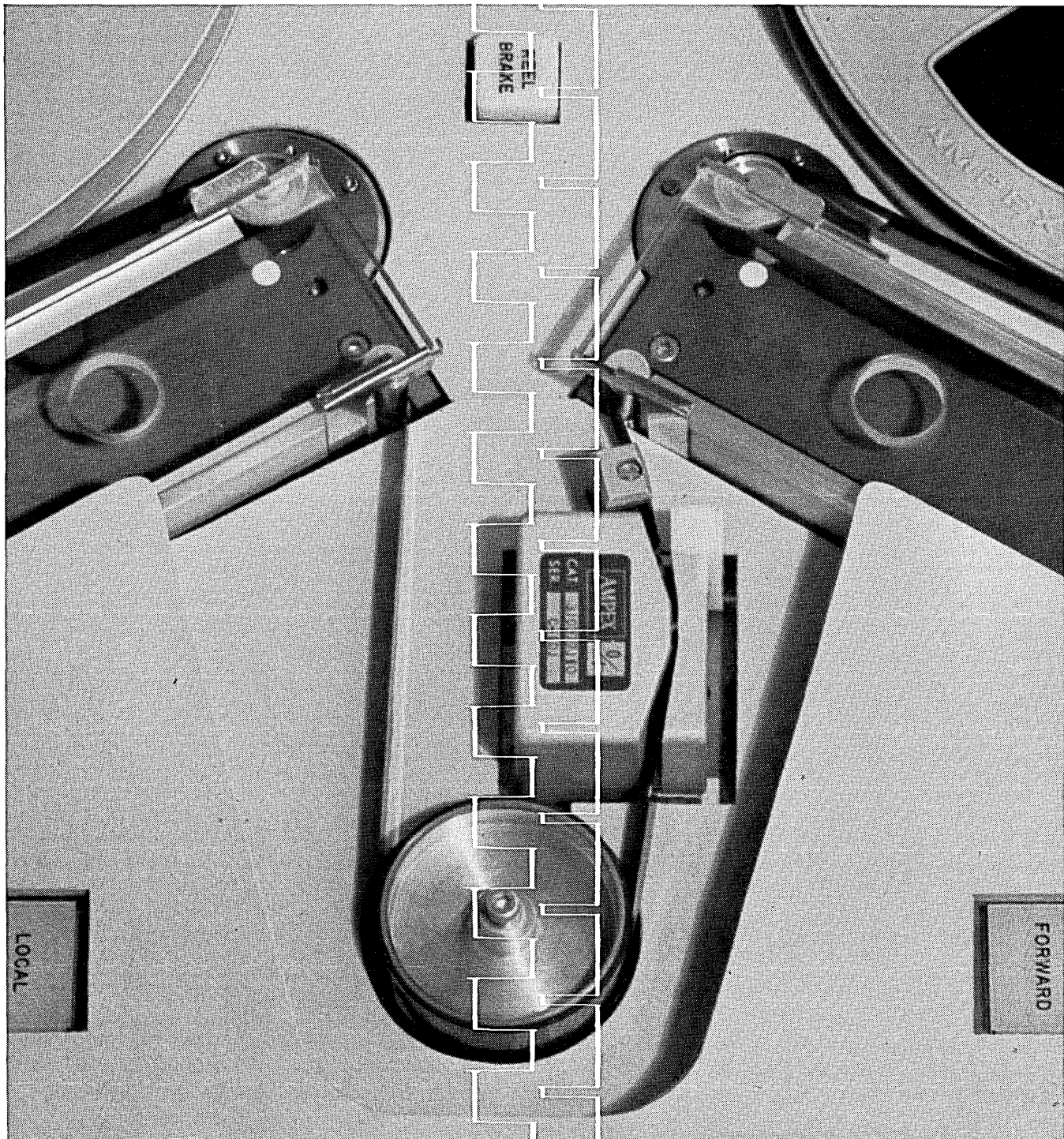


DATA MATION 64 N®

January



year of the tiger?



What has a drive concept so simple it's revolutionary?

AMPEX TM-7

Here's a transport that's far in advance of anything in its class—the all new Ampex TM-7. It's a low-cost tape transport designed for less maintenance, less tape wear. And its most advanced feature is the revolutionary single capstan drive system. The new drive system has three major moving parts—a capstan and two reels. As a result, most of the components found in this type transport have been eliminated. Maintenance is far less. And tape wear? Virtually none. The two vacuum chambers keep a uniform tape tension on the capstan. There is nothing to smear the tape; nothing to stretch it. Tapes last and last. Even the old soft-binder tapes can be used with very little wear. The new Ampex TM-7



is completely compatible with IBM tape formats and with other Ampex equipment. It has a packing density of 200 and 556 bpi. A tape speed of 36 ips. A start and stop time of 10 ms with tape distance held within $\pm 10\%$. Also, Ampex designed a new series of data and control electronics for the TM-7 to provide low-cost tape memory systems. The TM-7211 is a complete memory system enclosed in a 19 inch rack cabinet. And the TM-7212 is a complete shared system with four TM-7 transports in one cabinet. Write to the only company providing recorders, tape and core memory devices for every application: Ampex Corporation, Redwood City, California. Worldwide sales and service.

PROGRAMMERS

COMPUTER SCIENCES CORPORATION —one of the world's largest firms engaged exclusively in computer-oriented services — offers outstanding career opportunities in Los Angeles, San Francisco, Houston, and New York.

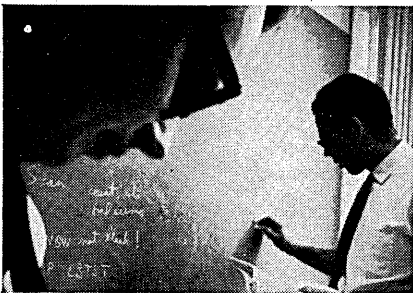
Since its inception in 1959, CSC has performed services for nearly all major computer manufacturers and many of the largest computer installations in all fields of business and science. In less than five years, CSC has grown from a small team of specialists to several hundred senior analysts and programmers. This page depicts some of the people and the working atmosphere responsible for CSC's impressive growth.

THE STAFFING PHILOSOPHY OF CSC



CSC's technically oriented management provides an unequalled professional climate, challenging projects, incentives and rewards well in the forefront of the computer field. This professional environment at CSC provides recognition and advancement in both technical and managerial directions to follow immediately upon performance and demonstration of capability.

THE CREATIVE CLIMATE AT CSC



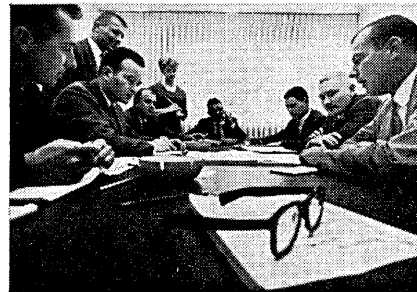
CSC staff members are widely recognized throughout the computing profession for major contributions to the state of the art. Professional capabilities at CSC extend over the complete range of computers produced by all equipment manufacturers and include the design and implementation of programming systems in current use throughout the business and scientific communities. The CSC staff includes such well known professionals as Roy Nutt, Owen Mock,

Charles Swift, Lou Gatt, Joel Erdwinn, and others. Above all, CSC is a problem analysis and programming organization — these are primary functions, not secondary to any other product.

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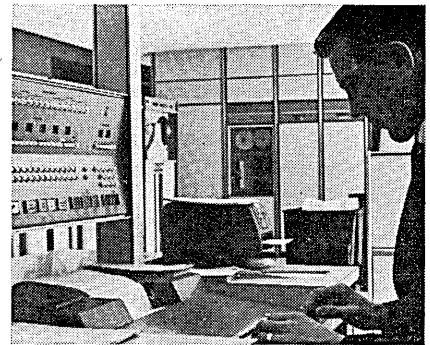
Today, CSC is solving problems in the computer sciences for such distinguished clients as IBM; UNIVAC; Lockheed Missiles & Space Company; Litton Industries; Philco; Douglas Aircraft; Hughes Aircraft; Union Carbide; Jet Propulsion Laboratory; Standard Oil Company; Lear Siegler, and many others.

VARIETY OF CSC APPLICATIONS



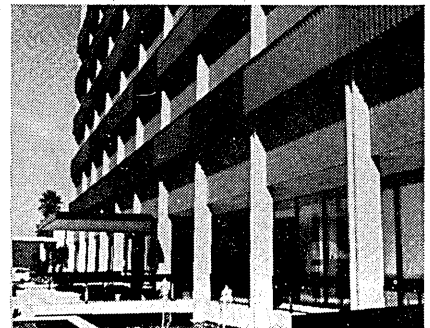
From advanced business and scientific language compilers to real-time communications with space vehicles, CSC projects cover a broad spectrum of activity. CSC has designed and produced programming systems for more than 20 machines including complete integrated systems for both medium and large scale computers. In the space sciences, CSC has designed and implemented programs for orbit determination, data acquisition and analysis, and video data reduction for such projects as Surveyor, Mariner, Ranger, Dyna-Soar, and Apollo. In business applications, CSC has developed advanced PERT/COST techniques and implemented major management reporting systems.

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A recent expansion of CSC facilities includes installation of large scale computing equipment in Los Angeles, marking CSC's entry into the Service Bureau field and providing programmers with highly advanced equipment to implement the solution of problems. CSC's 1107 computer features 65K words of main memory and over six million words of drum storage with the industry's fastest and most efficient programming system. A remote data-link with other CSC offices makes the 1107 available to the entire company.

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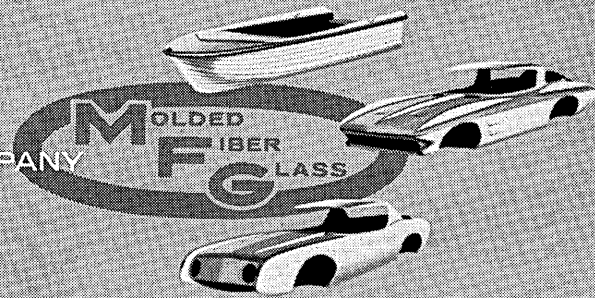


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CIRCLE 81 ON READER CARD

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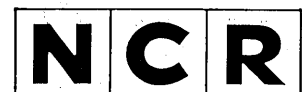
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"We believe our demand for fast, accurate information couldn't possibly have

been met without our '390'. Growth notwithstanding, it easily manages all our records relating to labor, material, inventory, sales analysis and payroll for 1,000 people."

Robert S. Morrison
Robert S. Morrison, President
Molded Fiber Glass Body Company

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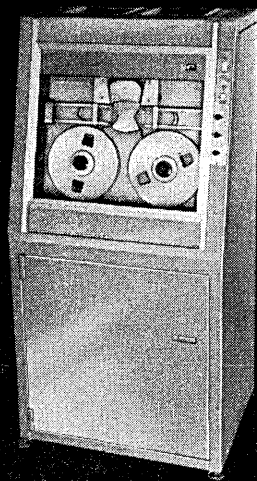
uniformity of signal response from channel to channel, from reel to reel. That's why we can honestly say that MAC Panel Computer Tape is manufactured for performance . . . tested for performance . . . packaged for performance. Ask your MAC Panel representative for the full story, or write for information on how the same high quality standards that made MAC Panel the leading independent manufacturer of control panels have led to the development of computer tape that's guaranteed to give you assured performance every time.

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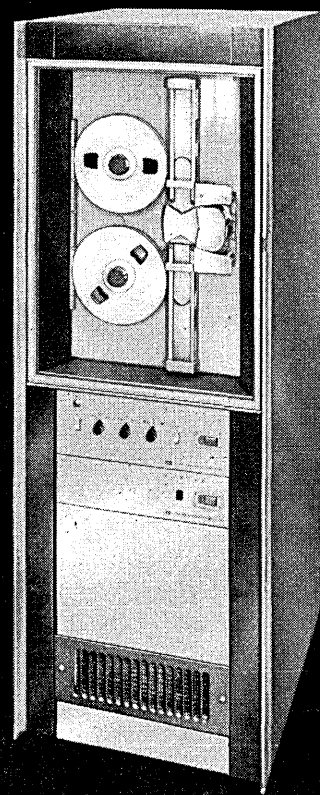
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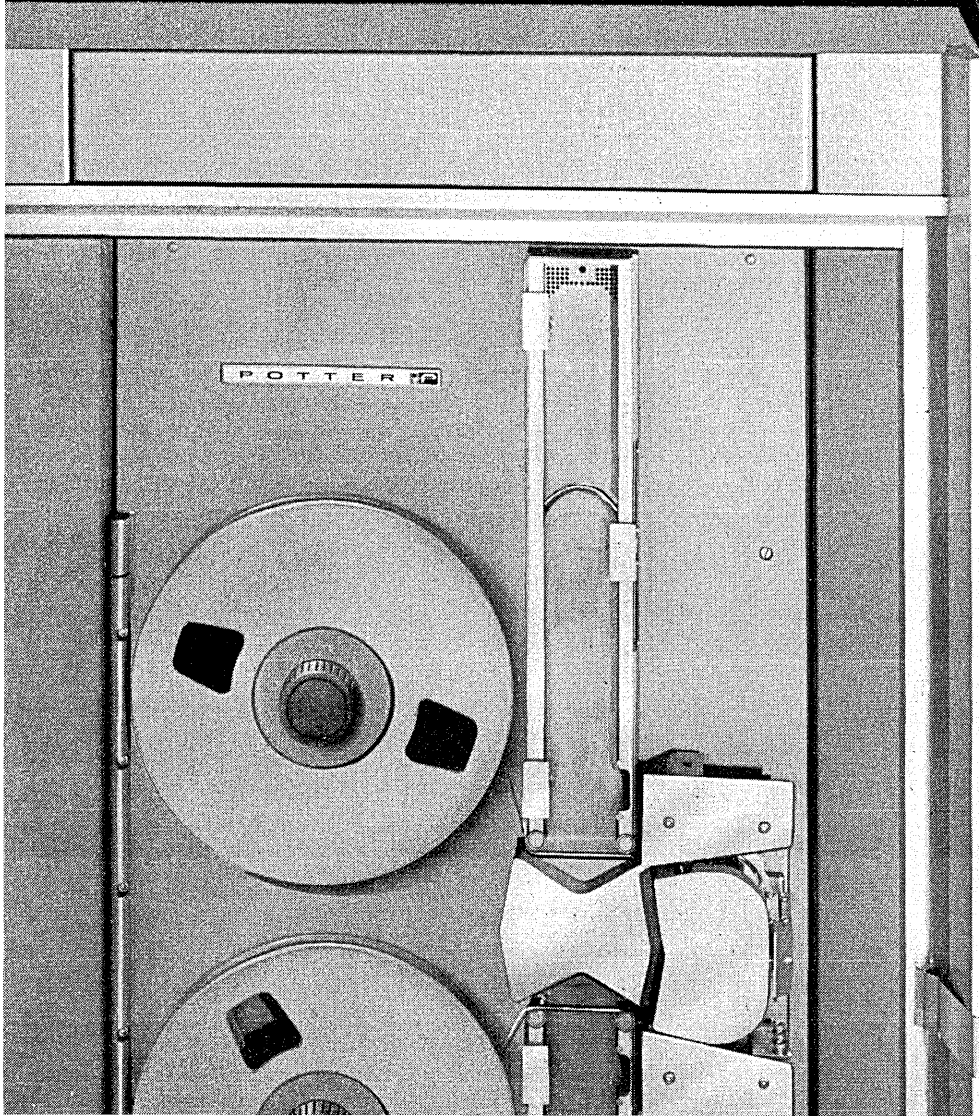


the MT-24



the MT-36

and now...the MT-75



Small cost . . . **BIG PERFORMANCE**

Now, with the introduction of the new MT-75, Potter offers a complete family of high-performance, vacuum-column magnetic tape transports, featuring packing densities to

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These new Potter transports, the MT-24, the MT-36, and the MT-75, have been thoroughly value-engineered for the highest possible reliability at minimum cost. They cover a tape speed range of 1 to 75 ips; provide data transfer rates to 60kc. All are IBM-compatible. Here are the facts:

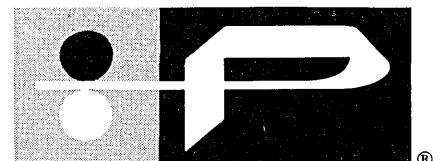
MT-24: 1-36 ips — data transfer to 28.8kc, 200 commands per sec.

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and the NEW MT-75: 1-75 ips — data transfer to 60kc, 200 commands per sec.

Interested? Complete data is available on these, as well as many other Potter models for speeds to 150 ips and packing densities to 1200 b.p.i. For information on the broadest line of digital transports available anywhere, just write to Sales Manager.

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CIRCLE 7 ON READER CARD

DATAMATION 64 N

the automatic handling of information

volume 10 number

1

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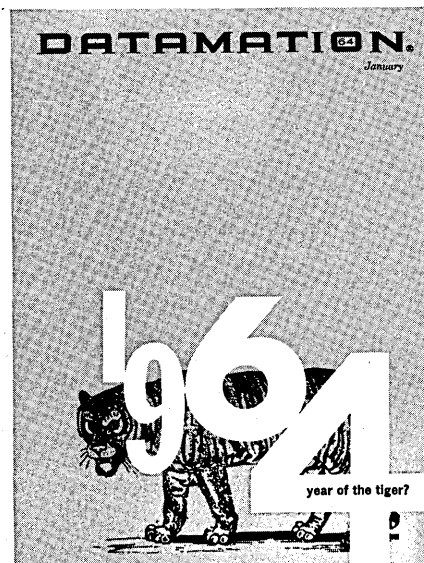
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THIS ISSUE—46,253 COPIES

Cover

Will 1964 be a year of significant information processing developments? Art Director Cleve Boutell's pensive tiger symbolizes the big question, examined in this special preview issue.

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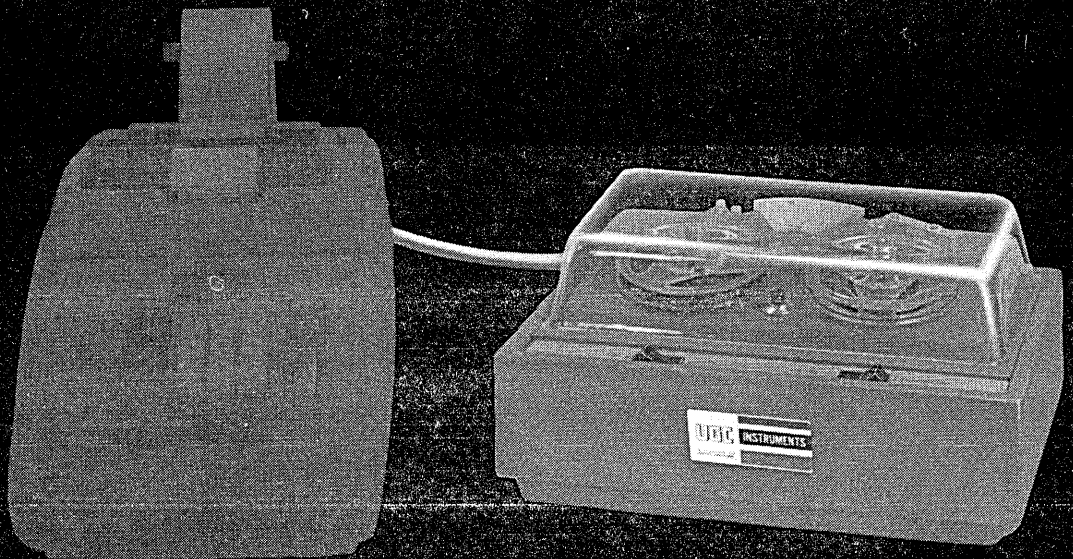
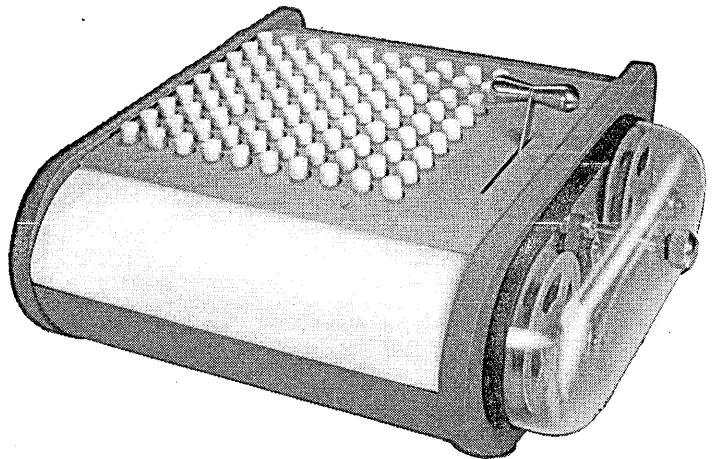
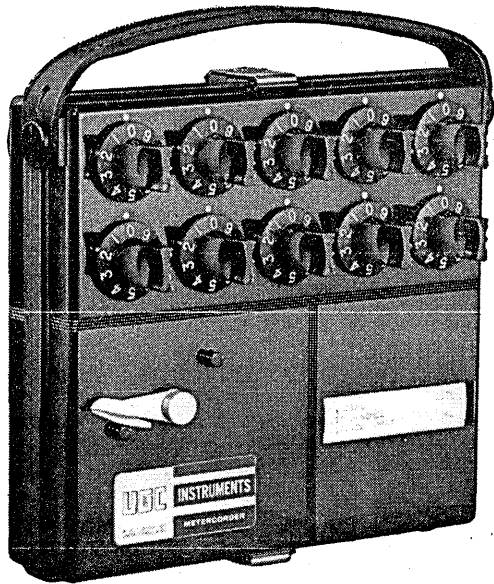
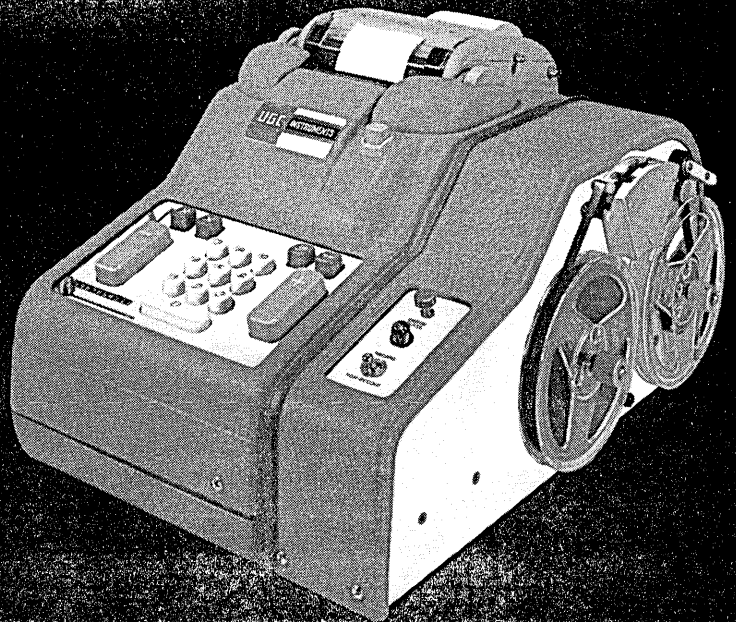


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Adding Machine

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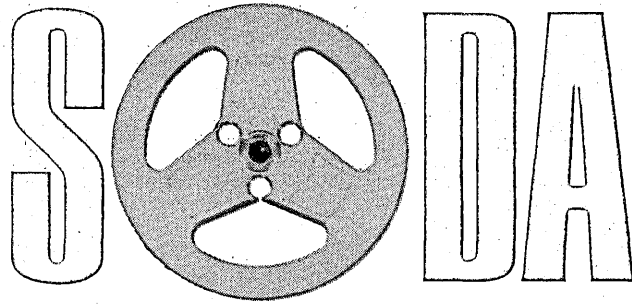
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SOURCE ORIENTED DOCUMENT ACQUISITION SYSTEMS
FROM UGC INSTRUMENTS

SODA systems magnetic tape recorders save hours in recording, and days in transferring, checking and reproducing digital data for computer processing. □ Wherever document acquisition is performed—in the field, factory or business office—there is a specially designed SODA system to do the job. □ With SODA systems, no further processing is required between the data acquisition and the computer processing center. □ This new concept in data acquisition is faster, more reliable, and considerably less expensive than other data collecting systems. □ For brochure write to UGC Instruments, developer and producer of magnetic tape recording SODA systems.



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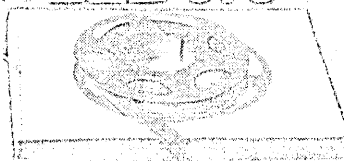
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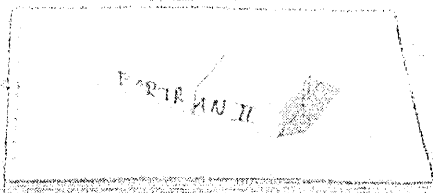
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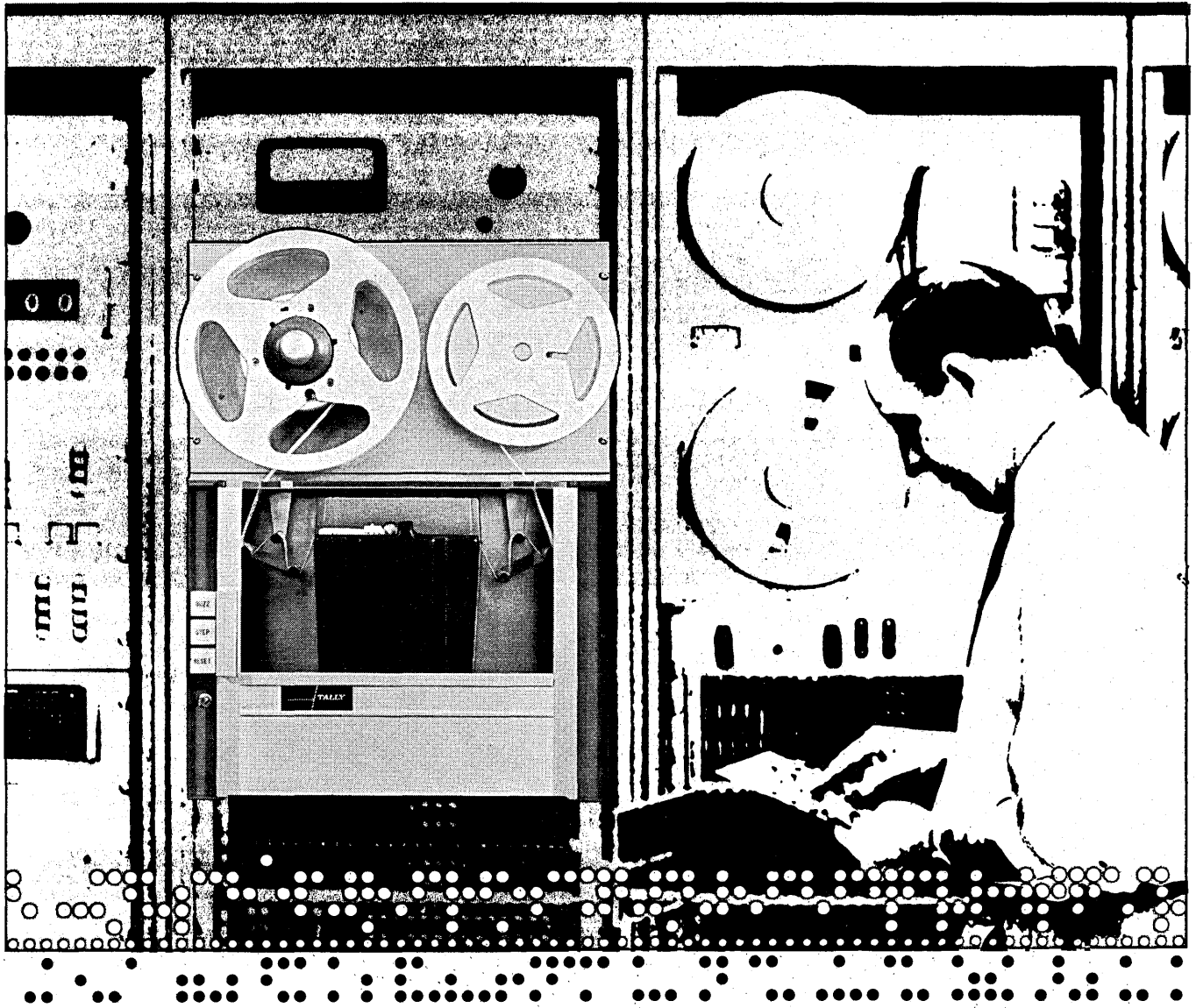
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SPEED DEMON ON PAPER

New Tally Perforator does 150 cps on paper, mylar, or foil tape.

Why is the new Tally P-150 the most advanced paper tape perforator on the market today? Speed, of course, is one reason. A price of \$2,850 is another.

But there's much more to the story of this remarkable new product. For instance, pin sense error checking through odd or even parity summing is standard on every punch. When a parity error is sensed, the flow of data and tape advance can be inhibited and the incorrect character deleted instantly at full character rate. Bi-directional tape handling and a remotely controlled backup speed of 25 cps simplify error correction even further.

The Tally P-150 offers asynchronous operation so that associated systems need not be synchronized to the cyclical rate of the perforator.

If you would like to know more about this well-designed and well-engineered new product, let us hear from you. Please write Tally Corporation, 1310 Mercer Street, Seattle, Washington 98109.

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The Friden 6010 Computer is easy to program. It provides random access storage and logical function ability; accepts data from punched tapes and cards, or its Flexowriter® keyboard, and produces both printed and punched-tape output.

For complete details, call your Friden Systems representative. Or write: Friden, Inc., San Leandro, California.

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CIRCLE 11 ON READER CARD

letters

c&c language study

Sir:

Permit me to correct two erroneous statements regarding the DOD programming language standards (Nov., p. 61). Phase I includes a definition of an interim language standard only if such is considered justified. It is "permissible" for the study to reveal that an existing language is already an acceptable standard, or that there is no need for a command and control language for the NMCS. In either event, there would be no need for Phases II and III.

Secondly, you state that the NMCS is expected to be operational in 1966. . . . DOD is well ahead of this schedule since the NMCS is operational now, and will be improved.

MALCOLM R. BILLINGS

JCCRG

*Organization of the Joint Chiefs
of Staff
Washington, D.C.*

In answer to the first paragraph, obviously. As to the NMCS, we doubt that it fulfills today the Secretary of Defense's definition of it. The '66 date stands.

more on-line comments

Sir:

One must congratulate E. D. Reilly on his excellent arithmetic ability (Dec. Letters). Pity his reasoning does not match. The installation in question runs 300 jobs per day at six minutes each (yes, that is 30 hours of productive time in 24 hours) through two great-big 7094-I computers. You see, it's a two-shift operation. Readers who jump to conclusions shouldn't.

R. L. PATRICK

Northridge, California

eighth grader's request

Sir:

I am an eighth grade student. For a science project I have chosen electronic computers, and hope to build a small, very simple binary computer to display. Any research material and information you could send me would be tremendously appreciated.

