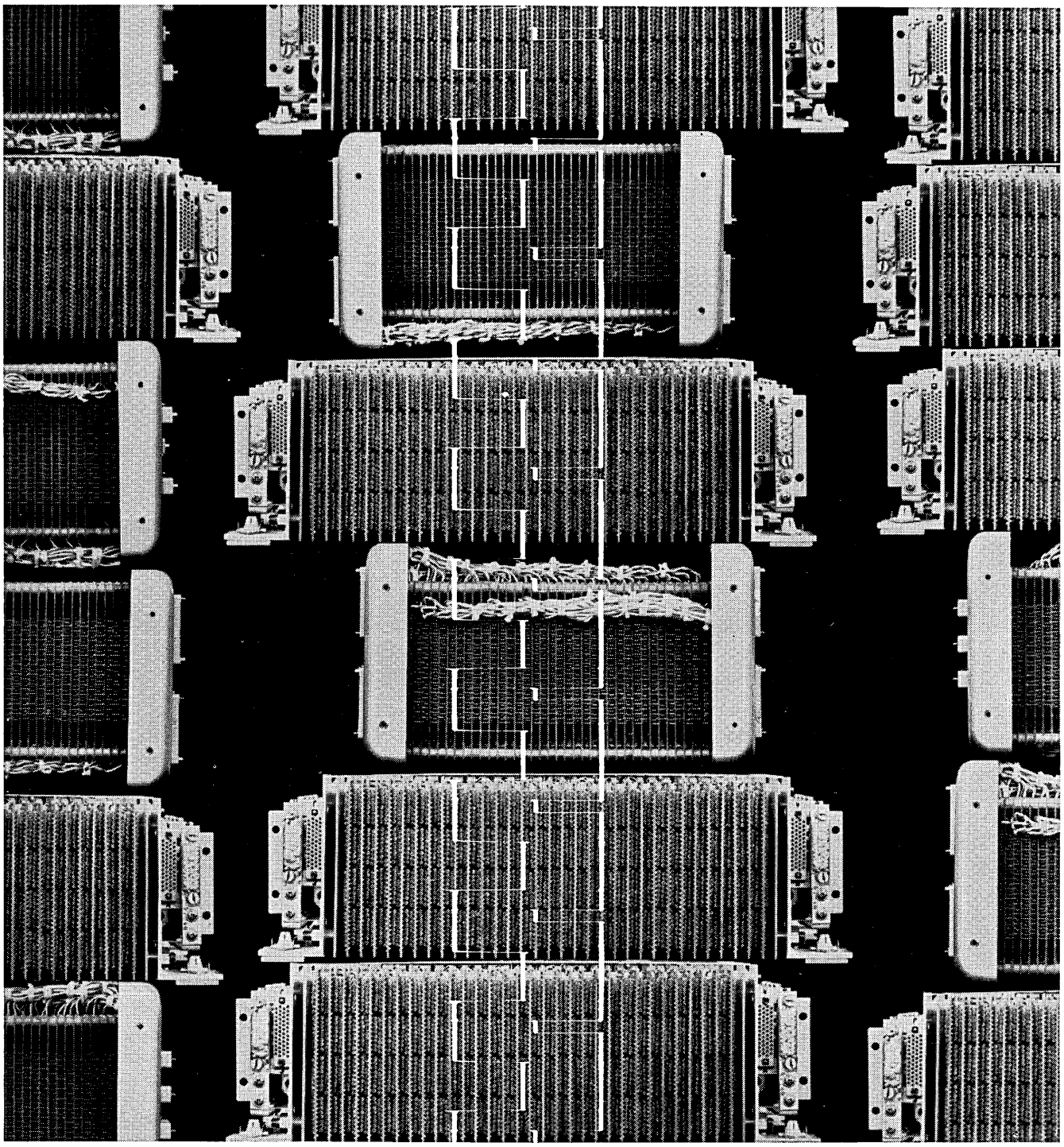
DATAMATION®

63

April

SJCC

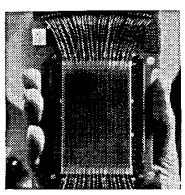
DETROIT '63



Who can give you stacks of stacks?

AMPEX

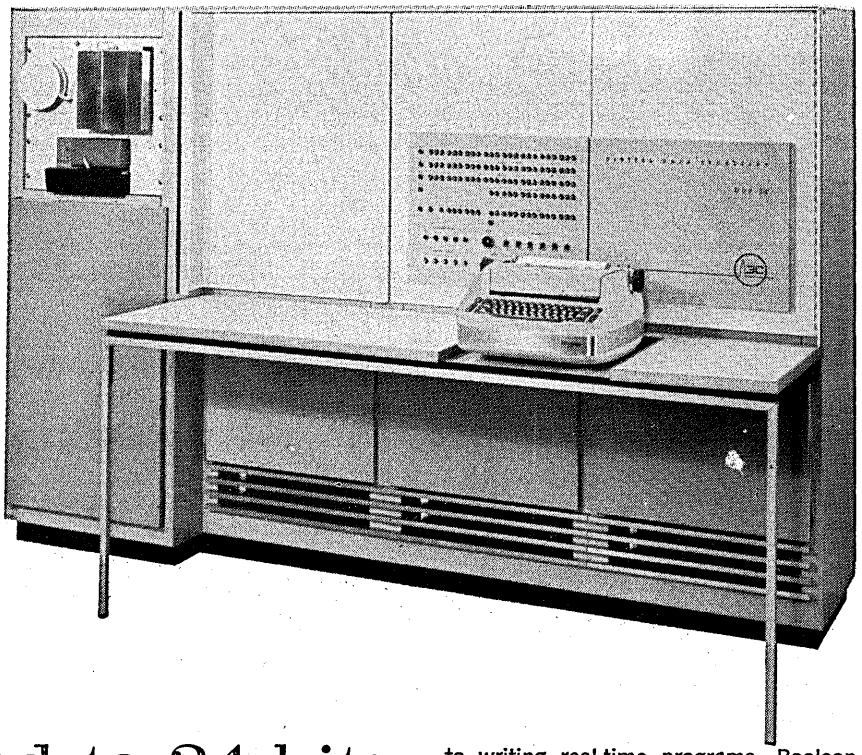
Just say the word. Ampex can give you every kind of 30 and 50 mil component. Stacks, for example. We've got both word select and coincident current types. They can provide complete memory cycle times ranging from 1 to 2.5 microseconds. They offer high signal-to-noise, high voltage output with low drive. And what's more, they're compact! 30 and 50 mil cores? We've got those—plenty of them. High speed cores, low drive cores, and cores in-between. 30 and 50 mil arrays, too. All performance perfect. All now available! Ampex Computer Products Co., Culver City, Calif. A division of the only company providing recorders, tape and memory devices for every application: Ampex Corp., 934 Charter St., Redwood City, Calif. Worldwide sales, service.



