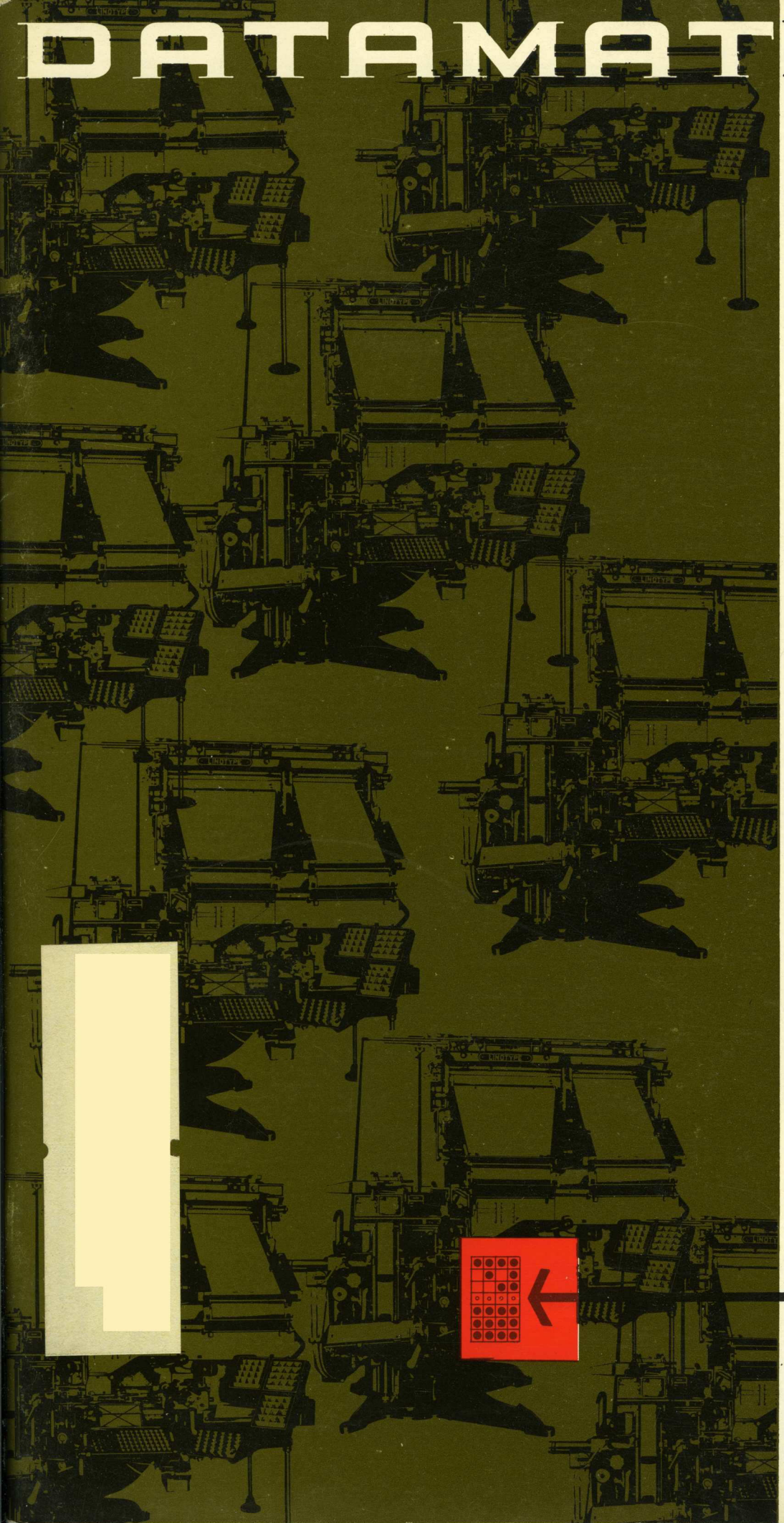
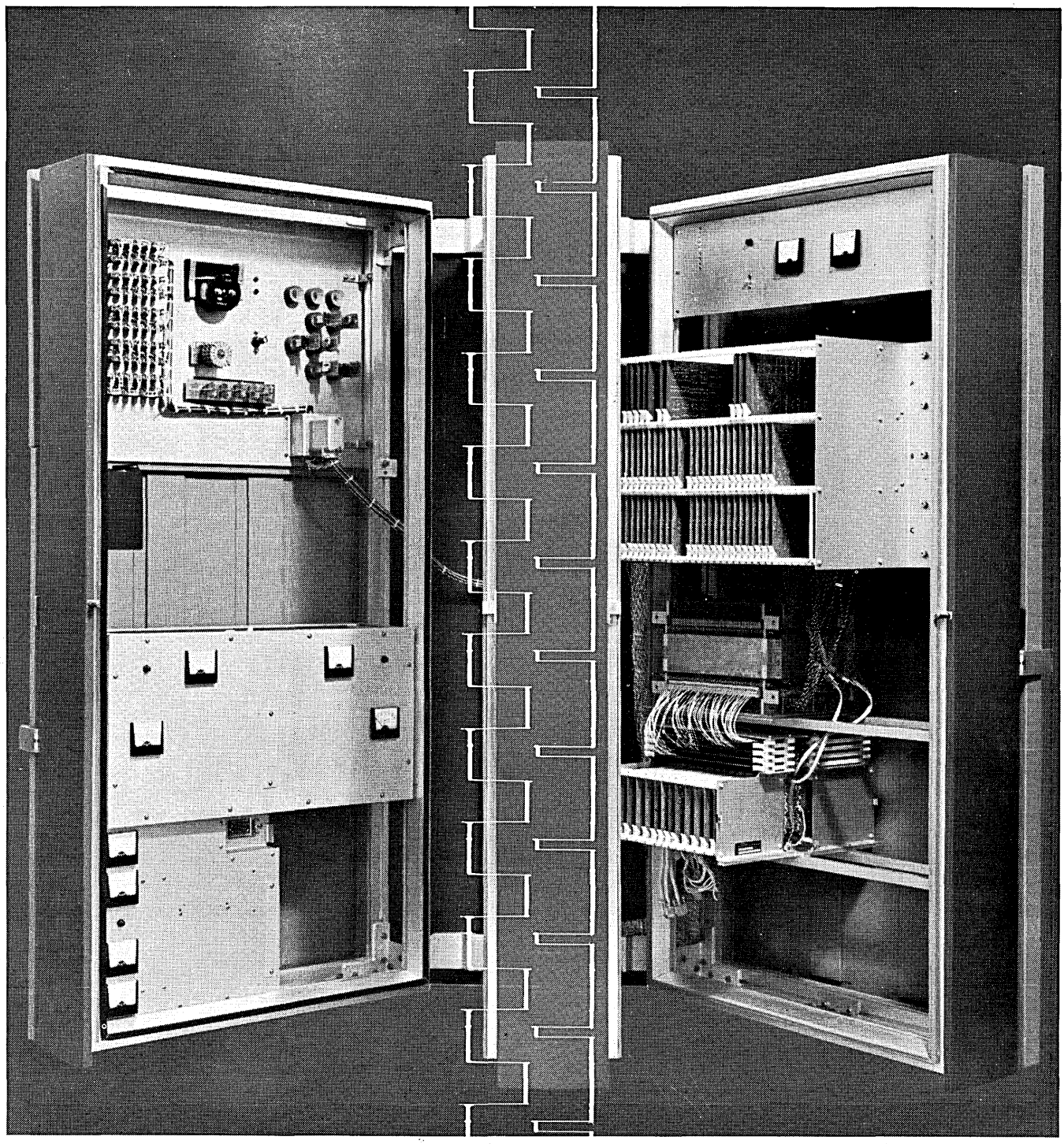
DATAMATION 63®

March

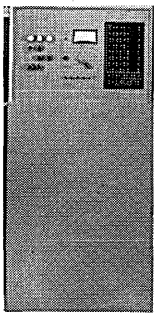


the com
put — er
&
news — print
page 27



What 16,384-word core memory has a complete cycle time of 1 microsecond? **AMPEX LZ**

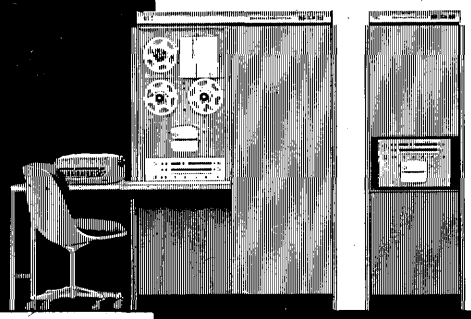
There you have it: the fastest large core memory today. The Ampex LZ. Its cycle time: 1 microsecond. Its capacity: 4096 to 16,384 words. It can handle word lengths of 18 to 72 bits, in 2-bit increments. It can read-restore and clear-write. And it offers twice the capability of the largest memory previously available. Yet occupies approximately half the space. Power requirements are also reduced—by 50%. Second in a series of high-



speed Ampex memories, the LZ is packaged in a new tri-sectional cabinet for easier accessibility. It's made by Ampex Computer Products Company, Culver City, California. A division of the only company providing recorders, tape and core memory devices for every application: Ampex Corporation, 934 Charter Street, Redwood City, California. Sales and service engineers throughout the world. AMPEX 0/1

CIRCLE 1 ON READER CARD

COST
VALUE
SPEED
RELIABILITY
INPUT/OUTPUT
PROGRAMMING



BALANCE

There are two SDS 900-Series computers. The 910 costs $48,000; the 920 costs $98,000. Both are worth twice as much.

Speed? Both add in 16 microseconds. The 920 multiplies floating point in 184 microseconds.

In/Out? Both have six distinct built-in input/output systems.

Programming? Both have complete software including Fortran II.

Reliability? The predicted mean-time-to-failure is 2,000 hours.

Value? We'll take on any computer, in any general purpose scientific/engineering application, on any combination of operating parameters—and in a majority of cases, we'll save you from $10,000 to $50,000 on both purchase and operating costs.

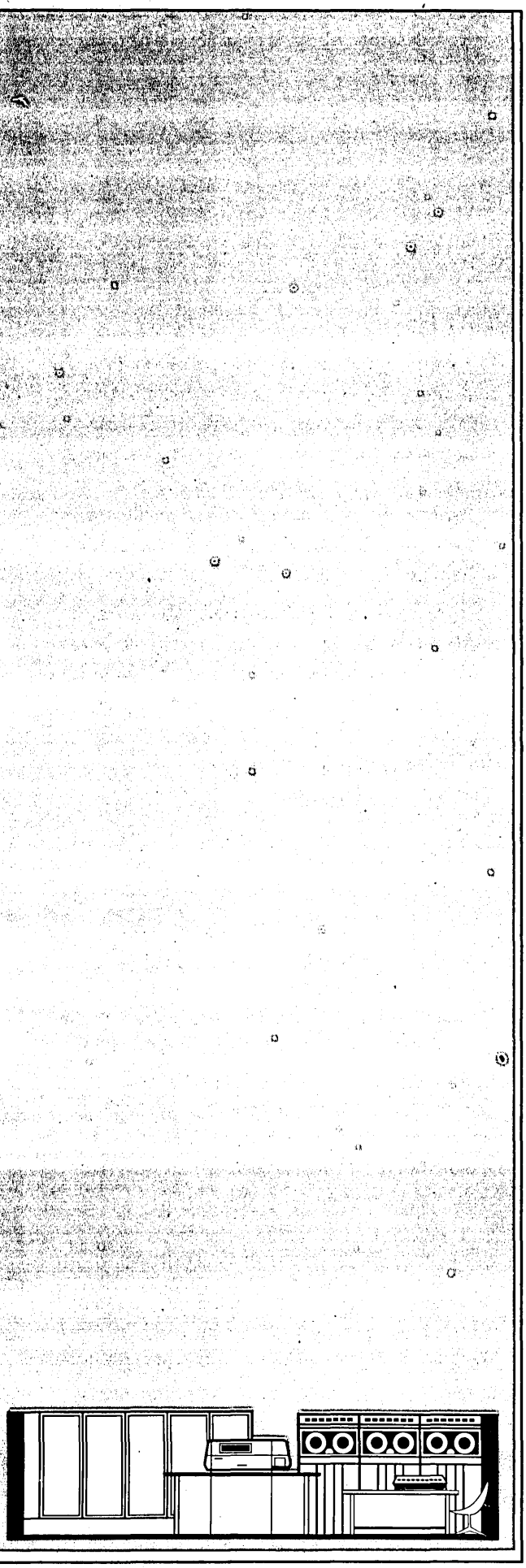
That's what we mean by "balance." May we send you our brochure?

SDS
SCIENTIFIC DATA SYSTEMS
1649 Seventeenth Street, Santa Monica, California

CIRCLE 7 ON READER CARD

Meet the new welterweight champ: the Honeywell 1400

This new big brother to the Honeywell 400 can lick anything anywhere near its own weight. The fastest, dual-purpose intermediate computer around, its 6.5 microsecond access time means speed on the order of 14,000 binary additions per second. Optional floating-point arithmetic and multiply-divide instructions make it a dual-purpose workhorse equally proficient at scientific as well as business data processing tasks.



More memory, more simultaneity

The memory for the new system is available in modules of 4,096 words up to a maximum of 16,384 words. In comparing this with other computers, it is important to remember that a Honeywell word is 12 decimal digits or 8 alphabetic characters, and 16,384 words are equivalent to 196,608 decimal digits or 131,072 alphabetic characters.

A key feature of the Honeywell 1400 is its ability to double-up on many operations. It can read cards, compute, and print at the same time. Or it can read on one tape while writing on another with both moving at full speed. And two high-speed printers can be operated simultaneously.

Handles more tape units

The ability to control up to eight magnetic tape units is standard with the Honeywell 1400. Control of an additional eight is optional. Three models of tape units — economy, standard and high density — are available, with transfer rates of 48,000, 96,000, and 133,000 decimal digits per second, respectively. All tape units feature Honeywell's famous vacuum-actuated tape transport design and Orthotronic Control, a unique automatic error detection-correction system.

Meets any peripheral requirements

Peripheral equipment includes a 900-line-per-minute high speed printer which can be operated on-line or off-line, and print storage and control options to permit simultaneous printing by two printers; a 650 card per minute card reader; and a reader/punch that reads 850 or punches 250 cards per minute. A card storage option permits card reading or punching concurrent with other operations.

Paper tape equipment, disc storage units, optical scanning and Orthoscanning devices and communications control units are also available for use with the Honeywell 1400.

Features EASY programming

The Honeywell 1400 central processor has many features that make it easy to program. These include: three-address instructions, choice of binary, alphanumeric or decimal information, program interrupt, three index registers, edit instructions and masking operations. Programming aids for the Honeywell 1400 are compatible with the Honeywell 400 system. EASY assembly language, COBOL, and the AUTOMATH scientific (algebraic) compiler form the basic software package. Programs for the Honeywell 1400 can be run and tested on Honeywell 400 or large-scale Honeywell 800 computers.

Has speed and precision to spare

The use of unique three-address instruction enhances the Honeywell 1400's high internal operating speeds. Typical add-time for a single three-address instruction is 77 microseconds. The floating point arithmetic unit uses a 12 digit number system, which includes a sign (one digit), exponent (two digits) and mantissa (nine digits).

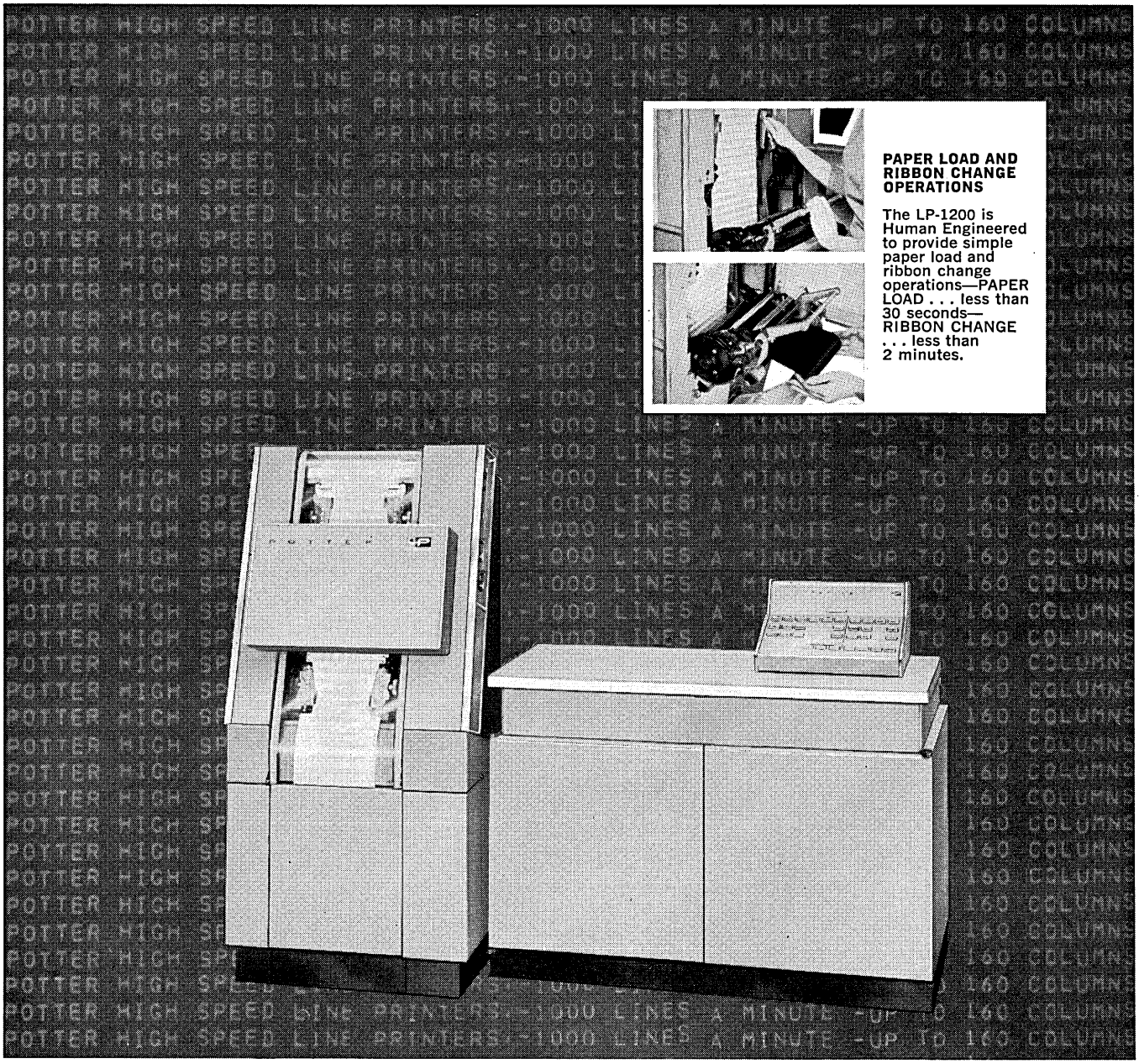
Rounds out the Honeywell line-up of champions

The 1400 is the latest addition to the fast growing line of Honeywell computers. Purchase price, depending on size and configuration, ranges from $450,000 to $900,000; corresponding monthly rentals range from $10,000 to $20,000. Delivery time is nine months. For a complete run-down on the new 1400 — or, for that matter, the Honeywell 400, Honeywell 800 or Honeywell 1800 — just contact any Honeywell EDP sales office or write to Honeywell EDP, Wellesley Hills 81, Mass. In Canada, Toronto 17, Ontario.

Honeywell

ELECTRONIC DATA PROCESSING

CIRCLE 8 ON READER CARD



PAPER LOAD AND RIBBON CHANGE OPERATIONS

The LP-1200 is Human Engineered to provide simple paper load and ribbon change operations—PAPER LOAD . . . less than 30 seconds—RIBBON CHANGE . . . less than 2 minutes.

This Printer System Can Save $50,000 Per Year In Computer Time!

The LP-1200 High Speed Printer System provides unusual savings of computer time through the use of magnetostrictive delay lines. This innovation permits compatibility with the fastest systems — conserves computer loading time by 20:1 or more!

Is your computer system fast enough to take advantage of LP-1200's performance? If so, our representative can show you how computer time savings of up to $50,000 a year can be realized. Write today, for full information.

THE LP-1200 FEATURES:

- **LOW COST BUFFER STORAGE** . . . Computer proven Magnetostrictive Delay Lines provide compatibility with the fastest computer systems.
- **NEW DELAY LINE AMPLIFIER** . . . Peak Detection circuit improves reliability at higher frequencies.
- **QUALITY HIGH SPEED PRINT-OUT** . . . Vacuum Paper control, coupled with high speed paper feed produces clean, sharp impressions.
- **HUMAN ENGINEERING** provides . . . quick, front paper loading, ease of ribbon change, access to drum and hammers, convenient operating controls.
- **ADDITIONAL FEATURES** . . . non-wearing Elastomeric torsion bearings assure long hammer life; low inertia drive belts minimize clutch and brake wear.
- **12 WEEK DELIVERY**

POTTER INSTRUMENT COMPANY, INC.
PRINTER DIVISION • *East Bethpage Road • Plainview, New York*

T.M.

CIRCLE 9 ON READER CARD

DATAMATION 63

the automatic handling of information

volume 9, number 3

Staff

EDITORIAL OFFICES

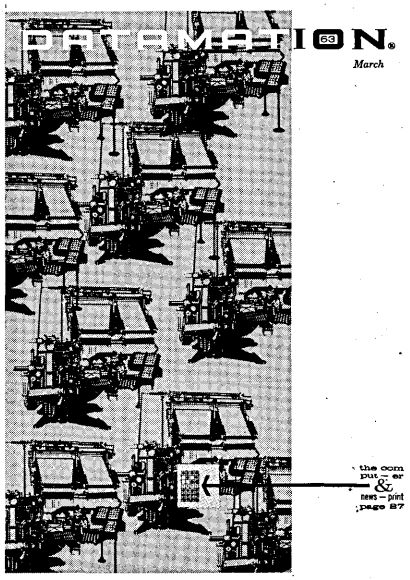
1830 WEST OLYMPIC BLVD.
LOS ANGELES 6, CALIF.

Microfilm copies of **DATAMATION** may be obtained from University Microfilms, Inc., 313 No. First St., Ann Arbor, Mich.

Feature Articles

Departments

THIS ISSUE—45,214 COPIES



Cover

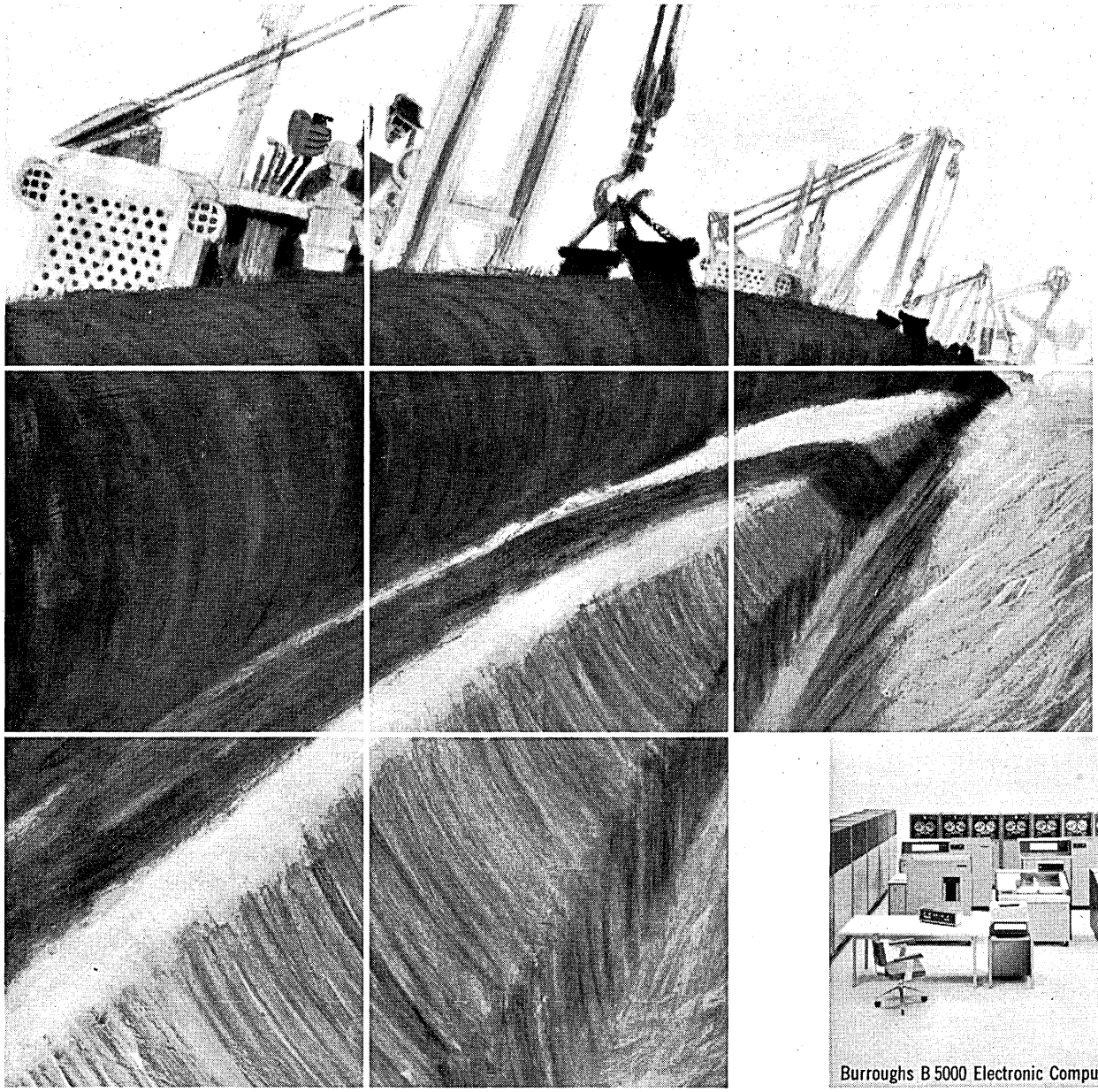
Too early to accurately measure the worth of edp in newspaper composition, initial stirrings of this application however, have prompted nationwide attention and the editorial focus for a six page *Datamation* survey. Art Director Cleve Boutell offers her sprightly, graphic interpretation for this month's cover design.

Circulation audited by Business Publications Audit BPA

Member, National Business Publications NBP

DATAMATION is published monthly on or about the tenth day of every month by F. D. Thompson Publications, Inc., Frank D. Thompson, president. Executive Circulation and Advertising offices, 141 East 44th St., New York 17, N.Y. (MUrray Hill 7-5180). Editorial offices, 1830 W Olympic Blvd., Los Angeles, 6. Published at Chicago, Ill. Controlled Circulation paid at Columbus, O. Form 3579 to be sent to F. D. Thompson Publications, Inc., 201 N. Wells St., Chicago 6, Ill.

Printed by Beslow Associates, Inc.



Burroughs B 5000 Electronic Computer System

Northern Natural Gas had a million reasons for ordering a Burroughs B 5000

Actually, a million one hundred thousand reasons.

Because that's how many consumers the Northern Natural Gas Company in Omaha, Nebraska, serves. And Northern is continually expanding its vast network of pipelines that stretches from Texas deep into Northern Minnesota.

So they are depending upon the large-scale B 5000 EDP system to not only increase the efficiency of present operations but to help cut costs on new operations as well.

It will be used in solving scientific problems, such as the most economical way to increase gas supplies to present customers and build facilities to serve new customers. It will also be used in solving the company's business data processing problems.

In every phase of its operation, Northern looks forward to greater efficiency because of the B 5000. For full details write us at Detroit 32, Michigan.

Burroughs Corporation

so many data processing problems end with Burroughs

Burroughs—TM

CIRCLE 10 ON READER CARD

important DATES

- The IEEE International Convention will be held March 25-28 at the Coliseum and the Waldorf Astoria, N.Y.C.

- The IEEE International Conference on Nonlinear Magnetics will be held at the Shoreham Hotel, Washington, D.C., April 17-19.

- A conference on "Problem of Cybernetics" will be held April 23-25 in Karlsruhe, Germany.

- The Electronic Components Conference will be held May 7-9 at the Marriott Twin Bridges Hotel, Washington, D.C. Sponsors are the PGCP, AIEE, and the EIA.

- The 1963 Spring Joint Computer Conference will be held May 21, 22 and 23rd at the Cobo Hall, Detroit, Michigan.

- The Fourth Joint Automatic Control Conference will be held at the University of Minnesota, Minneapolis, on June 19-21. Sponsors are the American Institute of Chemical Engineers, IEEE, and American Society of Mechanical Engineers.

- The annual International Data Processing Conference and Business Exposition, sponsored by the Data Processing Management Association, will be held June 25-28, at Cobo Hall, Detroit, Michigan.

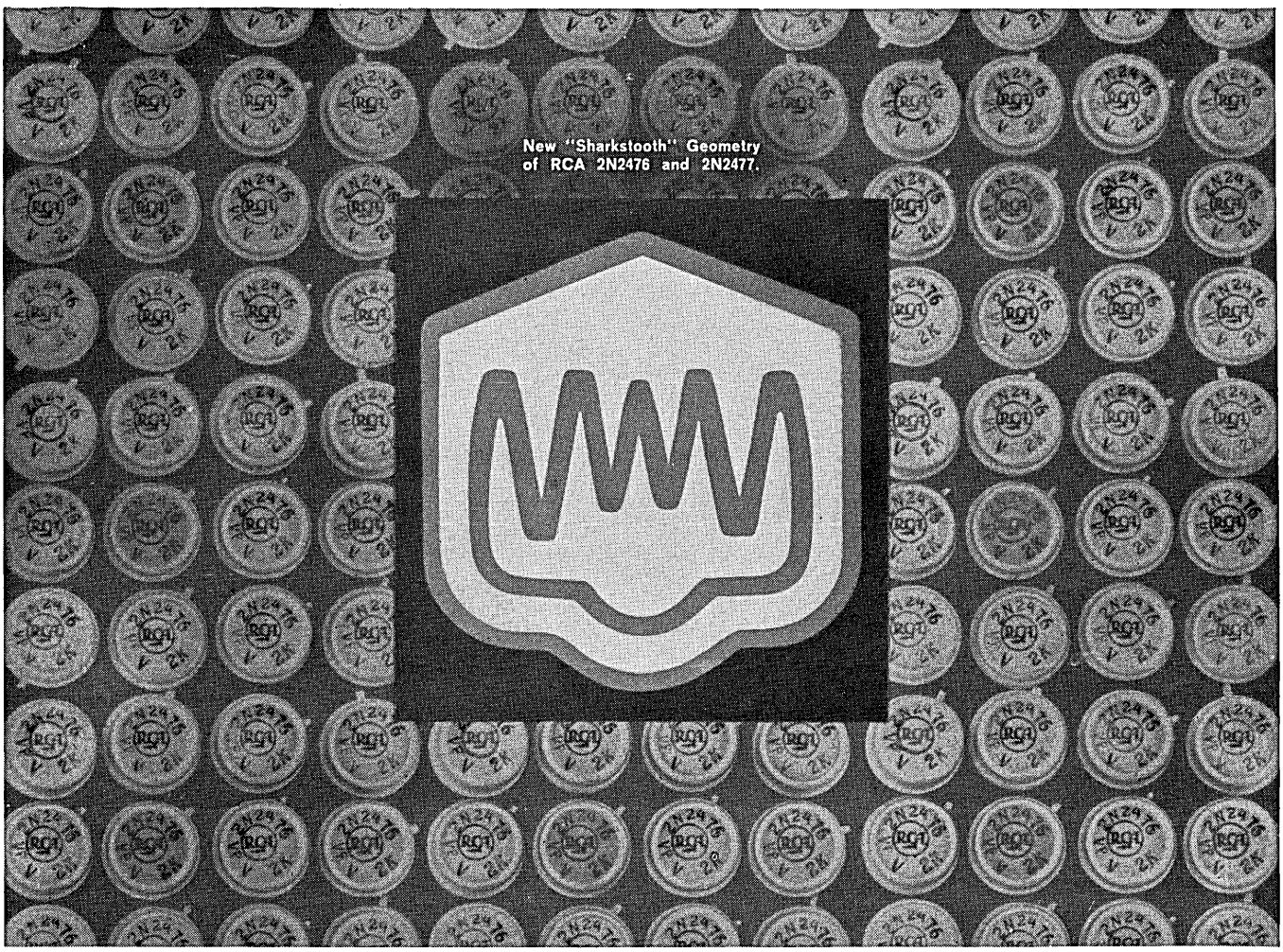
- The 1963 ACM National Conference will be held Aug. 28, 29, and 30th in Denver, Colorado.

- The 1963 Fall Joint Computer Conference will be held in the Las Vegas, Nev., Convention Center, Nov. 12-14.

- The Fifth International Automation Congress & Exposition has been scheduled for November 19-21 at the Sheraton Hotel, Philadelphia.

- The 1964 Spring Joint Computer Conference will be held at the Washington Hilton Hotel, Washington, D.C., May 26-28.

- The IFIP Congress 65 is scheduled for New York City in May, 1965. It is the first International Congress scheduled for the United States.



The Revolutionary New RCA 2N2476 & 2N2477

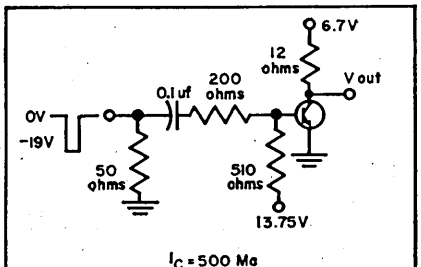
Switch 500 Milliamperes in 50 Nanoseconds

Unique "SHARKSTOOTH" geometry of RCA's new Silicon NPN 2N2476 and 2N2477 provides new levels of performance as core or line drivers in high-speed memory circuits, and in other high-frequency, high-current applications.

The unique internal geometry of RCA's new 2N2476 and 2N2477 achieves a much larger emitter periphery AND a substantially reduced emitter area, providing high beta over a wide range of collector currents AND excellent switching speeds at high currents. For example, these new types have more than adequate speed and current capabilities for driving RCA's new Microferrite Memory Stacks. Check these outstanding performance features:

- **Excellent high-current beta**...20 typ. at Ic = 1 amp. for the 2N2476; 40 typ. for the 2N2477 (pulsed condition).
- **Low V_{CE} (Sat) at High Currents**... V_{CE} (Sat) = 0.75V max. for the 2N2476, 0.65V max. for the 2N2477 at Ic = 500 ma, I_B = 50 ma.
- **Low Collector Capacitance** . . . 10pf max.
- **Short Turn-On Time**...25nsec. max., Ic = 150ma, $I_{B_1} = I_{B_2}$ = 15ma.
- **Short Turn-Off Time**...45nsec. max., Ic = 150ma, $I_{B_1} = I_{B_2}$ = 15ma.
- **Dissipation**...0.6 watt max. free-air temp. up to 25°C (in TO-5 case).
- **Gain-Bandwidth Product**...250 Mc min.

Call your RCA Representative today for complete information or write RCA Semiconductor and Materials Division, Commercial Engineering, Section CD3, Somerville, N.J.



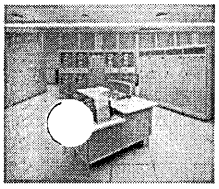
AVAILABLE THROUGH YOUR RCA DISTRIBUTOR

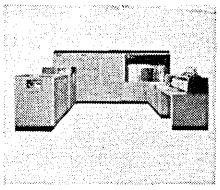
THE MOST TRUSTED NAME IN ELECTRONICS

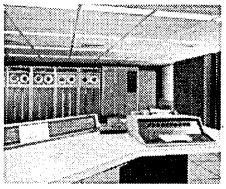
RCA SEMICONDUCTOR & MATERIALS DIVISION FIELD OFFICES . . . EAST: Newark, N.J., 744 Broad St., HU 5-3900 • (Camden-Philadelphia Area) Erlton, N.J., 605 Marlton Pike, HA 8-4802 • Syracuse, N.Y., 731 James St., Rm. 402, GR 4-5591 • Baltimore, Md., EN 9-1850 • **NORTHEAST:** Needham Heights 94, Mass., 64 "A" St., HI 4-7200 • **SOUTHEAST:** Orlando, Fla., 1520 Edgewater Dr., Suite =1, GA 4-4768 • **EAST CENTRAL:** Detroit 2, Mich., 714 New Center Bldg., TR 5-5600 • **CENTRAL:** Chicago, Ill., Suite 1154, Merchandise Mart Plaza, WH 4-2900 • Indianapolis 5, Ind., 2132 East 52nd St., CL 1-1405 • Minneapolis 16, Minn., 5805 Excelsior Blvd., WE 9-0676 • Denver 11, Colorado, Continental Terrace Bldg., Suite 301, 2785 N. Speer Blvd., 477-1688 • **WEST:** Los Angeles 22, Calif., 6801 E. Washington Blvd., RA 3-8361 • (San Francisco Area) Burlingame, Calif., 1838 El Camino Real, OX 7-1620 • Seattle 4, Wash., 2250 First Ave. S., MA 2-8816 • **SOUTHWEST:** Dallas 7, Texas, 7905 Carpenter Freeway, ME 1-9720 • **GOV'T:** Dayton, Ohio, 224 N. Wilkinson St., BA 6-2366 • Washington, D. C., 1725 "K" St., N.W., FE 7-8500 • **RCA INTERNATIONAL DIVISION,** 30 Rockefeller Plaza, New York 20, N. Y. Cable Address: RADIOINTER, N. Y.

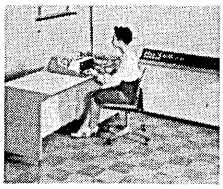
Visit The RCA Exhibit at IEEE

CIRCLE 45 ON READER CARD

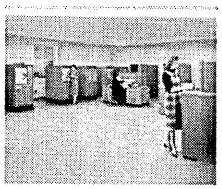

GE-210

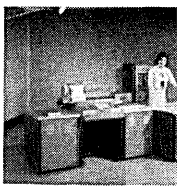

IBM Ramac 305 I

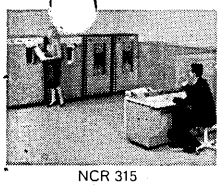

Honeywell 1800


General Prec. RPC-4000

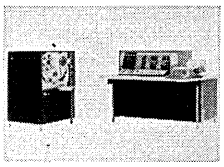

RCA 301


Univac File Comp. 1

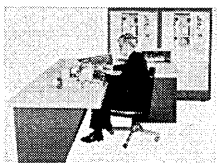

NCR 390

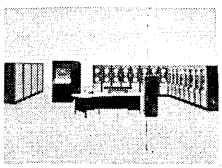

NCR 315

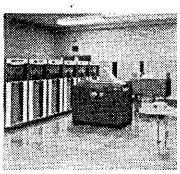

Teleregister Telefile


IBM 1620


ITT 7300 ADX System

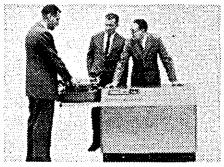

Adv. Scientific ASI 210

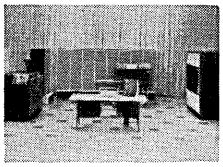

Philco Model 212

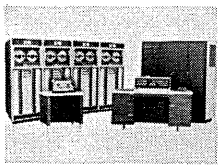

IBM 7044

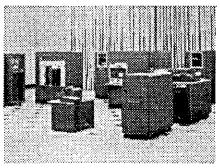

GE 225

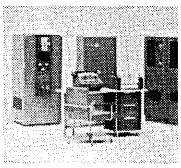

Univac 1101

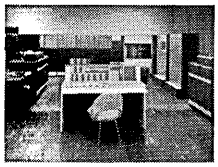

General Prec. LGP-30

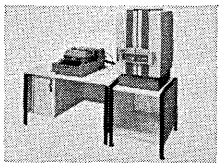

IBM 1410 (All Types)

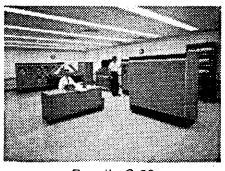

Control Data 924

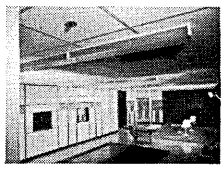

IBM 650 (All Types)

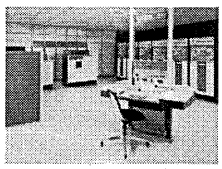

Bendix G-15

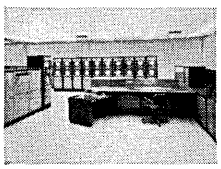

IBM 7094

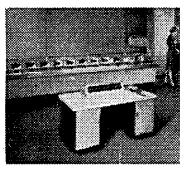

Packard Bell PB 250

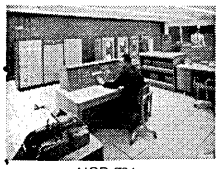

Bendix G-20

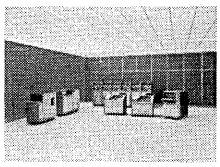

Univac 490

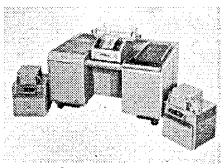

Univac 1107

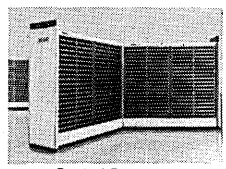

Philco Model 211

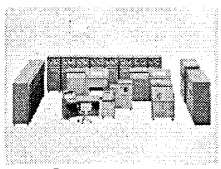

NCR 310

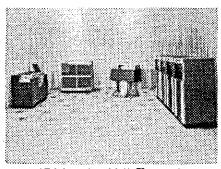

NCR 304

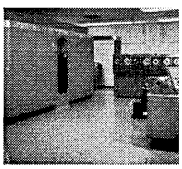

Burroughs B280

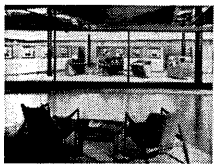

Burroughs E103

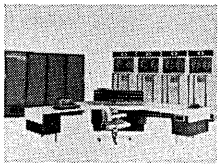

Control Data 3600

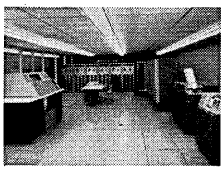

Burroughs B5000

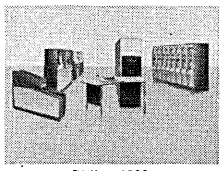

IBM 1401 (All Types)

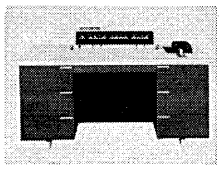

Univac II


RCA 501


Control Data 1604-A


Honeywell 400


Philco 1000


Control Data 160

Univac III

IBM 7090

IBM 7040

Univac 1105

Monroe Monrobot XI

Control Data 160A

Philco Model 210

Honeywell 800

Alwac III-E

What do these 49 computers have in common?

