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port includes either as standard equipment or as options, tape rewind, end of tape and beginning of tape sense, and automatic record gap insertion. Some incremental recorders have the ability to operate in an incremental read mode, and operate in a conventional digital tape transport block read mode.

advantages of incremental recording

The incremental recorders are considerably faster than the paper tape perforators as their high recording density does not require that they move the tape as far to arrive at the next record position. Top recording speeds of currently advertised products vary from 100 to 650 steps per second (see Table 1). Typical performance seems to be in the range of 0-300 cps compared with paper tape equipment which typically operates in the range of 0-150 cps. These speeds may be compared with the recording speed of low cost conventional mag tape transports which are capable of recording in the magnitude of 4000 cps in 100 character blocks. As mentioned previously, the low cost conventional mag tape transport drops to speeds of 50 cps when recording single character blocks.

Table 1 Incremental Recorders NRZI 7 Channel IBM Format Recording Speed, Density, Cost

	Tape Density	Asynchronous Steps/Sec.	Reel Size	Unit Price
Honeywell 6200	200	0-180	10½"	$ 4,500
Precision Inst. 1167	200	0-200	10½	3,650
Digi-Data 1420	200	0-200	10½	3,200
Dartex 4000	200	0-200	10½	7,500*
Cook 150	200	0-250	10½	5,951
Digi-Data 1430	200	0-300	10½	3,600
Kennedy 1400	200	0-400	8½	3,500
Kennedy 1500	200	0-400	10½	4,000
Digi-Data 1440	200	0-400	10½	4,000
Kennedy 1400H	200	0-500	8½	3,750
Kennedy 1500H	200	0-500	10½	4,250
Digi-Data 1420	556	0-200	10½	3,450
Precision Inst. 1107	200/556	0-300	10½	10,000
Cook 150	556	0-300	10½	6,200
Digi-Data 1430	556	0-300	10½	3,850
Potter MT-SW	200/556	0-300	10½	5,550
Precision Inst. 1200	200/556/800	0-300	10½	5,800
Kennedy 1400/5	556	0-400	8½	3,750
Digi-Data 1440	556	0-400	10½	4,000
Kennedy 1500/5	556	0-400	10½	4,250
Kennedy 1400/5H	556	0-500	8½	4,000
Kennedy 1500/5H	556	0-500	10½	4,500
Ampex TM7	200/556	0-650	10½	9,975

*Available only as read record unit.

Price comparison of incremental magnetic tape transports with other digital data recording devices are deceiving because the incremental recorder is usually sold as a complete unit ready to accept data in digital form. It includes the tape handling facilities, record head, writing and control electronics, and is a functionally operating unit ready to accept digital data.

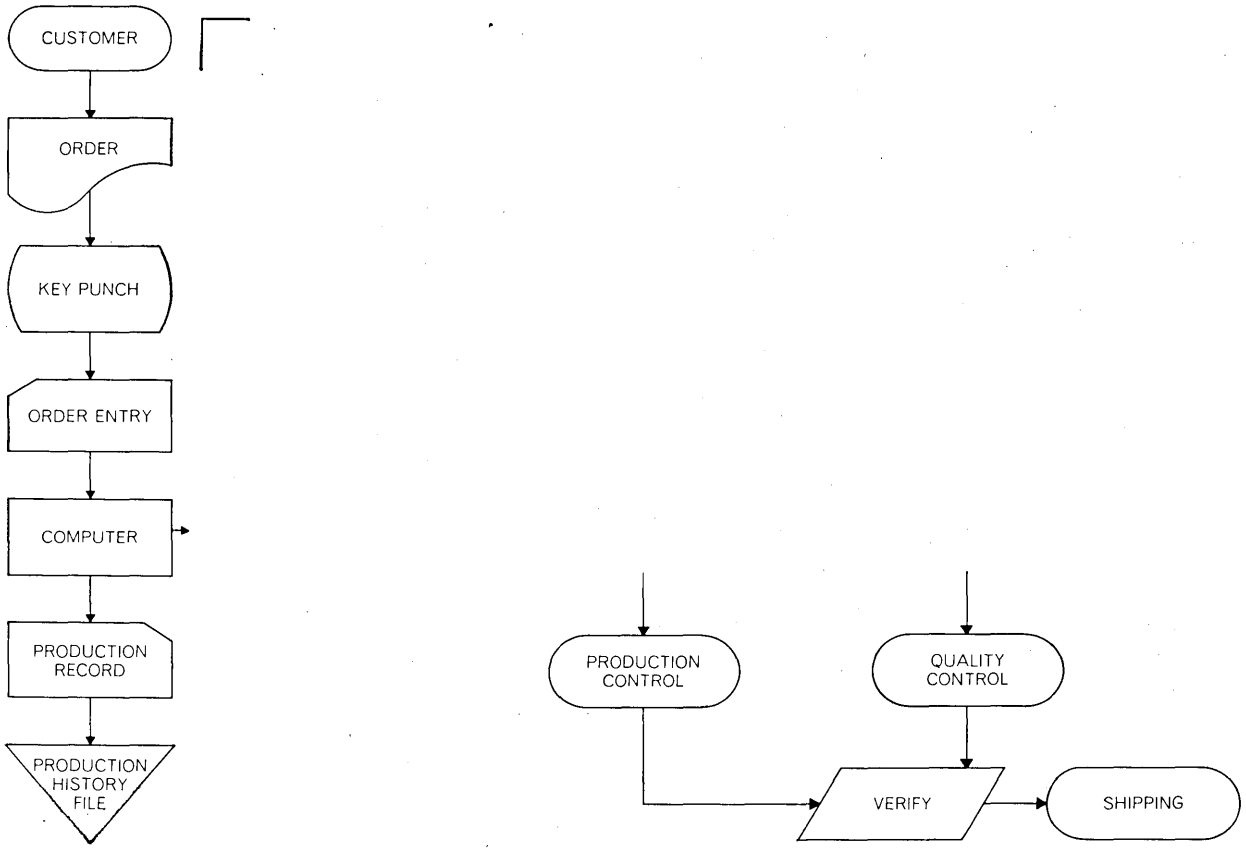
Paper tape units and mag tape transports, on the other hand, are not so complete. Paper tape perforators are usually priced as a punch head only, however, the price of an equivalent perforated tape system would have to include not only the paper tape punch, but also paper tape supply and take up reels, their associated controls and tape rewind capability, the necessary drive electronics and interface to solid state signal levels, and control electronics to insert preceding codes and stop codes.

A conventional block oriented mag tape transport includes all of the tape handling facilities of an incremental recorder. However, as it is essentially a block oriented synchronous writing device, it would require a block sized buffer and the necessary electronics to control writing the contents of the buffer on tape and insertion of beginning of block and end of block marks. As shown in Tables 1 and 2, the going price for a complete incremental recorder seems to be about $3700 in single unit quantities. This compares with a conventional computer tape transport with write only electronics at about $6000 not including the buffer and control. This would probably run about $10,000 with the buffer and control. It can also be compared with paper tape equipment which may cost anywhere from $500 to $10,000 depending upon the performance level of the equipment. These prices do not include tape servos.

From a functional standpoint, the incremental tape recorder fills a performance gap that begins between 150 and 300 cps and extends to 500 or 600 cps. It would fill the gap to several thousand cps if this were within the state-of-the-art for incremental recorders. It is not. On a price basis, incremental recorders become competitive with paper tape punches and their associated equipment at speeds something in excess of 100 cps. They are also competitive with all asynchronous character recording applications of block oriented tape transports that are within the present performance capabilities of the incremental recorders.

comparisons

Although a unit cost comparison of incremental tape transports with block oriented tape transports is valid, a unit cost comparison with paper tape units is not necessarily valid for systems applications. In many systems the only reasons that paper tape readers are provided



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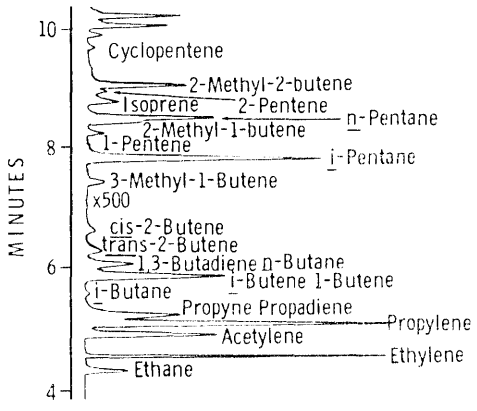

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with computers is to read data that is generated in paper tape form by off-line devices. These same systems often require that the computer have conventional mag tape transports for other functions. In such applications, the true cost of the paper tape equipment includes not only the paper tape punches involved but also the paper tape readers and the paper tape reader interface associated with the computer system since incremental mag tape may be entered through one of the existing mag tape transports provided with the computer system.

Incremental recorders require less maintenance and are less expensive to operate than paper tape perforators. They require less maintenance since they have very few moving parts. A paper tape perforator must not only move the paper once for each character recorded but it must also move the punch pins and their associated drive mechanism. Large amounts of energy are consumed in the process of driving the punch pins through the paper and wear results. Recording a character on an incremental tape recorder necessitates partial rotation of the capstan. The only other moving parts are the tape reel servo motors and the tape buffer arms. These move once for every few thousand characters recorded.

Operating costs of incremental recorders are less than costs of paper tape perforators since the mag tape is recorded at high density and is a reusable media while paper tape is recorded at low density and is consumed in the process of recording. Operating costs of a paper tape perforator are approximately 8¢ per 10,000 characters. The cost of mag tape used in incremental recording is about 3¢ per 10,000 characters at 500 bits per inch recording in 100 character blocks. The mag tape used in incremental recorders is reusable for many thousands of passes with the result that the actual cost for tape used in an incremental recorder is practically zero.

High recording density also provides many advantages for the incremental recorder when compared to the paper tape perforator. A 1000-foot reel of paper tape is able to record approximately 120,000 characters whereas a 2500-foot reel of magnetic tape is able to record 9.6 million characters at 556 bits per inch or 14.4 million characters at 800 bits per inch. Both reels are about the same diameter because of the greater thickness of paper tape. These capacities assume records of 1000 character lengths. If longer record lengths were used, somewhat greater recording capacity would be obtained on the magnetic tape because of the lesser number of inter-record gaps. There is no advantage to this increased storage capacity if the tape is changed infrequently. However, there is a definite advantage in applications where data rates are high, thus requiring frequent change of tape or where the recorder is relatively inaccessible and must operate unattended for long recording periods.

This difference becomes particularly dramatic when you consider that a paper tape punch operating at 300 cps would consume a 1200-foot reel of paper tape in slightly over 7½ minutes whereas a more conventional unit operating at 120 cps would consume a reel of paper tape in about 18 minutes. An equivalent incremental recorder operation at 556 bits per inch in thousand character blocks would operate 5333 minutes or almost 4 days continuously at 300 cps on a 2400-foot reel of tape. Putting it another way a reel of mag tape is equivalent to about 80 reels of paper tape.

Table 2 Comparison of Incremental Tape Recorders, Computer Tape Transports, and Perforated Tape Punches

			Paper Tape Systems			
	Incremental Magnetic Tape	Conventional Buffered Write-Only Computer Tape Transport	Very High Performance	High Performance	Medium Performance	Low Performance
Typical Cost*	$3,700	$10,000	$10,000	$2,500	$1,500	$500
Typical Speed in Char/Sec	200-400	4000 (in 100 character blocks)	300	120-150	60-75	20
Density in Char/In	200 or 556	200, 556, 800	10	10	10	10
Cost of Tape per Character	.0003¢	.0003¢	.0008¢	.0008¢	.0008¢	.0008¢
Is Tape Reusable	Yes	Yes	No	No	No	No
Max. Char/Reel with 1000 Char Records	9.6×10^6	9.6×10^6	0.12×10^6	0.12×10^6	0.12×10^6	0.12×10^6

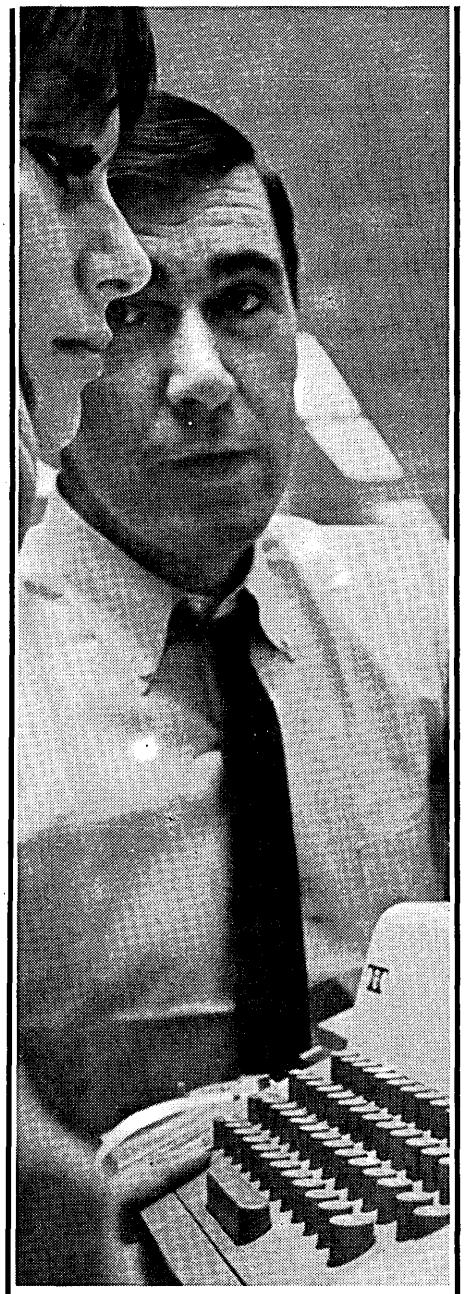
*Including Electronics

applications

The applications of incremental magnetic tape recorders include off-line digital data collection systems, digital communications systems, data logging, point of origin recorders such as point of sale recorders, time recorders, telemetry, etc. An incremental recorder can be connected to a communications device, shaft encoder, counter, cash register, typewriter, thermometer, adding machine, time clock, or any other digital data generating device. The incremental recorder provides a versatile and economic means of data storage that may be used as a buffer, time delay, or means of converting asynchronous data to block oriented format suitable for synchronous reading.

Output from an incremental recorder may be used on any computer equipped to accept IBM729 compatible tape. When the computer is not so equipped some manufacturers provide a direct computer interface for their incremental readers. Output format is flexible and can be designed to be similar to that provided by paper tape, punched card, mag tape, etc. The incremental recorder requires little attention and is cost competitive with paper tape at speeds in excess of 100 cps. ■

HOW RELIABLE CAN DATA COMMUNICATIONS BE!



Reliability is becoming an increasingly important factor in the growing sophistication of data communications and processing systems. In a real-time system, data has to be available quickly if accurate, timely decisions are to be made. Thus, any equipment breakdown can cause serious delays in the movement of raw or processed data. This is why Teletype sets — the simplest and most versatile terminal equipment — are built to last with little maintenance required.

In fact, you can find Teletype machines still operating daily that were built over twenty-five years ago. Today, this same reliability is still part of Teletype data communications equipment. Modern Teletype sets will stand up continually under all kinds of rugged conditions—regard-

less of whether they are used in a steamy jungle, out in space, on ships at sea, in offices or data processing centers.

The following examples point out how Teletype equipment reliability improves the efficient operation of any data system.

Speeds flow of data "Use of (punched) paper tape as our exchange medium has permitted ever-increasing volumes of data to flow between company points at no appreciable increase in cost." That's the way the communications service manager of a midwest automotive parts manufacturer described the results of the company's data processing system.

As finished goods are produced at any of the firm's several plants, shipped to one of the distribution centers, or transferred between locations, data on these transactions is recorded onto a continuous roll of punched paper tape. This is done by the local operator of a Teletype Model 33 ASR (automatic send-receive) set. Periodically the prepared tape is loaded into a Telespeed 1050 high-speed tape-to-tape sending set, which operates at 105 characters per second (1050 words per minute).

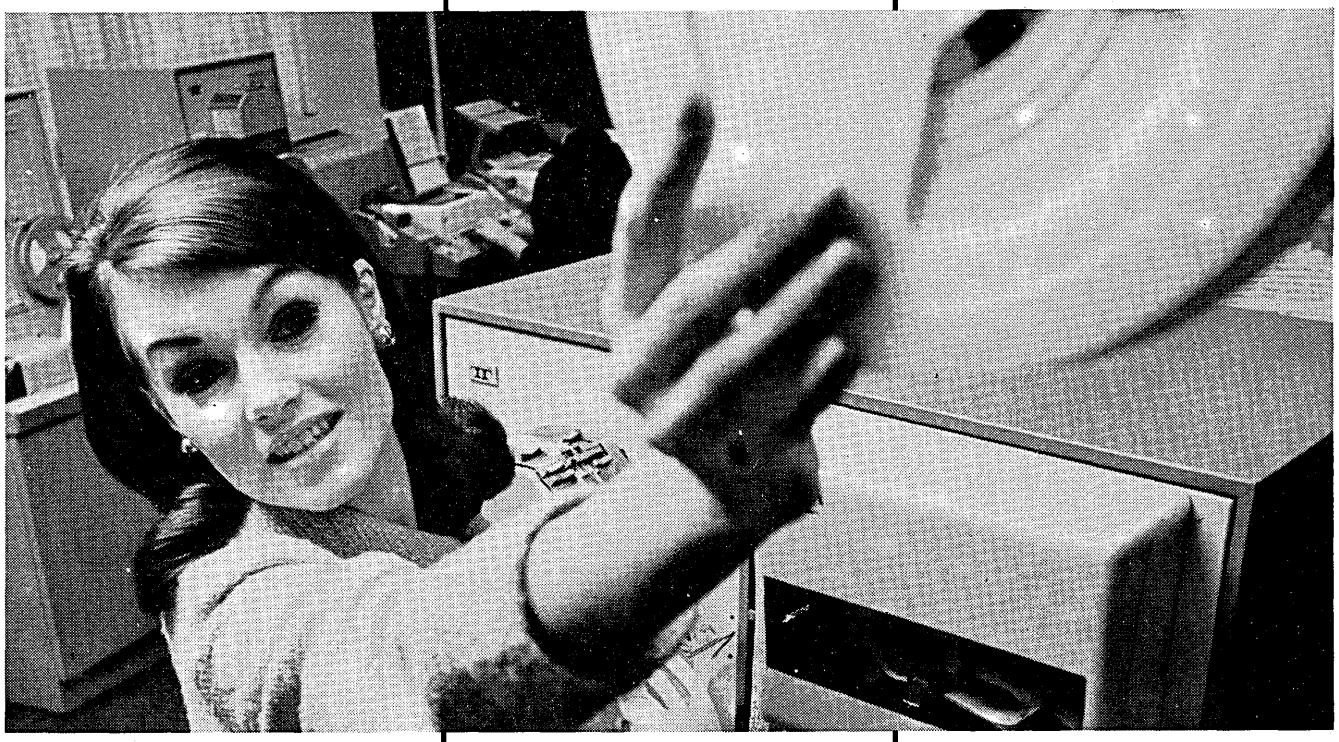
This is where reliability becomes an important factor in this data system. Six times during the day and night the company's data processing center automatically polls each of the Telespeed sets at the eight distant plants and distribution outlets, requesting transmission of the prepared tape. As the tape is received at the data processing center, it is fed directly into the computer. In only a few hours after a transaction is made, management has an up-to-date report to assure inventory control and accurate production scheduling.

Since the operation is automatic, no attendant is needed at night. If there were a breakdown, no one would be present to correct it and see that the data is transmitted. That's why Teletype equipment reliability is so vital to this system's operation.

Assures reliable turbine operation An electric generating plant uses computers and Teletype page printers to provide quick and accurate performance information to assure reliable operation and prevent turbine damage. The system's operator control center has three Teletype printers. One is used to provide periodic logging of variable station operations.

Another serves as an alarm, displaying "off-normal" and "return to normal" conditions. The third Teletype machine is used as a demand point log for digital trending, group review of preselected variables, and turbine startup and information log. Thus, without the reliable performance of Teletype equipment, the accurate operation of this electric generating plant would be seriously jeopardized.

Most widely used terminal equipment Their reliability as well as versatility and other capabilities point out why Teletype machines are the most widely used for transmitting data from where it originates to where it must go to be of value.



And, that is why this Teletype equipment is made for the Bell System and others who require reliable communications at the lowest possible cost.

Additional uses of Teletype equipment in aiding data communications and processing systems within a number of businesses and industries are explained in our brochure, "WHAT DATA COMMUNICATIONS CAN DO FOR YOU." For your copy contact: Teletype Corporation, Dept. 81L, 5555 Touhy Avenue, Skokie, Illinois 60076.

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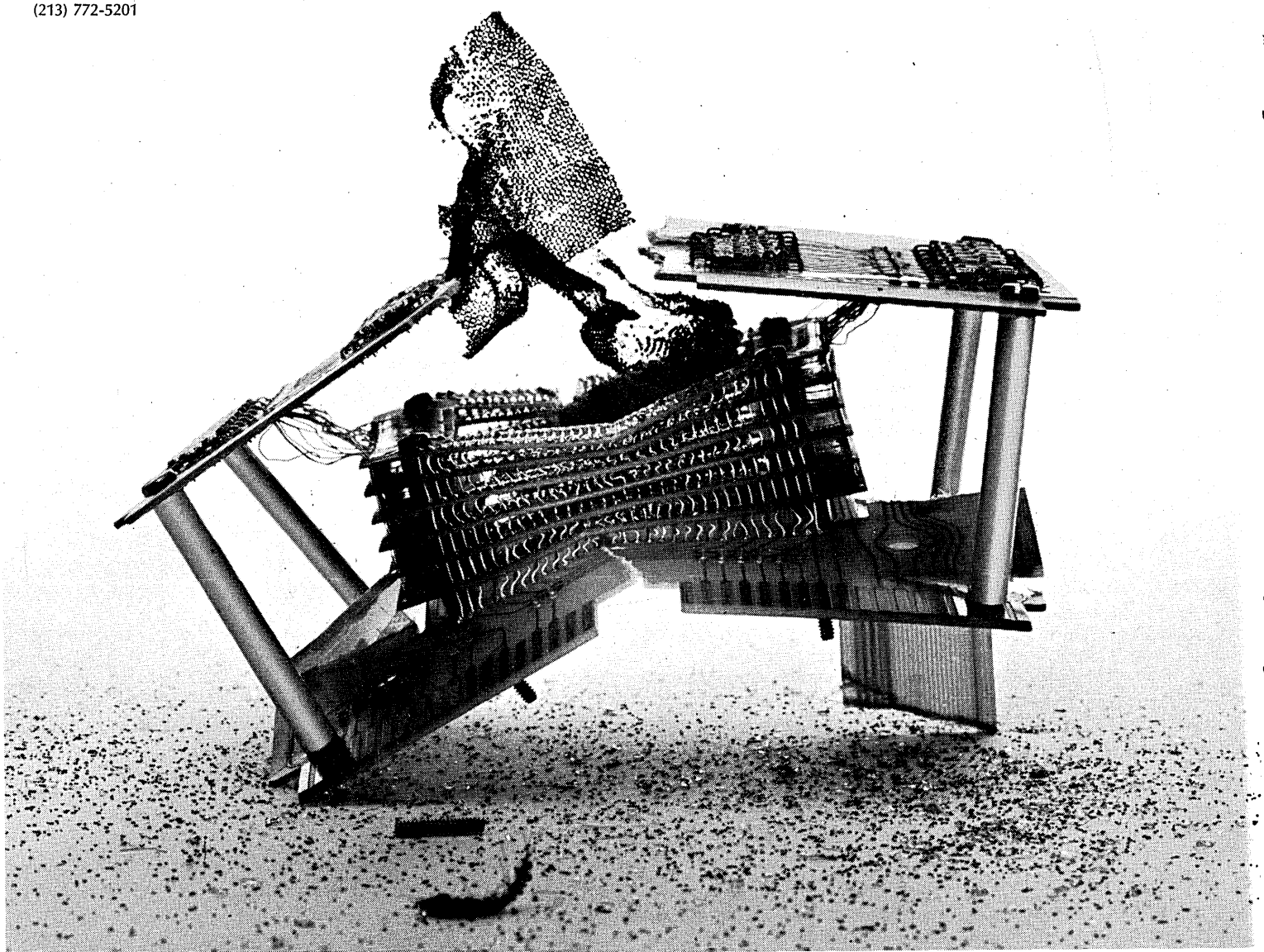


lite and aid

AUTOMATIC ABSTRACTION OF LEGAL INFORMATION

by JACK SIEBURG

In the area of legal information, as well as in the fields of science and technology, the size and cost of every research delivery is following an exponential law of growth. In 1948, J. E. Holmstrom summed up the scientific researcher's dilemma when he remarked;

> The problem is a formidable one. We have heard estimates of how anything up to a million or more scientific papers a year are poured like rain over the scientific world and of how formidable are the difficulties of ensuring current awareness, by scientific men, of the new publications which may concern them in the particular fields of research which these publications serve to irrigate . . . . these torrents and rivers of current literature pour themselves into libraries adding, without cease, to what is already there. . . . . Our problem is founded on the fact that on the one hand every man's reading time is limited whilst on the other hand there must exist, somewhere among the millions of items of literature available, the particular ones which contain the ideas most apposite to his needs if only there was some means of singling these out from the mass. The scientist's time and power of attention are precious things which need to be husbanded; and to do this we need techniques of controlled selectiveness in supplying his needs.[1]

By substituting the words "attorney" for "scientist" and "legal opinions and decisions" for "scientific papers," Mr. Holmstrom's summation well describes the dilemma of the legal researcher today.