WAYNE AFFELDT

*2410 Leesburg Pike
Falls Church, Virginia*

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- Has highest throughput speeds available
- Transports paper at magnetic tape speeds

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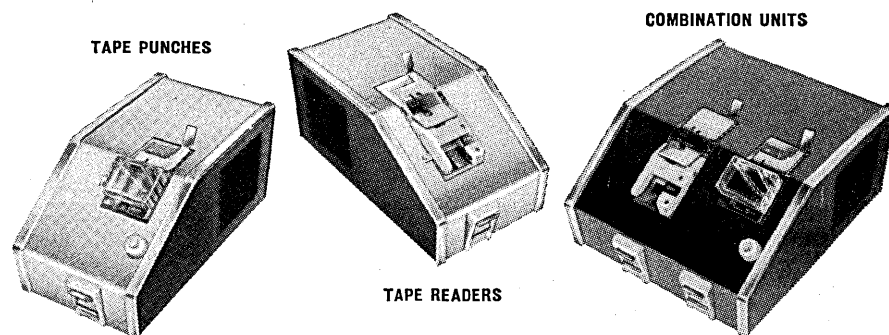
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New... from the research and development facilities of Royal McBee comes the Series 500... a complete range of precision punched paper tape units that operate smoothly, with less noise and greater reliability over longer periods than previously possible. And, their simple, foolproof construction permits significant cost savings. Prices start at \$285 for readers and \$300 for punches.

New design features give new standard of performance

Efficient electro-magnets and off-center springs provide smooth, trouble-free punching ■ Reluctance type pick up for timing eliminates contacts and cams... reduces arcing and system noise and increases reliability ■ Bi-directional reader operates with high reliability at low noise level through action of sensing pins on wire contacts and strobe-like interrogate pin ■ Sealed read station protects mechanism... saves maintenance ■ Semiautomatic feed allows fast tape loading (operator merely places tape in head assembly throat).



There is a Royal Series 500 unit for every punched tape requirement.

Basic punch and reader mechanisms that can be built into equipment with the means for mechanical drive.

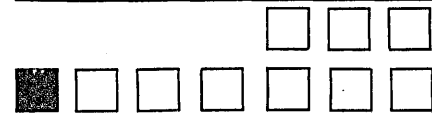
Desk or Panel Mounted Units, with and without logic and circuitry.

Combination Reader/Punch Units share drive, but are electrically independent. Send for complete specifications today to Royal McBee Corporation, Industrial Products Division, 850 Third Ave., New York, N.Y. 10022.

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INDUSTRIAL PRODUCTS

DATA MATION calendar



- The American Institute of Technology, Phoenix, Ariz., will hold a series of courses on Audit and Controls for EDP on Feb. 3-7, March 2-6, and April 27-May 1.

- The Sixth Institute on Information Storage and Retrieval is being sponsored by the American Univ., Washington, D.C., Feb. 10-14, 1964.

- The International Solid State Circuits Conference will be held at the University of Pennsylvania and the Sheraton Hotel in Philadelphia, Pa., February 12-14, 1964. Sponsors are the U. of Pa., PGCT and IEEE, Phila. section.

- The 17th annual Southern California Business Show, sponsored by the L.A. Chapter of the National Assn. of Accountants, will be held Feb. 25-28 at the Ambassador Hotel, Los Angeles, Calif.

- The third national symposium of the Society for Information Display will be held Feb. 26-27 at the El Cortez Hotel, San Diego, Calif.

- The winter 1964 meeting of SHARE, the IBM 704/9/90/94/40/44 Users Group, will be held at the Jack Tar Hotel, San Francisco, March 2-6.

- The American Management Assn.'s EDP conference will be held March 2-4 at the Statler-Hilton in New York City.

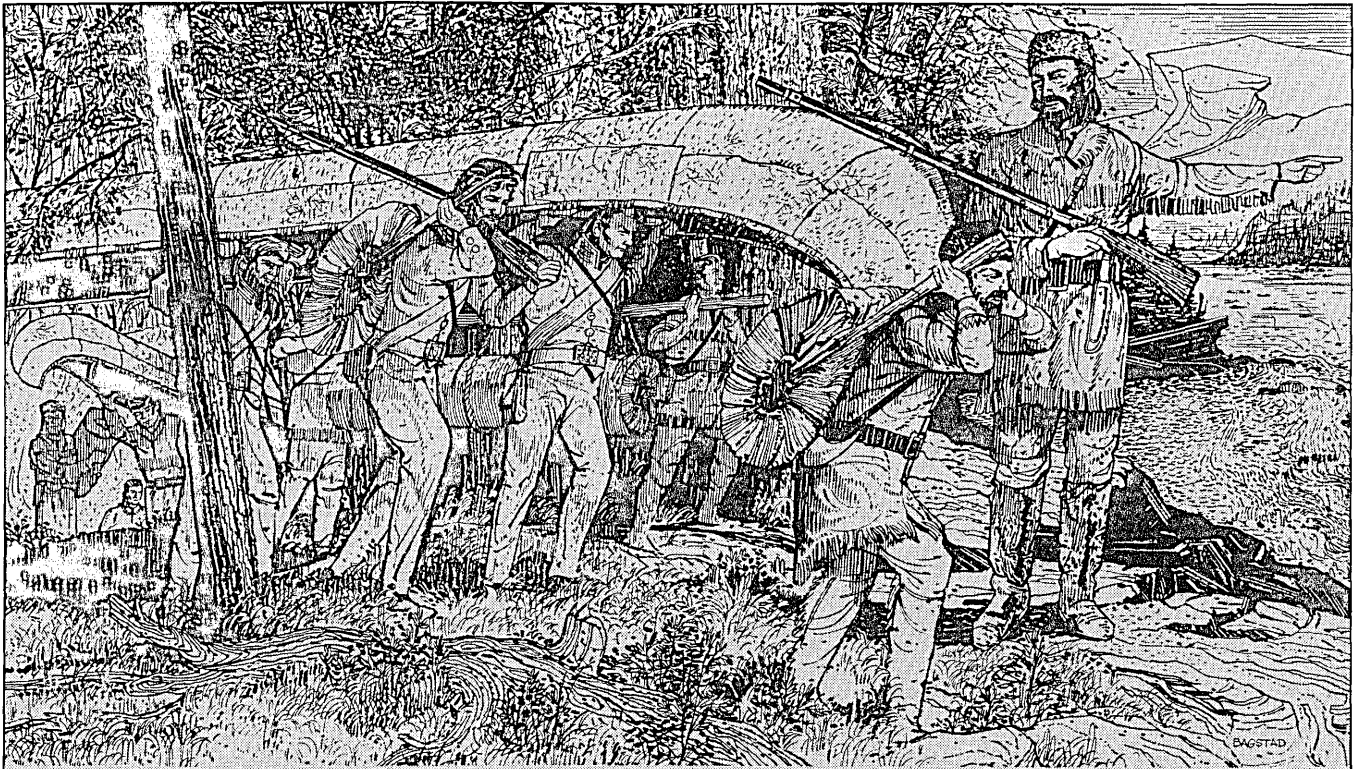
- CDC's small and medium-scale computer users group will meet April 7 at the Hilton in Albuquerque, N.M.

- The 1964 Spring Joint Computer Conference will be held at the Sheraton Park Hotel, Washington, D.C., April 21-23.

- The spring meeting of CUBE (Burroughs Users group) will be held April 22-24 at the Ben Franklin hotel in Philadelphia.

- The fourth national conference of the Computing and Data Processing Society of Canada will be held on May 11-12 at the Univ. of Ottawa.

- The ninth annual Data Processing Conference will be held at the Hotel Stafford, Tuscaloosa, Ala., May 12-13. Sponsors include DPMA, National Accountants Assn., U. of Alabama, and Certified Public Accountants.



“... Let every man keep a close watch!”

Lieutenant James Allen and his small detachment of soldiers cautiously portaged through the dense woods around the perilous but beautiful St. Croix falls. The date was July 28, 1832 and the Chippewa and the Sioux were at war. Allen's diary candidly refers to “inhospitable Indian country.” Wandering white men in those days often failed in health and hairline if they failed to keep “a close watch.”

Near this same spot, 131 years later, very careful men are designing and building core memories at Amery, Wisconsin.

With Fabri-Tek's manufacturing facility stringing over two million cores a week, quality assurance means the health of a reputation — a reputation that is based on “a close watch!” Every single core is fully inspected three times

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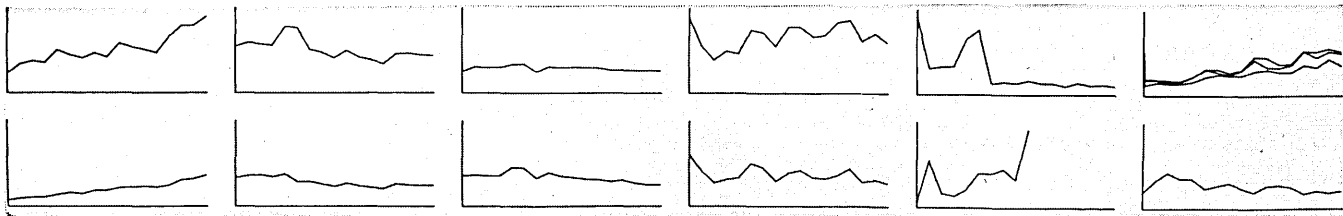
- Airborne Instruments Laboratory
- Dynatronics
- Ferranti-Packard
- Hamilton Standard
- Navcor
- Potter Instrument

For the asking, we'll be happy to send you some very interesting material about core memories and memory systems. Write FABRI-TEK, Incorporated, Amery, Wisconsin.

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CIRCLE 14 ON READER CARD



FOR PENNIES, YOUR COMPUTER CAN PLOT DATA DIRECTLY IN EASY-TO-READ GRAPHIC FORM

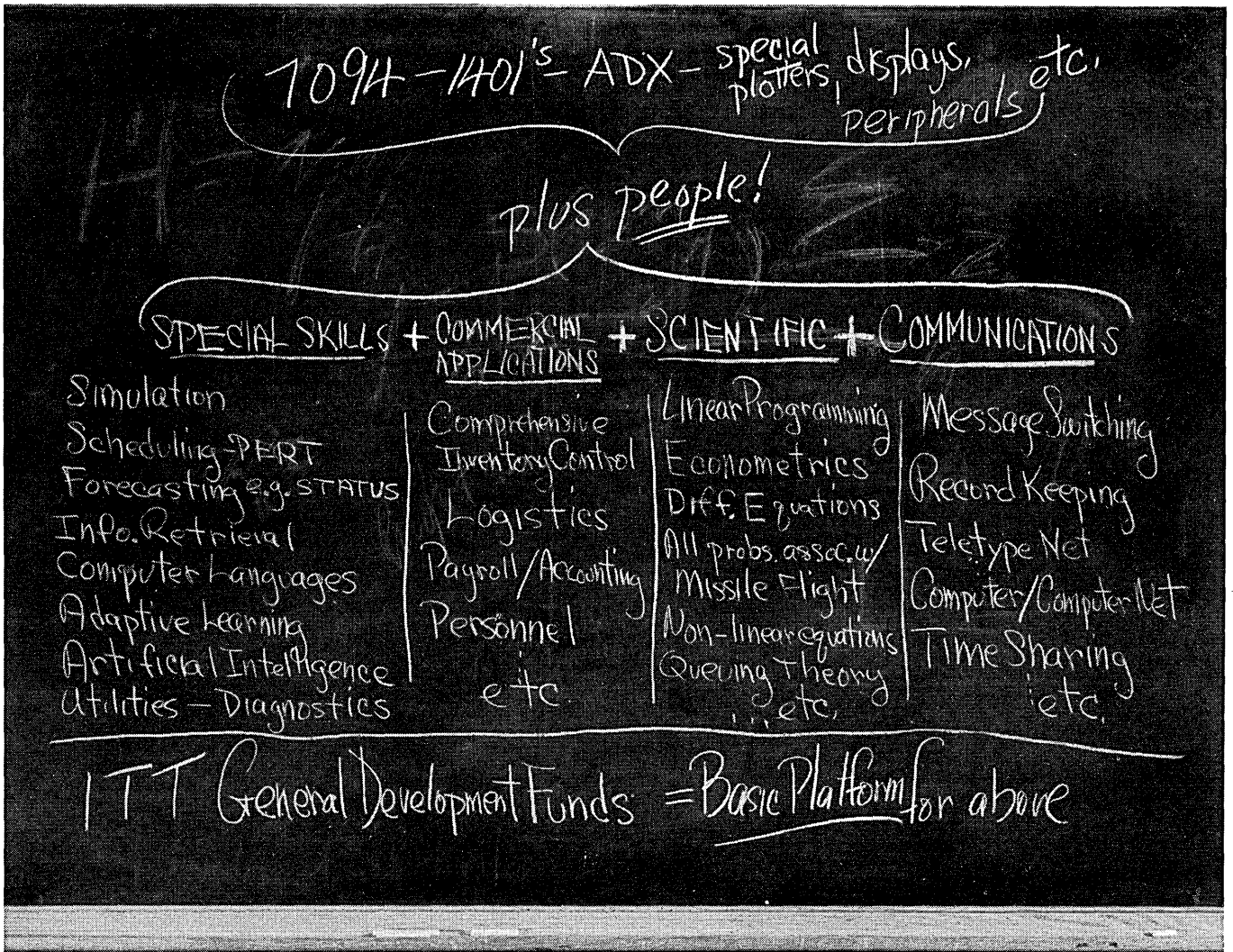
Why try to visualize the significance of masses of digital data—or plot it laboriously by hand? The new EAI DATAPLOTTER® Series 3110/3120/3130 automatically plots digital information on-line from almost any digital computer or from punched cards or punched tape. It will plot lines, points or symbols with extreme accuracy at speeds up to 120 points per minute on charts up to 10" x 15". YOU CAN RENT IT FOR \$3.50 AN HOUR.

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CIRCLE 15 ON READER CARD



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This is a functional way of looking at one of the largest concentrations of systems hardware and software specialists in the nation. You can see why we don't only pursue monumental military programs like 465-L and NTDS. Some of our most interesting company-funded projects are small ... but not their potential. Our approach to modern information systems design is at once theoretical, analytical and empirical. To our long and growing list of customers, we sell a "marriage" of software skills, applications know-how, communications orientation, and hardware virtuosity. This mix seems to be pretty appealing to high level contributors in our field as well. Maybe you?

Write Mr. E. A. Smith, Manager of Employment, Div. 35-MA, ITT Data and Information Systems Division, Rt. 17 & Garden State Parkway, Paramus, New Jersey. (An Equal Opportunity Employer)



DATA AND INFORMATION SYSTEMS DIVISION

CIRCLE 91 ON READER CARD

When it comes to computers twice as fast as a 7090 at 25% the cost... SDS wrote the book.

SDS 9300 The SDS 9300 is a general-purpose digital computer comparable in speed and other features with large-scale scientific and systems computers. In price, however, the 9300 is comparable to medium-scale computers - basic system prices start at approximately \$250,000. The 9300 thus represents a significant reduction in the cost-per-answer of computing equipment.

The SDS 9300 is the third computer manufactured by Scientific Data Systems. It is logically and electrically similar to the other SDS computers - the SDS 910 and the SDS 920 - and incorporates the same high degree of reliability and flexibility.

The SDS 9300 has the following characteristics:

- 24-bit word plus a parity bit
- 48-bit word for floating point arithmetic
- 3 Index Registers and Indirect Addressing
- Basic memory of 4096 words expandable to 32,768 words, all directly addressable, with:
 - 0.7 μ sec access time
 - 1.75 μ sec cycle time

- Memory non-volatile with power failure
- Execution times, including all accesses and indexing (using overlapped memories):

Fixed Point

1.75 μ sec	Add
3.5 μ sec	Double Precision Add
7.0 μ sec	Multiply
5.25 μ sec	Shift (24 positions)

Floating Point

(39-bit mantissa, 9-bit exponent)

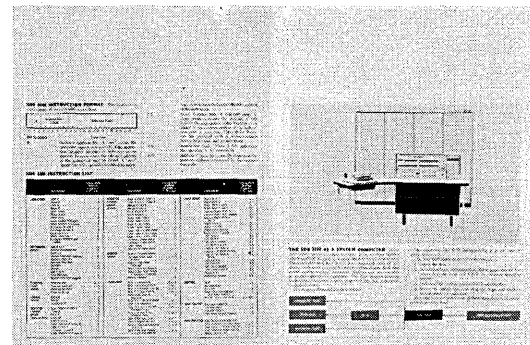
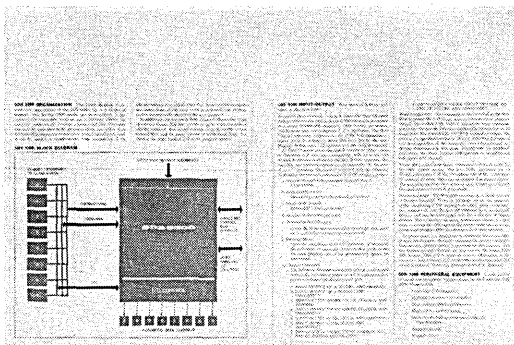
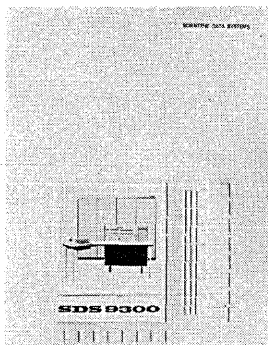
14.0 μ sec	Add
12.25 μ sec	Multiply

- Extensive repertoire of powerful instructions (more than 110)
- Byte operations which permit manipulation of 3, 6, 9, 12, 15, 18, or 21-bit Bytes. Two 12-bit Bytes may be multiplied in 3.5 microseconds
- 6-bit Flag Register with set/reset/test instructions which provides fast, easy-to-use program switches for logical decision making. Each position may be set or reset under program control and the status used to control program flow
- 11 high-speed search operations operate at 1.75 microseconds per item
- Multi-level indexing and indirect addressing

- Index Registers which contain and operate with a base value and an increment or decrement
- REPEAT instruction which operates with variable size incrementing or decrementing; when used with Input/Output, permits Gather-Read and Scatter-Write
- Extensive shift and inter-register instructions for data manipulation
- Flexible and easily programmed subroutine execution
- Up to 8 Automatic Data Channels each capable of fully buffered operation at one word every 1.75 microseconds simultaneously with full speed computation
- Automatic Data Channels which operate upon either words or characters. The number of characters per word is under program control
- Addressing of I/O operations can be both indexed and indirect to facilitate Gather and Scatter operations
- Parity checking of Memory and I/O operations
- Searching of magnetic tape, discs, etc., can be accomplished independently of the memory and requires no computer time
- A Parallel Word I/O system in addition to the Automatic Data Channels to facilitate operation upon certain types of asynchronous information under program control
- SDS 910 available as a satellite I/O Processor
- Up to 32,000 output control signals and input test signals
- A complete priority interrupt system with up to 1024 priority levels. These can be individually enabled and disabled under program control
- Automatic program loading from cards, paper tape, magnetic tape, drums or discs
- Complete display of all programmable registers with extensive manual controls
- Six Sense Switches, two Manual Interrupt Switches and a Selective Halt provide complete capability for console control during execution
- FORTRAN, Symbolic Assembler, and a Monitor System as part of a complete software package
- No air conditioning required for computer proper - operating temperature range 10°C to 40°C
- Small size and simple installation - over-all dimensions, including expanded memory, approximately 6 x 8 x 2 feet plus an operator's console
- Low power requirements: 4 KVA
- All silicon semi-conductors for high reliability; small component count yields long Mean Time Between Failures

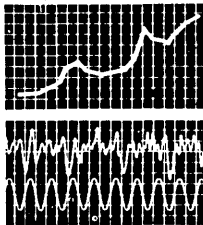
Here's page three.

You'll have to write for the rest.



SDS 9300
SCIENTIFIC DATA SYSTEMS 1649 Seventeenth St., Santa Monica, Calif.

CIRCLE 17 ON READER CARD



BUSINESS & SCIENCE

FOR DSI: A NEW MARKET, GROWING PAINS

Tiny, infant Data Systems, Inc., Detroit-area computer manufacturer, has been so successful with its small DSI 1000 that for awhile it called a moratorium on orders. Right now, with a \$300K backlog, the company is accepting "key" orders for March delivery. Some gear has already been delivered to NASA, work progresses on orders for Union Carbide (automatic battery inspection) and Dow Chemical (message switching). Still incomplete for the 1000, which features a 2048-word glass memory with a 100 usec average access time and a 1.6 usec cycle time in the minimum latency mode, is a macro-assembler.

The firm feels it is working in a new market area in which the computer loses its identity as a separate device, becomes instead a system component. Application targets include photocomposition, antenna pointing and message switching. Still privately held, DSI has no immediate plans for going public, hopes its growth will be "more controlled" than that of Scientific Data Systems, faster than that of Digital Equipment Corp.

UNIVAC STRIKES BACK

Univac's second-best complex hasn't been evident lately in Washington, where it's secured a succession of large government orders. Crowed one Univac executive: "In the last six months of '63 we outpaced IBM in government sales." Univac's success has not created any apparent discomfort at Number One, which may not object just now to a dash of competition.

In addition to the recent \$37-million AF order for 152 modified 1050's Univac has also received a 5.5-megabuck order for three 1107's and six 1050's from the Air Force Logistics Command, which will be tied in with AUTODIN, DOD's big telecommunications system (soon to be updated). Other orders: two 1218's and a 1004 subsystem from the FAA for ARTS (Advanced Radar Traffic Control System) which will provide 3-D control over aircraft... 11 more 1218's for NASA, to be installed at tracking stations for manned space flights... four 409's for Navy Bureau of Supplies & Accounts... three Univac III's for the Marines for inventory accounting.

AEROSPACE UPS EFFICIENCY WITH IBM PRODUCT PREVIEW

Aerospace, El Segundo, has decided to scrap a twin 7090 lashup for a 7040/94 system which they expect to be nearly twice as fast as a single 90; by also replacing several 1401's with printers on-line to

New, Low-Cost Communication Printer System

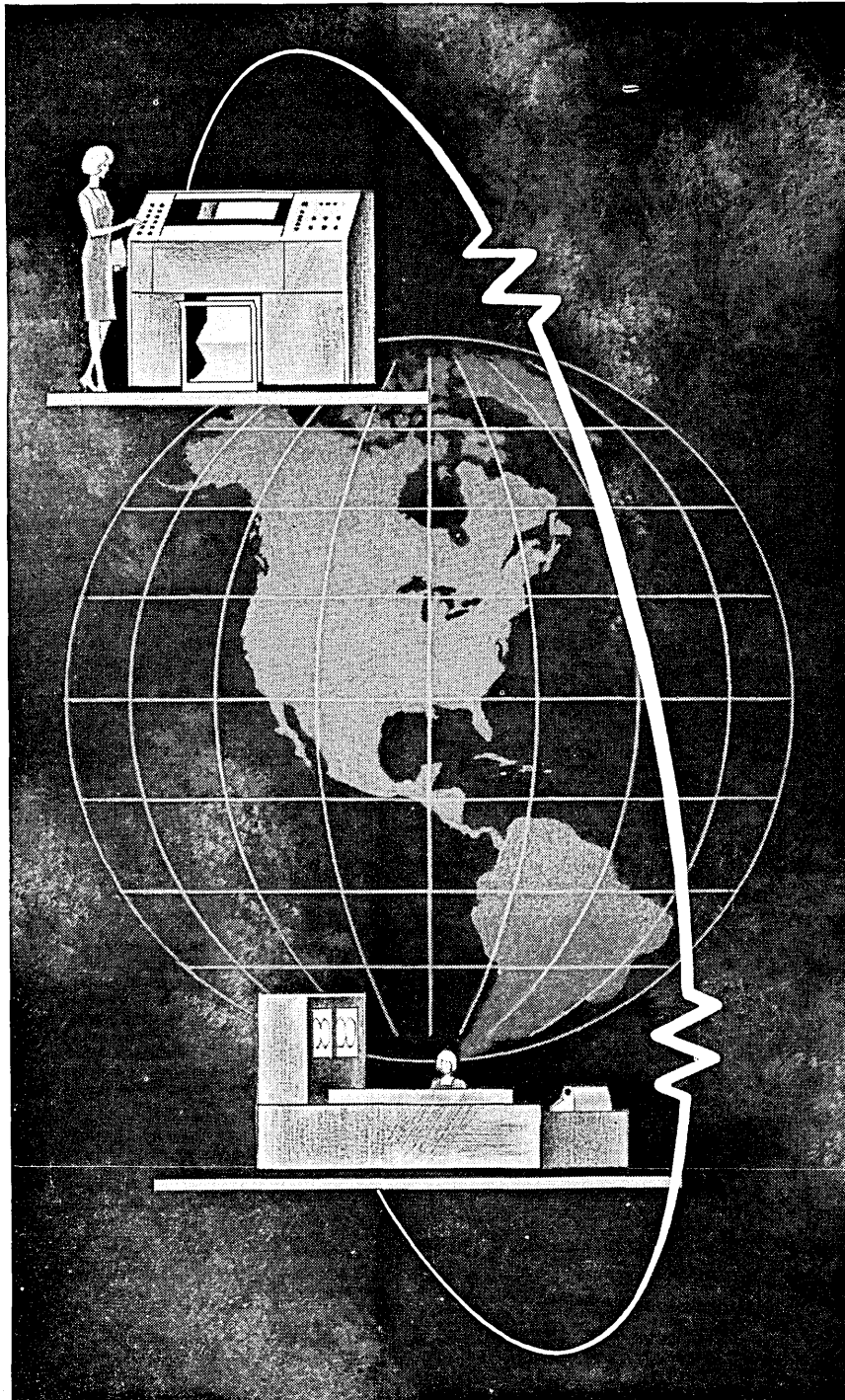
Full printer capability at low cost is now available for printing computer data transmitted to distant satellite installations with the introduction of the Anelex Series 5 Communication Printer Systems. These new Printer Systems have been engineered to take full advantage of the economical Anelex "building-block" concept which makes possible hundreds of printer configurations by simply arranging various combinations of standard modules and logic designs. As a result, designers and end users of data communication networks can specify the exact equipment they require, from a simple, slow speed data recording system to a complex 2-way system and off-line processing unit.

Write for further information.



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CIRCLE 18 ON READER CARD

NA
TI
CO
AD
CI

PRC

1	1
10	1
19	2
28	2
37	3
46	3
55	4
64	4
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NA
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PRC

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64	4
73	5

the 7040, twin-90 system cost will be slashed by approximately 50%. Several instructions in the 40 allow it to talk directly to the 94's memory; information is transmitted between the two machines at 62.5K words/sec. over a direct couple connection. Says an Aerospace spokesman, "It looks as if we'll be able to pick up 10-15% efficiency without any trouble...and without reprogramming." The company's San Bernardino division will install the 7040/94 too, the same as the recently announced IBM direct couple system, which is also going into NASA/Houston.

SOFTWARE SLOW-DOWN
AT GENERAL KINETICS

General Kinetics, Inc., Arlington, Va. computer services company, has wiped out its Computer Application dept. in what is termed "a partial deemphasis" of software development. The company will reportedly focus efforts on proprietary programs, not bid contract work. But vp Al Roberts -- once called the world's greatest programmer by von Neumann--says he'll stick with GKI.

COBOL ADDITIONS EMERGE
FROM CODASYL MEETING

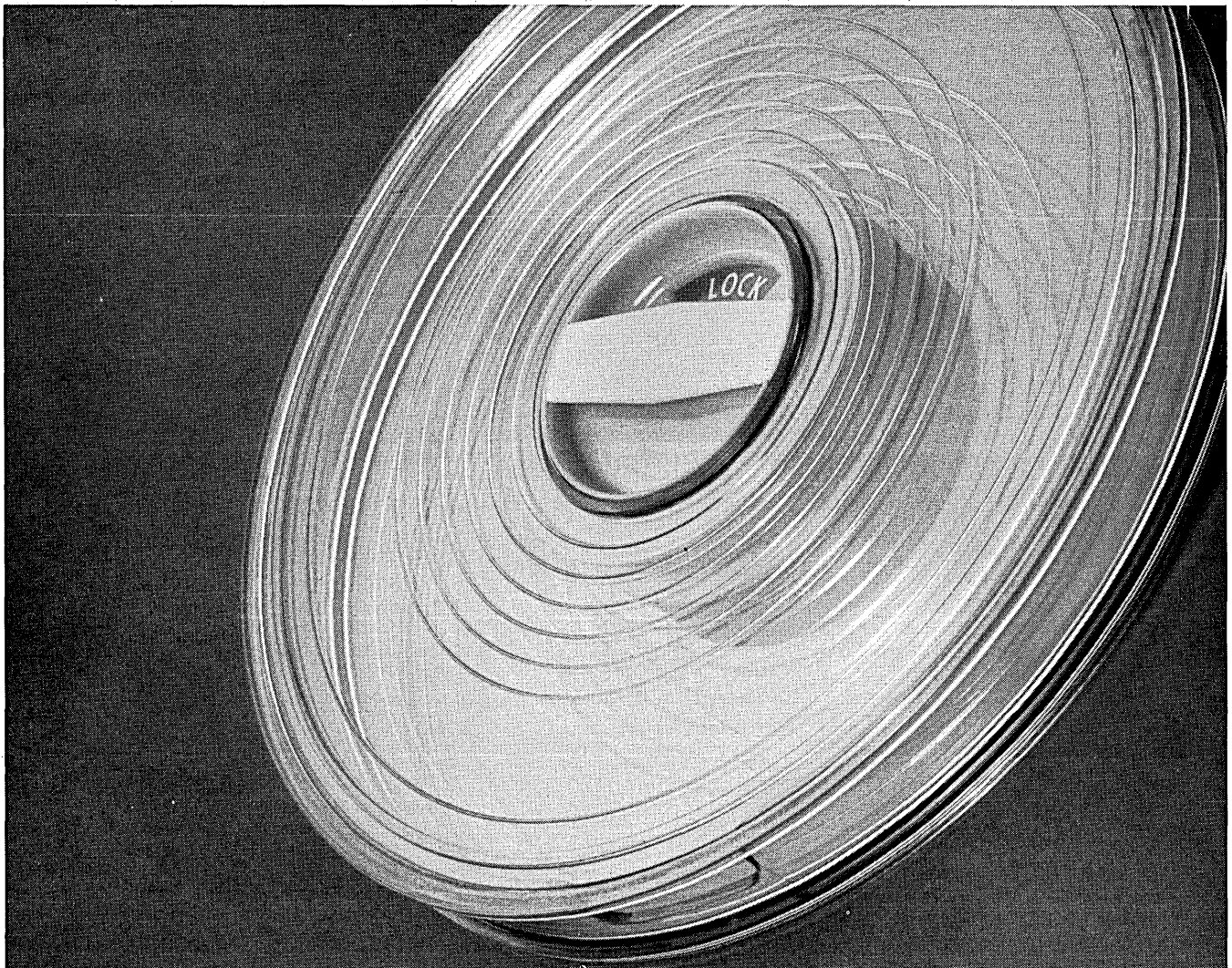
At the most recent CODASYL meeting, mass storage and table handling proposals were passed. The committee will probably now be able to turn its attention to definition of a COBOL subset, primarily of interest to makers and users of smaller machines. The COBOL maintenance committee may be reorganized, re-named the Improvement Committee.

THE COBOL HUNTERS

On the prowl for COBOL compilers with all the bells and whistles are RCA and General Precision. GP wants one for the Air Force's 473-L system; finalists are said to be Computer Sciences and an Informatics/Programmatics team. The latter helped design the software specs. But the company, evidently learning how expensive COBOL can be, may pull it inside. It appears that the RCA 3301 COBOL bid will go to another team: Applied Data Research and National Computer Analysts.

RUMORS AND
RAW RANDOM DATA

Significance of the recent acquisition of Scientific Research Assoc. by IBM: it gives the computer firm a publishing outlet, entree into the "largest peacetime industry" -- education ... Bids for the LA Sheriff's real-time system ranged from \$14-15-million (4-5 megabucks more than the county's hopes) to \$23-million... RCA doubled its orders for the 601 recently when NJ Bell ordered 3 megabucks worth of three 601's and 12 satellite 301's to go with its current complex (one 601, four 301's)... Two ALGOL compilers have been implemented for the USSR's M-20, described in the Nov. Datamation ... Rumors are that SRI will get the contract for the first two phases of the DCA's command & control language development program (see Nov. Datamation, p. 61) ... Beginning this month, a new dept.: Washington Report. You'll find it on p. 70.