AMPEX 0/1

CIRCLE 1 ON READER CARD

$87,000



*DDP-24 IS NOT designed to be all things to all people. DDP-24 IS a fast digital computer, versatile, a sophisticated "component" built to move in company with a precision team in complex real-time on-line configurations. Equally comfortable performing off-line engineering and scientific computations. Reliable? Very.**

DDP-24 pays for itself on a diet of challenge. DDP-24 hardware, comprehensive software, user services and options belong in the hands of qualified professionals who know their applications and how to evaluate a computer against these selected applications. Under these conditions DDP-24's are a lot of computer for the money.

DDP expanded to 24 bits Faster arithmetic unit Comprehensive software

DDP-24 is a parallel 24-bit word, core memory, sign-magnitude, binary, general purpose computer, with indexing and indirect addressing. Instruction repertoire includes multiply and divide, load and store, shifting, logical, jump, index, and input/output. Standard memory capacity is 4096 words (optionally expandable).

Simplicity, maintainability, user convenience are factors of design. Regulated power supplies and power failure protection preserve integrity of computation. Ready and interrupt modes give DDP-24 master or slave relationship with external equipment. Optional independent memory banks and fully buffered channels give true input, output, and compute overlap.

SPEED

Computation rate is 100,000 additions per second. Multiplication takes 31 microseconds, division 33 microseconds. Times include instruction and operand access. Other arithmetic speeds:

Add floating point	125μ/secs. max.
Multiply floating point	99μ/secs.
Add double precision fixed	55μ/secs.
Add double precision floating	181μ/secs.
Multiply double precision fixed	263μ/secs.
Multiply double precision floating	371μ/secs.

Core memory cycle time is five microseconds with three microsecond access. Input and output can occur asynchronously and be interleaved with processing at transfer rates up to 166,000 24-bit words per second.

INPUT-OUTPUT

Strong input-output capabilities enhance communication with surrounding equipment; offer unique freedom of system implementation. Standard DDP-24 incorporates an eight-bit I/O character buffer register and channels, a 24-bit parallel input channel, a 24-bit parallel output channel, sixteen lines for external sense inputs, eight output control pulse lines, and four interrupt lines capable of asynchronous operation with the associated four basic input-output channels. Standard I/O equipment: typewriter, paper tape reader, punch.

SOFTWARE

Programming software provided with the DDP-24 is comprehensive; satisfying professional programmers writing complex routines, mathematical analysts, and the occasional user. Fortran II, DAP, and DIP are modular, patterned after SHARE, easily adapted to specific hardware configurations. Diagnostics for rapid isolation of programming and system faults are included. Also provided: mathematical subroutines, number conversion, memory dump, library routines, master executive program, load program, and computer exercise routines.

Fortran II compiler permits investigation and development of math models prior to writing real-time programs. Boolean augmentation and macro calls are provided.

DAP — DDP-24 Assembler Program — with one-to-one and one-to-many assembly, facilitates tight real-time programs in convenient language.

DIP — DDP-24 Interpretive Program — permits users with minimum programming experience to generate scientific computation routines after only half a day's study.

OPTIONS

To offer still greater system adaptability and functional capabilities, extensive standard options and peripheral equipment are available for the DDP-24:

☐ core memory expansion to 16,384 words, with special expansion 32,768 words. (directly addressable) ☐ additional index register ☐ word forming buffers ☐ character I/O buffer registers ☐ interrupt lines ☐ eight level hardware interrupt priority system ☐ additional sense lines ☐ output control pulses ☐ parallel I/O channels.

I/O control units for maximized interlace and truly simultaneous operation: ☐ direct memory access control unit with unlimited channels ☐ fully buffered I/O control unit with unlimited channels.

Peripheral equipment optionally available: Magnetic tape control and transport units, A/D, D/A converters, card adapter, high speed line printer and adapter, digital plotter and adapter. Digital Resolver, satellite computer, increases DDP speed up to 10 times for algebraic and trigonometric functions. Other peripheral requirements can be fulfilled. Write for the full story.

**Design is typical 3C. Modular construction is with S-PAC digital logic modules. Based upon a million PAC-hours of life test without failure the DDP-24 calculated MTBF is over 4000 hours.*

COMPUTER CONTROL COMPANY, INC.

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

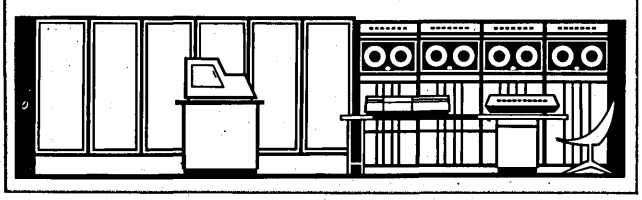
CIRCLE 4 ON READER CARD

Two new cost-cutting computers from Honeywell

New models of the two most powerful computers in the Honeywell line offer expanded input/output control capabilities that can strip thousands of dollars off the costs of your medium-to-large scale data processing applications.

Called the H-800-II and the H-1800-II, these new computer systems feature an integral Input/Output Control Center (IOCC) that contains all the control functions necessary for operation of up to three input/output terminal devices and four magnetic tape units. The peripheral devices attached to the IOCC may be operated simultaneously in addition to the concurrent operation of other peripheral devices connected to conventional peripheral control units.

This new feature, combined with the speeds, capacities, Parallel Processing power and dual business/scientific capabilities of the H-800/H-1800 series, provides flexibility and economy unmatched by any other EDP systems on the market.



More flexibility with less equipment

The Honeywell 800 is a high-speed computer with a wide range of peripheral devices and the unique ability to do up to eight independent jobs at the same time. The H-1800 has all this, plus more speed and versatility. Both systems have optional floating-point arithmetic and a full complement of software to prepare them for business and scientific applications. Both systems also utilize separate control units to provide buffering and control functions for all input and output units connected to the system.

The new -II models have the same internal performance specifications as their counterparts. Their central processors contain the same arithmetic and control units, the same memory units, and the same floating-point units. But something new has been added — an Input/Output Control Center. This IOCC is an extremely versatile and efficient element. It contains all the functions necessary to control a card reader (800 CPM), a card punch (250 CPM), a printer (900 LPM), and up to four magnetic tape units. The controls for the operation of all of these devices are contained in the central processor. No additional peripheral control unit is needed. Card reading, card punching, printing and tape operations can proceed simultaneously. Although at any given time, only one tape may be reading or writing together with card and/or print operations.

Additional card, printer and tape units and other types of equipment such as scanners, communication units and mass storage devices may be attached to the central processor through standard peripheral control units.

From input to output in one easy session

The IOCC is capable of controlling data flow from input devices to memory, from memory to output devices, from input devices directly to output devices, or any combination of these. Where the memory is involved, the IOCC is operated by a stored program. Straight card or tape conversion operations where no computational steps are required, can be accomplished without any demands on the central processor control and main memory sections. This "off-line" operation can be initiated by stored programs or by the console operator. Once initiated, the conversion function proceeds without any reference to the programs operating in the main memory.