They can "listen" and "speak" with punched tape (or electrical signals) from Teletype equipment. This means that Teletype equipment and tape-to-tape systems—connected by existing communications channels—put your computer at the disposal of your most remote operation. You thus assure optimum use of your computer, and at the same time you provide vital operating data wherever needed—quickly, regardless of the distance involved.

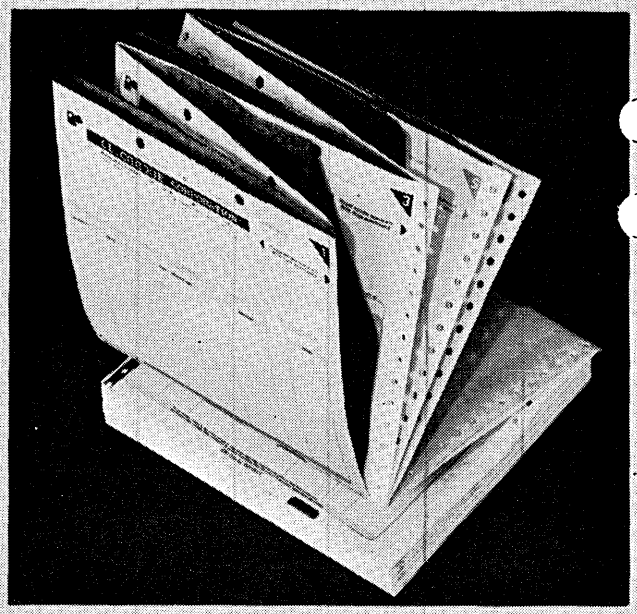
Teletype equipment is made for the Bell System and others who require the utmost versatility from their communications systems.

For additional information on how Teletype equipment can serve your message and data communications needs, contact: Teletype Corporation, Dept. 81C, 5555 Touhy Avenue, Skokie, Illinois.

TELETYPE®
CORPORATION SUBSIDIARY OF *Western Electric Company* INC.

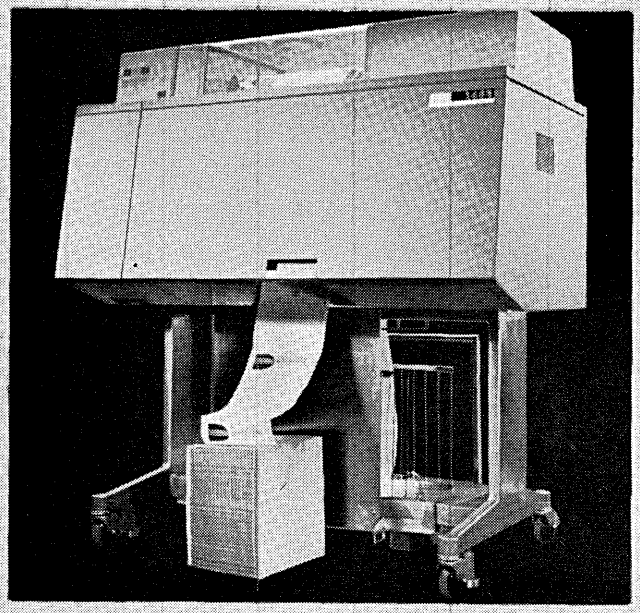
CIRCLE 19 ON READER CARD

Moore interleaved fanfold...

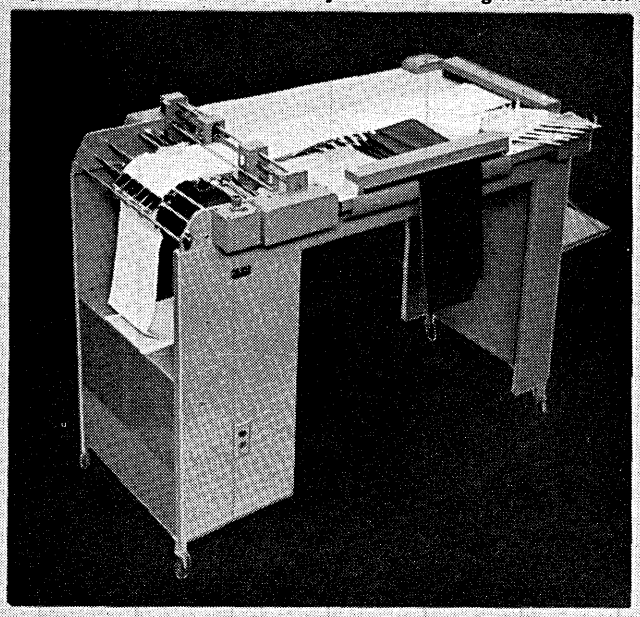


FANFOLD CONSTRUCTION lends itself to copy control, later-entry operations, routing, filing and other writing and later handling operations.

DESIGNED for best performance in any forms-writing, subsequent-handling system. Ideal for high-speed printer volume production.



FANFOLD WORKS on your auxiliary equipment . . . decollators, detachers, imprinters. Offers maximum efficiency in forms-handling time and costs.

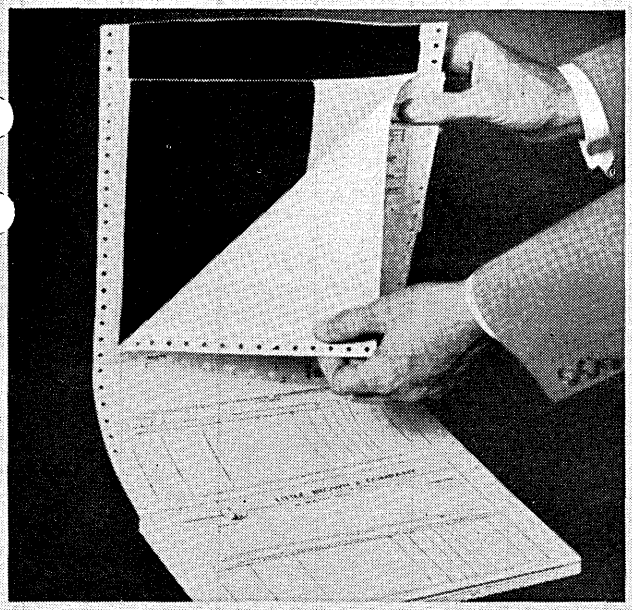


MOORE FANFOLD has many fine features and the finest is its versatility. Fanfold is adaptable to every development in the forms-writing field.

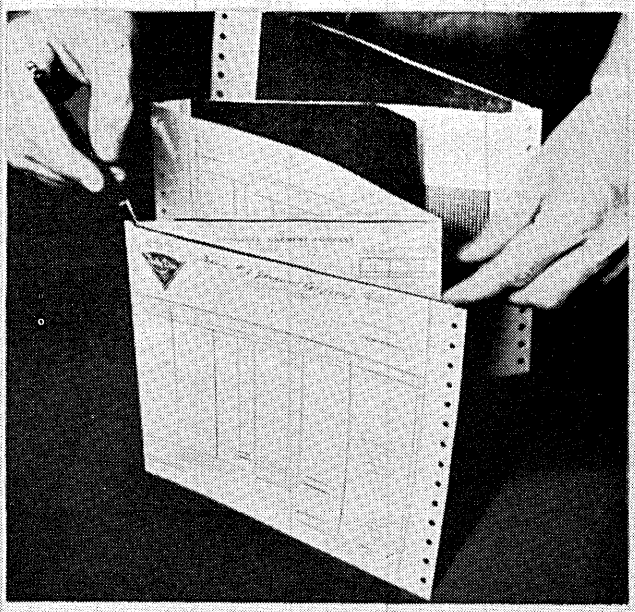
When some or all parts and carbons must be held together for later entries, filing, or distribution, Moore's unique method of manufacture assures absolute register throughout all writing and post-writing operations.

Fanfold, supplied in longer, unbroken strips of forms, limits downtime on all types of high-speed writing machines and auxiliary equipment.

It offers many system-building possibilities: You can have wide and narrow parts and carbons at either or both sides of the set; strip-coated or narrow carbons; a wide selection of punching or perforations within the set. Any method or combination of methods for decollating can be designed into a system.



CARBONS are short of control punching. They never interfere, vibrate, shift or creep in the set while being written over any kind of machine.



FANFOLD SIDE TIES and flexible control margins hold together in perfect alignment for trouble-free operation on all speed writing equipment.

A MORALE BOOSTER for staff thanks to trouble-free operation. Fanfold has top-quality, high-economy features not to be found in other forms.

the form with versatility built in

Construction can be varied to supply one or more Speediset sections within the Fanfold form; can be furnished on paper suitable for whiteprint duplicating processes; or to supply tab cards with prepunching for automatic processing of source documents . . . all system requirements to reduce manual forms handling.

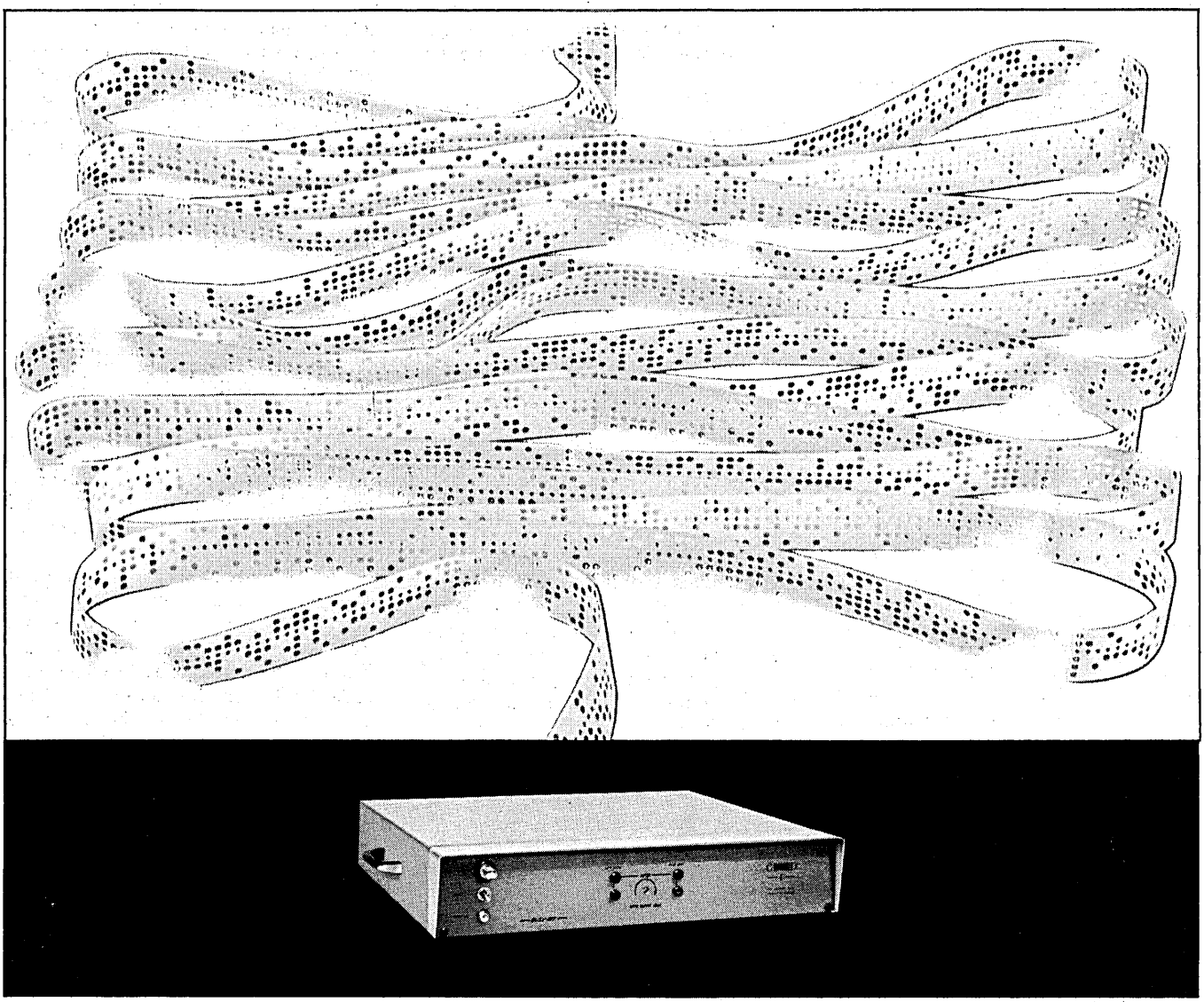
Fanfold perforations are 'system perfs.' The exactly right perforation or combination of perforations is selected for each individual job. Perforations can even be eliminated from carbons for trouble-free mechanical deleaving. Let the Moore man demonstrate Fanfold's many system possibilities. If you work with forms we can show how to make forms work for you.

'The right business form for every form of business'

NIAGARA FALLS, NEW YORK · PARK RIDGE, ILLINOIS · DENTON, TEXAS
EMERYVILLE, CALIF. · OVER 500 OFFICES AND FACTORIES IN NORTH AMERICA

MOORE BUSINESS FORMS INC

CIRCLE 15 ON READER CARD



NOW! HIGH-SPEED DATA TRANSMISSION GOES FRUGAL!

BUSY-BIT*

Up to 2400 bits per second
Uses low-quality telephone lines for rates up to 2000 bits per second
Low initial costs
Light, Compact, and Reliable

Busy-Bit—from General Dynamics/Electronics—is the compact new Model SC-309 communication product that brings the cost of high-speed digital data transmission down to new levels of economy. □ Busy-Bit sends and receives, in either a synchronous or asynchronous mode, up to 2000 bits per second—2400 bit per second operation is synchronous only. (For a specific data rate, we can provide integral regenerated receiver timing.) □ Its physical characteristics speak for themselves. Its dimensions are: 19 x 3½ x 17½ inches—Weight: 16½ pounds. □ To install Busy-Bit, you place it on a desk or mount it in a rack, plug it into an ordinary wall socket and set the transmitter level. After that, Busy-Bit is ready to go—any time and immediately—at the flick of a switch. □ Reliability? Exceptional. Take the matter of transistors and diodes. Only one type of each is used... and each type is one of the most dependable made. This also drastically reduces your spare parts requirements. □ Busy-Bit costs less than $2000 a unit to own. You'll amortize this in no time at all in toll savings and in increased efficiencies. □ You'll want more information and specifications for Busy-Bit. Write us at 1470 North Goodman St., Rochester 1, N. Y.

*Trademark: General Dynamics Corporation

GENERAL DYNAMICS | ELECTRONICS

CIRCLE 16 ON READER CARD

letters

maturing women

Sir:

Your news editor made compelling points in her January article on "'The Woman Programmer." However, she scarcely did justice to the subject in failing to mention that women, in several instances, were first to take up the gauntlet in this field.

Indeed the earliest, and also the only programmer prior to the present century, was Ada Agusta, Countess of Lovelace and daughter of the poet, Lord Byron. Her subroutines for Babbage's universal machine have been brought to light in B. V. Bowden's book, "Faster Than Thought."

The "grandmother" of American programmers is the title often attached to Grace Hopper, who began programming as far back as 1946 for the Harvard Mark I computer. In 1948, the first scientific problem was solved on the EDSAC computer at the University of Cambridge—this being achieved by a Canadian woman who later joined the first group of programmers to work with the FERUT Computer at the University of Toronto.

Also in 1948, the English woman, Cicely Popplewell became one of the earliest programmers for the first University of Manchester computer, writing codes for many of Alan Turing's projects. She now uses her knowledge of foreign languages to teach programming abroad and help edit proceedings at international computer conferences.

Beatrice Worsley
Assistant Professor
Institute of Computer Science
Univ. of Toronto
Toronto, Canada

maturing men

Sir:

I have read and reread Patrick's article and I find it difficult to understand what he is trying to tell the reader. Was this a "tongue-in-cheek" article in which he wanted to start a controversy? I believe he succeeded! In his third paragraph he implied that those 100 or so "inner circle" men in the early days of the computing profession are no longer powerful leaders today and they are not making major contributions in the digital computer field.

This inference should not go unchallenged . . . These 100 plus men are leaders—leaders in their own companies within their own installations. Indefatigably they are continuing to lay ground rules and educate others in the company in the proper use of computers; they are conveying the meaning of computing to personnel in other complexes of the company and outside where permitted. These techniques require technical skill and patience in solving the customer's intricate problems. In addition, they are providing work for the technicians in the computer field.

The real leadership in computing today seems to be in the activity of disseminating the information of what the computer can do in the industrial world. This requires experienced individuals with technical knowledge and the ability to convince the prospective user of the benefits of using computers. I think you will find many of the old timers are the leaders in this activity.

James A. Porter
Cincinnati, Ohio

Sir:

R. L. Patrick claims membership in the "100 or so . . . inner circle" but experienced no transition from CPC's to 701's! What happened to three years of production computation on at least four UNIVACS??

Arnold L. Lawstein
IBM
Yorktown Heights, N. Y.

Sir:

R. L. Patrick's article, "The Maturing Field", and the January *Datamation* proved to be excellent reading. As an eight year veteran in this field of new and constantly changing concepts and machines, your spotlight on people was refreshing.

As Mr. Patrick points out, to keep on or near the top requires insight, imagination, a continued enthusiasm for your work and plain, old fashioned hard work, especially in data processing.

Ted W. Sable
UNIVAC
Philadelphia, Pa.

a fishless story

Sir:

While we're reading your COBOL discussions with great interest, we're using NELIAC for business programming with fantastic success. We hesitate to make some legitimate claims with respect to business programming with NELIAC lest they be branded as "fish stories." We're pleased to be so far beyond the assemblers which most compilers, by comparison, seem to be.

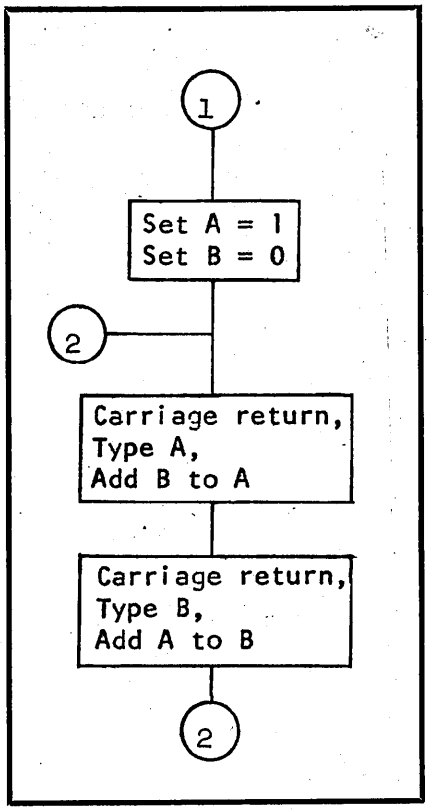
Viola Stroup
Management Technician
U. S. Navy Electronics Lab
San Diego, Calif.

plaudits for Fred

Sir:

Fred Gruenberger's diary of his seventh grade computing class which appears in your January issue is one of the most delightful articles I have seen in the magazine. My delight stems, partly, no doubt, from the favor in which I hold such well-planned and well-executed challenges to the intellect of bright children.

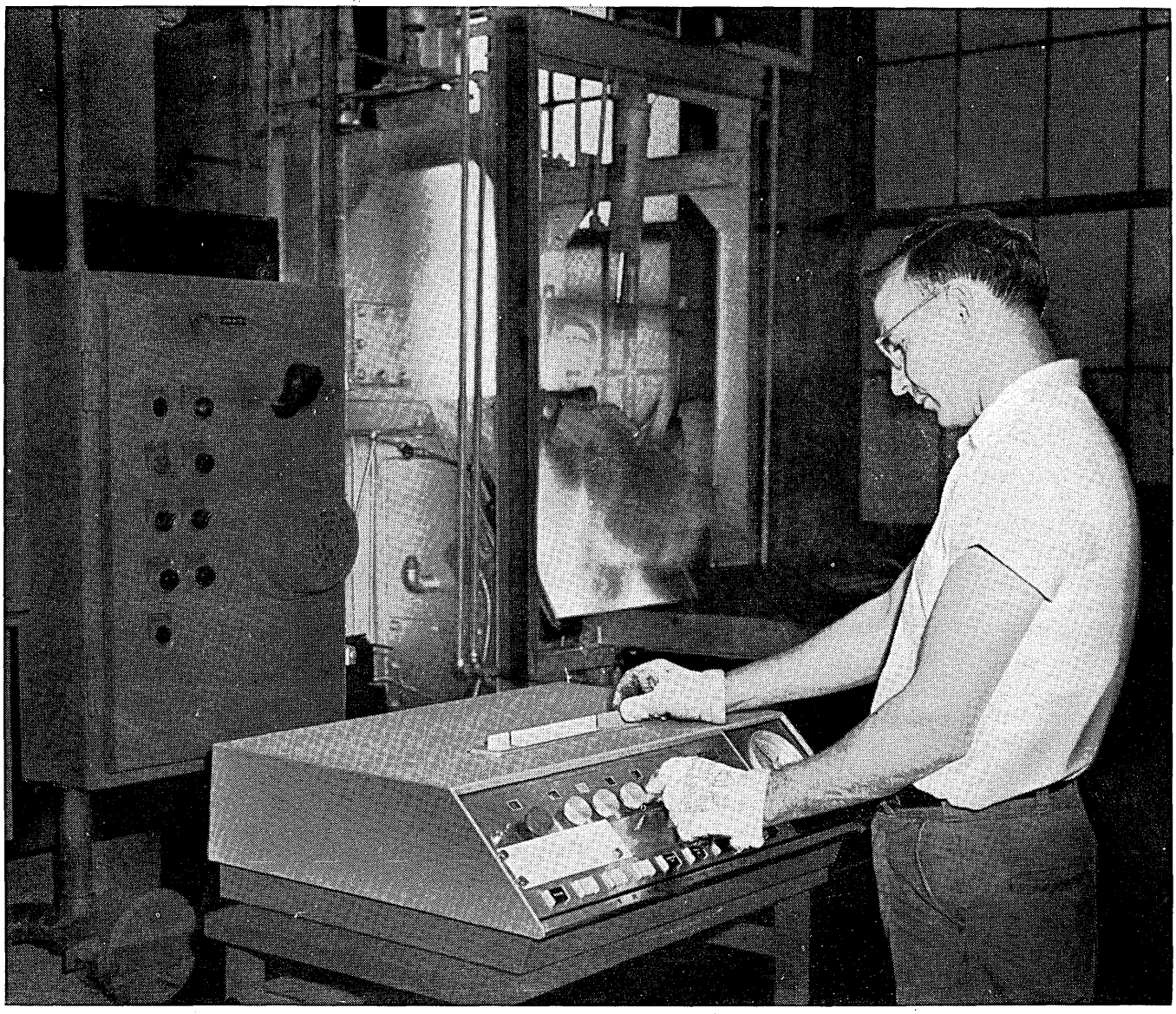
The Fibonacci series, which Fred mentions several times in the diary, deserves somewhat more discussion. First, does it really have a first term? The four terms (1, 0, 1, 1) which precede the first one he mentions on June 29, can be included in the computer output if the flow-chart of July 12, is slightly modified as follows:



This seems a little more "elegant" in that it doesn't "waste" the first two values of A and B.

Millard H. Perstein
System Development Corp.
Santa Monica, Calif.

TO MANUFACTURING MANAGEMENT:



NOW . . . data can be captured right where the transactions occur . . .

Are you being bombarded with problems that could have been solved had you only been given the facts in time to take effective action?

Are you getting **today's** data **today?** Or, are you getting reports which can be classified as ancient history?

Does your data collection system provide the type of timely information you need to effectively monitor and evaluate production performance, quality control, inventory, manpower, standards, etc?

NOW, with NCR's TRANSACTER* Source Data Collection System, data can be captured right where the transactions occur. It is then flashed over cables to a central collection point where it is fed into your processing system and converted into action-type reports — in time for your decisions to be most effective.

INTERESTED? Write to Data Collection Systems and Sales Division of The National Cash Register Company, Dayton 9, Ohio. A special Manufacturing Management Report will be sent to you by return mail.

*TRANSACTER is a trademark of the General Time Corp.

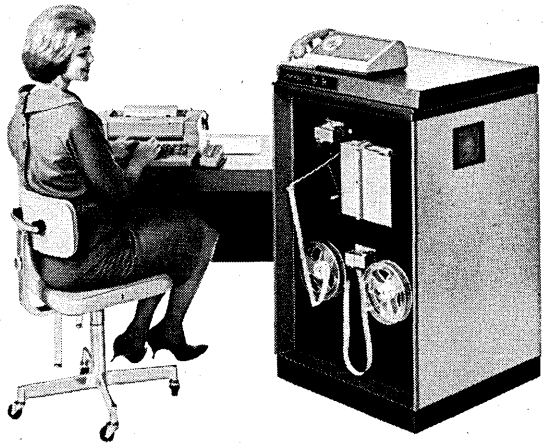
NCR PROVIDES TOTAL SYSTEMS—FROM ORIGINAL ENTRY TO FINAL REPORT—
THROUGH ACCOUNTING MACHINES, CASH REGISTERS OR ADDING MACHINES, AND DATA PROCESSING
The National Cash Register Co. • 1,133 offices in 151 countries • 79 years of helping business save money

NCR

CIRCLE 17 ON READER CARD

You can continuously control your  or  or  inventories with a Tally Data Communications System in Chicago, New York, Miami, Boston, and Seattle from your EDP Center in San Francisco for only $580* a month.

Shouldn't you?



An informative new brochure on Tally Data Communications Equipment is yours for the asking. It tells all about such things as high accuracy parallel transmission, quick delivery, our nationwide computer trained service organization, and all the various paper tape systems offered by Tally. For your copy please address Tally Register Corporation, 1310 Mercer Street, Seattle 9, Washington.

**$580 covers rental of 5 transmit stations, 1 receive station, and all required data phone sub-sets.*

TALLY®

CIRCLE 18 ON READER CARD

we know the light source will burn out!

(eventually)

But even the light source in a Digitronics photo-electric perforated tape reader has extra-ordinary life. A source under test is still burning after 18 months. All's to say that you'll need very few replacement parts ever in a Digitronics reader. High derating factors on all parts and careful design insure continuous use.

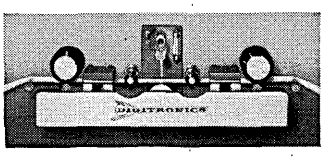
The number of moving parts has been reduced to a minimum. Ball bearings are double-shielded, so dust can't filter in. All of the metal parts are made of corrosion-resisting stainless steel or aluminum anodized to a sapphire-hard finish. And, the circuitry is all solid state.

To meet any of your perforated tape reading requirements, Digitronics photo-electric units are designed on the modular principle. These readers are capable of accommodating 5 to 8 level tape interchangeably at 60 to 5000 cps. Tape handlers are also available for 5 to 8 level tape up to 1000 cps.

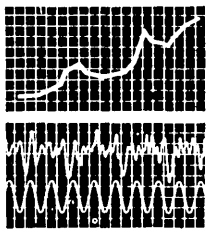
For information, write Digitronics Corp., Albertson, N.Y.

DIGITRONICS PERFORATED TAPE READERS

Where every bit counts



CIRCLE 35 ON READER CARD



BUSINESS & SCIENCE

ENGINEERS REFLECT ON SOFTWARE COSTS

An unusual source for fact gathering on the softer side of computing, the Institute of Electrical and Electronics Engineers (IEEE) recently reported some striking comparative statistics on the economic significance of programming.

At the Institute's '63 Winter General Meeting in New York City, a special Ad Hoc Group of the IEEE's Computer Devices Committee announced that one billion dollars of hardware had been sold in 1962, and an additional $500,000,000 spent for computer programming during the same period.

Anticipating even greater expenditures in future years, the group described the present state of languages and compilers as "chaotic...and in need of further development and rigorous definition which standards activities can bring."

I TOUCHED A B-5000

Late last month, DATAMATION was treated to a close view, feel and smell of the much-discussed B-5000. Its weenie console and modular main frame are now on the air at Burroughs' Pasadena plant.

Hailed in its conceptual stage as the machine without hardware, the 5000 is indeed a reality with the first external shipment directed this month at Huntsville, Ala. Other installations are scheduled at the rate of two per month. Over 20 5000 orders are reported in house.

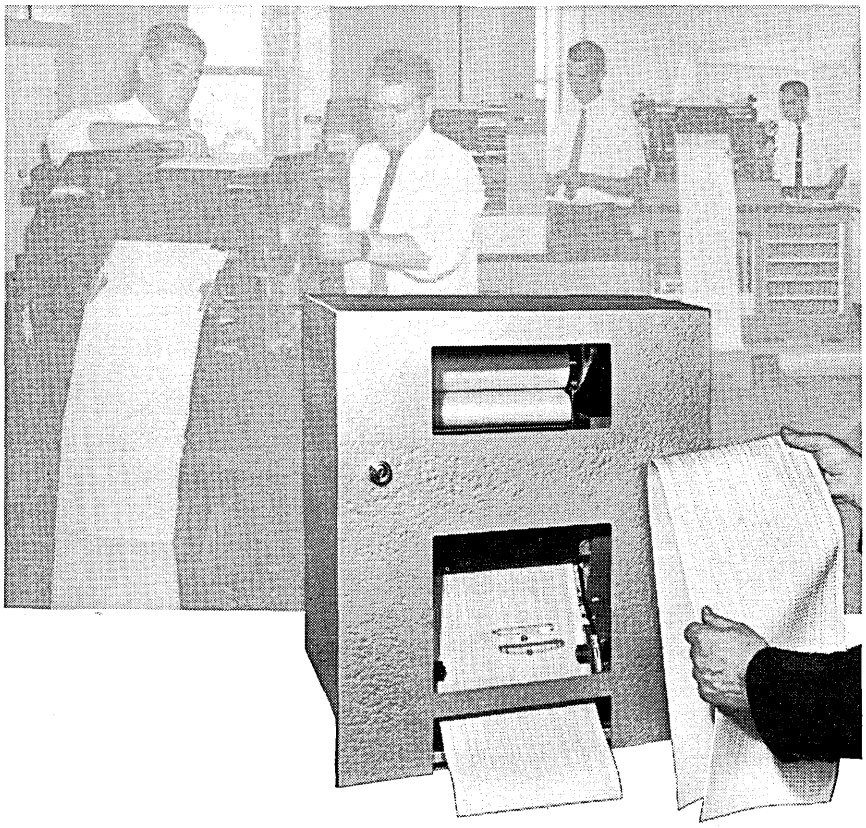
At present, checkout problems are invited for the 5000. A COBOL compiler as well as FORTRAN have been written in extended ALGOL.

Elsewhere in Burroughs, sales of the 200 series are excellent with 250 deliveries expected in '63. Shipments are averaging one per work day. On the near horizon, users may expect an announcement of a Burroughs disc file, an order of magnitude faster than the 1301 and priced in close proximity to the IBM hardware.

The Burroughs world market for edp equipment was estimated at $2 billion in 1959 with present official projections of $6½ billion for 1970. Current commercial computer backlog is in excess of 80 megabucks, excluding defense and space computers, about 25-30 per cent of total Burroughs revenue.

Future emphasis for the company will be on systems as opposed to the lone main frame. Says president Ray Eppert, "Individual equipment speeds don't mean a

WHO WANTS A BRAND NEW 10 YEAR OLD HIGH SPEED PRINTER?



Hydro-Electric Power Commission of Ontario, that's who. When they were building the world's largest single power plant, The Sir Adam Beck, they installed one of Anelex's first commercial printer systems, a Model 18-40.

Since then, every day, 24 hours a day, this printer has been monitoring 540 data points on the huge generators . . . printing clear, readable reports. Now the time has come to replace it . . . not with a new model but with a duplicate of the printer that has performed so well.

Performance like this has built the Anelex reputation for reliability. It also explains why 56 computer builders throughout the world include Anelex printer systems in their data processing equipment.

If you want to be confident of efficient operation and long years of service from your next printer system, write Anelex today.

ANELEX
SYMBOL OF QUALITY

ANELEX®
155 CAUSEWAY STREET, BOSTON 14, MASSACHUSETTS

CIRCLE 20 ON READER CARD

computer careers

NATIONWIDE CHOICE

Our clients have present critical needs for Managers and Seniors in the $9,000-$20,000 class.

N.Y., N.J., MASSACHUSETTS, WASHINGTON, D.C., BALTIMORE, PHILADELPHIA, HUNTSVILLE, HOUSTON, DALLAS, FLORIDA, OHIO, UTAH, CALIFORNIA & OTHERS

Contact us if you have experience or interest in any one of the following:

- ☐ **Scientific Computation and Analysis** — Will work on unusual Aerospace applications. IBM 7090 type experience & strong Mathematics
- ☐ **Real Time**—Operational
- ☐ **Software Development**—Language Development, New Compilers
- ☐ **Operations Research**—Linear Programming plus Computer Applications
- ☐ **Systems Design & Analysis**
- ☐ **Systems Planning**
- ☐ **Programming** — Large Scale Computers
- ☐ **Digital & Logical Design**
- ☐ **Command & Control Systems**

Personalized individual service by our technically trained staff helps you locate that unique position.

Ph.D.—DIRECTOR INFORMATION SYSTEMS To $26,000

•

DIRECTOR—COMMAND & CONTROL SYSTEMS To $22,000

Our select list of clients in the computer industry assume all expenses.

Write in confidence outlining Parameters or call (collect) Mr. Albert (Area Code 212) PLaza 9-1720

a&n
ALBERT, NELLISSEN, INC.
Leading Consultants to Management in the Data Processing Field
510 MADISON AVENUE, N.Y. 22, N.Y.

CIRCLE 78 ON READER CARD

thing. System through-put is the essential yardstick."

And while edp has "grabbed the spotlight" away from electromechanical business machines, Eppert emphasizes the importance of this aspect of his business. "Probably 90 per cent of the active corporations in the U.S. have total assets which are less than the price of most medium-scale computer systems, and 80 per cent of the nation's banks fall within the range of general business machines.

"According to our surveys," Eppert adds, "the $6½ billion world market of 1970 will include the $2½ billion worth of general business machines--more than the entire 1959 world market (for Burroughs) including edp equipment."

REHEATING COMMAND & CONTROL

Still a topic of much concern to government and other computer-based citizenry, standardization on a single language for command and control was the subject of a recent RAND memorandum to the Department of the Air Force, authored by J. P. Haverty and R. L. Patrick. Major conclusion of this report: "...It is not now appropriate to establish a standard programming language."

While urging immediate planning in this area, the report clearly advises that "much work remains to be done...before we can achieve the benefits of a standard programming language."

These conclusions stand in conflict with the advice given to DOD in several earlier reports edited by Lee Christie, SDC, and Marlin Kroger, Motorola, (see Datamation, p. 58, June 62) in which these authors conclude that a decision "to define and adopt a standard Procedure Oriented programming Language (POL)" for command and control, should be made now.

Following the Christie-Kroger reports, the Navy announced adoption of JOVIAL for command and control, and the air force initiated a series of compiler comparison tests with a similar purpose in mind. As yet, the Air Force has not announced its intention of adopting a standard language for C & C. Educated speculation suggests that no such announcement will be forthcoming.

THE MERGER MILL: FOR RUMOR MONGERS ONLY

Last month, DATAMATION's special phone for merger rumors and other unconfirmed ripplings was taken off the hook and dunked in a bucket of ice water. Nevertheless, it continued to ring.

The variety of mergers seemingly hanging on thin threads, remained unabated in February and for the most part, were firmly denied.

The most outstanding rumor of the month concerns a merger of Ford (and Philco's Computer Division) with Burroughs Corp.'s adding machines, calculators and higher level, internally programmed hardware. Repetitive reports on several news broadcasts, the Wall Street Journal and other media have lent dignity to this whopper. Replies Burroughs president Ray Eppert, "I don't think Henry knows anything about it and I damn well know I don't!"

Attracting somewhat less interest outside of the

industry, is the highly dubious intention of General Electric to acquire UNIVAC less razors. The staying power of this fable has persisted over a three month period despite firm denials.

On a somewhat lower level of importance, Advanced Scientific Instruments of Minneapolis, has been hailed as a possible acquisition for Autonetics, although more recent reports indicate that ASI has been purchased by Electro-Mechanical Research, Sarasota, Florida, a subsidiary of Slumberger, for approximately $825,000. Operations of ASI reportedly will continue in Minneapolis.

Acquisition of Bendix Computer by Control Data Corp. (see page 47) was confused by rumors of the interest of Bendix in acquiring Packard Bell's computer division or Digital Equipment Corp. in order to obtain a G-15 successor.

One fact in this muddle remains certain. IBM is probably not for sale.

THE IN & OUT OF EDP SALES ABROAD

Exports of U. S. computer manufacturers were tallied at $99,083,378 for nine months in '62, according to latest returns from the U. S. Dept. of Commerce. This figure represents a 25 per cent increase over the same period in '61. Out of almost $250,000,000 in all business machine exports for nine months studied, computers were estimated at 40 per cent of the total.

While imports of edp equipment are substantially below the outgoing figure, it is interesting to note that the import growth rate is substantially higher. An estimated $5,120,357 of computing equipment was imported by the U. S. during nine months last year, an impressive 58.6 per cent increase in foreign penetration of the U. S. market.

Also notable are recent announcements by firms such as SAAB of Sweden offering their edp equipment through U. S. offices (see New Products, p. 67), and from Ferranti, announcing that sales teams are now in this country to encourage greater interest in their ATLAS machine.

A NEW ENTRY FROM TRIPLE C

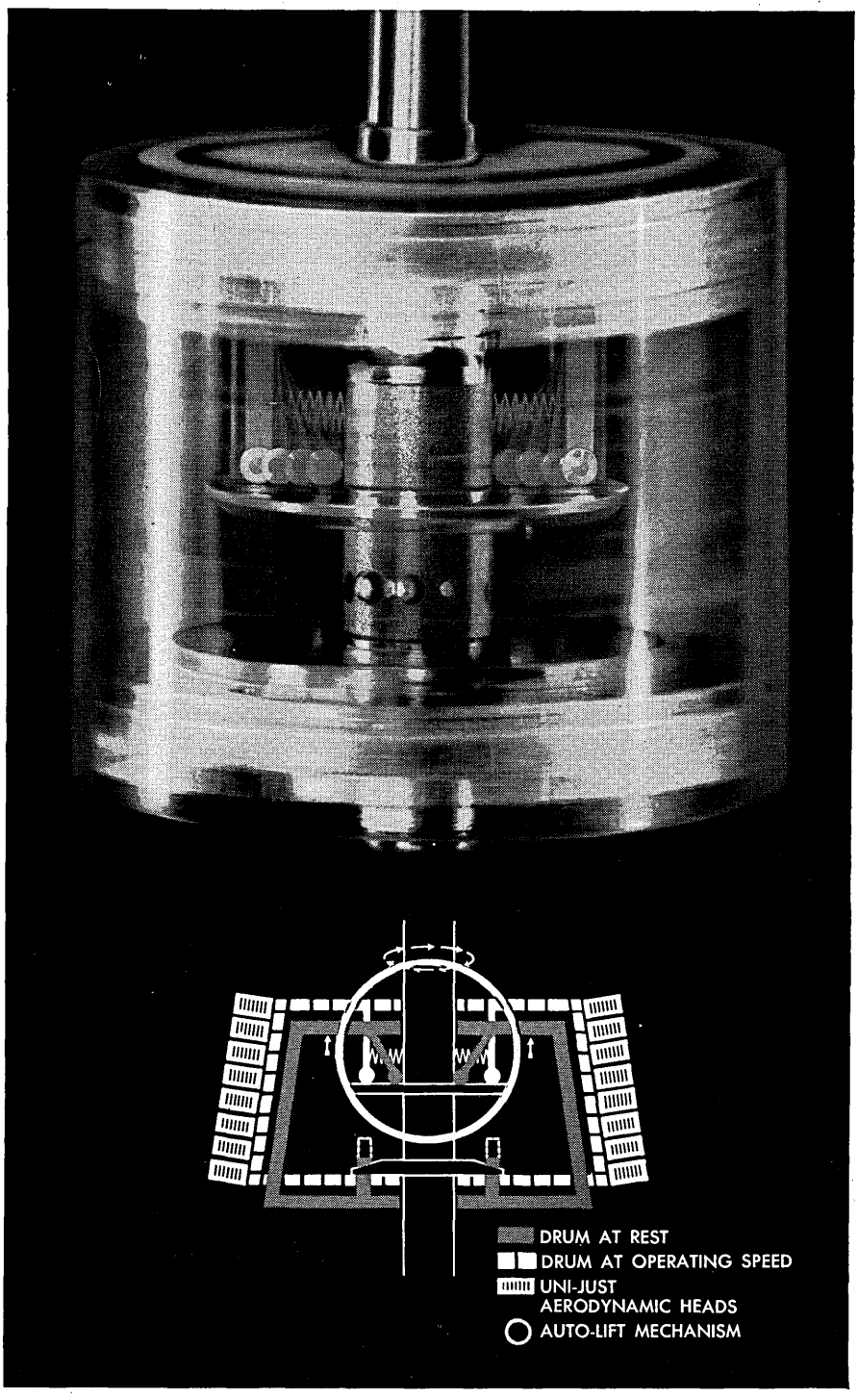
On the heels of last month's public offering of 200,000 shares of stock (at $8 per), Computer Control Company has announced plans for the DDP 24, a new, medium scale entry for real time scientific and engineering applications.

As a direct competitor with SDS' 920, the CCC hardware is priced at $87K (as compared to $98K for the 920). The 24 features an expandable core memory from 4-16K with access time of 3 usec; cycle time of 5 usec; additions in 10 usec; multiply in 31 usec and divide time of 33 usec. Word length is 24 bits.

Software will include FORTRAN II, an assembler, interpretive system and various utility and service routines. A contract for this work has been let to Systems Programming Corp., Anaheim, Calif.

The 24 will supersede the earlier DDP 19 of which there is presently one installation and two orders. Production of the 24 will begin with an initial run of 20 machines.

LOOKING FOR RELIABILITY?



THIS NEW MAGNETIC DRUM STORAGE SYSTEM PROTECTS ITSELF FROM FAILURE AND WEAR BEFORE THEY BEGIN

Inside Bryant's new Auto-Lift drums is this unique mechanism that sets new standards of data storage reliability. Here's how: Heads and drum are *never* in contact. Not during starts. Not during stops. Never! Two new design concepts have made this possible:

1. The "Auto-Lift" mechanism lifts the tapered drum into operating position *only* when it reaches speed. When the drum slows, it lowers away from heads *automatically*. No contact—ever!

2. "Uni-Just" heads *really* fly—no bumps or skips. One simple, fail-safe adjustment optimizes playback. And no contact—ever!

For details, see your Bryant sales engineer, or write direct to: 850 Ladd Road, Walled Lake, Mich. MArket 4-4571 (Area code 313).