TAPE PROTECTION!

A universal problem: "DPC" has the answer

DPC (Data Packaging Corp.) cases will safeguard your tape from contamination by dust and moisture better than any case now obtainable. For the first time, protection is available which will insure accurate retrieval of valuable information without fear of dropouts due to wear particles from the cam-lock.

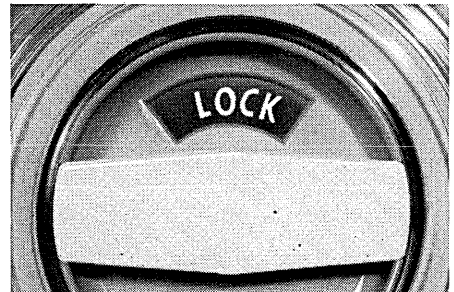
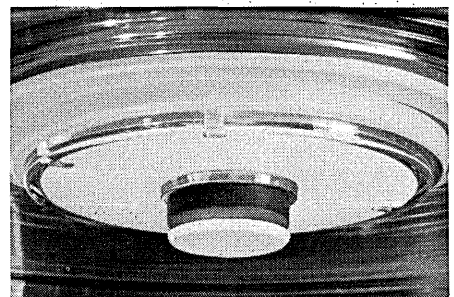
The completely enclosed locking-cam, exclusive patented* feature, prevents tape contamination caused by cam-wear-particles when opening and closing the case during normal usage.

Another safeguard: instantly visible "open" and "lock" indicators increase

the protection of stored information which may be lost when a reel falls from a half-closed case. As an added precaution, you'll hear a distinctly audible "click" when you turn the lock handle to either position.

These safeguards were designed with the user in mind. Tape contamination means computer-downtime and dollars to you. DPC assures you of retaining more data per dollar, at no price premium whatever.

Sold exclusively through magnetic tape suppliers. Contact your tape supplier today for Positive Profit Protection.



*All products manufactured for DPC by Morningstar Corp., 205 Broadway, Cambridge, Mass.
Case patent: U.S. Pat. 3,074,546; Des. 196,987. Other patents pending.

DATA PACKAGING CORP.
205 Broadway, Cambridge, Mass.

FORTRAN II

ASIST

CPM

PERT

AMP

ASI-1000

DIAGNOSTIC ROUTINES

MATHEMATICAL
SUBROUTINES

UTILITY
SUBROUTINES

ASI

21000

The Best is Stripped for you from ASI

ASI's outstanding new 21000 computers are delivered with complete user-tested software. Software for the 21000 differs greatly from programming systems thoroughly proved out on earlier ASI computers in that way 21000 programming aids have been tested, used, and corrected checked out on actual programs under field conditions. There are no ifs, ands, or buts left. You can write your program from the book and know it will run on the 21000.

FORTRAN II. Unlike earlier FORTRAN II compilers, ASI's complete FORTRAN II compiler includes sub-routine and function statements, arithmetic function statements, as well as Fortran algebraic statements. Statements will handle all peripheral equipment. An additional FORTRAN feature is that of "program chaining" which allows programs whose size exceeds available memory to be run in segments.

ASIST. A S I Symbolic Translator is an assembler program that allows the use of standard macro coding of such functions as floating point routines and input/output routines. Special features of ASIST include pseudo codes such as ENTRY, COMMON, and LINK which permit flexible linkage, data sharing among sub-routines, and program overlay. ASIST provides for the acceptance of source program from cards, paper tape and magnetic tape. Naturally, such assembler directing codes as RES, OCT, DEC, EQU, ORG, etc., are provided.

GRM and PERT. Special planning and scheduling procedures are available for real-time management con-

trol through the use of the Critical Path Method and the Program Evaluation Review Technique. These procedures provide management with project planning information, scheduling, costs and other associated intelligence.

ASIT. ASI Monitor Program allows for the unattended control of program operation. It provides a load/store operation without operator intervention. The operator can specify loading and execution of any program on the master system tape by a simple online typewriter directive.

ASIBOOL. This special interpretive routine allows programs written in binary, UNIBOOL for the 0-15 to be operated by the 21000. A converter program automatically converts binary 0-15 program tapes, including data, to binary paper tapes that can be run on ASI 10000. Therefore, no manual rekeying is required.

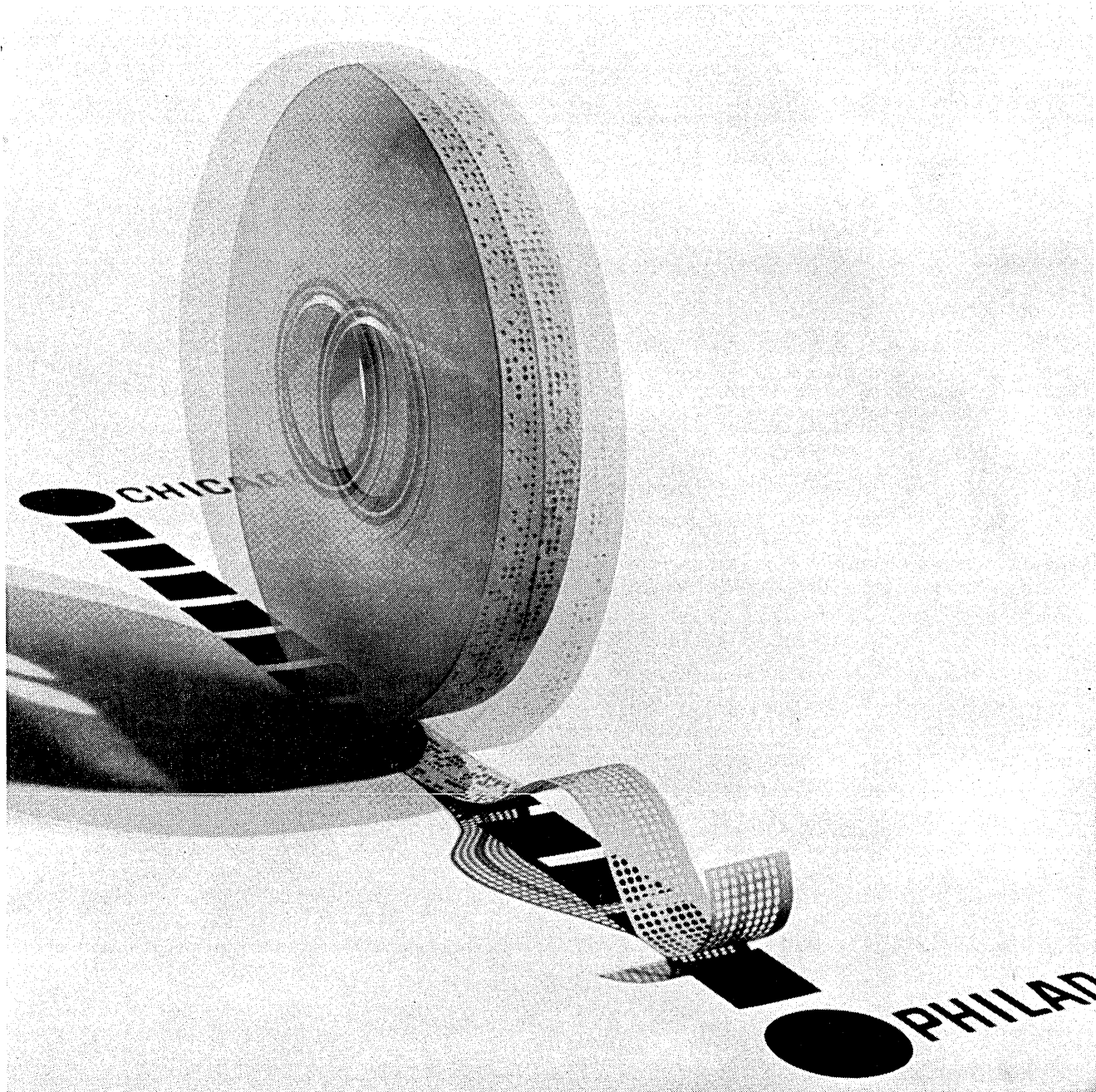
MATHEMATICAL SUBROUTINES. ASI provides a complete set of mathematical subroutines including SINE, COSINE, SQ. ROOT, EXPONENT, LOG, etc.

UTILITY SUBROUTINES. A number of routines allow tape reproduction, conversion of cards to tape and tape to cards, memory dump, paper tape updating, etc., are also available.

DIAGNOSTIC ROUTINES. Diagnostic routines covering both program and hardware checking are available.

We'd like to tell you more about ASI's outstanding new 21000 and its use-tested software. For software manual please write to:

ASI



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FROM PHILADELPHIA TO
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This is what DATA-PHONE service has done for business communications.

It gives computers an electronic "voice" that travels via regular telephone lines, at regular telephone rates.

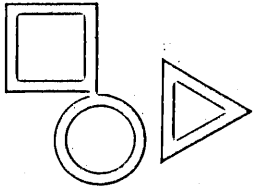
At speeds up to 2500 words per minute, DATA-PHONE service can send anything that can be punched on cards or tape—orders, technical data, waybills, inventories.

Talk with our Communications Consultant about it. Just call your Bell Telephone Business Office—and they'll gladly have him contact you.



BELL TELEPHONE SYSTEM
Serving you

CIRCLE 21 ON READER CARD



EDITOR'S READOUT

LOOKING AHEAD

Viewed from different distances and levels as omniscient, omnipotent, nearsighted, or nincompoop, an editor is perhaps more accurately defined as somebody who knows less about more things than the individuals who are doing the work he tries to report. And if the atmosphere at the legendary heights from which the editor observes the brawl below him is rare, so is the opportunity for a clear view. Rarer still are insights.

In an attempt to evade the awesome responsibility of overseeing the entire field, *Datamation* again this year turns to a bevy of experts to gird up their loins, muster their foresight, and saunter or charge into the valley of the unknown. Their charter was a dual one: to define the roles of their individual specialties, as well as to underline key trends.

Intelligent men all, this year's crop of crystal ball gazers knows that a trend is a collection of individual points moving steadily and clearly in one direction. They also know that trends, like empires, are not founded in a single year. Thus you will find in this year's look-ahead issue few dramatic or startling predictions, few wobbly branches on which to start sawing. Rather you will find a collection of fairly sober and reasoned descriptions of particular real worlds, with some hints of things to come.

Bolder, brasher predictions will be found in *Datamation's* look (p. 37) at what the next year holds for hardware (main frame and peripheral), software, standards, societies, and plain old people.

Combined, the articles are intended to represent in action the continuing editorial policy of *Datamation*: clear, sound interpretive reporting of the complete spectrum of information handling activities, performed as accurately, honestly and fairly as we know how. To this goal we dedicate ourselves anew as 1964 begins.

A MANUFACTURER SPEAKS

by W. R. LONERGAN



When the computer field is viewed from a broad perspective, it can readily be seen that the major problem area today does not concern the adequacy of the product itself . . . either the hardware or the software. Rather, it concerns the effectiveness of the utilization of the product. This is well attested by the findings of several recent computer installation surveys, such as the McKinsey study, the objective of which was to assess the economic success of those installations. This survey found that a substantial portion of the companies sampled had not realized savings from the installation of a computer.

Some of the factors which lead to this state of affairs can rightly be attributed to the computer manufacturers. Certain of them have tended to sell more hardware than the legitimate needs of the account could justify. The intense competition in the field should rectify this situation.

As with any other tool, however, the fundamental responsibility for effective utilization of computing equipment lies with the user. The manufacturer provides a hardware system with great productive capacity and a comprehensive software system to facilitate the use of this hardware. The efficient use of this total system is the responsibility of the user.

The management of too many companies has been more concerned that the available computer hours are rapidly filled, and not sufficiently concerned with examining the intended applications to determine if they even belong on a computer. All too often applications have been lifted intact from punch card equipment and placed on a computer. All too often, poor systems work has resulted in an enormous waste of computing hours.

Delineation of the computer utilization problem invites attention to another trouble spot — namely, the extreme shortage of good systems people. The most unfortunate aspect of this problem is that the demand for such people is constantly increasing and yet almost nothing effective is being done to generate and produce them.

A good systems man must have competence in a number of disciplines. The advent of on-line, communications-oriented systems has added further disciplines to the list. Paradoxically, the schools are turning out people who tend more and more to be specialists within a single discipline. The total explosion in knowledge almost forces this approach on the schools, but it means that good systems people will still have to be grown in the field, the hard way.

Perhaps the major technical problem in the field today is the need to find some way to enable users to preserve their substantial investment in operating programs when they replace old equipment with new equipment. The problem must be faced whether the new equipment is supplied by the same manufacturer or by a different manufacturer. There is no easy or magic solution to this

problem, but it is being attacked on several fronts, and there is good reason to think that it will be less of a problem in the years to come. The availability of special hardware can facilitate some of the translations involved; however, the major contributions toward solutions to this problem can be expected from new developments in the software area.

Progress in the software area has already been made. Special translators have been developed which largely mechanize the conversion of FORTRAN Assembly Language Programs to other Assembly Language Programs. In addition FORTRAN II programs can be "lifted" or "sifted" to produce FORTRAN IV programs. However, if the programs are being converted to a new computer, a certain amount of hand polishing of the converted programs must normally be done, after the conversion, to realize efficient programs on the new computer.

There are several things which the user can do to ease his equipment conversion problems: First, there are the higher level languages such as FORTRAN, COBOL, APT III, etc. The use of these languages can substantially minimize the conversion problem. However, the user must recognize that although these languages are relatively machine independent, the programmer must take into consideration the characteristics of the specific computer for which he is programming if he wishes to produce efficient object programs. Thus when moving a higher level language program from one computer to another, a certain amount of reprogramming must be done if program efficiency is of importance. Second, there is the adoption and rigorous enforcement of programming and documentation standards. Such practices can make it a relatively easy matter to go back to the flowchart level and recode for a new computer. Finally, the user should recognize that substantial benefits can often accrue from an entire



Mr. Lonergan is director of Product Planning and Systems Programming for the Univac Div., Sperry Rand Corp. In his 10-plus years in the computer field he has been a logical designer, applications engineer, and sales representative, as well as directing product planning, home office and field marketing activities. He holds bachelor's and master's degrees from the Univ. of Pennsylvania.

reprogramming of an old application. Toward such a decision a number of factors must be considered. For example, the application itself may have changed over the years, or the hardware configuration of the new computer may admit of an entire new approach to mechanizing the application.

This year the trend toward on-line, communications-oriented systems will continue. Communications-oriented software systems will be developed to accompany these newer hardware configurations. The availability of such systems will have a pronounced impact upon American industry. They will make it practical, for the first time, for a centralized corporate headquarters to have really effective control over a widely decentralized organization.

A USER SPEAKS

Asked to speak out on whatever currently interested and/or plagued him, the author of this piece chose anonymity as a means of ensuring candor. He is, however, a real user . . . top edp man at a large national user of computer systems. Is anybody listening?



Magnetic tape computer systems have been in general business use for the last nine years. Those who are using reels upon reels of magnetic tape should take an objective look at their operation. Granted that they are more efficient than in the past . . . but their greatest efficiency can also be their greatest weakness . . . the availability of a record from magnetic tape. This can be related to inventory management, accounts receivable, accounts payable or segments of a management report. A record printout or punchout every time a record changes has been the answer, and reference is then made to this hard copy medium to answer inquiries.

Disc files have been a partial solution. However, because a large file was expensive the discs were generally used to store short, incomplete records with the complete record retained and updated on magnetic tape. An operating system consisting of 500,000 customers records with a 1,000-character record for each account requires a minimum of 500-million characters of storage. Discs will store this many characters, but the economics is highly questionable!

How about the application of mass storage to computerized reporting systems often referred to as management information systems? This is the control level, where volumes of statistics and resulting reports are spewed out for management to ponder over. Much has been written about management by exception which preaches the doctrine of showing management the figures applicable to a situation, which in turn is an exception to somebody's rule.

One danger of management by exception is the possible dependency on individuals not equipped to make good

Hence, we can anticipate a trend toward recentralization of management.

Finally, the extensive research work underway in the area of integrated man-machine problem-solving systems must be noted. The fundamental concept is to provide a closer and more effective coupling between the man with the problem and the problem-solving device. Less design emphasis is placed on the computer as a free-standing problem-solving machine, and more emphasis on providing an effective man-machine problem-solving system. Such systems can greatly shorten the total elapsed time to solve problems and can hopefully attack entirely new classes of problems. These new systems will require new types of executive routines and new types of compilers. ■

initial decisions — decisions relative to the boundaries of a given variable and its interaction on, or relation to, other variables. Further, management refers to and makes use of variables in the form of figures that are not exceptions.

Competition, economies and future company plans can make it difficult to foresee this interaction between different business variables and establish boundaries within which everything is normal. In many instances one must be aware of fluctuations in one area and its effect on other areas not considered as exceptions. Therefore it seems that management should be able to select the information necessary to make a decision and not have to rely on a program with built-in degrees of stupidity.

manufacturers

Our first computers were delivered with consoles filled with blinking, pulsating lights. Now a computer system is considered overdressed if it has much more than an "on-off" switch. A deeper appreciation of the users' needs should be invaluable in the human engineering of a computer system. Perhaps the manufacturers should release their staff engineers long enough for them to spend a few weeks in a user's computer facility with operating personnel. It is possible that design changes would be forthcoming rather quickly relative to console efficiencies, etc. "Flaps down" computer operation or operating with the maintenance panel open is not uncommon.

This is not to imply that a console should be used for debugging, merely that an operator can possibly eliminate costly re-runs if he is provided with the ability to rapidly call out and view data sorted internally, on discs or on tape, without holding up processing.

The current crop of computers with multi-programming capabilities have contributed materially to processing efficiencies. More skill is required to realize these efficiencies in the design of software logic and in its ultimate use. An awareness of the logic within the software offered by the manufacturer is important if full effectiveness is desired. Because of the fact that the manufacturer must design routines to cover the broad industrial market, greater

continuing computer "horsepower" race will possibly make the approach more desirable.

education

In order to keep abreast of developments in electronic office tools, an individual must be well versed in the application of manual systems and mechanized systems. He must be knowledgeable in scientific management and diplomacy. The latter requirement provides him with the patience to listen to knowledgeable outsiders who wrote an article but never applied the theory discussed in the article.

An awareness of complex business systems is a must. An awareness of forecasting, trends, etc., is important. Such an awareness is skirting the edge of Operations Research, the domain that, for some strange reason, some

people feel is sacred to management engineering firms, universities and academic geniuses.

How does one acquire this ability? How and by whom is one taught the philosophy of systems, or the curiosity or desire to improve systems? At the moment we are not aware of any university or college curriculum providing a systems education. Some training in this direction is supplied by office equipment manufacturers, but how objective can a corporation's systems man be after attending one of their courses or seminars?

When considering the application of computers to business problems, teaching computer programming at the high school or college level *without* education in the philosophy of systems may be a waste of time. The real appreciation of a tool such as this is the ability to know how and where it should be applied, under what conditions. ■

FEDERAL EDP

by EDWARD J. MAHONEY



Federal agencies are planning to install approximately 300 to 350 additional computers during calendar 1964. This will bring the government's in-house computer inventory up to about 1,700 by that time. At this rate of growth, the 2,000 mark will be reached by the end of calendar 1965. Costs associated with the use of this equipment during fiscal year 1964 are estimated to be over \$700 million annually. All of these totals are exclusive of equipment used in military operational and certain classified activities of the Department of Defense.

Because of the tremendous increase in the use of this equipment by federal agencies and the impact of the new technology on government operations generally, top-level federal management attention is being focused on such questions as government organization for electronic data processing (EDP), lease versus purchase, effect on employment security, standardization of systems and equipment, and on a wide variety of other EDP management aspects.

As an outgrowth of this activity and on recommendation of a congressional committee, the President has directed the Bureau of the Budget to make a government-wide study of federal EDP policies and practices for the purpose of recommending guidelines for future government policy on EDP. This study group, being activated as of this writing, is expected to complete its work in time to submit a report to the President and to the Congress by June 30, 1964.

purchase versus lease of EDP equipment

Much of the activity of the past year in both the Congress and the executive branch stemmed from a report on the subject of lease versus purchase of EDP equipment. On March 6, 1963, the Comptroller General of the U.S. issued a report to the Congress on "Financial Advantages of Purchasing over Leasing of Electronic Data Processing Equipment in the Federal Government." This

report touched off several congressional and executive branch actions, the eventual impact of which will undoubtedly be felt throughout all EDP activities of the government as well as by government contractors and the manufacturing industry itself.

The report recommended a drastic change in the government's approach to the acquisition and utilization of EDP equipment. It contained a recommendation to the President that he establish, at the White House level, an organization to provide policy guidance and direction for the procurement and utilization of EDP equipment by the federal government. The report pointed out that unnecessary costs of hundreds of millions of dollars would result in the years ahead if existing individual agency procurement and utilization practices currently being followed are allowed to remain in effect.

This recommendation will undoubtedly be carefully considered by the study group now being organized by the



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Bureau of the Budget.

Also, as a direct result of the Comptroller General's report, the House has passed and sent to the Senate a bill (H.R. 5171), introduced by Congressman Jack Brooks, which will authorize the administrator of the General Services Administration to coordinate and otherwise provide for the economic and efficient purchase, lease, maintenance, operation, and utilization of EDP equipment by federal departments and agencies. This bill is now pending in the Senate, as is a companion bill (S. 1577) which has been introduced in the Senate by Senator Paul H. Douglas.

automatic interchange of data

Because of the many interrelationships that exist in federal government programs, opportunities abound for automatic transfer of data between systems and subsystems. Also, government-industry and government-state relationships are such that direct automatic transfer of data between related systems is feasible and desirable. However, in a broad sense, the tremendous potential for improvement of government operations through this means has been virtually untapped to date.

The Veterans Administration, the Department of Health, Education, and Welfare, and other agencies have successfully worked with the Treasury Department on major projects utilizing the outputs of agency systems as inputs to Treasury systems. Also, the Department of Defense and other federal agencies have worked out arrangements with government contractors and industry to accept magnetic tape records for use in government automated systems. Despite these efforts, only limited progress has been made so far. In the period ahead, we can look for more active programs in this area to strengthen government efforts all along the line where opportunities exist for transfer of data by automatic means.

GOVERNMENT RESEARCH

by Dr. JAMES A. WARD



Everyone knows that the government played a very important role in the early days of digital computers. The first electronic digital computer was the SEAC, completed in May 1950 for the Department of Commerce. It was soon followed by WHIRLWIND II. In 1951 the SWAC and UNIVAC I were made for the Department of Commerce and the EDVAC for the Department of Defense (DOD), and so on. Except for UNIVAC I, these were one-of-a-kind and would now be classified as engineering prototypes for experimental purposes.

Everyone also knows that the government is the largest single user of digital computers. The official Bureau of the Budget report states that, as of June 30, 1963, there were 1,248 digital computers in the government. This was about nine per cent of all computers in the country. Hence, through purchase and rental, the government has contributed a very large sum of money to the computer industry. The recent government trend to purchase rather than rent will have a great impact on many computer manufacturers.

agency programs

Increased emphasis is being placed on purchasing equipment by a number of agencies, including the Department of Defense. As of this writing, the DOD has identified equipment valued at \$225 million which is being considered for purchase.

Efforts toward standardization of procedures and equipment are evident, particularly in the Department of Defense.

Optical scanning is being seriously considered by the Post Office Department.

Some agencies are strengthening their central management organization and placing more stress on improving the management and administration of their EDP facilities.

We can look for increased top-level attention to all of these matters primarily because of the rising costs in almost all agencies for data processing functions and because of the congressional scrutiny which accompanies these increased costs.

increased interest on the part of the Congress

Throughout various appropriation hearings and in special hearings held this past year on the use of electronic equipment, it was evident that congressional committees are seriously concerned about such matters as costs versus value of EDP systems, the impact of these systems on agency activities, and costs associated with rent versus buy decisions.

In the second session of the 88th Congress, starting in January 1964, we can look for a further intensification of congressional interest in this subject with regard to almost all aspects of EDP development in government, not only because of the tremendous costs involved but also because of the many problems that remain to be solved in arriving at efficient management in this field. ■

The government is not only the largest user of computers but also has the widest variety of uses: account-



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ing, inventory, management, scientific, engineering, command and control, communications, and weapons systems. Military computers in the last category are not included in the Bureau of the Budget inventory. Digital computers are in missiles, planes, ships, and trucks.

In order to get computers to perform the ever increasing military requirements, the government is spending millions of dollars annually on digital computer research. As better techniques for military purposes are produced, these devices become generally available and go to improve commercial computers. In the space allocated it is possible to mention only two or three illustrations.

One of the research topics that is receiving a great deal of attention is that of associative memories. Many papers presented at meetings are devoted to this topic—papers on hardware design and utilization. Almost everyone who has looked into the problem seems convinced of their usefulness.

The DOD has contracted for the development and construction of two different models. Each, to be delivered in 1964, will operate as an ancillary device to a general purpose computer. Tests will be made to determine whether they can fulfill the need of a particular shipborne computer system.

Should the associative memories prove as flexible and useful as expected, they will greatly influence the design of hardware and software. This device will be very useful for such civilian applications as reservation systems, document retrieval, inventory systems, automobile registration, and even to speed up compilers. A built-in associative memory may soon be an optional component just as floating point capability was a few years ago.

Other branches of the government are furthering research in computer fabrication. NASA has a contract for delivery of a computer memory for the Orbiting Astronomical Observatory, a memory which looks like ordinary screen wire. It is made of wire, woven on a loom, and then "treated." The manufacturer claims it is potentially much cheaper to construct than conventional core memories. NASA is looking for additional potential properties: extreme low power (200 milliwatts for 4,000 bits) and good reliability for space operation where there are no maintenance men.

During World War II some military airplanes were equipped with computers for fire control, navigation, automatic pilot, etc. However, these were all analog computers, and each function and device was served by its own separate analog computer. The same was true for the early missiles.

Beginning a few years ago, some of these analog computers began to be replaced by special purpose digital computers. At present, consideration is being given to the use of general purpose digital computers to do almost all the computation (including control of communications) in the vehicle. This has caused considerable effort to develop a class of general purpose digital computers that are to be physically small, light weight, rugged, and use little power. At the same time they are to have large memory, high speed, great input-output capability and, above all, great reliability. It seems that integrated circuits may be just the building block that is sought.

Integrated circuits are extremely tiny, about the size of a setting in a finger ring. These "chips" are being connected with multilayered boards whose wiring is etched on. For memory, such a computer may use very small cores, or a ferrite sheet with holes bored in it, or vacuum-deposited magnetic film, or some such device. As a result, experimental aerospace computers of less than half a cubic foot have been built under DOD contracts. Some of this size have a capability greater than that of the large scale com-

puters of 1958 which weighed several tons. Whereas many commercial computers of 1958 vintage had 20 hours of mean time between failures, these "miniature giants" (miniature size, giant capability) expect to run about 10,000 hours MTBF, and some manufacturers predict 100,000 hours (10 years) MTBF.

Should these aerospace computers even approximate the claims made for them, they will have a terrific impact on the commercial field. It will be a revolution similar to that of going from vacuum tube to transistor computers. Who will want a computer twice the size of a large refrigerator if he can get one to fit into a drawer of the console? (Smaller tape units are also being made to work with them.) One would want it even more if it will need maintenance only once a year.

The vacuum tube computers were hand-wired devices with hundreds of thousands of hand-soldered connections. Current transistorized, commercial computers have far less hand work. The proposed aerospace computers tend to be made "without human hands." The cost for setting up to build such a machine is very high, but once set up the cost of making additional copies will be very small indeed, perhaps one-third that of present computers.

The DOD is conducting research to determine optimum designs. If an aerospace computer is selected for a particular missile or military plane, there will be several hundred to a thousand computers of that model sold. Since the competition is very keen, many manufacturers will soon be in a position to make "miniature giant" computers for civilian use and at a price that will put them in range for many more users.

The DOD is working on different ways to improve the use of computers. An interesting method is a man-machine (or scientist-computer-display) technique now in an experimental stage. Instead of the usual method of sending a program to the computer and getting back printouts, the scientist at a special console makes his own inputs and gets outputs on a CRT display. He can change parameters through the keyboard or on the display with a light gun. This offers tremendous possibilities for research.

Another technique is to have many consoles (conventional or as described above) for a large high speed computer. Scientists or operators at each of these will use the computer concurrently on a time sharing basis. The idea is that human reactions are so slow that while one scientist is making changes, the computer can do much work on the problems for several other scientists. It is expected that the concurrency of operation will slow down most problems by a very small percentage. This calls for some interesting programming techniques.

As the largest user of computers, the government is also interested in software. The requirement that every government-procured computer have COBOL (or demonstrate it is not useful for that particular machine) has made COBOL available to essentially all commercial users of computers.

Government-sponsored research in syntatics for use in military command and control systems leads us closer to machine language translation and to development of a basis for compilers that are more versatile and more efficient.

We can all look ahead to the day when each scientist will carry his digital computer in his coat pocket and communicate with it in plain English. This will not come about in 1964. But the results of government research will give us in 1964 commercial computers that are physically smaller, logically larger, and operationally more reliable than we have had to date. And we will communicate with them with better compilers. ■

SCIENTIFIC COMPUTING

by KENNETH L. AUSTIN



One must be either brave, foolhardy, or both, to put down in print predictions that have a good chance of becoming pure hogwash a year from now. This is an occupational hazard for all predicators, be they foretelling market trends, women's fashions, the end of the world, or heads or tails. For your own amusement, read the columns summing up trends in the stock market. These writers are fantastically skillful in using the English language to prophesy a trend that indicates the market will advance or decline or remain level, but that, in general, all indications, those computed from the Dow Jones average and those resulting from their personal research, conclusively point to the fact that the investor should buy growth stocks. They have a demanding and unenviable task. Any author who hopes to continue writing had better not be too obvious about what is going to happen. You will find that the rules of the game are followed in this article. An attempt is made to evade all issues and make no positive statement, other than that we can expect history to repeat itself.

- During the coming year, three (3) manufacturers of computing equipment will quietly and painfully go out of the business. Two (2) companies will enter the field—a net loss of one (1) for the year.

- One of those who goes out of business will not be IBM.

- At the end of the year the most popular, most maligned, software system will be FORTRAN. Advocates of ALGOL will put forth convincing, irrefutable arguments that this system should prevail. Their efforts will be futile.

- Seven (7) computer models will be announced.

- The total number of dollars spent for computing equipment will increase by 36.8 per cent.

- The number of computing service organizations will increase by 29.3 per cent.

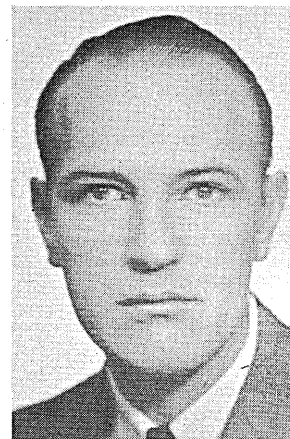
- Three (3) programmers who now work for a major New York bank will be exposed as the cleverest embezzlers of the year.

- Labor will adopt a more positive attitude toward computers. During the year, five (5) strikes will be called

because companies announce plans to install computer-controlled manufacturing equipment.

Are you not confused by the descriptive language used in the scientific computing and data processing field? For example: Scientific Computing and Data Processing. If you look objectively at the problems solved and the machines used to solve them it is difficult to tell which is which without a program. True, there are differences in the terms used to describe the data and in the chrome and accessories, but these are minor. Ultimately you realize that all washrooms used exclusively by executives are executive washrooms. Companies with segregated computing and data processing facilities could make significant cost savings if they were aware of this truism. But, human nature being what it is, don't expect it.