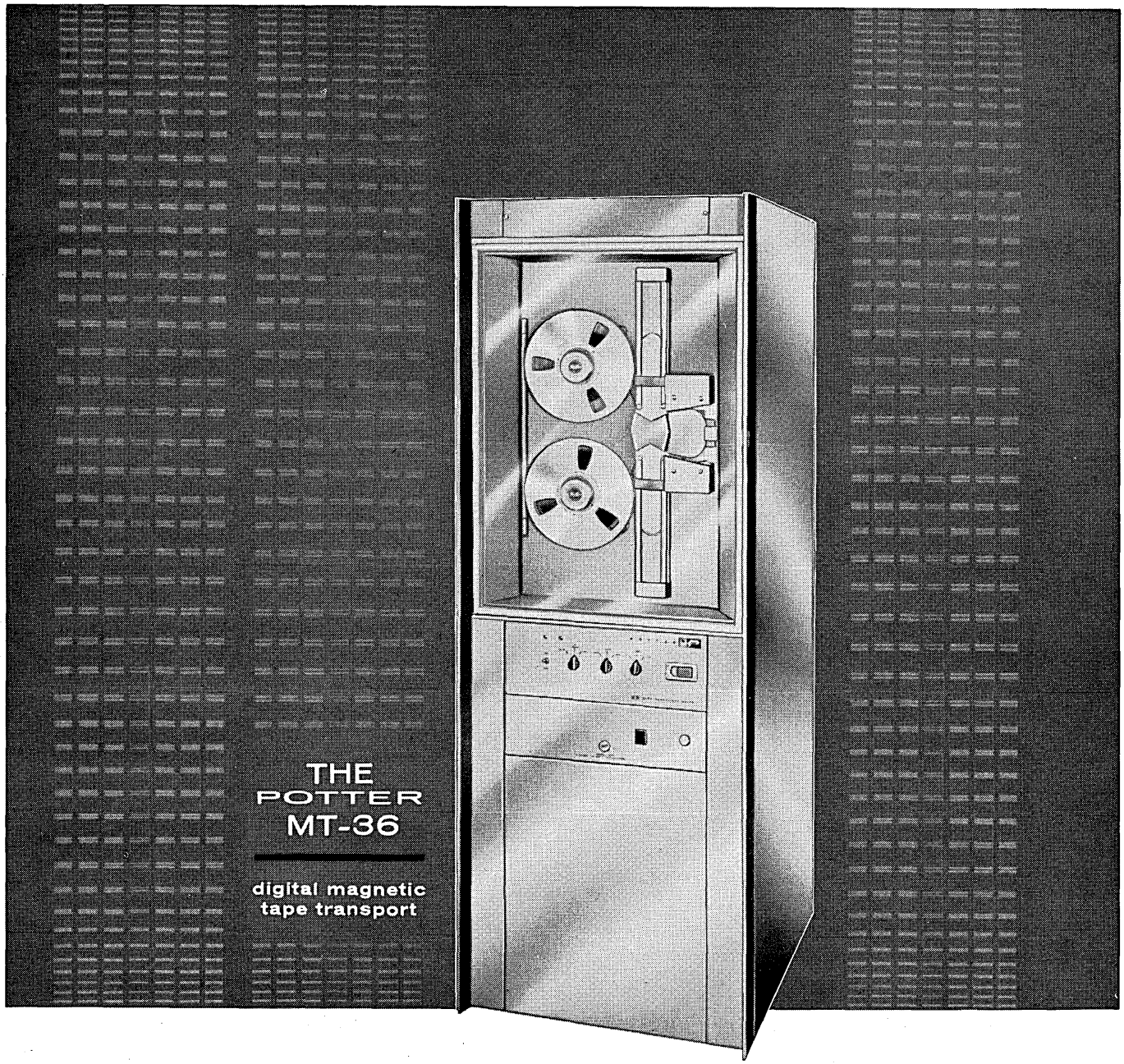
How to go at the same speed and get there faster

In summary, the unique capabilities of the H-800-II and the H-1800-II provide in an economical package, a wide range of peripheral control capabilities that can function both independently and simultaneously. If your computer application stands to benefit from economies in this area, you will want more information. Write to Honeywell EDP, Wellesley Hills 81, Massachusetts, or Toronto 17, Ontario.

Honeywell

ELECTRONIC DATA PROCESSING

CIRCLE 5 ON READER CARD



MT-36: THE MOST RELIABLE TRANSPORT IN ITS PRICE RANGE

The Potter MT-36 Digital Magnetic Tape Transport offers maximum reliability for computer systems requiring an economical transport. The Potter MT-36 features:

- **NO PROGRAM RESTRICTIONS** . . . up to 200 commands per second at 36 ips.
- **SOLID STATE CIRCUITRY** . . . photo electric sensing minimizes the need for switches and relays.
- **VACUUM TROUGH GUIDES** . . . provide smooth tape stops.
- **IMPROVED PINCH-ROLLER CIRCUITS** . . . offer fast tape starts and stops.
- **EASE OF MAINTENANCE** . . . drive electronics and fully regulated power supply are mounted on individual plug-in boards.
- **RAPID TAPE THREADING** . . . Just 15 seconds for complete threading.
- **BUILT IN TAPE CLEANER** . . . vacuum on trough guide removes all loose oxide and dust.

For full information and specifications on the MT-36 Digital Magnetic Tape Transport, write today.

POTTER INSTRUMENT COMPANY, INC.
TAPE TRANSPORT DIVISION • *151 Sunnyside Boulevard • Plainview, New York*
T.M.

CIRCLE 6 ON READER CARD

DATAMATION 63

the automatic handling of information

volume 9, number 4

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Feature Articles

Departments

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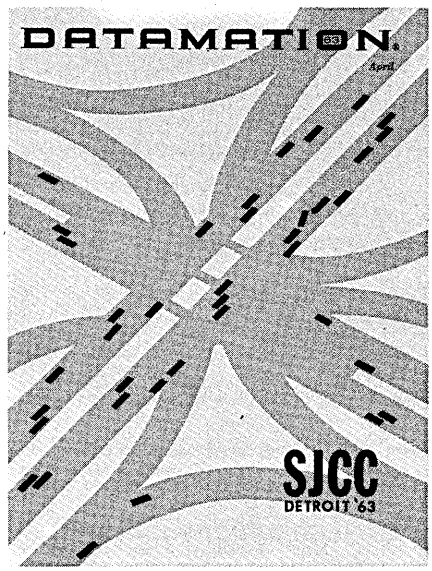
Cover



Reflecting the site of Detroit's Spring Joint Computer Conference more than the melange of traffic incubated by the season is this month's cover treatment. Details of the May 21-23 conference are in a special section beginning on page 53. Cover design is by Art Director Cleve Boutell.