SYSTEM SPECIFICATIONS

- Standard drum diameters: 5, 7½, 10, and 18½ inches.
- Drum lengths to 39 inches.
- 300/ppi standard.
- Operating frequencies to 750 KC.
- Capacities to 16,000,000 bits.
- Available for general and special purpose storage, buffer systems, and a wide range of commercial and military applications.

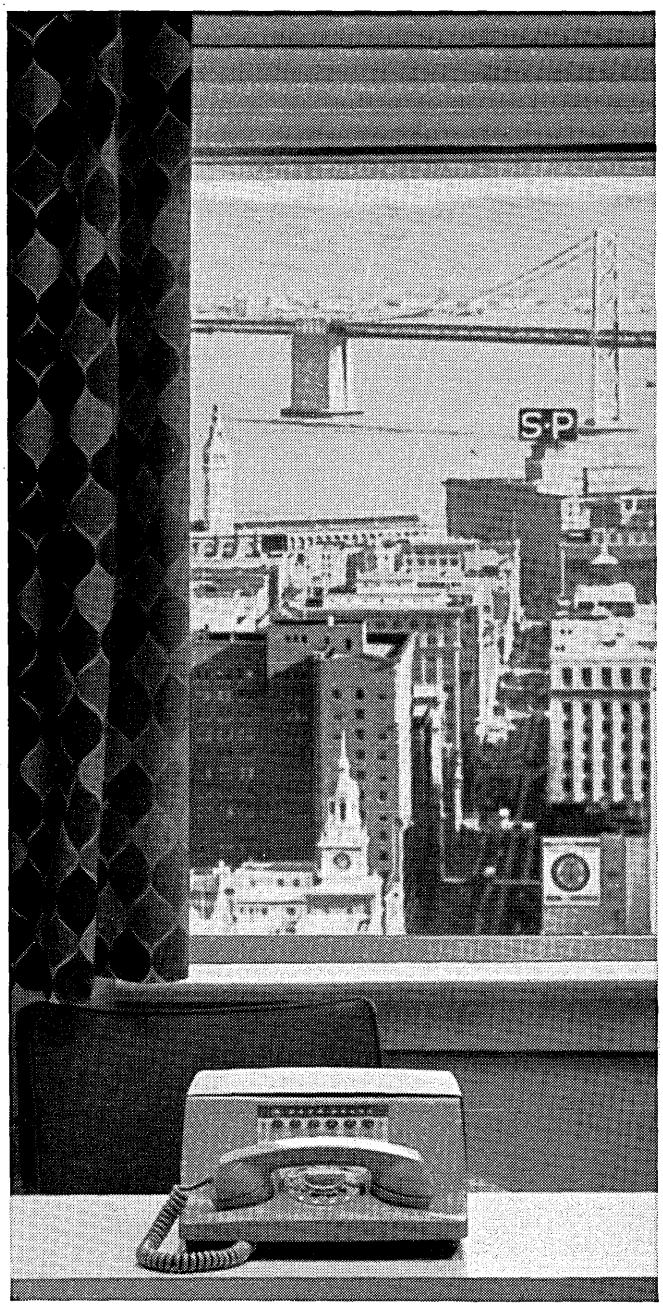
62-45CP

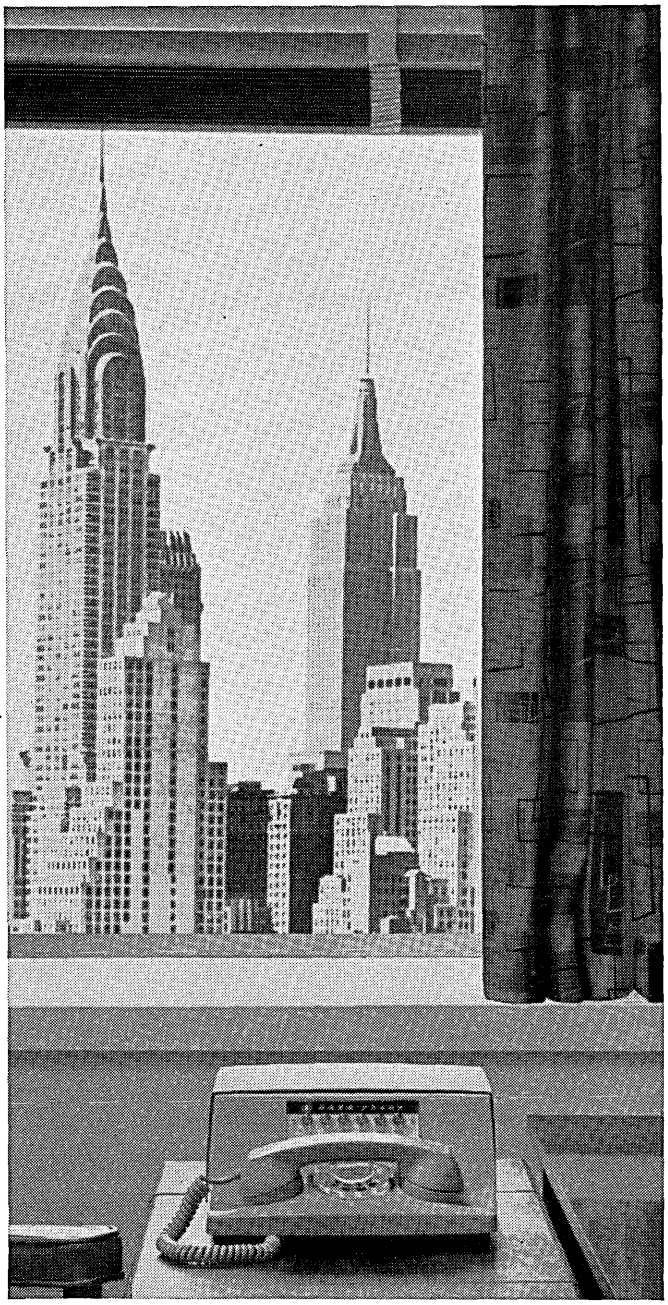
BRYANT **COMPUTER PRODUCTS**

852 Ladd Road • Walled Lake, Michigan • MArket 4-4571

A DIVISION OF EX-CELL-O CORPORATION XLO

CIRCLE 21 ON READER CARD





Give your computers a 3000-mile reach

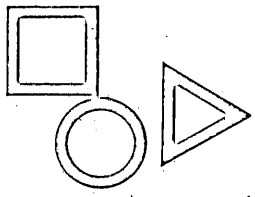
Put DATA-PHONE service to work for your company and your business machines can reach anywhere there are regular telephone lines.

Send any kind of data that can be put on punched cards or tape—any time of the day or night at regular telephone rates.

Think how DATA-PHONE service can save you time and money in shipping vital word and figure data to and from all your business locations. See one of our Communications Consultants about it. Just call your Bell Telephone Business Office and ask for him.

Bell Telephone System

CIRCLE 22 ON READER CARD



EDITOR'S READOUT

THE GREAT CONFERENCE DEBATE

An increasing proliferation of regional, seasonal, national and international computer conferences has prompted many a furrowed brow, depressed a few untidy budgets, and recently encouraged the initial stirrings of reappraisal by the leadership of the principal associations sponsoring these seemingly self-reproducing events.

An early resolution to the questions now being raised should not be expected. Pride, prejudice and a variety of other sins common in all debate, will be far more evident in delineating the influence of associations within the industry and reaching such needed conclusions as whether a particular group should change the format of its conference or for that matter, whether a conference should be held.

However, the fact that questions are being raised and answers proposed is encouraging news. To contribute to this reappraisal, the following queries and opinionated responses are not offered as definitive solutions but rather as an additional stimulant to further discussion.

1. Are the present number of computer conferences justified in view of the amount of legitimately new information presented at the technical sessions?

The answer implicit in this question is certainly a negative one at least within the framework of present methods of obtaining and selecting conference papers. The dwindling, frequently embarrassing attendance at the majority of technical sessions requires priority attention. The offering of *new* information at each computer conference, however, may not be as urgent a requirement as an occasional injection of iconoclasm and an intelligent reflection on *old* information.

And while the theoretical rationale for a conference includes the formal sharing of information, practice has indicated a necessity for the many informal exchanges hardly fit for a podium. It is in this area that the quantity of *new* information seems limitless.

2. Are the conferences over-emphasizing exhibits in view of the limited quantity of significantly new hardware introduced each year?

Despite the validity of a positive reply, the money problem for the industry's varied associations would seem to indicate an increase in the emphasis on fatter and fancier exhibits.

As a principal source of annual revenue, the exhibit area is as much a contribution to the coffers of an organization as it may be judged a drawback to the academic tones dignifying a conference. And regardless of what may be viewed by the erudite as significantly *new* in the way of a hardware offering, attendance figures at recent computer conferences point to the importance of exhibits as a major drawing attraction.

Somewhat similar to the area of improved technical sessions, *newness* may not be the sole criterion for a successful exhibit. Hardware presentations may be improved by the demonstration of useful work (i.e., a COBOL program) and the availability of an informed salesman or two, as opposed to tic-tac-toe and girlie-bedecked lotteries.

3. Are the Joint Conferences overly software oriented to a point of diminishing returns for the hardware registrant?

With the phenomenal growth and influence of the programmer population and the increasing separation of the engineer from many computer applications, this situation is undoubtedly reflected in the nature of the Joint Conference. Another

factor of importance is the expanding influence of the computer-oriented engineering societies in attracting wider attention to their own programs and encouraging the submission of the better class of hardware papers to engineering conferences.

The Association for Computing Machinery, one of the major participating groups in the Joint Conference, has largely evolved into a software-oriented organization and, proportionately, ACM members far outweigh representation from the IEEE at the JCC.

Two obvious indications of this change are that comparatively little attention is afforded the JCC in national engineering media, and at the conferences themselves, attendance at hardware sessions is virtually insignificant.

The effect of this change will prove an important factor in the future planning of Joint Conferences and may be most damaging if it is not faced realistically as a need for new directions in either unifying or accepting the widening paths of computing's diverse interests.

4. What effect will AFIPS have in the reevaluation of computer conferences?

Despite the impressive title of the "American Federation of Information Processing Societies," its jurisdictional boundaries are rigidly confined in this debate. The nature of the AFIPS charter for example, requires equal voices from non-salaried leaders responsive to the member society each represents. Another factor is the lack of representation from groups which AFIPS has failed to attract, such as the Data Processing Management Association (DPMA).

One result of this debate, however, may be the clarification and ultimate strengthening of AFIPS' position as a *real* rather than *paper* representative of the computing industry. ■

THE 1400

upgraded hardware from Honeywell

Honeywell's fourth computer, and the first since March, 1962, is the 1400, an upgraded version of the 400. Designed for scientific and business applications, the 1400 has floating-point arithmetic and multiply-divide options. Add time for a single three-address instruction is 77 usec, and average access time is rated as 6.5 usec. Memory capacity is from 4-16K words.

The user has a choice of binary, alphanumeric or decimal information. Word length is 12 decimal digits, or 48 bits. The 1400 also has program interrupt, three index registers, edit instructions, and masking operations.

Simultaneous peripheral processing capabilities include card reading-computing-printing, mag tape reading-writing at full speed, and operation of two high-speed printers at the same time.

Up to 16 mag tape units can be connected. Available are three models with transfer speeds of 48, 96, and 133K decimal digits per second. The tape units have the Orthotronic control file feature for automatic error detection-correction.

Other peripheral equipment includes a 900-lpm printer that can be operated on-line or off-line, and print storage and control operations to permit simultaneous printing; a 650-cpm reader; a 250-cpm punch, and a reader-punch unit with a reading speed of 850 cpm and a punch speed of 250 cpm. A card storage option permits reading or punching concurrent with other operations.

The basic software package for the 1400 includes the EASY assembly language, COBOL, and the AUTOMATH scientific compiler. The 1400, 400, and 800 are program compatible.

Basic configuration of the system includes a central processor with a 4K-word memory, eight mag tape units, printer, card reader, card punch, and operator's console.

Rental for the 1400 ranges from $10-$20K per month, the average configuration renting for $14K. Purchase price is from $450-$900K. ■

Operator tests prototype console of Honeywell 1400 which has scientific and business capabilities.

CIRCLE 110 ON READER CARD

THE COMPUTER & NEWSPRINT

problems, progress & the stirrings of a new application

by ED YASAKI, Assistant Editor

Computerized typesetting, barely one year old, has experienced one major failure and three initial successes. However, application of the computer in this field has stirred the interest of newspaper publishers throughout the country with a conservative comparison frequently made to the invention of movable type.

With a start that was anything but humble, the Arizona Journal announced the first application with a GE 225 that would prepare and bill for the entire classified section, beginning with the Journal's first issue on Feb. 14, 1962. Grand in concept, the system nevertheless failed.

Three subsequent applications have omitted any billing or circulation procedures, concentrating on only the typesetting functions. RCA 301s are being utilized at both the Los Angeles Times and by the Perry newspaper chain in Florida, the latter storing a dictionary for hyphenation purposes, and the former utilizing a logic system. In Oklahoma City, an IBM 1620's reference for hyphenation is to a table of probabilities.

These varied approaches to a common application may represent but a pioneering step, for their success to date has unleashed the imagination of newspaper publishers to even newer applications. It remains to be seen, however, whether technology can surmount the obstacles presented by labor unions. As this is being written, newspaper strikes continue in New York City and Cleveland, an unspoken issue reportedly being the use of perforated tape to run automatic linecasting machines. Of the newspapers currently using computers to justify lines, none has a union shop in the composing room.

first on and off the air

The first "composing room computer" to go on the air was also the first and only to suspend operations. Announcement was made jointly by the Arizona Journal, in Phoenix, and GE's Computer Dept. on Nov. 20, 1961, of a GE 225 that would handle the preparation and billing of classified advertising. It was to begin with the Journal's first issue on Feb. 14, 1962, with data transmitted from the newspaper office to the 225 in GE's information processing center, 15 miles away.

It was not until a month after contract date, however, that definitions of the specific functions of the 225 were set. And two weeks before publication date, the rate structure for classified ads had not been firmed—much less programmed, according to Ed McCauley, GE senior programming analyst.

There was cause for concern. A new metropolitan daily, guaranteeing advertisers 50K circulation, was beginning with non-union labor to operate newly-introduced offset presses and a new tape perforator, the ATF Typesetter. Both were the first installations anywhere. Without experience in the manual processing of advertising copy and billing, the Journal was trying to run a parallel operation with the computer system.

"If this had been an older paper with established practices, we could've gotten the computer operations to work," Robert Morrison, publisher of the Journal, says.

"GE didn't know newspaper problems, and the newspaper didn't know computer problems," adds McCauley.

In advanced billing, however, the Journal was described as "the world's largest daily newspaper printed entirely by cold type and photo offset processes." The publication's business manager, B.C. Sitton, delighted in the assurance that the computer system would make the Journal "a complete cold-type operation without a scrap of hot metal" in its new one megabuck building.

The decision faced by offset newspapers, Sitton explained, was to use hot metal for the setting of classified ads or, with photocomposition, to go through a tedious "jig-saw puzzle operation" in which classified sections had to be cut up into scraps, new ads inserted, and the entire section re-pasted for photographing.

Panacea supposedly lay in the 225 which would collate new ads with old ads to be rerun, and punch a tape of ad copy for the next day's issue—sequentially by classification and alphabetically within classification. The end product would be a classified section that needed only to be stripped into page form with classified display ads for the photo-offset process. The jig-saw puzzle was eliminated without the use of hot-metal typesetters. The Journal, it seemed, would be having its cake and eating it, too.

The 225 was also programmed to print a bill for a terminated ad (although the ads remained on tape in case any were rescheduled). For advertisers with regular accounts, daily invoices and monthly statements would be produced, in addition to a monthly accounts-receivable register which replaced the conventional ledger card file.

Daily circulation data also was to be processed. Loading

bills were envisioned, showing how many newspapers each truck was to pick up, and where the bundles were to be dropped off for carriers, newsstands, and dealers.

Total machine time for the classified advertising and circulation processing was estimated at about one hour per day, with a reduction of some 50 per cent in production and circulation accounting costs.

The first issue of the morning Journal was late by a few hours, and lacked a classified section, as did the next nine issues. The paper was forced to send its ad copy to a hot-metal typesetter, running the 225 on a parallel operation for testing and debugging purposes. The 225's output was in actual use for only five days, terminating toward the end of March. By that time, the advertising billing operations also ended. The accounts receivable program was never run, a master file for which was never constructed. And the circulation program, other than in dry runs, met the same fate.

The 225 did not justify lines or hyphenate at ends of lines, these being coded by tape perforators at the Journal office. The information, at 1K wpm, was then transmitted by Bell System's Data Speed to GE's information processing center.

It was here that some of the trouble lay. Experienced ATF Typesetter operators were not available and, to compound mismanagement, the punched tapes were not proofread before transmission as had been planned. Also, the Typesetter tapes lacked a parity bit. Result: garbage in, garbage out. In the early stages, about 50 per cent of the input was unusable, according to McCauley, some of the input over-running the machine.

By the middle of June, after the billing operation was curtailed, and then typesetting, the entire computer system was terminated. Contacted by DATAMATION after the Internal Revenue Service had formally taken over the Journal for unpaid taxes, Morrison repeated his oft-voiced threat to bring suit against GE, claiming a $200K loss.

What remains today to be a bold venture of a computer application in the newspaper field failed on its initial run. It has not been re-run; indeed, according to the publisher, Morrison, the Chicago Tribune and others had representatives in Phoenix to observe the operation, and were frightened away from this new application.

the narrowed approach

Rather than frightened by the Phoenix experience, the Los Angeles Times was working on its own system. Although their 301 was delivered in December, 1962, programming for the Times' application was completed in September after a reported $400K expenditure and 18 months' research.

The Times began with plans to store a dictionary of some 60-70K words. When possible inadequacies and the high cost of this approach became obvious, the decision was made to switch to a logic system for hyphenation. All efforts were expended on the typesetting function only, leaving billing or circulation operations for later consideration.

Today, all locally-written, computer-destined news copy is prepared on an IBM electric typewriter coupled to a Friden punch by Soroban Engineering. The product of this device is both a hard copy of editorial material which can be edited, and punched tape. An editing tape, showing only the alterations made in the original story, is punched, avoiding the retyping of the entire story before it is read into the 301's memory. The editing tape and the story tape, in that order, are read-in through an RCA 322-B reader at 500 cps (slower than the 1K capability, but necessary because only strip reading is being effected presently).

On a simultaneous mode, read-in and arithmetic functions proceed. As characters are received as input, a subtractive process begins, each character, symbol, and space being assigned a unit count. When the number of units exceeds the capacity of a line, the last word is dropped and three questions are asked:

1. Will the expansion of space bands (from a normal 10 units to a maximum 40) fill the line?
2. If not, will the addition of thin spaces suffice?
3. If not, will an en space fill it?

If the answer to all three questions is "No," the 301 goes to the hyphenation routine. The last word in the line is syllabified according to vowel and consonant patterns. Various techniques are employed in using letter sequences as a key to division, including table look-ups in which the cumulative effect of any three letters of the alphabet can be weighed, and various paths taken. The program follows word division criteria set forth in the introduction to Webster's Unabridged dictionary.

The 301 scans key letter sequences to determine if they follow the rules governing the type. If so, hyphenation proceeds. With the exceptions, however, key sequences and other letters affecting them are analyzed, backing up or moving forward two or three letters if necessary.

After selecting the maximum number of syllables to fill the line, the computer returns to the space-band routine—in rare instances, resorting to letterspacing with the longest word, then to the addition of another space between words.

Following typesetting, proofs are read to determine revisions necessary in the hyphenation logic. Ninety-nine per cent accuracy is claimed when the logic is tested against the 20K-most-common-words in the language. Chosen as the authority for correct syllabification, however, is the liberal Webster's Unabridged. And, because the space-band routine precedes the hyphenation routine, the number of hyphenated lines is reduced, and accuracy figures rise.

The program and tables of hyphenation logic occupy 5K positions of memory, one-fourth of the 301's capacity. The average time for hyphenation is 15 milliseconds. And 40-50 ms is required for the justification of each line.

Lines can be of varying widths, and set boldface, light face, or in any other manner within the capability of present linecasting machines. Although only two type sizes are presently programmed, others could be added by reading a table of character widths into memory. About 50 columns of news copy are run through the 301 daily. It is estimated that 36K lines per hour is the maximum rate possible, at which speed one hour of machine time could produce sufficient tape to fill a 128-page issue.

Output equipment, in addition to a monitor printer, includes a 513-7 punch which has a high-speed Soroban unit operating at 300 cps.

Unlike other computerized typesetting systems, the Times' 301 can accommodate teletypesetter tapes of wire services (Associated Press, United Press International). These tapes already contain justification codes, but for a type size at variance from that used at the Times, and only for one column width. (AP stock market tapes, however, are compatible and being used.) The 301 has been programmed to eradicate justification codes on news story tapes, to re-justify and, if necessary, to hyphenate lines.

A 30-40 per cent increase in the production of punched tape is claimed by the Times, using a 301. Eventually, its staff of 110 Linotype operators and teletype perforators will be reduced to 55 without the need for layoffs, according to Otis Booth, Times operations director. Through normal turnover (10 per cent) of its 400-man composing room staff, Booth says, the reduction is expected to be complete

in a year. The computer section, on the other hand, will be expanded to include about 10 additional persons.

With a prime shift contract, current monthly rental with the high-speed reader and punch is $5K. Each IBM typewriter with perforator attachment costs $1.5K. According to Booth, 10-12 such typewriters would be needed in the average newspaper's editorial department. Any newspaper with 50K circulation or about 20 typesetters can justify the rental of hardware for typesetting purposes alone at $3.5K per month, Booth says. ($3.5K is the average rental for a 301 configuration without the high-speed reader and punch.)

Disagreeing with Booth is Andrew Murvick, production manager for the Los Angeles Herald-Examiner. Murvick feels that $500 per week would be the approximate break-even point at his paper. Machine cost in excess of that amount, he says, would not be profitable. This assumes that the computer would not be utilized for billing, payroll, or accounting purposes, machine time for which might conflict with the deadline-meeting necessity of news copy.

If the Herald-Examiner uses a computer for line justification, it would be used only for locally-written stories, according to present thinking. AP stock tapes presently are entered directly into typesetting machines, but wire service tapes are incompatible with the newspaper's type face. In addition, the stories require editing and cutting, sometimes reducing a 12-paragraph story to only three. Thus, Murvick feels, a computer's ability to decode tape and rejustify lines is of relatively little benefit.

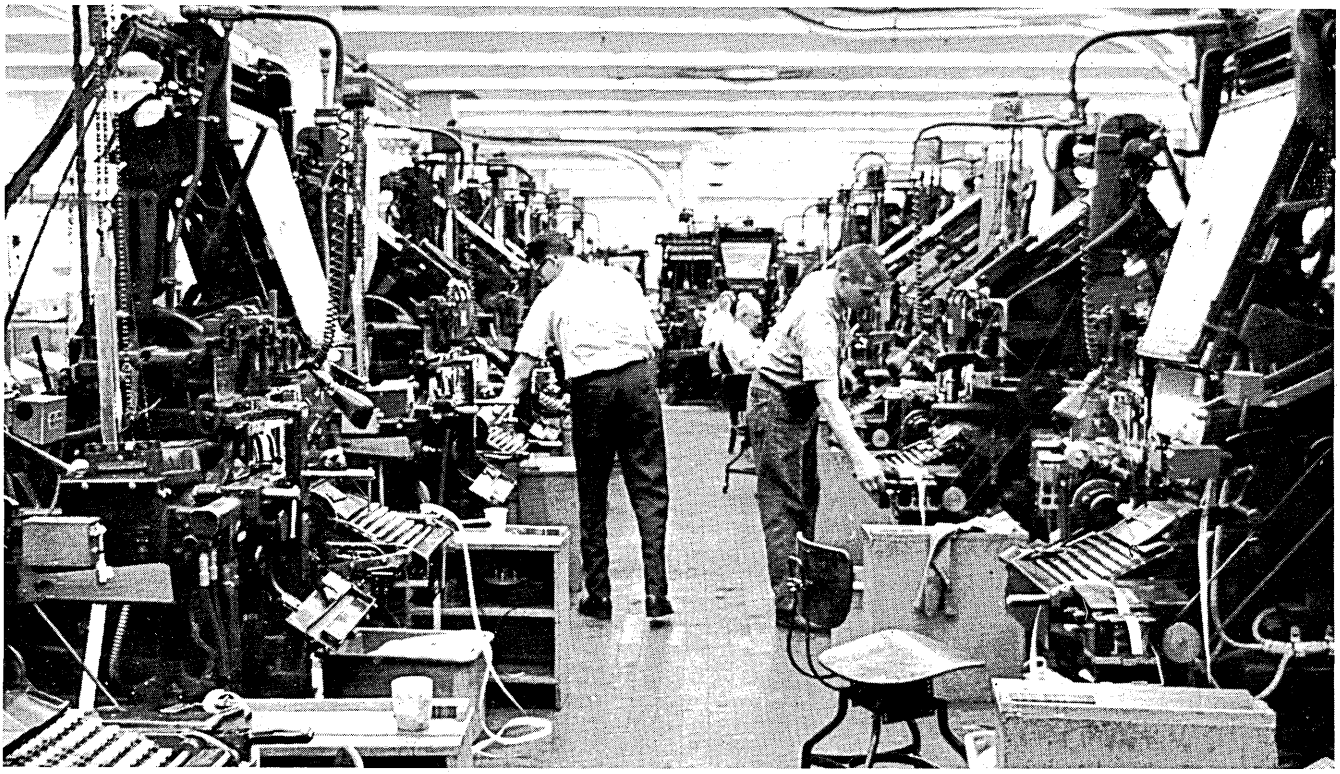
The Herald-Examiner, nevertheless, is undertaking a feasibility study, and a final decision is expected in several months.

The cost factor in utilizing a computer in the composing room was best expressed by Cecil B. Kelley, vice president of the Perry newspaper chain in Florida. In the matter of personnel, alone, Kelley said, clerk-typists can perforate tape, without regard for the justification of lines, faster (500-780 lph) than a teletype operator (350 lph). And clerk-typists (for whom the Perry organization's scale is $1.69 per hour during the day, and $1.81 at night) are more numerous than experienced teletype operators (currently receiving $3.20 by day, $3.30 at night). The Perry publications, like the LA Times, follow the no-layoff rule, transferring TTS operators to punching unjustified tape instead of releasing them in favor of clerk-typists.

In addition, computer-justified tapes generate less machine stops—for such items as tight lines, loose lines, etc.—and reduce accordingly the need for monitors and machinists on linecasting machines.

According to Kelley, savings also are effected from optimum utilization of linecasters, which operate most efficiently at steady speeds, as is possible with computer-justified tapes lacking tape-feeds, rub-outs, and the waiting for transmission of reperforated tape. Again, hardware tapes contain fewer hyphenations than occur when they are manually punched.

All this adds up to a most-frequently cited 40 per cent savings in time, alone, for which monetary rewards are heaped upon a closer deadline which is made possible in the acceptance of both advertising and news copy.



Tape-operated, unmanned linecasters are one result of computerized typesetting as seen at the Los Angeles Times.

dictionary look-up

Kelley's employer, Perry Publications, Inc., publishers of the Palm Beach Post-Times and numerous other dailies and weeklies in Florida, completed programming for its computer in October, 1962, and went on the air late in December. In the early stage of its research, the Post-Times planned to store more than 22 million characters, gradually reducing this to about 2.5 million which, in terms of five-unit words, approximates 500K words. It now has 30K words stored on four reels of mag tape for decreasing access time, although the data could easily fit on a single reel.

This dictionary is carried on four of six decks in a 381 data tape group which can read in either forward or reverse direction at the rate of 10K cps. Other peripheral equipment include a 1K cps paper tape reader, 100 cps punch, and a 1K lpm printer.

The central processor is a 301 with a 20K-character storage. Memory cycle time to address, bring into register, and

regenerate a diad in its original memory location is 7 usec. The 301 is programmed to justify 10 different type sizes/column widths. All can be indented, set bold or light face, etc.

The justification process begins with the read-in of approximately 1K characters. The input block is 1K characters in length, paragraphs of some 25 lines being considered the longest received at any one time. While the paragraph is being read in, the unit count of each character begins on a simultaneous mode. Following the space band after each word, a check is made to see if the line is justified. These checks continue until a line is filled, the 301 then branching to subroutines (if necessary) for the insertion of additional spacers and to the dictionary if hyphenation is called for.

The basic stored dictionary is from Webster's New Collegiate, the entries reduced to frequently-used words, and supplemented by local and common names. A separate program determined the frequency of word usage in newspapers, and arranged them by their first letters. In descending order of occurrence, the first letters were in this order:

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

The words were then written on four reels of mag tape, starting with the most accessed letter in the middle of each reel. The starting point for look-up is in the middle of the reel. Thus, the least accessed letter, X, is on the outside of all four reels.

The search begins with a determination of the first two letters in a word; this isolates the word to a particular block, an index for which is in memory. To save time, the most frequently-used blocks are grouped around a middle, homing position. About 98 per cent of the words, as a result, are accessible within one second.

"This permits us to operate on the dictionary without any loss of time," says Nolan E. Toothman, RCA-EDP, "since it is a rare instance when there isn't at least one second's worth of punching stored in the reservoir within memory."

Some five seconds, however, are required to hyphenate two words beginning with an "x" in successive lines, these words being stored at the extremities of reels. This case is generally a remote occurrence.

When the block in which the word should be situated is found, the block is read into memory, and words compared until the exact match is reached. The word has a hyphenation key to indicate proper syllabification, and the hyphenation point is determined by the maximum characters which will fit the line.

Failing a successful search, the word is checked to see if it ends in *s, ed,* or *ing*. If so, this ending is taken off and a second search proceeds. When completed, the used tape is rewound to the middle, or starting point, ready for the next search.

If the word being searched is not in the block, it is automatically hyphenated after the third, fifth, or seventh letter (the so-called 3-5-7 rule). Thus, all words which correctly break at these points have been purged from the dictionary. The 3-5-7 rule, according to Toothman, has been found to be correct in about 40 per cent of the cases, and within one letter in almost 90 per cent—which means that a maximum of two lines would have to be recast if the word is not in the dictionary, and if it does not break according to the rule.

Only after all lines in a paragraph are complete are they punched out on paper tape, and a hard copy printed out on the on-line printer. Output tape is punched continuously as long as the type size/column width remains the same; when this is altered, a 30-second change is inserted from the console to memory, and the new size continues through the reader.

Unlike the operation in Los Angeles, a news story is keyboarded twice—once by the reporter and, after editing, by the tape perforator.

two papers—one machine

The same procedure is followed by the Oklahoma Publishing Co., publishers of the morning Oklahoman and the evening Times. Here, a $2.6K-per-month configuration, with an IBM 1620, is producing justified tape. Another 1620 has been added for both back-up purposes and to expand hardware capability. (A 1620 should be in the hands of the South Bend, Ind., Tribune this month.)

In Oklahoma City, where AP stock market tapes are fed directly into a typesetter, both locally-written stories and classified ads are run through the 1620—but only a fraction of each.

For hyphenation, reference is to a table of probabilities which determines the best dividing point in a word. The word is broken down into syllables, and memory is examined for the greatest probability of the word being hyphenated. Through numerical analysis, that point where the word is most often split is then determined.

With the system continuing to be experimental since its implementation in September, Bill Williams, accounting manager, refuses to release any accuracy figures. "We've been trying to fill all lines as tightly as possible," Williams says. "Next week, we'll try looser lines to weigh the relative merits of decreased aesthetics and increased accuracy."

Effort is being made, however, to condense the current program to make room for a dictionary of local names, hyphenation of which presents problems beyond the capability of the program, Williams said.

The two papers currently use one Flexowriter, although numerous teletype perforators are used for the automatic setting of all classified ad copy. Here, a problem common to all papers using computing hardware in the composing room is reportedly holding up a more rapid conversion. This is the training of teletypesetter operators in the use of Flexowriter or comparable equipment not requiring justification codes.

At present, none of the systems of computerized typesetting cited here has branched to such other functions as billing, bookkeeping, circulation, or payroll. At each installation, the line justification process remains uppermost in mind; an attitude of other-jobs-in-time pervades. Perhaps much was gained by others in viewing the experience of the Arizona Journal.

As an official of the American Newspaper Publishers Association said late last year, "The newspaper business is concerned with the handling of an extremely perishable product. Deadlines must be met! There has been little appreciation for this fact in the computer industry to date, and newspaper management will have no confidence in computers until it is fully recognized."

Accordingly, the Los Angeles Times is arranging back-up facilities at the nearby Tabulating Consultants, Inc. In Florida, one of the reasons that Perry Publications went with RCA was geographic proximity. As John J. Perry Jr., president, said ". . . Their factory was just down the road, and if a breakdown occurred we could jump in a car with the tape and run over and use one of their factory models. Besides, they could send a repair man over in a few minutes, and this eliminated the necessity for renting an expensive, spare piece of equipment."

other applications & hardware

Computerized typesetting has also been applied by institutions outside the newspaper field. William R. Bozman of

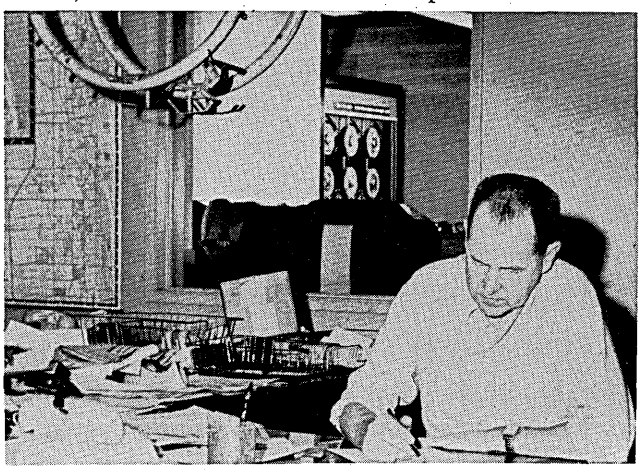
the National Bureau of Standards' spectroscopy lab has developed a 7090 program for repetitive types of literal, numerical, or symbolic output, including mathematical symbols, subscripts, and superscripts. It was written for the Bureau's tables of transition probabilities.

To produce an 8″-wide photographic film positive from which printing plates are made, mag tape with basic data is merged with parameters and equations on cards. The output tape then is merged with another tape bearing instructions and column headings.

The final output, mag tape, operates a photocomposition machine—although standard production models are actuated by punched tape, as are standard hot-metal typesetting machines. This mag tape-operated Linofilm machine was developed by the Mergenthaler Linotype Co. and IBM for the Air Force's language translation project, and reportedly had never been used before for a numerical type of output.

A specialized device for the production of punched tape to run linecasting machines is Compugraphic Corp.'s Directory Tape Processor (DTP). While both the input and output of the DTP are punched tape, Compugraphic claims a 69% increase in the production of tape for telephone directory printing because the input tape requires fewer coded instructions for bold-face, light-face, and line justification. There is, of course, no hyphenation involved although, when a line becomes overfilled, the DTP goes automatically into a second line without splitting a name.

A similar unit for the setting of matter by typesetting machines doing tabular composition is the Tabular Tape Processor. It requires two identical input tapes, one for counting the width of the text in each column and the other for transcribing the text when the TTP has made the necessary computations. Replacing the time-consuming, arithmetical process of figuring the "cast" of a table, the TTP requires only the wiring of a plug board to set column widths, and coded instructions on the tapes to tell the TTP



Latest addition to newspaper operations, elements of 301 hardware are seen in the background of the Palm Beach Post-Times newsroom.

where to fill a column with blank space (without regard to how many spaces are required), where to fill with leaders, when the end of a column has been reached, and the end of a line.

"Area for area," Compugraphic says, "because of fewer keystrokes, tabular composition is set faster than text." The two machines are priced between $15K-$22K.

While this equipment indicates considerable progress from the first movable, metal type in the early 15th century, metal type today just isn't moving fast enough to satisfy the appetites of contemporary readers. Reputedly the fastest typesetter is the Linotype Elektron, which casts 15 lines per minute from computer tape. This contrasts with seven to eight lines from manually-operated machines. But if an hour of computer time will produce sufficient tape to keep a battery of linecasters running all day, even the Elektron becomes a weak link.

tomorrow

By-passing the use of metal type would be a proposed "page generator" which produces an optical image of the page to be printed. "When properly programmed, stories and pictures contained in a computer memory automatically will be justified, composed, capitalized, and positioned in the desired form at extreme speeds," according to Harold C. Durbin, project director, American Newspaper Publishers Research Institute, Inc. "Pictures are displayed as halftones in the proper position and size, ready for production of an engraving for letterpress printing, a lithographic plate, or any other system of printing. Tear sheets, including halftone photographs, can be produced on Electrofax paper or by Xerography directly from the face of a cathode ray tube."

Durbin continues: "A special report to the ANPA research institute plate committee on Jan. 5, 1960, described a proposed system for newspaper production. The principal method of information handling involved a facsimile-type magnetic image and included ferromagnetography or electrostatography as a printing medium. Subsequent evaluation has led to the conclusion that the system . . . can be developed more quickly and be incorporated into an existing plant in discrete steps. It also offers advantages in composing that were not included in the original proposal. A major difference between the two systems is the predominance of analog signals in the previous system and the use of digital signals in the one proposed in this report. Digital systems offer the possibility of high-speed information transmission and permit the use of digital computers."

With the linecaster by-passed by the page generator, it seems obvious that the keyboarding of a story by a reporter

W. R. Bozman (standing), National Bureau of Standards, wrote 7090 program for repetitive type of literal, numerical, symbolic output.

might be improved upon. And so it will—at least plans along that line are being made at RCA's Princeton, N.J., Research Center. This involves the concept of a reporter "talking his story," instead of writing it, a development anticipated in eight to 10 years.

And with little being reported in the way of a new printing system, it could be that publishers are thinking of bypassing the printing process altogether, going instead directly to some facsimile process with receiving equipment in subscribers' homes. That would even by-pass the subscriber having to search his front bushes for the morning paper. ■

Hardly a new addition to computing's sundry associations, the Joint Users Group (JUG) will soon be celebrating its second birthday. Fanfare however, will not be evident since the organization has apparently eased its way into the field without the usual pyrotechnics. One result of this modest beginning is a considerable lack of appreciation and understanding of the function and current activities of JUG. The following article may help clarify matters—with modesty preserved.

THE JOINT USERS GROUP

a new catalyst; its background & objectives

by JERRY L. KOORY, Chairman, JUG

The objective of the Joint Users Group, a subsidiary of the Association for Computing Machinery, is the establishment of communications among digital computer user groups to promote study, an exchange of information, and cooperative effort in areas of common interest. These areas include:

1. Common programming languages and other means of communication between computing machines.
2. Establishment and maintenance of standards for communication and distribution of computer programs and techniques.
3. Exchange of information on problems arising from the operation of a computer installation.
4. Communication of methods and techniques for comparing the effectiveness of computer problem-solving techniques.
5. Consideration of hardware standards in cooperation with other interested agencies.

JUG is designed to be a catalyst for action on problems common to several user groups. It is, essentially, a federation of existing groups rather than a new and super computer society. Each user group is eligible to be a unit member in JUG, and is represented by its delegates. Thus, Joint Users Group meetings have relatively few participants, and JUG is dependent upon individuals from member groups for activity.

characteristics of user groups

User groups usually form spontaneously to fill a need to exchange information and general purpose programs. Composed of representatives of computer installations, the user groups find they have similar problems in getting results from computers today and planning for tomorrow. In general, the operating and training cycles tend to repeat and retread familiar ground rather than batter down the frontiers of computer science. Personnel look to user groups to strengthen communication ties, to establish working groups for action in areas of mutual concern, to advise professional and manufacturer groups as to their needs, to provide opportunity to meet and communicate with others, and to encourage competent documentation of lessons learned. Of particular interest is the conservation of time and expense in establishing a program library for a "new system."

activity of JUG

The Joint Users Group intends to refer its affiliates to established and active groups for assistance wherever possible. When problems arise for which no existing organization accepts responsibility, JUG will encourage the appropriate group to act in the matter. Where appropriate, JUG will establish contact between like committees existing in several groups in order to minimize duplication of effort and to provide active groups with personnel of broader experience.

Since its official acceptance by ACM in May, 1961, the Joint Users Group has:

1. Become an active elected member of the ASA X3 Committee on Data Processing.
2. Sponsored a session on "monitor systems" and co-sponsored a session on "installation management" at the 1961 ACM meeting.
3. Undertaken a study of FORTRAN as used on many machines today and its possibility as a standard (for report to ASA).
4. Encouraged the formation of SMALGOL, a stand-

ward subset of ALGOL, that can be implemented for small and large computers alike.
5. Established communication with problem-oriented groups (i.e., BIO, Machine Computation Committee of AICHE and CODASYL) to enhance cooperative efforts.

history of JUG

As early as 1954, people associated with computing activities were meeting to discuss mutual dissatisfaction with available coding languages and more economical use of personnel and computers. As more computers appeared, the tendency to form groups interested in using the same equipment became pronounced. By 1956, SHARE, USE, Univac Users Association, DUE and EXCHANGE were formed as machine-oriented user groups, and they expanded in direct proportion to the sales of equipment in which they were interested. By 1960, there were between 15 and 20 active users groups, most of which gained international members as their machines were placed abroad. While the interests in trading information, encouraging more efficient programming, and talking tricks of using equipment remained important, the groups became more interested in languages, standards, and general problem-solving. As manufacturers placed more computers on the market, the tendency grew for groups to represent the view of those using several different machines and more problem-oriented groups arose. Not only did groups interested in Highway Engineering, Reactor Physics, and Fieldata appear, but machine-oriented groups tended to concern themselves more with general principles and logic rather than coding details.

Because the groups arise from slightly different circumstances, there is a diversity in their membership definition and practices. The majority of people represented by user groups have found many similar problems and have now arrived independently at similar solutions. The larger groups allow for membership to interested individuals or by installation, which gives a loose structure representing a substantial number of persons engaged in "like" tasks of providing problem-solving service with computers. In August, 1960, H. S. Bright, a member of SHARE and TUG, stated that the major contribution of user groups in the future would be:

"A. Standardization of languages and their representation for particular machines.
"B. Manufacturer liaison on both hardware and software.
"C. Communication of ideas in programs between users of similar machines and/or of different machines.
"D. The advancement of means for achieving machine independence of programs expressed in widely accepted languages."

Part of this report was based upon the results of a meeting in San Francisco on May 6, 1960. Forty-four people, representing 17 different computer user groups, met to discuss the similar aims, objectives and problems of their organizations.