In the legal profession, a long-accepted "technique of controlled selectiveness in supplying the attorney's needs" is the *abstract*—which, by one of Webster's definitions, is "a short statement giving the main ideas of an article, book, case in court, etc.; summary." Today, however, conventional abstracts—those prepared by the human abstracter—are not adequate for the needs of the legal researcher. Two reasons for this inadequacy are immediately apparent. First, due to the mass of legal material being published, the preparation of the related abstracts is often months subsequent to the issuance of the original legal opinion or court ruling. Second, and perhaps of greater importance, the value and/or meaning of the decision may be distorted due to subconscious biases and misunderstanding on the part of the human abstracter. An improved technique of controlled selectiveness in supplying the research attorney's needs is mandatory, and urgent.

Can conventional abstracts be replaced? Can a computer be programmed to analyze an entire body of text and produce an abstract which clearly and explicitly sets forth the main points of the article or case in court? Assuming an affirmative answer to these general questions, what criteria must be established to ensure the *selection* (not *development*—I leave that problem to the structural linguists and grammarians!) of meaningful sentences and index words?

These were the questions faced by the Research and Development team of LITE—Legal Information Thru Electronics—an Air Force system originally designed and currently operating to retrieve fiscal management and legal information. An earlier article[2] discussed search and retrieval methods and a looping technique for updating immediate access storage files; our answers to the aforestated questions and a status report on the hypothesis of our system form the basis for this article.

In the original development of the LITE Auto-Abstract systems logic, four major criteria were established. First, it was decided that more exact measures for the significance value of single words (uniterms) were required;

A systems research analyst with the Office of the Staff Judge Advocate, Air Force Accounting and Finance Center, Denver, Colo., Mr. Sieburg is in charge of computer R&D efforts associated with Project LITE. His work currently involves development of specialized indices and thesauri in the area of legal and financial management.

[1]Joseph Becker and Robert M. Hayes, *Information Storage and Retrieval* (New York: John Wiley & Sons, Inc., 1963), p. 8, citing Royal Society Scientific Information Conference, 21 June-2 July 1948. Report and Papers submitted. London, The Royal Society, Burlington House, 1948, p. 78.

[2]J. Sieburg, "Updating An I.R. System," *DATAMATION*, 11 (June, 1965) 24-26.

the often-tried "simple-frequency" approach would not suffice. Second, the values of groups of words (multiterms) should be measured and incorporated into any functional abstracting technique. Third, a method of selecting sentences of maximal significance value would be required, and, finally, the number of abstract sentences and index words to be contained in the end product would, for the test period, be arbitrarily established. Assuming the ability to satisfy the established criteria, our original hypothesis was that the computer could be programmed to produce a printed document consisting of both highly significant index words and an abstract (perhaps "extract" would be the better word) containing the most informative sentences of the entire article.

operational phases

The following systems outline, segmented because of systems limitations and for simplicity of logic design and programming, illustrates how the four basic criteria were satisfied.

In Phase 1, new text material, in punched card format, is processed to develop a full-text tape and an uncondensed *non-common* word usage file. (Approximately 600 words, such as *the, and, but, because, accordingly,* etc., are classified as common or subjective words which, although contained in the main body of the text, have little or no value for abstracting or indexing purposes. The actual content of the common word group is subject to analysis and modification dependent upon the specific text base being processed.)

After being sorted into alphabetical sequence, the uncondensed word usage file is processed by Phase 2 to develop the original weighted word file, consisting of a single occurrence of the non-common word followed by a count of its frequency of occurrence. This file is then sorted, on its frequency of occurrence, in descending sequence prior to further processing.

Phase 3 processes words contained in the original weighted word file against an "interest profile" word file. (Interest profile words are defined as words or groups of words of particular interest to an individual or agency.) Computer applications, basically, consist of comparing text words against interest words; an "equal-to" condition results in the addition of a specific weight factor to the value (at this point, frequency of occurrence) of the particular text word.

In addition to modifying the values of uniterms contained in the weighted word file, interest profile words and word *groupings* cause the application of a multiterm technique to control selectiveness in supplying the needs of the attorney or legal researcher. To understand this technique, an explanation of interest profile word groupings and their internal processing is required. Let us assume that you, or your research personnel, have a primary interest in government regulations and legal decisions pertaining to the payment of civilian travel and per diem allowances. Your interest area word grouping might be expressed by such words as:

Group 1: Civilian
Group 2: Personnel — employee
Group 3: Travel — transportation — TDY
Group 4: Allowances — expense-payment-reimbursement

Auto-abstracts of new text material would be analyzed and annotated for immediate distribution to you or your agency if they contained the words as specified by the following formula: (.= *and*; v = *or*; numerals following the letter *W* identify groups.)

The search data, originally in card format but converted to magnetic tape for processing by the Auto-Abstract system, consists of all words previously used for search and retrieval purposes, plus the frequency and most recent date of use. Computer processing involves comparing text words against search words. When a "match" is found, the weight factor for the particular text word is modified by specific numeric values dependent upon frequency and recentness of use.

Phase 5 processes the final weighted word file against the total text file developed by Phase 1. Initially, internal processing consists of the development of individual sentences (limited to a maximum of 750 characters) as contained in the original text and comparing the words of these sentences against the 20 high value words contained in the weighted word file. When identical words are located, a numerical weight factor is added to the significance value of the sentence being processed. Output, properly annotated for immediate distribution to individuals or agencies whose interest profiles indicate their "need-to-know," consists of: (1) the first and last sentences of the original text, plus a maximum of 10 intermediate sentences determined to have the highest informational value, i.e., those containing the greatest number of "high-value" words, and (2) a listing of the 10 most heavily weighted words for indexing and subsequent retrieval purposes.

Two additional techniques for identifying and modifying the values of the index words have been developed and added to the original system design. The first processes the condensed word usage file, as developed by Phase 2, against a vocabulary file consisting of all unique words previously identified in the particular text base being updated. When a word is found in the new material which has not been previously used in the master file, it is dropped from further processing on the assumption that it is a proper noun and of minimal value for indexing and abstracting purposes. The second modification processes the weighted word file against a file of words which, by prior usage, have been determined to be "high-value" index words by human abstracters and indexers; again, an "equal-to" condition results in an addition to the value of the particular text word being processed.

present status

A status report on the LITE Auto-Abstracting and Indexing system must, I believe, be separated into two areas. First, the efficiency of its machine applications, and, second, the true value of its end product. In the area of machine applications, I feel the system may be declared "operational." Using the unpublished decisions[3] of the Comptroller General of the United States for test material, approximately 100 documents have been processed through the system and the final output analyzed for conformance to machine logic and programming requirements; no known deficiencies exist. (In an attempt to evaluate informative content of machine developed abstracts, test output was compared against conventional abstracts of the related Comptroller General's decisions. While there was minimal relationship between the language used by the human abstracter and that contained in the extracted sentences, an extremely high correlation existed between the high-value index words selected by the two methods. To illustrate, on Decision No. B-153549, June 1, 1964, the human abstracter indexed on the words *contracts, damages,* and *liquidated*; computer applications selected the words *damages, liquidated, and contracting,* a gram-

[3] In government terminology, the *unpublished decisions* of the Comptroller General are those which, while in force and binding, have not yet been incorporated into the bound, i.e., *published* volumes or series.

matical equivalent of *contracts.*) Machine time requirements for the prototype system, which encompasses the five original phases plus two separate sorts and requires card input for all but the weighted word file, averaged nine minutes per run; conversion of repetitive input data, i.e., profile interest words, common words, search data files, etc., from punched card media to magnetic tape should reduce running time by approximately one-half. (Timing factors are based upon use of an IBM 1410/40K, with four tape drives and a 1301 disc file. The disc file was used for sorting only.)

In the second area, the *value* of the end product, our original hypothesis must be subjected to additional analysis and evaluation. Preliminary tests indicate that:

1. *Some* of the abstract sentences contain the meat of the problem; *others*, particularly when read out of context, appear to have little or no real informational value.
2. *Some* of the index words are "on point"; *others*, primarily proper nouns and numeric dates, should be eliminated. (As previously noted, proper nouns are dropped from the list of index words by programming changes now in the system.)
3. While technically adequate, the weight factors assigned for the satisfaction of the various processing requirements are subject to continuing analysis and modification as the size of the universal set (work load and number of master text files) increases.

Further, some secondary areas of the overall systems logic now assumed to be valid but requiring greater in-depth analysis are:

1. Using the unpublished decisions of the Comptroller General for our text, the value of printing the first and last sentences as a part of the abstract is appparent: the first sentence always states the problem or question; the last, or, in certain, easily identifiable instances, the penultimate sentence gives the ruling or answer. But, will this premise hold true for all, or at least the majority of text bases?
2. The recentness of use—for search and retrieval purposes—may or may not be a valid factor in determining the value of an index word. Our current assumption is that if a word, or word grouping, has not been used for search and retrieval purposes within the last 90 days, the weight factor for a like word located in the new text material should be penalized. To illustrate, in the period 1942-1943, the use of the word group "Norden bomb sight" would immediately flag a document as of value to enemy espionage agents. Today? In my example, the value of the "recentness" factor is obviously—and intentionally—valid; does it hold true in all or most real-life cases? Only time and further analysis will tell.
3. The assumption that words not previously used in the main body of text are proper nouns and of minimal value for indexing and abstracting may well prove true in the area of legal research; in the scientific and technological fields—with their everchanging vocabularies—I must question its validity.
4. Is our arbitrary figure of 10 sentences and 10 index words proper? Too few? Too many? Should these factors be variables, based, perhaps, upon the size of the document being processed? And how about the limitation of 750 characters for the length of a sentence? (Set, primarily, because of core limitations.) Are we, perhaps, losing portions of sentences which have the most informational value? Or, to eliminate long and unwieldy sentences, should we reduce the acceptable size?

In an attempt to answer these and other pertinent questions, abstracts developed by the LITE system are now being compared against the original documents and, when possible, against conventional abstracts. Comparative tests are being conducted by attorneys, subject matter area research staffs, and, in some instances, by the author of the original document. More test data, covering a wide range of legal and regulatory material, will be developed and subjected to similar review and evaluation. We know that this analysis will result in changes to our original theories, and the related computer applications and processing techniques. We hope that the studies will, in time, enable us to reach our goal—a definitely affirmative answer to the question: "Can a computer be programmed to analyze an entire body of text and produce an abstract which clearly and explicitly sets forth the main points of the article?" We believe that it can, and that our efforts to date have been in the right direction.

> Any technique for auto-abstracting will, ultimately, succeed or fail according as the author of the document being abstracted succeeds or fails in expressing his thoughts clearly in the document. One cannot put more into an auto-abstract than the author of the document provides. This dependence may actually turn out to be an advantage, for auto-abstracts will reveal the poverty or richness of a document without either disguise or embellishment; whereas conventional abstracts sometimes make a document appear more valuable than it really is and are liable to subconscious biases and misunderstanding on the part of the human abstracter. One may hope that when, inevitably, auto-abstracting becomes widely used, it will tend to induce authors to set forth more clearly and explicitly the main points of their article.[4] ■

[4] *Research in the Field of Automatic Analysis, Auto-Indexing and Auto-Abstracting,* Planning Research Corporation Report 126, p. 51 (Defense Documentation Center, 1959).

Micromation Technology

a practical solution to information management

Stromberg-Carlson introduces an important advance—by cutting turn-around time and lowering the cost of turning computer data into readable language!

Would you like to turn a reel of magnetic tape into its equivalent in readable language — at computer speeds of 90,000 cps — and for a fraction of what you now pay? That's Micromation, a new approach to the two big problems in information management — high cost and slow turn-around. Now, for the first time, your computer is released from the 600-1200 line print rate of peripheral mechanical translators — free to go at its own pace!

Stromberg-Carlson now introduces an entire family of compatible equipment that turns computer output into readable text at electronic speeds and makes it readily available to anyone who uses it. The full Micromation system offers everything needed to convert digital data to S-C's own computerized microfilm — or paper — and display it on low-cost inquiry stations. No costly communications installations needed, either. Investigate Micromation — see if it doesn't let you break through to substantial savings.

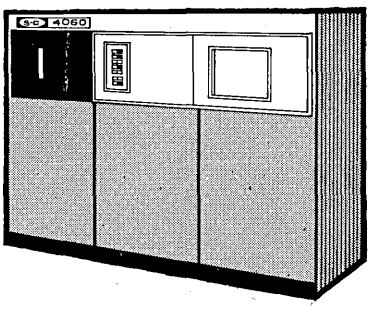
For more information about S-C Micromation Systems write to Dept. D-111 at the address below

Stromberg-Carlson

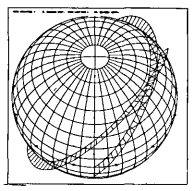
A SUBSIDIARY OF GENERAL DYNAMICS CORPORATION

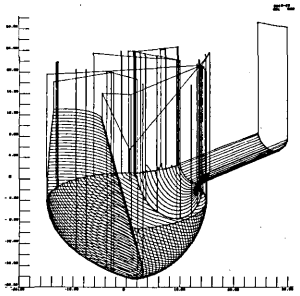
Data Products Division, P.O. Box 2449, San Diego, California 92112

S-C 4060 Micromation Plotter-Printer for precise scientific and engineering graphics

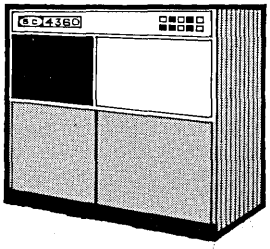


Instantly translates computer codes to line graphics or alphanumerics and records results on film or optional paper copy. Works on-line with newest computers or from multiple tape transports, accepts input from ASR 33, punch-card, paper tape. SCORES II (S-C output recording subroutines) software support package generates computer graphics. 4 sizes of alphanumerics permit the production of highest quality reports and publications. Offers ultra-high resolution plotting of points, vectors, characters, curves, diagrams representing Boolean equations, global maps, PERT — even frames for animated films. Presents data in visual form on optional display monitor. Typical System, leasing monthly at **$8,085***



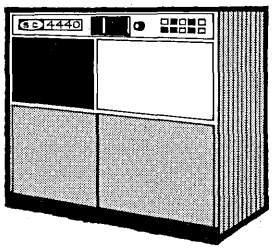


A whole family of Micromation Recorders for every business need



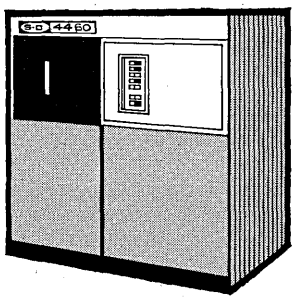
S-C 4360 Recorder

Translates data from computer or tape to readable text at rates of 30,000 characters per second, produces microfilm at rates of 20,000 pages in 8 hours. Typical System, leasing monthly at **$1,950***



S-C 4440 Recorder

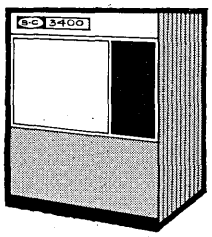
Translates computer or tape data at 90,000 character print rate, microfilms at rate of 70,000 pages in 8 hours. Can generate multiple business forms; simultaneously codes film for fast retrieval. Typical System, leasing monthly at **$3,950***



S-C 4460 Recorder

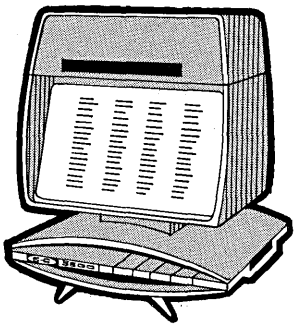
Translates from computer or tape at 90,000 characters per second and microfilms 70,000 pages in 8 hours. 96 character matrix, 4 type sizes, variable spacing. Can plot business graphics like charts, PERT. Typical System, leasing monthly at **$5,000***

Micromation Printers designed specifically for Micromation systems



S-C 3400 Production Hard Copy Printer

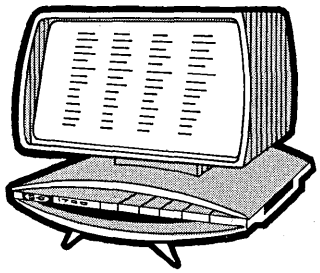
Produces paper copies of master-copy quality from roll film at the rate of one 11″ × 14″ page per second.



S-C 3500 Demand Printer-Reader

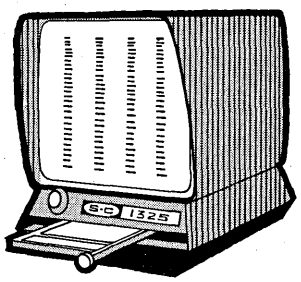
Presents computer data in full page format and produces a clear, sharp paper copy on demand. Desk-top size, handsome executive styling.

Inquiry Stations Micromation-designed for fast access to data



S-C 1700 Executive Inquiry Station

Offers 3 interchangeable display screens of different sizes. Displays page or record format up to 11″ × 14″ size. Executive design, speedy access.

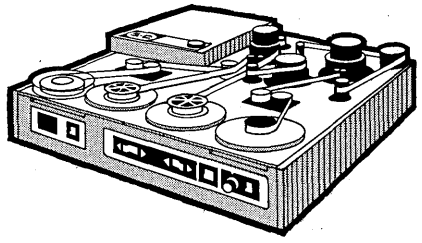


S-C 1325 Microfiche Inquiry Station

Displays any one of the 72 texts recorded on a 4″ × 6″ microfiche on a 11″ × 14″ viewing screen. x-y selection gives fast access to any record.

Kalvar Dry Process Duplication Equipment and Film

—for roll film or microfiche
—are an integral part of S-C Micromation systems.



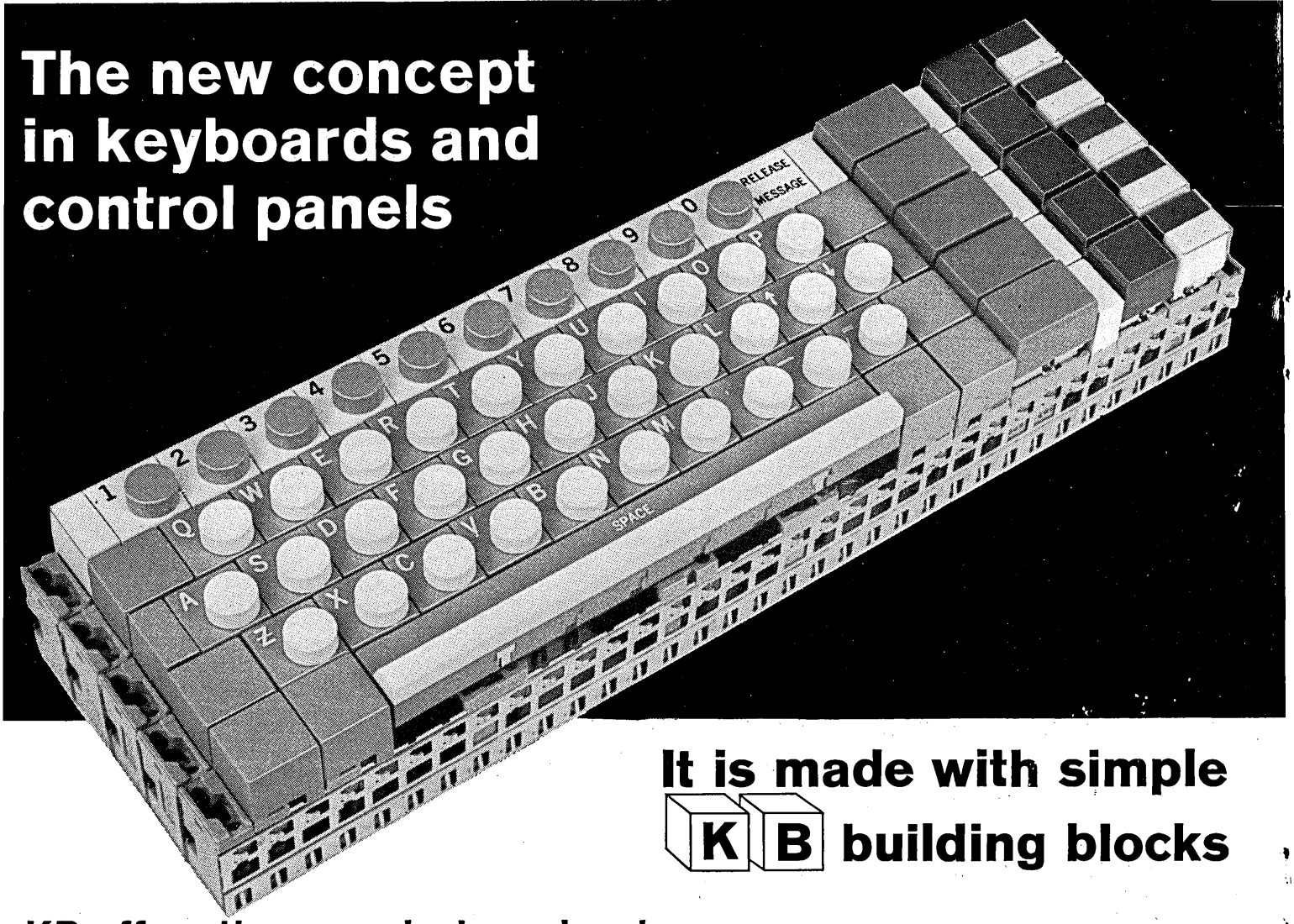
Keynote Option for Business Micromation Recorders:

Microfiche Camera: Permits automatic generation of titled microfiche at high speeds, without stripping. Produces 4″ × 6″ 72-image fiche at rate of 5 fiche per minute.

**Lease rates shown include certain optional features*

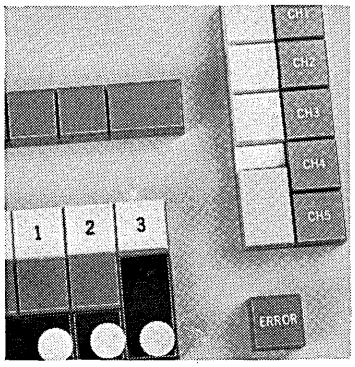
CIRCLE 29 ON READER CARD

The new concept in keyboards and control panels



It is made with simple KB building blocks

KB offers these exclusive advantages:

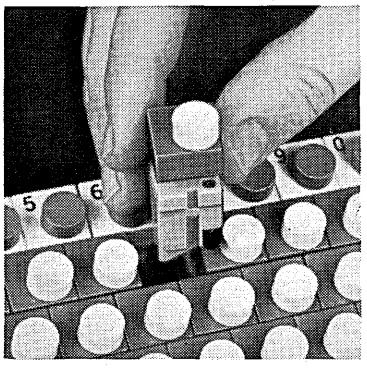


KB allows new freedom of arrangement. Modular construction makes it easy to customize your panels—economical, too.