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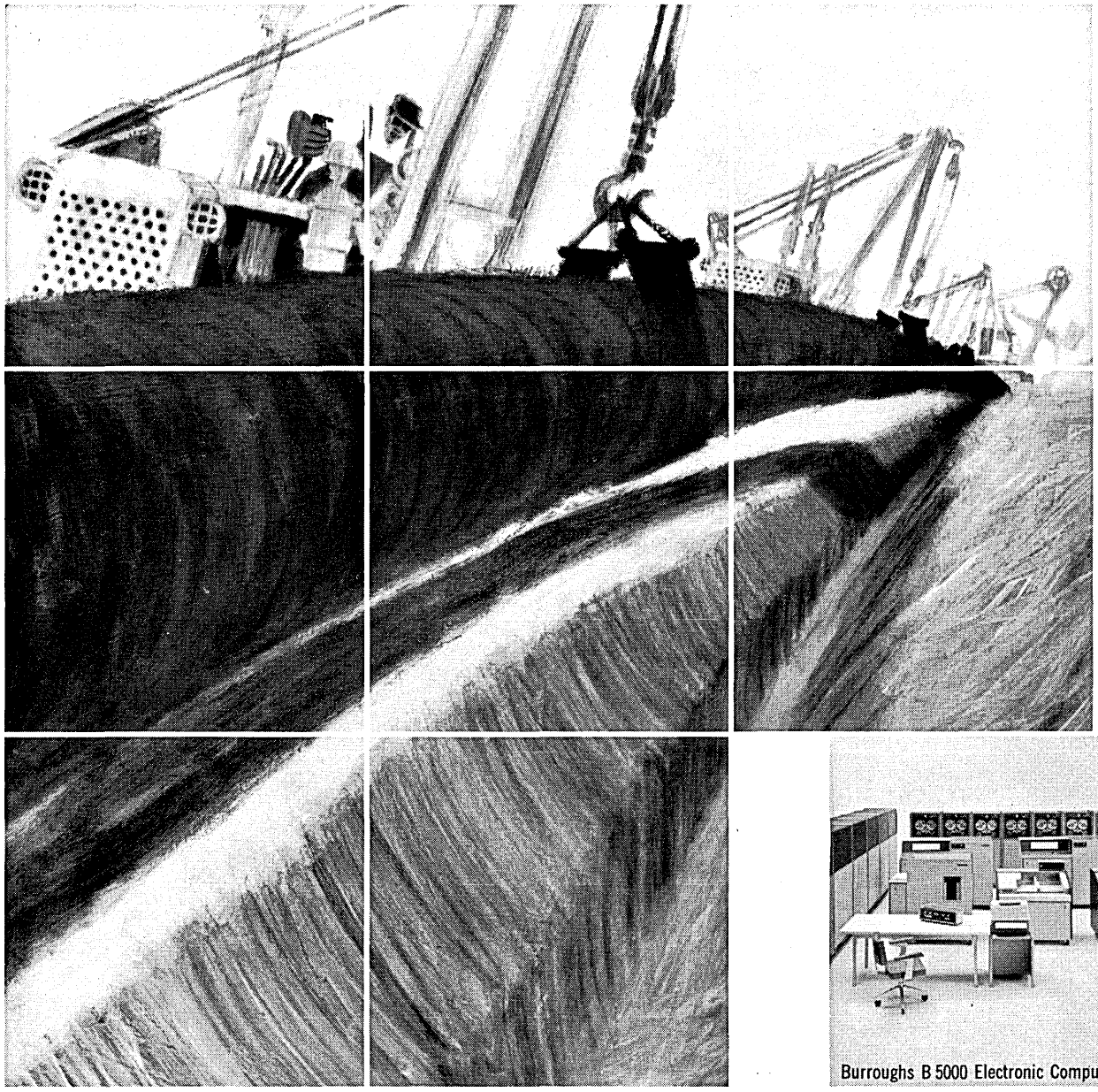


Burroughs B 5000 Electronic Computer System

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

Actually, a million one hundred thousand reasons.

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

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

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

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

Burroughs Corporation

Welcome to the Spring Joint Computer Conference in Detroit. See us here.

Burroughs—TM

CIRCLE 7 ON READER CARD

important DATES

• A joint meeting of the Eastern and Canadian region 1620 Users groups will be held April 22-23 at the Queen Elizabeth Hotel, Montreal, Canada. A meeting of GUIDE International will be held May 14-17 at the Statler Hilton Hotel, Dallas, Tex.

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

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

• A COINS (COmputer and INformation Sciences) symposium on Learning, Adaptation, and Control in Information Systems will be held June 17-18 at Northwestern Univ., Evanston, Ill., which is a co-sponsor with the Office of Naval Research, Information Systems branch.

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

• The sixth annual Summer Conference, sponsored by the Northwest Computing Assoc., will be held August 8-9 at the Pacific Science Center, Seattle, Wash.

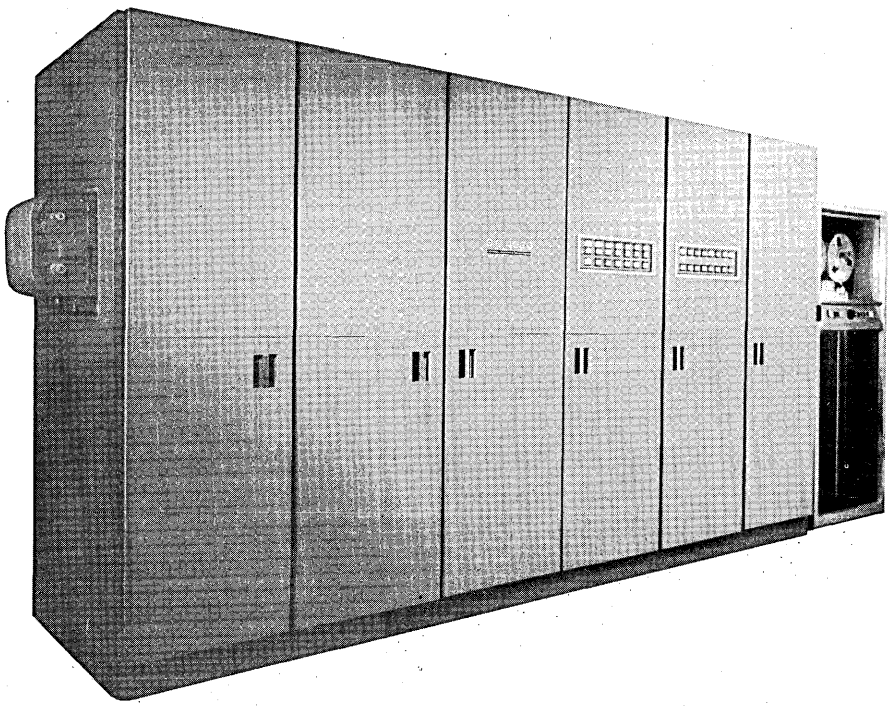
• The 1963 ACM National Conference will be held Aug. 28, 29, and 30th in Denver, Colorado.