On August 27, 1960, representatives of 15 user groups met in Milwaukee and received an invitation from the Association for Computing Machinery to organize a Joint Users Group within the ACM. After hearing a report on the American Standards Association, X3 Data Processing Committee, it was decided that a federation of user groups should be formed. A committee was appointed to explore the invitation of ACM to affiliate. On December 16th, representatives of about 14 user groups met in New York City and heard further reports on the ASA X3 Committee, affiliation with ACM, proposed JUG by-laws, and a survey on quality control of material distributed by users groups. The by-laws were provisionally adopted and the following officers were chosen to serve until the first JUG election under formally adopted by-laws:

Chairman: William A. Smith, Jr. (POOL)
Vice Chairman: Harry N. Cantrell (SHARE)
Secretary: Donald B. Houghton (Univac Users)

At this session W. M. Carlson, Chairman of the ACM Users Group Liaison Committee, recommended that JUG petition ACM for status as a special interest group with the proviso that the requirement for ACM membership be relaxed and that an associate editorship for the *Communications* be allowed. On January 4, Chairman Carlson reported to President Huskey of ACM, tendered his resignation as Chairman, and recommended the appointment of the newly-elected JUG Chairman as his successor. With this arrangement the Joint Users Group proceeded with plans for affiliation, coping with the problem of corporate installation membership which was not compatible with the criterion of personal membership in ACM. On May 8, 1961, representatives of 13 users groups met at Los Angeles to discuss universality of programming languages, ASA's acceptance of JUG as a member of its X3 Committee, and problems of installation administration. By-laws were adopted consistent with those of ACM, and a proposed ACM by-laws change to include JUG was discussed. On May 11, 1961, ACM Council passed By-Law 14, which set up the Joint Users Group as a part of ACM to establish communications among digital computer users groups and to promote the exchange of information in areas of common interests. No restrictions were placed upon membership or form of organization other than those already set forth in JUG by-laws.

In Washington, on December 11, 1961, JUG again met, this time beginning to leave its organizational problems behind. The Meetings Committee reported on the success of sessions which JUG sponsored and co-sponsored at the 1961 ACM meeting, and a proposal for CODASYL to sponsor a joint symposium was discussed. The Communications Committee reported on the status of its sub-committees which were developing SMALGOL, investigating the universality of FORTRAN and encouraging publication of creditable user-oriented material. The Training Committee established the need to survey the accomplishment of groups concerned with the education and training of persons engaged daily in computing services. Special problems of growth of individuals and the necessity for retraining in fundamentals are considered important.

future

Future plans call for a more active participation in planning programs for meetings of professional groups, providing stimulation for users to publish acknowledgedly sound papers, a representation of user views of standards, and dissemination of more useful and creditable information among users of many machines with an eye to saving time and expense. Working groups will be formed to act on problems facing personnel at a variety of installations. JUG will become what its member groups desire and need it to be.

On September 20-21 JUG sponsored a Symposium-Workshop on Decision Tables at the Barbizon Plaza Hotel, New York City. The Systems Group of CODASYL was responsible for the technical content and presentation. The initial feedback indicates that the attendees found the Symposium to be very worthwhile and as a consequence JUG will look for other such activities to sponsor in the future. ■

"A bird is an instrument working according to mathematical law, which instrument it is within the capacity of man to reproduce with all its movements"—Leonardo da Vinci (1452-1519)

ATTITUDES TOWARD INTELLIGENT MACHINES*

Part One: an examination of the continuum of opinion

by PAUL ARMER, The RAND Corp., Santa Monica, California

This paper attempts to analyze attitudes and arguments brought forth by questions like "Can machines think?" and "Can machines exhibit intelligence?" Its purpose is to improve the climate which surrounds research in the field of machine or artificial intelligence. Its goal is not to convince those who answer the above questions negatively that they are wrong (although an attempt will be made to refute some of the negative arguments) but that they should be tolerant of research investigating these questions. The negative attitudes existent today tend to inhibit such research. [1] Almost an entire book, *Computers and Common Sense, The Myth of Thinking Machines*,[a] has been devoted to condemning such research. [2]

history

Before examining the current arguments and attitudes toward artificial intelligence, let us look at some of the history of this discussion, for these questions have been around for a long time.

Samuel Butler (1835-1902) in *Erewhon and Erewhon Revisited* [5], concocted a civil war between the "machinists" and the "anti-machinists." (Victory, incidentally, went to the "anti-machinists.") Butler stated "there is no security against the ultimate development of mechanical consciousness in the fact of machines possessing little consciousness now" and speculated that the time might come when "man shall become to the machines what the horse and dog are to us." Discussion of this topic apparently took place in Babbage's time (1792-1871), for the Countess of Lovelace commented on it, negatively, in her writings of Babbage's efforts. [6] The topic came into

[a] Readers who have been exposed to this book should refer to reviews of it by Richard Laing [3] and Walter R. Reitman [4], particularly the former.

*This article will appear in "Computers and Thought," edited by E. Feigenbaum and J. Feldman, to be published this summer by McGraw-Hill, N.Y.

prominence in the late 1940's when Babbage's dreams became a reality with the completion of the first large digital computers. When the popular press applied the term "giant brains" to these machines, computer builders and users, myself included, immediately arose to the defense of the human intellect. We hastened to proclaim that computers did not "think"; they only did arithmetic quite rapidly.

A. M. Turing, who earlier had written one of the most important papers in the computer field on the universality of machines [7], published in 1950 a paper on *Computing Machinery and Intelligence.* [8] In it he circumvented the problem of properly defining the words "machine" and "thinking" and examined instead the question of a game wherein an interrogator, who can communicate with a human and a machine via teletype, but does not know which is which, is to decide which is the machine. This is now known throughout the computer field as "Turing's Test."

Discussion of machine intelligence died down (but not out) in the early and mid 1950's but has come back in the last several years stronger than ever before.

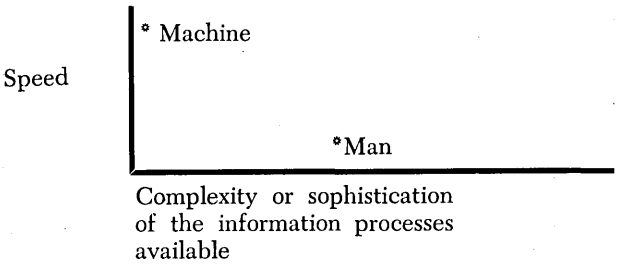
a way of thinking about thinking

Before beginning an examination of the negative arguments, allow me to introduce a concept which will aid in discussing these arguments and which may help resolve some of the semantic difficulties associated with discussions of "Can machines think?" Like Turing, I avoid defining "to think." Instead, observe that thinking is a continuum, an n-dimensional continuum. This notion is certainly not new, for it has existed since man first compared his mental abilities with another man's, and it is implicit in all of the positive arguments on machine intelligence. Psychologists long ago developed "intelligence quotient" as a yardstick in this continuum, and their concept of "factors" is indicative of the n-dimensionality of the continuum of intelligence. The use of the one-dimensional "I.Q." is obviously an over-simplification of reality. Although the concept of an n-dimensional continuum for intelligence is not new, and although it is implicit in many discussions of artificial intelligence, it is rarely stated explicitly.

An analogy may be drawn with the continuum of the ability to transport. With respect to speed in transporting people from New York to Los Angeles, the jet airplane of today outshines all other existing transportation vehicles. But it does not compare favorably, costwise, with ships for transporting newsprint from British Columbia to California. Existing commercial jet transports cannot transport people from one lake to another. A Cadillac may be the most comfortable vehicle to transport people short distances over a good network of roads, but it is hardly a substitute for the jeep in the environment of ground warfare – the jeep's forte is versatility and flexibility. In this dimension in the continuum of the ability to transport, man outshines the jeep, for man can go where jeeps cannot, just as the jeep can go where Cadillacs cannot. But men cannot carry the load that a jeep can, nor can men move with the speed of the jeep.

Similarly, comparisons can be made between men and machines in the continuum of thinking. If there is objection to the use of the word "thinking," then "ability to process information" or some similar term can be used. But it must be admitted that there exists some continuum of behavior in which men and machines coexist and in which they can be compared.

An n-dimensional continuum is difficult to draw when n is large, so let's examine a two dimensional one, realizing that reality is far from being that simple.



With respect to raw speed, machines outdo men, but when it comes to the sophistication of the information processes available, machines look pretty poor. This dimension deserves further discussion. While the repertoire of today's machines is quite simple – a few basic arithmetic operations and comparisons – man's information processes are very complex. Let me illustrate this point with the following incident. We have all had the experience of trying to recall the name of a person we have once met. On a particular occasion Dr. Willis Ware and I were both trying to recall an individual's name. We recounted to one another his physical characteristics, where he worked, what he did, etc. But his name eluded us. After some time, I turned to Dr. Ware and said, "His name begins with a 'Z'." At which point he snapped his fingers and correctly said, "That's it, it's Frizell!"

Now of course, the basic question is "Can the machines' capabilities in this dimension be improved?" Let me turn the question around – Is there any evidence that they cannot? I know of none. In fact, over the last decade I think impressive progress has been made. It's easy to underestimate the advances, for "intelligence" is a slippery concept. As Marvin Minsky put it, "You regard an action as intelligent until you understand it. In explaining, you explain away." [9]

Today's computers, even with their limited capability in the sophistication dimension, have had tremendous impact on science and technology. Accomplishments of the last decade in the fields of nuclear energy, missiles, and space would have been impossible without computers. If we can push the capabilities of computers[b] further out in the sophistication dimension, won't they have an even greater impact? *In this context then, the goal of research on artificial intelligence can be stated – it is simply an attempt to push machine behavior further out into this continuum.*

It is irrelevant whether or not there may exist some upper bound above which machines cannot go in this continuum. Even if such a boundary exists, there is no evidence that it is located close to the position occupied by today's machines. Is it not possible that we might one day understand the logical processes which went on in Dr. Ware's head and then mechanize them on a machine? We obviously will not achieve such a goal unless someone believes that it is possible and tries to do it. One does not have to believe that the boundary is non-existent in order to try; one need only believe that the boundary is much further out than the position occupied by today's machines.

intelligent machines and today's digital computer

A common attitude toward today's computers is that such machines are strictly arithmetic devices. While it is true that

[b] I make no distinction here between the attributes of the computer and those of the program which controls the computer.

machines were first built to carry out repetitive arithmetic operations, they are capable of other, non-numeric tasks. The essence of the computer is the manipulation of symbols – it is only an historical accident that the first application involved numeric symbols. This incorrect notion of the computer as a strictly numeric device results in the inability of many to conceive of the computer as a device exhibiting intelligent behavior, since this would require that the process be reduced to a numerical one. The reaction of many people to statements about intelligent behavior by machines seems to indicate that they take such statements to imply complete functional equivalence between the machine and the human brain. Since this complete functional equivalence does not exist, such people believe they have thereby debunked intelligent machines. Their argument is hollow since this equivalence was never implied. Intelligent behavior on the part of a machine no more implies complete functional equivalence between machine and brain than flying by an airplane implies complete functional equivalence between plane and bird.

The concept of comparing the behavior of men and machines in an n-dimensional continuum recognizes differences as well as similarities. For example, a common argument against machine intelligence is that the brain is a living thing – the machine is not. In our continuum we simply recognize the dimension of living and note that machines and men occupy different positions in this dimension.

While I do believe that today's digital computers can exhibit intelligent behavior, I do not hold that the intelligent machines of the 1970's will necessarily resemble today's machines, either functionally or physically. In particular, in my desire to see machines pushed further out in the continuum of intelligence, my interests in the dimension of speed are very minor; the organizational aspects (sophistication of the information processes) are obviously much more important. Likewise, I hold no brief for the strictly digital approach; a combination of analog and digital equipment may prove to be better. I do not mean to disown the digital computer, for it will be a most important tool in the endeavor to advance in our continuum.

some of the negative arguments

1. The Argument of Invidious Comparison

Considering the behavior of men and machines in the context of intelligence being a multi-dimensional continuum, an argument that a machine cannot play chess because "it could only operate on standard-size pieces and could not recognize as chessmen the innumerable pieces of different design which the human player recognizes and moves around quite simply" [10] is like saying that the Wright brothers' airplane could not fly because it could not fly non-stop from Los Angeles to New York nor could it land in a tree like a bird. Why must the test of intelligence be that the machine achieve identically the same point in the continuum as man? Is the test of flying the achievement of the same point in the continuum of flying as that reached by a bird?

2. The Argument of Superexcellence

Many of the negativists[c] seem to say that the only evidence of machine intelligence they will accept is an achievement in our continuum seldom achieved by man. For example, they belittle efforts at musical composition by machine because the present output compares miserably with that of Mozart or Chopin. How many *men* can produce music that compares favorably? The ultimate argument of this kind occurred at a recent meeting in England, during which a discussant stated that he would not accept the fact that machines could think until one proved the famous conjecture of Fermat, better known as Fermat's last theorem. By this logic one concludes that, to this date, no man has been capable of thinking, since the conjecture remains unproven.

3. The Argument of Definition

There are many variations of this type of argument. For example, some negativists want to include in their definition of intelligent behavior the requirement that it be carried out by a living organism. With such a definition, machines do not behave intelligently. However, there does still exist machine behavior which can be compared with human behavior. To conclude that research on the simulation of such human behavior with a machine is wrong, as some have done, because the machine is not living, is like concluding that research on the simulation of the functions of the human heart with an artificial heart is wrong because the artificial organ is not a living one.

4. The Argument by Stipulation

An examination of the arguments advanced by the negativists reveals that many of them are not arguments at all, but only statements. They dismiss the notion out of hand, saying things like, "Let's settle this once and for all, machines cannot think!" or "A computer is not a giant brain, in spite of what some of the Sunday supplements and science fiction writers would have you believe. It is a remarkably fast and phenomenally accurate moron." [13]

5. The Argument by False Attribution

Typical of this type of argument is the following:

> "The Manchester machine which was set to solve chess problems presumably proceeded by this method, namely by reviewing all the possible consequences of all possible moves. This, incidentally, reveals all the strength and weakness of the mechanism. It can review far more numerous possibilities in a given time than can a human being, but it has to review all possibilities. The human player can view the board as a whole and intuitively reject a number of possibilities. The machine cannot do either of these." [14]

The statements about machine behavior in the above quotation are simply not true. While it is true that some of the early approaches to chess-playing machines were in the nature of attempts to review *all* possibilities in limited depth [15], this is not the only way in which the problem can be approached. The chess-playing routine of Newell, Shaw, and Simon [16] does *not* examine all possibilities. And those which it does consider it examines in varying detail. The routine rejects moves which appear to be worthless; it selects moves which appear to be good ones and examines them in depth to ascertain that they are indeed good. An earlier routine developed by this same team to prove theorems in logic [17] did not examine all possible proofs – to do so with today's computers would literally take endless time. Rather, the routine searched through the maze of possible proofs for ones which looked promising and investigated them. It relied on knowing which approaches had worked before. Most of those who scoff about research on artificial intelligence turn out to be unaware of the details of what is going on in such research today; it is little wonder that they frequently make erroneous statements about the field.

6. The Argument by False Extrapolation

This class of argument is typified by extrapolations based on assumptions that machine properties are invariant. For example:

> "The human memory is a filing system that has a far greater capacity than that of the largest thinking machine built. A mechanical brain that had as many

tubes or relays as the human brain has nerve cells (some ten billion) would not fit into the Empire State Building, and would require the entire output of Niagara Falls to supply the power and the Niagara River to cool it. Moreover, such a computer could operate but a fraction of a second at a time before several thousand of its tubes would fail and have to to be replaced." [18]

The point is tied to the vacuum tube (the article was written in 1954) and has therefore already been weakened by the appearance of the transistor, which requires less space and power and is considerably more reliable than the vacuum tube. An offsetting development is that the estimate of the number of nerve cells is undoubtedly too low. However, on the horizon are construction techniques involving the use of evaporated films, where the details of the machine will not be visible under an optical microscope. [19] It seems reasonable to expect that it will be possible with these techniques to house in one cubic foot of space the same number of logical elements as exist in the human brain. Power requirements will be trivial.

7. The Obedient Slave Argument

One often hears statements like "The machine can only do what it is told to do." People who advance this obedient slave argument would seem to be thinking that they are countering others who have pointed to a large conglomeration of unconnected transistors, resistors, and electronic components, and said "It thinks." Certainly man is involved in machine intelligence – so are parents and teachers in human intelligence. Do we deny flying to an airplane because a man is piloting it or even to an unmanned flight because a man designed it?

The negativists who say "the machine can only do what it is told to do" overlook the fact that they have not qualified their statement as to what is the limit of what the machine can be told to do. What evidence exists concerning the location of that limit? Might it not become possible to tell a machine to learn to do a given task, a task usually considered to require intelligence? Many of the tasks being accomplished with computers today were not considered possible ten years ago.

recent computer tasks and milestones

The mounting list of tasks which can now be carried out on a computer but which we normally consider requiring intelligence when performed by humans, includes such things as:

Proving theorems in logic and plane geometry [17], [20]
Playing checkers and chess [21], [16]
Assembly line balancing [22]
Composing music [23]
Designing motors [24]
Recognition of manual Morse Code [25]
Solving calculus problems [26]

The collection of capabilities which have been ascribed solely to humans in the past is being slowly chipped away by the application of computers. Space precludes going further into the evidence for machine intelligence; this topic is well covered in the articles previously cited and in other papers. [27, 28, 29] Such evidence is, of course, the basis for many of the arguments advanced by the positivists.

To prove that machines *today* do *not* exhibit intelligence, it is only necessary to define a lower bound in our continuum which is above the behavior exhibited by the machines and then say that behavior above that bound is intelligent and below it is not intelligent. This is a variant of the proof by definition. Many who use this gambit have been redefining the lower bound so that it is continually above what machines can do today. For example, we find:

"Perhaps the most flexible concept is that any mental process which can be adequately reproduced by automatic systems is not thinking." [30]

This redefinition may not be done consciously. A skill which seems highly intelligent in others becomes much less impressive to us when we acquire that skill ourselves. It would be useful to have at hand some milestones for the future. Turing's test is one such milestone [8] but additional ones are needed. To this end a clearly defined task is required which is, at present, in the exclusive domain of humans (and therefore incontestably "thinking") but which may eventually yield to accomplishment by machines. (See "Benchmarks in Artificial Intelligence" by Fred Gruenberger, p. 33, *Datamation*, Oct., 1962)

rivalry between man and machines

There is a strong personal factor in the attitude of many negativists. I'm sure it was a major factor in my being a negativist ten years ago. To concede that machines can exhibit intelligence is to admit that man has a rival in an area previously held to be within the sole province of man. To illustrate this point, let me quote from a letter received at RAND:

". . . semantics may have a lot to do with the degree of enthusiasm for supporting research in this area (artificial intelligence). Subjectively, the terms 'intelligent machine' or 'thinking machine' disturb me and even seem a bit threatening: I am a human being, and therefore 'intelligent' and these inhuman devices are going to compete with me and may even beat me out. On the other hand, if the very same black boxes were labelled 'problem solver,' or even 'adaptive problem solver,' they would seem much more friendly, capable of helping me in the most effective way to do things that I want to do better, but, best of all, I'd still be the boss. This observation is wholly subjective and emotional . . ."

Another explanation of why some negativists feel the way they do is related to what might be called the "sins of the positivists." Exaggerated claims of accomplishments, particularly from the publicity departments of computer manufacturers, have resulted in such a strong reaction within the scientific community that many swing too far in the opposite direction.

da vinci and flying

At this point allow me to paraphrase the quotation of da Vinci's, with which this paper was begun, and also, with the benefit of hindsight, expand on it somewhat. Thus, he might have said:

"When men understand the natural laws which govern the flight of a bird, man will be able to build a flying machine."

While it is true that man wasted a good deal of time and effort trying to build a flying machine that flapped its wings like a bird, the important point is that it was the understanding of the law of aerodynamic lift (even though the understanding was quite imperfect at first) over an airfoil which enabled men to build flying machines. A bird isn't sustained in the air by the hand of God – natural laws govern its flight. Similarly, natural laws govern what went on in Dr. Ware's head when he produced "Frizell" from my erroneous but related clue. Thus, I see no reason why we won't be able to duplicate in hardware the very

[c] The terms "negativists" and "positivists" are used in this paper to classify those who do not and those who do, respectively, believe machines can exhibit intelligent behavior. Of course, variations of degree exist.

powerful processes of association which the human brain has, once we understand them. And if man gained an understanding of the processes of aerodynamics, may he not also obtain an understanding of the information processes of the human brain?

There are other facets to this analogy with flight; it, too, is a continuum, and some once thought that the speed of sound represented a boundary beyond which flight was impossible.

approaches to the problem of building an intelligent machine

This topic can perhaps be expounded best with another analogy. Suppose we are given a device which we know exhibits intelligent behavior because we have observed it in action. We would like to build a machine which approaches it in capability (or better yet, exceeds it). We bring in a group of men to study the basic components of the device to understand how they work. These men apply pulses to subsets of the leads, and observe what each component does; they try to understand why the device behaves as it does in terms of basic physics and chemistry. They also seek to learn how these components function in sub-assemblies.

A second group of men approach the problem from the point of view that the device is a "black box" which they are not able to open. This group observes that some of the appendages of the device are obviously input devices while others are output devices. They observe the device in operation and attempt to theorize how it works. They proceed on the basis that it will not be necessary that the machine they are to construct have the same basic components as exist in the device under study. They believe that if they can understand the logical operation of the existing device, they can duplicate its logic in their own machine, using components they understand and can make.

This second group makes conjectures about the logical construction of the device and tries these conjectures out in a computer which they have at hand. These theories are very crude at first and do not mirror the behavior of the "black box" very well, but over time the resemblance improves.

Because we learned a lesson from the effort spent on attempting to build a flying machine that flapped its wings, we set a third group to work studying "intelligence and information processing" per se and building up a science in the area.

There is much common ground among the three groups and they keep each other posted on results to date. Furthermore, they all use computers to aid them in their research. The groups combine their know-how along the way to build better computers (low I.Q. intelligent machines) on which to try out their conjectures. Eventually, the three groups "come together in the middle" and build a machine which is almost as capable as our model. They then turn to the task of building an even better one.

In the real life situation of studying the human brain, the first group, studying components and assemblies thereof, is represented by physiological work. The second, or "black box" group, is represented by psychological efforts to explain human mental activity. This analogy represents, I believe, a plausible scenario for the way things might go in trying to understand the human mind. *(To be concluded next month.)* ■

REFERENCES

1. MacGowan, R. A., Letter to the Editor, *Science*, July 22, 1960.
2. Taube, M., *Computers and Common Sense, The Myth of Thinking Machines*, Columbia University Press, 1961.
3. Laing, R., Book Review, *Behavorial Sciences*, April 1962.
4. Reitman, W. R., Book Review, *Science*, March 2, 1962.
5. Butler, Samuel, *Erewhon and Erewhon Revisited*, Modern Library No. 136, Random House, New York, 1933.
6. Bowden, B. V. (Editor), *Faster than Thought*, Pitman, London, 1953.
7. Turing, A. M., "On Computable Numbers," *Proceedings London Mathematical Society*, Ser. 2, vol. 42, p. 230, 1936; vol. 43, p. 544, 1937.
8. Turing, A. M., "Computing Machinery and Intelligence," *Mind*, October 1950. Also available in *The World of Mathematics*, Vol. 4, p. 2099.
9. Minsky, M., "Methods of Artificial Intelligence and Heuristic Programming," *Proceedings of the Symposium on the Mechanization of Thought Processes, NPL, November 1958*, Her Majesty's Stationery Office, 1959.
10. Taube, Mortimer, Letter to the Editor, *Science*, August 26, 1960.
11. Samuel, A. L., Letter to the Editor, *Science*, September 16, 1960.
12. Wiener, Norbert, "Some Moral and Technical Consequences of Automation," *Science*, May 6, 1960.
13. Andree, R. V., *Programming the IBM 650 Magnetic Drum Computer and Data Processing Machine*, Holt, 1958.
14. Hugh-Jones, E. M., "Automation Today," *Automation in Theory and Practice*, Oxford, 1956.
15. Kister, J., P. Stein, S. Ulam, W. Welden, and M. Wells, "Experiments in Chess," *Journal of the Association for Computing Machinery*, April 1957.
16. Newell, A., J. C. Shaw, and H. A. Simon, "Chess-Playing Programs and the Problem of Complexity," *IBM Journal of Research and Development*, October 1958.
17. Newell, A., J. C. Shaw, and H. A. Simon, "Empirical Explorations of the Logic Theory Machine," *Proceedings of the Western Joint Computer Conference*, February 1957.
18. Troll, J. H., "The Thinking of Men and Machines," *Atlantic Monthly*, July 1954.
19. Shoulders, K. R., "On Microelectronic Components, Interconnections, and System Fabrication," *Proceedings of the Western Joint Computer Conference*, May 1960.
20. Gelernter, H. L., "Realization of a Geometry Theorem Proving Machine," *Proceedings of the International Conference on Information Processing, UNESCO*, Paris, France, 1960.
21. Samuel, A. L., "Some Studies in Machine Learning Using the Game of Checkers," *IBM Journal of Research and Development*, Vol. 3, No. 3, July 1959.
22. Tonge, F. M., *A Heuristic Program for Assembly Line Balancing*, Prentice-Hall, 1961.
23. Hiller, L. A., and L. M. Isaacson, *Experimental Music*, McGraw-Hill, 1959.
24. Goodwin, G. L., "Digital Computers Tap Out Designs for Large Motors, Fast," *POWER*, April 1958.
25. Gold, B., "Machine Recognition of Hand Sent Morse Code," *IRE Transactions on Information Theory*, March 1959.
26. Slagle, J., "A Computer Program for Solving Problems in 'Freshman Calculus'," Ph. D. Thesis, M.I.T, 1961.
27. Newell, A., J. C. Shaw, and H. A. Simon, *Problem Solving in Humans and Computers*, The RAND Corporation paper P-987; December 7, 1956.
28. Milligan, Margaret, "Machines are Smarter Than I Am!" *Data Processing Digest*, October 1959.
29. Minsky, M., "Steps Toward Artificial Intelligence," *Proceedings of the IRE*, January 1961.
30. Meszar, J., "Switching Systems as Mechanized Brains," *Bell Telephone Laboratories Record*, February 1953.

Broadening the scope of DATAMATION'S interview series with prominent executives in computer manufacturing, the following edited output of a two-hour session at Computer Sciences is the first of a three-pronged exposure to the views of leading citizens in the consulting field. Scheduled for April and May are taped interviews with Elmer Kubie, President of CUC, and Dr. Herbert Robinson, President of CEIR.

COMPUTERIZED REFLECTIONS AT CSC

an interview with Fletcher Jones, president, Computer Sciences Corp.

by HAROLD BERGSTEIN, Editor

Q: Some of our readers may not be familiar with the origins and current status of CSC. Could you provide us with a capsule summary?

A: Computer Sciences Corporation got under way early in 1959 and initially concentrated on systems programming. Our interests and capabilities, however, ran across broader lines and, after the first year or so, we extended our activities to other areas, such as scientific and business applications analysis and programming, command and control systems, operations research, process control, and other aspects of computer-oriented problem solution. We have recently entered the service bureau business with the installation of our 1107.

The company began with five members and now employs over 200. Of this number, about 180 are classified as professionals. In terms of volume of business, our first full year of operations grossed about $300,000. We are now somewhat over $4,000,000 a year. For the coming fiscal year, we expect our business volume to reach approximately $6,500,000. We have offices in Los Angeles, New York City, and Houston.

Q: Do you have any plans for becoming a publicly owned corporation?

A: We are interested in the subject in the long range sense, but have no immediate need or plans for public financing.

Q: Would you describe some of the major contracts which CSC has obtained?

A: One of our first projects included development of the FACT language, the design of its compiler, and implementation of most of the FACT processor. Later, CSC developed the LARC Scientific Compiler, an upgraded variant of the FORTRAN II language, and designed the ALGOL/FORTRAN compiler for the RCA 601. Recently, we have finished other complete systems for large scale computers such as the UNIVAC III and 1107. By complete systems, I mean the algebraic and business compilers, executive system, assembly program and other routines. For the Philco 2000, we developed ALTAC IV, COBOL-61, and a very general report generator. An assembly program for a Daystrom process control computer, a general sort-merge for another computer, several simulators, and many others at this level of effort have been accomplished.

In areas concerned with applications, we developed two PERT/COST systems for aircraft manufacturers and are responsible for the design and implementation of a command and control system at Jet Propulsion Lab for use by NASA in many of our space probes scheduled later this year and beyond.

In the scientific area we have worked on damage assessment models, data acquisition and reduction systems, re-entry and trajectory analysis, maneuver simulation, orbit prediction and determination, stress analysis, heat transfer, impact prediction, kill probabilities, war gaming, and video data analysis.

In the commercial applications area, we have produced systems for payroll and cost accounting, material inventory, production control, sales analysis and forecasting, insurance and banking problems, etc.

Q: As an accompaniment to your move to new quarters and the acquisition of an 1107, there has been speculation that CSC will expand the scope of its professional interests to include management oriented services for such industries as insurance, banking, oil, etc. Is this true?

A: Our scope is rather basic and concisely stated. We are interested in any area where a problem exists, so the answer to your question must be "yes". We have operated

in certain of these areas for some time now.

Q: There has been some discussion in the industry suggesting that you obtained the 1107 in a form of trade-off with UNIVAC for completing the machine's programming system. Would you care to comment?

A: Of course. The 1107 hadware contract between UNIVAC and CSC is a completely separate, free-standing, and independent agreement. There is no relationship between the hardware and software contracts.

Q: In your sale of 1107 time to 7090 users, do you expect to overcome the problem of reprogramming through the availability of FORTRAN IV?

A: First, this is not our only or even major source of business for the 1107. For this segment of our business, however, both FORTRAN II/IV and compatibility with 729 tapes will aid immeasurably.

Q: What about the variation in monitor systems?

A: This is a minor problem, but we feel the size and speed of the 1107 will offset this difficulty for many 7090 users. The 1107 monitor has all the features required, so conversion becomes a matter of fairly simple reformatting.

Q: In the sale of 1107 time you have recently announced an interesting departure from the customary prime shift concept (See *Datamation,* p. 21, February). Would you explain your reason for this change?

A: Our primary reason for the variation is evidence that service bureau customers have found other systems wanting. First, they have found that price breaks could be obtained only by committing to a guaranteed number of hours per time period, usually a month. We calculate price breaks based on volume *after* each month of usage, and hence give the user the benefit of volume usage without requiring his guarantee.

Secondly, the customer usually has a range of priority demands, but other service bureaus have only first and second shift rates, thus limiting pricing flexibility. Our system is set up to provide a far finer gradation based on a standard rate for return of results within 24 hours, with additional cost if the need is more urgent or if a precise time of day is scheduled. For many reasons, this tends to save the user money.

Q: Switching tracks to the broader scope of industry activities, would you comment on the unusual growth of the computer consultant or service house industry and the general economic condition of firms in this field?

A: I have heard the statement that the computer service industry will be as large in terms of gross revenue as the computer manufacturing industry within 10-12 years. This may sound dramatic at this point, but we see an almost unlimited growth potential in this field for anyone who can maintain high standards of capability and performance.

At present, however, some firms are losing quite a bit of money. I believe this is probably a momentary misdirection in the area of over-commitment to expensive tools; in this case, computers.

Many of the smaller service houses have come and gone, and this is a natural and healthy process which results from the fact that they were not well organized and financed or didn't have the talent to sustain a position in the field.

Q: Perhaps we can discuss a specific case. In Los Angeles, CEIR has a 7090/1401, 1604/160A, and last year planned to install a STRETCH. The STRETCH was cancelled, the Control Data equipment has been scheduled for removal this year (re: CEIR's recent annual report), and CEIR has put in a bid to System Development Corporation for the transfer of its 90. CEIR would then operate only a 1401. With the substantial amount of computer time required for Southern California, what is your view as an educated outsider, for this substantial reduction in CEIR's hardware capability?

A: It is my belief that, for the effective exploitation of hardware, a company must have a broad and deep base in terms of its capability in technical areas, notably those concerned with problem analysis and programming.

This is not something which is found wanting throughout CEIR, perhaps, but I understand there were about 15 programmers in Los Angeles supporting the large computer installation you described and I think this is very shallow support. It tells us that this organization overemphasized and relied upon the sale of pure time on their equipment, rather than having taken a more complete approach to problem solution. The philosophy of selling large computer time on a "laundromat" basis is a frail one at this point, although momentary successes can be noted. There must be a proper balance, between the sale of time and other services, which can sustain the operation as a whole even if either momentarily flags. We regard the computer as an aid to problem solution, not as an end in itself as a revenue producer. In short, we feel you must need the computer to solve problems, not merely to sell time; demand for time then seems to take care of itself.

To summarize, I believe that the condition you described is probably due to an over-commitment to machinery and under-commitment to people.

Q: A problem of major concern to the industry is the lack of competence common to many consulting firms and their ability to sell their services to the unsophisticated user. Would you comment on this problem?

A: There is an undeniable history of "malpractice" in the consulting field and, while it's not a generalized condition, it's not rare either. The malpractice usually occurs when an individual or organization undertakes a problem outside its area of competency. The dearth, and often a lack of appreciation, of talent in the field results in many examples of this, as in the classical case of the public accounting firm, perhaps outstanding in its own field, which attacks a complex business systems computer application armed with a few coders and little else – the result is nearly always disastrous, and "consulting" gets another black eye. We quite often read, in consultants' brochures, about people who are "compiler experts," when we know the limit of their systems programming experience is that they once wrote a utility routine or inserted manufacturer-issued changes into a FORTRAN deck. This condition has to result in disappointment.

The best safeguard against disappointment in the use of consultants will always be in the customers' hands: he should be positive that the consulting organization has a record of solid performance in the subject area, and he should rigorously check references, of both the company and the key individuals who will handle his problem. He should also be wary of "bargains." Some of the worst cases of problem mishandling arise from the "moonlighter" or often overcommitted, small firm, whose low price lulls the customer into forgetting that excellence in performance costs more but is invariably worth the difference.

Q: On the subject of compiler development, CSC is widely known for its work on the FACT language and processor. There has been considerable discussion on delays in meeting deadlines, delays in hardware availability, etc. Your experiences with FACT are often referred to as a basis for the establishment of new customer-manufacturer relationships such as a switch from time and material to fixed cost contracts. Would you explain CSC's position with regard to FACT?

A: A full statement of history would necessarily require far more time than we have now, due to the many cause and

effect relationships inherent in a development of the kind under discussion. There are things which CSC, and I'm sure Honeywell, would do differently if the problem were encountered anew, but this is always the case, whether the name of the project is FACT, FORTRAN, AIMACO, SOS or any other of the many compilers which, at their initial issue, were "late."

Within the framework of absolute accomplishment, however, neither Honeywell nor CSC need assume a defensive posture; FACT is a pioneering project incorporating a high level of achievement – no other language or compiler yet has the breadth of scope and completeness of facility to be found in the FACT system. The Intermediate Range Committee, by far the most knowledgeable group within CODASYL, voted unanimously, despite later politically-oriented recantations, for the FACT language as the standard of excellence for its time.

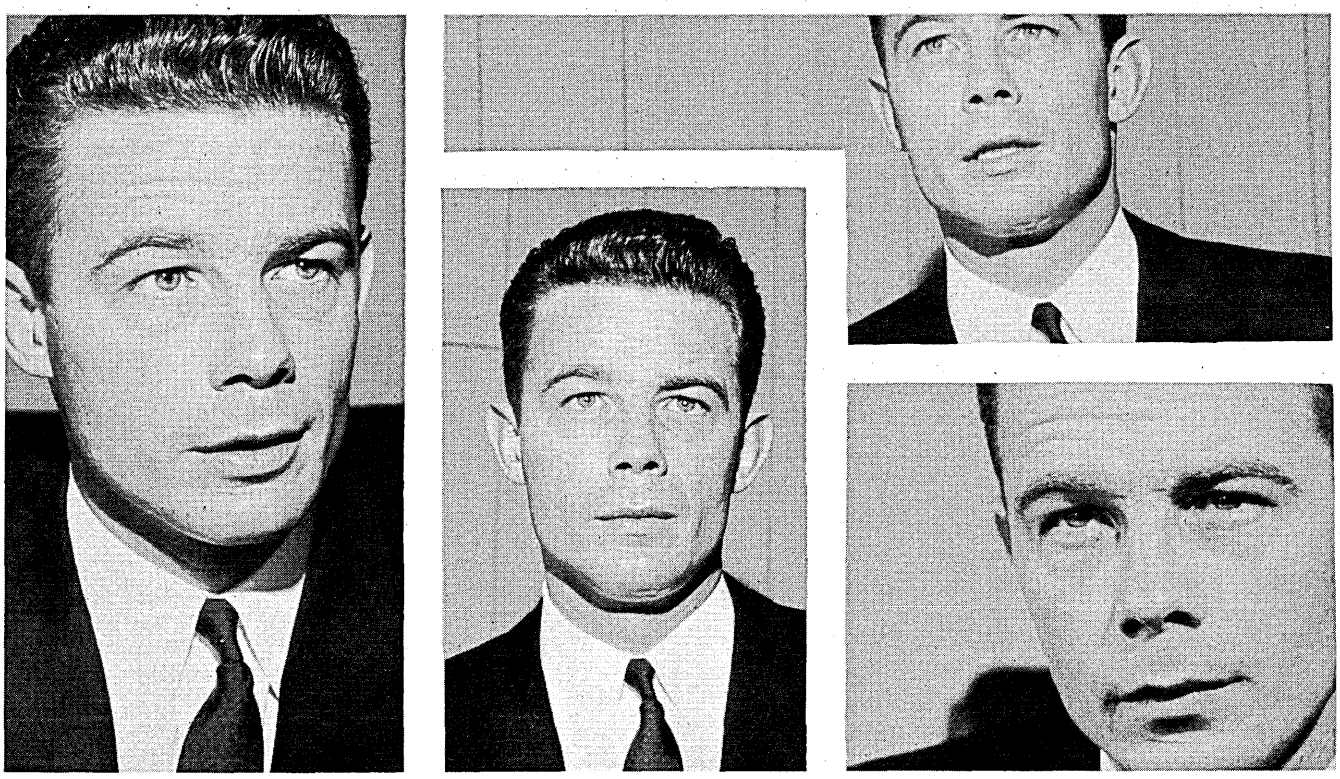
That it was an ambitious project, perhaps too ambitious for the immediate needs of the ultimate users; that there was overoptimism during its development; that there was too much change after the design freeze date (much of which was demanded by the users who later bewailed its lateness), cannot be denied. Much more prosaic developments have suffered the same fate, however, and rare indeed is the systems programmer who can cast the first stone on these counts.

As a practical matter, however, regardless of good motives and the whys of lateness, it is certain that, to the ultimate user, a very substantial part of the value of a system is its availability on schedule. On this score, both Honeywell and CSC learned lessons from FACT, and from the H-800 development itself, which I'm sure will protect their customers from a reoccurrence in the future. Certainly we learned; CSC has delivered complete software systems, including assembly program, executive system, COBOL and FORTRAN compilers, etc., on a fixed price basis and in a much shorter time frame, since the FACT project.

As to the effect of FACT on contract type for this kind of work, I'm not sure that there's any direct relationship, except as the experience might apply to the thinking of Honeywell and CSC. We have, since FACT, virtually always proposed a fixed price contract because we feel it induces a certain needed discipline in the contracted relationship and because it tends to keep the competition honest and to weed out, through economic attrition, those who bid low but don't have the capability to produce economically. As far as I know, CSC was the first to promote the use of fixed pricing on work of this type and size.

Q: Would you estimate the total costs to Honeywell of the development and implementation of the FACT language and compiler?

A: I have no way of accurately estimating this cost, since so many factors are involved, although some comparisons might be made. From exposure to software budgets and projects within other manufacturer's shops, I can state a belief that FACT did not cost more than now might be anticipated for a development of such scope. Certainly our own level of FACT effort has been exceeded by others in the implementation of even state-of-the-art systems devoid of the FACT design problems and accomplishments. As compared with the original FORTRAN, in many ways analogous to FACT development in its time, I feel intuitively but strongly that FACT must have been much less expensive.



By far the biggest influence on "cost," however, is that connected with loss of revenue from those customers dependent upon the system in question. This is more a function of marketing policy than one of spent manpower. Some manufacturers experience little or no loss of revenue due to late deliveries, while others, dealing from a position of less strength in an attempt to attract customers, assume a posture of high vulnerability in these regards. When, in the latter case, there is a slippage, economic trauma results which can far overshadow other costs of development.

Q: Since you've raised the subject of "other" compilers, what is your opinion of the COBOL compiler as far as compatibility, efficiency and ease of use are concerned?

A: As to the first part of the question, I can't believe now, and I haven't believed since the first meeting of

CODASYL, in which I participated, that the language stands a ghost of a chance of becoming common within the definition that a common language may be taken from one computer library and used immediately in another without a measurable change.

Those who felt that this could be done were not entirely familiar with some of the problems involved, and consequently overlooked several important and basic reasons why effective compatibility cannot be achieved with a language such as COBOL.

With respect to the efficiency of the language in problem statement, COBOL suffers the fate that any narrative-based language would – there must be a better way, and I personally believe that there is, namely through the use of a strong symbolic language form. As far as concerns the permissible efficiency allowed the compiler by the COBOL language, this is doubtless much lower than need be.

Insofar as ease of use is concerned, COBOL is without doubt easier to use than machine language, but also doubtless harder to use than a language should be. Most to whom I've spoken on the subject state they think it is fourth place in ease of use and power in a list which includes COBOL, FACT, COMTRAN, and JOVIAL.

All of this isn't to state that COBOL should not have been done. Contrarily, I believe it was and is a worthwhile development when considered in proper perspective. I don't believe, however, that its development has attained any of the major goals which its promoters asserted were cinches; I don't believe it is or will be "common," or that it is qualified to be; I don't believe that it's a good communication language, even though its promoters said that "vice-presidents could read it and understand what's intended after an afternoon's instruction"–a laughable assertion now, as it was then; I lastly don't believe it's easy to teach – there are too many exceptions, too many disconformities, too many singularities.

All of these points of criticism would, in general, be true of any language developed at the time, particularly if narrative-based, including, though it is often believed to a lesser extent, FACT, COMTRAN, and others. The pity, then, is not that COBOL was developed, but rather that naiveté and heavy-handedness forced it upon the field to the point that other developments are stifled for whatever period of time is required for the field to purge itself of the notion that COBOL is the panacea for language problems; then, parallel efforts using different approaches may resume and continue to a healthier conclusion. In the meantime, computer manufacturers, the principal source for new language development, are naturally inclined to produce only that which is in demand, not engaging in much parallel language development, in an effort to keep costs low.

As I stated before, I believe the field could eventually rely on a strong symbolic language for the statement of business problems. This form would provide conciseness and clarity, would be much more easily and efficiently processed than narrative forms, and would stand a much greater chance of becoming common. I'm convinced that relatively few programmers using a strong symbolic language could get a lot more done than hordes using a narrative-based form.