Because scientific and engineering activities are on the increase, the market for computers labeled "SCIENTIFIC" will continue to expand. This market, though smaller, has proved the most profitable, and newcomers are well advised to restrict their sales efforts to this area, at least until they are well established. The management of scientific and engineering groups is more prone to take a chance on a non-brand name and, more important, they



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demand and require less of the profit-killing services expected by data processing organizations.

The graveyard for computer manufacturers is rapidly being filled with the headstones of those who neglected to include programming and applications service costs in the price of their equipment and on their *pro forma* balance sheets. Both the stockholders of a dead company and its former customers suffer. A large portion of the customer's investment in manpower and facilities is lost. In the opinion of some, these losses and the losses due to reprogramming for model changes could be avoided if all manufacturers and customers would agree on a standard programming language. This is not only unlikely, but would prove ultimately unfortunate. Equipment development would be stifled, competition would be limited to the question of price, and near complete monopoly of the industry would be inevitable. The misguided attempt by the industry's largest customer, the government, is a case in point. COBOL is a well intentioned effort to reduce the high cost of programming. It is a shortsighted approach to the problem. COBOL is a language foreign to all machines; thus, each manufacturer who hopes to sell equipment to the government must take extensive and expensive measures to bend and jerry-rig his system to fit. Any savings which may be realized by the government are passed on in spades as negative profits to equipment vendors. The resulting economic pressure has played a significant role in the demise of more than one manufacturer.

Can we expect a more healthy, competitive computer industry in the future? This question can be answered only by the manufacturers and their designers. If it is to be an affirmative answer, they must make a break with tradition, exercise courageous initiative and take imaginative action.

The first step will be to debunk the cult of speed and disrobe its high priests. Barring the repeal of one of the natural laws, the speed of light, this should happen soon. Manufacturers, to compete on other than a cost basis, must design equipment with the user in mind. Computers delivered to date have been specified by, designed for and sold to experts who act as interpreters between the computer and the user. Emblazoned across the faces of machines and experts are the words, "This is too complicated, you wouldn't understand." A large segment of potential users resents the implications of this attitude and, consequently, limit their use to problems that cannot be handled by other means.

How often have you heard, "My problem is too small," "I haven't the time to explain," "I can get the answer by short cut methods," "It's too much trouble and there is too much red tape involved when I take my problem to the computer." Occasionally these excuses are valid but, more often than not, the man with the problem is awed by the mystery and resents sharing the glory for solving his problem with the computer group. He is reluctant to abdicate control. Here lies one of the keys for the development of the next generation of equipment. We must concentrate on system organization rather than speed and size. We must include the user as an integral part of the system.

Here are some suggestions:

- Place the user in direct communication with the computing system. Design multiple input and output stations in graduated capability, even to the point of supplying individuals with personalized communications sets. The majority of these units can be slow in speed, geared to the reaction and comprehension time of the human operator.

- Display results in a meaningful form, generally ana-

logue, for the user. Use video techniques for presenting intermediate results and reference data. Minimize the use of hard copy of all forms.

- Permit the user to talk with the computer in his own language. Mathematics is the basic language for all man-machine communication. Confusion exists because the different professional disciplines have traditionally spoken their private dialects. If the machine is designed to operate with the universal mathematical language, translation of dialect becomes a relatively simple matter. The system should be designed so that each user becomes a programmer and coder without being aware of it.

- Provide the user with the means to exercise his judgment during the course of problem solution.

- Marry the techniques of analogue and digital computing.

- Functionalize equipment. A large part of the time logged on high-speed computers is spent on generalized operations that could be carried out more economically—in parallel—on slower, less expensive equipment. These include: data editing, output preparation, system operation scheduling, system accounting, error monitoring, file maintenance and search, program testing and language translation.

- Modularize equipment. Design communications and switching so that an electronic systems controller assigns and connects modular units to meet momentary requirements.

A recent study of one of the largest scientific and engineering computing installations in the country indicated that approximately 80 per cent of the large-scale computer time was spent on problems that required less than two minutes. It was the opinion of those who made the study that a number of small computers would provide much better and more economical service for the users. But, how would they solve the big problems?

- Build special-purpose systems. Many jobs, especially those requiring a large volume of printed output, can best be performed by systems designed for that purpose.

Hardware and technology required to design systems along the lines suggested above are available today with one exception: a low-cost, reliable, random or semi-random access mass storage. However, RCA, Hughes Aircraft and others now have such devices in development and they should be commercially available during the next year or two.

There are a number of indications that we are already moving in the direction of user and problem orientation of computing systems.

- Small computers attached to large computers to perform editing, control and similar functions.

- Carnegie Institute of Technology is having equipment developed which will permit teachers, students, research personnel and special project workers scattered about the campus to communicate directly with a high-speed computer, on an interrupt basis, via low-speed electric typewriters.

- The Socony-Mobil research laboratory is installing a similar system. Scientists at various locations in the laboratory call out programs permanently stored on magnetic discs to solve their problems.

- A number of companies now offer film and video management display systems for use in conjunction with computers.

In my opinion the golden age of computers will evolve as equipment designers gain a better understanding of and sympathy for the user's requirements and his emotional attitude toward computers. In the final analysis, these are the people who will pay for, control, and justify the future of computers. ■

THE SERVICE BUREAU INDUSTRY

by Dr. BRUCE GILCHRIST



Service bureaus come in almost every shape and size. Some have lots of equipment, some have none; some specialize in particular applications, some will tackle almost anything; some operate nationally, others locally; some have hundreds of employees, some have only one; some are run by equipment manufacturers, some are independent. . . . The contrasts and diversities of the industry are too numerous to list, but the one thing all service bureaus have in common is that they each perform some type of data processing service on a fee basis.

As the data processing needs of business and industry have grown in magnitude and variety, so have the number and scope of service bureaus. An interesting question is whether the service bureau industry has grown at a lesser or greater pace than the total data processing industry. Figures to substantiate either viewpoint are difficult to find but if we confine ourselves to looking ahead, I would like to suggest that 1964 could be a year in which the service bureau growth rate will outpace the industry.

Electronic data processing is no longer novel to American industry and with this acceptance two phenomena are becoming observable. First, the smaller companies are realizing that in order to remain competitive with the bigger companies, they also must find a way of getting the benefits of electronic data processing, even though they cannot afford to install their own computers. Second, in the larger companies themselves, the "cost watchers" are being much more frequently allowed to question the recommendations and decisions of EDP departments. No longer is "we need the latest model" or "we have justified it, but you wouldn't understand the details" sufficient to get a new machine ordered. This increased emphasis on concrete justification is demonstrated by the increasing rate at which articles on the subject are appearing and by the growing interest of Congress in the efficient use of EDP equipment in the federal government. These two phenomena should produce just the right climate for the service bureau industry to shine in and to demonstrate conclusively that owning or leasing equipment is not necessarily the only or the cheapest way of solving data processing problems.

Needless to say, the road ahead for the service bureau industry is not without problems and the key ones will have to be solved if the full potential is to be achieved. Three of these key problems are associated with the interface between the customer and the service bureau, the updating of equipment, and the utilization of data communications facilities.

The need for a service bureau to understand exactly what the customer wants and for the customer in turn to know exactly what he has contracted for would appear obvious. It is, however, in just this area where a great deal of customer unhappiness with service bureaus has its

origin. While true of most kinds of service bureau business, it is especially true of the growing area of contract programming, where the detailed problem specifications are all too frequently not complete at the time the work is started. This results in unhappiness with both schedule and price. Perhaps it is time to adopt the discipline of the construction industry, where work does not start until the blueprints are completed and approved. The construction industry is not inflexible; "change orders" are accepted items but, as anyone who has ever built a house knows, they are costly and result in revised schedules.

effects of new hardware

Every new equipment announcement presents a problem to a service bureau. Is the increased efficiency enough to justify converting existing programs, and can sufficient savings be passed on to the customer to justify his being asked to bear the conversion costs? Two approaches to the problem are being tried and will be further exploited in 1964. Machine-independent programming languages offer the possibility of changing machines at only the cost of recompilation. Unfortunately, there are few programs which cannot be speeded up by the inclusion of some instructions specific to the machine being used. At conversion time, the piper must be paid! Generalized application program packages represent another approach since, hopefully, a single conversion job will result in many customers being able to use the new machine. Here again if generality is sacrificed to meet individual customer requirements, each such customer will have to receive some individual attention at conversion time. Perhaps the answer is to emphasize the cost of non-standard items at the time of the initial contract and to encourage customers to deviate from standard only when absolutely necessary.

Exploiting the economies of large machines via data



Dr. Gilchrist, who holds his PhD in meteorology from the U. of London, is special assistant to the president of The Service Bureau Corp., an IBM subsidiary. He has served as director of Systems Engineering Programs, IBM Corporate Staff, and manager of Programming and Computing, IBM Research, as well as director of the Syracuse U. Computing Center and member of the electronic computer project of the Institute for Advanced Study. He is vp of the ACM.

communications has been like a mirage before the service bureau industry for the last few years. At first sight the possibilities look very attractive but a detailed examination usually fails to produce demonstrable economic value. This is due partially to the cost of transmission and terminal equipment and partially to the nature of the service bureau business which consists in great part of a multitude of relatively small problems. Costs will undoubtedly come down gradually, but in the meantime, two somewhat complementary approaches to the problem suggest themselves. First, the service bureau industry should take the lead in educating data processing users to ask only for significant results rather than for the massive quantities of printed output which are so often the product of the service bureau. The rapid return of significant results to the customer followed later by the complete back-up data in many cases could significantly simplify the output communications requirements. While this approach is certainly easier to suggest than to implement, it should be pursued vigorously since it has important implications in the growing area of management information systems. The second approach is to use combinations of electronic data communications and the more conventional transportation facilities such as airlines and bus lines. The speeds of these facilities are frequently quite adequate for the majority of service bureau customers and the very low costs make them very attractive for bulk data transmission. The very frequent announcements of new and improved communica-

tions equipment make it essential for the service bureau industry to remain flexible and not to adopt an approach which cannot be modified to take advantage of lower cost equipment.

While these three problems will not be completely solved in 1964, each will be attacked vigorously since the success of the industry will be very dependent on the degree to which they can be solved. These are common problems to almost every service bureau and each bureau will have its own way of tackling them. Some will concentrate on improving job definitions, others on developing packaged applications and a few brave ones will make major investments in data communications equipment.

As in the past, we can expect newcomers to the service bureau industry in 1964. Some will start from scratch; others will be started by computer owners who wish to recoup part of their own data processing costs by selling services or who wish to diversify. Increased activity by industry groups such as banks setting up common data processing centers will also be seen. The relatively few large service bureaus will also continue to grow, but the growth will probably be internal rather than the result of mergers and acquisitions. Wide-scale consolidation in the service bureau industry may come eventually but not until the data communications problems are solved.

In summary, my outlook for 1964 is very favorable especially for those service bureaus that recognize and address the key problems of the industry. ■

DP CONSULTANTS

by Dr. CUTHBERT C. HURD

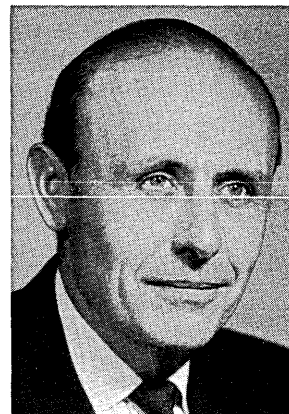


The purposes of this article are to describe the extent of consultation in the data processing field and to speculate concerning the growth of this activity in 1964.

A consultant is defined as an expert who provides professional advice and professional services. Proceeding from this definition, this article is divided into three main parts: First, a general description of the proliferation of and sources from which consulting in data processing comes; second, a discussion of the circumstances under which a client requires consulting in data processing; and third, a discussion of the factors which probably will affect the growth of consulting in 1964.

The discussion of the proliferation of and sources from which consulting in data processing comes will be divided into two main parts and in turn into business and the military. The two main divisions depend both on the nature of the business providing the services and the technical and systems orientation of those participating in these businesses. Thus, on the one hand there existed by 1950, principally in the United States and in Western Europe, a large number of well established consulting firms. These firms served both industry and the military, and provided services of many kinds. They did not offer

consulting services in data processing, of course, because the field was only then beginning to develop. However, as data processing has grown, many of these established consulting firms in business and the military have extended their services into the new field. Simultaneously, a great variety and number of firms have been established to pro-



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vide data processing consulting per se. These new firms are computer based in interest and in technology. They can be thought of as extending their services outward from the computer into business and into the military. The former firms which were established prior to 1950 can be thought of as having been oriented toward business and military problems and having now extended their services into the new field.

An example of the first kind of firm is the public accounting office which prior to 1950 offered professional advice and services to its clients. Clearly, accounting practice and procedure have had strong interactions with data processing; thus, it was natural, essential and profitable for public accounting firms to add data processing services to those which they already offered. Corresponding remarks can be made about management consulting organizations whether they specialize in one or more of engineering, production, marketing, finance, personnel, or the general organization and management problem. A similar discussion can be made with respect to the consultant in the military since any or all of the just mentioned business and industrial functions have interest for the military. In addition, a new kind of consulting service has grown rapidly in the military in the past few years. This development has placed many of the larger defense contractors in the business of providing services in data processing which are encompassed in the above definition of consulting. This activity has paralleled the increasing complexity of military systems and is a part of what a contractor likes to describe as a total systems capability. Thus, a company which five years ago used data processing primarily for the purpose of engineering design and financial administration and production management may now be offering every conceivable data processing service on a contract basis to the Department of Defense or to NASA. All of the major manufacturers of computers in the United States are, of course, also engaged in this activity in varying amounts.

The computer based consultant, both in the United States and abroad, is characterized most importantly by the fact that his expertness derives fundamentally from data processing technology. To this has been added interest and experience in the problems which must be solved by industry whether again in engineering, manufacturing, marketing, finance or general organization and management problems. Similarly, in government the computer based consultant is interested in all of the just mentioned fields. He also has an interest in providing services with respect to information processing for engineering systems which may be developed by the government.

Clearly, there is similarity in client and in problem between the business and government based consultant and the computer-based consultant. There are also differences, sometimes sharp, sometimes only in degree. Only one difference will be mentioned. On the one hand an industrial organization is sometimes faced with the problem which is primarily managerial and organizational in character and in which data processing is either only a small piece or is a piece concerning which its technical characteristics are at the moment relatively unimportant. In this instance, one would look primarily for a consultant whose experience and ability in management per se is a prime requisite. On the other hand, perhaps on the other extreme, help might be required in the systems design, in the logical design, or in the evaluation from an application and programming point of view of a piece of equipment. One would perforce then seek the assistance of a computer based consulting firm.

The circumstances under which a client requires consulting in data processing are described under the head-

ings: Objectivity, smoothing, specialization, and the ever-present need for additional good people. Objectivity is prized by a client whether the primary task involves reorganization or, say, equipment design and evaluation. Objectivity on the part of the consultant is a prime requisite; without it, he cannot remain in business.

Smoothing or load-leveling is another principal reason for the use of a consultant. In the terminology of a control theory a disturbance occurs. There is a sudden change in policy, a new piece of equipment or a new programming system becomes available, a merger occurs, there is a sharp increase in business. Any of these events may warrant the use of a consultant either to provide advice as to how to meet the disturbance or to provide services. The alternate is over-staffing to meet unexpected future demands.

The need for specialized skills at the time they are required represents the third major source of demand for the consultant. A check list of all the functions required to plan, select, install and operate a data processing system is in itself large. Moreover, within these functions there is enormous variety; for example, there are data processing facilities which run more than one thousand commercial applications weekly. There are facilities which run more than one thousand scientific applications daily. On the face of it, there is no single organization which can be an expert in every function and in every specialty within that function. Hence, not only will a user on occasion require a consultant for specialization purposes, but in addition, he must have a means for selecting among consultants in such a way that his specialization needs are met.

Finally, it is a fact that there are capable and widely experienced people on the staffs of consultants. Thus, the services of consultants can be used to help fill the ever-present need for additional good people which the client has.

All of the above has been intended to give a general picture of the consultant in the data processing field both with respect to who provides the services and the need which the user of those services has. The main impression which one has is that there are thousands of people engaged in consulting with respect to data processing and that they provide a wide variety of services from a number of different technologies and that these services are required for a variety of reasons. What can be said concerning the outlook in the future for these services?

Over a short term, the principal factors are the level of the economy, the nature of the political and geopolitical situation and the reputation of the individual consulting firms. The first two of these factors will not be further discussed here. With respect to the third, it is increasingly evident that those who employ consulting services expect the consultant to be able to perform as well as he advises. In short, they expect that the healer can heal himself and that he can produce his professional advice and services on time, within the budget, and at a technical level which is at least as good as promised.

Over the long term, the consultant will be affected by the degree to which the hopes and aspirations of the data processing industry are realized and upon how well he is able to compete within the general environment. For example, should the computer industry increase by a factor of three by 1970, as some suggest, the consulting segment in its entirety or an individual consulting firm will be faced with a challenge of trying to increase by more than a factor of three. How well the consulting segment or the individual meets this goal will depend primarily upon its own management, particularly in meeting the requirements of the client as briefly described above and particularly in establishing those internal conditions which will attract people who are outstanding. ■

STANDARDS, TRENDS AND RELUCTANT TEMERITY

by HOWARD BROMBERG



standard inlook

Currently, efforts toward standardization are directed toward the following areas:

ASCII

MICR

OCR

Data Transmission—Speeds and the Interface between EDP units and Communications Terminals

Glossary of Terminology

Flowchart Symbols

Programming Languages

If nothing else, the concentrated efforts along these lines have provided an abundance of published matter. The underlying theme in most of the articles on standardization is that it takes an awfully long time to accomplish anything in such an awfully difficult area. The awful reasons for this situation are three-fold:

1. Individuals serving (by the grace of their companies) on these standards committees have difficulty operating as free men.
2. Overlap among various committees, standards bodies, organizations and countries is at times too vague and at other times overly incestuous. (A result of poor communications, and in the computer business too; tsk, tsk!)
3. Incertitude on the part of everyone involved concerning the outcome of their labors.

The first two difficulties are surmountable and can be met and vanquished. The last, however, represents a political, moral, ethical, social and professional problem all rolled up into one great amorphous exercise. Has IBM stated that they are in the process of or will imminently retool to accept the ASCII on all their equipment? Has the U.S. government really accepted COBOL as their absolute standard commercial programming language? Or NELIAC? Or ASFSIP?

standards standard

Perhaps the way out of this dilemma is to establish criteria for describing a standard. These criteria will enable us to measure the intrinsic content of the standard itself. That is, before being able to measure the value of the standard it is necessary to measure the standard. Therefore, criteria describing the quality of the standard must be established first. For example, everyone will no doubt agree that a standard should be:

1. Perspicuous—i.e., clear, intelligible, and palpable
2. Persuasive—i.e., convincing and seductive
3. Pertinacious—i.e., firm and persistent
4. Peremptory—i.e., absolute, conclusive and compulsory (Also, pregnant, precise, preeminent, and punctilious, but why dawdle on the obvious?)

If the standard measures favorably against these criteria then we can measure its value. In the case of standards,

value is a matter of need and need is measured by weighing advantages against disadvantages. Thus, the standard's standard involves measurements of both the standard and its value.

Let us consider the ASCII. Is it clearly convincing and conclusive, and if so, to what extent? If these criteria are favorably measured, then we are able to measure the value of the ASCII; this is accomplished by questioning the benefits and detriments that accrue to various groups through recognition and acceptance of the standard.

standards harvest

The following list presents a first pass at recording the "plus" and "minus" attributes which are related to acceptance of a standard. Many are obviously subjective and reflect the author's narrow prejudices. However, the list could be purged and augmented with more accurate entries and then weighed by each group involved. It is my personal opinion (what other can I have?) that the benefits in each case will outweigh the injury.

Manufacturers	Users and Government	Independent Contractors
+Compatibility within his product line.	+Savings in training	+Added responsiveness to standard proposals
+Compatibility with competitors	+Computer and program compatibility	+Ability to develop greater competence on same product
+Savings in programming, documentation and hardware	+Proven tools	
	+Ease of equipment switching	
-Ease of replacement by competitors	-Loss of new concepts and breakthroughs	-Narrower market
-Difficulty in maintaining hardware conformity	-Slow response to changes	
-Loss of individuality	-Generalized rather than hand-tailored vehicles	

In 1964 there is an even-money chance for American standards to be ready for the following total group. (Odds



A stout (sturdy, staunch, substantial) defender of and developer of standards, Mr. Bromberg is chairman of both X3.4.4 and X3.4.5, as well as being chief U. S. delegate to the ISO technical committee on Programming Language Standardization. He is presently manager of Equipment Manufacturer Service for CEIR Inc. His former associations were with the Commerce and Navy Departments, and as administrator, Advanced Programming Languages, RCA-EDP.

on individual standards were not available at Las Vegas at time of writing.)

OCR Numeric Font
OCR Alphanumeric Font, Print Specifications
I/O Media (perforated tape, magnetic tape, punched cards)
Bit Sequencing of the ASCII
FORTRAN
COBOL
Glossary on Information Processing

Similarly, on the international side, 1964 will probably produce standards for:

Glossary
Coded Character Set (6 & 7 bit)
Data Transmission (guide for signalling speeds)
ALGOL

However, the mere presence of these standards is not sufficient reason to justify their existence. They must be universally accepted and uncompromisingly used. Unlike

Grosch's square law for computers, standards obey the law of oscillating halves, wherein each new user of a given standard reduces by half his cost of using it and increases everyone's benefits from it. Who will be the first to test this law? That, dear reader, is the message in the acronym of the title. ■

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AUTOMATION, UNEMPLOYMENT & UTOPIA

by Dr. LOUIS FEIN



Three things may be noted about the pre-automating economies of Europe (especially England) in the nineteenth century: most of the able-bodied in the population were required to produce the goods and services needed and wanted by the whole population; economic theories were just being developed; realizing the limitations on productivity by human labor aided by few machines and in the midst of economic hardship, Karl Marx suggested that a fair policy for producing and distributing the world's goods and services could be epitomized by the Augustinian dictum: "From each according to his ability, and to each according to his need." Elaborated, this dictum might have read: "From each (person, since there were few machines) according to his ability (to labor to produce and distribute goods and services), and to each according to his need (to consume the goods and services)."

Three contradistinctive things may be noted about the rapidly automating economies of the world (especially the United States) in this present half of the twentieth century: it takes a decreasingly small number of man-hours and an increasingly large number of machine-hours to produce and distribute all the goods and services that the whole population needs and wants; no economic theory exists nor is it being developed; with the accelerated pace of automation, it is now feasible to achieve an economic utopia together with an ethos that might be epitomized by the maxim: "From each according to his need and to each according to his ability." Elaborated, this reads: "From each (person) according to his (internal drive and) need (to compose music, to write plays, to sculpt, to make discoveries and inventions, to do science, to labor to produce or distribute goods and services, to teach, to raise children, to heal the sick, to play sports,

Marx, St. Augustine reversed

to go fishing) and to each (person) according to his (natural and cultivated) ability (to appreciate art, to enjoy listening to music or watching sporting events, to benefit from consuming goods and services, to learn, to be healthy)."

the abhorrence of utopia

It is a curious fact that many of us deny the signs that the once creeping automation is now running, and we also contemptuously reject the very idea of a utopia. Not surprisingly, an economic theory for the largely automated society is not missed. (What we do miss are concrete steps to solve our accelerating unemployment problem.)

Our discomfort, intolerance, and abhorrence of the idea of a utopia are fortified by the threatening thought that



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the largely automated economy of labor-saving, management-saving, and brain-saving machinery will render obsolete the economic, political, psychological, and moral defenses that we have so patiently built to cope with the conditions that formerly prevailed in pre-automated society. We worry that virtues would become vices and vice versa. We recall the failure of other economically-oriented utopias including the more recent ones in the USSR and in the People's Republic of China. Perhaps most distasteful of all is the projected picture of a society of indolence and lethargy—of the U.S. watching an automated parade go by like a bunch of village idiots with nothing to do.

On the practical side, we contend that it is unrealistic (yes, utopian) to expect people to change their behavior in accordance with an ethos that is uncongenial with the one they have become comfortably adjusted to.

shrinking labor force

We will consent to academic discussion of the spectre of a society in which the notion of "gainfully employed" with its respectable concomitants of initiative, fiscal responsibility, and self-respect derived from hard work, is largely replaced by its opposite "not gainfully employed" with equally respectable concomitants. But we doubt that society will ever, in fact, condone, respect, congratulate and support most of the population permanently "unemployed." The opposition is all pervasive and ubiquitous.

To the capitalist and small business man, the idea of having the few working for the material benefit of the many is abominable.

To the labor union official and the organized professional person, the decrease in the number of persons "gainfully employed" will cause an undesirable (to them) reduction in the size, power, and need for labor unions and professional organizations.

Government officials wonder how they themselves might continue to be gainfully employed monitoring an economy in which the number of gainfully employed was continually going down and where the concept of gainful employment itself was becoming irrelevant.

To the keepers of our morals and psyches, the encouragement and support of the "idle" by the equal denial of gainful-employment, or the equal opportunity for non-employment, could not be countenanced.*

In brief, our society says that one still earns his leisure and his living by his wits or his work, and insists apparently that it will always be that way. We can imagine another credo, but we think we cannot countenance it.

Yet, a close examination of our census statistics, actions, and attitudes reveals that we are closer to both a psychological and economic realization of this utopia than we think. Nineteenth century virtues are already obsolete. To work is no longer to labor necessarily. For millions it is to be on a payroll; i.e., to be gainfully employed, which in effect is a license to consume. We do condone and support (albeit grudgingly) unproductive people. Only our congratulations are withheld. Consider the following economic facts: In the United States, it takes about 68 million gainfully employed persons and their machines (not counting 2 or 3 million military personnel) to do the administrative tasks and to produce and distribute goods and services for our own 180 million persons, for millions of others who take our exports and who are the recipients of our foreign aid, and for just plain storage of millions of tons of unconsumed food and fiber. About one-third of our industrial plant is shut down most of the time. Few

bemoan the waste of these industrial resources. Let us for the moment divide our population into two groups: (1) those forty or so million (my rough estimate) gainfully employed who are directly or indirectly involved in administering, producing, and distributing six goods or services: food, housing, clothing, health services, education, and recreation, and (2) all others. If the 28-million in the second group lost their jobs (but not their incomes) at this instant, the remainder of the 68-million gainfully employed and their machines would obviously still be able to feed, house, clothe, and provide health services, education and recreation to the new unemployed and their dependents *exactly as they did before the "lay off."* Our economy would never know the difference although our psyches would probably be outraged.

My own estimate is that 40-million gainfully employed man-years per year might be reduced to 20-million actually working man-years per year by improving organization and efficiency, by using full machine capacity, and by rationalizing distribution as we have production. Then, with the introduction of man-displacing machines at the already achieved rate of one-million gainfully employed persons each year, it follows that in 20 years, very few people will be required to make and distribute life's necessities—machines will do most of it. In a few years after that *all* goods and services, including those produced by the second group, will be largely automated. Even the new industries spawned by today's automation will be largely staffed by machines.

the attitude gap

You say, this won't happen in 20 years. Then, make your own estimates. Even today it takes a very small fraction of our population working a very small number of (man) hours to make and distribute what we need. Perhaps, you think that 30 years or 50 years will elapse before the production and distribution of life's necessities are mostly automated. So?

Scrutinize our economic policies and actions in the agricultural part of our economy. Many years ago we recognized that we were sufficiently advanced technologically, that available agricultural manpower and machines could produce much more (agricultural products) than the whole population could possibly use. We respect, congratulate and support those farmers who accept money for not planting and who charge government-chosen prices for the things they do produce. By considered policy, a good deal of our land lays unused for pasture, tilling, or planting. Few bemoan the waste of these agricultural resources.

Our disdain toward those who do not work (sic) has changed to condonement and even encouragement. We urge and encourage more schooling, earlier retirement, longer vacations, sabbaticals, more generous pensions, coffee breaks, sick leaves, attendance at boondoggles usually called conventions, shorter work periods, overtime premium pay, higher wages, profit-sharing, higher minimum wage, more fringe benefits, unemployment insurance, tax reform, guaranteed annual wages, crop supports, farm subsidies, featherbedding, and myriad devices that directly or indirectly render socially acceptable the idea of paying "potentially gainfully-employed," "now-gainfully employed," or "once-gainfully employed," persons *for not working*. We are productive enough to support other non-producers—viz, the young, the sick, the old, the jailed, the lazy, the coupon clippers and the incompetent. Few bemoan the waste of these human resources. It is curious that only the relatively small number of non-producers labelled "unemployed" (6-million or so out of 180-million) do we continue to deprecate, disrespect, and begrudge support; of all the non-productives, we choose to bemoan

*Consider this switch—a labor union official bargaining for a guaranteed annual wage insisting that management agree to lay off men of highest, rather than lowest, seniority!

the waste only of these few million potentially productive human resources. In a speech to the AFL-CIO convention in November 1963, President Kennedy said, "Last year, loss of man hours in terms of those willing but unable to find full time work was a staggering one-billion work-days lost, equivalent to shutting down the entire country for three weeks with no pay. That is an intolerable waste for this rich country of ours."

As always the common objective of labor, industry and government is to get the unemployed back to work, i.e., on somebody's payroll in order to qualify them as consumers. To accomplish this, Governor Rockefeller suggests a national employment bureau; Snyder of U.S. Industries would spread the work by shortening the work week; Secretary of Labor Wirtz contends that this would spread "unemployment, increase costs, curtail markets and reduce jobs." Many of the AFL-CIO, observing that automation is potentially a blessing but actually a curse that could lead to a national catastrophe, said he would make a pact with the devil himself if it brought a solution to the problem of unemployment. To spur the economy, i.e., to license consumption and capitalization as well, the Administration urges tax reform and tax cuts: "This will help consumer markets, and build investment demand, and build business incentive and therefore provide jobs for a total addition to the economy of the U.S. in the next months of nearly \$30 billion." On the other hand, some economists counter that a tax decrease cannot stimulate new investment in areas that will provide new *net* employment.

T. J. Watson of IBM, one of the few mavericks among automation industrialists (he admits that his machines cause a net loss in employment) insists that "The problem of unemployment is solvable. To solve it we must be willing to face up to the facts and act decisively . . . (unemployment) problems will be with us forever in one form or another as technological changes take place and what we must do is step up to each of them, find an answer, and move on to another." At this time, he suggests among other things, government subsidies for

development and renewal programs in distressed areas.

There are programs, suggestions, and counter-suggestions for massive retraining and education.

But each of these suggested economic actions is based on the premise that even in a highly automated society, unemployment is a bad, wasteful phenomenon; that it is a symptom of something wrong. This premise, however valid yesterday, cannot be defended today. Today, unemployment—more accurately, the stage reached by an automating society when fewer than the available man power is actually needed to administer, produce, and distribute what we all need and want—is a prize of technological success, not its price. It is a good, potentially useful phenomenon; it is a symptom that things are right. That is why these actions and suggestions, however sincerely made, are at best superficial and *ad hoc*, at worst preposterous and irrelevant. They are more congenial with the economic theories, social attitudes, and technological conditions of Marx's time than with ours!

the absent economic theory

Economic actions should be based on economic theories and social attitudes congenial with the actuality of the present. Since there is a consensus that automation will not be stopped, the actuality of the present and the future dictates that we recognize and face our technological success. Such actions can be soundly taken if they are based on a valid economic theory of increasingly automating societies. This we do not have. This is our most desperate need. To help realize the fruits of automation and computers as indeed a prize for our technological accomplishments, rather than a price to pay for economic bungling, I propose that labor, industry, and the government jointly sponsor and support the planning and operation of Economics Research Projects to develop the desperately needed economic theories of increasingly automating economies. Setting up such an activity would at least show that we are willing to face the problems caused by our technological success. ■

YEAR OF THE TIGER?

by ROBERT FOREST, Editor



By 1963, most manufacturers had finally learned a terrible but profound truth: there is little glory, less profit in being a trailblazer. The accepted watchword had become "wait."