• The second Institute on Electronic Information Display Systems will be held September 16-20 at The American Univ., Washington, D.C.

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

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

In versatility, and in speed, one computer output device stands alone, challenged only by the imagination of its users



The S-C 4020 Recorder is the only proven equipment, available now, which converts and records digital output in combinations of curves, vectors and characters at speeds consistent with today's large-scale computers.

Users of the S-C 4020 have imagination. They are proving it in more than a score of data processing labs across the country. Some of the current applications of the S-C 4020 even surprise the designers of the equipment. But our users are willing to share their ideas, applications and programming techniques.

USERS SOCIETY

To do this, they have formed a society of users of the S-C 4020 named UAIDE for "Users of Automatic Information Display Equipment." UAIDE has already set up a software library to exchange programming and application data.

VARIETY OF OUTPUT

Tapes from a large-scale computer (typically a 7090 or 7094) are fed through the S-C 4020 which translates the numerical language by using an improved CHARACTRON® Shaped-Beam Tube. Directly opposite the tube face is a recording camera, either 35mm or 16mm. Another optically aligned camera is optional which gives you page-size paper copies. A slide projector allows standard formats to be superimposed on the frame or page automatically at the command of the computer program. The microfilm can be viewed through a standard viewer,

reproduced into multiple reports, projected for group viewing, or placed storage and retrieval systems.

SPEED

S-C 4020 will accept data from magnetic tape at input rates up to 90,000 six-bit characters per second. The S-C 4020 will print this data at speeds in excess of 17,000 alphanumeric or symbolic characters per second. Frames combining characters, vectors and curves vary with the complexity of the drawing, but an average annotated graph can be recorded in fractions of a second.

ECONOMICS

The S-C 4020 can be leased by the month or purchased. We also operate a service bureau where you can lease 4020 time by-the-hour and try some of your own problems on the machine for evaluation. Prices on the 4020 have lifted some eyebrows of prospective users — but only at first glance. Used properly, the 4020 is paying its way many times over in labs throughout the U.S. For example, one user is doing a complex plotting job required daily by his engineering analysis group which was previously done in several days by more than 100 draftsmen. The S-C 4020 is producing the same annotated curves complete with grids, axis lines and titles in minutes for considerably less cost. The equipment's high density input tape adapter results in minimum use of valuable computer time for S-C 4020 tape preparation. Part of our lease or sales price includes trained field servicemen to install, operate and maintain your S-C 4020.

The S-C 4020 is not "blue sky". There are more than 20 machines in use, and orders exist for many more.

APPLICATIONS

The S-C 4020 can be employed to record tabular and other alphanumeric information such as stock catalogs, program debugging, and other statistical data at speeds of 17,000 characters per second. The equipment's versatility, however, is best illustrated by applications involving combinations of both drawing and character recording.

SCIENTIFIC CURVES

In many scientific computer labs the 4020 is being used to plot highly accurate curves involving one or more parameters. All axis and grid lines, annotations and titles are included in the program. For curves requiring more than one frame length, a continuous graph may be plotted by butting the frames together under program control. Typical curves include flight tests, engine performance, missile trajectory simulation, etc.

BUSINESS GRAPHS

The recorder is proving its usefulness daily by plotting curves and other business charts for cost analysis, production control, manpower forecasts, projected sales, and other administrative tasks. The machine's ability to summarize the data in a visual form speeds decision making, saving time and money.

TOOL PATH DRAWINGS

Magnetic tapes programmed in APT language to guide machine tools can first be played on the S-C 4020 which makes a drawing of the part. The drawing can be checked for errors prior to making a part, and can also be used for final inspection. In addition to tool path drawings, the 4020 can be used for such computer drafting applications as logic and flow diagrams, ship and missile design.

SCHEDULE NETWORKS

PERT and other critical path charts can be produced and updated on the S-C 4020 in seconds.

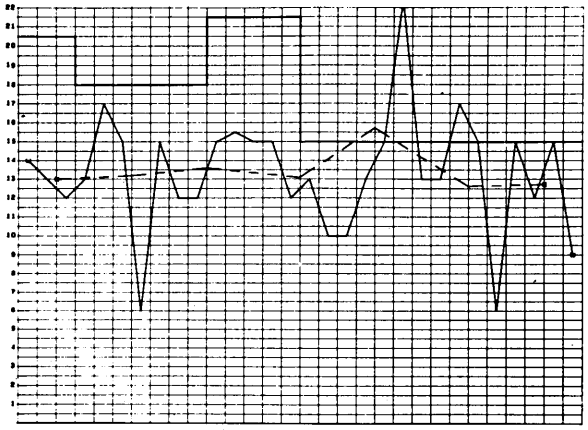
MAPPING

The 4020 is producing maps for such uses as weather patterns, satellite tracking and population studies. The map itself may be superimposed by the slide projector. The CHARACTRON Tube then displays the variable information, or the entire map may be drawn by the tube, allowing area expansion by computer command.

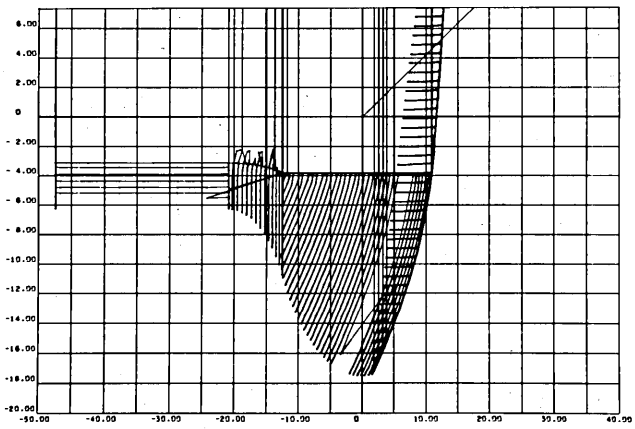
SEQUENTIAL EVENTS

One of the exotic uses of the equipment is the drawing of a series of slightly changing graphs for calculation of core reactor characteristics, simulation of shock waves and explosions, or for training aids. The series is then projected and viewed as a movie giving a time scale sequence.

Challenge the imagination and inventiveness of your programmers, engineers and managers to utilize your digital computer more fully in new ways through the S-C 4020. Write to Department D-13, General Dynamics| Electronics-San Diego, P.O. Box 127, San Diego 12, California.