Q: Assuming that COBOL has many disadvantages, wouldn't the use of a symbolic language be a reversal in efforts toward facilitating communication?

A: No, I feel it would be a definite advance. Symbolic notation has proven to be vastly superior to narrative as a communication medium. To illustrate, I believe we can point to the experience of those who've done more research in problem statement language than anyone else – mathematicians. Logicians and mathematicians have spent 3,000 years in language development, and you won't find one defining, solving, or even communicating on a problem in English. This is one reason I find it nearly unbelievable that some of the strongest supporters of narrative-based language, and COBOL in particular, are allegedly well-grounded in mathematics and its principles.

As to the ease of teaching symbolic form, the countless people who've learned and used FORTRAN, as an example, attest to the fact that symbolic is no harder to teach than narrative; contrarily, most I've heard who've been exposed to both, feel that FORTRAN is vastly easier to learn than COBOL.

Q: Is there any correlation between COBOL development and the lack of commercial implementation of ALGOL?

A: I don't see a direct correlation, except perhaps one having to do with the fact that, if ALGOL had been well specified and subsequently expanded in scope to include a facility for commercial problem statement, COBOL might never have entered the picture; however, this is true of other languages as well. Unfortunately, this was not the case. There are many, by the way, who believe that either ALGOL or FORTRAN is a good base for expansion to handle business problems, and some good students of this area even believe that one or both are now better than COBOL for this purpose.

In most directions, the two cases are quite different. COBOL entered the picture in a near vacuum, where hardly anyone was committed to the use of a given data processing language. ALGOL, on the other hand, faced the de facto standard, FORTRAN, and the pragmatics of the situation were and are such that popularity is not in the cards for ALGOL – no computer user who has a large library of FORTRAN programs, or who has access to the huge collective FORTRAN library, can justify the cost of conversion to a system which most are not even sure is better. Retraining of programmers is a significant factor, too. And, since user demand isn't present, most manufacturers think of ALGOL as a luxury or nice experiment, while they must regard FORTRAN as the sine qua non in the marketplace. The effect is cyclic and cumulative.

Also, COBOL had the benefit, if it is such, of sponsorship by government edict, while ALGOL didn't.

Q: As a concluding question, what particular problem current in our industry would you nominate as requiring priority attention?

A: All problems and their solutions have their roots in people, and consequently the lack of more effective capability on the technical side and leadership on the management side is probably our biggest problem. I have always felt that there are no financial problems, no technical problems, no engineering problems; just people problems. The others are mere manifestations of the people problem.

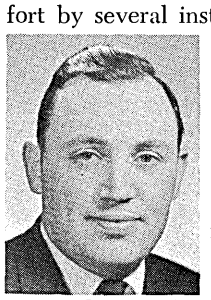
We see evidence of this all around us: Good computers *can* be built, but not all built are good; a computer manufacturer *can* be profitable without a large share of the market, but hardly any are, etc. People make the difference. We are a young industry; the technical talent shortage and the groping of management for a direction is characteristic of a new industry practicing frontiersmanship. Time will, of course, aid these problems.

Apart from generalities, I think two of the biggest problems the field faces in the near future have to do with impending labor reaction and its possible implications, and the establishment of a profitable base for more manufacturers. On a different plane, such problems as the need for economical, remote computer communication facility, and language development are very important. ■

HARE NTERNAL ORTRAN RANSLATOR

for sifting from II to IV

by J. J. ALLEN, IBM;
DONALD P. MOORE, UCLA, and H. PAUL ROGOWAY, AIS,
Los Angeles, Calif.



Just as compilers have eased the transition from one computer to another, source program translators ease the transition from one compiler to another. SIFT, the SHARE Internal FORTRAN Translator, is a FORTRAN program to translate FORTRAN II source programs into FORTRAN IV language. SIFT is the result of a cooperative effort by several installations.

Source program translation frees the specifications of the new language from the need to be compatible with the old language. Programmers are encouraged to learn the new language and to use it exclusively. Furthermore, the translator is a valuable teaching aid; it provides each programmer with correctly translated versions of his own old programs.

One of the unusual aspects of SIFT is that it was coded primarily in FORTRAN. Coding in FORTRAN is easier and faster than coding in machine language. The code is easier to read, and this simplifies communication, debugging, maintenance, and modification. Coded in FORTRAN II, SIFT can be converted to work in a FORTRAN IV system, by translating itself. It can be used on any computer which possesses a FORTRAN compiler; and every computer installation which might be interested in SIFT will certainly have a FORTRAN compiler.

Most of the incompatibilities between FORTRAN II and FORTRAN IV can be resolved by a simple transliteration, but three areas require more analysis. These are EQUIVALENCE-COMMON interaction, double-precision and complex arithmetic, and Boolean statements.

In FORTRAN, all variable mentioned in a particular program or subprogram are local to that program unless they are mentioned in a COMMON statement. That is, if one program uses the variable A and another program also contains the variable A, these programs will not refer to the same storage location during the execution of the program which contains these two subprograms.

There are two ways of communicating information from one subroutine to another. One way is to use the variable name as an argument in a CALL statement to the second subprogram. The location of this variable is then passed along through the calling sequence to the other subprogram. The second way to communicate information from one subprogram to another is through COMMON. If both subprograms contain an identical COMMON statement which includes the variable A then both programs

will be referring to the same absolute core location when they refer to the variable A.

The EQUIVALENCE statement in FORTRAN causes the same storage location to be shared by two or more variable names. Thus in the statement

EQUIVALENCE (B, C)

B and C will share the identical absolute core location.

In FORTRAN II the existence of a COMMON variable in an EQUIVALENCE statement may affect the COMMON storage allocation. This situation is illustrated in Figure 1.

Figure 1

FORTRAN II	FORTRAN IV
COMMON A, B	COMMON X,Y
EQUIVALENCE (B,C)	EQUIVALENCE (Y, Z)
Storage Allocation	Storage Allocation
1. B.....C	1. X
2. A	2. Y.....Z

When the variable B which is actually the second variable mentioned in the COMMON statement appears in an EQUIVALENCE statement, as it does here in the example, then the variable B and its equivalent C take precedence and are located in the first COMMON cell. The variable A which appears first in the COMMON statement is then located in the second COMMON storage cell.

In FORTRAN IV, however, no such reordering of COMMON occurs; thus, in the FORTRAN IV example we see that although the variable Y appears in an EQUIVALENCE statement, nevertheless X, the first variable in the COMMON statement, occupies the first COMMON cell. The variable Y and its equivalent Z occupy the second COMMON cell.

The COMMON-EQUIVALENCE problem is further complicated as illustrated in Figure 2.

Figure 2

FORTRAN II	FORTRAN IV
COMMON D	I
DIMENSION E(2)	L
EQUIVALENCE (D, E(2))	L
	E
Storage Allocation	G
1. E (1)	A
2. E (2).....D	L

The DIMENSION statement in FORTRAN enables one to define an array. That is, when one writes

DIMENSION E(2)

he defines E as being not a single-celled variable but rather an array containing two elements.

Here we see that E is an array of dimension 2 and D is declared equivalent to E(2). The COMMON storage allocation is as noted; namely, since the array E must precede D in order to provide that E(2) be equivalent to D, the array E occupies COMMON cells 1 and 2 while D, the first variable in the COMMON statement, shares COMMON cell 2.

In FORTRAN IV such an EQUIVALENCE specification is illegal since the first variable in COMMON always occupies the first COMMON cell and the array would therefore have to start in the 0th cell, which is clearly not allowed.

Finally, consider the example illustrated in Figure 3.

Figure 3

FORTRAN II	FORTRAN IV
COMMON F, G	COMMON U, V
DIMENSION H (3)	DIMENSION W (3)
EQUIVALENCE (F, H)	EQUIVALENCE (U, W)
Storage Allocation	Storage Allocation
1. F.....H(1)	1. U.....W(1)
2. } Gap H(2)	2. V.....W(2)
3. } Gap H(3)	3. W(3)
4. G	

When the COMMON variable E is equivalent with an array C in such a manner as to cause the array to extend beyond the length of the COMMON variable, FORTRAN II causes a gap to exist in the COMMON storage allocation as illustrated in Figure 3. That is, F which is EQUIVALENT to H(1), the first element of the H array, is located in the first COMMON cell and a gap is left in cells 2 and 3 of COMMON to allow for the elements H(2) and H(3). The second COMMON variable G is thus allocated to the fourth COMMON cell.

In FORTRAN IV however, no such gap is left. That is, in this example where U and V are in COMMON and U is equivalent to the array W of dimension 3, U is stored in the first COMMON cell and even though U is equivalent to the array W, and W(2) and W(3) will therefore occupy COMMON cells 3 and 4, respectively, the variable V nevertheless is allocated to the second COMMON cell.

As illustrated here, the incompatibilities between FORTRAN II and FORTRAN IV with regard to COMMON storage allocation are very severe. SIFT solves this incompatibility problem by determining the storage allocation caused by the FORTRAN II specification statements and generating a new COMMON statement such that when processed by the FORTRAN IV compiler will yield the identical storage allocation as was assigned in FORTRAN II. Figure 4 illustrates.

Figure 4

FORTRAN II	SIFT OUTPUT
COMMON P, R	COMMON S, Q000CM (2), P
DIMENSION S(2), T(3)	DIMENSION S(2), T(3)
EQUIVALENCE (R, S(2), T)	EQUIVALENCE (R,S(2), T)

Storage Allocation	
1. S (1)	
2. S(2).....R.....T(1)	
3. } Gap	T(2).....Q000CM(1)
4. } Gap	T(3).....Q000CM(2)
5.	

Here we see an example which contains all three of the problems of incompatibility between FORTRAN II and FORTRAN IV which we have previously illustrated in Figures 1 - 3. Namely, first, the COMMON variable R appears in an EQUIVALENCE statement while the COMMON variable P does not. P therefore, is allocated in the last COMMON location instead of the first. Second, the variable R is equivalent to the second element of an

array S thus causing the variable R to be located in the second rather than the first COMMON cell, and third, the array T is three cells long and equivalent to the variable R thus causing a gap of two cells to be created in COMMON locations 3 and 4.

SIFT generates the FORTRAN IV statement shown in Figure 4; namely, first the array S, second an artificially constructed variable Q000CM of dimension 2 and finally the variable P. Incidentally, this example also illustrates that in FORTRAN IV the DIMENSION information may be included in the COMMON statement. Thus, Q000CM followed by the constant "2" in parentheses in the COMMON statement is equivalent to having written the variable Q000CM in the COMMON statement and then having included the dimension information separately in a DIMENSION statement.

The second major area of incompatibility between FORTRAN II and FORTRAN IV is in the area of double-precision and complex statements. Figure 5 illustrates.

Figure 5

FORTRAN II

```
I  DIMENSION XI (2, 3), YI(5,5,5)
D  ALPHA=BETA*GAMMA
   B=YI (I,J,K)
```

SIFT OUTPUT

```
DIMENSION XI (2, 3), YI(5,5,5)
DOUBLE PRECISION ALPHA, BETA, GAMMA
COMPLEX X1, YI
ALPHA BETA GAMMA
B=PART (YI, YI (I,J,K), 125)
```

In FORTRAN II a *statement* is marked as being double precision or complex, by virtue of the appearance of a D or I in column one of the card containing the statement. This signifies that all of the variables and functions mentioned in that statement are to be treated as double-precision or complex for all computations for that particular statement. Thus, in the second statement in Figure 5, ALPHA, BETA, and GAMMA would all be treated as double-precision variables. That is, two machine words would be reserved for the storage for each variable and the multiplication and the store would be done assuming two-cell double-precision words.

In FORTRAN IV, however, no column one character is used. Rather a *variable* or a *function* is marked as double-precision or complex by virtue of its appearance in a DOUBLE PRECISION or COMPLEX Type statement, and this type remains associated with that variable or function throughout the program or subprogram. SIFT therefore translates the second statement

ALPHA=BETA*GAMMA

into two statements, namely,

DOUBLE PRECISION ALPHA, BETA, GAMMA

and simply

ALPHA=BETA*GAMMA

removing the D from column one. Similarly, the complex DIMENSION statement becomes two statements, a COMPLEX Type statement and a DIMENSION statement without the I in column one.

A serious problem arises when in FORTRAN II reference is made to only one part of a double-precision or complex variable. This is illustrated in the arithmetic statement in the FORTRAN II program

B=YI (I, J, K)

Here, the values of the subscripts determine whether the real or imaginary part is desired.

In this case FORTRAN IV has already recognized YI as being a complex variable by virtue of its appearance in a COMPLEX Type statement, so special action must be taken to indicate that in the arithmetic statement only one part of the complex pair is desired. SIFT solves this problem by creating a CALL to a PART function. The PART function has as arguments the name of the array, the particular element of the array which is to be referenced, and the total length as specified in the DIMENSION statement.

Thus

B=PART (YI, YI(I,J,K),125)

becomes the SIFT or FORTRAN IV equivalent to the FORTRAN II statement. The PART function yields the real or imaginary (or more significant or less significant) part of the element depending on the values of the subscripts.

The third major area of incompatibility between FORTRAN II and FORTRAN IV concerns Boolean statements. FORTRAN II has a means of specifying the computation of the Boolean operations of "and", "or" and "complement" on machine words. Although FORTRAN IV has statements which perform Boolean computations on "logical" variables which may take on only the values "true" and "false", it has nothing corresponding to the FORTRAN II Boolean computation on full machine words. Therefore, SIFT must replace Boolean statements by statements which call subroutines to perform the Boolean operations. Figure 6 illustrates.

Figure 6

FORTRAN II	SIFT OUTPUT
B A=B*C+D	A=OR (AND (B,C), D)
B F=G*(—H)	F=AND (G, COMPL (H))

FORTRAN II uses "+" for "or", "*" for "and", and "—" for "complement" in Boolean statements. A Boolean statement is identified by a "B" punched in the first column of the card. Thus, the FORTRAN II statement

B A=B*C+D

must be translated into the FORTRAN IV statement

A=OR (AND (B,C),D)

similarly

B F=G*(—H) becomes

F=AND (G, COMPL (H))

To accomplish such translations, SIFT must make the same kind of analysis performed by a compiler when processing arithmetic expressions.

In addition to these operations (and several more mundane transliteration tasks), SIFT also replaces all numeric input-output unit designators by symbolic designators, and, if requested, replaces the names of certain variables by more readable names supplied by the user.

Figure 7 (pg. 46) gives a rough flow chart of the SIFT program. SIFT processing takes place in three steps.

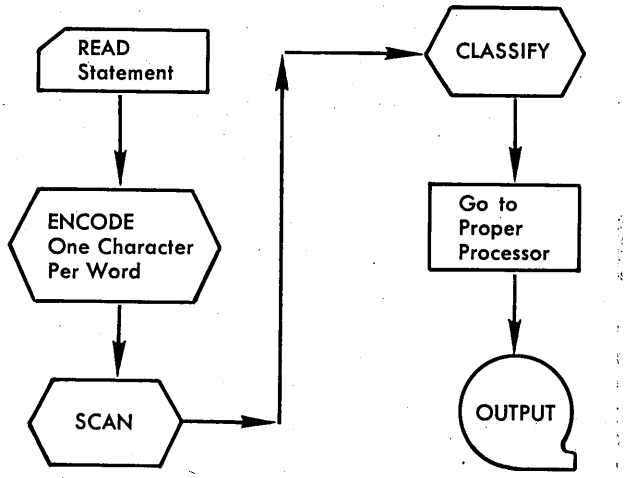
Figure 7

This block diagram illustrates the basic flow for both the first and the third steps of the SIFT program. First the statement is read. Then it is encoded one character per word. (This point will be explained in greater detail in a moment.)

Then, each input statement passes through a scan routine which builds a pointer table. The pointer table indicates the location within the statement of each verb, noun, operation sign, and punctuation mark. All subsequent analysis routines refer to the pointer table, and are thus spared such problems as scanning past blanks and ignoring operation signs within alphanumeric literals.

Next, each statement is classified according to type: arithmetic, DO, IF, input/output, etc. Then control is transferred to the processor for that type of statement. An

Figure 7



example of such a processor is the routine which processes COMMON, DIMENSION, and EQUIVALENCE statements. This processor records the name and order in COMMON of every COMMON variable; the name and length of every array, and all of the EQUIVALENCE information. All of this information is stored in tables for use during step two. Finally, the statement is written onto the intermediate tape.

The second step of SIFT processes many of the tables formed during step one and generates the new statements required to resolve the EQUIVALENCE-COMMON incompatibility.

The third step of SIFT may be described by this same diagram. Of course, in this case, the statement is read from the intermediate tape rather than from the initial input tape. Also, the processor for each type of statement makes use of tables previously formed in step one and outputs the statement not onto an intermediate tape but rather onto the output tapes which are then printed and punched.

Several interesting programming techniques were used in SIFT. The problem of writing a FORTRAN program to handle character strings was solved by using an internal character representation in which each character occupies one machine word. Ordinary FORTRAN indexing is then used to scan across an input string. Machine-language subroutines perform conversion between internal and external character representations. The internal character representation uses a character code especially designed for SIFT. It is illustrated in Figure 8.

Figure 8

Character	Internal Code
O — 9	0 — 9
A — Z	11 — 36
Blank	38
Other Punctuation	39 — 50

Example:

```
100 I = I + 1
    IF (IS (I)—LBLANK) 110,  100,  120
```

Here we see the characters 0-9 are the same as in the BCD code, 0-9; A-Z take on the code values 11-36; Blank is 38, and other punctuation such as comma, parentheses, etc., have the code 39-50.

Using this code, two FORTRAN statements suffice to scan to the next non-blank character in determining whether that character is a punctuation mark. For example, if IS is the name of the array containing the string and LBLANK is the name of the variable containing a blank, the statement

$I=I+1$

will increase the IS pointer and the IF statement will go back to statement 100 if the character in IS(I) is blank, thereby continuing the scan for the next non-blank character. If the character is alphabetic or numeric it will be numerically less than blank in our character code and hence control will pass to statement 110. If the character is a non-blank punctuation mark, control will pass to statement 120.

As was mentioned, SIFT must often insert new variable names into the programs it translates. An option is provided to allow the user of SIFT to specify classes of names to be inserted; otherwise standard classes of names are used. In addition, all entries on a list of variable names to be inserted are compared with all names appearing in the program being translated. Any conflicting name is deleted from the list of names to be inserted. (The list contains a number of spare names.)

The SHARE FORTRAN Committee, which represents the largest single body of FORTRAN users, went on record in March 1961 as favoring a new FORTRAN language which did *not* contain all of FORTRAN II as a subset. The committee, at that time, expressed its willingness to provide a translator program.

In April 1961, a Conversion Subcommittee of 15 members was appointed to study the problem. This subcommittee was divided into three divisions on a geographic basis. The divisions met separately prior to a full subcommittee meeting in June, at which time detailed specifications of the task were prepared, and methods were discussed. The western division completed the final specifications, and three of its members did the coding, which was completed in January 1962. The geographic proximity of these three (two in Los Angeles, one in San Diego) permitted them to meet several times, although most communication was by telephone and mail.

When the translator program was working to the satisfaction of its authors, the SHARE FORTRAN Committee sponsored a field test, with participants from more than 20 computing installations.

Results of that field test indicate that more than 250 programs have been SIFTed at a rate of approximately 200 cards per minute on an IBM 7090 computer, and all of them have been SIFTed apparently correctly. We say "apparently correctly" since no FORTRAN IV compiler existed at that time, and correctness had to be measured by manually examining the SIFT output and comparing it with current FORTRAN IV specifications.

To summarize, although SIFT does not allow for translation from any language to any other or even from any FORTRAN-like language to any other, nevertheless the results seem to indicate that automatic translation of this sort is practical. Although SIFT is basically a set of unique solutions to distinct problems, nevertheless many of the techniques seem widely applicable to the production of automatic translators. Further, the SIFT effort seems to illustrate that with careful planning a group of people at separate locations can successfully produce an involved program. Finally, it should be stressed that a complicated string program can be written almost exclusively in a scientific programming language. ■

CDC TO BUY BENDIX COMPUTER DIV.

for 10 megabucks

Early this month, the first contender to depart from the loss-ridden ranks of computer manufacturers in recent years made the critical transition from speculation to accomplished fact. Purchase of the Bendix Computer Div. by Control Data was jointly announced on March 2, pending formal approval by both corporations' boards of directors. Sale price: slightly under 10 megabucks.

In a recent statement to DATAMATION, Jim Miles, vice president for marketing of CDC, suggested that negotiations were initiated "quite recently" by Bendix, and a decision to acquire the division was reached in less than 30 days.

Reasons for the CDC decision, according to Miles, involve Control Data's long range corporate intention to enter various restricted areas of the industrial and business dp market, one of the directions which Bendix has taken.

Specifically, the G-20 affords CDC a system with software in a stage of near-completion, that can be used as a saleable approach to this segment of the medium-scale market. The fact that "Bendix is not in military systems" was also an attractive advantage to CDC, Miles adds, providing a better marketing balance for the profit-producing Minneapolis corporation.

Having announced a military systems division early last year, Bendix has been unable to secure any firm contracts. Within recent months, an impressive and costly effort was expended in bidding for a Navy contract involving seven G-20 installations. Although the contract was awarded to Bendix, it was never signed, and bids were reopened last month. Bendix General Manager Charles Edwards explained to DATAMATION that BuShips required the initial acceptance of a G-20 by a single installation with the provision that Bendix commit itself in advance both in manpower and production capability to all seven installations before contract signing. Bendix, Edwards said, would not accept these terms.

Control Data's close association with the Navy (through its Polaris contracts and other work) has led some speculators to assume that this contract was a major reason behind the recent purchase of Bendix. Miles, however, states that this was not an important consideration, but adds that BuShips may suspend further negotiations with other manufacturers until the Bendix-CDC acquisition is finalized. Just prior to the CDC announcement, Univac was suggested as a probable successor to Bendix for the Navy contract.

The unusually short time period in which the sale of Bendix was considered and confirmed has delayed numerous decisions concerning the computer division's integration into the CDC organization.

Included in current considerations are such questions as whether the present Bendix manufacturing facility in Los Angeles will be continued; whether officers of Bendix Computer will join CDC; whether CDC's 160 will be marketed as a replacement for the first generation G-15 and, finally, whether the G-20 will substitute for the two-year-old, still unannounced CDC 924, also in the medium-scale range. At present there are approximately 280 G-15 users and 20 installations of the G-20.

The economic headaches of Bendix Computer were brought to public attention early last year when a general "consolidation" of the division was announced (see DATAMATION, p. 19, April '62), during which five sales offices were closed and several key personnel left the firm including the general manager, M. W. Horrell.

Now with Univac, Horrell told DATAMATION late last month that despite its many years in the computing field, Bendix Corp. had never firmly decided to remain in this business and, therefore, no heavy, sustained investment had been planned for the computing division.

Somewhat analogous to political contests, however, denials of intentions to run for office or leave the computer field are not always to be taken at face value. To ascertain the future of Bendix Computer, DATAMATION visited with the division's present general manager, Charles Edwards, in mid-'62, and published a "rumor repellant" interview (see p. 29, August '62). Following are brief excerpts from this question and answer, tape recorded conversation:

"**Q.** Do you feel you have received adequate corporate support for the Computer Division?

"**A.** Bendix management is a conservative management. It doesn't speak to the outside world about all its problems to the extent that some other managements do. But from an internal standpoint, all the top corporate people have devoted a lot of time and attention to the Computer Division and to its future plans. The financial support which we have received is very substantial. You just can't be in this business at all if you don't receive substantial support.

"**Q.** Would you be able to state emphatically that 10 years from now Bendix will still be in the computer field?

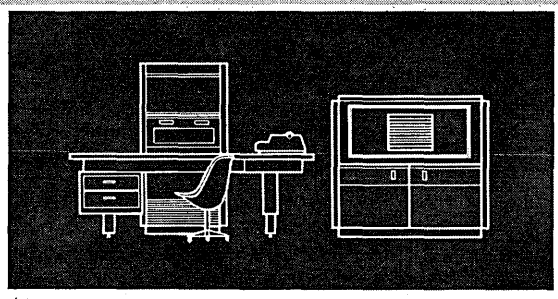
"**A.** For me to make such a prediction that far ahead would be inappropriate since business conditions vary considerably and I don't believe we know whether or not we are going to be in auto pilots, for example, 10 years from now.

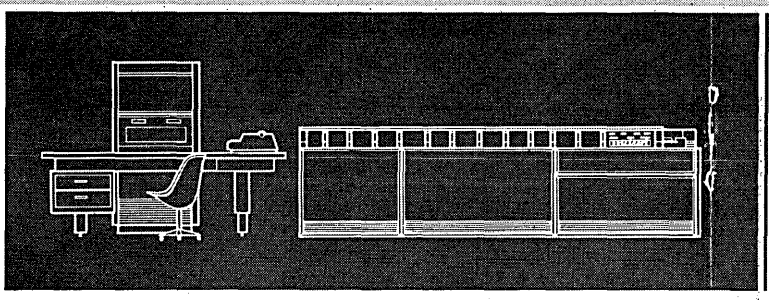
"**Q.** And if we shortened the period of prognostication to five years?

"**A.** I would say there is no prospect of our leaving the computer field in that period of time.

"**Q.** Has there been any recent consideration to selling the Computer Division?

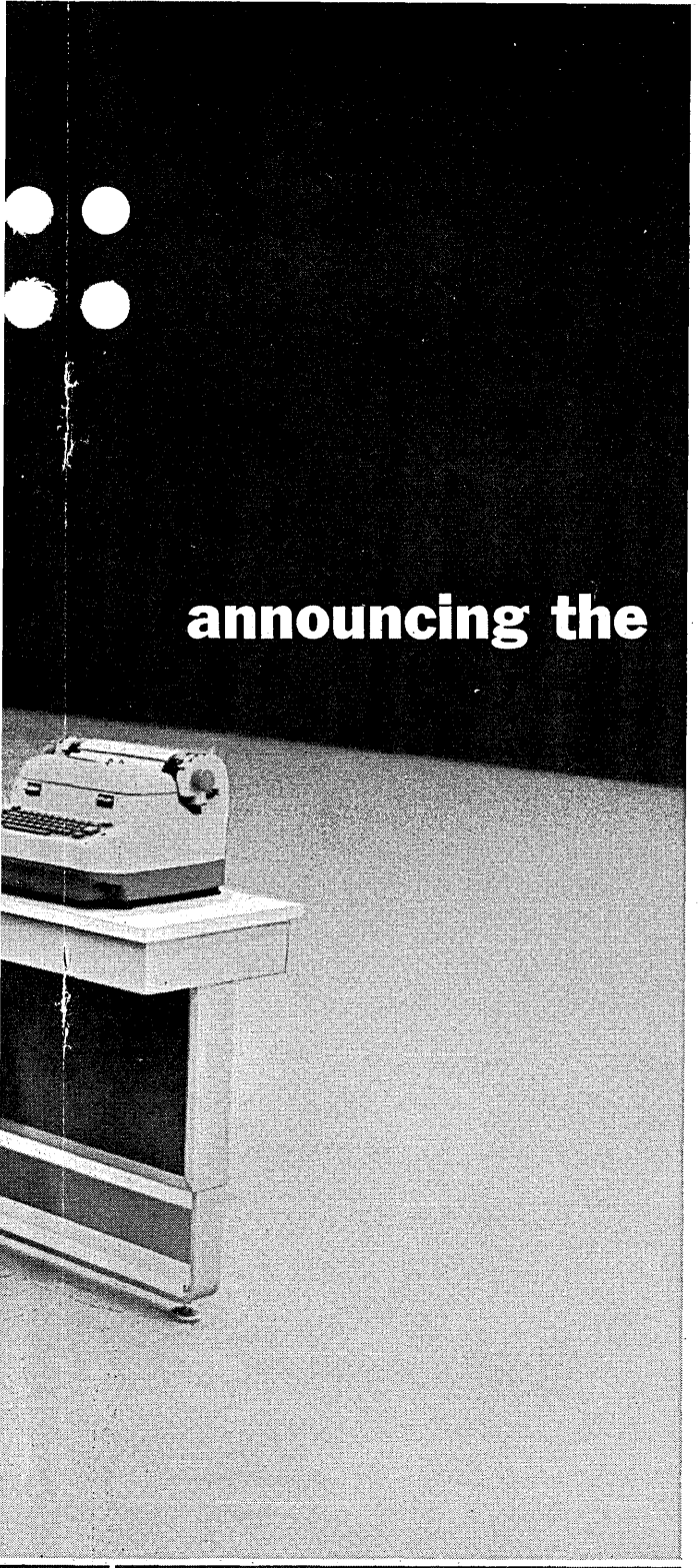
"**A.** I have not been involved in any such activities and I might add that I have no qualms about indicating to our customers and prospects full support of their hardware installations and software requirements." ■





For Manufacturing: Ideal for assembly-line balancing, scheduling, inventory control, order processing. Random access memory, data communications equipment available.

For Banking: Proven system using MICR techniques. Meets demand-deposit and other customer service ne of banks with assets in the two-hundred-million-do range.



announcing the

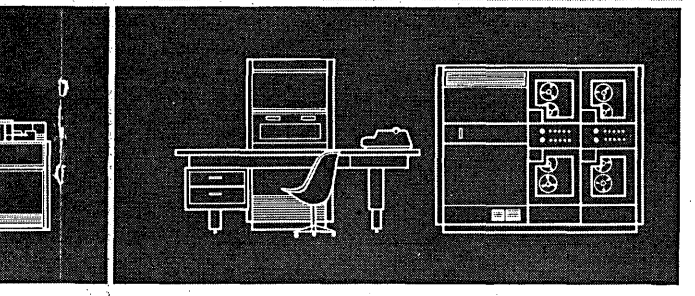
GE-215

Newest member of the growing General Electric EDP family. Priced in the $4,000 to $10,000 per month range.

Now General Electric offers an EDP system for those who want a wide range of big-system features without paying for unneeded capacity.

The new GE-215 is not a concept, or a prototype, but a working system built around circuitry, auxiliary equipment and programs tested and proved by hundreds of users of the larger GE-225. And you can use all of your GE-215 programs when you step up to a more powerful G-E system.

Whether you're going into electronic data processing for the first time, or planning to update your present system, don't commit yourself without first finding out the full story on the new GE-215. Write to General Electric Computer Department, Section J-3, Phoenix, Arizona.



For Accounting: Payroll, accounts receivable, accounts payable, personnel, billing, etc., using magnetic and paper tape, punched cards, high-speed printers.

CIRCLE 23 ON READER CARD

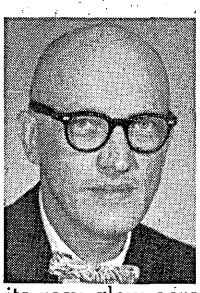
Progress Is Our Most Important Product

GENERAL ELECTRIC

adventures of a maturing consultant

SAINT PATRICK'S DAY

by JACKSON GRANHOLM, President, Mellonics, Inc.
Tucson, Arizona



It had been a number of years since St. Patrick came to Bitland. He had driven the snakes from the land and brought the light of learning to the peasants. He had also driven the bats from the belfries and confronted the Witch Doctors in their own computing laboratories.

This morning in Bitland the sun rose over the Sepulveda Mountains and cast its rosy glow across the Santamonica Sea. St. Patrick rose from bed secure in his faith. He was the foremost consultant in Bitland.

St. Patrick began his day seated at his simple Bullockmay breakfast table. Before him was his simple breakfast of bacon, sugared Alphnumericbits, and coffee. At his left elbow was *The Gospel According to Codasyl* which he studied. At his right elbow was the telephone.

At 7:33 a.m. the telephone rang. It was Dave van Glitch, young programmer, unhappy in his work and seeking insight leading to a new job in new surroundings. St. Patrick gave him a polite brushoff, noncomittally. At 7:41 a.m. the phone rang again. It was Fred Heffalump, Head, Digital Philosophy at Orangecrate Aircraft. Fred was seeking free information on how to locate a programmer to hire. He outlined precisely Dave van Glitch's qualifications and pay range. St. Patrick gave a non-committal answer, politely.

At 7:52 a.m. St. Patrick kissed his charming wife, dropped the *Codasyl* into his brief case, and strode to his two-car, tract-house garage with the fake pigeon loft over the garish, two-car Southerncal door. He placed his brief case in his Mercedes 300SL, started the engine and drove out of the neighborhood.

At 7:58 a.m. St. Patrick drove up the Beasly Street on-ramp of the Torrance Freeway. While he maneuvered rapidly in and out of the screaming traffic with his left hand, he dictated into his portable tape recorder with his right hand, shaping up the second chapter of his classic report, "On creeping dunderheadism in Management." At 8:11 a.m. he picked up a sigalert on his transistor radio, warning of an overturned milk truck ahead on the Torrance Freeway. Expertly St. Patrick shifted to an alternate route, swinging through the next interchange to end up at 80 m.p.h. westbound on the El Segundo Freeway, and, incidentally, running two old-lady school teachers on vacation from Iowa a good 112 feet up into the Callistemon bushes which lined the freeway.

At 8:27 St. Patrick pulled his Mercedes into a parking slot before the impressive facade of the Really-Way-Out Research Corporation. He strode inside, down the main hall, and into the monk's cell assigned to him on Tuesdays. His phone was ringing.

The call was from his faithful wife. The message was from Clinton Utterboosie. Would St. Patrick call as soon as possible? Utterboosie proved to be a flesh peddler with offices on Wilshire. He was looking for free advice on programmers he might add to his listing. St. Patrick gave him a polite but useless answer.

St. Patrick opened his briefcase and began speaking into his dictating machine. He moved rapidly through the salient points of his current report to Really-Way-Out entitled, "The Role of Radio Noise Shielding in Key Punch Cable Placement."

At 8:58 a.m. his phone rang. It was his wife with an urgent request to call Dan Scream. Dan Scream was Director of Product Planning with Electrobitty, a subsidiary of International Amalgamated Lunch Meats. Dan had an interminable series of questions aimed at finding out St. Patrick's rates. Dan was unsuccessful. Dan had a second series of questions aimed at soliciting a half hour of free advice over the telephone. Again he was unsuccessful.

At 9:30 the phone rang again. It was Paul Hefty, St. Patrick's angel at Really-Way-Out. He called to schedule a meeting in the engineering conference room for ten.

At 9:59 a.m. St. Patrick strode confidently into the engineering conference room to attend the weekly meeting on the subject, "Which is the most Implementable programming language, utilizationwise?" During the conversation St. Patrick twice disagreed severely with Paul Hefty, and twice referred to the comptroller of Really-Way-Out, directly to his face, as you "poophead." In each instance the comptroller smiled weakly and thanked St. Patrick for his advice.

At 11:58 a.m. the meeting broke up until the following week, and St. Patrick headed for his luncheon date at the Gilded I-Beam. There he met Franklin Kummer and George Zorch, chairman and co-chairman of the upcoming Fall Disjoint Computing Conference. During three martinis and a minute steak, St. Patrick succeeded in vetoing all plans to date for the Fall Disjoint solely by the force of his charming personality.

At 1:22 p.m. St. Patrick in his red Mercedes pulled into a parking slot in front of the headquarters of Peachyclean Laundries, Inc. The Vice President, Futures, of Peachyclean was determined to go full EDP in the shirt room, and St. Patrick was keeping him on the right track.

At 1:24 p.m. St. Patrick strode into the monk's cell assigned to him in back of the boiler room at Peachyclean. The phone was ringing.

It was St. Patrick's charming wife. She had an urgent message from Hector Rascable. Rascable was one of St. Patrick's clients. St. Patrick dialed his number. Actually, Rascable did not want help, advice, or counsel from St. Patrick. He wanted approval of his own ideas. Since this paid quite well, St. Patrick was able to reassure Hector Rascable on three vital points, and thus complete his call quickly.

The afternoon was spent with the VP, Futures, of Peachyclean, Howard Buttoncrush. Buttoncrush was unsure about how to hire keypunch girls. St. Patrick went over the procedure in detail, referring to his lengthy memo on the subject which Buttoncrush did not fully understand.

At 4:06 p.m. they switched to an even more vital subject: how to lay out the machine room. Since the ACAC 222 which Peachyclean had on order consisted of a single cabinet with console attached, the number of permutations of its physical arrangement was somewhat limited. Nonetheless, the matter was a serious one to Buttoncrush. St. Patrick described the affliction known as "operator's arm" which sometimes occurred with this machine when an unskilled individual tried to load FRAMTRAN statements one-at-a-time into the one-at-a-time card reader while simultaneously overriding the OVERFLOW light. Improper machine room layout could greatly aggravate this condition.

At 5:08 p.m. St. Patrick completed his briefing of Howard Buttoncrush. Buttoncrush could feel a migraine attack coming on, and an incipient feeling of terror was lodged somewhere in the back of his mind.

At 5:09 p.m. St. Patrick stopped by his Peachyclean monk's cell to pick up his briefcase and his dictating machine, and to call his charming wife, reporting in. There were two calls. One was from Tom Ichabod for whom St. Patrick ghost-wrote the well-known "Ichabod Reports on EDPM." Tom wanted to know about the latest copy. The other call was from Dave van Glitch. St. Patrick ignored it.

At 6:01 p.m. St. Patrick strode into the Rumpus Room of the Recursive Restaurant on South Ramshaw Boulevard. The Jolly Hour of the ACCM chapter meeting had begun.

For the next hour St. Patrick stood at the bar, pouring down massive belts of bourbon. His friendly laughter rang through the rumpus room. His joyful conversation dominated the scene. Everyone knew and loved St. Patrick, and the simple peasants flocked around him. Lady programmers smiled at him. A young logic designer humbly sought his approval. A softwares honcho softly inquired about hiring some more programmers. Paul Hefty bought him a drink. A young keypunch operator rested her chin on his arm, gazing up at him soulfully. Indeed, St. Patrick was a man of the people. His wisdom had made Bitland a better place in which to live.

At 7 p.m. it was time for dinner. Paul Hefty helped St. Patrick to his seat near the front of the dining room. St. Patrick's charming witticisms punctuated the dinner hour.

Speaker for the evening was Dr. Gordon Eastedge III, professor of numerical analysis at Abercrombie, Institute. His topic was "Bit Strings in a Flip-Flop Register." Eastedge was young and personable, a noted researcher and an abominable speaker.

When Eastedge was halfway through his second page he was hit squarely on the ear by a small cork thrown by St. Patrick. St. Patrick kept a supply of these corks in his pocket to make sure he could wake up dull speakers. Throughout Eastedge's sixth and seventh pages, St. Patrick beat his spoon on his glass. During the fifteenth page he made loud aside comments to Paul Hefty. From the fortieth through the sixty-fifth pages, St. Patrick yawned loudly.

At last, at the seventy-fifth page, Eastedge finished. St. Patrick had the first question. "What are you talking about?" he asked indecently.

Dr. Eastedge had some difficulty with this question, but finally made the grade. By the time St. Patrick had asked seventeen more questions, the implausable arguments and heretical reasoning of Dr. Eastedge were plain to see. The peasants could never be led astray by such a stranger as this. They remained loyal to St. Patrick.

Paul Hefty and Dave van Glitch helped St. Patrick into his Mercedes. He drove home through the moonlight, clipping a few Callistemon bushes from alongside the freeway. The red Mercedes drove up the driveway into the garish Southerncal two-car garage and stopped 1.3 feet through the back garage wall. St. Patrick got out, briefcase and dictating machine under his arm. He walked in the backdoor. The phone was ringing. His charming wife was asleep.

St. Patrick took the phone off the hook and went to bed. So drew to a close another day in the life of St. Patrick, patron of Bitland, leader of the people. ■

EPPERT TO KEYNOTE 1963

The Spring Joint: May 21-23

A technical program with 38 papers and three panel discussion sessions featuring talks by more than 100 U.S. and overseas scientists and engineers have been scheduled for the 1963 Spring Joint Computer Conference, May 21-23 in Cobo Hall, Detroit, Mich.

Papers will be presented on algorithms in business dp, machine organization, analog and hybrid systems, and data acquisition, transmission and display, in addition to information retrieval and computer-aided design. There will also be a session on a critical analysis of the current state of the art.

Panel agenda include sessions on manned space simulation, prospects for list processing, and the future of biomedical computing activities.

Program chairman is Brian W. Pollard, director of engineering, Burroughs Corp. Associate chairman is Bernard A. Galler, associate professor of mathematics, Univ. of Michigan. Others on the committee include Walter Hoffman, director of the computing and dp center, Wayne State Univ.; Norman R. Scott, professor of electrical engineering, Univ. of Michigan; Robert L. Sink, manager of engineering, Burroughs Military Electronic Computing Div.; and George B. Wolf, assistant to the director of engineering, Burroughs.

Keynote speaker of the meeting will be Ray Eppert, president, Burroughs Corp., who will discuss the nation's position in the world computing industry. General chairman is E. Calvin Johnson, manager, Information and Control Systems Laboratory, Bendix Research. Donald E. Hart, head of the Data Processing Dept., General Motors Research Laboratories, is vice chairman.

Computer components and systems valued at more than 12.5 megabucks will be exhibited.

SJCC-63 is sponsored by AFIPS, represented by the Institute of Electrical and Electronics Engineers (the merged AIEE and IRE) and the ACM. Also participating in the cooperating society and on behalf of analog computer activities is Simulation Councils, Inc.

Preparations for the 1963 Fall Joint Computer Conference have begun with the appointment of a chairman, James D. Tupac, head of computing services, The RAND Corp., Santa Monica, Calif. The FJCC will be held Nov. 12-14 in Las Vegas, Nev.

A call for papers for the fall conference has been issued. Deadline is June 3, and a complete manuscript is requested in addition to a 300-word abstract. Three copies should be sent to Paul M. Davies, chairman of the technical program, Abacus, Inc., 1718 21st Street, Santa Monica, Calif. Subjects of particular interest are novel computer organizations, information retrieval, computer memories and devices, modern trends in programming, and analog and hybrid systems. ■

DPMA Conference: June 25-28

Over 200 exhibitors and more than 2,000 registrants are expected at the 12th annual International Data Processing Conference and Exposition, June 25-28 in Cobo Hall, Detroit, Mich. Sponsored by the Data Processing Management Association, the conference theme is "New Directions in Data Processing."

In addition to 37 seminars, there will be an Executive Forum with a panel of top management in edp. It will be moderated by Edward C. Bursk Sr., editor, *Harvard Business Review*, and will be held on Wednesday evening, June 26.

The keynote speaker will be Ray R. Eppert, president, Burroughs Corp. The luncheon speaker, Dr. E. Dana Gibson, professor of office management, San Diego State College, will have just returned from a nine-month world tour, studying edp abroad.