A quick review of the year's major general-purpose entries—ASI 2100; CDC 3200; DDP-24; GE 235, 400 family; Honeywell 200, 1400; IBM 1401C, 1460; PDP 5 & 6; PDS 1020; SDS 930 — shows that '63 was hardly a year to take away the breath (or dollars) of users or prospects. Most of the systems were attempts to up-

grade or replace an obsolete model . . . or to copy (slightly cheaper, slightly faster) something out for three years which had already captured 75% of the market. No names, please. There were significant "bang-for-the-buck" improvements, but no pace-setting, major-share-of-the-market-grabber equivalents of the 1401 or 1004. Impatiently, users who had not yet learned to use what they already had awaited the third generation.

Generally scheduled for '65 by paid pundits, the breathlessly awaited third generation — Wall Street's name for

anything new from IBM — may bust out ahead of schedule. A year which was supposed to highlight Chinese copies and paper tigers may turn out to be the year of the *real* tiger.

It all depends on IBM. And the rumors are growing louder that this is the year the giant will awaken. Expertly equipped to play the waiting game from behind its huge pile of installation chips, IBM has faced in recent months increasing large-scale and medium-scale competition. The tip-offs: announcement of the 1401C, coupling of the 7040/90. After all,



year of the tiger?

it's been over four years since the first 90 was installed, three-plus for the 1401. And while this hardly makes them obsolete, it does mean both machines are near the end of their active marketing lives.

Too, systems announced in '64 would probably not start delivery before '65; people buried on the waiting list can expect delivery in '66 . . . long enough to allow most of the current installations to soak up thick layers of protective, black-ink fat. So . . . look for IBM to make a really big announcement soon . . . perhaps in March. We predict that this will *not* be the long-awaited 8000 series, but a family of machines . . . maybe five (5) of them. The big question about IBM's plans covered, let's turn to some others:

Q. When will Control Data start acting like a mortal manufacturer?

A. Sooner than you think. The famous rifle-shot marketing philosophy which moved the company so far so swiftly must now give way to something more like a shotgun approach . . . encompassing targets more densely covered than those which offered initial success. In expanding, the company may be expected to expose its flank to snipers who want to do to CDC what it did to IBM. And the new targets will require software and support overhead which will bite into a pocketbook not nearly as fat as some of its competitors'.

But don't sell the boys from Minneapolis short; they're bright, well-organized, strong on both engineering and marketing savvy. One knowledgeable observer says, "They're going to get *really* aggressive now; they'll end up by out-IBMing IBM." Look for the company to market a system (3400?) between the 3200 and 3600; they're toying with an upgraded 160. But the IBM announcement may change all this.

Q. Is the Univac resurgence for real?

A. Ask some of the boys selling against them. With a solid product planning and software effort to back up acknowledged engineering skill, the company should be able to overcome even its own incredible talent for bungling. The Univac penetration of the military market has some people wondering if Doug is pulling strings. Univac is also making strides abroad; the ICT agreement to market the 1004 may be extended to the 1050, and we hear that a Japanese firm may build 1004's there.

Assessment of other leading contenders for the runner-up spot is a bit harder. GE has the dollars; the recent announcement of the 400 family, plus plans for two big 600-series scientific machines underscores the company's serious intent. But the company has been making noises about a big push for a long time. Maybe this time they're real.

RCA, completing its "best year yet," has had success with the 301 (perhaps 500 installed and on order), but the large-scale 601 (six orders), has disappointed. The 501 has captured some 85 orders, but it's been over four years since its first installation. It's too early to evaluate the 3301. The company's edp product line, however, has not kept pace with those of CDC, GE and Honeywell. A '64 announcement may help to correct this situation. Foreign marketing may have peaked out: there is little action in Japan; the arrangements with Bull and ICT have been extended to the 3301, but may not include forthcoming gear. RCA, like Honeywell, expects its edp operation to be in the black this year; how this will affect their willingness to expand their product line to meet Number One across the board is the big question right now.

Honeywell has said its computer division will be in the black this year, but this prediction comes from HQ, not the EDP division. The 800 was first installed three years ago, and seems near the end of its sale life; the 1800 has not moved well, we understand. The 400 is probably holding its own, and the 200 may help, although it's possible — depending on IBM's plans — that it is too late. The 200, a faster 1401, is certainly the boldest follow-the-leader bid for IBM business made yet. The big question at Honeywell: will corporate management continue to pour money into computers if no black ink appears on the ledger this year?

In the second division, NCR seems to have found a comfortable niche, unlike its fellow business-machines maker, Burroughs. Of the smaller, computer-only firms, Max Palevsky's Scientific Data Systems and Digital Equipment Corp. appear solid. Fast-moving SDS will probably go public this spring, and may experience growing pains. DEC, in no hurry, can be expected to maintain its steady progress.

One thing on the main-frame front is sure: the accelerating announcement pace started in December will continue in '64. The IBM announcements will trigger a lot of competitive activity . . . and hopes that lack of compatibility between old and new IBM gear will help shrink IBM domination.

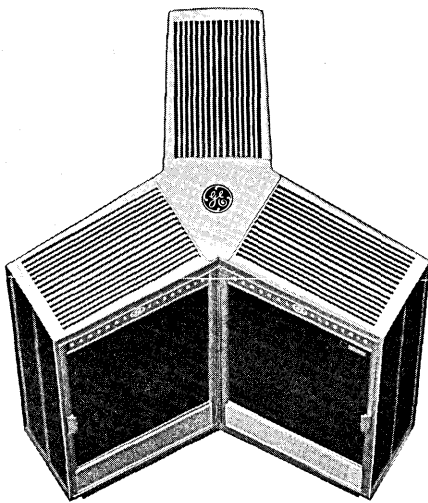
peripherals

Last year could be called the year of the disc (and, to a lesser extent the big drum). But many people feel that big disc claims and performance haven't yet jibed, that perhaps they never will. Another soft spot: effective disc software. Look for more manufacturers to start producing their own disc units, which will continue big . . . with one eye over the shoulder at

General Electric originated the concept of a full family of compatible computers. The concept first became product in the GE-215 -225 -235 family
—THE COMPATIBLES.

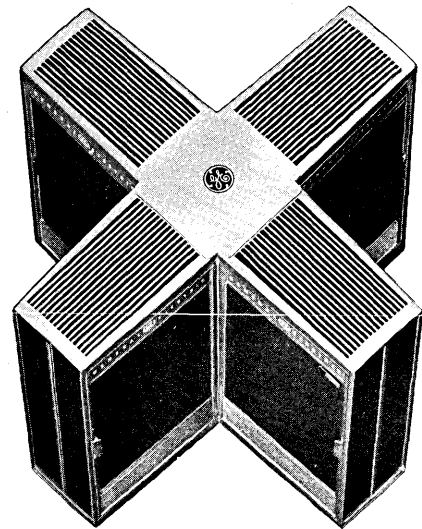
Now, to meet the demand for very high performance data processing systems,
General Electric announces...

THE COMPAT



GE-425

Four character/word memory, up to 131,072 characters. Memory cycle time equivalent to 1.28 μ sec/character. Data manipulation and arithmetic operations programmable for 4, 8, 12, or 16 characters. Fully upward compatible.



GE-435

Processor performance 80% greater than GE-425. Memory cycle time equivalent to .68 μ sec/character. Fully upward compatible.

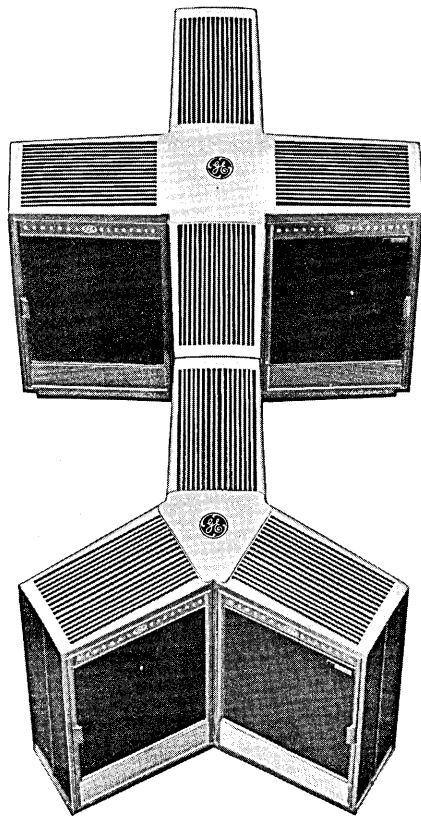
“These computers are going to cause a lot of excitement. If they don’t make G.E. the top challenger in the computer business, then I’ve really missed my calling.” Those are the words of one veteran computer installation manager when he saw the specifications on the COMPATIBLES/400. His comments are typical. Each of the COMPATIBLES/400 systems is so packed with features . . . so efficient . . . so powerful for its price, that — well, let’s see what you think.

THE FEATURES

- Complete data processing/data communication capabilities. Equally powerful on batch, random, or real-time.
- A complete Operating System, usually found only on very large computers, cuts lost time between programs. Reduces dependence on operator.
- Outstanding software, including two language processors (Macro Assembly Program and COBOL); two input/output systems; a Sort and Merge Generator; a Report Generator; Multi-way Media Conversion—all give maximum hardware to get applications on the air fast.
- Hardware, software, and the operating

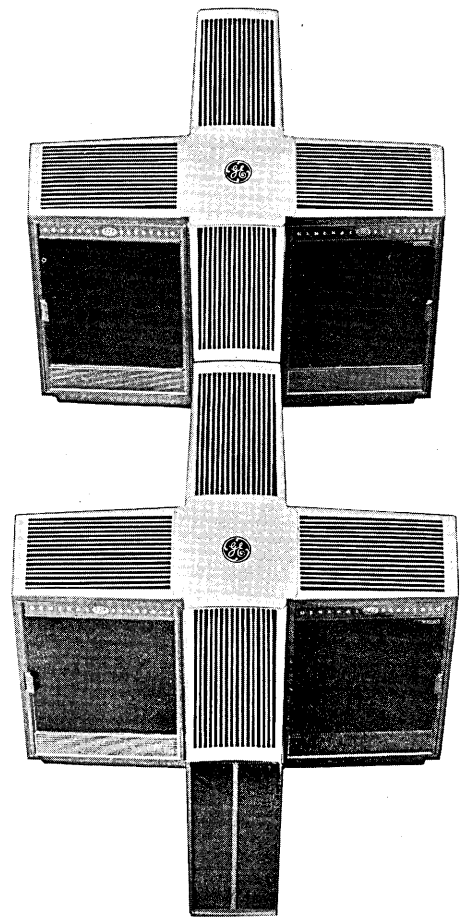
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ATIBLES/400



GE-455

Processor performance 80% greater than GE-435.
Memory cycle time — $2 \mu\text{sec}/\text{word}$.
Optional thin film memory — $.5 \mu\text{sec}/\text{word}$.
Fixed and floating point operation.
Fully upward compatible.



GE-465

Processor performance 80% greater than the GE-455. Maximum processor throughput of 1,000,000 characters/sec. Memory cycle time — $1 \mu\text{sec}/\text{word}$. Optional thin film memory — $.5 \mu\text{sec}/\text{word}$ cycle time. Fixed and floating point operation.

system have been designed together, by a team of users, programmers, and engineers. Look at the features that can make your everyday operations easy and fast:

Sort/Merge: Record scatter/gather feature on all peripheral subsystems; dual-channel controllers for tapes; indirect addressing; and a Sort/Merge Generator that will accept your own coding — all contribute to greatly increased speed and ease of use.

Report Writing: Powerful edit and control features in the central processor and a new Report Writer that eliminates de-

tailed coding make report writing easy and efficient—even on one-shot reports.

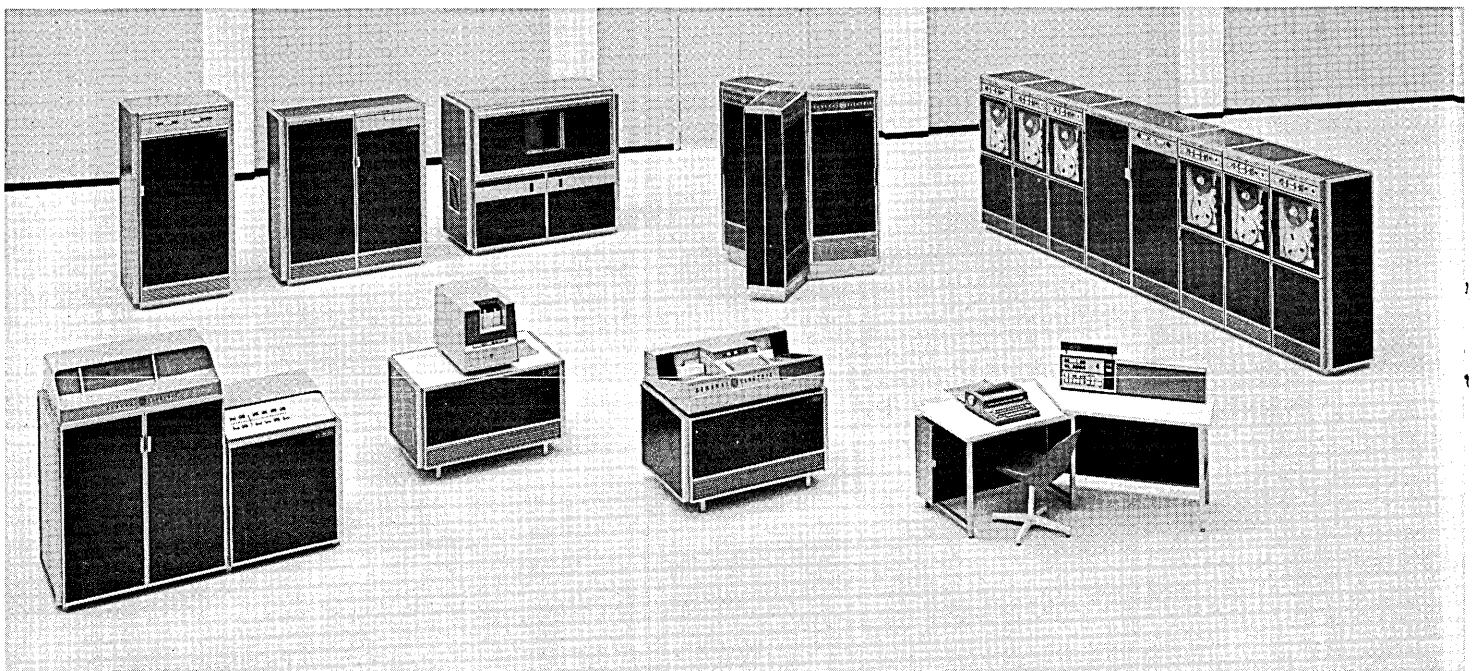
Data and File Manipulation: Scatter/gather by character (gives the flexibility of a character-oriented system with the speed of a word system); 1 or 2 address instructions; any-word indexing; a first-rate I/O system, and a move command are some of the features that bring a new efficiency to these operations.

- Full upward compatibility. The programs written for one system will run on any larger member of the family. Any peripheral will work on any system. And no retraining of personnel is needed when

you step up. System upgrading over-the-weekend.

- Alphanumeric input/output, basic decimal instructions and addressing with added binary capabilities.
- Relocatable accumulator eliminates needless shuffling of data. Programmed length of 4, 8, 12, or 16 characters, with ability to operate on fields of unequal length.
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year of the tiger?

new mass memory techniques (still a year or two away from practicality). Out among the off-line equipment, the swing to centralization will see small, nearly special-purpose computers like the 1004 replacing some tab shops and 1401-class systems. Communications costs will prevent massive centralization in big companies and service bureaus, but the move has begun. Another bottleneck: automatic or semi-automatic source data acquisition, which should start coming into its own in late '64 or '65.

Look for no big I/O breakthroughs: mag tape, punched card gear and printers are all about as fast as they have to be. There's some futuristic talk about 500KC mag tape. A swing will begin toward cathode ray tubes, which are really a couple of years away, as is non-impact printing. Also lagging: special-purpose information retrieval systems, practical consoles for remote computing.

societies, standards and software

The American Federation of Information Processing Societies — not yet three years old — continues to exhibit understandable signs of immaturity; it lacks an executive secretary and enough members to make it a truly representative society. For AFIPS in '64, a secretary will be found . . . moves to add new members will be made, but not accomplished until '65.

Older but hardly wiser, the Association for Computing Machinery continues to struggle with severe financial troubles, and the problem of control by a narrow and extremely theoretically-minded minority which wants to represent everybody without catering to their mundane needs. Higher dues will make ACM members put their money (or their companies') where their mouths are. We'd guess that a significant number won't, and that the

minority will become the controlling majority. As the legitimate spokesman for numerical analysis and high-level scientific problem solving, ACM will be a stronger, healthier influence, less torn by dissension than in the past.

The Data Processing Management Association, more realistic and aided by its ability to focus on a single, simple goal — upgrading of its membership — will grow somewhat in stature. Its current lack of professionalism will be helped by plenty of eager beavers and aggressive leadership.

On the standards front, last year saw the acceptance of ASCII (American Standard Code for Information Interchange). As the song says, who could ask for anything more? A glossary, perhaps, and standard flow chart symbols? Hundreds of thousands of expensive man-hours have been thrown into the standards breach, more will follow . . . and the result will be a slight lessening of lethargy among users, who would rather complain about lack of standards than make use of proposed standards and semi-standards. One important trend in '64 will come from increasing federal government pressure for standards. Aware that if they don't recognize industry standards, they must accept Big Brother's, members of BEMA have shouldered their expensive standards burden and will attempt, with some success, to accelerate this work. If they don't, the industry may find out government standards aren't so bad . . . or are at least better than no standards.

Where were we? Oh yes, software. Ho hum. COBOL continues to cost manufacturers almost as much as they can pad the hardware bills to hide; FORTRAN IV staggers forward, changing faster than any standards group (as currently constituted) can keep pace with. Smaller manufacturers prudently implement a F-II

Subset of IV, letting the big boys bear the brunt of IV development costs, which are plenty. ALGOL, carried on the shoulders of a dogged but lurching Burroughs, is the sad symbol of what befalls superfluous excellence. The software story mirrors that of hardware: users want more than they can reasonably expect or are capable of taking advantage of.

people and education

In its hasty search for bodies, the computer industry has minimized excellence, hoping blindly that 100 people chosen at random will do a better job than 10 carefully selected. In an attempt to keep pace with this artificial demand for people — programmers, mostly — information processing has flirted with vocational training, which it has chosen to call education . . . ignoring its own volatile, revolutionary nature, forgetting that today's skills will not satisfy tomorrow's requirements.

DPMA uses its data processing certificate as a lure to get its members off their duffs; ACM has a sporadic and poorly-coordinated education program which is as good as the individuals in some chapters make them. Still sorely missing: solid programs to educate 1) the information processing community to its responsibility to society . . . and 2) the public and public officials. A realistic appraisal sees little progress on these fronts in the coming year. The only gleam of hope: the rumor of a plan to indoctrinate high-level DOD officials to the wondrous world of computers and edp.

In summary: 1964 may well be the year of the tiger for main-frame hardware. In other areas, look for a repeat of years past—an exciting and baffling combination of initiative and inertia, progress and pill taking.



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The following is based on a paper presented at the Disc File Symposium held in Hollywood, Calif., and sponsored by Informatics Inc., Culver City, Calif., on March 6-7, 1963.

INVENTORY CONTROL WITHOUT BATCHING

by JOE A. PHILLIPS

With the implementation of the Department of Defense operating manual MILSTRIP (Military Standard Requisitioning and Issue Procedure), inventory control without batching has become the standard approach to the military supply application. MILSTRIP established a time limitation on the handling of supply transaction which resulted in most supply bases using disc files to meet the stringent time requirement.

The military installation used as an example of one way of handling the supply problem is the MATS (Military Air Transport Service) GE-225 installation at Charleston Air Force Base, South Carolina. Charleston is the MATS pilot installation, with seven additional to follow. It is planned that the supply programs developed at Headquarters MATS will be utilized at the other installations with minimum modification.

To set the stage for this installation let us assume we are to design a computer system to handle a maximum of 60,000 federal stock numbers and that the system must further be capable of processing "receipts," "issues," and all other supply transactions on a "real time" random basis rather than on a scheduled "batched" approach. A batch approach could not be utilized in this application because of the processing time parameters on priority coded transactions established by MILSTRIP. The requirement of real time processing dictates the prime system configuration, a disc storage unit (DSU) rather than a tape approach.

How large a DSU is required? This is a function, of course, of the supply record types and volumes, shown in Fig. 1. Note that:

1. Only 33 per cent of the item masters (20,000 out of 60,000) normally have Due In, Due Out, Work Order, etc., balances. Because of this characteristic, it is possible to break the Item Master record into two segments, Item Masters, which contain the basic information about each item, and Item Trailers, which contain detail amount balances and the DSU address where more detail can be obtained.
2. Item Trailer, Due In, Due Out, WRM, etc., individual records are to be established and cross-referenced to the appropriate Item Master in disc storage.
3. The number of GE-225 20-bit words (within a 64-word sector) required by each record type is shown to the far right under the heading "GE-225 Record

on-line disc, files

Length." Whenever possible, numeric fields are maintained in binary to increase the data storage capacity. 4. Only the Item Master and Due In records are to be

Fig. 1

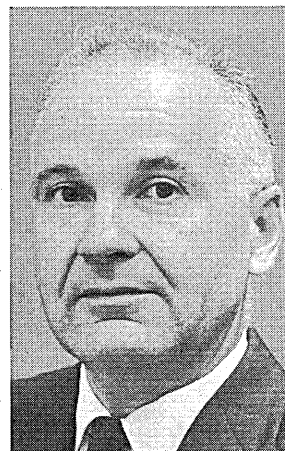
Record Type	Volume	Record Length**
Item Master*	60,000	40
Item Trailer	20,000	24
Due In†	15,000	17
Due Out	15,000	17
Work Order	4,000	4
On Base Stock (Pre-Issue)	8,000	6
Forward Supply Stock (FSS)		
T. C. Property	16,000	6
WRM		
Project		

*Randomized by stock number

†Randomized by document number

**Expressed in word size

referenced in random order; all remaining records will be cross-referenced to the Item Master. Expressed differently, the DSU will normally be ap-



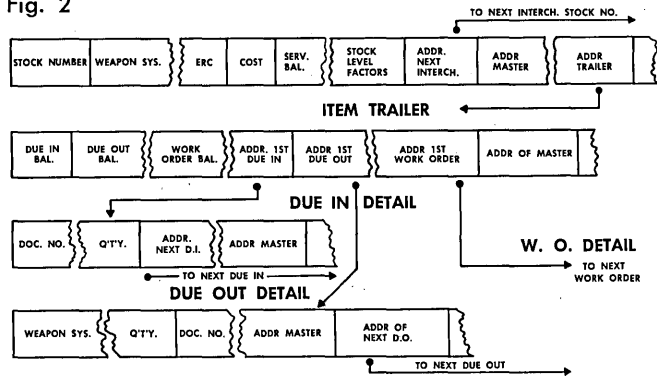
A senior application engineer with the General Electric Computer Dept., Mr. Phillips has been engaged in business systems analysis and administrative capacities with the firm. He has also assisted in the preparation of programming and systems manuals for the 225, and currently is responsible for the preparation of all proposals to the federal government. He holds a BS in accounting from UCLA.

proached with one of two different control keys—stock number (in the case of “issues,” etc.) and document number (in the case of Due In transactions).

By computing the number of characters required (record type volume by the number of characters) for the supply application and relating the result to the DSU capacity (18.8-34.4 million characters, depending on whether the mode is BCD or binary), it can be determined that one DSU will adequately handle this application.

Having determined the record volumes, types, and content, attention can now be directed to the detailed layout

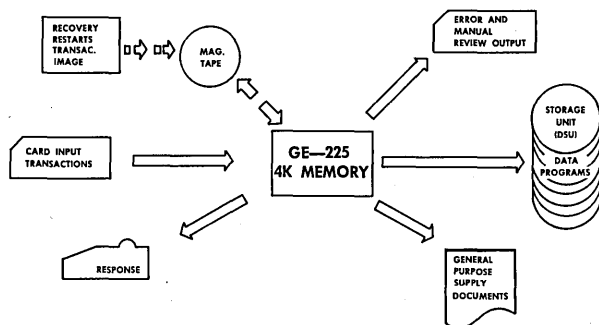
Fig. 2



of record formats. Fig. 2 shows the five major record types and their “linking.” Note that:

1. There will be one Item Master for each stock number.
2. “Prime” Item Masters are cross-referenced to Interchangeable (substitute) Item Masters. The last Item Master Record in an interchangeable chain is blank in the Address of Next Interchangeable field.
3. Each Item Master has an Address of Master field used only in the case of interchangeables to find the prime master in the event a Due Out must be established.
4. The Address of Trailer field in each Item Master will contain a blank if there is trailer or the DSU Address of Trailer if there are Due In, Due Out, etc., balances applicable to the appropriate Item Master.
5. Item Trailers contain the summary balances of Due In, Due Out, and other details.
6. Item Trailers carry the DSU address of the first Due In record, first Due Out record, etc. Each of the first Due In, Due Out records are in turn cross-referenced to subsequent details (of like type) in the chain.

Fig. 3



The hardware configuration in Fig. 3 shows the components recently placed on rental by MATS to process a MILSTRIP system similar in volume to those in Fig. 1. Equipment is run on a real-time basis for approximately seven hours per day, processing an average of 4,500 supply

transactions in random order. In studying Fig. 3, certain considerations should be kept in mind:

1. A 4K memory is not large enough to contain all the programming required. An “overlay technique” (to be covered later) must be adopted.
2. Input transactions are to be read in the card reader (400 cpm).
3. The typewriter is used for error indications and instructions to the operator.
4. The card punch (100 cpm) is utilized for error and action output.
5. Only one tape handler (15KC) is used for capturing the transaction “picture” as well as recovery and restore purposes.
6. The 300 lpm printer is used principally for preparing General Purpose Supply documents during real time operations and for Reports run during off hours.
7. The DSU contains data and programs.

Two components, the central processor and the DSU, require additional explanation for an understanding of the system. The GE-225 central processor:

1. Processes data in both binary and alphanumeric form. Normally operates arithmetically in the binary mode using subroutines to convert from one mode to the other.
2. Has a memory composed of 20-bit words plus a parity bit and is available in word sizes of 4K, 8K and 16K. Normally a word is considered to be three alphanumeric characters or 5½ decimal digits in binary. The 20-bit word plus parity is the image transfer unit between the central processor and the DSU.
3. Has a memory access time of 18 microseconds, or 55,000 accesses per second.

The DSU is the heart of the supply system. It contains 16 discs which provide 32 data storage surfaces. Each of the 16 discs has an independently operated positioning arm. There is an actuator for each arm which moves the arm parallel to the disc. The arm remains positioned until a new positioning instruction requires a movement to another location. There are 128 read/write heads, 8 heads per disc and 4 heads per surface. The disc revolves at 1,200 rpm. The data capacity of the file is 18.8 million alphanumeric characters or 34.4 million decimal digits in binary. The actual number usually varies as data in most applications is mixed. Each disc surface is divided into an inner and outer zone. The transfer rate from the outer zone is 25,000 words per second and from the inner zone 12,500 words per second. The transfer unit is words instead of characters or bits because the data content of a word can vary depending on the data mode. The maximum number of alphanumeric characters per second would be 75,000 from the outer zone and 37,500 from the inner zone. There are 128 circular tracks in each zone, making a total of 256 tracks on each disc surface. The outer 128 tracks are divided into 16 sectors and the inner 128 tracks are divided into eight sectors. Since there are four read/write heads for each side of the disc the actuator must move the arms only 64 positions to serve the 256 tracks on each disc surface. This, of course, helps minimize the access time. The total number of sectors per file is 98,304.

Each sector contains storage space for 64 words of information which, of course, can be tables, computer programs, or data. It is the smallest unit that can be transferred between the central processor and the DSU file. The actual transfer is made in words, but in minimum units of 64 words. Any number of sectors from 1-16 can be transferred with one instruction, so the maximum transfer on one instruction would be 16 sectors x 64 words or 1,024 words.

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INVENTORY CONTROL . . .

error output and returns control to the Executive Program, which in turn reads a new card.

If the card initially read was found to be valid, the Executive Program calls in the appropriate program from DSU and passes control to the overlay area. Note when the issue program is being processed that if Back Orders are required, the Executive Program calls in the Back Order Program, etc. Control, after all work has been performed, is always returned to the Executive Program.

At Charleston AFB, the Inventory Control System required approximately 100,000 instructions to handle this real-time supply system. This does not include other programs required to process data generated during the real time processing.

With such a small memory (4K) to accomplish a MILSTRIP supply application, there was, of necessity, a great amount of duplication of programming effort. Many overlay programs had their own error punch routines, preparation and writing of transaction tape routines, linkage error card routines, and special level review and index card routines. With a larger memory, many of these routines would have been included as part of the Executive Program, and not duplicated in many programs. The number of overlays required to complete an average transaction varies between three and five using a 4K memory. Overall processing time would, of course, be reduced if a larger memory were utilized.

It is conceivable during transaction processing that a series of DSU records may be updated and written onto the DSU prior to reaching a point in processing where an invalid condition is detected. This invalid condition requires that all records previously changed be restored to their original content and the transaction rejected. The technique used for accomplishing restores was to write a tape image each time a card was read, a record was read from DSU, a record was written on DSU, and for each transaction output.

If DSU image restore is then required, the tape is backspaced and the Beginning Balance image for this series of updating written on to the DSU thus restoring the DSU record to its original content prior to transaction processing. Backspacing ends when the card image record is sensed. The next transaction records are written over the invalid tape transaction records. Note that each DSU record has 66 words instead of the sector length of 64 words. Two words have been added to assist in this restore. The 65th word is the DSU address of this record and the 66th word is either zeros or all 1's to indicate whether the record is the beginning image record (a read) or the ending image record (a write). Only the beginning image records are written on DSU during the restore processing.

This Restore Tape is used for two major purposes over and above restore capability:

1. The transaction records on tape can be used to feed tape oriented accounting routines, and
2. The tape itself can be saved for a period of time to serve as a recovery tool if a DSU failure is detected.

Experience has disclosed that the techniques covered to this point permit normal MILSTRIP processing on the GE-225 at an average rate of 3.9 seconds per transaction, based on an average daily transaction volume of 4,500. Indications are this time can be significantly reduced. During the GSA acceptance test at Charleston AFB, the computer configuration was operated 408.97 hours with only 5.33 hours down time—an availability of 98.69 per cent. ■

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THE '63 FALL JOINT



Fall Joint computerites in Las Vegas, meandering as though unaware whether they were in the exhibit area or a casino, were exposed to an obvious parallel between gambling facilities there and computers everywhere: both are expensive fun, and both have systems that are difficult for the ultimate user to comprehend. The issue of user-oriented computers and the necessity to overcome the heavy operational expenses of problem analysis and programming were taken up by the keynote speaker.