Business Graphs



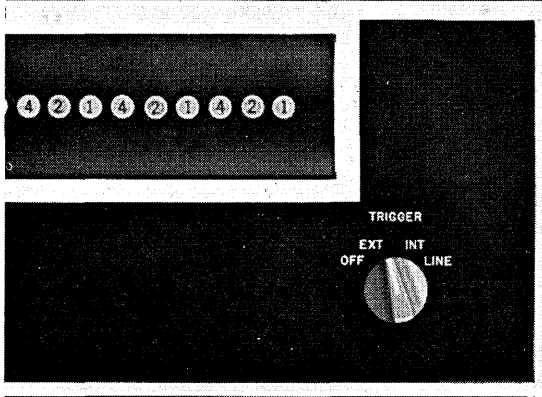
Tool Path Drawings

GENERAL DYNAMICS | ELECTRONICS GD SAN DIEGO

CIRCLE 9 ON READER CARD

So radical in concept, so conservative in design...

this solid state converter digitizes analog signals with unparalleled speed, accuracy and sensitivity. Its built-in flexibility and variety of input-output options satisfy the most sophisticated needs of our EDP and aerospace customers—IBM, General Electric, Bell Laboratories, Northrop Nortronics and others. Join them. Wire today for specs.

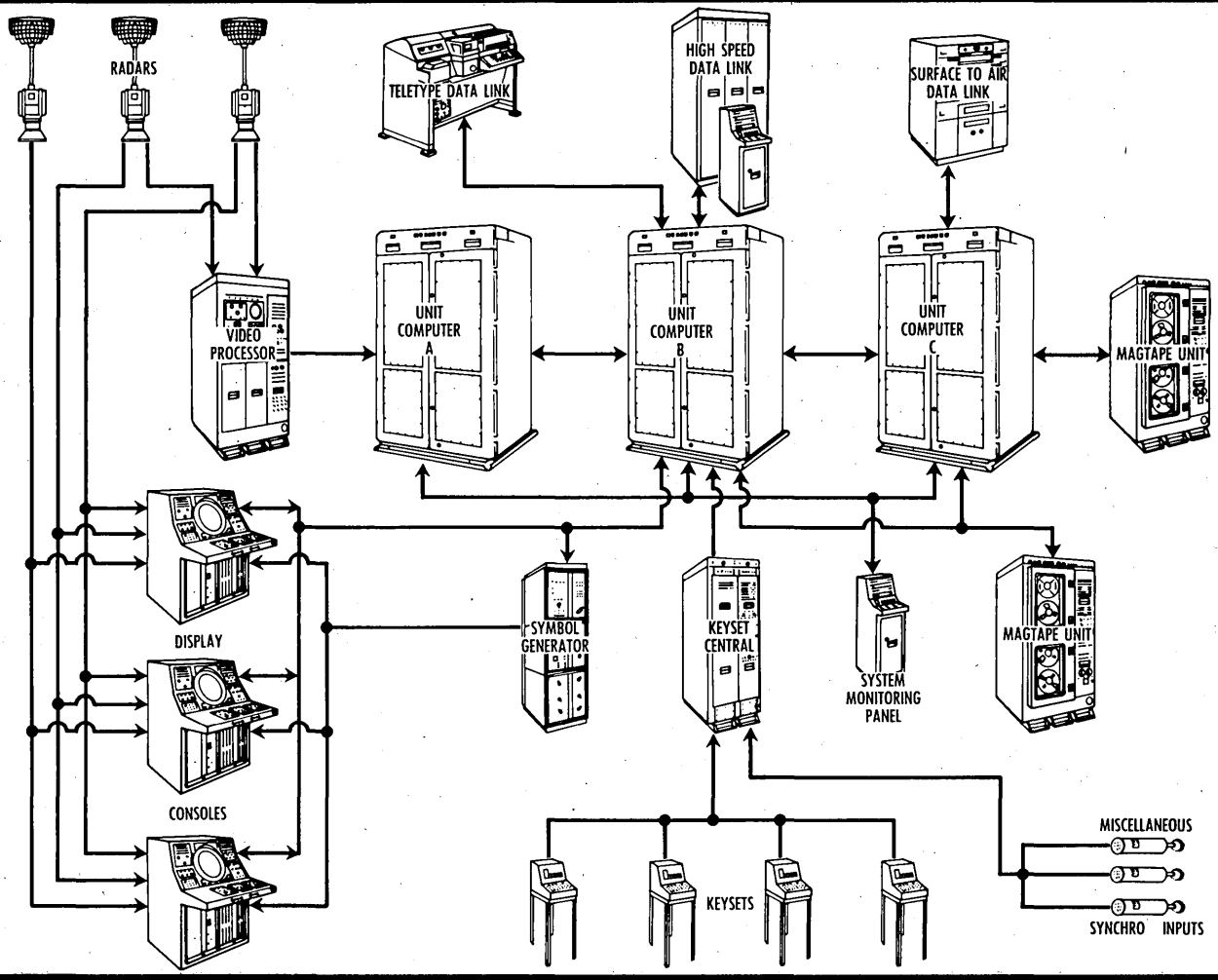


Adage INC

292 Main St., Cambridge, Mass.
1145 East Ash Ave., Fullerton, Cal.

CIRCLE 11 ON READER CARD

THE NAVAL TACTICAL DATA SYSTEM MODULAR CONCEPT



MULTIPLE COMPUTER PROGRAMMING

The above diagram shows a typical real-time system centered around the use of multiple "Unit" computers. This system has been designed and implemented by UNIVAC for the U.S. Navy and is now operational. Forward thinking, advanced programming and system design techniques have led to this system, and many new applications utilizing the unit computer concept are being developed. A few of the major features of the computer available to the systems analyst and the programmer are:

- Internal high-speed ferrite core storage with a cycle time of 8 microseconds and a capacity of 32,768 words. (Advanced models have several times the effective speed and greatly enhanced storage capacity.)
- 30-bit word length.
- 14 input and 14 output channels for rapid data exchanges with external equipment without program attention.
- The unit computer is very compact, 72" high, 38.1" wide and 36.9" deep, and has proved to be ultra reliable with a mean time to failure of 1500 hours.

If you are qualified for any of the following positions, please contact us as soon as possible.

Immediate Openings for:

Military Systems Analysts and Scientific Programmers for systems development and programming on multiple computer utilization concepts. Several levels of experience are required in each category. Salary level and classification are commensurate with education and experience. Engineering or scientific degree preferred with two or more years' experience on systems using modern real-time computers.

These openings are at Saint Paul, Minnesota and San Diego, California.

Senior Systems Programmers for business and/or scientific systems language development and the development of Executive, Communications Control and Compiling Systems. Mathematics or business degree preferred with five or more years' programming experience on modern large-scale data processing systems, including ALGOL and FORTRAN.

These openings are at St. Paul, Minnesota and other Univac locations including New York City.