Switches and indicators available in a wide variety of colors, shapes, sizes. Arrange in vertical columns, horizontal rows, compact rectangles, or individually—all, in a single cutout.

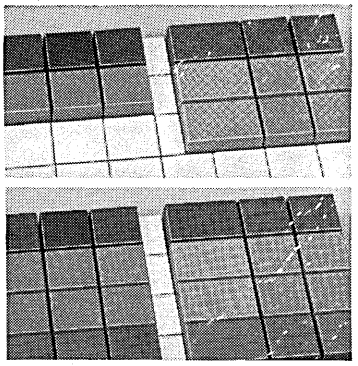
KB allows bench assembly. Assemble a complete keyboard matrix at the bench where the job is easier, faster. Even the wiring is done before the matrix is set into the console.

And only one panel cutout is required because KB forms its own self-supporting matrix—no additional support required.



KB provides plug-in modularity. With KB plug-in switches, simply loosen two screws, lift out the unit and plug-in a replacement—all from the front of the panel.

Store a reserve unit right in the board—or "borrow" one that is not as urgently needed elsewhere on the panel. Downtime is practically eliminated.



KB simplifies expansion. KB modular construction makes planned or unplanned expansion easy, economical. In many cases, you simply remove spacers and plug-in additional switch or indicator modules to up-date your panel. No additional cut-outs, no wiring, no soldering, no behind-the-panel work required.

What is KB? The KB system provides all the components necessary for a complete, self-supporting matrix, including: Power Switches and Indicators with lighted display, Encoding Switches with up to eight output bits, Mechanical Interlock Modules for a variety of sequential functions, and a unique Modular Framework System.

Find out what KB can save you in engineering time, tooling costs, assembly costs, panel space and weight—and how KB can put more sales appeal into your panels.

For a KB demonstration, call a MICRO SWITCH Branch Office (see Yellow Pages). Or, write for literature.

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CIRCLE 30 ON READER CARD

EDP CONFERENCE FOR RETAILERS

Although a portly merchant at the 8th Annual EDP Conference for Retailers said to his neighbor during a conversion session "I've been selling softwear for thirty years but this guy must be talking about something else," there was considerable evidence during the four-day conference that retailers have a strong and active interest in using computers.

Over 300 retailers and people with things to sell—notably IBM, Honeywell, and NCR—attended the conference in New Orleans the week of Sept. 18, sponsored by the Electronics Committee of the Retail Research Institute, National Retail Merchants Association.

Smoothly and firmly run by Electronics Committee chairman Peter Gundell and the NRMA's Ethel Langtry (who would appear in the halls suddenly to scold attendees who dawdled on the way to meetings), the conference was tightly scheduled with general sessions daily, luncheon speakers, panel discussions, a visit to a user, a trip up the river, and the dreaded concurrent workshops. But no equipment exhibits. Or almost none. A new communications unit from Digitronics appeared as a sidelight at one meeting and there was rumored to be a 1050 on line to Higbee's department store – somewhere on the seventh floor of the Royal Orleans Hotel. When asked if this might violate the conference equipment ban, an IBM man said that even if there was something to the rumor, "there aren't any *sessions* on the seventh floor."

Accelerating progress in applying computer techniques to retailing was mentioned by the keynote speaker, Honeywell's Walter Finke. He noted that examination of the conference program revealed a much larger collection of complex acronyms in use than at previous conferences—strong testimony to the retailers' growing sophistication. Finke talked about some fears related to the computer that he said have proved groundless, such as automation creating unemployment, noted the new importance of communications, and registered his doubts about the feasibility of information utilities "where everything is on line to everything else."

He then discussed the changes in habits, customs, and social patterns being brought about, in part, by the widening influence of the computer. He noted that this was a problem of special interest to this convention because of the retailers' concern for good relations with their vast number of customers. (An example of the legitimacy of this concern, brought out in later informal discussion: one big store has customers who may run up bills of $100,000 and pay them only at the end of the year. A few ill-advised, computer-generated dunning notices to these affluent folks and they would take their business elsewhere.) Finke concluded with a prediction that the '70's would be a golden age for the computer world and praised the merchants as supporters of free choice and the individual.

The first morning's sessions covered accounts payable automation, internal organization of the edp function, credit and collection, and communications in retailing.

The credit and collection discussion was led by Wallis Hocker of J. C. Penney, who raised a complaint often heard in other corners of the business world: the operating managers have been losing control to the technicians. This trend, he said firmly, will be reversed.

Credit and collection, apparently, remains a nagging problem for department store managers—with or without computers. There is little agreement about how to set credit limits, prevent overbuying, or handle dunning. One store starts out new customers with fairly low credit limits, keeps raising them every month by an amount equivalent to two monthly payments as long as the money comes in promptly. Another store builds up a "customer image" according to the credit applicant's income, neighborhood, number of children, nature of jobs, etc., then bases sales promotion on this to encourage the good guys to buy, buy, buy. As for the bad guys: Penney's has about 150 form letters on tape for them, presumably ranging in subtle gradations from chuckling affection to outright threats. One area of agreement among credit men is that there is no correlation between size of income and a good payment record.

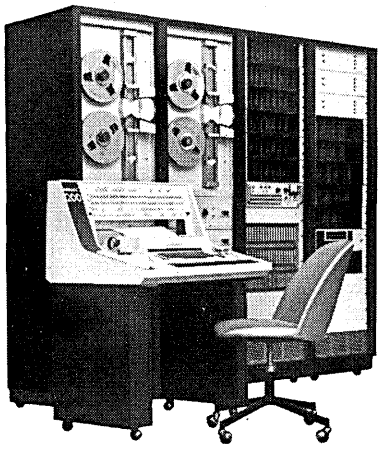
Afternoon sessions included a progress report on merchandise classification standardization, a thorny problem since everything women wear, for example, comes in an incredible variety of sizes, styles, colors and patterns—and all these parameters are constantly changing. (The NRMA will publish their standards scheme by January, 1967.)

An exceptionally good session that drew one of the biggest groups at the convention was given by Samuel Harvey of the Singer Co. on his company's approach to on-line data collection. Harvey was in on the earliest attempts to fit computing machinery into the special world of retail trade, back in the dark ages of the early 1950's. He reminded the audience that most of the things they are planning for the future were done, on a pilot project basis, some 10 years ago. At that time, the Associated Merchandizing Committee—composed of department store people and representatives of manufacturers selling such machines as the Datatron 205, IBM 650, and Univac File Computer—spent a lot of time analyzing the needs of retailers and trying to adapt them to the new technology.

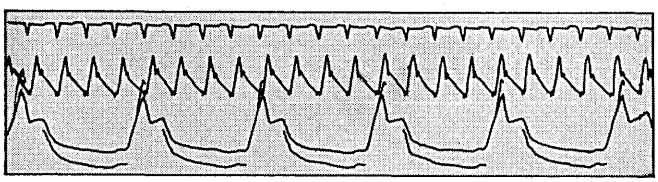
Their work helped lead to the installation of the BIZMAC at Higbee's in Cleveland. It had error-control checks, credit look-up, and on-line cash registers. What's more, it was installed, programmed, and operative. But in November of 1958 a detailed cost study from AMC estimated that the pay-off period for this sort of complete system would be seven to ten years. Back to the breadboards. From this time on, most stores going into edp at all started gently with backroom operations, such as accounts receivable.

The Singer Co. is now all out for edp, with the unusual impetus of a vice president who said, shortly after joining the company, that the whole U.S. operation should be tied together with a computer/communications

AMBILOG 200 the only computer designed especially for signal processing



Using the best of both analog and digital techniques, the AMBILOG™ 200 Stored Program Signal Processor is designed from the ground up to handle the "floods of data" generated in test and research programs. Although such programs cover many fields — biomedical monitoring, geophysical research, test stand instrumentation, automatic weapons checkout, speech analysis — all require complex *signal processing:* multiple input acquisition and output distribution, monitoring, editing, arithmetic, analysis, recording and display. Because of its high processing speed and extensive input/output for both analog *and* digital data, AMBILOG 200 is ideally suited for such tasks. Here are some examples.



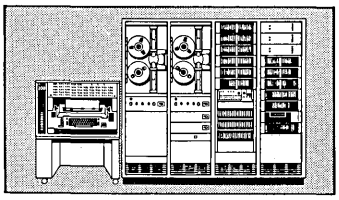
Real Time Waveform Measurement

Peak values, axis crossings, ratios of successive differences, and other characteristics of analog signals are measured in real time. Incoming signals are monitored for events of interest, using complex programmed detection criteria. In a typical biomedical application, the result is a 100-to-1 reduction in the bulk of magnetic tape output records.

$$A(n,w)=\int_0^T W(t)F(n,t)\cos(wt)dt$$
$$B(n,w)=\int_0^T W(t)F(n,t)\sin(wt)dt$$

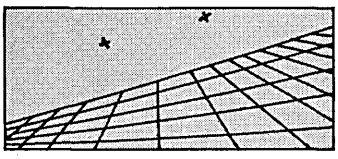
Spectrum Analysis

Parallel hybrid multiplication and summing, 2 microsecond 30-bit digital storage, and a flexible instruction format providing efficient list processing combine to make the AMBILOG 200 powerful in statistical signal analysis techniques such as Fourier transformation, auto and cross correlation, power spectrum density analysis, and generation of histograms of amplitude spectra.



Digitizing and Recording

Multiple inputs, from up to several hundred sources, are routed through a multiplexer switch array under stored program control. At no penalty in sampling rates over conventional systems, the AMBILOG 200 converts incoming data to engineering units for recording or monitoring. An analog-to-digital converter performs a complete 15-bit conversion in 4 microseconds for digital storage, recording or outputing.



Display Generation

Multiple analog outputs facilitate close man-machine relationships in systems involving visual displays. Points of an image stored in memory are rotated through three space angles and projected on a CRT at a 50 Kc rate. Co-ordinate transformation is accomplished simultaneously with digital-to-analog conversion.

For technical reports describing in detail these and similar AMBILOG 200 applications, write I. R. Schwartz, Vice President.

Adage INC

1079 Commonwealth Avenue, Boston, Massachusetts 02215

CIRCLE 34 ON READER CARD

network. Singer has 2000 stores in the U.S. and they now sell other products besides sewing machines – such as sound equipment—that Singer makes.

The system they conceived, to be phased in over a few years, was designed to fit the special needs of their widely scattered stores. It began with 1004's sending data to four regional processing centers; these centers have now been centralized at the Long Island facility. Airmail has been used to return the output. Standard communications, Harvey noted, are far too expensive for on-line operation with the chain's remote locations, mainly because of the cost of so many datasets. But Digitronics may have come to the rescue with a new product, a low-cost store-and-forward system. The units make use of special magnetic tape recorders that put big bits on the tape, send them acoustically at 35 cps over ordinary telephones. Four stores are now using the equipment and results are promising. The stage coming up for Singer is on-line inventory control, with the central computer dialing all the stores automatically at night. With several stores reporting in at once, Harvey says the whole operation can be completed in five hours per night.

Monday afternoon workshops included presentations by IBM and Monroe Sweda as well as one called Customer Preference Clinics, which proved to have little to do with edp.

The general session next morning featured Richard Canning on the third-generation computer. (Question from the floor: We don't have a *first*-generation computer yet. How do you convert from cards to the third-generation? Answer: You're better off, because you'll be going to a small machine that's likely to work.)

Going from second- to third-generation machines, Canning said, is a bigger step than from cards to computer. And he shook up the edp manufacturers' representatives a bit by suggesting that the retailers might be wise not to rush out and get equipment now. Instead, he said, they could get going on planning but wait until '68-'69 for the machines, when both hardware and software should be debugged.

Canning warned that emulation is only a stopgap. Translation is better, with Honeywell offering the efficient Liberator and Burroughs supplying good programs. But by waiting, he said, users might be getting far better software in the form of generalized programming systems.

In a further mention of software, he cited the Burroughs B 5500 operating system as being the best available and the Honeywell H-800 as another good one. (Burroughs, however, has been dormant in retailing and none of their representatives could be found at the conference to hear the good news.)

Canning disagreed mildly with Finke, putting in a good word for computer utilities. In response to a question about this, he said that a visit to Keydata had shown him business application programs that a small merchant could put into use "in a few weeks." He guessed that such services might account for 50% of all computing by 1975.

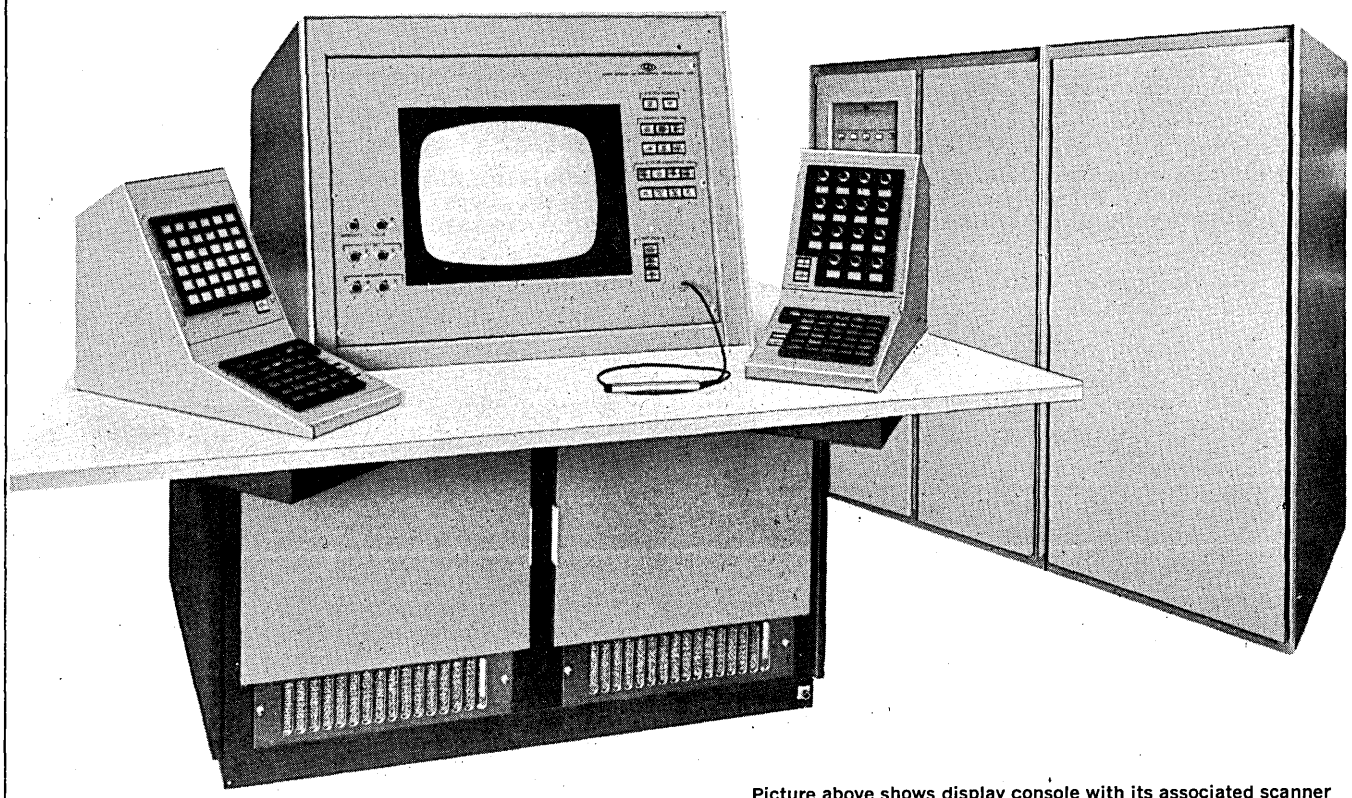
During the rest of the morning. there were sessions on exception reporting, the use of mathematical techniques to solve retail problems, and a 360 users' workshop. Another workshop was titled What Merchants Expect From a Computer but, considering the problems described by some of the panelists, might better have been called What Merchants Are Getting From the Computer, Whether They Want It or Not. In some cases, they seem to be getting a collection of numbers in the form of reports and accepting them resignedly because those "are the main reports we get from our IBM."

This attitude prompted a question from the floor: But where are you heading and what do you *want* from the computer? Answer: We want the buyers to get interested in the reports but they have to be "translated from IBM to English." (This was the only session attended, though, where computers were equated with IBM.)

A question to another panelist brought out some good words for IBM's IMPACT program (see August DATAMATION, p. 28). This store applied the method to their most profitable department and increased profits further. They also found it effective in detecting the slow sellers fast and stopping further orders to the manufacturers.

During lunch, William H. Borghasani, Jr., who serves as the NRMA's special counsel on communications, summarized the present state of affairs in that area. Since the Aug. 22 FCC decision allowing cost-sharing of private microwave facilities, the next project is to win approval from the FCC to share Telpak facilities.

Afternoon sessions included discussions of the advantages of controlling merchandise beginning with the stock level, vendor pre-marking, input systems requirements, and the function of service bureaus in retailing. Honey-



Picture above shows display console with its associated scanner and control cabinets.
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CIRCLE 36 ON READER CARD

well, NCR, Kimball, and the Service Bureau had workshops, with Honeywell pushing their CRT display as a useful and convenient replacement for volumes of reports and for credit checks.

Next morning's general session was another reminder that computer-based credit transfer is coming along. The generalized example given, by William Power of Retail Services and Richard Sprague of Touche, Ross, Bailey & Smart, using slides and a Chet-and-David format, stressed the fact that the technology is ready and the technicians eager to usher us into the checkless society.

Discussion sessions that followed in the morning dealt further with credit and reporting. There was a session on personnel and recruiting, and Fitzroy Kennedy of Rohm-Wheatley, Inc., talked about remote input/output devices and communications. He reminded the audience that it's a good idea to remember the telephone and the mail service before getting involved in other kinds of communications. The fancier ones are needed only when the time cycle is short, costs can be reduced, or time-saving leads to money-saving.

Kennedy noted that complaints are heard about all types of terminals: too expensive, not flexible enough, inadequate software. There has been talk, he said, of development work going on at AT&T leading to a really cheap recording device. And a question about communications is now often asked, in a tone approaching seriousness: When does it pay to have your own satellite?

Among the equipment workshops in the afternoon, Ohrtronics presented details of a new product called System 80 to produce punched tags for attaching to merchandise. It's a different approach than that of Kimball and Dennison, in that it uses a papertape format. The company is working on adapting the equipment for direct input; it now requires papertape punch and reader as an intermediate step.

A trip across the river had been arranged for after the sessions that day, to see UniTote in action at the new D. H. Holmes store. Resisting the temptation of a conflicting cocktail party hastily arranged by Kimball, a full busload of delegates took the tour. This equipment, made by American Totalisator division of Universal Controls ("We were putting in on-line systems at racetracks before anyone knew that they were called that"), was pretty much the hit of the show. The Holmes company, which has had considerable experience in computer processing, had installed 45 UniTote on-line registers about two months before. They transmit directly to a mag tape unit in a format compatible with the user's computer; the reel is then transferred manually to the processing system. Virtues cited by Holmes people: salespeople like them, don't want ever to go back to writing up saleschecks by hand; customer service is improved because any clerk can use any machine, so the buyer of a pair of socks doesn't have to find another salesman if he wants a tie; they're easier to use and take less training than some of the giant new cash registers. Drawback: they're not easy to move around the store—lots of wiring involved.

Thursday's general session offered descriptions of operating systems by representatives of IBM, Honeywell, and NCR. (Another new word made its appearance at this session. What used to be called housekeeping, red tape, and overhead time now has yet another label: "machinehood." Machinehood, it turns out, covers all those things a computer must do "because it's a computer.") Both Honeywell and NCR now offer three levels of operating systems, with the highest allowing multi-programming, compared to IBM's four. IBM estimates that the present cost ratio of people to machinery is 50/50, but that this will go to 79% for people by 1970; hence the necessity of efficient operating systems.

The last day's workshops included sessions on remote billing, automation of high-fashion stocks, auditing requirements, and a description by Frank Buescher of D. H. Holmes' past, present and future use of edp. There was more praise for UniTote and for IBM's IMPACT. Holmes likes to experiment (besides a tape 1401 they have a high speed Anelex printer, some MICR input, as well as UniTotes) and has done so with IMPACT. First they tried it on a very successful department where they knew of nothing wrong. A year later they found that sales were up 5%, inventory down 7%, and turnover up 14%. Then they used the system with a real dog of a department—found sales went up 8% and inventory down 20%. Conclusion: "It's hard to get going but it works."

DATAMATION's conclusions on the conference: retailers are a great bunch; New Orleans conferences shouldn't be scheduled in the summer; and stay away from Bourbon Street.

—WILLIAM ROLPH

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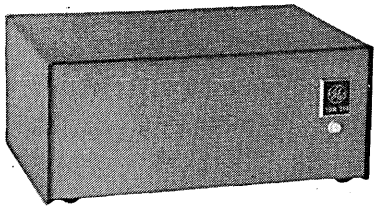

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472-02

GENERAL ELECTRIC

CIRCLE 38 ON READER CARD

guidelines get graded down

THE PATENT OFFICE EXAMINES SOFTWARE

The U.S. Patent Office spent most of October 4 collecting answers to the question, "Are computer programs patentable?" So many answers were volunteered that it will probably be awhile, if ever, before program patents are granted. Besides the patent office, a number of other agencies may help shape the outcome —notably the Dept. of Justice and the U.S. Congress in the person of Rep. Jack Brooks. Most of the discussion at the Oct. 4 meeting concerned a set of guidelines issued by the patent office last August; they propose one basis for determining the patentability of computer programs.

These guidelines, when issued, seemed like a good way of resolving a sometimes-acrimonious debate that has been droning on for at least 10 years. Things didn't work out according to plan, though. While there was no dearth of industry response on Oct. 4, it was all negative. As E. R. Reynolds, assistant commissioner of patents, suggested, the critics—instead of knocking the guidelines—might have employed their time more profitably by proposing an acceptable alternative. (Bell Telephone Labs and a few of the others did so, in written comments filed afterward).

Because of the industry's unconstructive criticism, the patent office is probably no nearer a usable policy now than it was last August. The resulting void creates problems for program developers as well as the government.

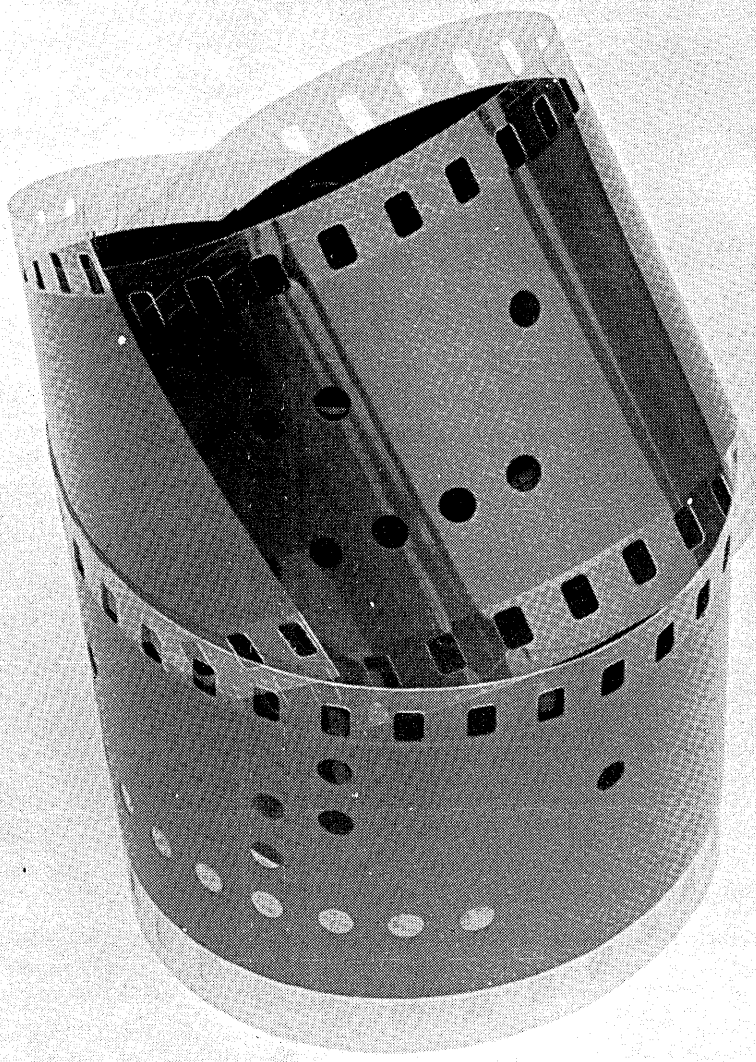
One of the speakers at the Oct. 4 meeting, Carl Richards, a Dallas patent attorney, reported that two recent patent applications covering computer programs were denied at least partly on the grounds that they did not meet the standards in the proposed guidelines. In other words, even though the guidelines have not been formally adopted, they are apparently being used to support patent decisions.