Detroit to host both events

SJCC & DPMA CONFERENCE

Among computer manufacturers exhibiting will be Burroughs Corp., Electronic Associates, Inc., GE Computer, Honeywell EDP Div., IBM, National Cash Register Co., Philco Computer Div., RCA EDP, and UNIVAC. Peripheral equipment manufacturers include AT&T, Computron, Inc., Digitronics Corp., Farrington Electronics, Inc., Friden, Inc., Mac Panel Co., and Statistical Tabulating Corp.

Three major categories of seminars are scheduled, each having two sub-categories. In the Data Processing Management group are the following:

General Management: The Rising Status of Data Processing Personnel, Affects of Data Processing on non-edp Personnel, Management Information System, Economic Aspects of edp, Gaining the Auditor's Confidence, External Support for edp, and The Use of Consultants. Industries: Banking, Utilities, Retailing, Government, Transportation, Insurance, Manufacturing, and School System Administration.

Computer Management – General Management: Management of the Computer Dept., Sequence of Installation Procedure, Introduction to Software, Computer Evaluation, Random Access vs. Sequential, COBOL Experience Reviewed, Data Communications for Computer Processing, Use of Decision Tables, and New Directions in Computer Equipment.

Applications: Simulation by Computer, Information Retrieval, PERT and CPM by Computer, Operations Research, Inventory Control & Scheduling, and Parts Generation Procedure.

Punched Card Management – General Management: Management of a Punched Card Dept., New Directions in Punched Card Systems Design, and Data Collection & Transmission for Punched Cards. Applications: Information Retrieval by Punched Cards, Personnel Accounting, Financial Reporting, and Marketing Assistance.

During each seminar, an optional game in edp management will be offered; there will be four problems awaiting solution by attendees.

Computer sites to be visited are the Michigan Consolidated Gas Co. (7070 and 1401), and the National Bank of Detroit (210 and MICR check reconciliation).

The ladies program, fee for which is $28, includes brunches at the Statler Hilton, lunches at Lovett Hall, Greenfield Village, tours, and a fashion show at the Roostertail. ■

OMNITAB ON THE 90

an NBS, English-language program

A computer program that permits scientists and others unfamiliar with programming to communicate with a 7090 by using English sentence commands has been developed by the National Bureau of Standards. It is called OMNITAB.

The program is used for the calculation of tables of functions, for solutions to non-linear equations, and for statistical and numerical analysis of tabular data. It is designed to allow rapid computation of routine laboratory problems.

With OMNITAB, various sections of problem analysis can be checked independently to determine proper programming procedures; data can be checked for validity, and one-shot jobs can be done with a working program.

A wide variety of mathematical and manipulative procedures are available in the OMNITAB routine. There are provisions for raising to powers, use of logarithms to base 10 and base *e*, elementary and special functions, curve fitting, integration, differentiation, interpolation, etc., in addition to the basic arithmetical operations. The program has a capacity of 7.2K results, arranged in 36 columns of 200 rows each.

A statistical analysis package which computes the average of a set of numbers (200 maximum) and 30 statistical measures related to the average, dispersion, randomness, and other properties of the distributions, has been incorporated in the program. It is anticipated that this analysis, which takes less than a minute of machine time, will have a standardizing influence on the statistical analysis of laboratory data.

OMNITAB is the work of Joseph Hilsenrath, Philip J. Walsh and Guy G. Ziegler of NBS. ■

Table 1. Typical Problem and OMNITAB Instructions

Compute the Einstein functions:

$-G = -\ln(1 - e^{-x})$

$H = xe^{-x}(1 - e^{-x})^{-1}$

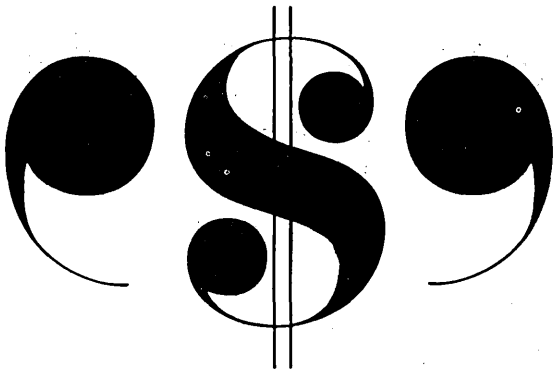
$C = x^2e^{-x}(1 - e^{-x})^{-2}$

$S = -G + H$

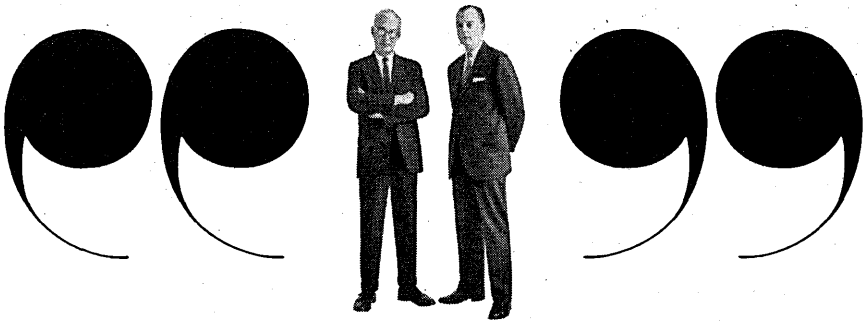
for X = .01(.01)2.

List of OMNITAB Commands

```
LIB 7,10000
IDENTIFICATION HILSENRATH 4-19-62
TITLE 1 EINSTEIN FUNCTIONS
GENERATE .01(.01)2.00 IN COL 1
NEGEXP OF COL 1, STORE IN COL 2
MULTIPLY COL 2 BY -1. STORE IN 3
ADD 1. TO COL 3  STORE IN 3
LOGE OF COL 3, MULT BY -1., ADD INTO
  4
RAISE COL 3 TO -1., MULT BY COL 2,
  ADD 5
MULTIPLY COL 5 BY COL 1, STORE IN 5
ADD COL 4 TO COL 5 STORE IN COL 6
DIVIDE COL 5 BY COL 2, MULT BY 5, ADD
  7
HEAD COL 1/  X
HEAD COL 4/  G
HEAD COL 5/  H
HEAD COL 6/  S
HEAD COL 7/ CSUBP
FIXED POINT  5 DECIMALS
PRINT 1, 4, 5, 6, 7
```

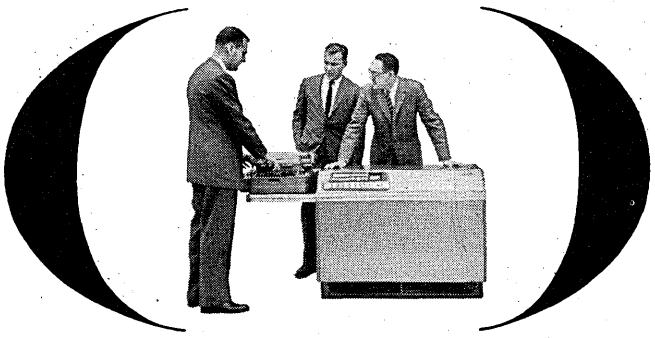


OTHER COMPUTERS WERE DESIGNED FOR BUSINESS MEN!



THE LGP-30 WAS CREATED FOR ENGINEERS AND SCIENTISTS.

What does an engineer or a scientist respect most? Answer—sheer brainpower. The LGP-30 packs more brainpower than any computer in its class. 4096 word memory—2000 more than its nearest competitor. And alphanumerical input-output via keyboard or punched paper tape. □ Then comes—independence. The LGP-30 is the easiest computer to program and operate. If you know algebra—you can achieve programming competence in hours or days. Even non-technical personnel can master it. You'll never have to be dependent upon computer programming specialists. And you can set it up right in your own office or any other point of use. No expensive installation—just plug it into conventional outlet. □ Right now—scientists and engineers, in addition to businessmen, in hundreds of universities and corporations are using the LGP-30. Therefore, the LGP-30 is able to offer you the use of the most extensive Program Library in its class. No doubt, the program you'll need is ready now—and that's a big saving in time and money. You also benefit from membership in the computer industry's largest, most active information-swapping (POOL) of users. □ Cost? Well, let the businessmen in your organization worry about that. And there's mighty little worrying to do, for a computer with comparable capacity would cost twice as much. The LGP-30—a complete system—rents for only $1100 per month. For more information about the LGP-30, write Commercial Computer Division.

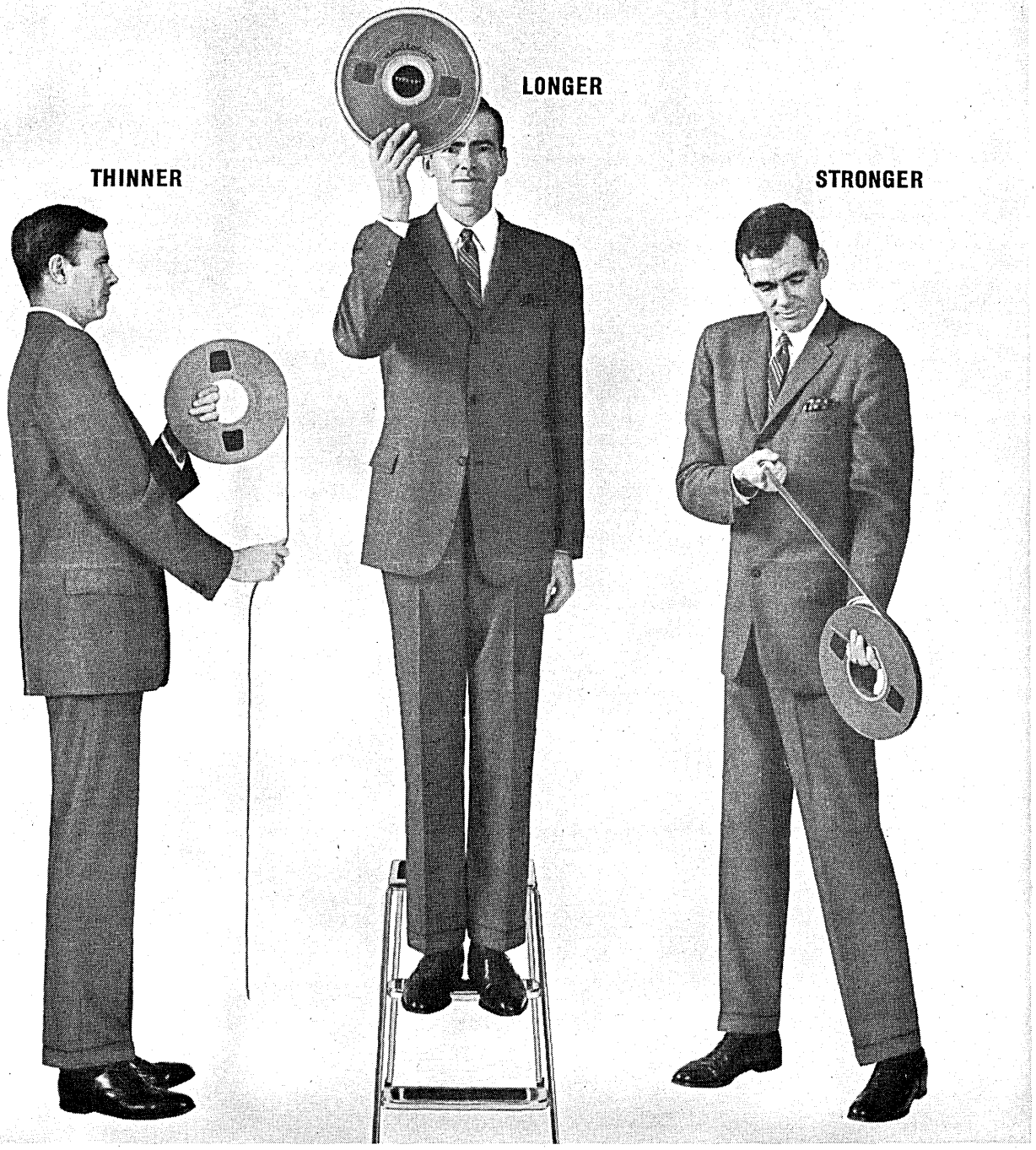


GP GENERAL PRECISION

COMMERCIAL COMPUTER DIVISION/ GENERAL PRECISION, INC./ BURBANK, CALIFORNIA

CIRCLE 28 ON READER CARD

Now Audio introduces a new computer tape...



EXTRA LENGTH COMPUTER AUDIOTAPE

Extra Length Computer Audiotape is the unique new product that gives you far more tape on the same size reel—almost half again as much. As a result, you not only save storage space but can run your longer programs with fewer reel changes.

This new computer tape, with a 1 mil base, is actually stronger than standard 1.5 mil polyester tapes, thanks to the superior base material, Mylar*T, which increases tensile strength and holds elongation to a bare minimum.

You can use this exclusive new tape without making any special adjustment of your IBM equipment, since it is completely compatible with standard 1.5 mil computer tapes. Extra Length Computer Audiotape is available on 8½" and 10½" reels, with certification of 556 or 800 bits per track-inch at a speed of 112.5 inches per second.

A number of leading companies are already using Extra Length Computer Audiotape and report complete satisfaction. Why not try this dependable new product that saves storage space and machine time? It's another Audio first.

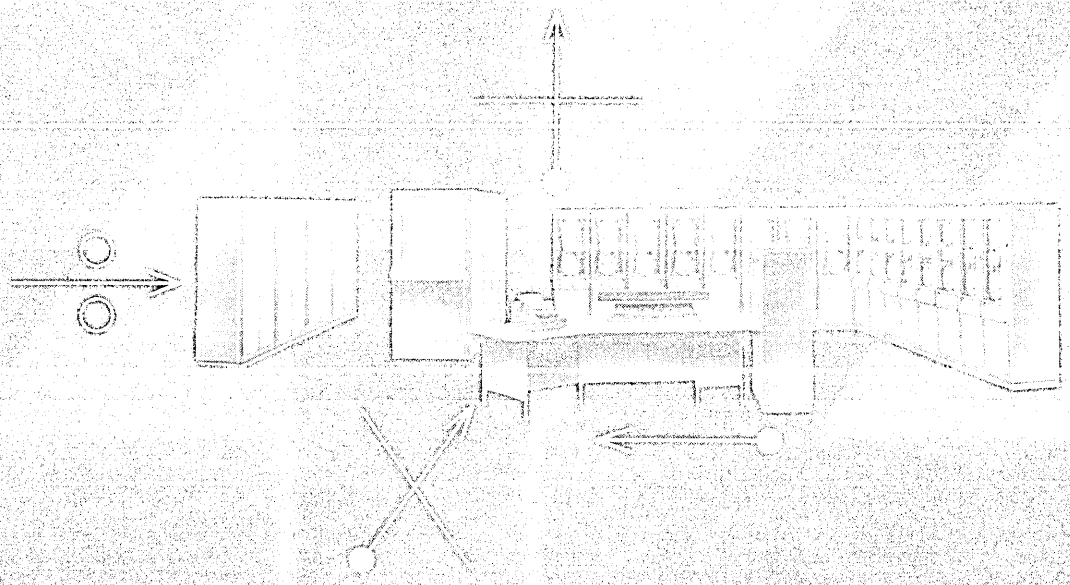
*Du Pont trademark for its polyester film.

AUDIO DEVICES, INC., 444 MADISON AVENUE, NEW YORK 22, N. Y.

CIRCLE 25 ON READER CARD

Even the computer's theme is large-economy size . . .

the PHILCO 212



No large-scale computer is "cheap"
not even ours.
But one computer is the best buy
in terms of price and performance.
And that is ours . . . the Philco 212.

Bold statement? No sir!
We don't scream facts.
We've compared the Philco 212
with all available mid-
and low-priced large computers.

The Philco 212 comes out on top
by every measuring stick—
and not by estimated performance
but with real programs
run on real computers.

Here's performance money can buy—
and not too much money either.
There's no comparable computer
measured throughput for throughput—

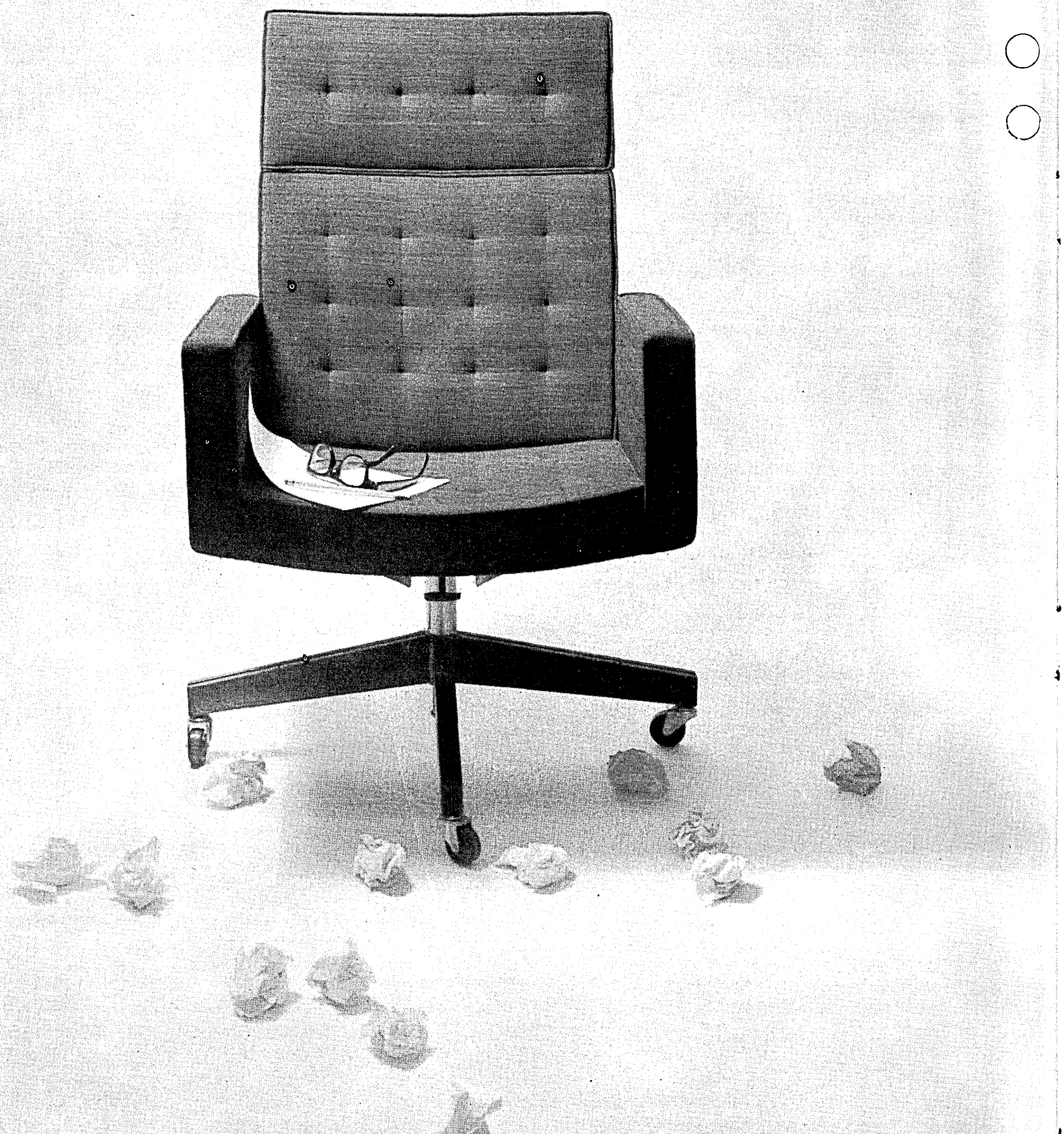
that costs less than the 212
and most cost a good bit more.
To prove our point
we'd like to run your problems
on one of our systems—not for you.

Compare Philco 212 with the rest.
We're sure that's how you'll
want to do it.

FOR MORE INFORMATION WRITE, CALL OR STOP IN TODAY

PHILCO
a subsidiary of Ford Motor Company
COMPUTER DIVISION

3900 Welsh Road
Willow Grove, Penna.
Oldfield 9-7700



THIS IS NOT AN EASY CHAIR In fact, from where we sit, the programming of a computer is grueling, long-houred, trial-and-error work; of course, it can also be brain-tingling, ample-salaried and a labour of love—especially when the creator of computer soft-ware sits in concert with the seasoned professionals who staff Computer Concepts, Inc., with offices in Washington, D. C., New York City and Los Angeles. These programmers, esteemed by the mushrooming computer industry, are steeped in such information processing activities as machine translation, computer efficiency studies, systems programming, business data processing, and advanced scientific and logistic programming . . . If you have a minimum of 2 years experience on IBM computers, and you yearn to scan the soft-ware horizons of computery — pull up a chair; it won't be easy, but then, nothing worth while ever is.

1012 14th Street, N.W., Washington, D. C.

CIRCLE 76 ON READER CARD

COMPUTER CONCEPTS INC.

NEWS BRIEFS

PHONE TRANSMISSION AT 2.4K BITS PER SECOND

Data transmission over telephone lines and by radio at speeds up to 2.4K bits per second has been announced by General Telephone & Electronics Corp., New York, N.Y. Using duobinary coding, the speed is double that of comparable binary systems; the circuitry and complexity of the system is said to be half that of current models. The system accepts binary data and regenerates it in the same form, but uses duobinary coding for the transmission.

Error detection is incorporated in the coding technique, the data checked as it is received. An error rate of one per one million bits is reported with typical noise conditions on telephone lines.

Duobinary coding extends the theoretical maximum rate of binary signaling for a given transmission medium from two to four bits per second for each cycle of bandwidth. Applying this factor of two to the bandwidth of a 5 mc, high-quality television type channel, data transmission at the rate of 20 megabits per second would be obtained.

"COBOL-61 EXTENDED" NOW AVAILABLE

A new COBOL manual, "COBOL 61 Extended," has been published by the COBOL Maintenance Committee. The new publication is said to extend the language without changing essential features. It revises the previously published "COBOL 61."

COBOL has been translated into French, German, and Italian, and compilers for several machines manufactured in Europe are in process of development, according to the committee.

The COBOL Maintenance Committee is headed jointly by Gregory M. Dillon, DuPont, and John Jones, Air Force Logistics Command.

Copies of the new manual may be obtained through the government printing office, Washington 25, D.C.

DIGITAL PROGRAM CHECKS ANALOG PROBLEMS

A digital simulation program to check solutions for analog computer problems has been developed for the Honeywell 800 by Robert Stover. PARTNER (Proof of Analog Results Through a Numerical Equivalent Routine) reportedly "permits engineers to write problems quickly and in a language they understand," avoiding extensive preparations.

The system is said to provide a solution to a given problem prior to its analog simulation, as well as to simulate an analog-digital computer arrangement by using only a digital configuration.

The program was described as being essentially a series of subroutines with each subroutine representing a particular transfer function or nonlinearity. The subordinates are combined into the program as called for by the specific problem. Only one instruction is required for any function, the problem solved on a point-by-point basis with the output appearing as a listed time history of the selected variables.

COBOL TEXTBOOK SET FOR MAY PUBLICATION

"Guide to COBOL Programming," a new textbook by Daniel D. McCracken, will be published in May by John Wiley & Sons, N.Y.C.

Written for individuals inexperienced in COBOL programming, the paper covered book will include three case studies, a chapter on object programming efficiency and a survey of the entire process through documentation and running.

The format of this book will be similar to McCracken's earlier texts on FORTRAN and ALGOL.

CIRCLE 100 ON READER CARD

STANFORD PLANS FOR COMPUTER-BASED TEACHING LAB

Stanford Univ., Palo Alto, Calif., has received a one megabuck, five-year grant from the Carnegie Corp. for a computer-based learning and teaching laboratory. A matching grant from the Ford Foundation, under the university's PACE program, increases this by $350K. The lab will be located in an 1,800 square foot addition to Polya Hall, the university's new computation center housing a 7090 and B-5000.

Using the 90 and a PDP-1, the lab will help develop a normative theory of the human learning process and, specifically, how individuals learn math and language—beginning with Russian. Electric typewriters, audio and visual equipment will be used to communicate between experimental subjects (school-age children and young adults) and the computer. A print out summary of individual progress will allow researchers to adjust the program to suit each of five students as they proceed, even in mid-lesson.

Some 20 or 30 hours of programmed learning will be stored in memory so that students can work at different levels of ability without conflict. The student will work at an IBM typewriter in each booth, which will record his responses and also feed information back to him. For visual responses, an oscilloscope screen in front of him will be equipped with a light pen with which he can make responses directly on the scope.

It is expected that some experiments will be running by September, 1964, and the lab in full-scale operation by the following academic year. This will be the second facility in the area of computer-based teaching; the other is at System Development Corp., Santa Monica, Calif. ■

LAW ENFORCEMENT & EDP: FEASIBILITY DISCUSSED

California law enforcement officers met in Santa Monica, Calif., recently to discuss the feasibility of using edp equipment for an integrated, statewide, law enforcement records and communications system. Sponsored by USC and the System Development Corp., it is said to be the first such effort conducted on a state-wide basis.

An integrated system is necessary to speed the filing and accessibility of police reports, a factor considered more important than the need to save money, reports Claud T. Smith, chief,

OF ALL THE COMPUTERS AVAILABLE TODAY THE PB250 WAS CHOSEN AS THE CONTROL ELEMENT IN THESE SYSTEMS:

Digital-Analog Simulation of Space Vehicle Control and Guidance Systems

Control of Prototype Transit Shipboard Navigation Systems

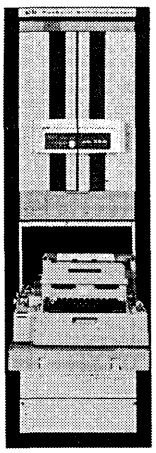
Control of Digital System for Recovery of Satellite Doppler Data

Real-Time Tracking and Control of Radar Antennas

Rapid On-Line Monitoring in Data Acquisition System

Controlling Receive Operation and Sampling Receiver Output in Signal Analysis Operation

Control of Testing, Data Editing and Recording in Navigation Study System



Automatic Checkout of Space Vehicles

Real-Time Satellite Tracking, Antenna Control and Visual Display

On-Line Performance Analysis of Steam Cycles

Computer-Controlled Astronomical Telescope System

Control of Nylon Filament Manufacturing Process

Real-Time, On-Line Simulation of Inertial Navigation Systems

Controlling Data Acquisition System for Shock-Tube Wind Tunnel

Controlling Mobile Data Acquisition Facility

WHY? *Because with the PB250, custom engineering is eliminated or reduced, cutting costs and time. Because the PB250's stored program control permits simple, fast and economical changes in systems operation. Because the PB250 can check and, in some cases, correct itself and other elements of a system in case of faulty operation. And because the proved reliability of the PB250 produces trouble-free system operation. (More than 100 PB250's have been installed.)*

These benefits come with the PB250 for $40,000 purchase price or $1,200 per month lease, making the PB250 as much as 26 percent less expensive than any other control computer on the market today.

For systems operation, the PB250 provides 11 control input and 32 control output lines for sensing, signalling and controlling other systems elements.

Another 18 control input lines are available. An optional high-speed buffer provides two-way communication between the PB250 and asynchronous system elements at up to 80,000 words per minute. Memory can be expanded from a basic 2,320 words to 15,888. And the PB250 offers microsecond add, subtract, multiply and divide speeds.

For more information on the PB250 and its value as a systems control element, write today for Data File C12-7

pb Packard Bell Computer

1905 ARMACOST AVENUE, LOS ANGELES 25, CALIFORNIA

A DIVISION OF PACKARD BELL ELECTRONICS

See Packard Bell at IEEE, Booth 3911-3913

CIRCLE 26 ON READER CARD

Technical Services Div., Los Angeles County Sheriff's Dept.

Several system design approaches were introduced at the meeting by Herbert H. Isaacs of SDC. However, no computer system has been decided upon, Isaacs said. It is necessary first to determine the kind of information involved and the volume anticipated, he added.

The first installation of hardware is expected in 1964-65.

Currently employed on a feasibility study in this area for the L.A. County Sheriff's Dept. is Computer Usage Corp. However, CUC was not invited to the USC-SDC meeting.

ICT TO MARKET UNIVAC 1004 IN U.K.

The UNIVAC 1004 will be marketed in the United Kingdom and certain Commonwealth countries by International Computers and Tabulators, Ltd. (ICT) under a recent 10 megabuck agreement. Initially, ICT will purchase more than 100, 1004s and spare parts. They will be sold as the ICT 1004.

The non-exclusive distributing agreement covers three years. UNIVAC also plans to expand sales efforts on its medium and large-scale hardware in the United Kingdom.

At present, ICT also sells the RCA 301 in U.K.

M-H, SDS MERGE HARDWARE FOR PROCESS CONTROL

Scientific Data Systems and Minneapolis-Honeywell have concluded an agreement under which SDS will provide 910 and 920 computers for integration by Honeywell into process control systems, according to Max Palevsky, SDS president.

SDS computers are now being produced at the rate of one per week, Palevsky adds, and expects this production rate to be doubled by mid-year.

DOC INC, NASA SIGN 2.9 MEGABUCK CONTRACT

A 2.9 megabuck contract for the second year's operation of NASA's Scientific and Technical Information facility has been signed by Documentation Inc., Bethesda, Md., with the space agency. The facility uses computers in the collection, processing, and distribution of technical information for the nation's aeronautical and space community.

Under an expansion program, STI will publish some 30,000 abstracts

The Palm Beach Post-Times

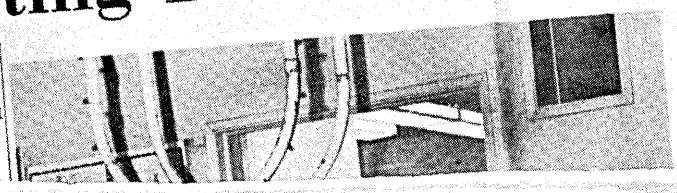
WEST PALM BEACH, FLORIDA, MONDAY, JANUARY 14, 1963

PRICE 5 CENTS

rinting Breakthrough Demonstrated

Newspaper Executives View RCA Computer Typesetting At Palm Beach Post-Times

"When all our plans are activated, they will revolutionize our thinking and planning of the composing room of the future," said John H. Perry, Jr., president of [illegible] Inc., publishers of 23 weekly and daily newspapers in Florida



Times Telephone Numbers:
MAdison 9-4411—Classified Advertising
MAdison 9-2345—For all other calls.
Circulation—Largest in the West:
772,439 Daily; 1,120,153 Sunday.

Los Angeles Times

EQUAL RIGHTS — LIBERTY UNDER THE LAW — TRUE INDUSTRIAL FREEDOM

ONE OF THE WORLD'S GREAT NEWSPAPERS

MONDAY MORNING, JANUARY 14, 1963

Computer Typesetting System Announced by Times-RCA

Expandability Feature of Computer Described

Can Be Used for Many Applications in Addition to Type Composition

BY WALTER BROUSARD
RCA Sales Representative

The RCA 301 being used at The Times for typesetting is a general-purpose computer which, because of its flexibility and its expandable design, can perform many other functions besides type composition.

The RCA 301 system is analogous to the unit-type press in terms of its ability to expand in several directions.

For example, the design expandability of the 301 facilitates adding those units necessary to accomplish all the accounting functions of a newspaper. For small newspapers this may make the cost justification possible; for large newspapers it will materially increase the dollar savings to be realized through an RCA 301 system.

The 301 can be configured in many different ways to handle a wide variety of different functions.

Expanding Functions

For example, the basic system which accomplishes typesetting can be expanded to handle the entire classified advertising [illegible] by the basic RCA 301 system with [illegible] paper-tape reader, paper tape punch, and a monitor printer.

Then, depending on the specific requirements of the newspaper, this basic system can be expanded in many ways.

On-Line Printers

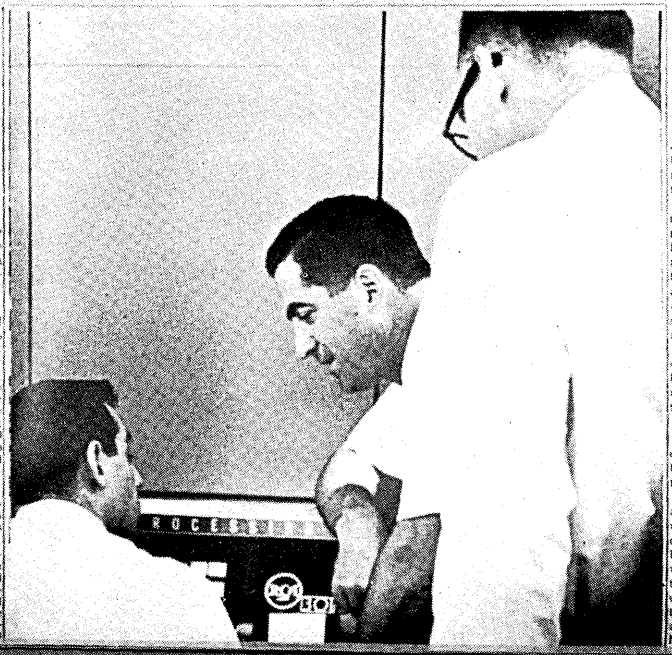
Where large volumes of printing are required up to two 1000-line-per-minute printers can be added to the system.

If serial processing is desired up to 14 magnetic tape stations with the ability to read or write data at speeds ranging from 10,000 characters per second to 66,667 characters per second can be added.

Random Access

If random processing is desired, up to 176 million characters of random access storage may be added.

Remote inquiry units, machines to read and punch 80-column cards, high-speed paper-tape equipment, on-line, real-time equipment all can be added to the basic RCA 301 system with [illegible]



High-Speed Composition Method Now in Use

BY JAMES GRIDER
Times Production Superintendent

The Los Angeles Times and Radio Corporation of America have developed a revolutionary new typesetting system built around an electronic computer. It is now being used for daily production at The Times and is the first high-speed use of a computer for typesetting.

The basic economy of the new system is that it eliminates double keyboarding. By double keyboarding we mean that the reporter keyboards or types a story once and then, after it is edited, an operator in the composing room keyboards it a second time to set it in type.

In the past, wire service stories have also been keyboarded by an operator as a means of getting them into type.

One Keyboarding

With the advent of the computer, this costly keyboarding is eliminated in two ways:

First, we receive perforated tape from wire services which is justified for a certain group of type faces but not for the 9-point type we use. With one pass through the computer we unjustify and dehyphenate this tape and then rejustify and rehyphenate it to conform to our type size.

EDITORS 'DIAL' TYPOGRAPHY

The Times-RCA typesetting program is so flexible that an editor can actually dial, so to speak, the appearance of his body type.

If he wants an open appearance with few hyphens, more spacing can be introduced.

If he wants type set as tightly as possible, the dial can be turned the other way.

Once the typography is tuned in, the entire newspaper will be set with the same appearance.

components, we use a monitor printer and will soon have a stand-by reader and punch.

Reading at the rate of 1000 characters per second and punching at 300 characters per second, our rate of production is 10 newspaper-column-width lines per second. Total computing time with this program averages 40 to 50 milliseconds per line.

NEWS BRIEFS . . .

and indeces of the world's published and unpublished aerospace literature.

Since its creation a year ago, STI has issued semi-monthly abstract journals, cumulated quarterly and annual indeces, and answered more than 100,000 inquiries from NASA, its prime contractors and others for copies of reports.

CDC ON N.Y. EXCHANGE; REPORTS MID-YEAR EARNINGS

Common stocks of Control Data Corp., Minneapolis, Minn., are now listed on the New York Stock Exchange. About 3.9 million, of a total 4.7 million shares, are outstanding. Originally capitalized at $600K at its founding in 1957, the company's current net worth is estimated at 24.5 megabucks.

In its mid-year report, CDC shows a 24.9 megabuck income, up 44 per cent over the same period of the previous year. Net profits were $954K, up 50 per cent, and per share earnings were $.24, compared with $.16.

● A 3-megabuck Control Data 3600 configuration has been ordered by a French industrial management firm. The contract was signed less than six months after CDC opened its European subsidiaries.

The hardware will go into the new Paris computing center of the Societé d'Informatique Appliqué, computing subsidiary of the Societé d'Economie et de Mathematique Appliquees. It will be used in economics, statistical studies, and industrial planning.

This is the third 3600 order. Michigan State University and Lawrence Radiation Lab, Livermore, Calif., will be recipients of the other two.

● Multiple processing on a B280, running from two to five programs together without permanent programmed linkage, has been demonstrated by Burroughs Corp. Software consists of an executive routine which controls the individual programs, and an advisor which lets the user assign priorities for the run.

CIRCLE 101 ON READER CARD

● A UNIVAC 1107 computer will be delivered this summer to the Dept. of Aerostatics and Aerodynamics, Stuttgart Technical Institute, Stuttgart, Germany. Applications include computation of stresses; displacements and vibrations of aircraft; immersion studies of flying objects; research in rocketry and thermal effects in the atmosphere. The configuration includes 32K words of core memory, card reader, read-punch tape unit, printer, FH 880 drum, disc storage unit with capacity of 40 million characters, and six UNISERVO IIIA mag tape units.

CIRCLE 102 ON READER CARD

● Philco has delivered a 211 configuration to the edp center of the Aeronutronic Div., Ford Motor Co., Newport Beach, Calif. Included are 12, 234 mag tape units; a 236 I/O processor; a 280 universal buffer controller; a 256 900-lpm printer; a 259 controller to control a 2K-card-per-minute reader, and a 100-card-per-minute punch. A subsidiary of Ford, Philco has also delivered a similar system to the parent company in Dearborn, Mich.

● A Burroughs 5000 system, valued at more than $750K, will be used by Marathon Oil Co.'s Denver Research Center in the exploration and conver-

NEWS BRIEFS . . .

sion of petroleum into diversified products. The B5000 replaces the smaller 205 which had been in use on an around-the-clock basis since the center opened in 1956.

● The fifth MOBIDIC system, and the second for the U.S. Army in Europe, has been delivered by Sylvania Electric Products Inc. It will provide dp control of ordnance supplies within the communication zone of the army in Europe. The other MOBIDIC in use overseas is at the Seventh Army's stock control center, Zweibrucken, West Germany.

CIRCLE 103 ON READER CARD

● A GE 225 has been installed at Cape Canaveral to analyze launches of the Saturn booster vehicle. NASA also has four other 225s at its Marshall Space Flight Center, Huntsville, Ala., for assistance in designing the Saturn. A sixth unit, at NASA's new computer facility at Slidell, La., is employed in fabricating and testing of other Saturn systems.

CIRCLE 104 ON READER CARD

● Two optical scanning code systems, Honeywell's orthocode and IBM's optical character code, are being tested for coupon processing purposes by Proctor & Gamble. The company has been using punched cards for seven years.

● The Denver Research Institute, Univ. of Denver, will hold its 10th annual symposium on computers and dp on June 26-27 at the Elkhorn Lodge, Estes Park, Colo. Papers will be presented on components, logic design, philosophy of computer design, and artificial intelligence.

● The Required COBOL-61 Self-Teacher, a programmed instructional text developed by the Auerbach Corp., is being marketed by Basic Systems, Inc. The course consists of four instructional sections and a manual with modifications for hardware or translator.

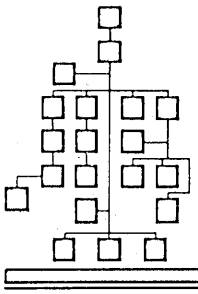
CIRCLE 105 ON READER CARD

● The Veterans Administration is using a Digitronics Dial-o-verter system to transmit insurance data between Denver and St. Paul and the computer center in Philadelphia. Using a Data-Phone 201B subset, transmission speed is 300 cps.

CIRCLE 106 ON READER CARD

● Computer Concepts, Inc. Washington, D.C., has been awarded a $500K contract for operations research, computer analysis, system design, and programming services for the Army Strategy and Tactics Analysis Group (STAG), Bethesda, Md. The Army's war-gaming agency, STAG is adapting computers to the techniques of war-game play. Computer Concepts will augment the agency's programmers in writing machine language instructions. The consulting firm has also announced gross revenues of $650K and earnings of $60K during its first full fiscal year ending Dec. 31. The company's former marketing VP, William L. Witzel, has been named executive VP.

● Burroughs and IBM have announced a licensing agreement under which each makes available to the other, for five years, its patent rights covering information handling systems. The license is non-exclusive and contains reciprocal rights to the use of patents owned by each company. The announcement contained no reference to specific equipment included in this agreement.



people IN DATAMATION

■ Harrison Van Aken, former general manager of the GE Communications Products Dept. at Lynchburg, Va., has been named general manager of the Computer Dept., Phoenix, Ariz. He replaces Clair C. Lasher, who has been appointed manager of a newly-established Computer Offshore Operation, formed to mobilize the company's computer effort abroad.

■ William Doherty, former director of marketing, has been named director of marketing, Eastern Region, Philco Computer Div. The former director of memory development, C. L. Wanlass, has been appointed director, research and development office. Associate director is J. W. McNabb, who had been director of computer data handling systems. Named assistant director of manufacturing is R. S. Turley, former program manager for the 212.

■ W. Barkley Fritz has been named chairman of the X3.5 Glossary subcommittee of X3. He entered the computer field as a programmer on the ENIAC at the Ballistic Research Laboratory in 1948. Chairman of the SHARE committee on flow chart symbols, Fritz is manager, Information Processing Dept., Westinghouse, Baltimore, Md.

■ Dr. L. R. Bickford Jr. has been appointed director of General Science at IBM's Watson Research Center, Yorktown, N.Y. He was formerly manager, Magnetics Dept., at IBM.

■ Dr. Car Hammer has been named director, Scientific Computer Government Marketing for Univac. Dr. Hammer formerly was manager of scientific applications for RCA EDP in Washington.

■ Helmut David Neumann has joined Data Processing, Inc., Waltham, Mass., as a senior analyst. He was formerly with Ford's Aeronutronic Div. Neumann will work on an advanced proprietary compiler system currently under development.

TODAY'S COMPUTAPE IS BETTER THAN EVER—AND IT HASN'T EVER CHANGED A BIT

556 or 800 bits per inch. No dropout. That's a real guarantee of reliability. *That's a reel of Computape* — product of the first company to manufacture computer and instrumentation tape *exclusively*. Investigate new Computape today. Better still — *immediately*.

COMPUTRON INC.
122 Calvary Street, Waltham, Massachusetts

CIRCLE 32 ON READER CARD

NEW PRODUCTS

SAAB computer

A gp, parallel sequence computer, the D21, has been introduced by Svenska Aeroplan Aktiebolaget (SAAB). Designed for small offices and labs, it is expansible for process control applications.

Core storage capacity is from 4-32K words. Although the basic word size is 24 bits, the D21 has word lengths of one, 12, 24, and 48 bits. Access time is 4.8 usec.