Address inquiries with a resume of your education and experience to:

R. K. PATTERSON
UNIVAC
Univac Park
St. Paul 16, Minnesota

OR

W. K. LOWE
UNIVAC
P.O. Box 6248
San Diego 6, California

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letters

ALGOL abroad

Sir:

The article 'ALGOL and FORTRAN Revisited' in your January issue, which describes the entrenched position of FORTRAN in the United States, prompts me to reply from the other side of the Atlantic where ALGOL compilers are in general use; practically all manufacturers are offering such translators.

It is true that many of these compilers do not include a subroutine facility as defined by Messrs. Norman Sanders and Charles Fitzpatrick; this is, however, a limitation of the *compiler* rather than the ALGOL *language*. There is no difficulty in providing a library tape of pre-compiled ALGOL procedures. These need be subject to no restriction on generality and may make free use of global variables. The procedures would be automatically found and inserted into the correct block-level (not necessarily the outer block) of the object program by a single procedure call directed at the compiler.

R. L. Cook
Elliott Bros. Ltd.
London, England

inputted

Sir:

Regarding "The Son Of In and Out" and inventing a past tense for "output", I respectfully submit "outpast" . . . . . and duck.

J. A. Dinan
Avco Corp.
Wilmington, Mass.

outrated

Sir:

We read with interest the compendium of computer system time charges in the February, 1963 issue. Because the rates for NCA's 301 system differ significantly from those you have shown, we have forwarded our schedule of charges for RCA 301 system time at the NCA Datacenter in Princeton, N.J.

We hope that the publication of this information will make a further contribution to the very comprehensive listing of last February.

Sherman Blumenthal
President
National Computer Analysts, Inc.
Princeton, N.J.

dimming the console lights

Sir:

"Sprightly Packaging," as your insult/compliment in the February editorial indicates, is symptomatic of the requirements of a highly competitive industry (like enlarged memory modules, floating point option and ALGOL). There is no argument that an organization may have EDP problems (and I doubt if the console lights will really cover them), but equipment appearance is independent of the decision which brought in that equipment.

Unlike Detroit philosophy, the visual design of today's EDP equipment is not ostentatious or stylized for yearly fashion change. However, a V.P. authorizing an expenditure of a few hundred thousand dollars for his newest corporate status symbol has a right to a quality product in his environment in addition to computing power. Another rationalization for eye-fetching EDP gear is that, "Jack's hardware is well designed." (Jack's corporate headquarters is at White Plains.)

William H. Harkins
Staff Industrial Designer
Minneapolis-Honeywell
EDP Division
Newton Highlands, Mass.

Connecticut pioneering

Sir:

In the January 1963 issue of "Datamation", (News Briefs section, page 65) is a news article pertaining to the California Department of Motor Vehicles ordering a Philco 210 computer, for the purpose of Motor Vehicle Registration processing.

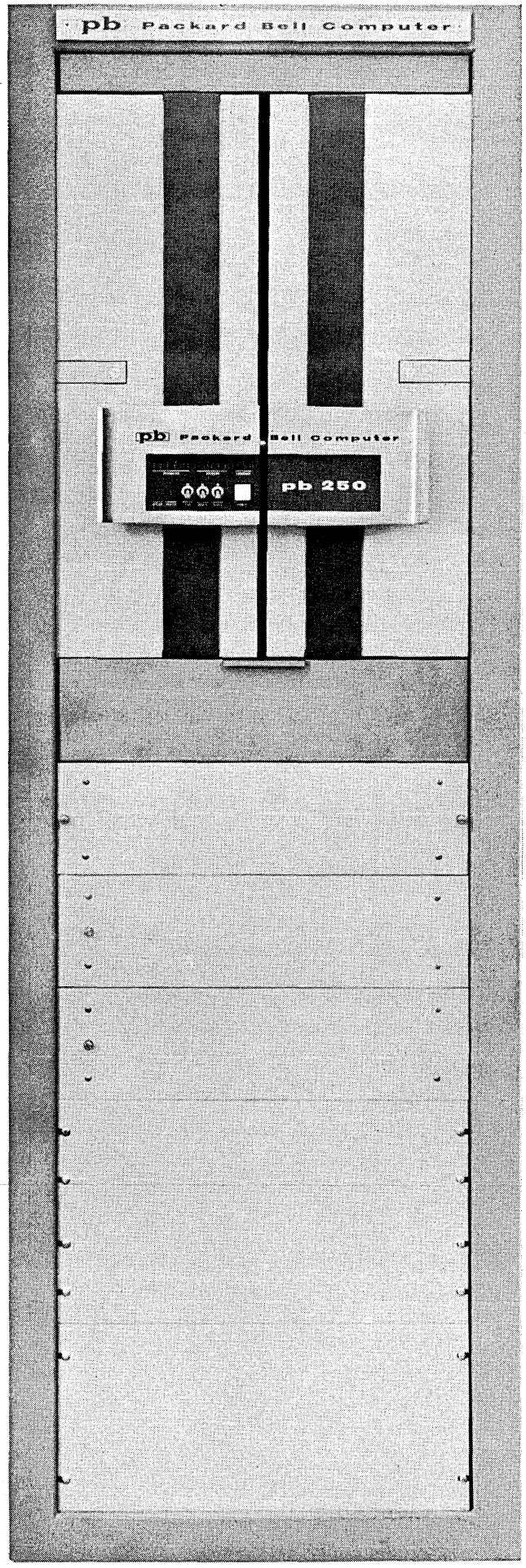
The statement was made that, "When installed this summer, California will be the first state to use large-scale dp equipment for auto registrations."

This statement is erroneous. The Motor Vehicles Department of the State of Connecticut has been processing their auto registration application on an IBM 1401 computer very effectively since October 1961. Presently, we are processing our Registration, Title, and Operator License Control applications on a combination 1401-1410 system.

I am sure that the present status of the Connecticut computer program makes this State a pioneer in the processing of Motor Vehicle records through electronic data processing.

William J. Kissane
Director, DP Div.,
Dept. of Motor Vehicles
State of Connecticut
Hartford, Conn.

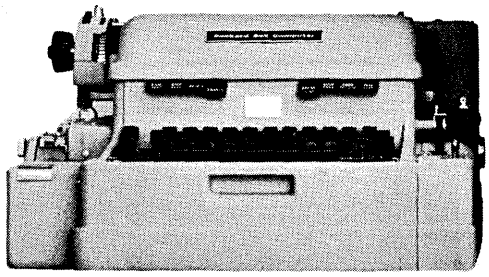
(Editor's Note: While the State of Connecticut is to be commended for its early efforts in this application, the news item in question clearly indicates "large scale dp equipment." Unfortunately, the 1401 and 1410 do not fill the bill.)



Cost Breakthrough for Computer Control from PACKARD BELL

PB250 Computer
2320 word memory
Flexowriter with paper tape reader and punch. A complete control computer for $33,000—saving the systems designer $7,000.

PB250 Computer
3856 word memory
Flexowriter with paper tape reader and punch. A complete control computer with expanded memory for $38,400—saving the systems designer $4,700.