Citing the cost as \$32 per instruction to program the 650,000-instruction SAC Command System, Major General C. H. Terhune Jr. of the Air Force's Electronic Systems Div. called for an "absolute rethinking of computer design, programming, and operation." Needed, he said, are main frame versatility, on-line problem solving, and a user-oriented language. "... The ESD is recommending a new program focused solely on the acquisition of capabilities inherent in implicitly programmed systems. When this capability is achieved, the Air Force will have extremely powerful and flexible data processors which can be used directly by large numbers of people who will have had little or no training in programming and computer technology."

The 2,900 registrants and representatives of 75 exhibitors at the '63 Fall Joint didn't suffer from a lack of activities. Indeed, the diversionary attractions on The Strip were deemed by some to be overpowering, making Las Vegas a less desirable town for a conference, they say. But the Convention Center was, all agree, excellent. One criticism of the latter: a pronounced echo toward the center of the circular auditorium, especially distracting to those addressing questions from the floor. On the credit side, the conference went on with a minimum of hitches and a maximum of attention to such details as slide presentations (which were weeded of mathematical equations) during technical talks.

Those who chose to watch Lili St. Cyr disrobe on Wednesday night missed what is reported to have been an excellent discussion of multiprocessor systems, a spillover from the well-run Tuesday afternoon session and exceeding it in quality. Much interest was shown in this topic. Perhaps the largest attendance at a formal session was in to hear the tutorial, "Software for Hardware Types," which drew an estimated 500 to a room with a capacity for little more. The award for the best paper: "Laminated Ferrite Memory" by RCA's R. Shahbender, C. Wentworth, K. Li, S. Hotchkiss, and J. Rajchman — which shows what a committee of five can do.

The exhibit floor was adorned with an abundance of operating systems (computing and communications hardware) and a dearth of attractive girls (perhaps this observer was jaded by the city's showgirls). Introduced was the SDS 930, a gp computer with a two usec memory cycle, and the Beckman 420 (see Oct. *Datamation*, p. 19), which has independent central and I/O processors, and

is being sold only as part of a hybrid or data acquisition system. The SDS 930, which has the 9300's circuits and the 920 logic, has an add time of four usec, and multiplies in eight usec. Software includes the 920's FORTRAN II; price with 4K words of core is \$108K.

General Precision debuted its L-1500 content-addressable disc file. Features: head-per-track design on 47.5-inch discs, 35-70 millisecond average access times, up to 2.8 billion characters (17.1 billion bits) in a 56-disc configuration, and transfer rates from 2-15 million bits per second. Prices range from \$40-250K. The firm also released the first of its L-300 series of 10-inch, head-per-track disc memories with a capacity of 180,000 bits per disc. Average access time is 25 msec.

Adding to its 4000-series disc files was Bryant, its 4000A having one to six discs and a maximum capacity of 390 million bits. Others in the series have 13 and 25 discs.

Plugging its computer-generated movies (via its S-C 4020), General Dynamics/Electronics had a five-cent movie machine, a la the penny arcade. A supply of nickels in a bowl negated any out-of-pocket expense on the part of the viewer. But one affluent visitor, after receiving oral operating instructions, proceeded to put his own nickel into the dish instead of into the machine. He was from IBM, probably a blue-sky researcher.

Hardware to send pictures over voice-grade phone lines was demonstrated using an ITT Videx system, which also accommodates regular audio tape recorders for playback of both the voice and picture.

Apart from the formal FJCC sessions, an educational dp session was held. In attendance were 150 primary and secondary school educators from the Western states, presentations for whom covered the use of computers in education, and a review of current research in the modification of teaching methods and the use of automated devices. As a bonus, some 15 local high school students were given a one-day programming course, a day to write, and a day to debug. They demonstrated their proficiency on the fourth day — factoring a cubic polynomial, finding the roots of a quadratic, etc. One boy, showing imagination, also wrote a program which accepted the current day, hour and minute, and outputted the number of seconds until Christmas, accompanied by the ringing of the G-15's bell to the tempo of "Jingle Bells."

For those unable to attend, published proceedings of the conference are available for \$16.50 from Spartan Books Inc., 301 No. Charles St., Baltimore, Md.


Shortly after the conference, the Treasury Dept. announced the minting of silver dollars — now, along with all other coins, in short supply. Fall Joint attendees know where they all are, but, with few exceptions, failed in their attempts to take any home. Back to the kiddies, instead, went sales promotion literature, aching feet, and exasperation. Alas, there was just too much to see and do.

Next stop: Washington, D.C. ■

The personal experience related here is no fable. The author, a senior programmer, writes about a computer being marketed today. And while highly critical, its intent is to question both this nation's military procurement procedure and the performance of a highly-regarded computer manufacturer. The particular model described bears a serial number in the teens — not the first off the assembly line — from among 100 or so delivered and on order.

COMPUTER X: A USER'S CRITIQUE

by GOMER WHEATLY

 Brand X was conceived in a laboratory committed to profit at any price. The genetic defects of this computer reflect the general sickness of the computer manufacturing industry; its poor performance reflects the irresponsibility of the hard sell and soft buy. It's the soft buy that concerns me most. If we, the computer programmers, do not insist on adequate design and performance, our supervisors will continue to buy inferior equipment. But with enough pressure from the bottom, the computer industry may eventually amount to something. Some of the areas which need significant and industry-wide improvement are illustrated by my experience with Brand X.

the minimization fallacy

There is a widespread feeling that if a computer is small it is easily repaired. Brand X achieves small size by time-sharing and by a minimal instruction set. Servicing a time-shared computer is extremely difficult; most of our computer failures have been, naturally, so basic that a whole constellation of operations was affected. The computer simply would not do anything; the service man could not get a live symptom. His usual approach was to replace one card after another until the air cleared. Naturally, this shot-gun approach was time-consuming. If

34-week test

the failure was intermittent, a week's loss of time was not unusual.

Small size was achieved partially by abbreviating the order code, eliminating many orders which have been useful in other machines. At the technical level we think the "baby was thrown out with the bath." Salesmen emphasize its simplicity, but jargon is a not-too-effective cover for real trouble. It is unthinkable to write a program in other than an interpretive mode of operation. One false move in storing the calling sequence, and some subroutine is clobbered . . . this ruins several other subroutines . . . errors proliferate . . . and the program blows up in a chain-reaction. The original source of the error is usually impossible to find because contents of the sequence counter are gone.

Most program errors eventually lead to the low order memory, which calls for input, usually illegal, and the computer will stop.

If the program is using the interrupt feature (which cannot be disabled by programming), the program would, after false input, be off and running. For this reason, I didn't use the interrupt input system.

abbreviated console

A small console usually means that the computer is

difficult to operate, and this is certainly true of Brand X. Toggle switches are provided to set up the address and then the contents. A whole handful of buttons must be pressed between toggle setups. Thus, temporary changes in memory are hard to make correctly, and the program usually blows up.

The computer can't even be started with the cover on, and must be off all during checkout so that one can see the lights on the registers. To avoid interfering with cooling, a sheet of polyethylene is taped over the gaping hole.

Most console setups require the resetting of several logical toggles. This is accomplished by applying voltage by a wire (called the magic wand) which goes to a power jack. The day is spent reaching for switches and squatting to set logic. One is physically fit, but exhausted.

standard peripheral equipment

Brand X uses a Brand XY paper tape reader which, according to XY's advertising, was not intended to make all other tape readers obsolete. It won't. It runs like a Vietnamese tricycle, and reads tape with equal facility. When 70 per cent of our troubles were due to the reader, manufacturer X realized its mistake in specifying Brand XY. The reasonable solution was a different brand of reader; instead, X began replacing with new XY gear. I have lost count, but we have had, in 1½ years, about four optical units and five reelers, each guaranteed by X to solve all our problems. If it is possible to read the program twice a day, I consider myself lucky. Never mind if I keep one finger on the brake, and a whole hand on the take-up reel. I have a colleague to push the computer buttons.

Incidentally, the torque on rewind is so great that, by the time you get to the front of the tape, it has folded over and reverse-wound about 20 feet. The tape will tangle and break if you don't rewind the first few feet by hand.

With such a reader, no one would think of assembling a program on Brand X. Instead, an assembler is written for a commercial machine, and the assembly output deck is fed to a card-to-tape perforator to get an input tape which, fortunately, has check sums every 10 locations. The machine is not self supporting on the land, in the air, or at sea. It must be mothered by a BIG machine.

software support?

X provides a software package of subroutines free of charge. It's no bargain. We couldn't get it to multiply two negative numbers; it couldn't tell the difference between second and fourth quadrants; square root shifted incorrectly, giving incorrect results; and on and on. All this was due to slipshod debugging at X. We wrote 75 per cent of our software ourselves; the remaining 25 per cent we took from X, but had to debug.

Not a good record for X's support, particularly since they have put most of the burden on software in order to sell a small computer. What they left out in hardware the customer pays in programming; no net saving is gained and large delays result. They say that you don't have to know the engineering details of the computer to program it, but that is very far from true.

service

Each service man brought a trainee with him. On the next call, the trainee came alone with another, greener, man. The crop got greener and greener, until the last man to come was alone, a graduate of a two-week course, which had been cut to one week due to scheduling difficulties. They were all brave men, and I liked them all, but we certainly lost time on our delivery schedule.

documentation

Both the engineering and programming documents are incorrect and otherwise difficult to interpret and use. They were typed directly from personal notations collected from all over manufacturer X's facilities with little attempt at organization. The paragraphs are numbered and there are pictures every so often, but there is little other appearance of organization.

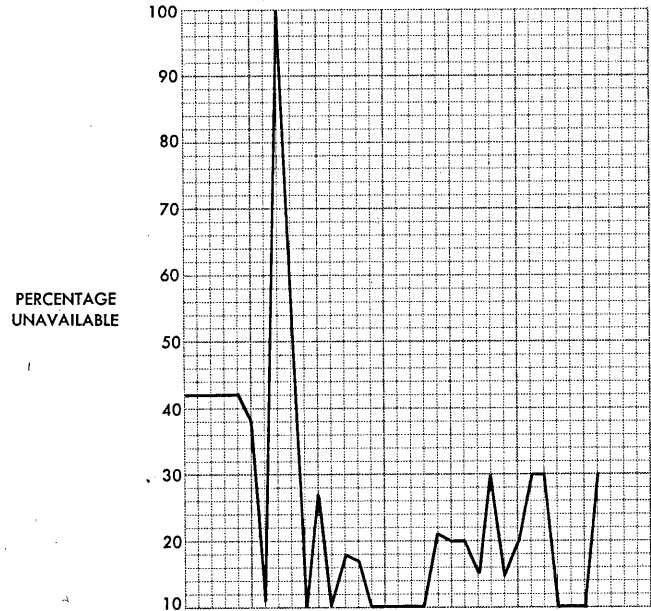
reliability

The following graph is not a schematic for a rollercoaster; it is the up-time record for our Brand X.

history

All of the above-mentioned difficulties with Brand X were completely obvious on first reading the advertising literature. Why then, you ask, did we buy one? First, there was not another computer in its class for the price. Since there are no standards in software or performance, the hardware price tells the story.

Second, we gave up too soon. I objected strongly to buying the computer, favoring two other machines which were adequate for the job but more expensive. My supervisors supported me into high-level conferences, so I have



Shown is the down time for a Brand X computer, beginning four weeks after its delivery to the prime contractor for checkout, and continuing through 30 weeks until its shipment to the installation.

no complaint there. But our customer was the department of an armed service, and ultimately an officer who wears stars. I can only guess what bad technical advice, selling tactics, or political pressures he succumbed to in specifying Brand X as a standard service computer, but he insisted on Brand X.

Had I been willing to quit my job, or if my company had suggested turning down the contract, we might have won our battle for another computer. I'm ashamed that money and the inconvenience of interviewing held me back. (I think it would have been easier to find a new job than to battle Brand X.)

Anyway, we all blamed the service, instead of ourselves. There are now more Brand X's than ever. If we had put our money where our mouths were, we might have made our good advice stick, and would have saved our national defense effort from the trouble it will experience with Brand X. ■

COMPUTERS AND THE CONTINENT

europe revisited

by W. K. De BRUIJN



The following article, which originated as correspondence, complements coverage of the British-European computer scene in the August 1963 issue of *Datamation*.

In Europe, computers have been built by firms with a variety of backgrounds:

- Manufacturers of punched card equipment: Bull in France, BTM and Powers Samas (now together in ICT) in the U.K.;

- Office machine manufacturers: Olivetti in Italy, Olympia in Germany, Facit in Sweden, and several others who have built machines that are partly computers and partly office machines, such as Addo in Sweden and Siemag in Germany;

- Electrical equipment manufacturers: English Electric, EMI, and others in the U.K., Telefunken and Siemens in Germany, and Philips in The Netherlands;

- Universities and scientific organizations in such countries as the U.K., Germany, Austria, Sweden, The Netherlands, Denmark, and several East European countries;

- Firms such as Lyons in England (highly diversified lines), Saab (airplanes and motorcars) in Sweden, Sepsea (Schneider group) in France.

Many of these computers have never gone beyond the laboratories where they were built, and are not being produced for potential customers.

Already leaving the market are Addo in Sweden, starting with the Alvac III; Olympia in Germany (subsidiary of AEG and now brought together with another subsidiary named Telefunken); Standard Electric both in England and Germany. Others like Facit in Sweden and AEI in England have, so far, sold but a few machines.

Many have scored local successes, few have succeeded in really penetrating markets other than in their home

market. Most successful in this way is the French firm, Bull, but this firm was already for a long time entrenched as a punched card equipment manufacturer. ICT is, since its combination with EMI and Ferranti, maybe the biggest European manufacturer. But even then this firm is mainly oriented on the Commonwealth and is now starting to penetrate the Continent. It has sold a score of machines in France and another score in Scandinavia and Germany together. Considering the market, this is only a small number. ICT has a very strong position in the U.K. but on the Continent they have but recently started.

The main difficulty in the European market is that a firm having, for instance, a strong sales organization in Germany does not necessarily have a good chance for success in any of the neighboring countries (with maybe the



Mr. de Bruijn is manager of application research of the Netherlands Information Processing Research Center, and co-author of the report, "Development of the Computer Market in Europe," prepared at the request of the European Economic Community and published in June 1963.

exception of Austria). This is caused by differences in language, in mentality, in habits, in traditions, and so on. One has to start anew in each separate country finding people who know the way, establishing contacts. It is still amazing how little people know about other countries. (A Netherlander must not be surprised if an inhabitant of southern France asks, "Is not Amsterdam situated somewhere near Paris?") Manufacturers with good success in their own country are:

The U. K.:	ICT (including EMI and Ferranti), English-Electric, Leo and Elliott (in combination with NCR);
France:	Bull and Sepsea;
Germany:	Zuse, Siemens (coming out with a bigger and better computer), and Telefunken (mainly with analogue computers);
Italy:	Olivetti;
The Netherlands:	Electrologica;
Sweden:	Saab;
Denmark:	Disa Electronics (recently started).

Few of these firms have had success outside their own countries. Apart from the two big ones mentioned before, Ferranti had some success in Sweden and Electrologica successfully penetrated the German market; several others have sold odd machines in other countries.

u. s. manufacturers in europe

The main part of the European market is still in the hands of U.S. manufacturers. And here IBM is the giant. They have (apart from the U.K.) probably something like 50-80 per cent of the computer market in most of the continental countries. Maybe sometimes even more. IBM is probably bigger than all the other manufacturers together as far as the European market is concerned.

The only other U.S. manufacturers with real success in Europe are Univac and NCR. Univac has sold over 100 Solid State computers and is now successfully concentrating on bigger machines such as Univac III, 490 and 1107; NCR has started late, but has some success with the 315 and is quite successful with the 803. Many others have just started, notably Honeywell, GE and Control Data. A special case is RCA, selling its 501 in England under the name KDP 10 through English Electric, and its 301 through ICT under the name ICT 1500, and through Bull as the Gamma 30. Bull has been especially successful in selling these RCA machines, and will probably soon reach the first 100. ICT has probably sold something more than half that number, mainly in the Commonwealth. The competition in France of ICT and Bull with the 301 is only slight. So far, only one ICT 1500 has been sold in France against several scores of Gamma 30's.

There is a marked tendency to use bigger (not yet really big) computers which is shown by the success of machines like the IBM 7070 (probably about 70), Univac III (some 20), Olivetti 9003 (more than 10), Telefunken TR 4 (some 10), Gamma 60 (15), Leo III (over 20), Ferranti Mercury and Orion (some 30), and Siemens 3003 (some 20). The big market, however, is that for machines of the IBM 1401 class; of this type more than 2,000 have left the IBM factory in Germany destined for the whole world (U.S. excepted) but mainly for Europe. A fair estimate is over 600 to Germany, 300 to France, 200 to the U.K., 150 to Italy, between 50 and 100 to the smaller countries, Switzerland, Sweden, The Netherlands, Belgium and Austria, and a score or more to Denmark, Norway and Spain. Without trying to be complete, I think this gives a fair view of the situation as it stands now.

computer use in europe

Comparing the state of computer use in various countries is a very difficult job. The difficulties lie in finding an acceptable standard of comparison and in getting the data. For our study, the best we could find was the number of computers against the total of the working population, excluding agricultural and fishery workers. There may be better standards theoretically, but these cannot be used because the data needed are not available.

One can try to introduce some refinements, such as computer development, the number of tape and disc systems, the number of bigger machines, and the relation between old and new machines. With this in mind, some data for these are given below.

The second problem of getting needed data is also very serious. In only one country is a regular, quarterly survey of computers installed and ordered published; this is the U.K. As a result, it is very difficult to compare the U.K. with other countries where such data are difficult to obtain. Moreover, it invites the opinion that more computers are being sold in the U.S. than in some other countries.

As far as computer development is concerned, the U.K. is undoubtedly leading the field. The Atlas (formerly Ferranti, now ICT) is probably the most advanced and the biggest computer known, at least if the year of installation (1961) is taken into consideration. The German industry, however, is fast catching up, as shown by the new Siemens 3003 computer.

Data on the number of magnetic tape and disc computers installed are again difficult to obtain. France has probably far more disc computers than any other European country as a result of the success with the Gamma 30 (RCA 301). Many IBM 1401's in Europe have magnetic tape units, as do nearly all 1410's, which are sold in scores all over Europe. One may safely state that in this regard, development is about the same in most West European countries.

Some idea of the volume of installations of larger scale computers can be obtained from the following:

Belgium:	one Gamma 60, three IBM 7000 class, one Ferranti Mercury
Austria:	one IBM 7040, one Univac III, one Univac 490
France:	12 Gamma 60, over 40 IBM 700 and 7000 class, one Univac 1107 (first Univac computer in France), three GE 225, one CDC 3600
Germany:	at least 20 IBM 7070, 12 other IBM 700 or 7000 class, two Univac 1107, nine Univac III, eight Telefunken TR 4, over 15 Siemens 3003, one CDC 3600
Denmark:	one IBM 7070
Italy:	two Gamma 60, some 15 IBM 700 and 7000 class, over 10 Olivetti 9000 class, two Univac III, one Univac 490
The Netherlands:	one IBM 7070, one IBM 705, one Univac III, two NCR 503, three Electrologica X8, two Telefunken TR 4
Norway:	one Ferranti Mercury, one Univac 1107
Spain:	one IBM 7070
Sweden:	over 10 IBM 700 and 7000 class, three Ferranti Orion, at least two RCA 501
Switzerland:	six IBM 7070, six Univac III
U.K.:	Some 10 IBM 700 and 7000 class, seven AEI 1010, \pm 10 RCA 501 (KDP 10), some 20 LEO III, some 30 big Ferranti machines among which

three Atlas, five NCR 502 and 503, one Univac 1107, one Univac 490, three EMI 2400

When studying these figures it should be taken into consideration that only those concerning the U.K. and the Netherlands may be regarded as nearly complete. IBM 1410's are not mentioned because the available data are undoubtedly incomplete.

When comparing the numbers of computers in each country there is still another important point. This is the type (and quantity) of machine that make up the total. The fact that in the earlier years (only some years ago!) the U.K. was undoubtedly leading the European field, has its natural setbacks in this respect. Many of the British machines are earlier generation computers such as ICT 1200, 1201, 1202 (some 60 together), English Electric Deuce (about 30), LEO I and II (some 12), Ferranti Pegasus, Mercury and Mark I (together about 60), National Elliott 400 series (over 30), Stantec Zebra (over 20). These together with some IBM 305 and 650 machines make a total of about 200 still in use.

The percentage of similar computers in other European countries is much smaller. Only the Gamma ET and the older IBM machines have been used in these countries, many of which have in the meantime been replaced. The later start on the Continent resulted in a far higher percentage of solid state computers. The fact that IBM is now penetrating the U.K. market will soon change this. It may be of interest to mention that since the agreement between IBM and BTM (now ICT) was stopped, IBM sold more computers in the U.K. than all U.K. manufacturers together on the Continent, and probably even more than all European manufacturers together outside the U.K. This all seems to indicate that the European manufacturers so far have not succeeded in really threatening IBM, and it will be interesting to see how other U.S. manufacturers will fare in the difficult European market.

comparing the u. s. and europe

If it is difficult to compare European countries, it is many times more so when the U.S. is taken into consideration. There are a few important points that may make it nearly impossible to make a fair comparison.

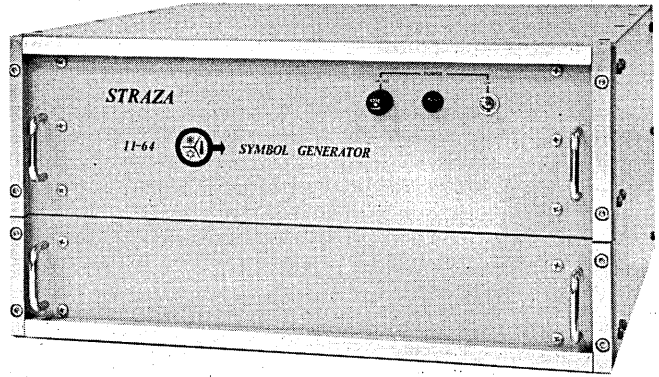
First of these is the fact that the U.S. forms one very big country with one language, relatively uniform business practices and many big firms, whereas Europe is divided into many countries with nearly as many languages, other important differences, and a much smaller number of big firms.

Second, and maybe even more important, is the fact that computer prices all over the world are based on dollar prices. There is a marked difference between the buying capacity of a dollar in the U.S. and a pound sterling, a Dutch guilder, a German mark, etc., in their own countries on the one side, and the rate of exchange between dollars and pounds or guilders or marks on the other.

For instance one dollar is \pm fl.3.60 (rate of exchange) but of most commodities one can buy much more for fl.3.60 in The Netherlands than for a dollar in the U.S. In other words a computer of a certain price is much more expensive in Europe than in the U.S. In order to put a computer into economic use, a U.S. user need only save so many men, but a European user will have to save maybe twice that number because of that difference between rate of exchange and buying capacity. As long as this difference lasts, it will be one of the main reasons why the total number of computers to be sold in Europe will be smaller than that in the U.S. ■

January 1964

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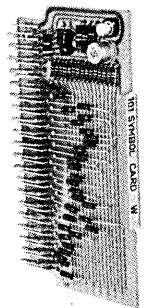
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CIRCLE 28 ON READER CARD

GOVERNMENT REPORTS ON USE OF EDP

A report on the use of edp equipment in the federal government has been issued by a House of Representatives Committee on Post Office and Civil Service (actually it's the work of the Subcommittee on Census and Government Statistics). Released in October, the 121-page report is a thoughtful, well-organized and well-written survey of the major problems facing federal government in its use of computer systems.

After noting in the introduction its agreement with the Comptroller General on the general inefficiency and wasteful management and use of edp equipment in "agency after agency," the report goes on to spell out 48 recommendations in five key areas: organization and management; machine technology and people; reports, statistics, and evaluation guides; purchase vs. lease (procurement); and standardization.

Many of the recommendations are vague and inconclusive; there is a plaintive tone in the one concerning purchase vs. lease: "There are widespread differences of opinion as to whether it is advantageous to purchase or to lease edp systems, and the causes of the dilemma should be determined." Others are intriguing — the consideration of establishing a management sciences academy, the sug-

standardization, people too

gestion that the standardization problem warrants attention at the cabinet level. One healthy sign: the report's recognition of the importance of people in edp systems.

In passing, the report takes a few swipes — at H.R. 5171 (a bill to authorize GSA coordination of procurement, maintenance and operation of federal edp activities), at the "rental fixation," at underutilization (e.g., one-shift use of a 24K 7070), and at GSA "delays in negotiating contracts" which have proven "very costly to the industry."

On the important problem of standardization, the report notes, "Thus far, progress has been slow." And it calls for an accelerated program, with the federal government taking a leadership role, "probably through the Department of Commerce."

Also included in the report are descriptions of applications at the departments of Treasury, Defense (Defense Supply Agency, Air Force), Post Office, and the AEC and NASA.

The report, "Use of Electronic Data Processing Equipment in the Federal Government," is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, for 35 cents. ■

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CIRCLE 76 ON READER CARD

DATAMATION

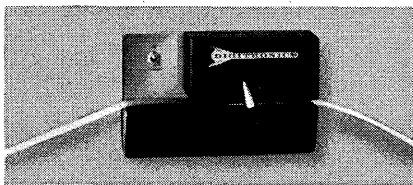
CIRCLE 75 ON READER CARD

Who's the best tape reader in town?

me!

I'm barely 1 year old—a tyke in the unidirectional world of photo electric tape readers. Even so, I've achieved a reputation for "clear vision" that's the envy of many of my older cousins. Depend on me to read perforated tape at speeds up to 300 cps. I've all the basic qualities of

higher speed units: self-adjusting brakes, solid state circuitry, self-cleaning photo diodes, corrosion-resistant stainless steel parts and conservative derated components.



The way I've been sounding off, you might think I was the only one in the family. I'm not. I come from a long line of tape readers and handlers. Readers that are immensely capable of accommodating 5 to 8 level tape interchangeably at 60 to 5000 cps. Tape handlers for

5 to 8 level tape up to 1000 cps. I'm Model 2500; for full details on all models, see your local Digitronics representative or write Digitronics Corporation, Albertson, N. Y.

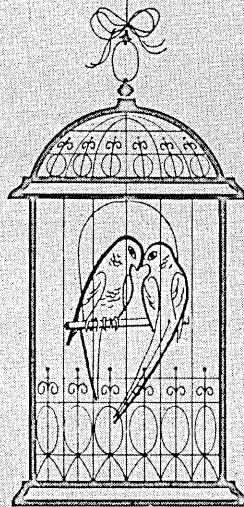
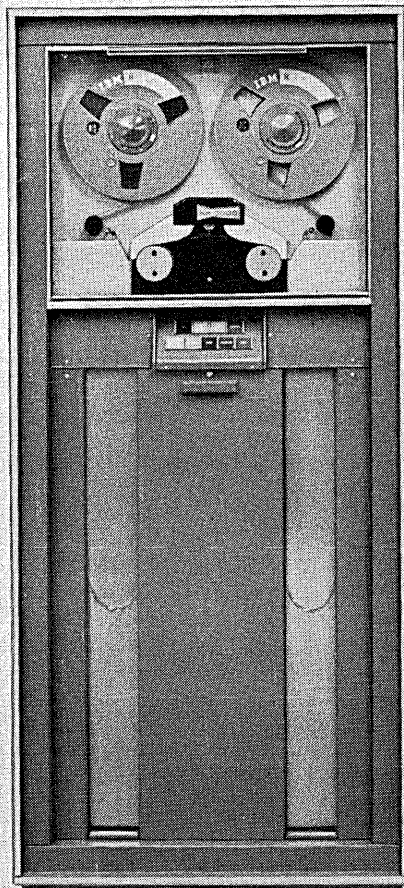


DIGITRONICS

when every bit counts

CIRCLE 26 ON READER CARD

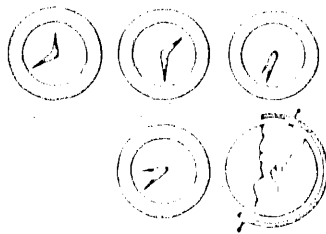
compatibility plus



*[we could sing a song of praise . . . but it all comes back to the simple phrase
... COMPATIBILITY PLUS]*

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CIRCLE 29 ON READER CARD



NEWS BRIEFS

INSURANCE FIRM PLANS NATIONWIDE INQUIRY SYSTEM

Communication linkage of 79 nationwide cashiers offices with a real-time dp system in the home office is being planned by the Equitable Life Assurance Society of the U.S. In addition to record maintenance, it will speed the handling of inquiries from policyholders; an average response time of less than five minutes is expected. The investment by the world's third largest insurance firm: 12 megabucks.

Completion of the project is slated to take five years, with initial installation contemplated this year. Tentative hardware include three 160K IBM 7080's, 16 IBM 1301 disc files, and a 7750 transmission control unit. Some 114 IBM 1050 terminal units will be placed at cashiers offices and home office operating departments. Transmission will be by phone lines.

BANK ADDS MEDICAL BILLING TO KEEP ITS COMPUTER BUSY

An automated accounting service for doctors is being offered by the U.S. National Bank of Omaha, both to use idle GE 225 time and attract new banking customers. For a monthly fee, the bank handles billing and mailing,

and supplies a daily register of business, monthly accounts receivable list, and income tax records. The customer need not bank with the firm.

In each doctor's office are a Data-Phone set (\$7 per month) and an IBM 1001 card reader (part of the fee). Supplied by the bank are pre-punched cards for each patient, with space to record charges, and a file of cards with data on services rendered by the doctor. Patient statements, which can be mailed by the doctor, do not identify the bank.

A goal of 50,000 patient billings per month has been set, and expansion of services to include other professionals and businesses is contemplated. A prescription druggist already is using the service.

CALTECH SHOOTS FOR MID-YEAR ON-LINE SYSTEM

A new Caltech computer center, housing a 7090/7040 system, was dedicated last month. The 32K '40 serves as a monitor/controller for the 32K '90; the two systems share a double 1301 disc file. They are also linked by a special Caltech-developed communicator which allows either machine to trap the other under program control,

and uses a tape channel for core-core transfer of control data at 375K cps.

The 7040 is linked to I/O—remote consoles, plotters, a Burroughs 220, printer and punched card gear—by an IBM 7228 multiplexer. Four of the remote consoles—developed and built by Caltech—will be installed in on-campus departments and research organizations for on-line use by students and faculty. Target date for this time-sharing use of the system is June '64. The building of the Willis H. Booth Computing Center was made possible by gifts from the Booth Ferris Foundation, NYC, and the National Science Foundation.

ITT DP CENTER DEVISES BUSINESS PLANNING AID

A computerized economic yardstick for business has been announced by the ITT Data Processing Center, Paramus, N. J. STATUS reportedly checks historical figures of a company against a data bank of some 300 economic indicators, and selects the meaningful statistics which relate to a company's activities. Forecasting can be from 1-15 months in advance.

A time-series analysis reduces data on a company's seasonal performance to detect major trends, and a regression analysis then compares this history with such economic indicators as population, employment, GNP, and the perennial favorite: freightcar loadings. Statistics are national, international, and by industry. In a controlled test of sales forecasting, results to within 15 per cent of actual are reported.

CIRCLE 240 ON READER CARD

IBM INTRODUCES DATA ACQUISITION SYSTEM

A data collector-processor, the 7700, has been announced by IBM. It features a multiplexor with provisions for up to 32 input or 32 output subchannels, core storage of 16-48K (18-bit) words, and a two usec memory cycle time. It operates with telemetry, microwave, and conventional transmission lines.