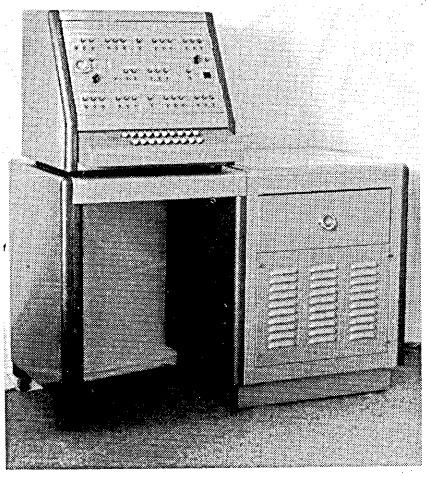
The central processor, which has elementary logical sub-units on printed circuit cards, consists of an arithmetic and two control units, memory and power unit. Power consumption is 250 watts.

The D21 uses the DAC autocode which has 45 commands, including floating point arithmetic, double-precision accuracy, matrix calculus, equations and functions. SAAB OVERSEAS, 405 Park Avenue, N.Y. For information:

CIRCLE 200 ON READER CARD

gp computer

Model I-85 has a repertoire of eighteen commands and uses magnetic



drum storage. The computer has a capacity of 3K, 19-bit words. The I-85 is priced at $13,500. GENERAL INTELLITRONICS, INC., 900 Nepperhan Ave., Yonkers, N.Y. For information:

CIRCLE 201 ON READER CARD

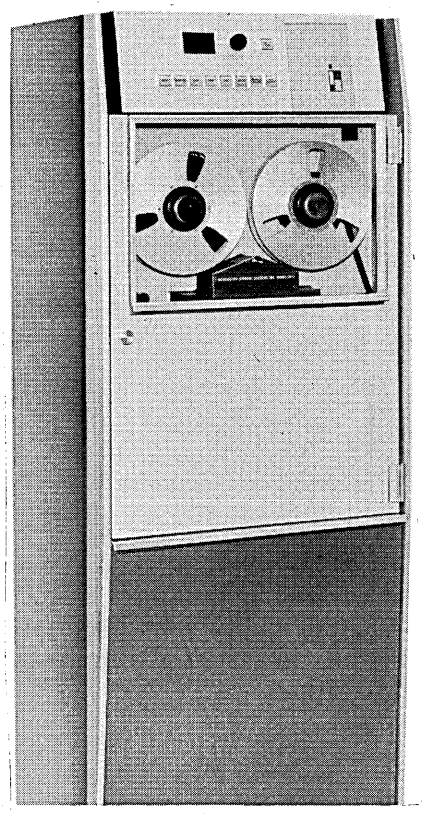
military computer

The 1218 is a stored program, medium scale, gp digital computer with a 4, 8, or 16K memory, 18-bit word, and four usec cycle time. It can operate on a real-time basis. The 1218 is available with four or eight 18-bit input channels with the ability to form up to four 36-bit I/O channels. Add time is eight usec. It has 98 instructions. UNIVAC DIV., SPERRY RAND CORP., 315 Park Ave. S., New York 10, N.Y. For information:

CIRCLE 202 ON READER CARD

mag tape transport

The Dynatape DK-1 line includes three IBM tape and interface compatible models, tape control/data synchronizers for the 7090 and 7070/7074, and five 100 or 200 ips models with transfer rates up to 750K BCD



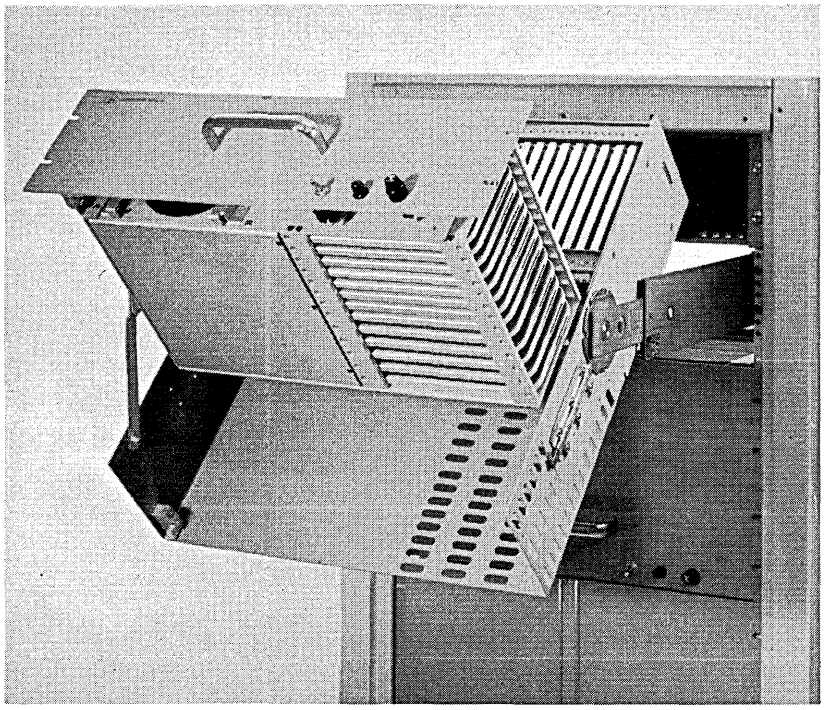
digits per second. Storage capacity per reel is 185 million alphanumeric characters. INFORMATION STORAGE SYSTEMS, INC., 222 Wanaque Ave., Pompton Lakes, N. J. For information:

CIRCLE 203 ON READER CARD

BC 422 mag tape

This unit features a maximum alphanumeric transfer rate of 66,600 KC, with dual tape speeds of 90 and 120

NEW



Front Access Core Memories with Logic Flexibility

Computer Control 5 microsecond random access magnetic core memories are now available in slide-out, break-open 1- and 2-block units. The TCM-32 unit above offers complete, front-of-rack access. Logic modules are easily removed, and memory core and wiring arrays exposed. All indicators (optional) mount on front panel. Units are functional and practical. Height: 5¼" for a single block; twice that for a 2-block drawer. Word capacities, up to 4096; word lengths to 32 bits in a 2-block unit. (A 1-block unit has a 1024 word capacity and a 16 bit word length.) Flexible? Very. Designed around 3C's extensive line of S-PAC digital modules, 3C core memories can be integrated easily into surrounding logic. Design is conservative. Operating margins are broad. Options and accessories are available. Off-the-shelf delivery runs 30-90 days. Prices are attractive. Write for the full story.

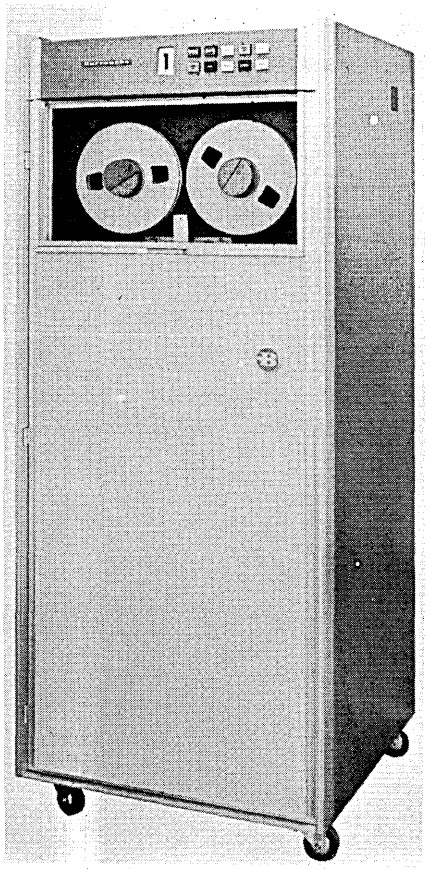
3C

COMPUTER CONTROL COMPANY, INC.

OLD CONNECTICUT PATH, FRAMINGHAM, MASS. · 2251 BARRY AVENUE, LOS ANGELES 64, CALIF.

CIRCLE 34 ON READER CARD

NEW PRODUCTS . . .

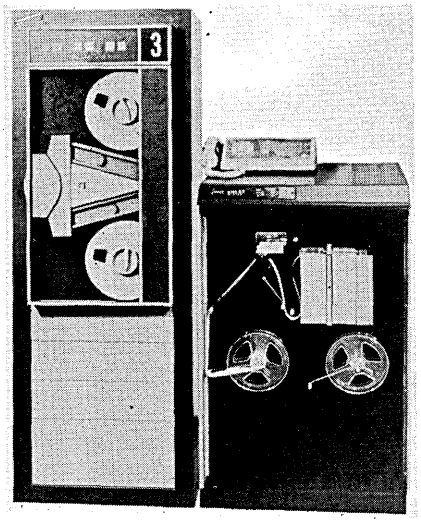


inches per second, and dual densities of 200 or 555.5 bits per inch. Start/stop times for the BC 422 are less than three milliseconds. BURROUGHS CORP., 460 Sierra Madre Villa, Pasadena, Calif. For information:

CIRCLE 204 ON READER CARD

data transmission terminal

The Mark 63 enables conversion of mag to paper tape and paper to magnetic tape during transmission. It is a bi-directional unit which has been designed to communicate with a Mark 3 or Mark 53 paper tape terminal.



Lateral and longitudinal parity checking with automatic back-up and re-

MEETS SPECIAL-INTEREST NEEDS...PRODUCES TOTAL-ORGANIZATION RESULTS

From every point of view within your organization, the Bendix G-20 makes immediate dollar-savings sense. *Technical management* benefits, for instance, because the Bendix G-20 incorporates the latest hardware and software techniques...because it offers the speed, precision and reliability they require. *Accounting and Systems* management benefits because the communications-oriented Bendix G-20 provides multiprocessing capability, maximum total-system utilization...programming ease and compatibility. By meeting the needs of both these special interests, the Bendix G-20 assures *Top management* of its ability to produce total-organization results on the complete range of computer system applications...now and for years to come. The proven productivity of the G-20 at installation after installation...the extensive services of one of the nation's largest, most respected corporations are additional reasons for investigating the Bendix G-20...*from every point of view.* Call your nearest Bendix Computer sales office. Or write to: Bendix Computer Division, Los Angeles 45, California, Dept. E-45.

THE Bendix CORPORATION

Bendix Computer Division

CIRCLE 14 ON READER CARD

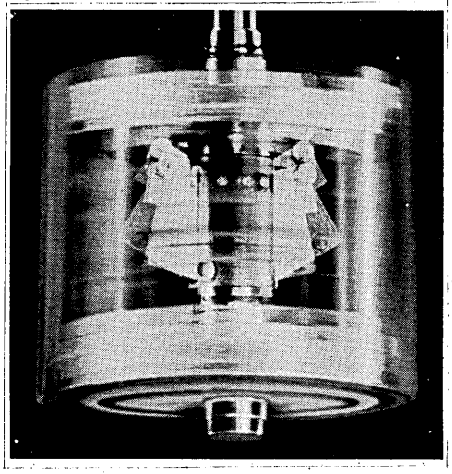
NEW PRODUCTS . . .

transmission of blocks upon detection of transmission error are featured. TALLY REGISTER CORP., 1310 Mercer St., Seattle, Wash. For information:

CIRCLE 205 ON READER CARD

auto-lift drum

This system features a self-starter consisting of an automatic drum/head spacing mechanism which works together with an adjustable flying head.

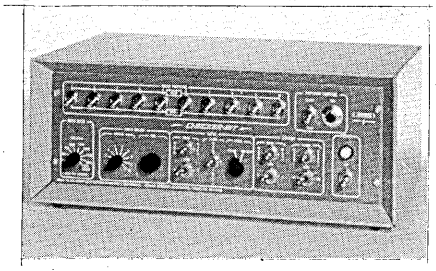


This combination eliminates inadvertent head-to-drum contact. BRYANT COMPUTER PRODUCTS, 852 Ladd Rd., Walled Lake, Michigan. For information:

CIRCLE 206 ON READER CARD

pattern generator, comparator

The SC-310 Checker-Bit generates a 10-bit binary data pattern for checking data transmission systems which is selected by switches on the front panel and presents this pattern in serial form. The rate can be set at 75, 150, 300, 600, 1000, 1200, 2000, 2400, or 4800 bits per second. GENERAL DYNAMICS/ELECTRONICS, 1400 N. Goodman St., Rochester, N. Y. For information:



CIRCLE 207 ON READER CARD

data reduction

Five scientific instruments for data reduction include a variable scale, which performs computations directly on graphs, curves and recordings; a Graphanalogue, which is an enlarged version of the variable scale; a Derivimeter, which reads the slope directly

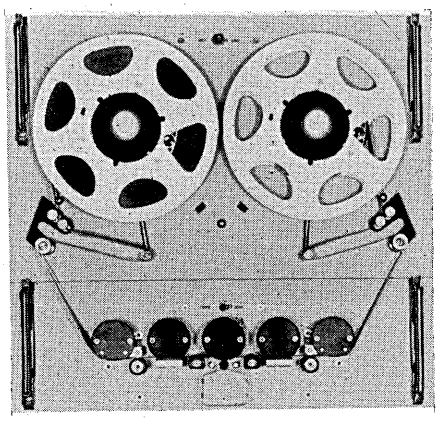
NEW PRODUCTS . . .

from a curve; an oscillogram scanner model S-2, provides quick look and scaling of oscillograms, film or strip charts; and an oscillogram amplitude tabulator, model B that will reduce data recorded on film and paper records. GERBER SCIENTIFIC INSTRUMENT CO., P. O. Box 305, Hartford, Conn. For information:

CIRCLE 208 ON READER CARD

readers and spoolers

The RR-300MB bidirectional tape reader can sense tape of eight levels plus sprocket hole at 300 cps continuously and stop on-character. The unit



can read in the asynchronous mode at speeds of 100 cps and 200 cps for special applications. It is priced at $2,525. The RS-300M tape spooler uses standard 8″ NAB reels and provides fast forward and reverse at 200 inches per second. Price for the spooler is $1,470. RHEEM ELECTRONICS CORP., 5200 W. 104th St., Los Angeles 45, Calif. For information:

CIRCLE 209 ON READER CARD

extra length tape

Extra length computer audiotape utilizes a thinner-base tape which enables a 50% increase in tape length available on a standard size reel. These tapes are offered on reels of either 10½ or 8½″. AUDIO DEVICES, INC., 444 Madison Ave., New York 22, N.Y. For information:

CIRCLE 210 ON READER CARD

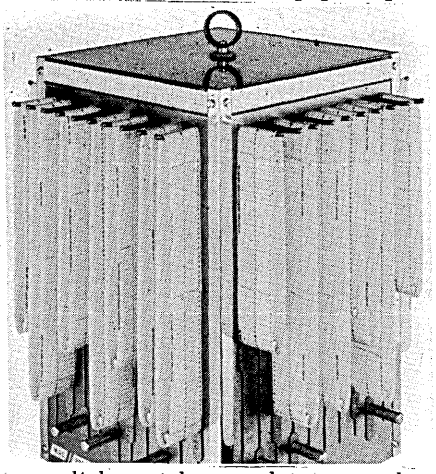
special purpose system

The SC-1 is a fully integrated special purpose, low cost data gathering system with a numerical code capacity of 9999. The central console can handle up to 49 information stations and is able to print the numerical codes of the cards at a particular station selected at the central console, search the information stations to find the location of any card whose numerical code is selected at the central console, sequence through all information stations and print a complete inventory. DYNALOG ELECTRONICS CORP., 380 Great Neck Rd., Great Neck, N. Y. For information:

CIRCLE 211 ON READER CARD

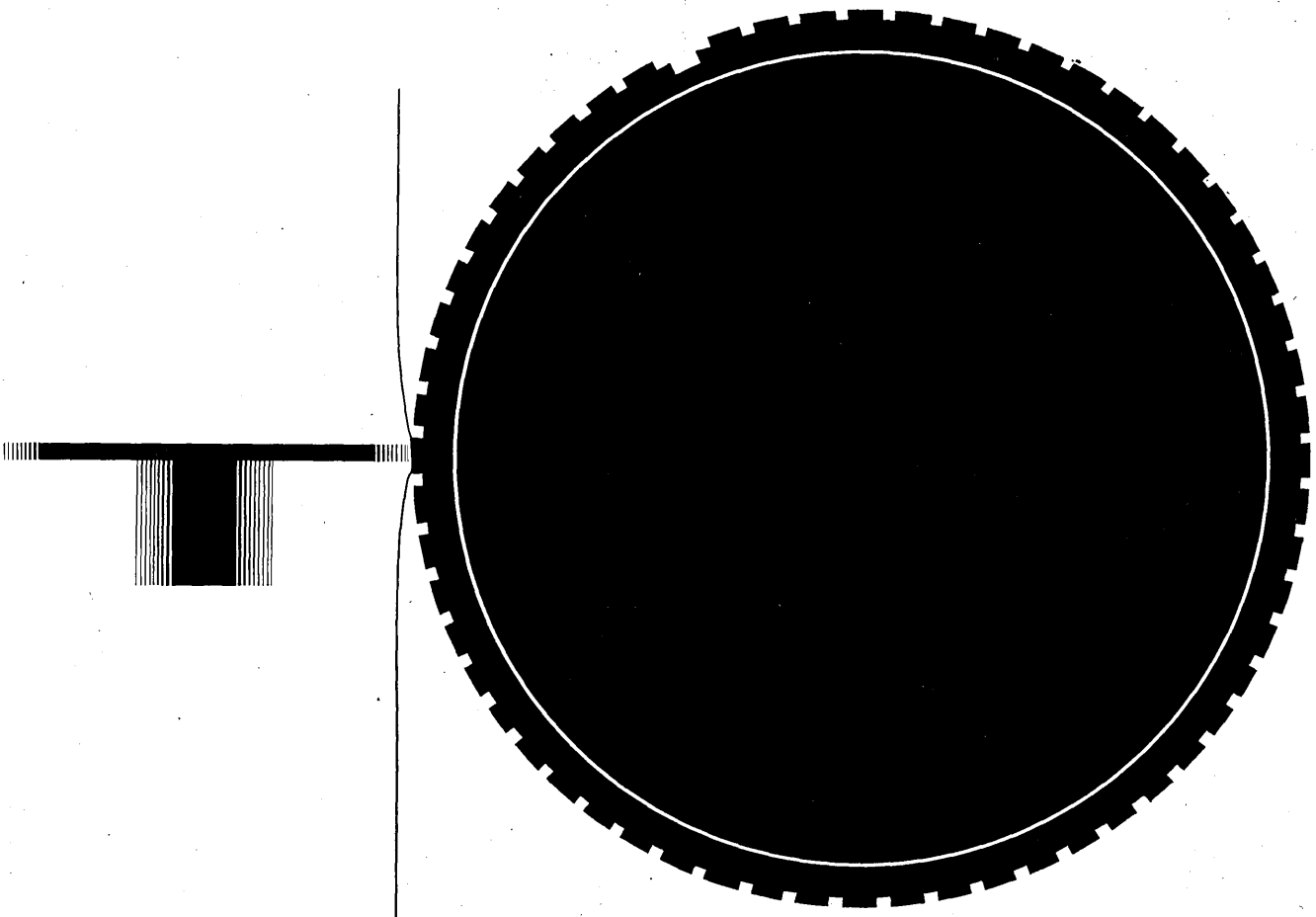
dp accessory

This Carriage Tape Console has been designed to hold up to 40 paper tapes



on a light-weight, revolving console. MAC PANEL CO., P. O. Box 5027, High Point, N. C. For information:

CIRCLE 212 ON READER CARD



Meet the new,
LINE/PRINTER™
—with just one moving part in its hammer drive!

Lowest cost/highest reliability; that's the essence of the new, medium-speed LINE/PRINTER by *data products corporation*. No need for hammer adjustment. Ever. Hammer activation is electromechanical, utilizing permanent magnets and a coil (in the tried-and-true tradition of the dc motor), to activate a single moving part: the hammer. Further minimizing maintenance: no troublesome clutches, brakes or mechanical latches in either the hammer or paper advance mechanisms.

More. 300-lines-per-minute rate and standard series or parallel interface, plus associated selection logic,facilitate the dp/p-3300 LINE/PRINTER's application to all medium- and low-speed digital computer systems and permit on-line use with minimal buffering. Other features: 10 characters/inch and 64 character types; up to 132 columns in 12-column increments; 6 lines/inch spacing; and smooth paper feed on forms up to 19 inches wide.

Complementing the DISCFILE,™ LINE/PRINTER is the second in a unified line of technologically advanced data input/output/storage equipments by *data products corporation*. For detailed technical data, write on your letterhead to: *data products corporation*/ Room 301/8535 Warner Drive/ Culver City/ California/ 837-4491.

data products corporation

PLOTTING DIGITAL DATA IS OUR SPECIALTY

Since 1952, EAI plotting equipment has been applied to a steadily lengthening list of data reduction applications — from simple, manual point plotting to high-speed magnetic tape input contour plotting. Again and again, the flexibility, speed and extreme accuracies of EAI plotters have dictated their selection over competing instruments. □ *EAI standard plotters include 11"x17", 30"x30", and 45"x60" boards. Operation can be either off-line from punched cards, punched tape and magnetic tape, or on-line with various computers. Output modes include point, line, symbol, and contour plotting. Plotting speeds up to 4500 line segments per minute can be provided. Reliability is assured by solid-state circuitry and superior mechanical design.* □ *You can draw upon EAI's wide application and design knowledge by describing your requirements. Write for information, detailing your needs, today.*

EAI

This product demonstrated at the IEEE Conference, Booths 3712-18

ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

CIRCLE 40 ON READER CARD

SYSTEMS ANALYSTS

PROGRAMMERS

. . . with Scientific Computer experience in the application of data processing systems for the collection, programming and dissemination of information at a high input-output level. Orientation in large Communications Systems desirable. B.S., M.S., or Ph.D. in Electrical Engineering, Mathematics, or Physics essential.

HIGHLY DESIRABLE ASSIGNMENTS IN

- PENNSYLVANIA
- MASSACHUSETTS
- VIRGINIA
- WASHINGTON, D.C.
- CALIFORNIA
- FLORIDA
- MARYLAND
- COLORADO

■ PROGRAM SYSTEMS ANALYSTS

To develop requirements and prepare specifications for design evaluation tests, to examine operation of experimental and production models of the system. Design of system tests and special test operating procedures. Will participate in live system testing of various complex systems. Will analyze test data and prepare documents which spell out results and conclusions to be derived from system tests. These conclusions should cover adequacy of the design logic and implementation of equipments, computer programs, and control manning.

■ SENIOR PROGRAMMERS

Will be responsible for the overall planning and supervision of computer programs. Will assign, outline and coordinate work of programmers and write and debug complex programs involving mathematical equations. Requires experience in the operation and programming of large electronic data processing systems, such as the AN/FSQ-7N8, IBM 700 series, or Philco 2000 series.

■ COMPUTER PROGRAMMERS

To develop and/or analyze logic diagrams, translate detailed flow charts into coded machine instructions, test run programs and write descriptions of completed programs. Requires experience in the operation and programming of large electronic data processing systems, such as the AN/FSQ-7N8, IBM 700 series, or Philco 2000 series.

Direct Resumes in Confidence To Dept. 801
G. T. EVANS
Employment Manager

PHILCO
A SUBSIDIARY OF FORD MOTOR COMPANY

TECHREP DIVISION
P.O. BOX 4730 PHILADELPHIA 34, PA.
An Equal Opportunity Employer

IBM® Data Systems Division Extends the Range of

SYSTEMS PROGRAMMING

IBM's Data Systems Division offers experienced programmers unusual opportunities to make significant contributions in research, development, and applications. Listed below are some of the many interesting areas presently open to experienced programmers.

SUPERVISORY PROGRAMS: Development of control program functions, such as:

Automatic Operator
Systems Supervisor
Symbolic I/O
Interrupt Control
Machine Control
Stack Job Scheduling
IOCS
Symbolic Debugging

PROGRAMMING LANGUAGES: Developing generalized programming languages using experience with machine-oriented languages such as SAP and problem-oriented languages such as FORTRAN and COBOL.

BUSINESS-ORIENTED PROGRAMMING: Advanced development of sorting techniques, merging, report generators, and file-maintenance programs.

ADVANCED PROGRAMMING: Research and development to advance programming technology, contribute to programming improvement, explore new techniques in programming, and explore new uses for computers.

ADVANCED PROGRAMMING TECHNIQUES: Involve research and development in such areas as new compiler techniques, operating systems (including real-time), advanced language development, symbolic debugging of source language programs, non-numeric algebraic manipulations on computers, and information retrieval systems.

These are opportunities for both personal and professional growth. Your opportunities for original achievement and rapid advancement are excellent. In addition to educational and benefit programs, IBM salaries are commensurate with experience, ability, and merit. Relocation expenses are paid.

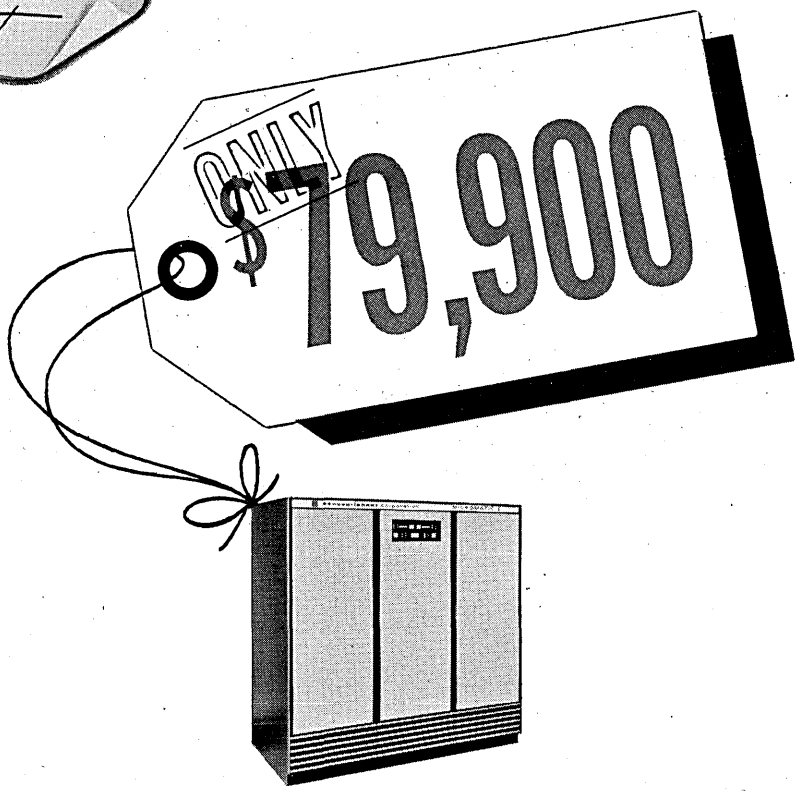
Programming facilities are in Beverly Hills, California; Boston, Massachusetts; New York City, White Plains and Poughkeepsie, New York. IBM is an Equal Opportunity Employer.

Qualifications depend on assignment, and require a minimum of one year's experience in programming large-scale computer systems. For further details, please write, outlining your background and interests, to:

J. B. Zwynenburg, Dept. 701C
IBM Corporation, Box 390,
Poughkeepsie, New York

Other IBM programming facilities are located in San Jose, California; Rochester, Minnesota; Bethesda, Maryland; Endicott, Kingston, Owego, and Yorktown Heights, New York.

Looks as though Benson/Lehner has come out with several interesting new products. Please get technical information. —



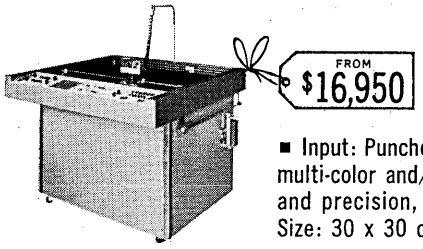
STILL SOUNDS EXPENSIVE!!!

Until you compute the value in productivity of electronic printing and plotting at computer speeds: This new Benson-Lehner/Transdata 944 is 3 times faster, yet ⅓ the price of systems already proving their worth in actual operation. ■ Input: BCD Magnetic tape. Compatible with most tape drives. Accepts 200, 500 and 800 CPI record densities at speeds up to 62.5 KC. Binary on-line units available at same price ■ Output: 35MM Microfilm. Optional quick look (4 second) 9 inch wide hard copy. ■ Speed: 30,000 lines per minute; 62,500 characters per second; 33,000 points per second. ■ Accuracy: Characters are distinct, uniform and precisely registered; Plotting/drawing resolution and accuracy have introduced new standards for digital CRT recorders. 3 character sizes and 4 orientations.

CIRCLE READER CARD #6

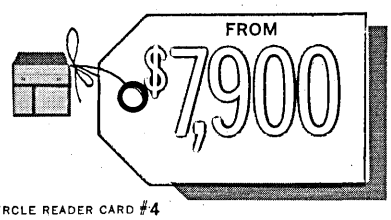
NOW COMPUTERS ARE DRAWING IN 4 COLORS THROUGH THE ALL NEW ELECTROPLOTTER II

Benson-Lehner's exclusive new double warranty Policy gives you a full 6 months of factory service at no charge.



■ Input: Punched cards, punched tape or mag tape ■ Output: Final, multi-color and/or multi-line width drawings of engineering quality and precision, including 48 character Alpha-numeric printing ■ Size: 30 x 30 or 42 x 58.

CIRCLE READER CARD #5



Miniplotter: For quick yet economical conversations with your computer—the all new 11 x 17 Miniplotter ■ Inputs: Magnetic tape, paper tape, cards.

CIRCLE READER CARD #4

Over 70 sales and service engineers to serve you both here and in Europe.

MAIN OFFICE: USA • 14761 Califa St., Van Nuys, Calif. • Phone: 781-7100
Benson-France • 1 Rue George-Mandel, Seine, France • Phone: TRE 2982
Benson-Lehner Ltd. • W. Quay Rd., Southampton, Eng. • Phone: S.H. 2-7831

BL benson-lehner *corporation*
14761 califa street / van nuys, california

THE 1824

a 17-lb. weenie from Univac

A 17-pound computer with 74K bits of thin film storage has been announced by Univac.

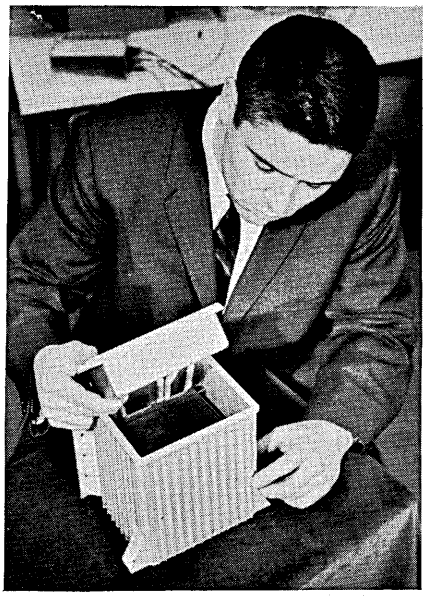
Designed for aerospace applications, the model 1824 consumes 53 watts, and measures 6″ square and 7″ high. In one second, it can perform 125K additions or subtractions, multiply 30K times, divide 15K times, or compute 8K square roots. Access time from memory is 3 usec.

The 1824 has four basic sections—the central computer (arithmetic and control), the memory, power supply, and I/O. There are five input and 11 output channels, modular expansible to 156 channels. The memory and logic circuits also are in modules.

With added memory banks, the computer is said to be capable of edp applications, as well as for weapons control and the detection and identification of aircraft. In its present form, it can serve guidance and control functions aboard space and aircraft. Reliability of 20,000 hours is forecast.

The 1824's integrated circuits take the form of semiconductor wafers, a circuit having as many as 18 transistors. Circuits measure 0.25″ X 0.125″, and are 0.035″ thick. ■

Ted Sammis, microtronic project engineer at Univac, examines the 1824 which occupies less than 0.2 cubic feet and features 74K bits of thin film storage.



CIRCLE 111 ON READER CARD

THE 1460

upgrading the 1401

The IBM 1460, announced in late February, is the fourth in the 1400 series, taking its place between the 1401 and 1410. The 1460 has an access time of six usec, contrasted with 11.5 usec for the 1401. It has 8, 12, or 16K positions of core storage. The console may contain an I/O printer; printed output speed is 14.8 cps.

A new 1,100 lpm printer, announced concurrently, is the 1403 model III. As with its predecessor, it employs a laterally moving line of type. However, instead of being attached to a steel band, the type slugs ride in a channel. Because the type slugs, containing three characters each, are separate from each other, individual slugs can be replaced. Linear type speed is 206 ips, instead of the 90 ips of the model II. Both can be used with the 1460, as well as with the 1410 and 7010.

The 60 will also accommodate up to six 729VI mag tape units which have a speed of 90 KC; this is 44 per cent faster than the 62.5 KC rate of the 729 IV, presently the fastest drive available on the 1401.

Initial shipments of the 1460 are scheduled for the fourth quarter of 1963. A typical tape system, including the model III printer, will rent for $9.8K per month, and sell for $479K. The model III printer is scheduled for first delivery during the spring of 1964. It will rent for $1.8K, and sell for $83.4K. ■

HARDWARE FOR THE CADETS

Air Force installs 1401; West Point uses 225

Computing instruction at the air force and army military academies has been implemented recently with the installation of an IBM 1401 at Colorado Springs and a GE 225 at West Point.

At the Air Force academy, courses in both digital and analog computation are available. The digital course covers FORTRAN, introduction to the theory of computers, and introduction to numerical analysis. In a closed shop operation, each cadet must write six programs as one of the minimum requirements. Programs too large for the 1401 are run on the 7090 at the Western Data Processing Center at UCLA via data transmission links. About 215 cadets are enrolled for the course, which is required for the Engineering Science major at the academy.

Analog courses are offered by the Department of Electrical Engineering in a two-semester sequence with optional advanced study available. In addition to basic theory, the course covers applications to the solution of basic and advanced engineering design problems. About 115 are registered.

All of these courses will be required or will satisfy elective requirements for the proposed Master of Science degree in Astronautics.

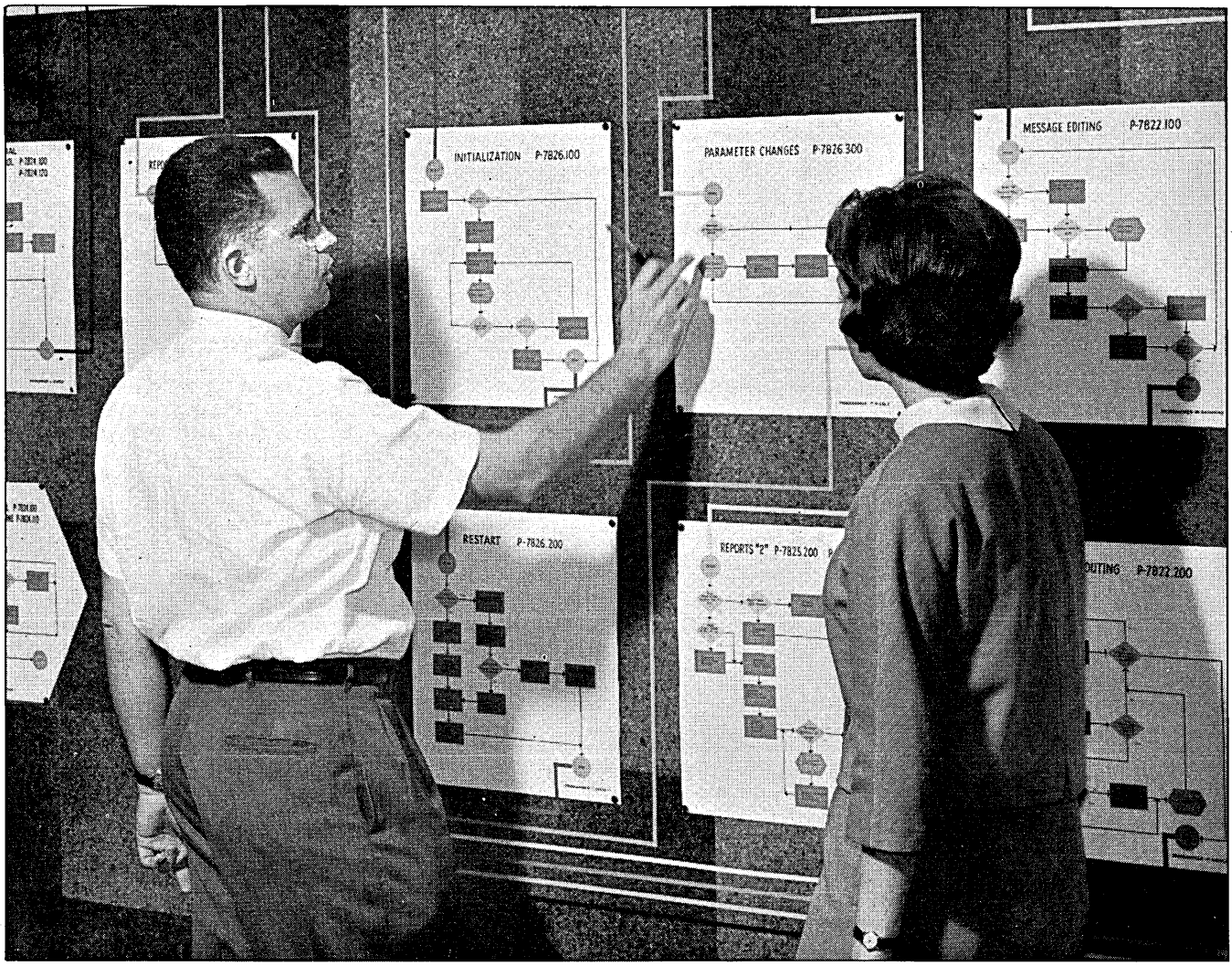
A new computer center is planned to handle the instruction and research by students, faculty, and the Colorado Astronautical Research Laboratory of the Office of Aerospace Research.

At West Point, N.Y., the academy's 225 is installed in a room which seats 200. Peripheral equipment include a card reader and punch, printer, and four mag tape transports. The instruction hall also contains movie and slide projection equipment, chalkboard, and other training aids.

These are to be supplemented by closed-circuit television to give large-screen projections of close-ups, and a graphic plotter to enlarge the printer-plotting capabilities of the equipment.

Officers' training on the computer preceded the instruction presently being given to cadets. This training is to be continued throughout a cadet's four years at the academy.

The computer center, the main room of which is the lecture hall, is designed to serve all academic departments and research activities, as well as individual instructors and cadets. ■



If you're a data processing specialist . . .

YOU SHOULD BE AT COLLINS

Why? Because Collins is taking an entirely new approach — the Microprogramming Technique — to computer design. We're using this technique in combining communication functions — message switching, priority routing, data transmission and conversion — with conventional computer data processing applications. This new Collins concept of what a computer can do opens up a whole new field to programmers. You'll be able to experiment and explore. You'll have the opportunity to actually participate in logical design. You'll be looking for new ways to use this computer system, new applications in which it can be used, new product development ideas. Talk about ground floor opportunities! We've already sold and are installing these systems in airline and railroad communication networks. But the surface has just been scratched. If you have at least three years of programming experience, a degree in E.E., Math or Business Administration, we'd like to talk with you. The listings at right tell you what fields are open and where to write.

Microprogrammers
(Logic Designers)

Applications Programmers
(Customer's Problems)

Software Programmers
(Business & Scientific Problems)

Diagnostic Programmers
(Automatic Fault Location)

Operating Systems

Look for us at the New York IEEE Career Center.

COLLINS

Send your reply, marked Dept. DT., to:

E. D. Montano
Information Science Center
Collins Radio Company
Newport Beach, California

L. R. Nuss
Collins Radio Company
Cedar Rapids, Iowa

C. P. Nelson
Collins Radio Company
Dallas, Texas

A Equal Opportunity Employer

CIRCLE 93 ON READER CARD

COMPONENT PRODUCTS

nanosecond transistor

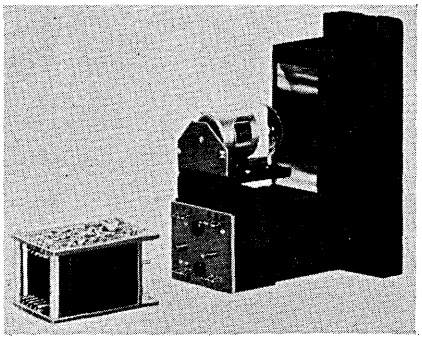
The metal oxide semiconductor transistor is an insulated-gate, field-effect device. By varying the input voltage on the insulated gate, it can switch, amplify, or otherwise regulate its output of current similar to a pentode vacuum tube.

Temperature range of the device is -80°C to 190°C. Switching speed is 10-20 nanoseconds. Both negative and positive types have been made. Sensitivity to nuclear radiation is reportedly less than for conventional transistors by a factor of 10. RADIO CORP. OF AMERICA, 30 Rockefeller Plaza, New York 20, N.Y. For information:

CIRCLE 213 ON READER CARD

plug-in adapter

The KRM-1 permits operation of a binary - operated, self - decoding readout directly from the computer logic circuitry. The unit requires four input lines in BCD, each line present-



ing about a 4,000 ohm load with driving voltage levels of 0 volts and -12 volts for the true-false states. Price of the adapter is $34. KAUKE & CO., INC., 1632 Euclid St., Santa Monica, Calif. For information:

CIRCLE 214 ON READER CARD

digital card module

Circuit model DCA01034 consists of seven AND-OR Gates and is suited for applications requiring moderately large numbers of isolated inputs such as encoding or decoding. SOLID STATE ELECTRONICS CORP., 15321 Rayen St., Sepulveda, Calif. For information:

CIRCLE 215 ON READER CARD

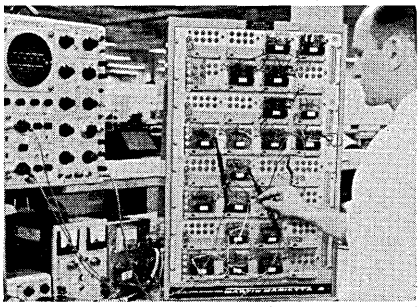
decades

These decades are available in 400 VDC units, .01 MFD to 0.1 MFD, 0.1 MFD to 1.0 MFD, and 1.0 MFD to 10.0 MFD. This line has a guaranteed tolerance change of less than ±0.1% over five years and less than 1% change over the entire temperature range from −55° to +85°C. HOPKINS ENGINEERING CO., P.O. Box 191, San Fernando, Calif. For information:

CIRCLE 216 ON READER CARD

breadboarding

This kit consists of four 7″ x 19″ patch boards mounted in a standard 32″ table rack, and an assortment of frequently used standard digital logic modules. Utilizing the kit provides



the design engineer a means of configuring various logic design schemes and enables him to see a logic diagram of the breadboard model. MARTIN CO., Baltimore 3, Md. For information:

CIRCLE 217 ON READER CARD

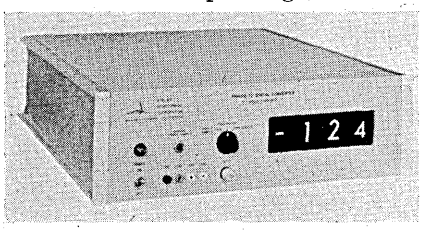
numeric indicator

Model 2661 indicator is an incandescent numeric display that accepts broadside digital time in a seven-level lamp driving code. The readout consists of five digits, sign and color in red or green. EDP CORP., 3501 S. Orange Blossom Trail, Orlando, Fla. For information:

CIRCLE 218 ON READER CARD

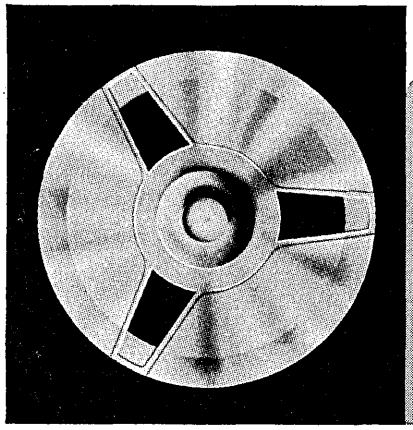
a to d converter

The 3-905 uses the binary approximation conversion method to translate an analog input signal of ±5V full scale to three digits plus sign BCD or 10 bits plus sign SB. The



conversion takes place within 60 microseconds. Price of the 3-905-SB is $3,800; for the 3-905-BCD, $4,500. APPLIED DEVELOPMENT CORP., 1131 Monterey Pass Rd., Monterey Park, Calif. For information:

CIRCLE 219 ON READER CARD



Careers in COMPUTERS

Programming — to design and implement programs for a wide variety of scientific, military and commercial applications on medium to large-scale computers. Several openings with a client exist now in the following areas:

Manufacturing — to analyze systems, flow chart and code for Manufacturing Control Systems. Develop Systems Supervisory Programs, Compiler and Application Programs.