The discussion at the October conclave revolved primarily around the question of whether computer programs deal with "mathematical" or "functional" entities. This is important because under present patent law, a functional process is patentable, but a mathematical process isn't.

The guidelines, which deserve a prize for murky syntax, seem to say that a program as usually written is an algorithm—i.e., a mathematical process—and hence unpatentable. But they go on to say that if the individual steps are described in functional terms—as changes "in the state of certain electrical or mechanical devices within the computer"—the program would be eligible for patent consideration.

Henry L. Hanson, patent counsel for Honeywell's computer group, and a foe of program patents, pointed out one trouble with this distinction: ". . . each and every program (written in algorithm terms) may be thrown into the patent arena by a semantic exercise on the part of a claim draftsman" simply by rewriting the algorithm in functional terms. Norman Zachary, director of Harvard's computation center and chairman of an ACM committee studying the patent problem, added that it would be easy to get around a functional patent by preparing a different set of machine steps based on the same algorithm.

Other speakers insisted that although written program instructions



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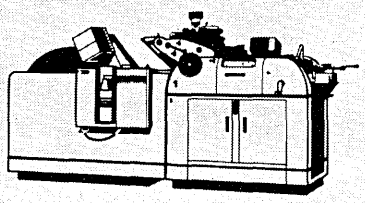

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may be distinct from the changes they produce in circuits, and/or gates, and other logic design components, there is a direct correlation between the former and the latter. Also, describing a program in algorithm terms is the generally-accepted, generally-understood method. Therefore, the patent office should be willing to base the patent on the algorithm rather than the logic design.

As attorney Morton Jacobs put it: "The logic design of a computer is clearly patentable . . . Logic design and program techniques are but two sides of the same coin . . . Thus, a program . . . should be patentable."

A good deal is at stake here besides semantic precision. Says one program developer: "A patent covering an algorithm program would be far more valuable to the owner than one written in functional steps. The latter is considerably more restrictive, in terms of applications and hardware, than the former. And if anyone wanted to program the same job without paying a royalty, he could devise different machine steps much more easily than he could devise a different algorithm."

This interpretation helps to explain why all the software users at the meeting were against the guidelines but in favor of patents. Equipment manufacturers, on the other hand, were against both.

BEMA's John Farley worried that if patents were granted, examiners might give less weight to computers as "prior art." He added that computer manufacturers who now indemnify the user against patent infringement suits would reconsider their position. Perhaps the most concise statement of the manufacturer's position came from Honeywell's Henry Hanson.

He argued that a computer program can't be new, in the sense meant by the patent statute, because the corresponding logic design is "contemplated fully in the design of the computer . . . In evaluating a computer program . . . it should be kept in mind that the hardware . . . at any particular instant . . . will be under the control of a program instruction which will . . . establish pre-determined . . . circuit paths. At that particular instant, the paths . . . established are (those) fully contemplated by the designer of the equipment."

If the program designer and equipment designer always worked for the same company, Hanson's argument probably would be less important. But Honeywell, like most other computer makers, frequently develops programs cooperatively with customers. Patents might upset this happy relationship by leading to crass arguments over ownership rights.

One striking feature of the Oct. 4th meeting was the relative absence of spokesmen for software houses. The head of a Washington software firm, interviewed several days after the meeting, says he isn't interested in patents because "the programs we develop change too quickly. By the time a patent on a particular program was granted, we'd be using an updated version. The new program, of course, couldn't be protected until another claim was submitted and granted."

Some software houses favor patent protection, he adds, but mainly because "it gives recognition to the programmers who do the work, and improves the company's image, not because of the property rights involved." Others, who produce relatively long-lived programs on contract, *are* interested in property rights; but they, like the equipment manufacturers, "have to worry about customer relations."

Copyright isn't much more useful than patent protection, he adds, because "copyright doesn't prevent someone from developing an identical program independently."

There is at least a suggestion in these remarks that the revised patent office guidelines, if and when published, may not be much better than the present system. Now, many programs are plagiarized; the remainder are protected through contractual agreements between developer and user.

Revised guidelines probably won't appear before next year. The patent office is accepting written statements through the middle of November, and may extend the deadline; it will take another few months, at least, to evaluate the arguments presented. Undoubtedly, there will be consultation with the Justice Department, which is looking on from afar to guard against possible anti-trust violations.

Opponents of patents have Congressman Jack Brooks in their corner, and his support could be decisive. Brooks is a senior member of the House Judiciary Committee, which is responsible for patent legislation. He already has obtained assurance from Assistant Secretary of Commerce J. Herbert Holloman that any guidelines, before being officially adopted, will be reviewed by the department's front office. Brooks is to be kept informed of the review.

—PHIL HIRSCH

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PRICE CHANGES, MOSTLY UP, SPREADING FAST

IBM announced price changes at the end of September and was quickly emulated by many of the other manufacturers.

The IBM adjustments are an increase of about 3% in rental and a decrease of the same amount for purchase. They apply, however, only to most of the System/360 line; unit record, 1400 and 7000 series equipment are not affected, and some peripherals are also excluded. Rental price changes are effective Jan. 1, 1967, while the reduced purchase price applies to transactions on or after Sept. 19, 1966.

The IBM announcement was followed within a week by one from Honeywell. They are raising both lease and purchase prices by amounts from 2% to 4% on the 200 series machines Dec. 15. But the changes won't apply to present customers until existing leases expire.

Burroughs didn't follow along and Control Data's James Miles pointed out that CDC was "the first in the industry to raise prices. It's interesting to see how others are doing the same. But we don't feel that any future moves on our part are necessary."

In the middle of October, Scientific Data Systems chimed in with announcement of price increases for the new Sigma series—to be ready for first deliveries in December. Both purchase and lease costs will be up from 3% to 5% for typical configurations of the Sigma 7. For the Sigma 2, the lease rate will go up about 5% but purchase price will stay the same. The increases will be effective on orders received after Dec. 15.

GE was next—with yet another variation. They are raising rental rates 4% and leaving purchase prices alone on the 400 and 600 series. The changes, effective Oct. 24, don't apply to existing lease agreements. And NCR will increase rental rates by about 5% on the 500 series Oct. 31, leaving purchase price the same.

Univac then announced that they wouldn't make any changes. But RCA, latest to be heard from, has set up a pricing schedule on the Spectra 70 similar to IBM's. They're increasing rent 3% on the 35, 45, and 55 models but reducing purchase prices 3% to 5%. For the 15 and 25, however, rent stays the same while purchase price goes down—a 5% cut for the 15 and 3% for the 25. An exception to all this: RCA will keep the old rates for three and five year leases. The rental rate changes are effective Feb. 1, 1967, and the purchase price changes Nov. 1, 1966.

Trying to assess the effects of this mixture of price juggling this early doesn't seem very promising. The general view is that it won't have much effect, considering the added complication of the tax credit suspension which, in most cases, amounts to more dollars than the purchase price reductions. Likely beneficiaries, however, are the large leasing firms—the ones who have substantial capital or can get it at rates that are considered reasonable in today's money market. Those dealing in IBM equipment, for example, can buy it for 3% less and their potential customers, faced with higher rents from the manufacturer, will be especially interested in saving through the leasers. One such firm estimates that the situation—and *their* slightly increased rates—will lead to a 5% increase in earnings over their estimates for next year.

AIR FORCE/AEROSPACE WORKSHOP ON SPACEBORNE COMPUTER SOFTWARE PLANS

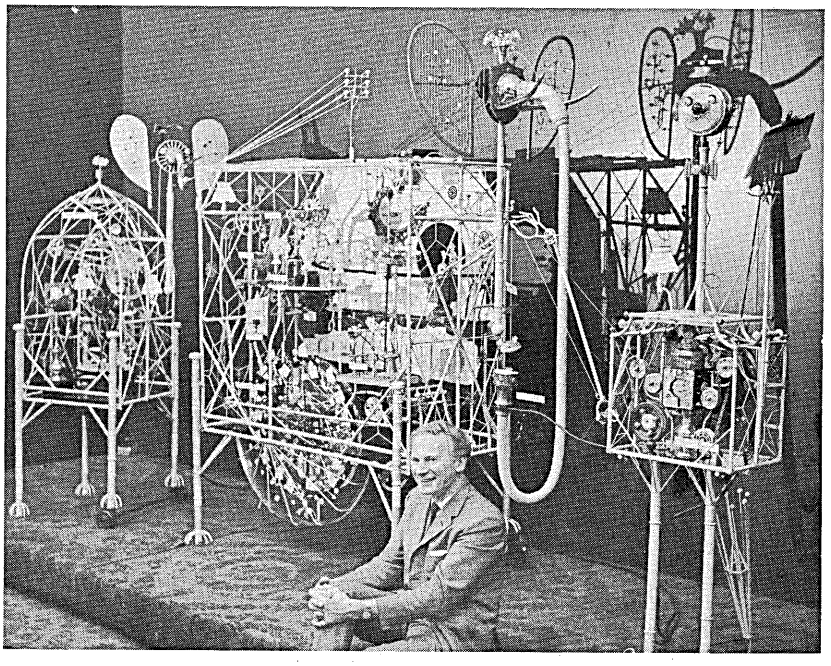
Between 150 and 200 spaceborne-computer software specialists got together recently to discuss common problems and probe for solutions at a workshop co-sponsored by the Air Force's Space Systems Division and Aerospace Corp.

Triggered by the realization that new spaceborne hardware will offer new opportunities and challenges to software producers, the workshop stemmed from Air Force desires to lower software costs and to shorten lead times.

After papers and lively discussions during five sessions covering three

THE HONEYWELL-EMETT FORGET-ME-NOT COMPUTER

Commissioned by Honeywell and designed by English cartoonist Rowland Emett, the Honeywell-Emett Forget-Me-Not Computer was a big success at the Business Equipment Exposition, McCormick Place, Chicago, in October. Emett explains that "we know there are machines in the world but we try to keep them in their place." Major components include FRED, the Fantastically Rapid Evaluator and Dispenser, a central processor, and a card reader/punch unit, featuring a set of electrified woodpeckers. The system, of course, is solid state. It includes half a brick from an old Scottish home and "nothing," Emett says "could be more solid or stately than that."



days, the workshop participants agreed on several key points of commonality in their work: (1) Most current spaceborne computer software is written in machine language. (2) This has been largely caused by primitive hardware techniques. (3) Spaceborne-computer problems do not differ significantly from the problems of the world of general-purpose information processing. (As one participant put it: "All of their problems are familiar to us . . . we just have them all . . . and in their extremities.") (4) Spaceborne-computer management has similar problems to those of general-purpose data processing, but some problems are aggravated due to the more stringent requirements in the development of spaceborne software.

The topic of a suitable programming language was one of the most hotly debated at the workshop. The consensus seemed to be that a standard common language for spaceborne computers is a timely consideration due to the impending changes in the hardware—both on the ground and in space. Given equal importance was the notion that new processors would have to be able to handle the new language as it evolved in response to changing requirements. An obvious need: a language which can change and grow. There is no consensus yet as to whether the new language should be an extension of a current language, or represent something entirely new.

An analysis of spaceborne computer systems conducted by the System Development Corp., and summarized at the workshop, recommended that a common language be adopted. SDC further recommended that this language be based on an existing POL, which should be based on one of three yet-to-be selected languages: such as JOVIAL, FORTRAN IV *or* PL/I. The recommendation adds that the common language contain extensions to meet spaceborne computer requirements, and that it contain three subsets (problem formulation, support programming, and operational programming).

Proceedings of the workshop are scheduled to be published in November. The L.A. chapter of the IEEE Computer Group will hold a one-day symposium on the same topic late in October. The last stronghold of machine-language coding may be ready to crumble.

MOSCOW TRADE FAIR DRAWS WESTERN MACHINES

U.S. computer sales to Russia are now zero. But observers seem confident that the federal government will lift the trade restriction on some systems since it permitted U.S. computer and peripheral-equipment makers to exhibit at the Moscow business machines fair, "Interorgtechnika 66," in September. Among U.S. computers shown were the Univac 1004, GE (with Bull and Olivetti) 115's, and the Honeywell 200. No third-generation systems were permitted. Peripheral equipment included the Mohawk Data Sciences Data Recorder and the Dura and Friden lines of punched tape equipment. IBM and NCR, which have markets in East Europe, exhibited but not computers.

Although Hungary, East Germany, and Poland showed systems (primarily vacuum tube and transistor), the USSR did not. It was apparent, said B. P. Taylor, export agent for Mohawk Data Sciences, that the USSR intended the show as a means of letting its business and industry personnel examine Western equipment—not as a means of comparing technologies. Russia has good scientific, but not general-purpose, systems and is eager to buy when the U.S. permits, he said. Among applications of interest to Russian personnel at the MDS exhibit were production control and hospital administration.

During the 15-day fair, about 100,000 people a day visited the hundreds of exhibits—mostly office equipment—in the seven halls. Notably, the United Kingdom had one of the largest exhibit areas, with every one of its major computer manufacturers represented. French, Italian, German and Danish computer makers were also on hand.

George Cogar, vice president of MDS, noted that his firm now has potential orders from Russia for its Data Recorders. The market there for such a peripheral unit in 1967 could be 25 a month. An attractive aspect of trade with the USSR for a manufacturer is the fact that no maintenance need be provided. Cogar said that the manufacturer is only required to train Russian personnel in operation and maintenance. You do not even know where the equipment goes, he said, as a central purchasing office negotiates for the units.

U.S. OFFICE OF EDUCATION PLANNING CAI PROJECT

The U.S. Office of Education is preparing to launch a project to determine what modifications will have to be made at all levels of education in order to phase in computer-assisted instruction successfully. No contract for the study has been negotiated yet, according to Dr. Glenn Boerrigter of USOE, but the Bureau of Research will probably start by conferring with teachers, administrators, social psychologists, and others about the implications of CAI. This will help determine the priority areas for funding of research and development, he said. Boerrigter made the announcement at the opening of a CAI center at Florida State Univ., where an IBM 1440 and five typewriter-like terminals have been installed.

Elsewhere, newly renamed Philco-Ford Corp. has developed the $1.3 million CAI system for the School District of Philadelphia. A central Philco 2000 computer will feed the smaller Philco 102 processors at each of four schools. The 102's, which can operate independently, will serve 32 CRT student terminals.

APPLIED LOGIC OFFERS REPORT GENERATION PROGRAM

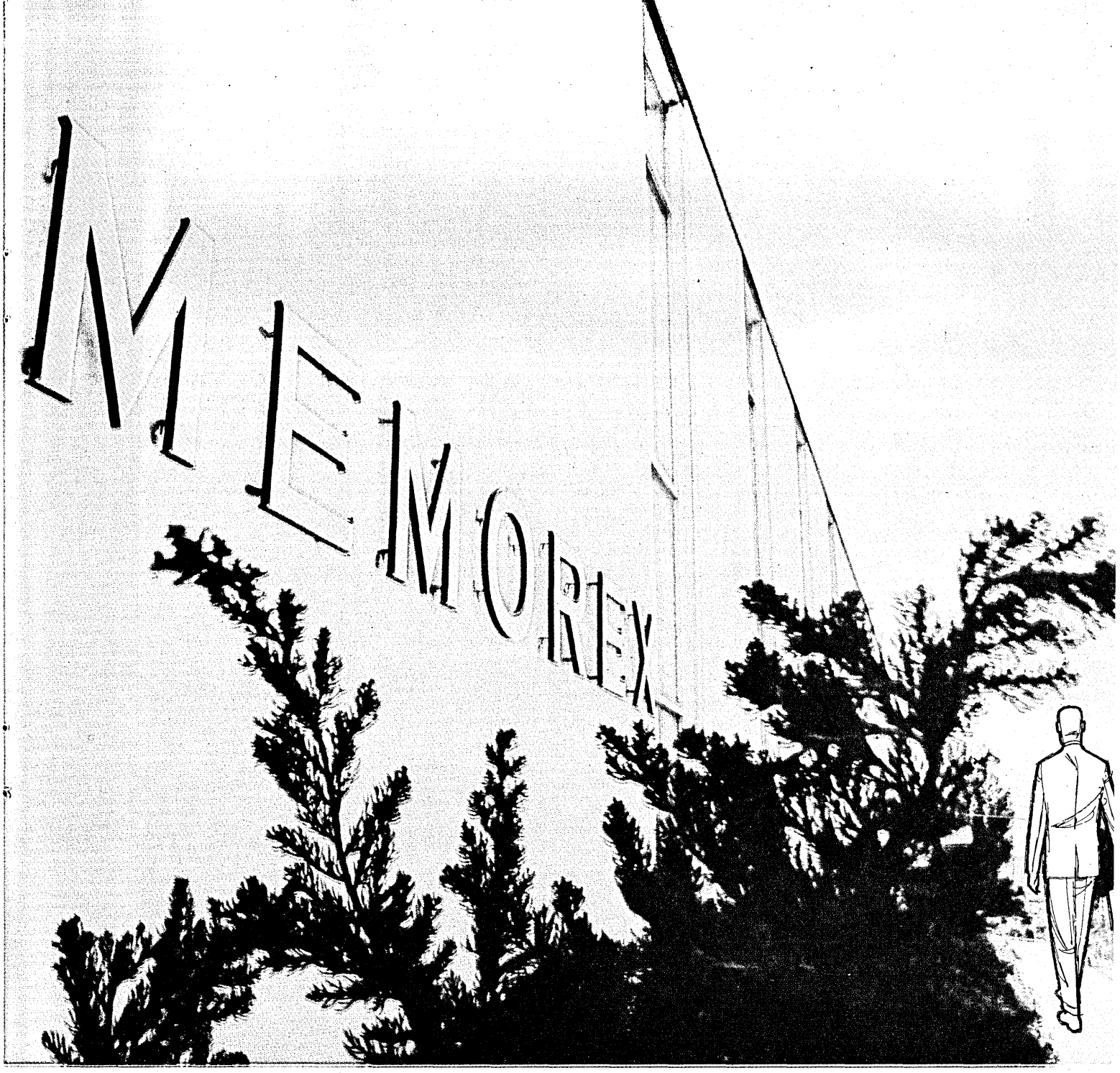
Applied Logic Corp., Princeton, N.J., has developed a new report generating program for use in such areas as market, sales, and opinion research. The program, ALREN, is being offered on the PDP-6 at the ALC center, both on a batch and on-line time-shared basis. ALREN is designed to produce tables based on large amounts (say, several thousand cards) of raw data and is capable of complex manipulations of the input data. Major features of the program are that it: is simple enough to use so that "substantially correct" output is produced on the first run; is modular; has a specification language easily tailored to each user; and has a macro facility (once a related group of instructions has been specified it can be re-used as a unit).

The ALREN compiler is written in the PDP-6's MACRO-6 language. The input language is analogous to a load-and-go compiler; an example of simplicity is that when one wants to percentage a given table in various ways, one writes: PC (percentage) + identification number of table + continuation code + name of table + name of base. Subroutines in a lower level language can be inserted into the program with minor modification.

ACM CHAPTER HEARS FREDKIN ON PATTERN RECOGNITION

Almost any pattern recognition program will work 95% of the time, but the ultimate goal of 100% effectiveness is fairly remote, the Los Angeles Chapter of the ACM was told at its October meeting.

Edward Fredkin, vice president, advanced development, Information International, Inc., said that an ap-



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propriate mix of the various 95%-level methods can be created to achieve 100% recognition.

Fredkin said III's project in pattern recognition used the learning approach where the program is given samples to analyze and then appropriately identified. He claims excellent results for a 10-character alphabet, thus far.

A panel made up of Einar Stefferud, SDC, Dr. Gabriel Groner, RAND, and Mort Bernstein, SDC, asked the speaker for clarification of points contained in his unstructured talk. Initially, they used the batch mode; subsequently, they found that on-line time-shared questioning was more satisfying.

EDS TAKES OVER PEPSICO DATA PROCESSING

Electronic Data Systems, Dallas-based company that handles complete computer operations, has won a long-term, fixed-price contract to do all data processing for Pepsico Corp. and its Pepsi Cola, Sugar, and Manufacturing Divisions. Applications include everything from accounting to market research. Processing will be done at EDS' New York office, which gets the first of its computers, a 360/30, in November. Long-range plans include on-line access to data for Pepsico.

EDS will also develop management information systems for each of the 21 bottling franchises, to be coordinated with the corporate system. Processing will be done at EDS offices in New York, Dallas (which now has five 360/30's) and Detroit, where an office will open in mid-1967.

Significant aspect of the contract is that Pepsico will get rid of its own computers and has canceled those on order.

Similar EDS contracts are held with People's Life Insurance and Weaver Bros. in Washington, D.C., and Blue Cross of Texas.

BEMA SPOKESMAN ESTIMATES FURTHER DELIVERY INCREASE

At the BEMA meeting in Chicago, W. C. Doud of IBM, vice chairman of the data processing group advisory committee on plans and policy—representing chairman F. R. Raach of Univac—summed up current predictions of computer installations and deliveries.

He noted, first, that estimates at last year's meeting called for 8,000 systems to be shipped in 1966, bringing total installations to about 35,000. He quoted trade publications, however, as agreeing that this total was reached by the end of July. At this rate there would be 13,700 shipped during the year instead of the previously estimated 8,000. But the size of the present backlog—some 22,500 units as of July 31—indicates an even greater increase, he said, making it likely that at least 15,000 systems will be installed this year.

Doud also observed that the small-computer market is expanding, representing today 30% or more of the total, while medium and large-scale machines are maintaining their growth rates. And exports should increase by 29% over last year, reaching $315 million.

● Fox Computer Services and Special Studies Inc., New York firms, have formed a jointly owned computer education company, MCE, Inc. (Institute for Management Computer Education). Offerings to management and other dp personnel will be courses at the client's premises, on computer applications and programming IBM System/360.

Another course aimed at System/360 users is one on mathematical programming systems, offered by Bonner & Moore Assoc., Inc., in New York and London. The five-day course centers on the use of MARVEL, a problem-oriented, multi-purpose computer language to be available generally from IBM early next year. The language is said to permit a problem to be stated in an abbreviated form of the vernacular of the business or industry using it.

● The Red Cross Blood Center in Los Angeles, serving Orange and Los Angeles Counties, has developed an inventory control system using data transmission to and from the computer center at Lockheed Missiles and Space Co. in Sunnyvale, Calif. Automatic dial polling of 220 hospitals in the two-county area collects data on changes in the blood supply during the previous 24 hours at each hospital. This information is sent to the computer center, which sends back a listing including every pint of blood available by number, location, group, and type, shows the number of days remaining of the 21-day period when whole blood is fresh enough for use in transfusion.

● System Development Corporation will review and evaluate existing and proposed urban and regional information systems for the U.S. Department of Housing and Urban Development under a nine-month study contract. The

introducing
the balanced computer

EAI 640

Some computers emphasize computational speed. Others, flexibility. Still others, low cost. The new EAI 640 offers all three.