Peripheral devices include a card read-punch, typewriter, and mag tape units. Price of a 7700 system with 16K words of core, typewriter, and

SIGBDP PANEL SIGHTS IN ON COBOL

COBOL compile times of one minute on the IBM 7090, three hours on the 1401, 45 minutes on the 7080, and six minutes on the 7010 were cited by a member of a panel at a San Francisco Bay Area meeting of the Special Interest Group on Business Data Processing. Chaired by Dr. Ned Chapin, panelists were John Walters, California Standard Oil, Bill Shaw of Lenkurt, Harry Hicks of Computer Usage, and Paul Sleeper, United Technology Center.

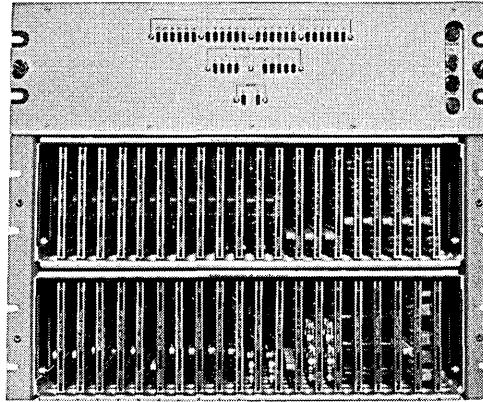
Regarding COBOL compatibility, a panelist said, "It was a refreshing admission when the RCA 301 manual stated 'It isn't.' Each manufacturer has selected only a subset of the total language for implementation, including his own 'extras.'" Use of different character sets which required re-key-punching caused incompatibility be-

tween the B 5000 and the 7090, but, it was suggested, compiler diagnostics usually point out changes required when going from machine to machine.

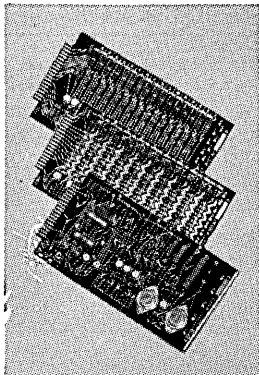
As to the language's documentation value, it was observed that an outline program format is easy to follow, but its documentation value is lost. The tendency to abbreviate and leave out optional words also negates documentation value. Save time? Re-writes and debugging are reduced because of diagnostic aids, COBOL errors are grosser than in machine language (thus easier to find), and keypunch operators seem to prefer English to mnemonic codes.

Said one panelist: "Anyone can write a COBOL program, but it almost takes the author of the compiler to write a good one."

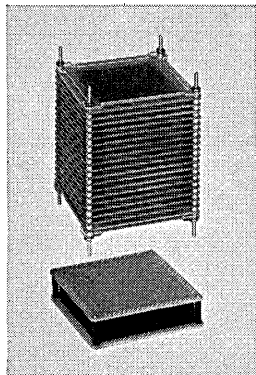
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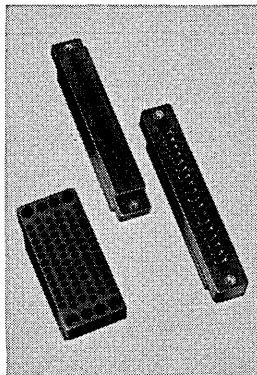
FROM THESE STANDARD, IN-STOCK IGC MODULES



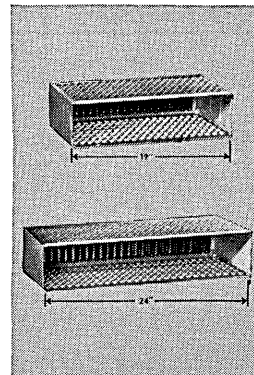
Printed Circuit Cards — Standardized circuitry fits memory systems having wide range of speeds and capacities. Cards clearly titled and coded. Convenient test points.



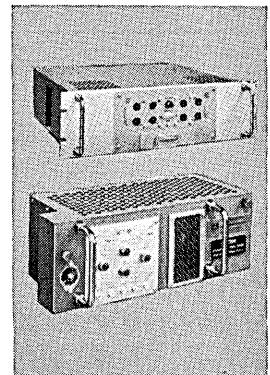
Memory Stacks — Micro-stack, printed circuit, or temperature controlled stacks. Coincident current speeds down to $2\mu s$, word organized to $1\mu s$. Capacities virtually unlimited.



Connectors — All cable and card connectors are solderless and gold plated. Card connectors furnished in two types: standard computer grade and bifurcated, bellows type.



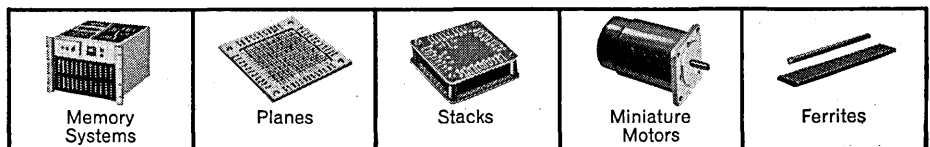
Mounting — Memory systems can be packaged in 19-inch or 24-inch unitized relay racks, or in a cabinet. Unique design gives maximum air flow for cooling, extends component life.



Accessories — Rear mounted or remote power supply . . . indicator lights . . . built-in test and parity modes . . . custom input and output voltage levels . . . ruggedized packaging.

Indiana General offers you a complete line of high dependability, standardized, commercial memory systems . . . available with a wide range of optional features. **Magnetic Storage Systems Are Our Business.** Profit from our unequalled design experience and production capabilities. Call or write today to Indiana General Corporation, Electronics Division, Keasbey, New Jersey.

INDIANA GENERAL



CIRCLE 30 ON READER CARD

NEWS BRIEFS . . .

console is \$269K, and rental is \$6,700.

● Honeywell EDP, which manufactures computers in Massachusetts and Japan, has begun manufacture of all but the recently-announced 200 in Scotland—for sales in the U.K. and Commonwealth countries. The 200 reportedly will be included “when volume of sales there justifies it.” A 1.7-megabuck order for four H-400’s has been placed by the Nippon Tel & Tel Public Corp. of Japan, hardware to handle manual toll accounting and billing for some 1.2 million phone subscribers.

● A computerized typesetting system using the RW-230B has been designed by TRW Computer Div., Canoga Park, Calif. Requiring no air conditioning, the computer’s output speed is 9,000 newspaper lines per hour, its hyphenation accuracy better than 95 per cent. Hyphenation is by the logic method, a process which reportedly takes two to three milliseconds. Marketing, installation, and servicing of typesetting systems with the TRW Comp/Set computer and Teletypesetters is being conducted by Fairchild Graphic Equipment under a recent agreement between the two firms. The computer sells for \$85K. Rental cost, not yet announced, is said to be about \$2K.

CIRCLE 241 ON READER CARD

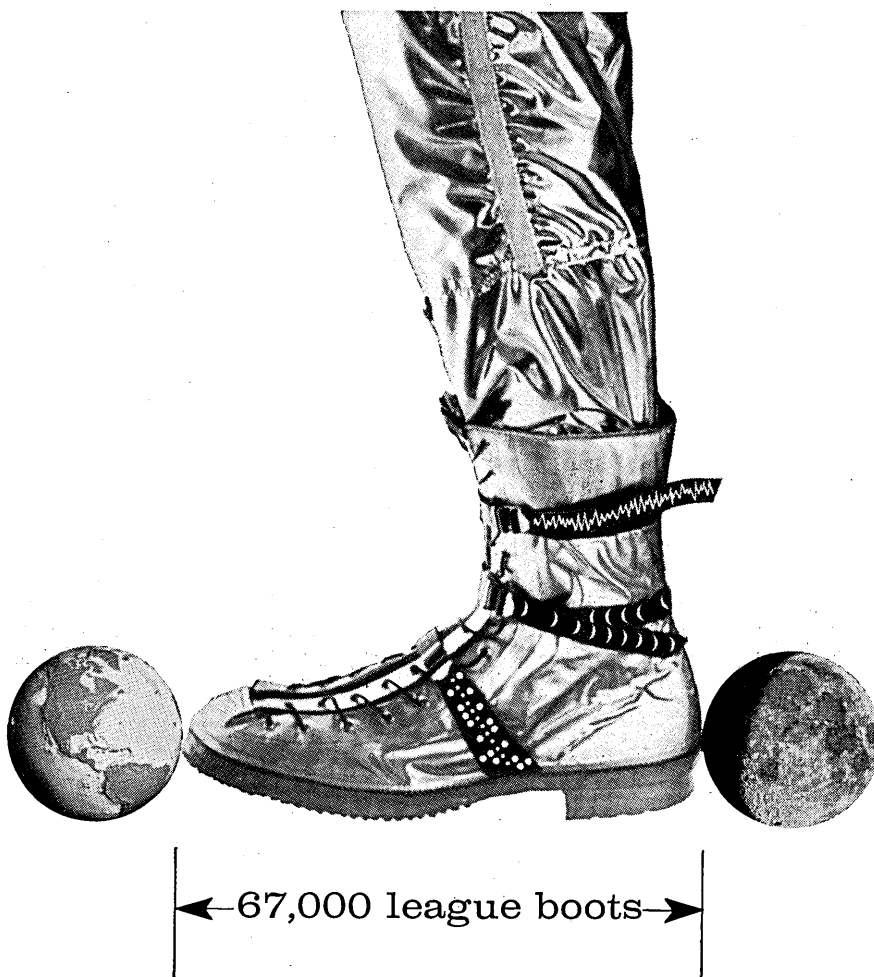
● An agreement to enhance its compiler-writing abilities has been made by Planning Research Corp., West Los Angeles, with Digitek Corp. The former’s Information Systems Div. (primarily command-control systems) will use Digitek’s syntax-oriented compiler technique to write JOVIAL compilers.

● A dp consultant-brokerage firm, Information Processing Systems Inc., has been formed in New York City to aid users in evaluating, selecting, and upgrading computer systems, and act as selling agents for used hardware. The president is George H. Heilborn, formerly with TRW and Philco Computer Div.

● RCA, which has developed a lab-model cryogenic, thin-film memory (see Aug. *Datamation*, p. 67), has announced experimental memory units made of tissue-thin, laminated ferrite material. One such unit stores 16K bits on a 1 x 3-inch surface only 0.005 inch thick. A 256-bit unit is said to process information at “10 million bits per second.”

January 1964

DATA HANDLING ENGINEERS



To maximize success of future lunar and space probe flights, in-flight performance data must be conveyed rapidly, accurately, and reliably from vehicle to Flight Control at Cape Kennedy. Planning, systems design, and implementing the required instrumentation systems at range stations and the Cape is the task of Data Handling Engineers with Pan Am’s Guided Missiles Range Division.

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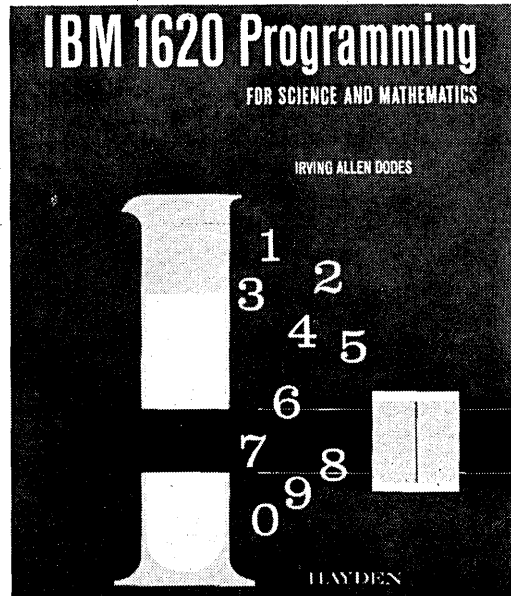


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3. It is complete. The book reviews numerical analysis and teaches three major types of programming—Machine Language (absolute), SPS, and FORTRAN. In addition, both fixed-point and floating-point calculations are explained and profusely illustrated.
4. It covers these basic problems in detail. The production of a table of values for formulas of any complexity; the solution of equations to a pre-determined degree of precision; problems involving vectors and matrices; problems in statistics—including the processing of large bodies of data.
5. It provides explicit answers to virtually any question on programming: how to avoid the five major areas of error in programming; when to use SPS or FORTRAN; what specific types of paper and cards to use.
6. It's useful. The author has included a number of sample programs—including debugged programs—as well as several sets of practice problems for self-testing. Also, a big, nine-part Appendix summarizes essential procedures, error codes, messages, and other vital information to solve your on-the-job problems instantly.

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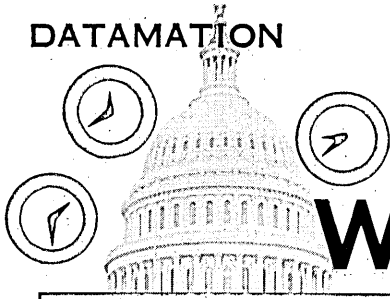
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WASHINGTON REPORT

NEW YEAR OUTLOOK FOR EDP LEGISLATION

Strong pressures being exerted by President Johnson for economies in military and space spending create more favorable prospects for passage in 1964 of the Brooks Bill (H.R. 5171). Approved by the House last July but now sidetracked in the upper chamber, the bill has aroused considerable opposition in nearly all computer-using executive agencies.

Heart of the bill is delegation of sweeping authority to the General Services Administration to coordinate and control the purchase/lease, maintenance, and use of dp equipment, and to operate or provide for the operation of the hardware. According to its author, Rep. Jack Brooks (D.--Texas), implementation of the bill would save the government more than \$100 million a year -- about one-eighth of anticipated government expenditures for dp equipment in fiscal '64.

Leading the forces for passage of the Brooks Bill is the General Accounting Office, auditing arm of the Congress, which reportedly was told by President Johnson: "I want you to help me find every penny we can save, wherever it may be." But opposition to it (and to a similar measure sponsored by Senator Douglas) has been spearheaded by DOD and other executive agencies. At forthcoming appropriations hearings for these agencies, fireworks may result, with Congressmen armed with a series of GAO reports documenting misuse of funds in edp equipment procurement (see below).

The House Committee on Post Office and Civil Service found fault with the Brooks Bill on several counts, although sympathetic with its overall intent. Faults: too hastily drawn up, too broad in scope, proposed after too little consultation with agencies involved, and passed with excessive haste. The committee also contends that any edp procurement agency should be located high on executive organization charts, not as a lower-level GSA department. A general if nebulous feeling is that the establishment of such an agency anywhere would result in a whittling down of IBM's present massive share of federal installations.

Outlook for passage has been brightened, some say, by the political association of the bill's author with fellow Texan Lyndon Johnson. The two are identified as "close personal friends" for many years, and the President's "closest associate in the House."

Even so, the biggest influence on the bill's passage in '64 will be the handling by Sen. McClellan's Committee on Government Operations. No hearing on the bill is presently scheduled until after June 30, when a report on dp procurement is due from a blue ribbon commission appointed by BuBudget at the late President Kennedy's behest.

LEGISLATION TO ESTABLISH
NATIONAL I.R. CENTER

Another piece of pending legislation is H.R. 1946, introduced by Rep. Roman C. Pucinski (D.--Ill.). It provides for establishment of a National Research Information Center, preferably in Chicago, Pucinski's home bailiwick. At hearings last year, testimony on the pros and cons -- mostly pros -- of such a center have been recorded, and more are scheduled for 1964. With tangible legislative action, prospects are for some exciting in-fighting among manufacturers on equipment to be installed. Prestige value of having a system in such a national center would be enormous.

McNAMARA LIKELY TO STICK

The consensus of informed opinion in Washington is that Defense Secretary McNamara will continue in his present post for the duration of President Johnson's bob-tail term, perhaps much longer if the former vp is re-elected. The heavy emphasis by McNamara on the use of computers in DOD is thus likely to continue, a policy making the Officer Corps perhaps the nation's biggest pool of displaced middle management. Objective conditions, however, rather than McNamara's personality, are considered to be the principal cause for continued centralization of command and control via computers. Potentially catastrophic events like the Cuban Crisis of October '62 have made it mandatory that the Secretary and President have instant, intimate details on the military defense posture. Forecast: more, bigger computers in DOD.

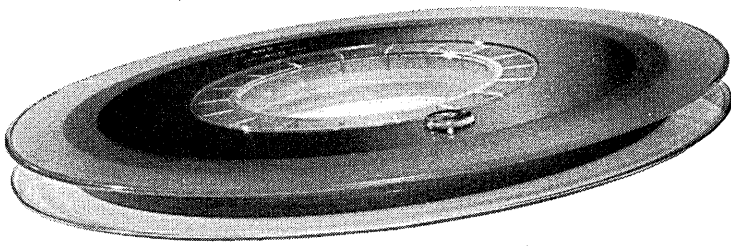
SCIENCE & TECHNOLOGY COUNSEL

Congressmen, confronted by the almost daily task of making decisions on technical matters involving hundreds of millions of dollars, have been increasingly concerned about the lack of counsel in resolving technological complexities. Sen. McClellan's Committee on Government Operations is tentatively slated to hold hearings this session on establishment of a 12-man Science and Technology Counsel, which would advise both legislative and executive branches on these complex subjects, among which is computers and their use. Appointed by and available to both Congress and the President, the Counsel would presumably relieve the situation.

REPORT RIPS WHITE SANDS

Last November, the Comptroller General's office released the 12th in a scathing series of reports which detail slipshod financial management by government agencies in procuring dp equipment and services. Thus far, excess costs amount to \$6,696,000.

Focusing on the White Sands Missile Range in New Mexico, this 12th report is one of the most devastating in the series. In 1960, according to GAO, the Army, which operates WSMR, continued to lease rather than purchase two IBM 704's although an offer was made to sell the systems at a 70 per cent discount from list. The decision to continue leasing, in less than three years' time, resulted in "unnecessary cost of \$1.3 million" to the government, GAO says. Piling injury on injury, the report notes the Army turned in the 704's, in mid-63 for more modern equipment at the same time the Navy was purchasing another 704 at an additional cost of almost \$650K.



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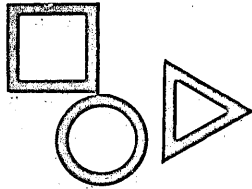
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The desk-top PACE TR-20 features internally packaged resistors, an amplifier computing accuracy of .01%, and four-channel oscilloscope display. Power requirements are 110-120 volts, 60 cycles/220-240 volts, 50 cycles. ELECTRONIC ASSOC. INC., Long Branch, N.J. For information:

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memory system

PERMACARD is a read-only memory system which uses plug-in planes and no cores. The principle of current loops on a pluggable printed circuit word line array is used to store digital data. System cycle time is one usec with an access time of 0.5 usec. FABRI-TEK, INC., Amery, Wis. For information:

CIRCLE 201 ON READER CARD

digital tape transport

The TM-7 has a tape speed of 36 ips, packing density of 200 and 556 bpi, and start/stop time of 10 ms. Start/stop distance is .180 inch $\pm 15\%$, and rewind speed is 180 ips. AMPEX CORP., 401 Broadway, Redwood City, Calif. For information:

CIRCLE 202 ON READER CARD

analog memory

ANA-LOK model 420A uses hybrid analog-digital circuitry and provides effective time-independent storage of a single voltage level. Response time is 10 usec to 0.05% in track mode for full scale step function. ADCOM CORP., 9732 Cozycroft Ave., Chatsworth, Calif. For information:

CIRCLE 203 ON READER CARD

data communications system

The Data Line Terminal permits the 1004 card processor to transmit or receive data over ordinary telephone lines. The device enables one 1004 to communicate with another, or with the 1107 or 490. UNIVAC, Sperry Rand Building, New York 19, N.Y. For information:

CIRCLE 204 ON READER CARD

memory systems

The DDI series memories are comprised of magnetostrictive delay lines packaged with complete interface

electronics. A typical system incorporates a five-msec line operating at two mc and having a capacity of 10,000 bits. DIGITAL DEVICES, INC., 212 Michael Drive, Syosset, L.I., N.Y. For information:

CIRCLE 205 ON READER CARD

block tape reader

Series 1600 photoelectric block tape reader, designed primarily as a programming input for control systems, reads 20-line, 140 data bit blocks from standard one-inch, eight channel, four mil black opaque paper tape. The standard block is 20 lines and speed is 100 blocks per minute. COLEMAN ELECTRONIC SYSTEMS, 3210 W. Central Ave., Santa Ana, Calif. For information:

CIRCLE 206 ON READER CARD

computer controlled displays

Up to 2,300 points or formatted characters can be plotted at a rate of 30 frames per second on this CRT display unit. Continuous line symbols can be made any size between 3/32" to 1/2" without breaking up into illegible dots or scanning lines. RMS ASSOC. INC., 102 E. Sandford Blvd., Mt. Vernon, N.Y. For information:

CIRCLE 207 ON READER CARD

data acquisition

SODA (Source Oriented Data Acquisition) offers four systems utilizing digital mag tape recordings: Metercorder, Amcorder, Adaptocorder and Countercorder. Each is designed for a

specific function in producing mag tape recordings for computer processing. UGC INSTRUMENTS, DIV. OF UNITED GAS CORP., Shreveport, La. For information:

CIRCLE 208 ON READER CARD

data acquisition

Portable Model 303 features switch dials for entering up to 15 digits of data, recorded on mag tape cartridge, which can then be transferred to Mark I input unit for entry to computer tape. ELECTRIC INFORMATION CO., Broomfield, Colo. For information:

CIRCLE 209 ON READER CARD

optical reader

The 1231 optical mark page reader can scan data sheets at up to 2,000 sheets per hour and transmit this data to a 1440, 1401 or 1460. IBM DATA PROCESSING DIV., 112 E. Post Rd., White Plains, N.Y. For information:

CIRCLE 210 ON READER CARD

disc pack cabinet

Several convenient and attractive disc storage units, including various cabinets in different styles are available. TAB PRODUCTS CO., 550 Montgomery St., San Francisco 11, Calif. For information:

CIRCLE 211 ON READER CARD

display systems

These multiple display digital clock systems provide the capability for observation of digital quantities at from one to 80 remote locations. Time, date or count can be remotely displayed with all displays operating in synchronism. PARABAM, INC., 12822 Yukon Ave., Hawthorne, Calif. For information:

CIRCLE 212 ON READER CARD

cabinet

The 7250 control panel cabinet contains eight shelves for storing eight 910 IBM panels or 16 908 control panels. The unit is mounted on casters. STEELCASE INC., Grand Rapids, Mich. For information:

CIRCLE 213 ON READER CARD

telepath selector

This device has been designed for selection and control of telegraph and data handling equipment. It regener-



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CIRCLE 214 ON READER CARD

tape memory systems

The TM-5100 series combines the TM-5 digital tape transport and DE-100 solid state electronics and can deliver up to 800 bpi packing density at 150 ips. AMPEX CORP., 401 Broadway, Redwood City, Calif. For information:
CIRCLE 215 ON READER CARD

perforator

Model P-150 can punch paper, foil, or Mylar tape at 150 cps, and is able to operate asynchronously, has bi-directional tape handling, and pin sense error checking. TALLY CORP., 1310 Mercer St., Seattle, Wash. For information:
CIRCLE 216 ON READER CARD

decommutation system

The 640 accepts either PAM or PDM signals, regenerates the input and converts the data to a 10-bit parallel word. The system produces an output of 10 parallel binary bits plus parity, and generates up to 50 channels of analog channels for strip chart and oscillograph recordings. TELMETRICS, INC., 12927 So. Budlong Ave., Gardena, Calif. For information:
CIRCLE 218 ON READER CARD

disc file

Series 4000A, capable of storing from 31 to 390 million bits of data, has an average access time of less than 100 milliseconds. 75 milliseconds is required for head positioning. BRYANT COMPUTER PRODUCTS, 850 Ladd Rd., Walled Lake, Mich. For information:
CIRCLE 219 ON READER CARD

d to a converter

The AKRAVERTER has been designed with no capacitors. Its specifications include digital input, $-6V \pm 1V$ binary one, $0V \pm .5V$ binary zero; code is binary coded decimal; output accuracy is .005% per binary one with respect to the reference; and switching time of less than one usec. SILTRONICS INC., 108-140 Pennsylvania Ave., Allegheny County, Oakmont, Pa. For information:
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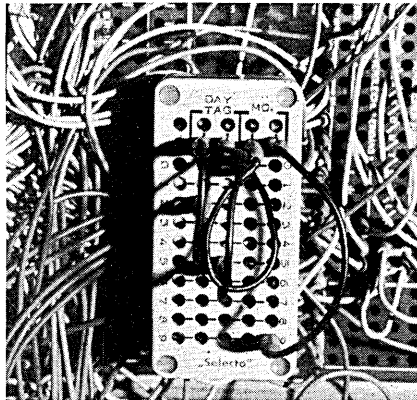
January 1964

monitor oscilloscope

The 12-677 provides visual display of electrical signals ranging in frequency from d-c to 1,500,000 cps for quick look or quantitative analysis. CONSOLIDATED ELECTRODYNAMICS CORP., 360 Sierra Madre Villa, Pasadena, Calif. For information: CIRCLE 221 ON READER CARD

selecto

This data-selector for IBM accounting machines fits over the normal wiring of a control panel. It can set the current date or, when different jobs are

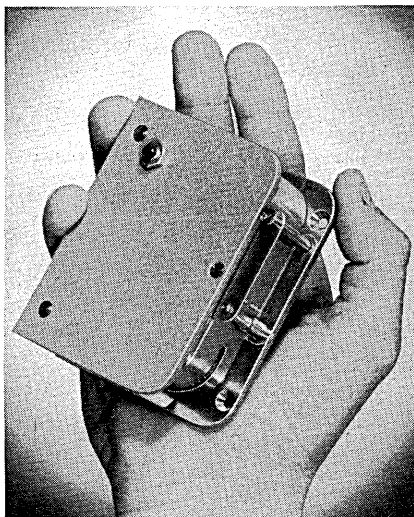


carried out with one control panel, plugged to machine functions, paths of which can then be joined or broken at will. SELECTO-VERTRIEB, 415 Krefeld-Linn, Pastoriusstr. 137, Germany. For information:

CIRCLE 217 ON READER CARD

paper tape reader

The 1280 is able to read well-worn paper or Mylar tapes at 1500 characters per minute. The reader processes 5, 6, 7, or 8 level tapes, even



those exceeding standard EIA hole-to-hole tolerances. NAVIGATION COMPUTER CORP., Valley Forge Industrial Park, Norristown, Penna. For information:

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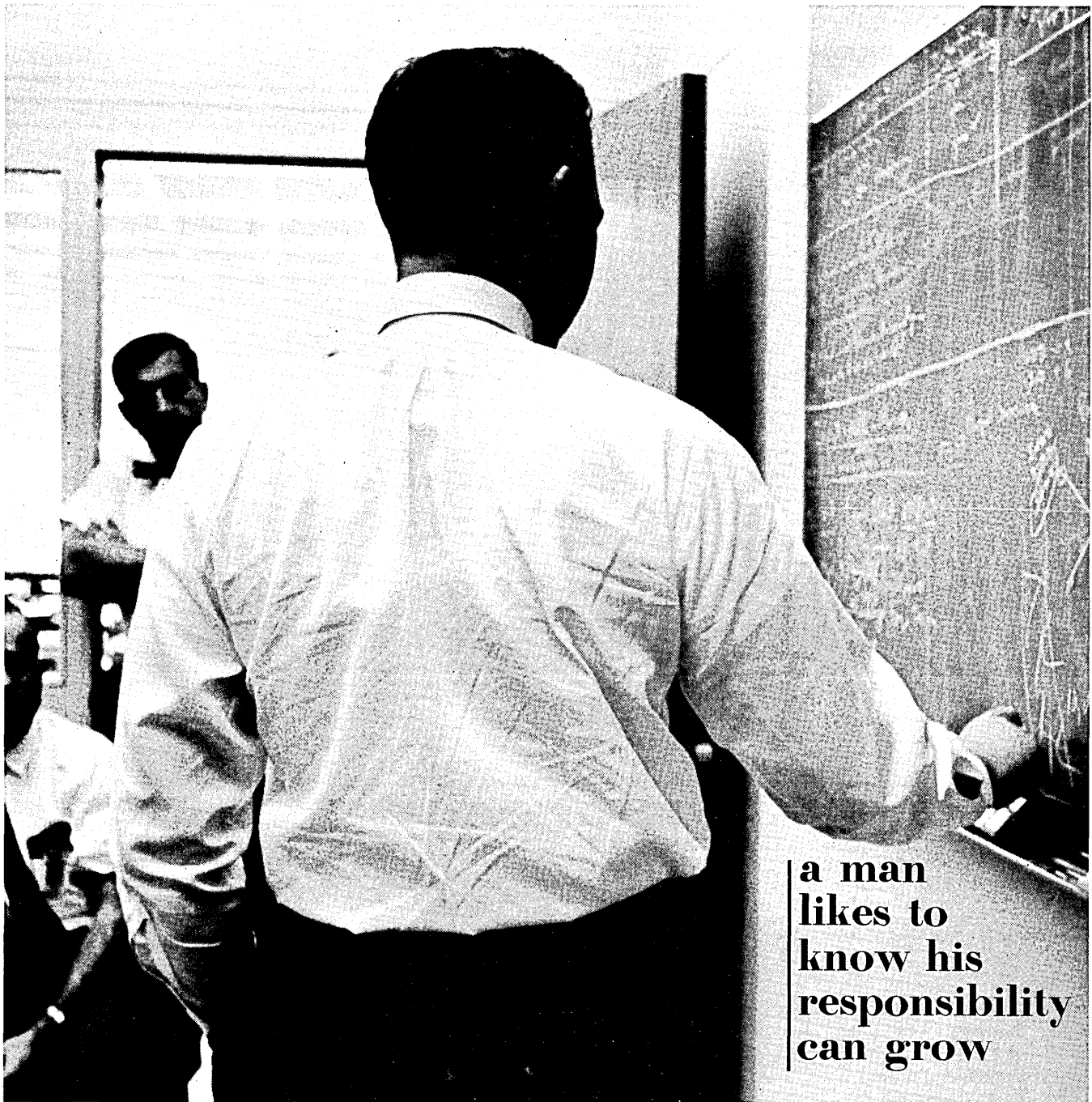
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munication, to mention a few, attests to that fact. The continuing growth of our engineering and scientific staff is further proof. The expansion of our Cedar Rapids, Dallas and Newport Beach facilities offers still more. With company growth, expansion of product lines, with development of new products comes the opportunity for your own growth into areas of ever increasing responsibility, as well as financial and material rewards.

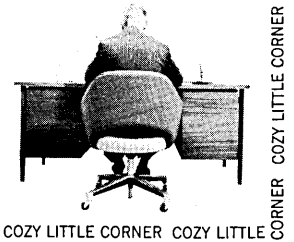
If you are a man who knows that growth and responsibility come from individual effort, if you are a man who

puts all his creativity, talent and initiative into a project, if you like to know that your efforts will be rewarded with ever increasing responsibility, we'd like to talk with you. Write in confidence to our manager of professional employment. **COLLINS RADIO COMPANY**
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COZY LITTLE CORNER COZY LITTLE CORNER

Collins is looking for experienced professionals. We're looking for hardware-oriented men. We're looking for men with theoretical and analytical capabilities, men who know their fields thoroughly and completely, men who like to carry projects from conception to installation. If you are one of these men and you have a Bachelor's or advanced degree in E.E., Math, Physics or Business Administration, you'll be interested in the computer programming and engineering opportunities Collins can offer you.

SOFTWARE

SENIOR SOFTWARE SYSTEMS SPECIALISTS

(Newport Beach and Dallas)

Broad responsibilities entail development of automatic programming languages and other high level advanced languages for programmed logic computers. Candidates must be creative individuals with several years of programming experience preferably on several computers and who are willing to accept broad responsibilities in the Collins software development program. Responsibilities inherent in these positions demand extraordinary capability built on sound education and diversified experience.