Department Stores — to define information needs of the department store industry and to develop advance information systems.

Graphic Data Processing — to work in the following major problem areas of Graphic Data Processing: input languages, computer representations of graphic data, drawing compilation and generation, space allocation, post processors, etc. Prefer individuals experienced with Apt, Adapt, Autoprompt, Autospot, Automat, 1620 and 7090 engineering application, design information systems, compiler and language writing.

Research — to develop advanced programming languages, particularly in the area of simulation and to plan production of programs based upon these languages.

Systems Analysis — to plan, design and analyze medium to large scale information handling computer systems for business and scientific applications.

Applied Mathematics — to analyze scientific problems for solution on general purpose digital computers utilizing such techniques as numerical and vector analysis, theory of matrices and mathematical modeling.

Operations Research — to conceive and apply advanced mathematical techniques to problems of distribution, scheduling, inventory control and resource allocation.

Technical Writing — to prepare programming manuals involving the documentation of software programs for large-scale systems.

The above opportunities are only a few of the many openings that we are filling with manufacturers, users and consultants throughout the United States. If your interests and qualifications are in the above areas, or related field, please submit detailed resume with salary information and geographical preferences and restrictions.

All inquiries are treated confidentially. Fee assumed by client companies.

DATAMAN*

ASSOCIATES

PERSONNEL CONSULTANTS

120 Boylston Street, Boston, Mass. 423-5858

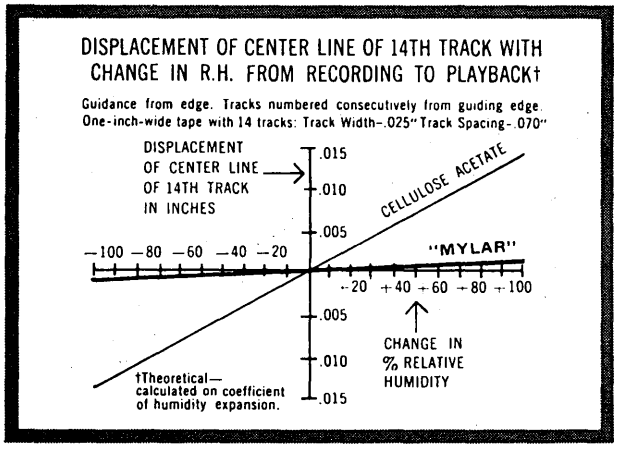
CIRCLE 91 ON READER CARD

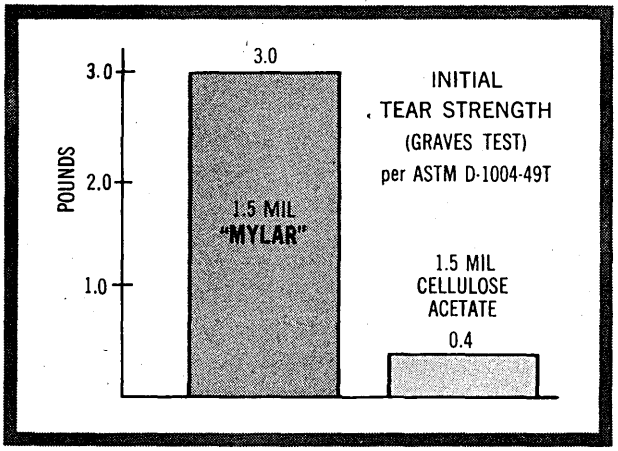
30 East 42nd St., New York, N. Y. MU 7-6330

CIRCLE 92 ON READER CARD

*DATA MANAGEMENT . . . *Recruiting Specialists for Data Processing and Computer Personnel Exclusively.*

GUARD AGAINST GARBLED SIGNALS WITH RELIABLE TAPES OF MYLAR®





An unreliable tape can shrink or swell—cause garbled signals because the tape tracks shift laterally away from the recording and playback heads. With tapes of dimensionally stable "Mylar"* polyester film you get accurate results . . . valuable programming time is saved.

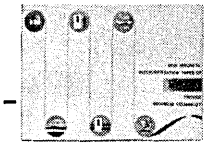
"Mylar" is strong—has a tear strength seven times greater than ordinary plastic of equal gauge. Tapes of "Mylar" resist edge nicks, stretching or breaking from sudden stops and starts. "Mylar" is durable—is not affected by humidity or adverse temperatures. And because it contains no plasticizer to dry out, "Mylar" does not become brittle in storage over long periods of time.

Why not safeguard your valuable program time by choosing reliable tapes of "Mylar". To be sure you'll get top performance, insist on a base of "Mylar" on your next order for magnetic tape. Send for free booklet of comparative test data. Du Pont Company, Film Dept., Wilmington 98, Delaware.

*"Mylar" is Du Pont's registered trademark for its brand of polyester film. Only Du Pont makes "Mylar".

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living . . . through Chemistry

DU PONT MYLAR® POLYESTER FILM



E. I. du Pont de Nemours & Co. (Inc.)
Film Department, Room #12, Wilmington 98, Delaware

Please send free, 12-page booklet of comparative test data to help me evaluate magnetic-tape reliability.

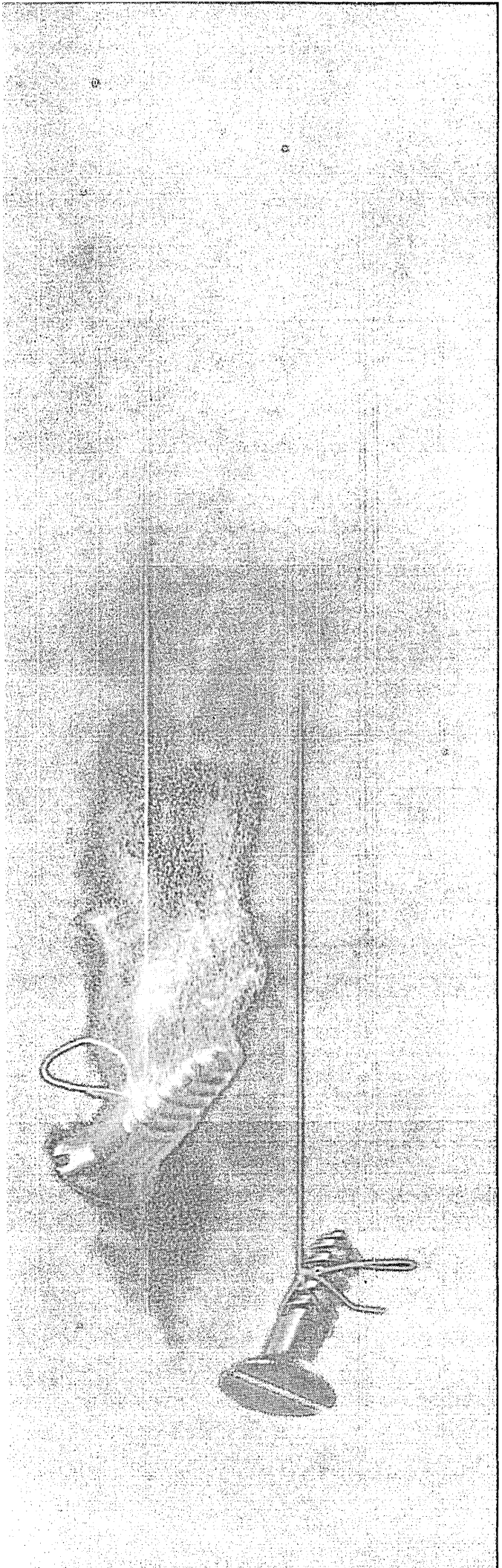
Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

CIRCLE 44 ON READER CARD



One of a series briefly describing GM's research in depth

The unsettled mobility of gases in solids

One of the more elusive phenomena of nature—the diffusion of gases into solids—may cause peculiar, even detrimental, metallurgical effects.

To explain these mysterious meanderings, physicists at the General Motors Research Laboratories are measuring the mobilities of gas atoms in metal lattices. Their goal: fundamental knowledge on which to base improvements in the properties of metals and other solids.

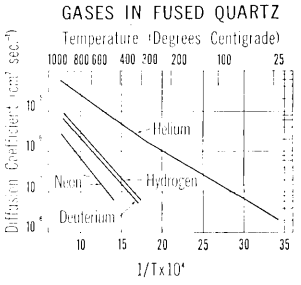
Diffusion rates for hydrogen in iron or steel have been found to drop off more than predicted as the temperature is lowered. For the theoretician, these results suggest that diffusion models will have to account for more than simple interstitial migration of hydrogen atoms. For the more practical minded, the new room temperature values can be correlated with the performance of hydrogen-embrittled steels.

In addition, the delicate nature of mobility measurements has diverted our experimentalists into investigating gases diffusing through glass lab equipment. The detour has proven fruitful. Their studies of gases in natural and synthetic fused quartz—the simplest form of glass—have furnished further clues to the basic structure of the glassy state.

It's another example of how General Motors engineers and scientists are working to find a better way—with research in depth.

General Motors Research Laboratories

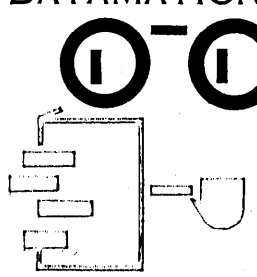
Warren, Michigan



Compiled from recent GM publications in *J. Chem. Phys.* List available upon request.

Screw at left loaded with hydrogen by electrolysis and suspended in a hot oil bath.

CIRCLE 41 ON READER CARD



NEW LITERATURE

PERIQUIP BROCHURE: A 75-page catalog includes descriptions of the company's accessories, card equipment, comparators, keyboards, key punches, military specifications equipment, printers, punches, readers, reproducers, tape and verifiers. SOROBAN ENGINEERING, INC., Box 1717, Melbourne, Fla. For copy:
CIRCLE 130 ON READER CARD

FORTRAN II: This 24-page manual outlines the specific statements and capabilities of SDS' 900 series FORTRAN II. Coding form, basic elements, expressions, and program statements are among the topics discussed. SCIENTIFIC DATA SYSTEMS, 1649 17th St., Santa Monica, Calif. For copy:
CIRCLE 131 ON READER CARD

FLEXOWRITER SFD: Specifications and operational procedures of this automatic writing machine are presented in this 48-page manual. Separate sections on edge-card punches and readers, tab card and auxiliary input readers, and Flexowriter programming are also included. FRIDEN, INC., 97 Humboldt St., Rochester 2, N. Y. For copy:
CIRCLE 132 ON READER CARD

OPTICAL CHARACTER READING: A 17-page article describes the application of optical character recognition to charge billing systems. The paper includes discussions on the economic ramifications of the system, capabilities of the hardware and cost analysis. RECOGNITION EQUIPMENT INC., Ross at Prairie Ave., Dallas 4, Texas. For copy:
CIRCLE 133 ON READER CARD

MEMORY CORE TESTER: This technical bulletin highlights model 2045A, a system designed for volume testing of a wide range of ferrite memory core types for critical laboratory analyses and for quality control applications. The system is capable of processing cores at the rate of 36,000 per hr. COMPUTER INSTRUMENTATION CORP., Route 38 & Longwood Ave., Cherry Hill, N. J. For copy:
CIRCLE 134 ON READER CARD

COBOL PRIMER: Characteristics and principal features of the Honeywell COBOL compiler and language, sample applications, codings, flow charting and background are contained in this 24-page booklet. HONEYWELL ELECTRONIC DATA PROCESSING, 60 Walnut St., Wellesley Hills 81, Mass. For copy:
CIRCLE 135 ON READER CARD

DATA CONVERTER: This 16-page brochure describes the preparation of a computer tape from analog and digital data using the model 751 computer format control buffer. Five systems applications are shown. ELECTRONIC ENGINEERING CO. OF CALIFORNIA, Box 58, Santa Ana, Calif. For copy:
CIRCLE 136 ON READER CARD

PB-440 COMPUTER: This six page brochure describes the 440's use for scientific and engineering applications as well as a real-time systems control computer. The dual memory stored logic feature is covered and command lists for various applications are detailed. PACKARD BELL COMPUTER, 1905 Armacost Ave., Los Angeles 25, Calif. For copy:
CIRCLE 137 ON READER CARD

DATA ACQUISITION SYSTEMS: An illustrated technical bulletin details the SYSTRAC™ Systems which combine features of both on-line and off-line data processing functions. SYSTRON-DONNER CORP., 888 Galindo St., Concord, Calif. For copy:
CIRCLE 138 ON READER CARD

Decision-Making: Logistics Support, What, Where, When?

Centuries ago the critical factor in logistics support was providing basic supplies—food, armaments, raw materials for simple industries. A few decades ago, carrying capacity—sea and land transportation—ruled as the decisive element. Within the last decade, a new critical element in logistics support has emerged. It has been created by the complex, interfacing governmental, industrial and military structure of today. This new factor is up-to-the-minute information—gathered from afar, varied in content, immense in volume.

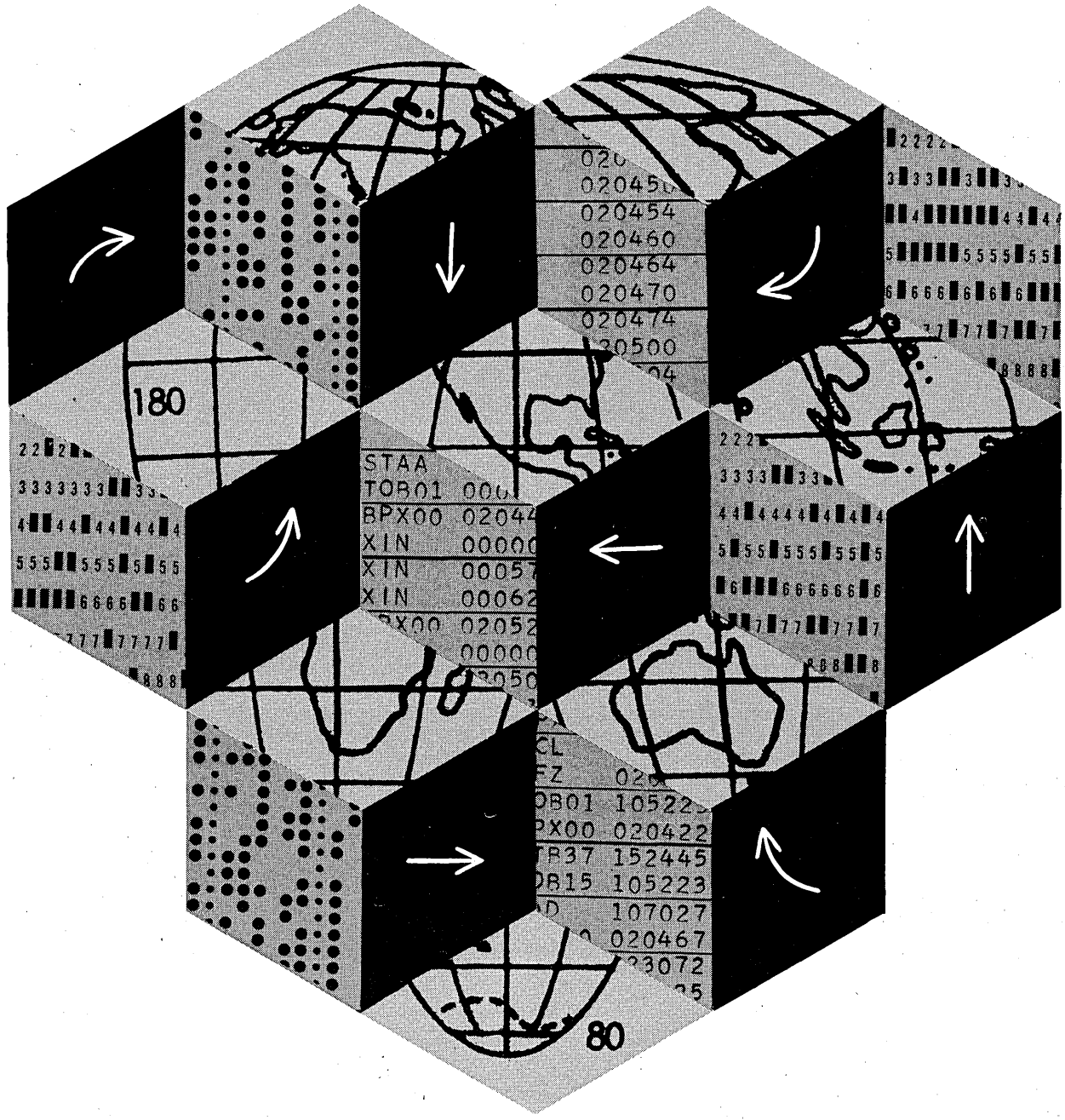
To help provide and control this flow of information, SDC scientists, engineers and computer programmers have helped create a new technology: information systems which aid managers in determining the "what, where and when" of logistics support for world-wide and continental activities and forces.

In developing these systems which provide information processing assistance, SDC scientists, engineers and computer programmers have evolved an interdisciplinary approach. Teams of computer programmers, operations research scientists, engineers and human factors scientists work together in these major system development steps: analyzing the system, synthesizing the system, instructing computers within the system, training the system, evaluating the system—and helping adapt the system to the changing needs of its users. The system itself, not the hardware within the system, is their concern.

Computer programmers, scientists and engineers interested in joining this growing field, are invited to write Mr. A. H. Granville, Jr., SDC, 2401 Colorado Ave., Santa Monica, California. Positions are open at SDC facilities in Santa Monica; Washington, D.C., Lexington, Massachusetts; Paramus, New Jersey; Dayton, Ohio. "An equal opportunity employer"

SDC

System Development Corporation



21-902

CIRCLE 83 ON READER CARD

PROCESS CONTROL ON WHEELS

TRW 330 housed in 40 foot trailer

A mobile computer center, housed in a 40 foot trailer, has been delivered by Thompson Ramo Wooldridge, Inc., to the Phillips Petroleum Co. in Bartlesville, Okla. It was designed to perform on-the-spot measurements, data logging, analysis, and process control functions at Phillips' plants.

The TRW-330 digital control computer with which the "computermobile" is equipped has a drum memory of 8-131K words. Word length is 28 bits. Display and recording equipment available are Flexowriter, paper tape punch and reader, logging typewriter, digital time-of-day clock, analog indicators, and strip chart recorders. The configuration can also include mag tape units, large display panels, X-Y plotters, and high-speed printers and punches.

The trailer is separated into an air conditioning compartment and a computer section. The latter is fitted with a 3′-wide storage cabinet, a 10′-long work bench supported by three sets of two-drawer file cabinets, and a standard office desk. A typewriter table, 8′ long, is made to support two electric typewriters, a high-speed tape punch, and a paper tape reader. The table also accommodates fan-fold paper fed from the floor. Space for additional equipment is provided.

The air conditioning compartment has sufficient space for the equipment, a computer regulator transformer, and a 10 KVA MG set which may be added. Controls for both devices, mounted on the bulkhead, are accessible from inside the computer room.

Air conditioning, by two commercial 2-ton units, is designed for typical hardware heat dissipation of 3KVA, with six persons working in the trailer, and external temperature limits of 0°F to 110°F at maximum humidity of 100%. It is said to maintain internal temperature at 70° to 80°F and 50% humidity. The system maintains a small positive air pressure in the trailer.

Size and weight restrictions are satisfied by the external dimensions of the trailer: 40′ long, 8′ wide, and 12½′ high. It is a straight frame, single-axle semi-van. The internal cross section is 88″ wide by 94″. It has a 44″-wide door on the curb side, and double doors on the front and rear for access to both the computer section and the air conditioning equipment. The rear corners of the trailer have jacks for leveling and to prevent swaying in high winds. There are also two manual drop legs.

Computer cables run in two metal conduit channels under the floor, and enter the trailer through a self-sealing hatch.

A mobile computer center, with either a TRW-330 or 340, can be purchased outright at $250-300K, or a standard unit can be leased on a short-term basis at $6-7K per month. The 340 is a combination core-drum computer with core memory of 4, 8, or 16K words, and a drum with the same capacity as the 330. With either system, more than 2,000 instrument signals can be received automatically. ■

NEW FIRMS & mergers in DP

Scientific Computers, Inc., Minneapolis, Minn., has acquired Computer Laboratories, Inc., Houston, Texas. SCI's Houston Computer Center will be consolidated with the latter's facilities in a pooling of personnel, software, and hardware. At present, Computer Laboratories has two 1401s and a 1620. M. Turhan Taner, VP, SCI, will head the merged center.

CIRCLE 119 ON READER CARD

Measurement Analysis Corp., a research engineering and consulting group, has been formed in Los Angeles, Calif. The firm will be involved in the engineering analysis of physical problems, and development of data measurement systems and other computer techniques. Julius S. Bendat, formerly of Thompson Ramo Wooldridge, Inc., is president.

CIRCLE 120 ON READER CARD

Data-Trol Systems Co., N.Y.C., has been formed to provide data processing services to apparel manufacturers and client stores of the parent organization, O'Shaughnessy, Dewes & Klein, Inc., a national buying office.

CIRCLE 121 ON READER CARD

Formation of EDP Supply Co., Boston, Mass., has been announced. Presently serving only the New England area, the firm supplies binders for marginal punched forms, flexowriter ribbons, punched tape and auxiliary equipment, card files, and indexes and guides. President of the firm is Robert A. Faulkner.

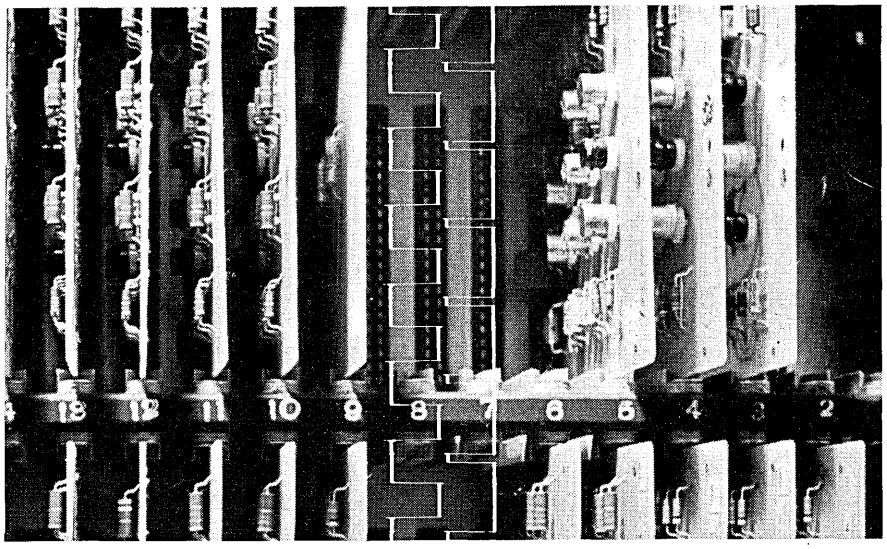
CIRCLE 122 ON READER CARD

Formation of Comress, Inc., has been announced jointly by Thomas P. Reath, president of Shieldtron, Inc., and Donald J. Herman, president of Comress. The new Washington, D.C. firm provides computer consulting services and software packages for users in government and industry.

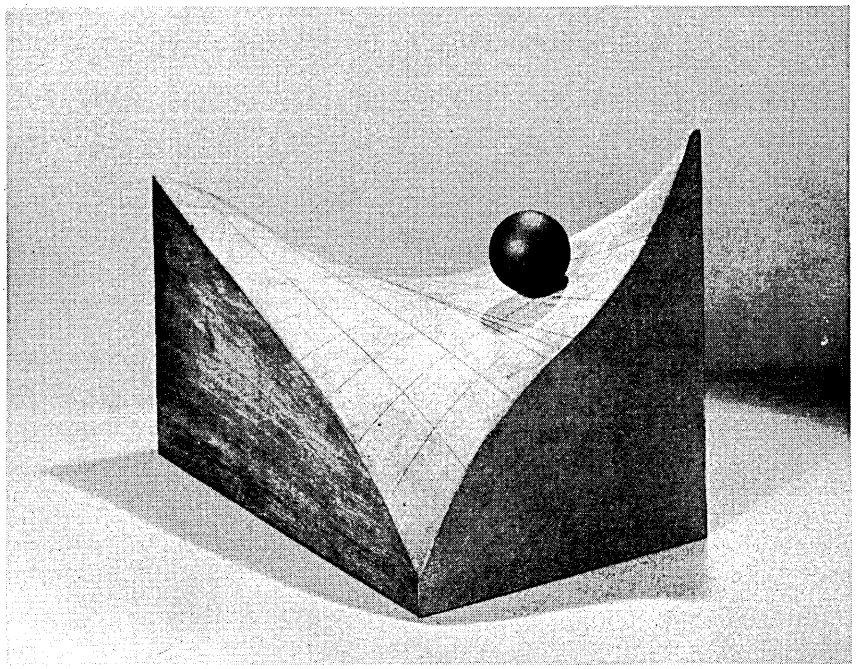
CIRCLE 123 ON READER CARD

James L. Halcomb, formerly program manager of Varian Associates, has organized his own management consulting firm, James Halcomb Associates, in Palo Alto, Calif. The firm will engage in training and implementation of the PERT system and its newest extension, PERT COST.

CIRCLE 124 ON READER CARD



WHICH PATH WILL THE BALL TAKE ?



MORE MEANINGFUL: HOW WOULD YOU DEFINE THIS PATH NUMERICALLY? THE SOLUTION TO THREE DIMENSIONAL PROBLEMS AND ALL OTHER PHASES OF NUMERICAL CONTROL IS GAINING MOMENTUM AT THE FORD MOTOR COMPANY. YOU TOO MAY WANT TO JOIN US AND PARTICIPATE IN A PROFESSIONALLY SATISFYING CAREER.

THERE ARE NUMEROUS OPPORTUNITIES FOR INDIVIDUALS WITH A MATHEMATICS OR ENGINEERING DEGREE, SKILLED IN ONE OR MORE OF THE FOLLOWING:

APPLIED MATHEMATICAL ANALYSES
PROGRAMMING I.B.M. 704 OR 7090 COMPUTERS
PART PROGRAMMING AND THE A.P.T. SYSTEM

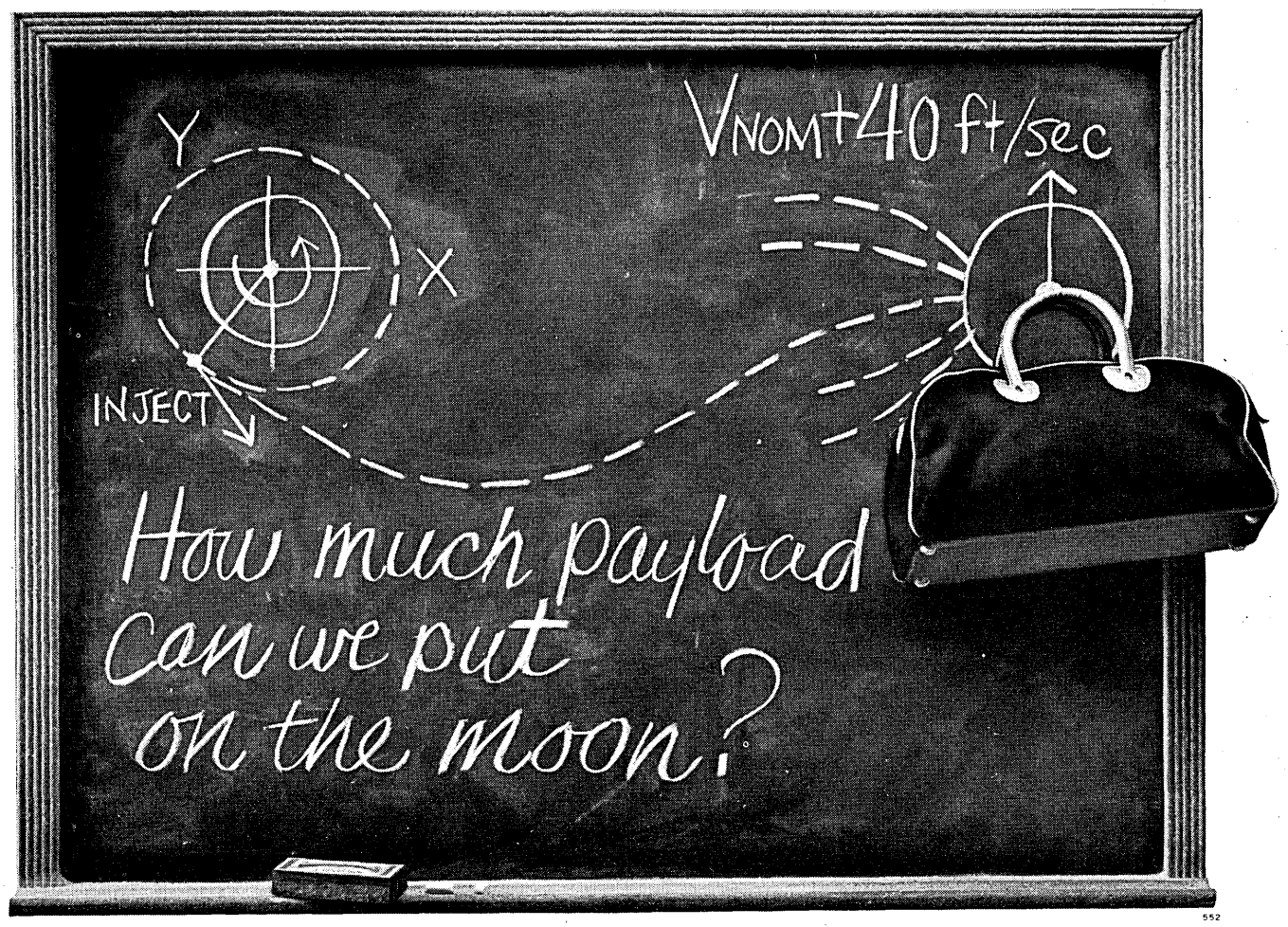
YOU ARE INVITED TO EXPLORE WHAT YOUR ROLE MAY BE IN THIS PROGRAM BY SUBMITTING A BRIEF RESUME TO:

MR. L. S. DOLL
PLACEMENT SECTION
INDUSTRIAL RELATIONS STAFF
FORD MOTOR COMPANY
DEARBORN, MICHIGAN

Ford

THESE POSITIONS ARE LOCATED IN DEARBORN, NEAR DETROIT.

AN EQUAL OPPORTUNITY EMPLOYER



To place a payload on the moon involves reconciling a highly complex set of variables. STL seeks to answer the question of payloads through analytical and computational studies of the interrelationships of vehicles, trajectories, and missions. This NASA project is part of STL's continuing investigations into space kinetics.

Computer Programmers, Numerical Analysts and Applied Mathematicians will find interesting assignments in space kinetics at STL's Computation and Data Reduction Center. For So. Calif. openings, you are invited to write Dr. R. C. Potter, One Space Park, Redondo Beach, Calif., Dept. M-3. STL is an equal opportunity employer.

SPACE TECHNOLOGY LABORATORIES, INC.
a subsidiary of Thompson Ramo Wooldridge Inc.

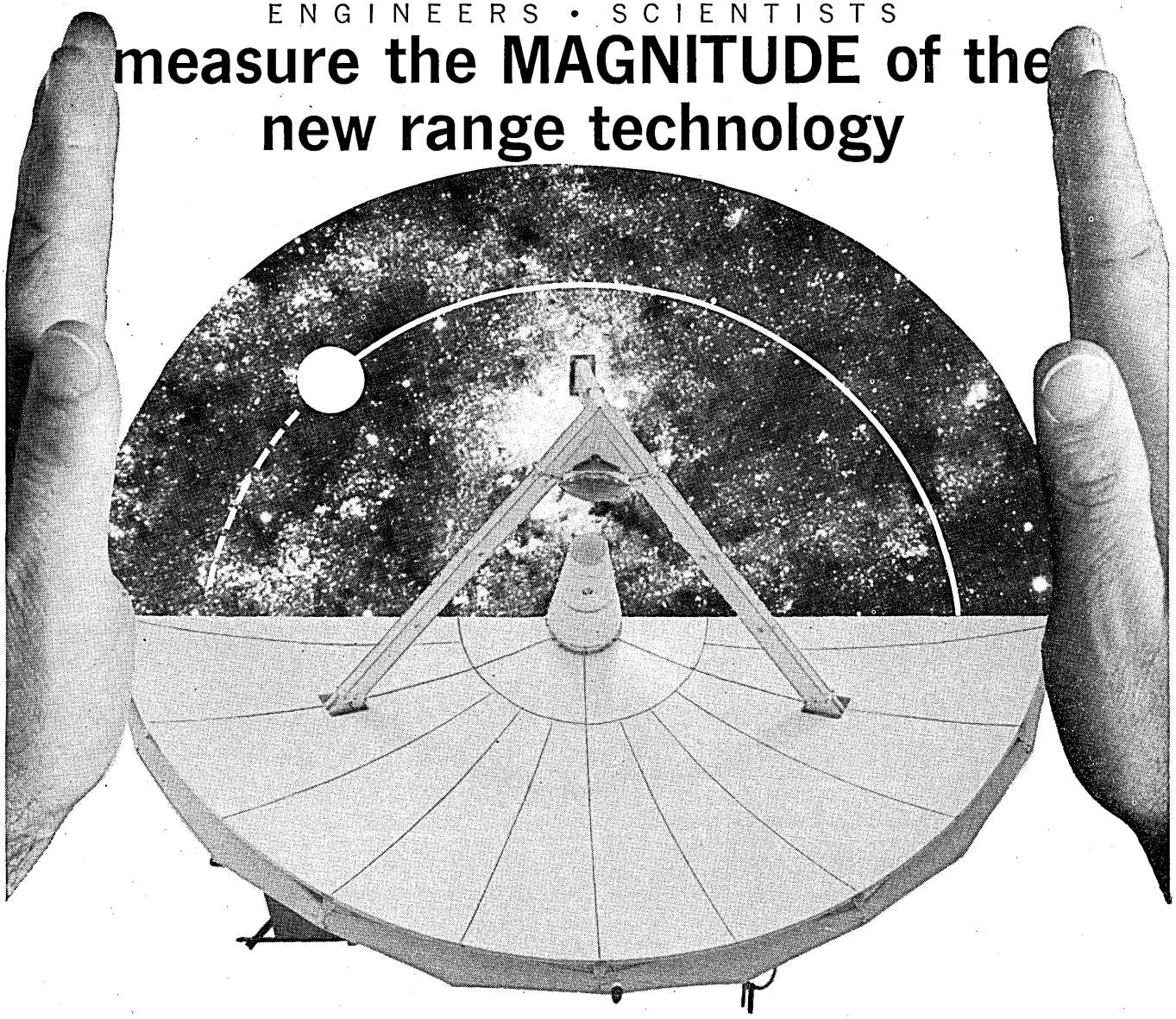
Los Angeles • Vandenberg AFB • Norton AFB, San Bernardino • Cape Canaveral • Washington, D. C. • Boston • Huntsville • Dayton • Houston

IEEE Delegates Visit STL Products Booth 3237-3239

CIRCLE 87 ON READER CARD

ENGINEERS • SCIENTISTS

measure the MAGNITUDE of the new range technology



...where a satellite may be just one element in a vast instrumentation system

Using a satellite to assist in monitoring flight performance of a Manned Space Vehicle is only one of the forward-looking projects under study by the Advanced Planning Group of PAN AM's Guided Missiles Range Division at Cape Canaveral.

Since 1953, the need to match range instrumentation systems with the constantly advancing capabilities of new missiles and space vehicles has spurred PAN AM to create a whole new range technology for the Atlantic Missile Range.

TODAY THE EFFORT IS ACCELERATING. PLANNING IS UNDER WAY AT 3 TIME LEVELS. 1. To meet the specific needs of scheduled launchings immediately ahead. 2. To meet the requirements of launch programs of the next 5 years. 3. To prepare for manned lunar flights and work as far into the future as the late 70's projecting range technology for interplanetary vehicles now existing in concept only.

YOU ARE INVITED TO INQUIRE ABOUT THE FOLLOWING OPPORTUNITIES:

Systems Engineers—EE's, Physicists capable of assuming complete project responsibility for new range systems.

Instrumentation Planning Engineers—EE's, Physicists to be responsible for specific global range instrumentation concepts.

Advance Planning Engineers—EE's, Physicists to evaluate and project the state-of-the-art in all applications of range instrumentation.

Experience in one or more of these areas: Pulse radar, CW techniques, telemetry, infrared, data handling, communications, closed circuit TV, frequency analysis, command control, underwater sound, timing, shipboard instrumentation.

Why not write us today, describing your interests and qualifications in any of the areas above. Address Dr. Charles Carroll, Dept. 21-C, Pan American World Airways, Inc., P.O. Box 4465, Patrick Air Force Base, Florida.

PAN AM

GUIDED MISSILES RANGE DIVISION

PATRICK AIR FORCE BASE, FLORIDA

AN EQUAL OPPORTUNITY EMPLOYER

PAN AM is now creating the range technology for launches of DYNA-SOAR, GEMINI, APOLLO, ADVANCED SATURN BOOSTERS

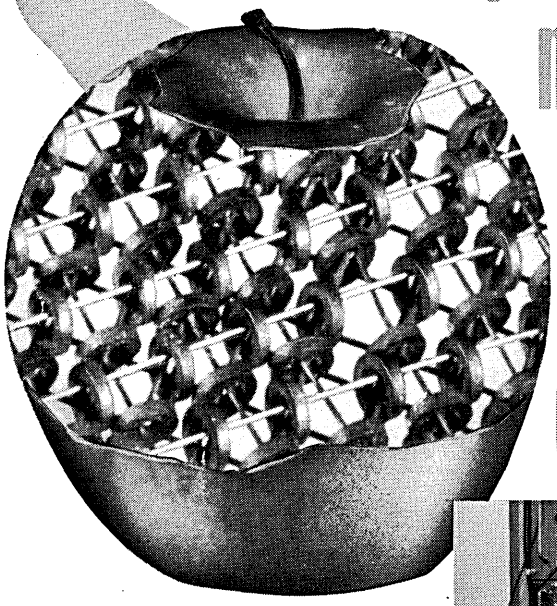
CIRCLE 88 ON READER CARD

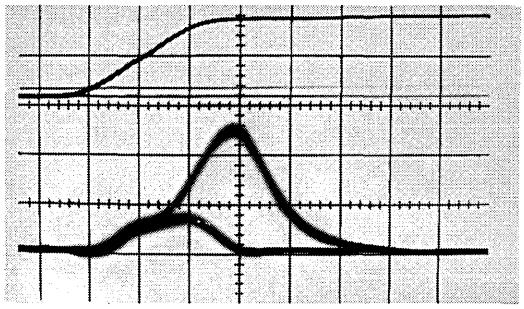
ADVERTISERS' INDEX

FOR ELECTRONIC ASSC. CIRCLE 2 ON READER CARD →

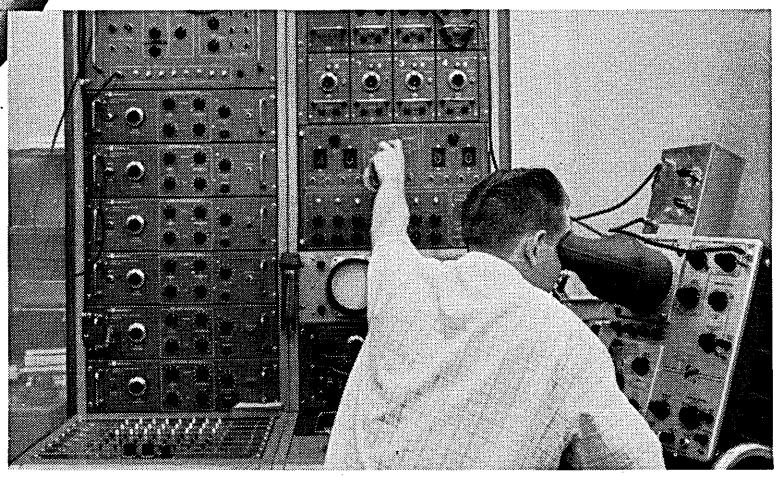

HYDAC 2000:
The *first* computer
capable of real-time
simulation of complete
missile and space vehicle
systems. Write for the facts today.
EAI
ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

we get to the core of performance in memory planes and stacks to assure maximum system operating margins





Actual photo-recording (unretouched) of 4000 word memory plan utilizing 30FC01 cores. Worse case pattern.



Some very good memory cores are thrown out at Ferroxcube simply because they do not meet the extra stringent requirements of performance in or out of the memory plane assembly. Only the best, closely matched to overall electrical requirements of the plane and stack, are delivered to our customers. Ferroxcube makes cores under precise batch kiln conditions and individually tests each core before assembly. After wiring in planes, cores are again submitted to advanced techniques of performance evaluation. Cores not up to Ferroxcube's specifications are replaced, until the entire assembly provides the **operating margins of performance** that means better overall memory characteristics, longer service life, and surprisingly, **you benefit by lower costs.**

WRITE FOR COMPLETE MEMORY COMPONENT TECHNICAL DATA...

FERROXCUBE
CORPORATION OF AMERICA
SAUGERTIES, NEW YORK

CIRCLE 3 ON READER CARD