The balanced design of the EAI 640 assures high computer performance – in systems or for general purpose computation – at a price you'll find hard to believe.

Where else can you get all these features for under $30,000?

1. 16-bit data word & memory protect
2. 1.65 microsecond complete memory cycle
3. Hardware multiply, divide and square root
4. 4K core memory—expandable to 32K
5. Teletype keyboard/printer
6. Paper tape reader and punch
7. 4 input/output channels
8. 4 interval timer interfaces

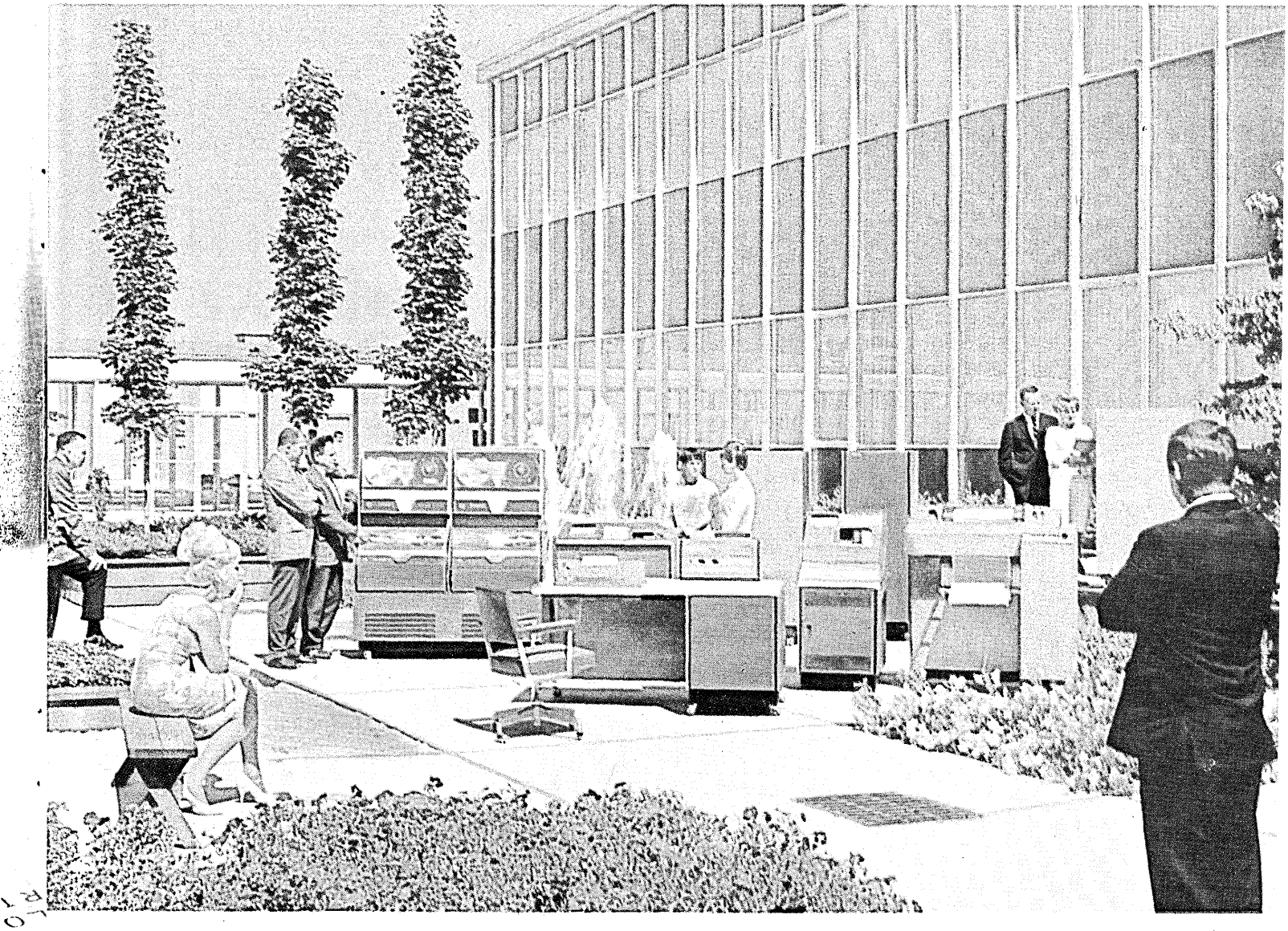
The balanced design of the EAI 640 means more computations per dollar.

The EAI 640 is not only a good, general-purpose digital computer, it can also be easily integrated into hybrid or special-purpose systems because of its extremely flexible I/O structure. Or it can be mated with scientific simulation systems, data acquisition/reduction systems, process control, and biomedical systems. It's a truly versatile computer!

And we've balanced the powerful hardware with all the basic software: assembler, FORTRAN, loader, update and debug packages. We're also offering something unique for a machine in this class—the 640 Operations Interpreter, an on-line interactive language system specifically designed for scientists and engineers.

Full supporting services further balance the total system. They include special systems engineering, customer training, maintenance, and applications assistance with your specific problems.

Write for detailed information on its characteristics. Or better yet, contact your EAI representative. We think you'll find the balance is in your favor.



CIRCLE 44 ON READER CARD

EAI® ELECTRONIC ASSOCIATES, INC.
West Long Branch, New Jersey 07764

news briefs

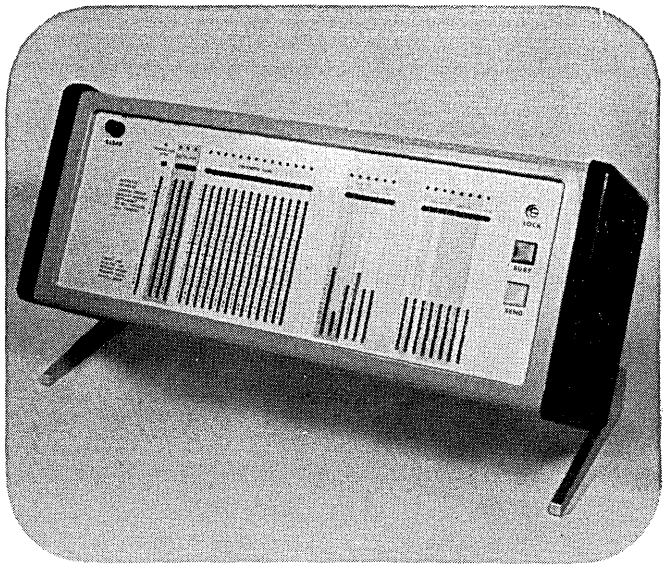
resulting report will recommend standards for federal support and serve as a guide for public agencies setting up such systems. It will also offer recommendations for future design, based on the survey and SDC experience with military and government projects.

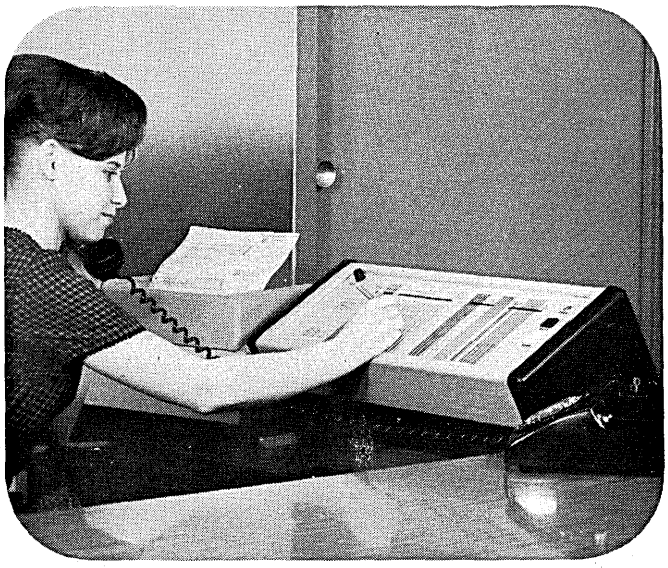
● ITT Worldcom has won FCC approval for a computer-based switching service that will sort, store, and route messages and data between the U.S. and other countries for subscribers to the company's privately leased international circuits. First customer is KLM Royal Dutch Air Lines, using the system to handle reservations and flight information transmission between their U.S. and overseas offices. Rate is one cent per 220-character message. Center of the system, called Automatic Retransmission Exchange, is a dual ADX 7300 computer at Worldcom headquarters in New York City. Like Western Union, the ITT subsidiary has long-range plans for offering computer services through the network.

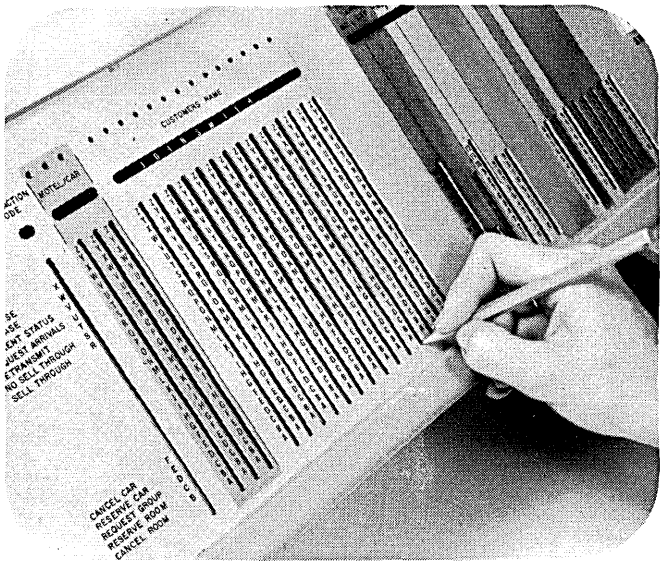
● The fifth annual conference of the Computer Personnel Research Group will be held in Washington, D.C., in late June, 1967. Papers are requested dealing with selection of computer personnel, training, anticipated changes in skills, and management problems. A 300-word summary should be sent by Feb. 1 to Dr. Charles D. Lothridge, General Electric Co., 570 Lexington Ave., New York, N.Y. 10022.

● An International Symposium on Automation of Population Register Systems will be held in Jerusalem, Israel, Sept. 25-28, 1967. Subjects will include system design problems, applications, technical and economic aspects, and derivation of vital statistics, population estimates and other statistical materials. The symposium is being organized by the Information Processing Association of Israel and sponsored by the International Computation Centre and the International Federation for Information Processing. Both edp and population register administrators are asked to submit papers, which should be a length suitable for presentation within a 20-minute period. One-page abstracts should be sent by Dec. 31, final papers by April 30, to International Symposium on Automation of Population Register Systems, Information Processing Association of Israel, P.O. Box 3009, Jerusalem, Israel.

This machine makes INSTANT INFORMATION economical







THE RIXON DATA MESSAGE COMPOSER

This is it—the computer input unit that's playing a major role in revolutionizing the world's travel reservation system . . . providing instant reservations and confirmations for hotels, motels, steamship lines, airlines, rental cars and package tours.

This same compact, low-cost Rixon Data Message Composer could well be *your* answer to transmission of instant information between your remote stations and central computer. For it's very flexible and can be tailored to your specific requirements—among them, inventory, production and documentary control, accounting and order entry.

Operation is simplicity itself. The composer eliminates the complexities of teletypewriter keyboard input units. Information is entered through an almost foolproof vertical dialing system so no typing skill is required. The message can be verified before transmission. All messages are pre-formatted so information can be entered in any sequence. In short, the composer is a human engineered replacement for a keyboard device.

The unit can be used in conjunction with a small printer, as in the lower left hand photo, to provide real time information retrieval. Or it can be used simply as a sending set to input information into a computer. Optional features include paper tape punch adapter, code converter, automatic reset, variable scan length and acoustic coupler link.

Write for specifications today and find out how this input unit can introduce new economy and ease to your computer system!

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CIRCLE 46 ON READER CARD

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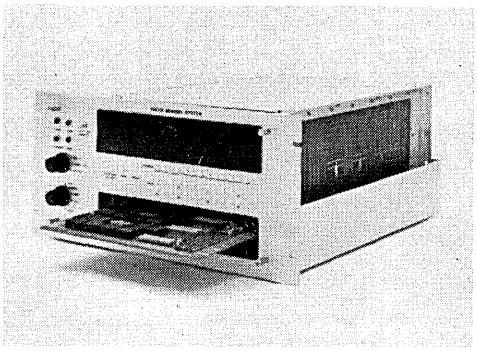


Fairchild's new 2.5D PACER™ Memory System is 8.75 in. high, 22 in. deep and 17.5 in. wide. It has a 250 to 400 nanosecond access time, 650 to 800 nanosecond read-modify-write cycle, and comes with 4K x 16 bits (larger models have up to 32K x 74 bits). It's big for its size.

FAIRCHILD
MEMORY PRODUCTS

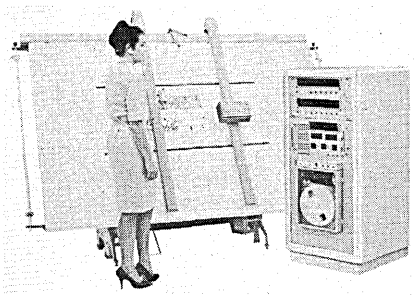
FAIRCHILD MEMORY PRODUCTS / A Department of Fairchild Camera and Instrument Corporation ■ 2525 Charleston Road, Mountain View, California 94040 (415) 962-2917 ■ TWX: 910-379-6949

CIRCLE 47 ON READER CARD

new products

coordinate digitizer

The LARR-V (large area record reader) enables an operator to measure and automatically record X-Y coordinate information from printed circuit layouts, engineering drawings, and other graphical data. Output is to paper tape, punched cards, or to IBM-compatible 556-bpi mag tape. Variable resolution demand readout is available



in both axes for use with pencil-type stylus.

A second system, GARD (graphic artwork reduction digitizer) is designed for quick digitizing of precise printed circuit artwork. It is adaptable for use with all coordinatographs or the LARR-V. Resolutions of 0.001, .010, .050, .100, .250 and .500 inch are standard. Grid offset, absolute and incremental outputs, and special commands are all included. BENSON-LEHNER CORP., Van Nuys, Calif. For information:

CIRCLE 100 ON READER CARD

data collection

The System 140 is a data collection system with input units for use at machine tools, shipping/receiving docks, office departments or remote branches, and automatically transmits the data in machine language to a computer system. WANG LABORATORIES INC., Tewksbury, Mass. For information:

CIRCLE 101 ON READER CARD

tty address key

Mounted on a teletypewriter, the Push-Button Addresser makes it possible to transmit up to an entire 32-character address by the push of a button. It is said to be easy to preprogram. The basic unit provides a 9-line or address capability, and is expandable in that increment. The solid-state device is said to be usable by any communication system that has more or less standard formats as addresses or short message forms. PIONEER ELECTRIC & RESEARCH CORP., Forest Park, Ill. For information:

CIRCLE 102 ON READER CARD

gp computer

The firm's second digital processor is the 640, which has a 1.65-usec cycle time. Word length is 16 bits plus memory protect bit, and core memory is expandable from 4K to 32K words. Designed for systems and hybrid applications, it has a direct memory access channel and expansion capabilities for teletype gear.

Using monolithic integrated circuitry, the mainframe also has a hardware index register, multi-level interrupt capability, and the capacity to handle up to 64 peripheral devices. Maximum I/O rate is 1.2 million 8-bit bytes per second. Software includes FORTRAN IV, an assembler, Hybrid FORTRAN, and HYTRAN. Price of a basic

PRODUCT OF THE MONTH

Reportedly the first commercially-available optical scanner capable of reading handwritten numbers, the model 1287 can also read five handwritten characters—C, S, T, X and Z—plus printed alphanumerics. Any combination of written, printed, imprinted and marked numbers can be read from a single document, and fields of numbers can be read selectively in two directions: horizontally across a document or vertically down a row of numbers. It accepts any cut-form document ranging in size from 2¼ x 3 inches to 5.9 x 9 inches, as well as cash register and adding machine paper tapes.

Model I reads hand-pencilled, printed, imprinted and pencil-marked cut-form documents. Mod II reads printed cash register and adding machine journal rolls in addition to cut-form documents. The 1287 is designed for use with a 360/30, 40 or 50. Although document reading speeds vary, the conventional 10-character/line journal tapes are read at 2,200 lpm. Typical handwritten retail sales checks —some 35 numbers/check—are read at about 125/minute.

The mod I rents for $3,600 monthly and sells for $162K. Rentals for the mod II start at $4K, and prices begin at $180K. Deliveries are slated to start the first quarter of '68. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 103 ON READER CARD

Big.

Size is allowable only if the compiler is fast. This one, from Digitek, is. Here is an all core FORTRAN IV G Level compiler produced for IBM for their System 360 product line with 40K bytes total size / high compilation speed / good object code efficiency / highly optimized subscript calculations / efficient use of multiple registers / multiple in line diagnostics / advanced debugging aids / predictable performance / excellent vehicle for future development / that's big news.

DIGITEK CORPORATION

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CIRCLE 48 ON READER CARD

system is below $30K. ELECTRONIC ASSOCIATES INC., West Long Branch, N.J. For information:

CIRCLE 104 ON READER CARD

solid-state calculator

The IME-86, three times faster than its predecessor, has up to seven working/accumulating registers, and automatic re-entry from all of the random-access registers. The desk-top unit stores 16 digits plus sign and decimal point in each of them. It can also raise whole or decimal numbers to a power without continuous visual proof of the power index. Square root extraction is accomplished with a single key. With its I/O connector, it can be interfaced to satellite keyboards, programmers, and other I/O gear. Other features: chain operations with or without reading intermediate answers, automatic item count, automatic accumulation of multipliers, repeat additional multiplication and subtraction without re-indexing, half-cent round-off in multiplication, automatic clearing, overflow signal, and algebraic logic. IME/USA INC., Los Angeles, Calif. For information:

CIRCLE 105 ON READER CARD

data acquisition

The Dextir II data gathering network consists of a single cable up to a mile in length interconnecting a series of individual plug-in data collection boxes, all linked to a central controller. Each collection box on the line can accept up to 25 analog and 25 digital input channels, and up to 100 such boxes can be handled by the central processor. Output is to paper or mag tape in a format usable by the user's own digital computer. BECKMAN INSTRUMENTS INC., SYSTEMS DIV., Fullerton, Calif. For information:

CIRCLE 106 ON READER CARD

flowchart software

Additions to the line of AUTOFLOW computer documentation systems are for the 360 COBOL, 360 FORTRAN, and 7090/94 FORTRAN. The automated flowchart systems automatically perform all editing, page allocation, line drawing, and statement rearrangement. APPLIED DATA RESEARCH INC., Princeton, N.J. For information:

CIRCLE 107 ON READER CARD

mag tape recording head

The recording head features an "almost complete immunity to wear," having an unconditionally guaranteed

It only takes a split second to access mortgage records at First Federal Savings and Loan Association of Miami.

Bell System Data-Phone* service is the vital link.

All of First Federal's 96,000 savings accounts at seven branches are "on line" with the association's central computer. A debit, credit or inquiry made at a teller's window can be handled in 5 to 10 seconds —complete with printout.

This real-time, input/output operation is performed on business machines connected to Data-Phone data sets and to the computer via telephone lines. The operation is simply to enter the account number and type of transaction. The computer answers immediately.

Mortgage records are stored on magnetic cards, 112 records to a card, and any single record can be accessed at random.

To trial-balance the entire mortgage portfolio takes just 17 minutes.
(It used to take days.)

So fast is the new system, that First Federal has computer time for automating other operations.

When you think of data communications, think of us.

*Service mark of the Bell System

AT&T Bell System
American Telephone & Telegraph and Associated Companies

new products

life of 200 hours. It is a 7-track IBM-compatible, record/reproduce contact tape head designed for high density recorders. The head is made by a process called all-glass bonding which combines pole pieces of a special high density ferrite (4R5), a ceramic non-magnetic ferrite, and glass—all into a single, mechanically homogeneous structure with an all-ferrite recording surface. No relapping or recrowning is required for the life of the head. FERROXCUBE CORP. OF AMERICA, Saugerties, N.Y. For information:

CIRCLE 108 ON READER CARD

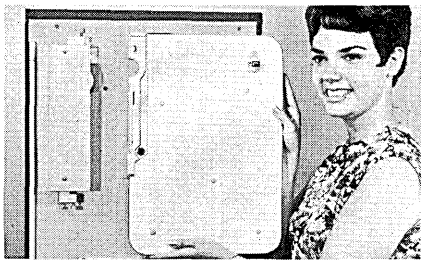
vehicle fleet monitor

The FLOW-DAC Fleet Data system is a data acquisition and reporting system for fleet vehicle cost accounting purposes. It consists of a card reader, keyboard unit, and Teletype machine. The card reader, which accepts only authorized cards, is at each fuel pump island for 24-hour unattended fueling. Thumbwheels accept variable data, which is recorded on a Teletype in the fleet office. The by-product paper tape is for subsequent machine processing. And the keyboard unit is to record maintenance costs, vehicle number, etc., as well as license fees, overhead costs, and others. MOTOROLA INSTRUMENTATION AND CONTROL INC., Phoenix, Ariz. For information:

CIRCLE 109 ON READER CARD

tape loop transport

The LT-1500, which operates off a 12-volt battery, stores a 240-foot mag tape loop in an interchangeable cartridge. A single-capstan system, it has tape speeds from 60 to 120 ips at densities up to 800 bpi. Storage capacity is 35 million bits, and transfer rate



is up to 192KC. With cartridges that also hold 60 and 120 feet of tape, it has applications in geophysical, aircraft, mobile and shipboard recording environments. POTTER INSTRUMENT CO. INC., Plainview, N.Y. For information:

CIRCLE 110 ON READER CARD

upgraded computer

The 315-502, a rod-memory computer, adds multiprogramming capability to its predecessor, the 315 RMC. Program-compatible with the latter, the new processor has 80K characters of main memory and also requires an auxiliary mass memory unit. Both CPU's have the same cycle time, 800 nanoseconds. The 315-502, however, has 31 index registers and 32 jump registers for the exclusive use of the executive program. It also has memory and file protection, and program relocation.