SOFTWARE DEVELOPMENT PROGRAMMERS

(Dallas and Newport Beach)

Develop software packages for business and scientific computer systems including translators, assemblers, executive and interpretive routines. Will also develop data communications software packages and utility programs for programmed logic computers. Should have Bachelor's or advanced degree in Engineering or Mathematics and at least one year's experience with computer languages and systems.

For complete information write in confidence to Manager of Professional Employment, Dept. 110.

APPLICATION

SENIOR APPLICATION ANALYSTS AND PROGRAMMERS/COMMUNICATIONS

(Newport Beach)

Involves producing system specifications and/or programming and program check-out of real time communication-oriented systems. Background should include wide experience in the analysis of communication and information processing problems.

SENIOR APPLICATIONS PROGRAMMERS/FINANCIAL

(Cedar Rapids)

Bachelor's degree and several years' experience programming business applications on medium and large scale computers.

SENIOR APPLICATIONS PROGRAMMERS/MANUFACTURING

(Cedar Rapids)

Bachelor or advanced degree in Math, Physics or Engineering. Experience requirements include 3 or more years' programming with exposure to Industrial Engineering, machine shop fabrication, or numerical control of machine tool problems. Experience on medium and large scale computers is desirable. Ability to carry projects from conception through installation is a must.

ENGINEERING COMPUTER PROGRAMMER

(Dallas)

Requires experience in business systems programming as well as scientific programming application. A background with 7070, 7074 and PERT analysis familiarity is desired. Must have Bachelor or advanced degree including statistics or math training and at least 3 years' related work experience.

OPERATIONS RESEARCH ANALYSTS

(Cedar Rapids)

Formation of Operations Research Department offers opportunities for candidates who have broad industrial operations research experience. Positions available at all experience levels.

ENGINEERING

PROJECT MANAGERS

(Cedar Rapids)

Over-all project management of automatic message switching and processing systems. Includes analysis of customer requirements, preparation of plans, specifications and cost estimates, providing technical liaison with customer, maintenance of cost and schedule control, etc. Requires B.S.E.E. or M.S.E.E. plus 2 to 10 years' applicable experience.

SYSTEMS ENGINEER

(Dallas)

Analyze customer requirements for large scale real time automatic message switching and processing systems. Prepare and present sales proposals to customers. Requires Bachelor's degree and 4 years' experience in computer and communication systems.

LOGIC DESIGNERS

(Cedar Rapids)

Background should include a B.S. degree in Electrical Engineering and 2 to 4 years' experience in logic circuit design.

DIAGNOSTIC PROGRAMMERS

(Cedar Rapids)

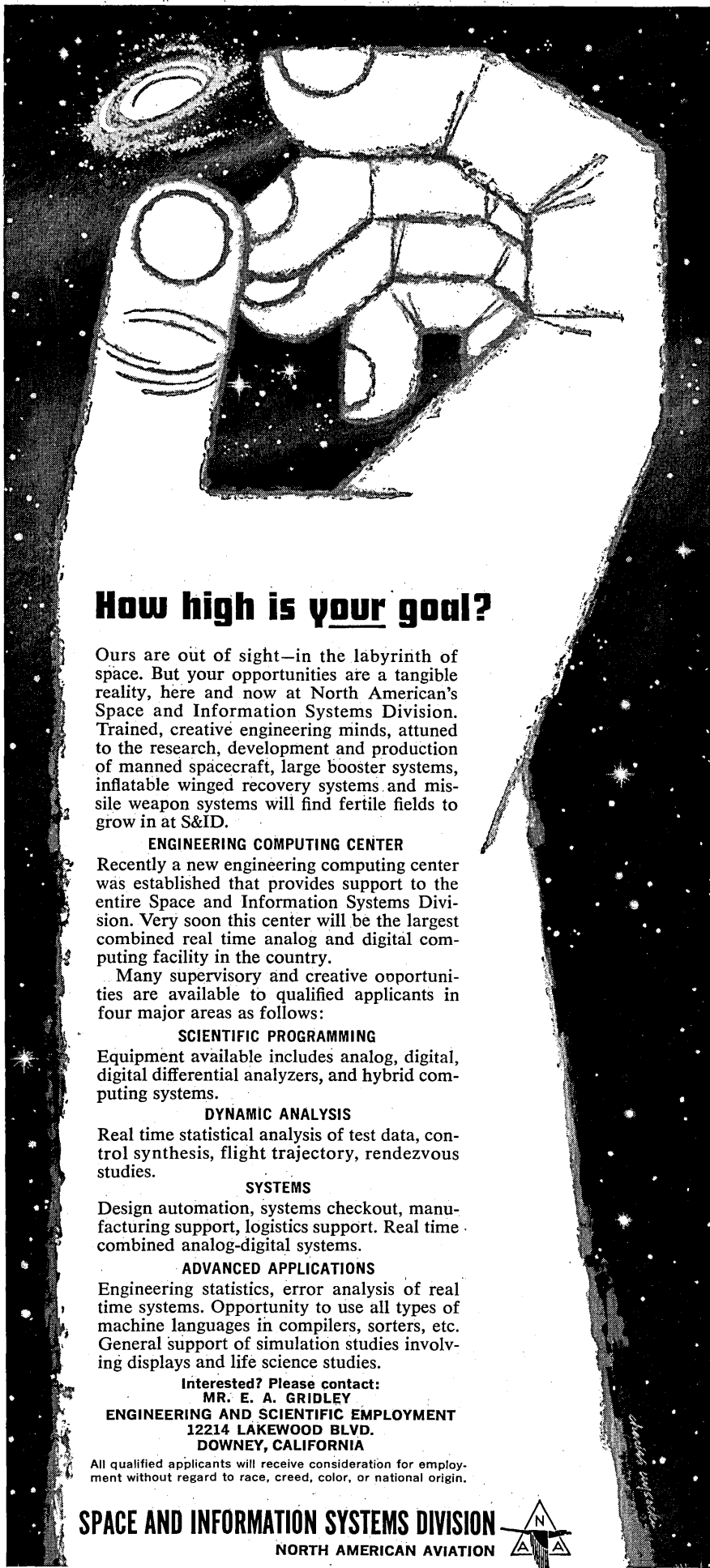
Requires a Math or Engineering degree plus 2 to 4 years' experience on large, general purpose computers. Openings are also available for digital circuit designers and memory systems designers.

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ENGINEERING COMPUTING CENTER

Recently a new engineering computing center was established that provides support to the entire Space and Information Systems Division. Very soon this center will be the largest combined real time analog and digital computing facility in the country.

Many supervisory and creative opportunities are available to qualified applicants in four major areas as follows:

SCIENTIFIC PROGRAMMING

Equipment available includes analog, digital, digital differential analyzers, and hybrid computing systems.

DYNAMIC ANALYSIS

Real time statistical analysis of test data, control synthesis, flight trajectory, rendezvous studies.

SYSTEMS

Design automation, systems checkout, manufacturing support, logistics support. Real time combined analog-digital systems.

ADVANCED APPLICATIONS

Engineering statistics, error analysis of real time systems. Opportunity to use all types of machine languages in compilers, sorters, etc. General support of simulation studies involving displays and life science studies.

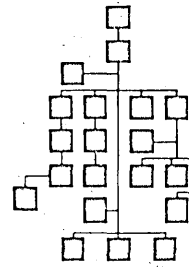
Interested? Please contact:

MR. E. A. GRIDLEY

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All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

SPACE AND INFORMATION SYSTEMS DIVISION
NORTH AMERICAN AVIATION



people IN DATAMATION

■ R. E. Utman has joined J. C. Penney, New York, as manager, advanced systems development. He was most recently director of standards for BEMA's data processing group.

■ John W. Carr III has joined the Moore School of Engineering, as associate professor of electrical engineering. He was most recently on the faculty of the Univ. of North Carolina.

■ With the resignation of M. O. Kappler of System Development Corp., Santa Monica, Calif., Wesley S. Melahn has been elected acting president. Melahn was elected vp one year ago, and has been with the firm since its inception.

■ Elected to the board of Computer Usage Co., New York, is Walter B. Nelson, vp-Eastern operations. He has been vp since 1961, and formerly was with the EDP Div. of the Armed Forces Supply Support Center.

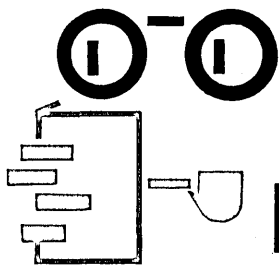
■ Gerhard L. Hollander succeeds C.A.R. Kagan as chairman of the Computing Devices Committee of the IEEE. A director of AFIPS, he is president of Hollander Assoc., Fullerton, Calif.

■ Robert E. Wesslund, formerly plant manager, has been named general manager of Control Data's Industrial Data Processing Div., Minneapolis, Minn.

■ George Vasilakos has been named manager of systems programming at Advanced Scientific Instruments, Minneapolis, Minn. He had been assistant manager.

■ Paul Finch has been appointed dp supervisor for Kierulff Electronics Inc., Los Angeles. Before joining the firm, he was with Atlantic Research and Litton Industries.

■ Joining Informatics Inc., Culver City, Calif. are Lynn W. Jones II and Roy V. Bigelow as director of operations and director of Houston operations, respectively. Jones is from TRW and Space Technology Labs, and Bigelow from Aerospace Corp.



NEW LITERATURE

AUTOMATION AND SCIENTIFIC COMMUNICATION: Collection of 162 state-of-the-art papers and proceedings of the annual meeting of the American Documentation Institute. 450 pages, in three parts for \$12.50. AMERICAN DOCUMENTATION INSTITUTE, 1728 N. St., N. W., Washington, D. C.

GROUND BASED DP SYSTEMS: Explains typical data inputs, formats, display and outputs. Describes advantages and compares the purchase and operating costs of an automatic system with costs of manual dp. RADIATION, INC., Melbourne, Fla. For copy:
CIRCLE 130 ON READER CARD

COMPUTER CONTROL INSTRUMENTATION: Instrumentation and controllers usable with computers for closed loop control are included in bulletin 91-53P-07. FISCHER & PORTER CO., 699

Jacksonville Rd., Warminster, Pa. For copy:

CIRCLE 131 ON READER CARD

MEDCOMP: This Handbook of Computer Applications in Biology and Medicine, Part I, on Statistics and Relevant Statistical Computer Library, describes the use of an integrated library of computer programs enabling statistical analysis of most biological data. UNIV. OF CINCINNATI, COLLEGE OF MEDICINE, Cincinnati 19, Ohio. For copy:

CIRCLE 132 ON READER CARD

FLOW CHART TECHNIQUE: Is particularly adaptable to dp, PERT and similar programs. Leaflet includes descriptions and prices. METHODS RESEARCH CORP., 95 Willow Ave., Staten Island 5, N.Y. For copy:

CIRCLE 133 ON READER CARD

RACK MOUNTED EQUIPMENT: Detailed is how gp analog computer components can be used to fabricate a special purpose computer or signal processing system using rack mounting modules of these components. APPLIED DYNAMICS INC., 2275 Platt Rd., Ann Arbor, Mich. For copy:

CIRCLE 134 ON READER CARD

30-MIL CORE STACK: Coincident current, memory's wiring configuration, worst pattern, electrical characteristics and values of this 4K-word memory are described. ELECTRONIC MEMORIES, INC., 12621 Chadron Ave., Hawthorne, Calif. For copy:

CIRCLE 135 ON READER CARD

TELEMEMORY DATA SYSTEMS: Illustrated booklet on "credit card" system for self-service bulk terminal operation includes information on system opera-

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- Scientific and Research Application
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Requirements include experience on IBM 1401, 1410, 700, SDC 910, 920, CDC 160, 160-A, PB-250 series equipment and two or more years' experience in analysis of problems, block diagramming, flow charts and checking of coding for reliability. A degree is desired.

Additional experience is desired in the design of clock controlled programs, executive control techniques and minor cycle programming with a basic understanding of computer operations.

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CIRCLE 86 ON READER CARD

NEW LITERATURE

tion, loading-spot and data acquisition equipment. MOTOROLA INSTRUMENTATION & CONTROL INC., P.O. Box 5409, Phoenix 10, Ariz. For copy:

CIRCLE 136 ON READER CARD

TRANSLATOR: UT-10, used for converting Hollerith code to Baudot code and vice-versa is described. Detailed performance specs are given. CANADIAN AVIATION ELECTRONICS LTD., Box 2030, "St. Laurent," Montreal 9, Quebec, Canada. For copy:

CIRCLE 137 ON READER CARD

AUXILIARY ARITHMETIC UNIT: Brochure lists instruction repertoire and formats, instruction execution times for use with 235. GENERAL ELECTRIC CO., COMPUTER DEPT., Deer Valley Park, Phoenix, Ariz. For copy:

CIRCLE 138 ON READER CARD

READOUT DISPLAY SELECTOR: Guide contains cut-away diagrams of various modules showing principles of operation, specs, prices, a complete lamp selection and specification chart. INDUSTRIAL ELECTRONIC ENGINEERS INC., 5528 Vineland Ave., North Hollywood, Calif. For copy:

CIRCLE 139 ON READER CARD

DECOMMUTATION SYSTEM: Data sheet covers 670-3 digital-circuitry unit that accepts FM, PAM, and PDM signals. TELEMETRICS INC., 12927 S. Budlong Ave., Gardena, Calif. For copy:

CIRCLE 140 ON READER CARD

ANGLE ENCODING: 16-page brochure gives information on precision angle encoding, analysis of "gear up" and optical techniques, flexible shaft couplings, testing of precision angle encoders, glossary. DATEX CORP., 1307 S. Myrtle Ave., Monrovia, Calif. For copy:

CIRCLE 141 ON READER CARD

ACM JOURNAL & COMMUNICATIONS: *Journal* vols. 1-7, 1954-60, in paper bound set, \$105. Vol. 5, no. 3, 1958; vol. 6, no. 1, 1959; and vol. 7, nos. 1-2, 1960, \$4 for single issues, paper bound. For *Communications*, single vols., paper bound, 1-3, 1958-60, \$24. Vol. 1, nos. 5, 7, 9, 12, 1958; vol. 2, no. 8, 1959; vol. 3, nos. 1, 5, 1960, single issues, paper bound, \$2. JOHN-SON REPRINT CORP., 111 5th Ave., New York 3, N.Y.

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DATAMATION

CONTROL DATA REQUIRES COMPUTER SOFTWARE SPECIALISTS FOR KEY POSITIONS

Because of the worldwide acceptance of Control Data's general and special purpose computer systems, a variety of professional positions must be filled to keep pace with the company's resultant growth. If you have medium or large-scale computer experience and a B.S. degree, please examine the following opportunities which exist at all experience levels.

AT PALO ALTO, CALIF.

SENIOR SYSTEMS INSTRUCTORS: You will conduct internal classes, seminars and workshops for Control Data personnel in new hardware and software systems. The position requires a minimum of two years' experience with medium or large-scale binary computers using magnetic tape and a knowledge of operating systems and assembly language. Fortran or Cobol knowledge helpful.

SYSTEMS INSTALLATION: Represent Control Data technically at various, nationwide customer sites. Responsibilities will include orientation, training, programmer consultation and software systems installation for large-scale Control Data 3600 and 1604 computer customers.

AT LOS ANGELES, PALO ALTO AND MINNEAPOLIS

PROGRAMMING SYSTEMS: Participate in the development of advanced programming systems, including Compiler Development, Monitor and Executive routines and language analysis.

AT LOS ANGELES, PALO ALTO, WASHINGTON, D.C., LONG ISLAND, N.Y., AND MINNEAPOLIS

PROGRAMMER ANALYSTS: You will be analyzing data center customer problems for computer applications. In addition, you will be involved in sales support work and the preparation of programming proposals.

AT PALO ALTO AND LOS ANGELES

SOFTWARE DOCUMENTATION: Assist in development of reference manuals, teaching aids, sales aids and other forms of documentation for programming systems.

AT LOS ANGELES

SYSTEMS ANALYSIS: Define problems in which the emphasis is on analysis, novel design, mathematical innovation and programming implementation.

AT MINNEAPOLIS

PROGRAMMING INSTRUCTION: Teach beginning and advanced programming to both Control Data employees and customer personnel. B.S. degree and one year's experience as a programmer are required.

AT CONTROL DATA SALES OFFICE LOCATIONS THROUGHOUT THE NATION

SALES SUPPORT ANALYSTS: Work with sales engineers in analyzing the customer's data processing system and in determining his equipment needs. Act as Control Data's technical representative after the new equipment is installed. Scientific and/or business programming experience on tape-oriented systems is required. A knowledge of monitors and programming languages such as Fortran will be helpful.

TO ASSURE PROMPT REVIEW OF YOUR QUALIFICATIONS AND INTERESTS, PLEASE SEND RESUME TO ONE OF THE FOLLOWING AREA STAFFING REPRESENTATIVES

PALO ALTO: B. G. CRIFE, 3330 HILLVIEW, PALO ALTO, CALIF.

LOS ANGELES: J. J. WARD, 5630 ARBOR VITAE, LOS ANGELES, CALIF.

EASTERN U.S.: K. T. CHASE, 11428 ROCKVILLE PIKE, ROCKVILLE, MD.

MINNEAPOLIS AND MIDWEST: T. U. OLDHAM, 8100 34TH AVE. SO., MINNEAPOLIS, MINN.

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We are equipped with IBM 7070/1401 computing systems. This is a permanent position with an established research and development organization. Company has excellent fringe benefits including profit sharing. Please submit detailed resume to:



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They work on Phase III of Nike Zeus, and on software systems relating to aircraft and missile tracking, target discrimination, intercept programming, missile guidance, command and control systems, simulation preliminary to hardware design, missile and aircraft flight and computer simulation for design evaluation. They are involved with systems integration, design specifications, mechanized design, and compilers and language processors. ■ ■ They are provided an unusual environment—a combination of job features unique in the programming field. Systems programmers here work on their own machines. Development engineers have their own. Software men have the opportunity to see that hardware design limitations are corrected. The technical content of the work is at the edge of today's knowledge in computer technology. All in all, the diversity of real-time programming projects, the uncommon breadth of exposure this provides and a unique environment add up to programming opportunity hard to match in industry today. ■ ■ The list of openings below is not complete by far but it confirms the breadth and diversity of current in-house activity.

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APPLICATIONS PROGRAMMERS

To define, analyze and design solutions to problems, and translate methods developed into computer techniques. BS or MS in Math or Engineering with 3-5 years large-scale data processing applications experience.

COMMAND AND CONTROL PROGRAMMERS

To design real-time information retrieval computer program for AF Intelligence and Command Control Computer Systems. Requires BS in Math, or Science with 3-5 years sound programming experience.

INTEGRATED PROGRAMMING SYSTEMS

Requires BS or MS in Math, Statistics or EE and 2-4 years experience in programming large-scale digital computers. Must know generative and operational elements and be familiar with auxiliary memory devices.

SYSTEMS PROGRAMMERS

To develop large-scale software packages. Requires BS in Math and 2 years experience in digital computer programming including symbol manipulation, input-output or basic utility routines.

RADAR SYSTEMS PROGRAMMERS

BS or MS in Math or Engineering with 2-5 years experience in systems checkout, radar control, I/O routines, simulation, dynamic radar tests, or executive control to work on advanced real-time systems.

LIBRARY SYSTEMS PROGRAMMERS

BS in Math or Science and 2 or more years experience in assembler-compiler development, simulators (computers, radar/missile), range safety, input/output, mathematical subroutines, or executive control systems.

For more information about these or other openings, or to apply, send your resume to Mr. R. K. Patterson, Employment Mgr., Dept. A-12, Univac Division of Sperry Rand Corp., Univac Park, St. Paul 16, Minn. An Equal Opportunity Employer.

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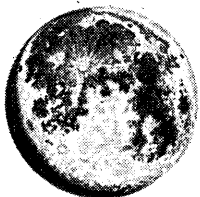
The shortest distance between two points is often imagination

There's a tried and true way...but sometimes there's an untried and new way. To conceive and consider the latter is to invent, to create, to imagine. Such original thinking is an important part of Bellcomm's daily work. This Bell System company is helping the National Aeronautics and Space Administration plan the systems needed to journey to the moon—a project for which much fresh thinking is needed. Bellcomm has rewarding openings for experienced, imaginative thinkers in such fields as physics, chemistry, engineering, psychology, mathematics, flight mechanics, computing and programming, propulsion, aerodynamics and aeronautical engineering. If you believe that you qualify, Bellcomm will give your résumé thoughtful study. Address it to Mr. W. W. Braunwarth, Personnel Director, Bellcomm, Inc., Room 1100E, 1100 17th St., N. W., Washington, D.C. 20036. Bellcomm is an equal opportunity employer.



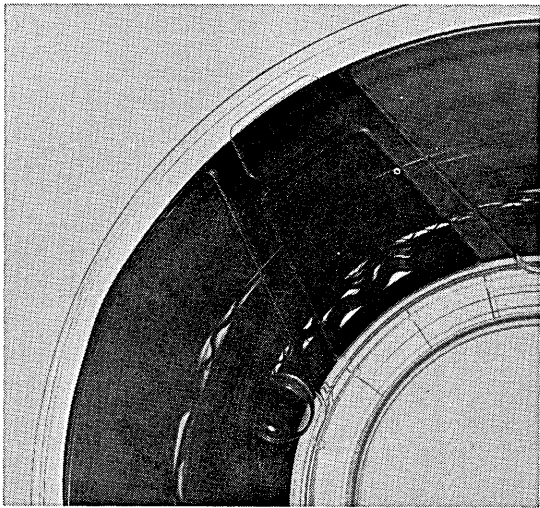
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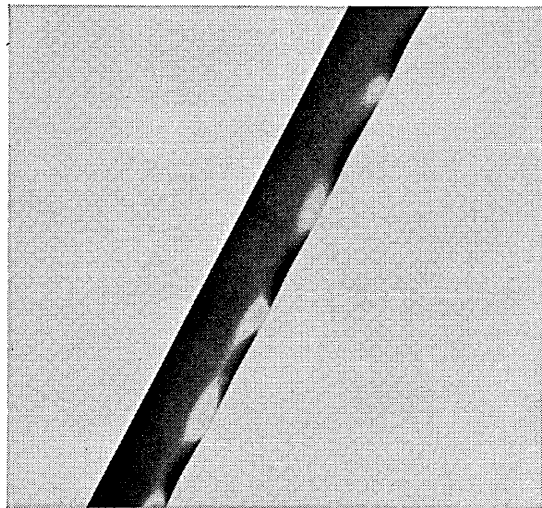
4 COMPLAINTS ABOUT COMPUTER TAPE

(And how Memorex solves them!)



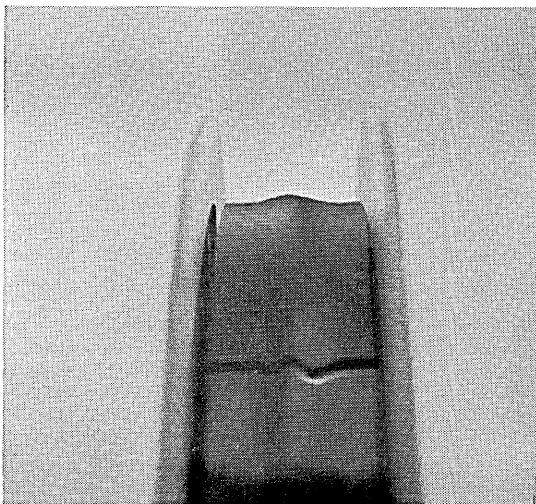
Complaint. Cinching during shipping, use or handling results when reel is wound under improper tension or exposed to temperature extremes.

Solution. Precision winding, special packing and careful shipping are examples of attention to detail that insure cinch-free delivery every time.



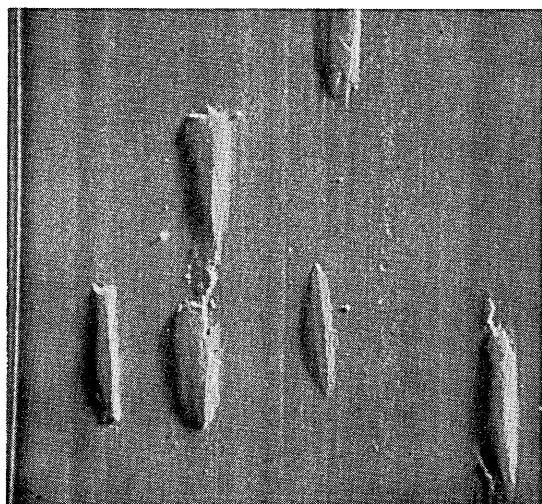
Complaint. Wavy edge caused by improper slitting.

Solution. Specially designed Memorex slitters and microscopic edge inspection of every reel prevent wavy edges. Fifty-one other quality control checks (many performed only by Memorex) guarantee every Memorex reel pre-test perfect.



Complaint. Semi-permanent ridging and loss of contact caused by microscopic scratches produced in manufacturing or use.

Solution. Memorex-designed manufacturing facilities include equipment unique to the industry which eliminates all fixed friction surfaces that potentially produce scratches.

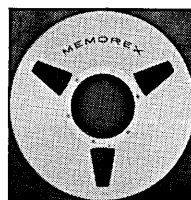


Complaint. Dropout-causing clumps of redeposited coating (50X magnification).

Solution. Memorex has developed coating formulations and processing methods to achieve superior bond between coating and base, extra toughness, high flexibility, and a smoother surface. Result: Memorex tape is essentially redeposition-free.

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Memorex certification means what it says: Memorex computer tape is error-free. Extra care, extra steps and scrupulous attention to every detail make it that way. We know the importance to you of having a tape you can depend on.

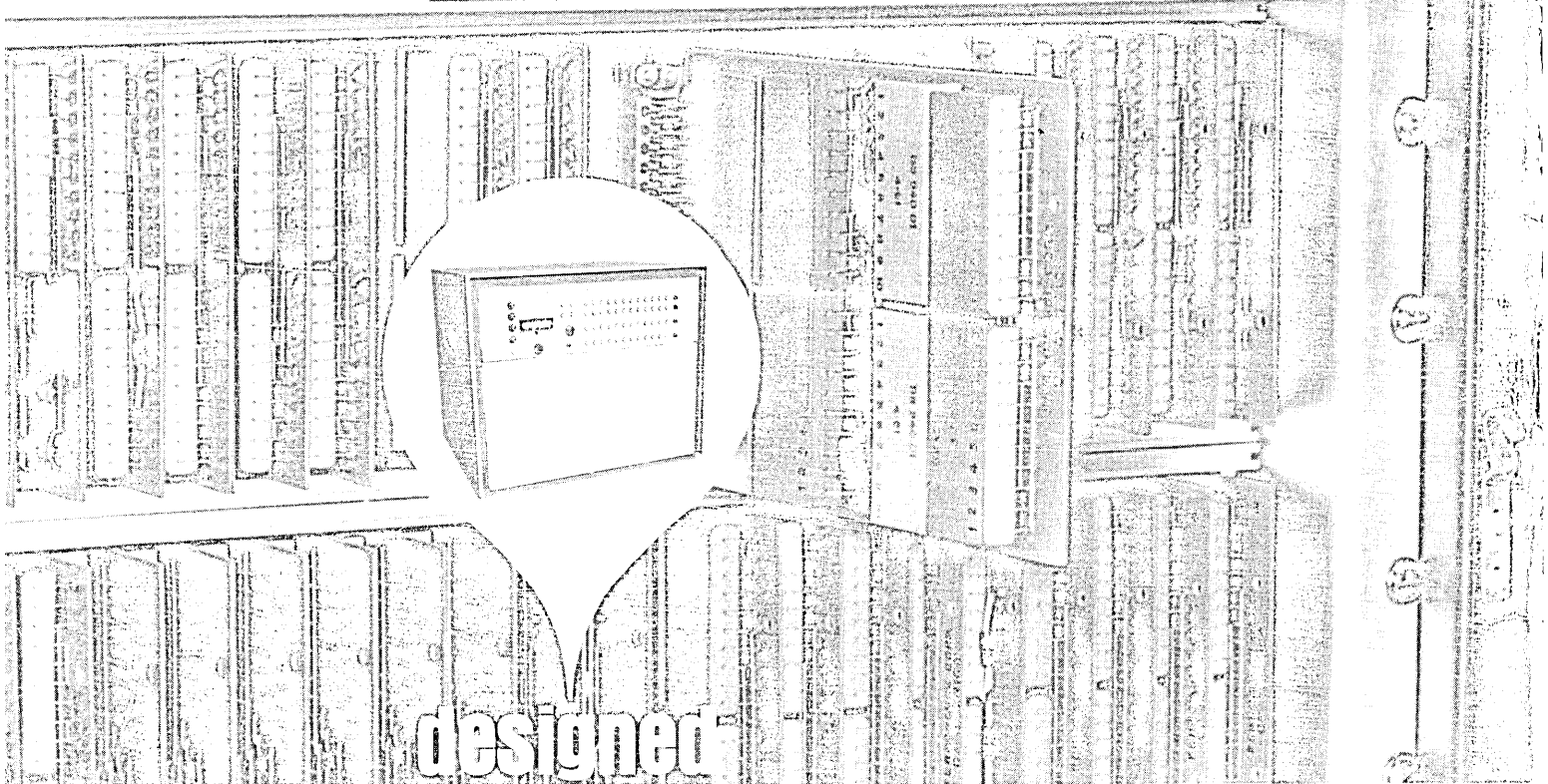
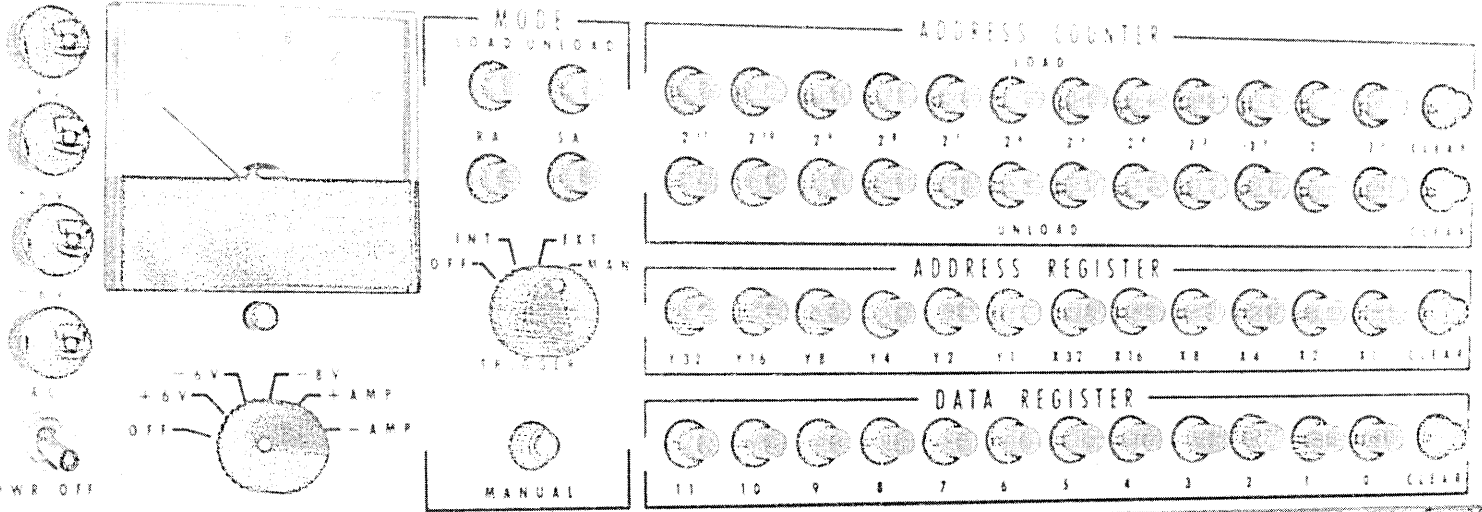


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