In addition to the earlier 315's peripherals, both 315's have new units, including controllers for a card read/punch, central comunications, and mag tape simultaneity. The communications controller accepts data from up to 100 lines, providing direct access to memory while an independent run is in operation. Price of the new mainframe is $46K, and rentals will be about $8,500 monthly. Deliveries are scheduled to begin in mid-'67. NATIONAL CASH REGISTER CO., Dayton, Ohio. For information:

CIRCLE 111 ON READER CARD

magnetic discs

Available for tailoring to user needs are 13 models of memories with capacities from 100,000 to over 10 million

1 *PERSONALIZED SERVICE through 2000 trained salesmen across the continent who share their forms experience and system know-how with forms users everywhere.*

2 *PRECISION MANUFACTURE for today's machine tolerances says that printing must be in exact part-to-part register. This is only one of the areas where precision counts.*

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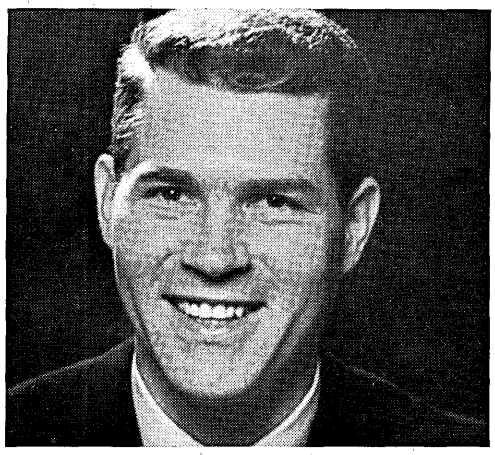

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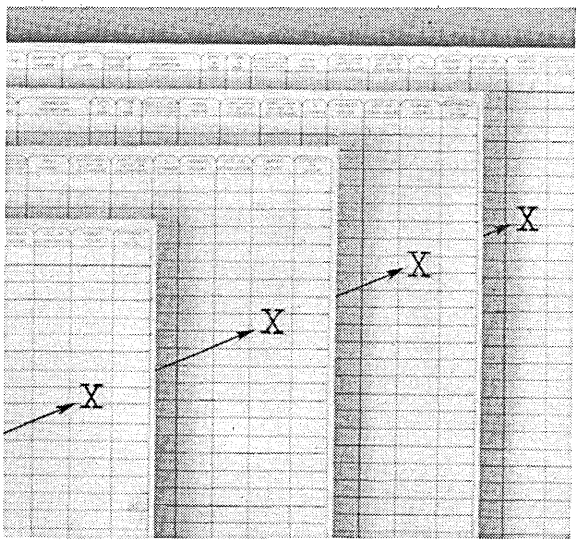

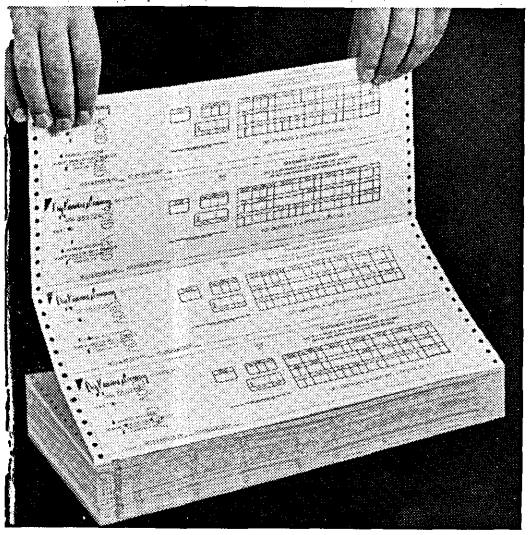

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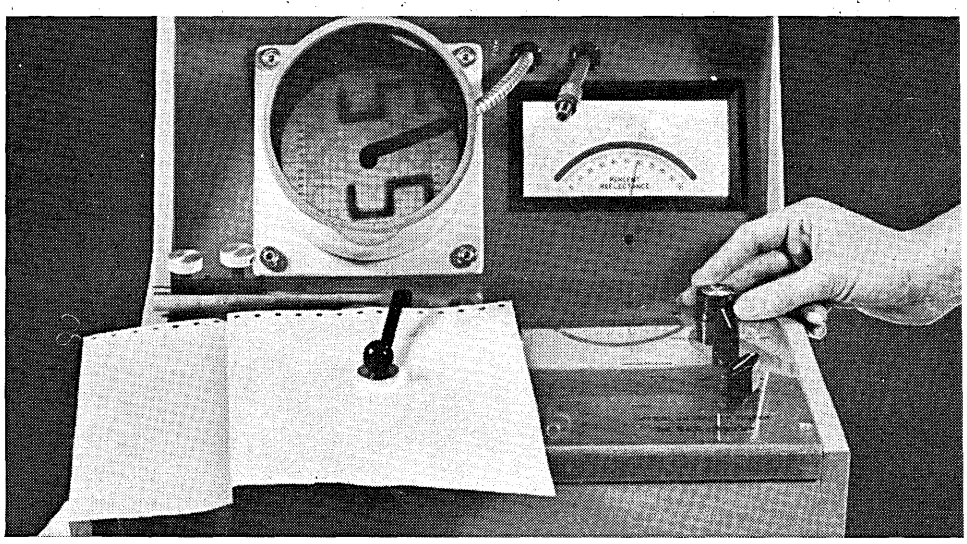

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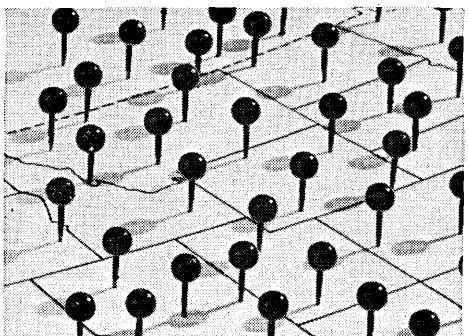

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'The right business form for every form of business'
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Over 500 offices and factories in North America

CIRCLE 50 ON READER CARD

new products

bits. They use discs with diameters of 7, 9, 11, and 13 inches. Packing densities are 1,000 bpi NRZ (600/inch phase modulation), and signal-to-noise ratio is 20 db. MAGNE-HEAD DIV., GENERAL INSTRUMENT CORP., Hawthorne, Calif. For information:

CIRCLE 112 ON READER CARD

instrumentation recorder

A portable tape recorder, the DI 5000 employs standard FM electronics for mobile applications in the bioscience, noise survey and transportation environments. It uses quarter-inch tape, operates at 3¾, 7½, and 15 ips. Powered by internal rechargeable, batteries, it reportedly operates for up to 40 hours. DATACRAFT INC., Gardena, Calif. For information:

CIRCLE 113 ON READER CARD

payroll software

For banks that offer payroll processing services to customers, the Bank Payroll System not only computes and prepares payroll checks but also transfers company funds involved and prepares payment reports for the company. Amounts paid employees can be automatically deposited in checking, savings, or loan accounts at the employee's wish. Optionally, the software will prepare statistical reports of labor distribution under various cost centers and for varying time periods. It reportedly will accommodate varying pay periods and tax requirements for a multi-department company operating in several locations in separate states. Being written for a 32K IBM 360, it also requires four tapes or four discs, or any combination, plus two more discs. Other third-generation computers also are being fitted. First delivery will be the first quarter of '67. COMPUTER SCIENCES CORP., El Segundo, Calif. For information:

CIRCLE 114 ON READER CARD

data set

The FM-12 is a frequency shift keying modem for data transmission at up to 1,200 bps (150 cps) over voice-grade lines. It is available in a range of configurations, including desk-top use, shelf and rack-mounting. It reportedly will operate in the full duplex, half duplex, or simplex modes. RIXON ELECTRONICS INC., Silver Spring, Md. For information:

CIRCLE 115 ON READER CARD

print drum

Available as an option on the firm's line printers is a 128-character print drum with multiple alphabets in upper and lower case, bold-face characters, and special symbols. Used on the L/PM-1000, its speed would be 500 lpm. DATA PRODUCTS CORP., Culver City, Calif. For information:

CIRCLE 116 ON READER CARD

asynchronous recorder

The ADR-100 writes at 2,000 cps and can record during the start interval in the asynchronous mode. Models available are compatible with the 7-channel IBM 727 and 729 and the 800-bpi 9-channel 360. Packing densities are 200, 556, and 800 bpi. The units come in 19-inch rack mounting and castor-mounted mobile configurations. REVERE-MINCOM DIV., 3M CO., Camarillo, Calif. For information:

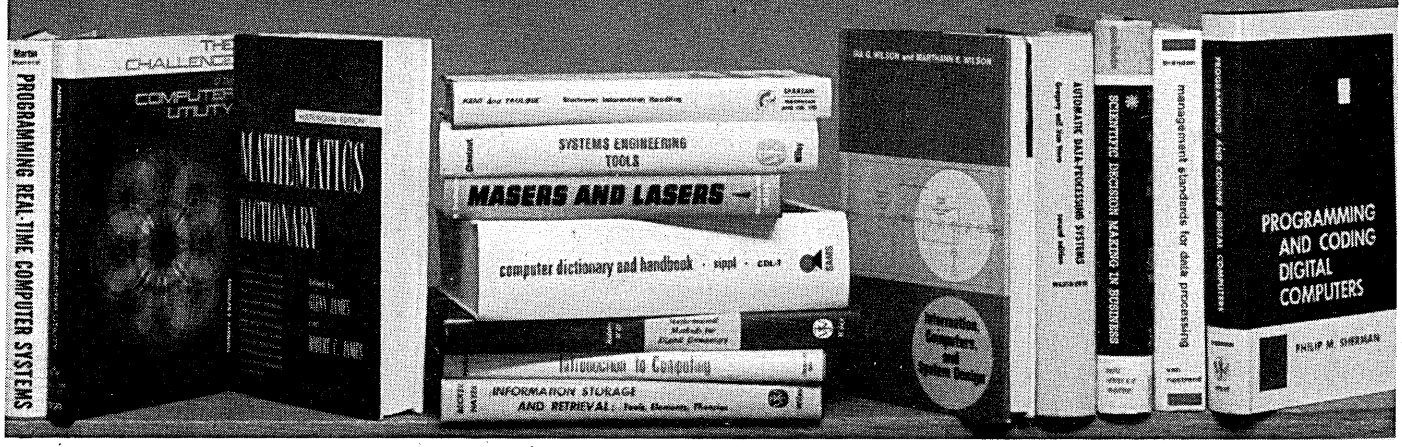
CIRCLE 117 ON READER CARD

one-inch tape drive

The TM-11 single-capstan transport for 21-track recording on one-inch mag tape is for applications in geophysical, medical and lab data acquisition projects. Tape speed is up to 120 ips. AMPEX CORP., Redwood City, Calif. For information:

CIRCLE 118 ON READER CARD

The Library of Computer and Information Sciences invites you to accept any 3 of these outstanding books (values to $45.35) for only $3.95



1. COMPUTER DICTIONARY AND HANDBOOK, *by Charles J. Sippl.* Authoritative reference containing over 8,500 definitions or explanations of computer terms, acronyms, and abbreviations—from "abacus" to "zone punch." *List Price $12.95*

2. MANAGEMENT STANDARDS FOR DATA PROCESSING, *by Dick H. Brandon.* A unique volume covering methods standards for data processing. Includes functions of systems analysis, programming, and computer operations. *List Price $12.00*

3. PROGRAMMING AND CODING DIGITAL COMPUTERS, *by Philip M. Sherman.* A complete, lucid guide to the principles, techniques, and special problems of computer programming, providing clarifying examples on a hypothetical computer. *List Price $11.00*

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5. REAL-TIME BUSINESS SYSTEMS, *by Robert V. Head.* A step-by-step guide to the *proper* way to make real-time systems operational—by the man who innovated the American Airlines' SABRE system and the Bank of America's ERMA system. *List Price $9.00*

6. COMPUTER SOFTWARE: PROGRAMMING SYSTEMS FOR DIGITAL COMPUTERS, *by Ivan Flores.* Practical handbook on the techniques and applications of computer software. Shows how sequences for software are built, and how to construct a complete system. *List Price $16.00*

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PROCESS CONTROL: Four-page brochure describes the P-250 with typical applications in the steel, electric utility, petro-chemical industries, automatic warehousing and repetitive manufacturing. Capabilities of the system, hardware and software features and application information, dimensions and specifications are covered. WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa. For copy:
CIRCLE 140 ON READER CARD

SOFTWARE PACKAGE: Four-page brochure explains how Free-Time systems makes possible both off-line and on-line computations in a computer. GE/PAC offers both FORTRAN and PAL and incorporates automatic memory allocation for various program libraries. GENERAL ELECTRIC CO., Phoenix, Arix. For copy:
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GP COMPUTER: 16-page brochure describes PDP-9 with central processor, core memory, I/O facilities, peripheral options, instruction repertoire and software. Basic price of $35,000 includes 8,192 (18-bit) words of core, a 300-cps tape reader, a 50-cps paper tape punch, console teleprinter, direct memory access channel, four data channels and a realtime clock. Typical application areas include physics, biomedicine, process control, chemical instrumentation, display processing and data communications. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:
CIRCLE 142 ON READER CARD

SATELLITE RECORDERS: 4-page brochure describes tape recorders used in space program, feature PAM/FM, direct, single carrier FM, Multiplex FM and PDN. LEACH CORP., Los Angeles, Calif. For copy:
CIRCLE 143 ON READER CARD

CORE MEMORY STACK: Data sheet describes military and space applications in which both a fixed program nondestructive readout (NDRO) and a destructive readout (DRO) scratchpad memory are required. Covered are construction, operation and performance. A wiring diagram illustrates typical x and y drive line wiring for DRO and NDRO sections. ELECTRONIC MEMORIES INC., Hawthorne, Calif. For copy:
CIRCLE 144 ON READER CARD

PRIME NUMBERS: Logs of primes when added provide an easy means of obtaining random numbers and should prove valuable in simulation, model building, sampling techniques, information retrieval or any other method requiring random numbers. Logarithms were computed at a computer center and booklet was prepared directly from printout, eliminating typesetting errors. COMPUTER METHODS CORP., White Plains, N.Y. For copy:
CIRCLE 145 ON READER CARD

COMPILERS: A small colorful sales brochure spells out the Digitek approach to compiler building, in which the compiler is divided into two sections: an interpreter and a translator which is written in POP (Programmed Operators and Primitives). DIGITEK CORP., Los Angeles, Calif. For copy:
CIRCLE 146 ON READER CARD

RECORDER SYSTEM: Information manual gives specs and operating procedures for Series F Electron Beam Recorder (EBR) for use in converting digital information on mag tape into printout at 20K lpm. Output media is Dry-Silver Microfilm. 3M COMPANY, St. Paul, Minn. For copy:
CIRCLE 147 ON READER CARD

TAPE SPLICER: Data sheet describes models 501-P for paper, 501-M for mylar and 501-PM for both paper and mylar. Prepunched 1.5 mil thermosplastic coated mylar tape can be used for the splicer and no special training is required in the use of the splicer. COMPUTER ACCESSORIES CORP., Huntington, N.Y. For copy:
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INFORMATION HANDLING: Discussed in 24-page booklet is a preliminary plan for selection, acquisition, organization and storage of information which will be the basis for the NBS information services. Covered also are operating methods and locating desired items in storage, retrieving and displaying or communicating them, and use of computers in the handling of information. Cost: $.25. NBS technical note 290. CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION, Springfield, Va. 22151.

SUPERVISORY CONTROL: Bulletin and specification sheets discuss DL-100 system that includes provisions for data logging and telemetering, utilizes telephone and telegraph lines. GULTON INDUSTRIES INC., Schiller Park, Ill, For copy:
CIRCLE 149 ON READER CARD

CRT DISPLAY MODULES: Catalogue diagrams CRT display system using modular blocks, includes listing and description of all modules, tube and coil mounts. Devices have silicon semiconductors and temperature stable metal-film resistors. BETA INSTRUMENT CORP., Newton Upper Falls, Mass. For copy:
CIRCLE 150 ON READER CARD

TELEMETRY PRODUCTS: Descriptions of electromechanical and solid state commutators and multicoders, FM telemetry products, amplifier products and PCM components are included in new publication. GENERAL DEVICES, INC., Princeton, N.J. For copy:
CIRCLE 151 ON READER CARD

NC CORRESPONDENCE COURSE: Consisting of a 90-page manual, 11 worksheets, a mid-course review and a final test, the course is designed for persons who have been associated with the metal-working industry. Handled on a prompt basis, the worksheets and tests are returned to the student within 24 hours. Enrollment fee: $25. NUMERICAL CONTROL SOCIETY, 44 Nassau St., Princeton, N.J. 08540.

MEMORY SYSTEMS: 12-page illustrated brochure describes production and specifications for core stacks and random access systems. FAIRCHILD MEMORY PRODUCTS, Mountain View, Calif. For copy:
CIRCLE 152 ON READER CARD

INTRODUCTION TO TELEMETRY: Technical report defines terms, presents history and applications, techniques and equipment requirements. Techniques covered are FM/FM, PAM, PDM and PCM. Equipment require-

new literature

ments are discussed for signal conditioners, subcarrier oscillators, transmitters, RF amplifiers, antennas, preamplifiers, multicouplers, receivers, discriminators, data display, mag tape recording and dp. INTERNATIONAL ELECTRONIC RESEARCH CORP., Burbank, Calif. For copy:

CIRCLE 153 ON READER CARD

PERIPHERAL DEVICES: Seven data sheets discuss the following devices: 7201/7205 RAD storage system, 7321/7322 9-channel magnetic tape system, 7120 400-cpm card reader, 7160 300 cpm punch, 7440, 7460 800- and 1000-lpm buffered line printers, 7010, 7011, 7020, 7021 keyboard/printers, and 7060 paper-tape I/O system. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For copy:

CIRCLE 154 ON READER CARD

PROGRAMMED CURRENT PULSE GENERATOR: Model 1550 is described in four-page bulletin and includes specifications for the program generator and current drivers. Schematic drawing shows pulse program for core testing, and waveform photographs illustrate performance capabilities of the 20-ns current drivers at the output stages. COMPUTER TEST CORP., Cherry Hill, N.J. For copy:

CIRCLE 155 ON READER CARD

SCANNING CARBONS: Booklet covers evaluation and selection of carbon paper for OCR systems, discusses OC data input forms and illustrates a number of "Go-No-Go" imprinted impressions. Detailed description of the laboratory equipment and procedures required for testing optical scanning carbons is given. PORT HURON PAPER CO., Port Huron, Mich. For copy:

CIRCLE 156 ON READER CARD

PROGRAMMING MATHEMATICAL EQUATIONS: Technical bulletin describes computer system which permits scientists or engineers to enter mathematical equations in mathematical format and to obtain a graphical display of the solution on an oscilloscope. System consists of an operator keyboard, storage and control keyboard, oscilloscope, and electric typewriter. Tech brief 66-10361. Cost: $.15. CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION, Springfield, Va. 22151.

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ICIREPAT Fifth Annual Meeting

Edited by **Harold Pfeffer**, U.S. Patent Office

736 pages, illus. $30.00

Contains the proceedings of the Fifth Annual Meeting of the Committee for International Cooperation in Information Retrieval Among Examing Patent Offices (ICIREPAT), held in London, England. *It examines the changes that the patent systems of the world today face in order to keep pace with modern technology* — from the viewpoint that the patent system is a combination of the law, on one hand, and science and technology on the other. By means of progress reports the activities of the past year by eight Patent Offices in different countries are evaluated. Systems that were tested and either accepted or rejected are presented for the benefit of all.

The discussions that follow the reports open new doors to greater mutual understanding and closer international cooperation between Patent Offices in the fields of classification and information retrieval. Seven technical sessions relate pertinent information in areas ranging from the early development stages of a mechanical retrieval system to more sophisticated study relating to patent office operations.

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These, and related information are contained in this significant work by the leading international information retrieval authorities.

INFORMATION RETRIEVAL — A Critical View

Edited by **George Schecter**, Frankford Arsenal, U.S. Army

272 pages, illus. $11.00

The symposium, co-sponsored by the Special Interest Group on Information Retrieval (Association for Computing Machinery, as well as groups representing Institute of Electronics and Electrical Engineers, American Documentation Institute, the Moore School of Electrical Engineering of the University of Pennsylvania and the U.S. Army) indicates the scope of this symposium. *The work represents "must" reading for all concerned with any ramification of information retrieval.*

Contents include: Information System Networks-Let's Profit from What We Know: The BOLD System; Associations and Thesaurus-Implicit Relationships; The Design and Testing of a Fully Automatic Indexing-Searching System for Documents Consisting of Expository Text; The TIP Retrieval System at MIT; A List-Structured Chemical Information Retrieval System; Performance of IR Systems; Psychology and Information Retrieval; User Appraisal of an Information System and Services through a Program of Joint Applied Research; A Generalized Language for Information Storage and Retrieval Applications; Getting it out of Our System; Relational Data File I: Designed Philosophy; Relational Data File II: Implementation; The SOLAR SYSTEM I: A General Method for Organizing and Searching Files.

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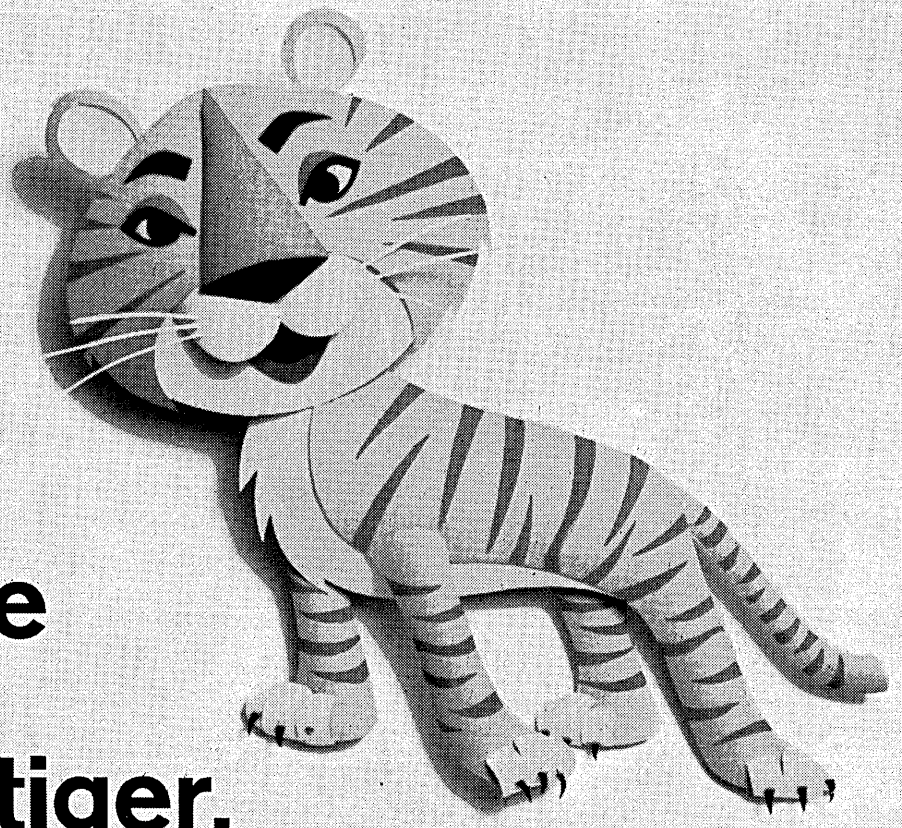
CIRCLE 58 ON READER CARD



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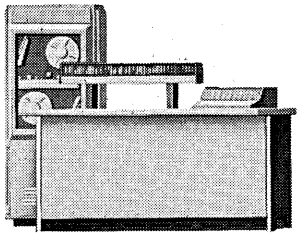

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CIRCLE 59 ON READER CARD

world report

NEW U.K. FIRM SLATES NEW LINE OF COMPUTERS

Britain has a new firm in the ranks of its machine makers that has intentions of becoming an SDS or DEC of Europe, and hopes of even becoming a CDC. Called Computer Technology, it is headed by Iann Barron, a former research and design chief at Elliott Automation. Barron's first machine, Modular One, is scheduled to surface early in '67. It will use integrated circuits; further details are still under wraps. However, he is known to be interested in a range of four processors going up from Modular One, and his basic idea is to produce a $600K machine at the top end with a 1-usec store of 212K 16-bit words.

Financial support is guaranteed by Pergammon Press and European Enterprise Developments. The former is the publishing house of I. R. Maxwell, which specialises in scientific and educational books. The company has recently been diversifying into areas of information technology such as teaching machines, educational films and scientific information retrieval. The other organisation is a venture capital company supported by major bankers such as Samuel Montagu & Co. and the Midland Bank. European Enterprise Developments is described as a sister company to the American ARD, which has supported groups such as DEC, Digitek and Itek.

JAPANESE FUND DEVELOPMENT OF LARGE TIME-SHARED COMPUTER

Two years ago, three Japanese firms -- Fujitsu, Nippon Electric and Oki -- developed the large-scale Fontac computer. It was not a howling success. Now, Hitachi replaces Oki, and the triumvirate is working on a home-grown, large-scale time-sharing computer. Some $34.72 million has been budgeted for this by the government, and completion date is set for 1970.

The same firms have also formed the Japan Software Co., capitalized at almost $1 million. In addition to developing software for the big t-s system, the joint firm reportedly will also develop other software and act as consultant to local users.

Another proliferation move: to finance manufacturers so they can lease their equipment, arrangements have been made to obtain loans from the Industrial Bank of Japan and the Long-Term Credit Bank to the tune of $8.3 million each.

FRENCH BEGIN TO REVIVE OWN COMPUTER INDUSTRY

October saw the end of the French cliffhanger: the Gaullist government appointed its overlord for spending $80 million to revive the native computer industry, and the U.S. government relented over its reluctance to sign export licenses for large-scale computers for France.

The nominee to put life into the flagging industry is the chief engineer of the Atomic Energy Centre at Pierrelatte, M. Robert Galley. His brief is understood to be to rule on all equipment orders funded by the central government for industry, commerce and science. Galley's new department, which he will head under the title of Delegue-General a l'Informatique, will also survey the needs of adminis-

(Continued on page 109)

From the original painting by Neil Boyle

APOLLO

Apollo's return from the moon is a planned splash in the Pacific Ocean. The total computer system problems involved in steering radars, acquisition, and tracking of Apollo aboard a sea-tossed vessel, and the continuous prediction of a splash point, were assigned by LTV Aerospace Corporation – Range Systems Division – to Planning Research Corporation.

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(Continued from page 107)

trative departments of federal government and prepare specifications aimed at producing a compatible range of small to medium designs for local machine makers.

At present, the French seem content to leave the development of large machines to American companies and to deploy their own limited resources in computers that will fit volume commercial and industrial markets in their own country and the rest of Europe. Aspirations to join forces with Britain in the design and manufacture of very big units have gone by the board. One observer, however, foresees French efforts to develop a large scientific machine.

An easing by Washington in its attitude towards supplying big computers to France has been an undoubted influence in the last decision. For nearly a year the French have been endeavouring to get clearance for a CDC 6600 to be delivered to its Atomic Energy Authority and other research centres. Licenses have now been granted for two 6000 series, one for SIA and the other for French Electricity, and a 360/92 for the French Nuclear Studies Centre, Saclay. The new coordinators of national computer policy believe that release of the computers for scientific centres is more than a placatory gesture.

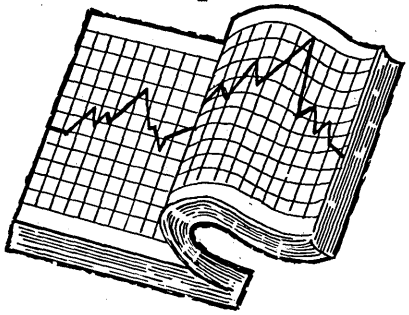
Revamping of the computer industry is to be achieved on the foundations of existing industrial groups; three of the largest electronic companies are to set up a joint subsidiary to handle four new processors by the end of 1969. The firms are SAE, CAE and Schneider. A second agreement is in embryo between Thomson-Houston-Hotchkiss-Brandt and Compagnie des Compteurs for development of another concern to develop and produce peripherals. This joint subsidiary will be known as Sperac.

NEW ARCHITECTURE STUDIED BY ICT DESIGNERS

ICT is examining proposals for its next machine series which would radically alter design philosophy. Under consideration and already in prototype form at their Brackwell research laboratories is the Basic Language Machine (BLM). The design is based on John Iliffe's code-word machine, a scheme for hardware implementation of the retrieval of storage addressing. Proponents of the machine see it as the remedy to much programming headache, and the multi-access challenge from the U.S. Development of BLM architecture demands very high speed logic to push the hardware programme around at speeds needed for good throughput.

BITS & PIECES

An Australian government report shows 486 computers in operation at the end of June '66, an increase of 67 for the first six months and 214 more than were on the air at the end of '64. The federal government had 70 installations and the metal manufacturing industry had 44 ... The Australian Atomic Energy 360/50 passed acceptance recently on its seventh try ... The British Navy has ordered five Ferranti F1600's plus digital displays worth $5.6-million for simulation purposes at an executive officer's training school ... G.E. has started a management overhaul of its U.K. subsidiary, De La Rue Bull Machines Ltd. The staff has been cut and sales of the 600 series is being soft-pedalled. With some 150 punched card and computer customers in the U.K., current company policy is to go flat out for commercial business.

Q. How many dollars does it take to produce this  ?

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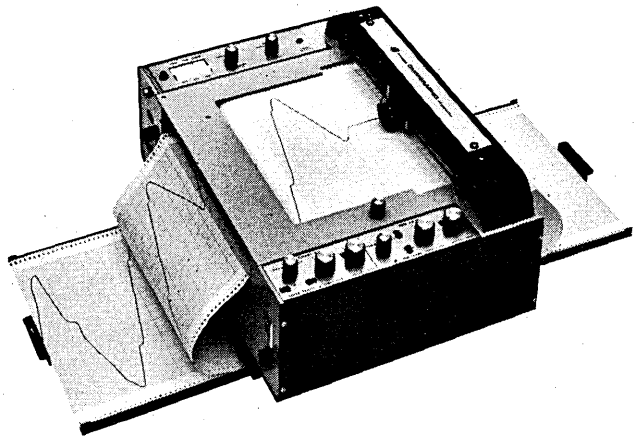

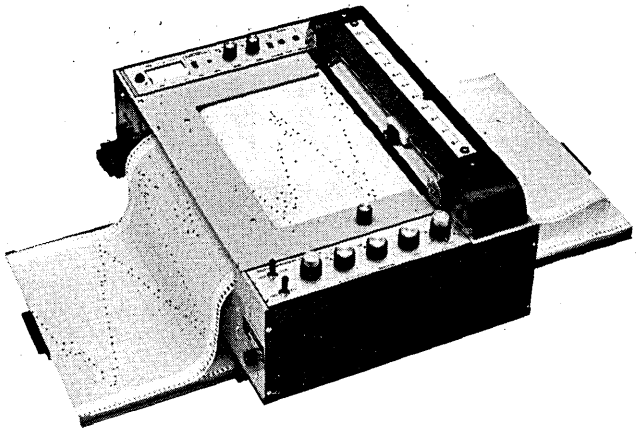

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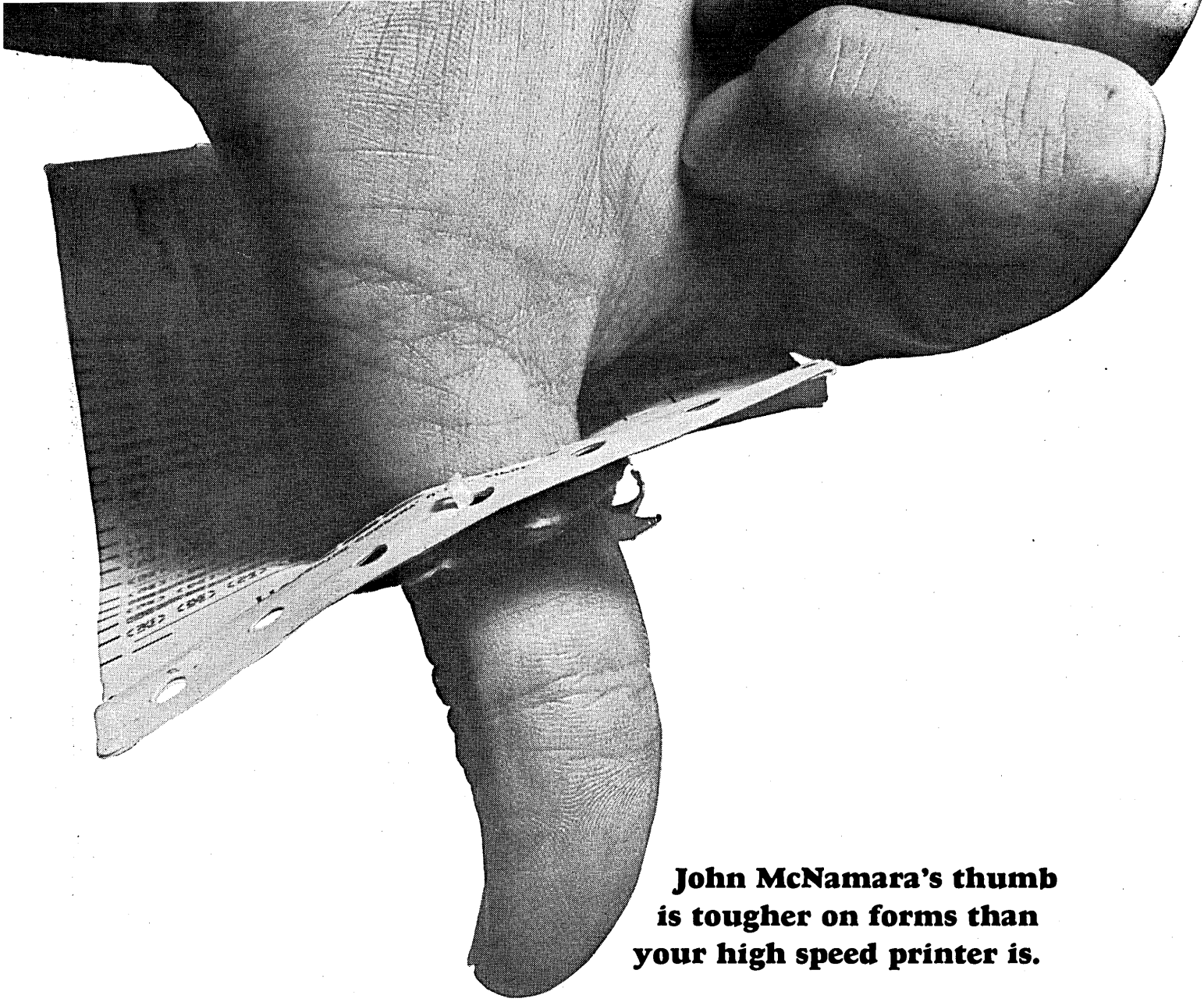

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washington report

FEDERAL DP REVOLVING FUND REMAINS CASHLESS

A main prop under the Brooks Bill, the adp revolving fund, will not be funded this fiscal year, or, probably, next year either, because of Viet Nam. Cong. Jack Brooks reportedly isn't going to object because the money won't be needed for awhile ... To reduce new equipment expenditures, GSA will try to match more agency adp requirements with excess equipment. This equipment, if inadequate, will be modified wherever possible. GSA will do the modifying, then bill the users.

DATA COMMUNICATIONS & COMPUTER UTILITIES

FCC will order Ma Bell to file higher Telpak A and B rates "shortly," in line with a recent court decision. Private line rates are likely to drop in the process ... FCC has published new rules, but received no license applications, covering shared microwave systems operated by non-regulated users ... Within 30 days, the commission will resolve the hassle between Comsat and the carriers over ground station ownership, a key obstacle to development of a domestic satellite voice/data system.

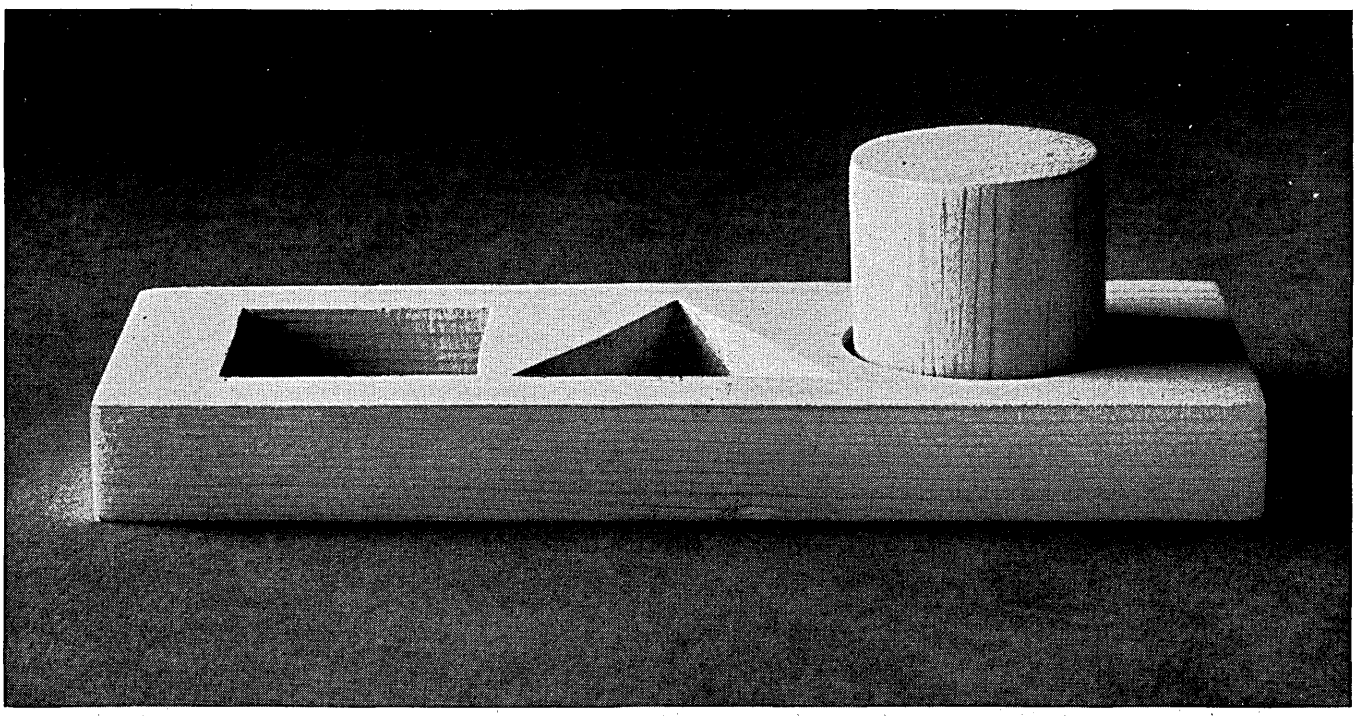
FCC will be asked, equally soon, to launch a public inquiry involving computer utilities. Speaking before ACM's Washington, D.C., chapter recently, Common Carrier Bureau chief Bernard Strassburg seemed to suggest that regulation of computer utilities would be a good thing because they are becoming more dependent on communication costs, which gives big fish like Western Union valuable advantage. Datatext, Quiktran, and similar IBM offerings, he added, may violate the consent decree.

LEGISLATORS STUDY LARGESS BUCKET

Sen. Ted Kennedy recently proposed study of a data bank able to help state and local officials select the federal grant programs their communities need most. This month, a Senate GovOps subcommittee is considering Kennedy's bill (Joint Res. 187); VP Hubert Humphrey and BOB director Charles Schultze are among the witnesses. Related legislation, allowing state and local governments to use federal adp facilities on a reimbursable basis, died in the last Congress but is certain to be resurrected. Meanwhile, the House Science and Astronautics Committee has advised government policymakers to "encourage and support" cybernetics in general and better information retrieval systems in particular.

CAPITOL BRIEFS

Several signs indicate a developing U.S. computer market in Europe -- the French-American agreement on sale of big systems, LBJ's Oct. 7th speech, and a subsequent relaxation of the embargo on U.S. sales to the Soviet bloc. Numerical control systems, a-d and d-a converters, electronic assembly testing gear, and thin-film memories are among products that now can be exported under a "general" license -- i.e., with far less red tape, delay, and government negotiation. The French agreement tends to confirm rumors that "Plan Calcul" will concentrate on medium- and small-capacity computers ... "Quite a few applicants" have answered the Air Force's help wanted ad last month, which sought a new associate director for data automation. AF went outside, it says, because of a shortage of Grade 16s who could be promoted into the associate director's Grade 17 slot ... Legislation barring banks from competing with dp service agencies will be reconsidered by Congress next year.



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books

The Impact of Computers on Accounting, by Thomas W. McRae, John Wiley & Sons Ltd., 1964, and The CPA Plans for the Future, by John L. Carey, American Institute of Certified Public Accountants, 1965.

A book reviewer is presumably chosen because he is particularly qualified to comment on the subject under discussion. This may lead the reviewer to tell how he would have written the book rather than to report fairly what the author has actually written. I warn the reader of this review that I have strong attitudes about the subject matter of these books. Probably very few of you will ever read either book. I propose to use this opportunity to editorialize about the probable impact on computer professionals of the current ferment in the accounting and auditing profession caused by our infernal machines.

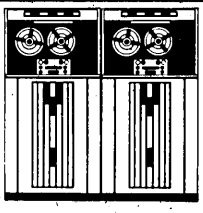
Thomas McRae qualified in 1955 as a Chartered Accountant, the equivalent of our CPA. After a brief stint in public accounting, he became involved with computers. It is refreshing to find a writer on computer-related accounting subjects who can make some claim to having been a computer professional. He writes in a pleasant, literate, informal style, with no hesitation to say what is on his mind. The book is written for a British audience, although it is not very difficult to penetrate the vocabulary. About half of the book has elementary material on electronic data processing. The other half explores the impact of computers and operational research on management, on accounting and the accountant, and on the education of the accountant. There is an interesting chapter on the audit and control of computer applications. The treatment is relatively light because of the considerable ground that is covered in 300 pages.

McRae's book is a plea for the European accountant to become more computer-minded and to face up to the challenge of a rapidly advancing information technology, especially computers. He holds out great opportunity for those who respond to the challenge. To those accountants who do not, he sees a minor role. McRae believes that the traditional industrial accountant's job of collecting and assembling business information is likely to be taken over by a separate edp department. The industrial accountant's other role, providing management with information to be used in decision-making, he feels can probably be done better by an OR department, which has more sophisticated tools. The independent auditor, another member of the profession, tends to view the computer as an additional cross to bear, rather than as an exciting new tool.

McRae feels that accountants should know programming in order to be able to cope with edp. Without such knowledge, information technology may pass into the hands of a new profession. He believes that an internal audit staff should have one man on it who has been a member of an edp department. Auditors have to justify the cost of control and the portion of computer time used for control. He has an interesting discussion of what he calls the "salami" fraud, such as a programmer accumulating the rounding part of all pay calculations to his pay or that of a friend. The amount deducted from any one item is too small to note, hence the terminology. (Amateurs should be warned on technical as well as moral grounds about attempting to slice the salami.) McRae also points up the woeful lack of edp educational and research facilities in Europe. The Institute of Chartered Accountants of Scotland has evidently been particularly enterprising in training accountants on edp. There was an announcement since the book appeared that they are considering establishing a Computer Education and Applied Research Center.

Aside from some minor errors, the book should do an effective evangelical job of motivating those accountants who read it. Unfortunately, these tend to be the accountants least in need of motivation, in the reviewer's experience. There is not too much meat here for computer professionals. McRae is quite naive in terms of how far things have progressed in the United States, which he holds up as a model. He also has a somewhat overly optimistic view of the role of operations research currently and in the immediate future, although I am already aware of some management accountants being supplanted as independent advisors to management by OR types.

A complementary book deals with the problem of the accountant rapidly becoming obsolescent in the US. John Carey is Executive Director of the American Institute of CPAs and, until recently, publisher of its Journal of Accountancy. His book is a candid



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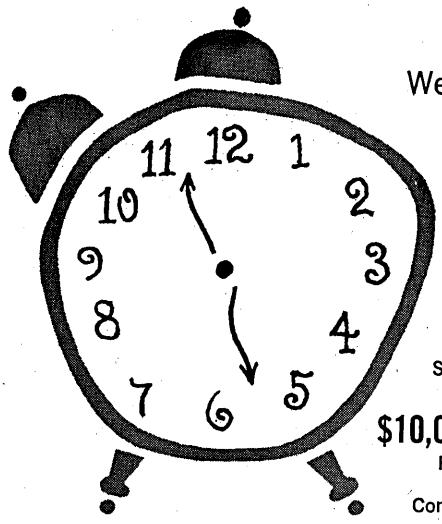

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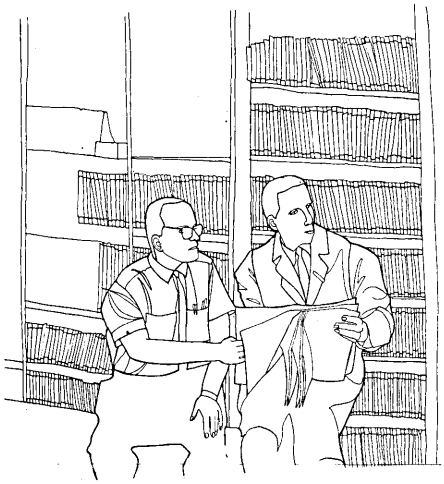
discussion of the problems which confront our accounting profession and of possible paths for future development. The material came from work of the Committee on Long-Range Objectives of the AICPAS, although a disclaimer is present that the views expressed do not represent official policies of the Institute. The book is oriented toward CPAs.

Carey shows how a changing environment and other factors may affect public accounting over the next several decades. There are a number of references in his book to the impact of computers on accounting. He quotes a statement that the accountant will have to have as complete a working knowledge of edp as he has now of the fundamentals of tax law. He too is concerned whether a CPA or accounting trained controller will control the new integrated information systems. Carey believes the accountant can direct information systems if he acquires more knowledge about systems, computers, including programming, etc. One way or another, he states, CPAs must make computer services available to their clients. He is concerned about the possibility of lay competition in the field of accounting services from banks and others. A new profession of information specialists may supplant CPAs. Supervisory agencies, banks and others



might use information specialists to examine and test corporate information systems to determine that the financial statements are fairly presented.

He believes that professional accounting can be an integrated service, covering all of management's needs in the measuring and communication of financial and economic data, both internal and external. Carey says that it is beginning to be understood that the CPA will not be able to make a satisfactory audit under conditions of a decade or two hence, unless he understands the methods by which internal information is generated and communicated, and the bases on which decisions are made. The CPA less and less finds familiar audit trails, but must develop other means of satisfying himself about the reliability of the information system. The computer must be used in the auditing process itself. There may be more continuous rather than periodic audits.

There is some concern about the auditor's independence if management services consultation is provided too. The Institute's official position is that the independent auditor's objectivity is not impaired as long as he does not have a financial interest in the client and does not participate in managerial decisions. If such a broad view of service to management is not taken, accounting may wither away. The liberal view among accountants is that the CPA's scope is any work he is competent to perform in all areas of management except those restricted to another profession by law. The independent audit, besides supporting a professional opinion on the financial statements for external reporting purposes, may also support a report to management on the effectiveness of the information system for internal planning, control and decision-making purposes.

Carey says that the local CPA firm which understands computer technology and knows how to interpret data for management planning, control and decision-making purposes could make itself virtually indispensable to its clients, most of whom could not afford the full-time services of an internal staff with equivalent competence. Every day sees hunches, guesses, intuitions and subjective judgment giving way to improved analytical methods. CPAs can ignore these developments only at their peril. CPAs will have to look at the client's business as a whole. Carey also discusses the severe problem of educating accountants for a rapidly changing environment.

The CPA Institute's Committee on Long-Range Objectives put in nine years of hard work to expose the profession's problems, weaknesses and future needs. Carey states them well in over 500 pages of a book intended as a planning document for the accounting profession. The major problem is that Carey speculates that it may take five more years for the planning committee to develop a program of action, and ten years after that to carry it out. The trouble is that the accounting profession has already pretty much wasted the first 15 years since electronic computers have appeared and time is al-

ready very late. Another 15 years may represent a luxury the profession can ill afford. Many accountants are in serious trouble today and need help today, or within the next two years or so. Some of the eventualities which Carey mentions for a decade or two from now confront some accountants today, such as the problem of using conventional audit techniques in highly integrated or real-time systems.

In view of the scope and magnitude of the problems faced by accountants today, the accounting profession has a very unimpressive record of attempting to cope with them, in my opinion. With a few exceptions, the schools, the professional societies, the large national accounting firms and government agencies are notable for their lethargy over the last decade in attempting to cope with the information processing revolution which is under way. Many of the schools teaching accountants are more concerned about PhD credentials than computer knowledge of those assigned to teach computer subjects. They seek the glamour of quantitative techniques and operations research when they are not providing obsolete vocational training. The professional societies suffer from an aversion to anything N.I.H. (not invented here) and have demonstrated endless patience with study committees and task forces that produce little useful output. The large public accounting firms are unable to cope with the problem of upgrading their own thousands of auditors to a level where they can adequately cope with computers, let alone contribute much to similar problems afflicting their clients. For too long they have tried to "leapfrog" the computer. Many of the government agencies and regulatory bodies have positions of considerable power and can retain very conservative audit approaches, at considerable cost to the information systems of many companies.

Fortunately, there are clear signs of change now that the impact of computers on accounting is becoming acute. The 1964 American Accounting Association Committee on Courses and Curricula-Electronic Data Processing made strong recommendations for increased edp study in the schools and increased edp capability of accounting professors. There are several special publications now for educators concerned with data processing. More computer and systems courses are becoming available in the colleges and universities. One of the accounting professional societies has just hired a computer consultant. More and more

computer related articles appear in the accounting professional journals and they are of better technical quality. More papers on computer topics appear at local and national accounting society meetings. The accounting firms are beginning to face up to the computer challenge. One large national firm is acquiring two computers, whose sole justification will be staff training. One firm is requiring three of 21 members of a customer internal audit staff to become electronic specialists living full-time at a utility's data processing center, writing audit programs among other things. Some independent auditors are clearing customers' system designs before a start is made on implementation. One of the large government audit agencies is experimenting with concurrent statistical sampling routines in aerospace industry production programs to reduce the cost of audit demands on the contractor's information system.

All this ferment in the accounting profession still does not add up to much. The individual accountant or auditor still is pretty much on his own as regards professional development to enable him to cope with the burgeoning information technology. Many are taking programming courses and other computer training, not all of it good, much not oriented towards them. Computer professionals may be of considerable educational help to the accountants and auditors in their organizations and may learn some things about control and audit problems in return. Professional programmers are now appearing on internal audit staffs.

Computer people will find an increasing impact on them of these incipient developments. The old, highly permissive days are fast disappearing. More auditors are auditing through the machine, some living full-time with the systems and data processing functions. Systems, policies and practices are experiencing more review. Computer professionals must answer long audit questionnaires. There will be considerably more use of the computer by auditors as an audit tool. Some internal auditors are going so far as to formally sign off on proposed system designs and to approve program change requests in advance of implementation.

Accounting has had formal professional organization in the United States since 1886. The profession is still trying to solve fundamental problems of standards, objectives, scope, organization, professional development, etc. We can anticipate that information technology professionals will be spending many years tackling similar problems.

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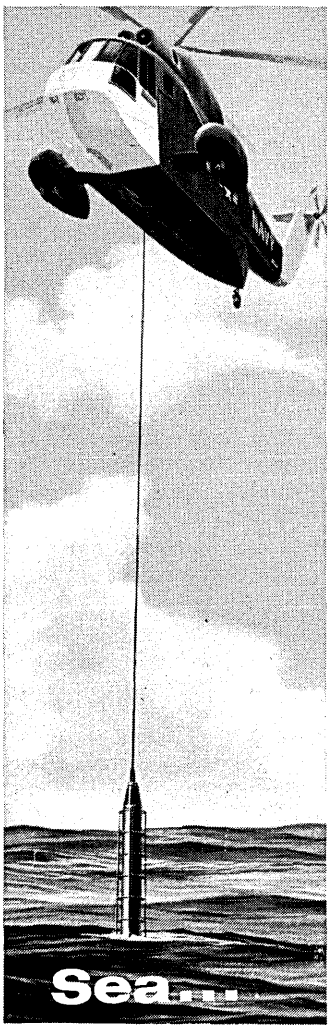

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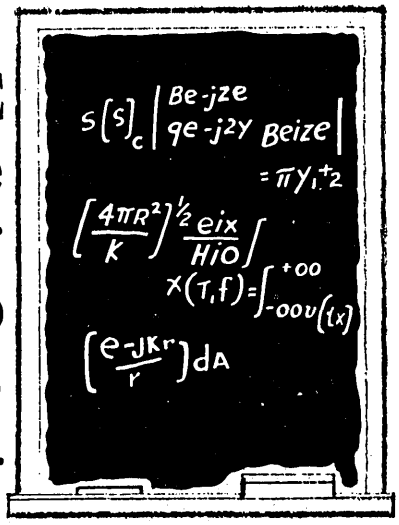

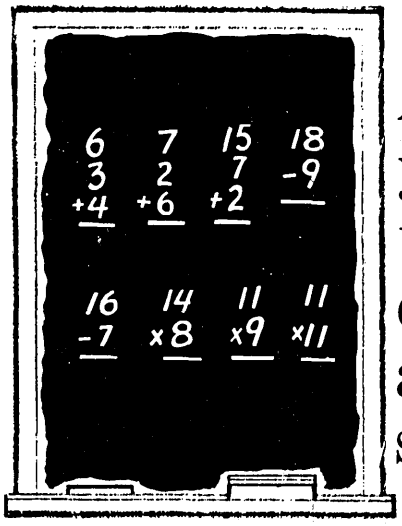

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people

■ Ivan E. Sutherland has joined Harvard Univ. as associate professor of electrical engineering. He was formerly director of information processing techniques in the Advanced Research Projects Agency of the Dept. of Defense.

■ Anelex Corp., Boston, Mass., has elected Herbert Roth Jr. president and chief executive. Former president, John Holbrook, will continue as a member of the board of directors.

■ James R. Bradburn has been elected vice president and general manager, RCA EDP, Cherry Hill, N.J.

■ Warren E. Burton has been named executive vice president, general manager of large-scale systems, University Computing Co., Dallas, Tex. He was formerly vice president in charge of computer centers, C-E-I-R, Inc., Washington, D.C.

■ Art Whitmore has been appointed manager, systems planning, American-Standard Corp. He was most recently with the corporate computer planning staff at Westinghouse Electric Corp.

■ Following Honeywell EDP's European expansion, Claude H. Smith, previous marketing manager in Wellesley Hills, Mass., has been named vice president, of computer operations, Europe.

■ Paul B. Goodstat has been appointed director of standards, Data Processing Group, BEMA. He succeeds Vico E. Henriques, who is now with Arthur Young & Co., Washington, D.C.

■ Dr. Melvin Klerer of Columbia Univ. has been elected chairman of the Joint Users Group of the Assn. for Computing Machinery. C. H. Davidson, Univ. of Wisconsin, was elected vice-chairman.

■ Casimir A. Zera is now vice president, computer services division, C-E-I-R, Inc., Washington, D.C.

■ Julius A. Archibald Jr. will manage computer operations and planning at G.E.'s Knolls Atomic Power Laboratory, Schenectady, N.Y.

■ Monroe Fein, former manager, IIT computer facilities, has been promoted to assistant director, computer science division, IIT Research Institute, Chicago, Ill.

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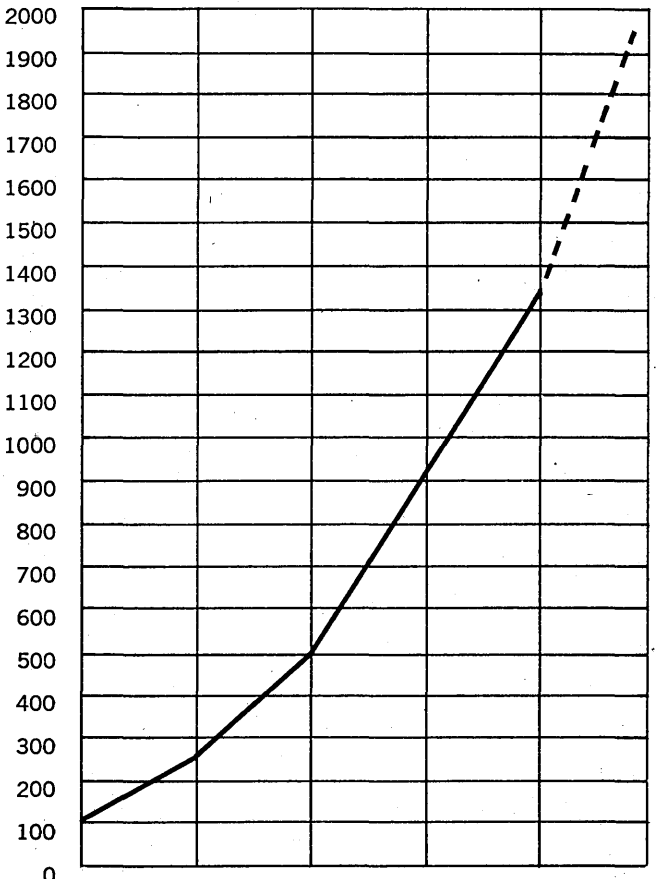

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look ahead

(Continued from page 19)

test-marketing its electron beam recorder in the mid-west and will install the first two units this year -- one at Bell Labs and the other internally at St. Paul to be used for a service bureau operation. The unit takes information from mag tape, uses an electron beam to write on dry silver film, which is processed in a few seconds, at the rate of 20-30,000 lpm. Rental price is $3-4K/month. It has the ability to merge graphics with alphanumeric printing, will be used by one customer for preparation of parts catalogs. First commercial deliveries are scheduled for mid '67. The company is setting up a nationwide sales, service and support organization ... and is reportedly dickering with one computer manufacturer for an OEM contract.

TIME-SHARING 6700 TO BE NEXT FROM SCC

Fast-growing Scientific Control Corp. of Dallas will soon announce the SCC 6700 Time-Sharing Computer, using the Berkeley software developed under an ARPA contract and now in the public domain. It's a 24-bit machine with up to 128K words of core, character or bit addressable, a paging structure that permits memory allocation in 2048- or 256-word blocks that can be interpreted as read/write, read-only, or execute-only storage. Sixth machine in the company's line, the 6700 can be delivered in six months "at a lower price than competitive systems."

SCC has gone from 8 to 80 people in one year and sold 15 machines -- showing a profit for the most recent quarter. Marketing approach so far has been "to interface with anything," supplying processors to systems houses who then take responsibility for the whole package. Their enviable purchase/lease ratio: 14 to 1.

RUMORS AND RAW RANDOM DATA

The SDS announcement that a COBOL-65 package will be offered as an extra-cost option with the Sigma 7 is the first break in the traditional software-included pricing structure. Produced by Computer Sciences, the compiler will sell for $20K or is available on the installment plan at $1K/month for two years. It will be ready for delivery in the first half of '68 ... Sperry Rand and Mohawk Data Sciences have settled their differences out of court with MDS agreement to pay Sperry $200K, ending the argument over the design of the MDS Data Recorder. The company has now sold 1800 units, is registered for another stock offering ... Software for the 360/67 is being prepared by desperate users. Lincoln Labs just contracted with Auerbach for a general editing system operating from a console; Univ. of Michigan is writing a fast MAD translator; and Carnegie Tech is developing ALGOL ... Some small-360 users are moaning because IBM's 16K PL/I subset for the disc and tape operating systems has slipped from Nov. '66 to July '67 ... Standard Computer Corp has moved manufacturing from Phoenix to Santa Ana, Calif., and installed their first machine (still unnamed) at the DataStation computer center in Los Angeles; it's designed to run 7094 programs in machine language ...

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Will prepare scientific problems for large digital computer programs. Requires degree in math or physics. Prefer 3-5 years' experience in scientific programming for high speed computers.

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To run and maintain x-ray codes, and code and document programs for calculating the behavior of physical systems. Requires degree in mathematics or physics and some experience in Fortran programming for scientific applications.

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To perform dynamic analysis of nuclear power plant systems using computer simulation techniques to determine steady state and transient response. Degree in ME, EE or NE required plus 1 or more years of system dynamic analysis, preferably on nuclear power plant systems. Should have familiarity with the use and application of digital and analog computers.

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Will perform analysis in the area of heat transfer related to power reactors (conduction, convection and radiation) and some fluid mechanics. Requires degree in engineering. Up to 3 years' experience and knowledge of numerical analysis and Fortran computer language desirable but not mandatory.

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St. Paul Facility Has Openings at All Programmer Levels

Thirty more programmers are to be hired at Control Data's Development Division in Arden Hills, a suburb of St. Paul.

Arden Hills develops software for 3000 Series computers.

Jobs are available at all levels, according to David M. Noer, Arden Hills Personnel Administrator. There are excellent openings in systems development, in continuing development of existing systems, and in quality assurance programming.

A degree in Math, Physics, Engineering or business is preferred, along with 2-5 years experience in assembly language programming.

An interview can be arranged by forwarding a resumé or letter to D. M. Noer, Arden Hills Facility, 4201 North Lexington Avenue, St. Paul, Minn. 55112.

ALLEGRO, Fastest Linear Programming System, Creating Top Openings

The Data Centers Division of Control Data has announced the release of ALLEGRO, the fastest linear programming system yet developed. The success of this system is creating exceptionally good jobs for programmer analysts in the Data Centers.

ALLEGRO is capable of solving up to 4000 constraints on the Control Data 3600 computer.

Data Centers are developing computer applications in practically every business field. The eight centers are located in Minneapolis, New York, Washington, D. C., Boston, Houston, Cincinnati, Los Angeles, and Palo Alto, Calif.

For more information on job openings, write J. D. Cassidy, Control Data Corporation, 8100 34th Ave. S., Minneapolis, Minn. 55440.

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A significant number of large businesses, scientific institutions, universities and defense contractors have installed or placed orders for Control Data Systems recently.

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University of Adelaide, Australia, a 6400 system.

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NASA Langley Research Center, two 6600 systems and one 6400 system.

University of Minnesota, Minneapolis, a 6600 system.

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For more information or to arrange an interview, write or call Dan Moran, Control Data Corporation, 3260 Hillview Ave., Palo Alto, Calif. 94304, phone (415) 321-8920.

CIRCLE 333 ON READER CARD

Howard Research Div., Bethesda, Md., Seeks Engineers and Analysts

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More qualified personnel are specially needed in projects covering the design of a Field Deployed Tactical Computer for the Army.

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the forum

The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

PRIVACY: THE DATA BANK PROBLEM

Hearings into a proposed Federal Data Bank before the House Special Subcommittee on Invasion of Privacy, of which I am chairman, have demonstrated the need today to evaluate the role of the computer in our society tomorrow. The proposal, as urged by the U.S. Bureau of the Budget, would have stored information, collected by various government agencies, in one source, and made this information available to government and private users.

Unfortunately, such a center would have included data with personal identifications attached, and could thus, according to computer experts who testified before the Subcommittee, be converted into an intelligence-type data bank. We therefore concluded the inquiry with the understanding that the government would not proceed with the creation of the center without approval from Congress—approval based on the construction of safeguards insuring privacy and other rights . . . safeguards as yet not devised.

With the knowledge of these hearings behind us, the members of the Subcommittee turned to the broader issue of establishing guidelines for the future utilization of computer sciences as they relate to our traditional liberties, including the right to privacy. We are all aware of the versatility of the computer and the wealth of benefits it offers mankind. As a lawyer, I welcome the day when legal research will be facilitated through the use of computers; as a legislator, I am aware of the ability of the computer to help solve many of the problems of the future. Already the vast Medicare program is scheduled for computerization.

My concern, however, is that we do not overuse the computer — that in our drive to achieve economy and efficiency we do not infringe on historical rights. Otherwise, we could inadvertently create a Brave New World in this country, populated by what I call Computerized Men. Such a development is seriously predicted by intelligent observers of the American technological scene.

Donald N. Michael, of the Center on Utilization of Scientific Knowledge, Institute for Special Research, the Univ. of Michigan, said in a statement to the Subcommittee: "Let us also recognize that the impact of computer technology will not be unilateral. Rather, it will be profoundly affected by attitudes held by significant portions of the public and their leaders — attitudes favorable, indifferent, or antagonistic to privacy and freedom. There are, of course, great social pressures already operating which run counter to the preservation of privacy . . . (the pressures) result in conformity and in the justification of exposure, and in order to conform or to assure that others meet certain standards of conformity, people need to know what other people are doing, especially in their less easily observable lives."

Privacy and non-conformity so far have been preserved largely because access to personal information has been restricted. Computers, especially when tied to a Federal Data Bank, could become the instruments to circumvent these restrictions and begin the gradual deterioration of privacy and the construction of the Computerized Man.

A Personal Dossier Bank has not yet been suggested, but once a so-called Statistical Data Bank has been established—with personal information and identification included—pressures would develop for more personal data. Already the halls of government are echoing with calls for more detailed information about households — in the name of planning for such worthwhile programs as urban renewal, housing and educational projects. As population and mobility increase, there will be more incentive to intensify personal data collection and to centralize data files.

Only the computer can process quickly enough the enormous amounts of data needed to understand the existing states of social and economic affairs.

Instead of *determining* norms, the computer, I fear, might be used to *set* norms, and thus could lead us into the era of the Computerized Man. Such a development would be bad enough, but think of the consequences if non-benevolent or over-zealous government officials were to control such a system as a data bank. Information could be retrieved deliberately and clandestinely by querying the computer with someone else's retrieval codes.

Even if the programmer's intentions were honorable, he could maintain life-and-death power over an individual by virtue of the decisions he must make in accumulating data for a decision-making official. The official seeking the information need not have the full details of an individual, but the programmer would have to collect intimate and extensive data to understand it and to produce a printout that would satisfy the assignment.

We are in this way placing too heavy a responsibility on future technologists and investing too much power in our technological creations.

The proponents of the National Data Center confidently assured me that all of this information could be restricted to no more than five or six people in our government. Can you think of five or six people you can select to have at their fingertips total information on every American? I prefer to place my trust in law, rather than in man.

We should not deter scientific progress for fear of what it might achieve, but neither should we defer decisions to update our laws to the great scientific accomplishments of this age. Computers have put us on the threshhold of a revolutionary new environment that can achieve man's greatest progress. Equally important is our responsibility to see that this new environment has the legal safeguards to provide our life with "liberty and the pursuit of happiness."

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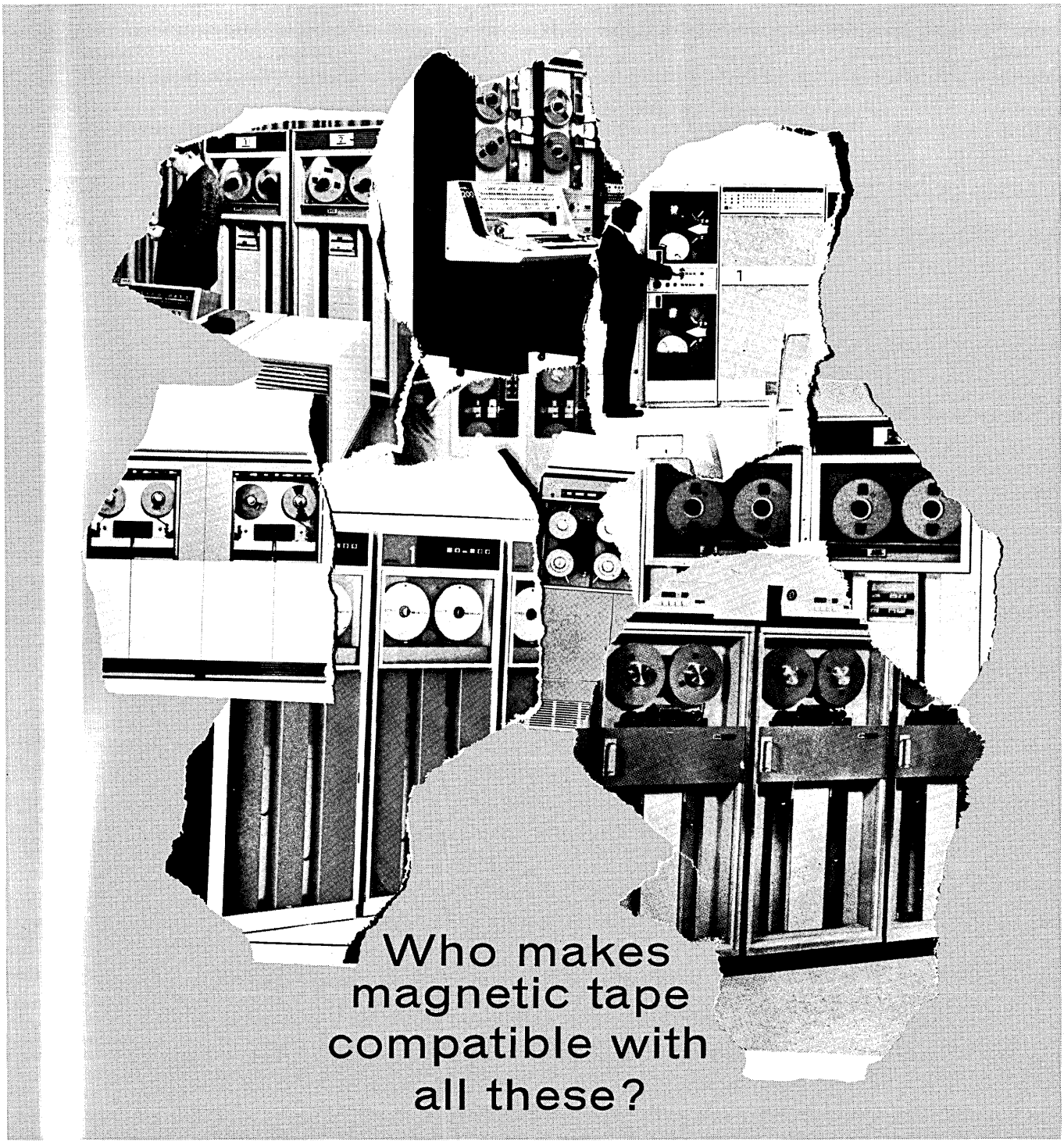

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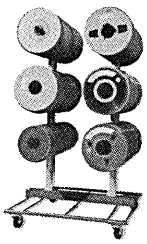

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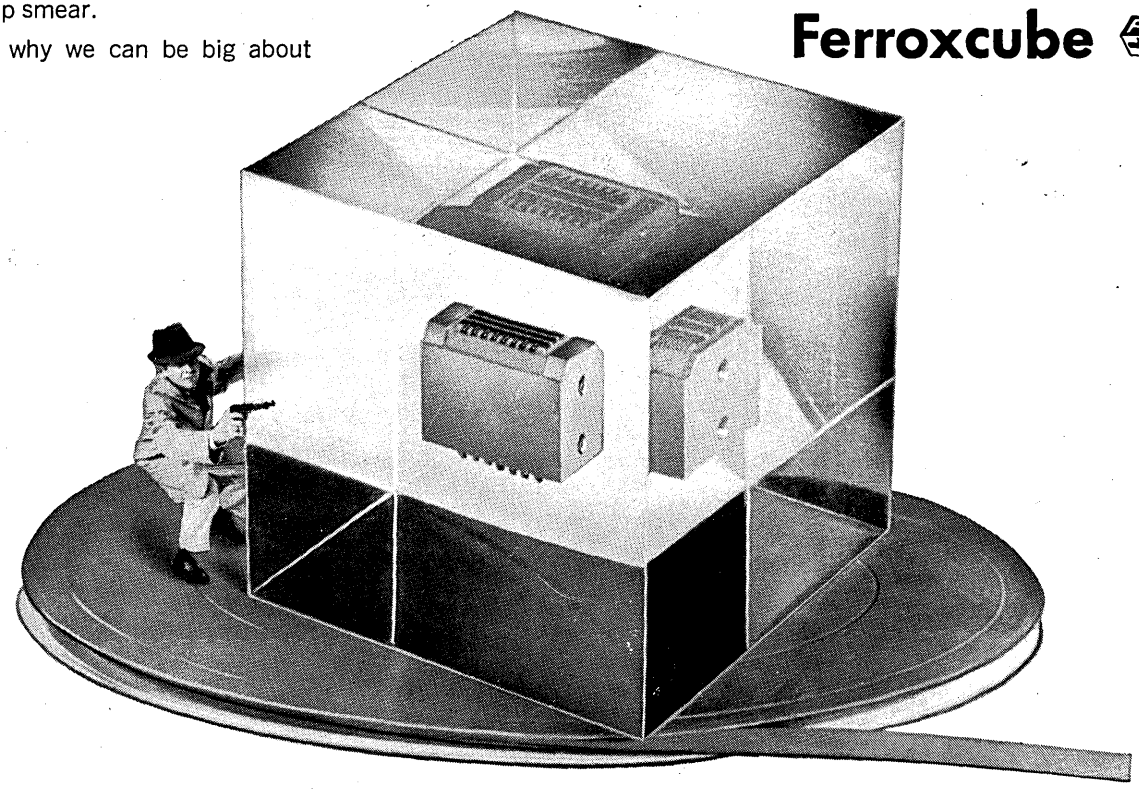

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