These new PB250 prices mean that you can now have a solid-state microsecond speed computer ready for operation at up to $15,000 or 30% less than any comparable computer on the market today.

Nearly 150 PB250 digital computers have found successful application in a variety of system applications. Including: automatic checkout • data logging • radar antenna, astronomical telescope and wind tunnel control • data acquisition • telemetry and tracking. Now, through volume production and improved manufacturing techniques, the systems designer can have the PB250's versatility and reliability at significant new savings.

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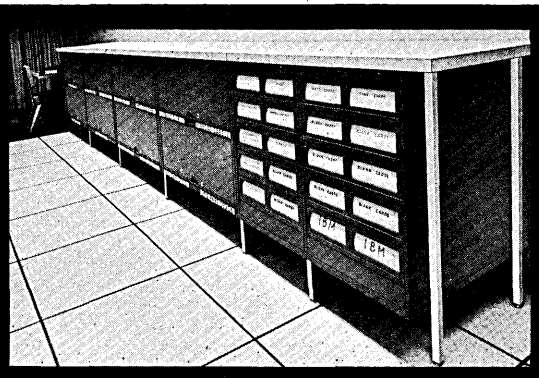

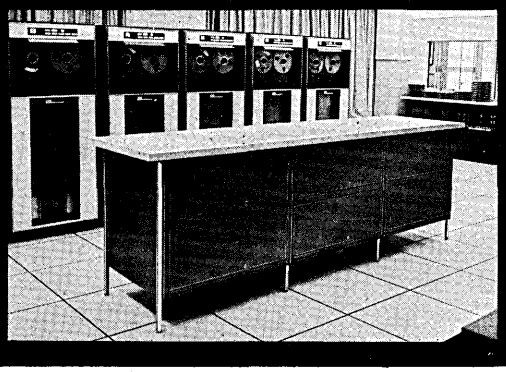

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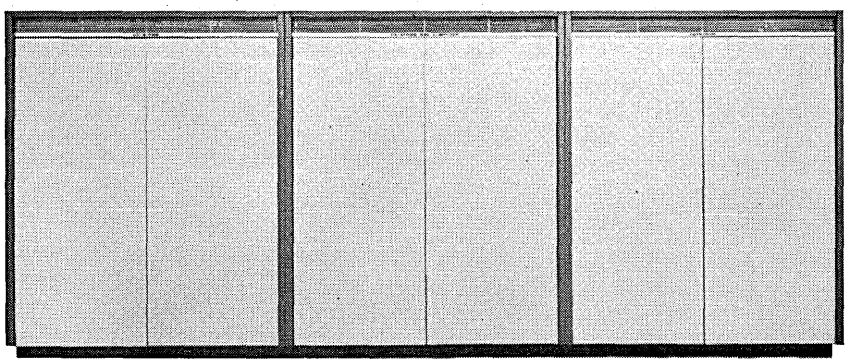

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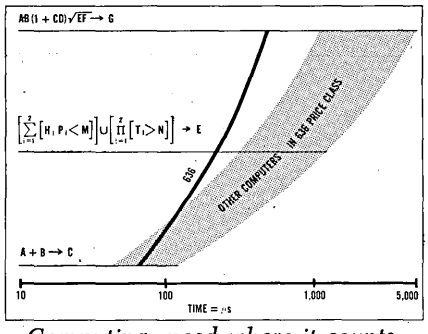

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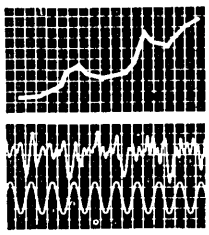


BUSINESS & SCIENCE

ALGOL FOUNDERS SWITCH TRACKS

Charles Katz of GE Computer, and one of the original members of the ALGOL-58 committee which defined the language, said last month that he has switched his loyalties to FORTRAN because of the widespread demand for its implementation and the lack of commercial interest in ALGOL.

Katz made this statement during a meeting of the X3.4 committee on programming language standards. His declaration to the group was a surprise package of sorts since he urged that the U.S. should discontinue its standardization efforts on ALGOL (See Editor's Readout, p. 23).

Also a member of the ALGOL-58 committee, Joe Wegstein, National Bureau of Standards, told DATAMATION last month that he felt ALGOL should be standardized only as a publication language and not as a programming language. When informed that no provision presently exists for a standard publication language, Wegstein suggested that "maybe one is needed," and that the direction X3.4 has presently taken on ALGOL, if continued, "would destroy the language."

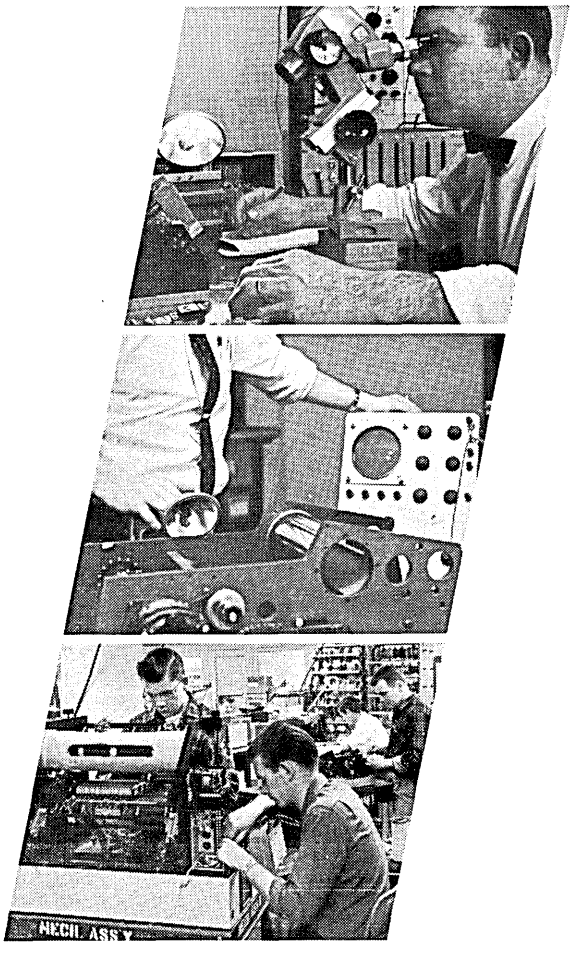
BIZMAC REVISITED

Widely known throughout the computing industry as one of RCA's early booboos, the Bizmac configuration (sic) was announced in the mid-'50s at a Western Joint Computer Conference during the course of a full afternoon. Attendees were astounded at the size of the equipment. A few were frightened!

To be kind, however, Bizmac was not entirely unsuccessful. One system was sold commercially to the Army Tank Automotive Center (ATAC) in Detroit for 4.1 megabucks. All tubes were lit early in '57. Three other Bizmacs were constructed but were used "internally" by RCA.

ATAC has recently installed slightly tidier, solid state equipment and, several months ago, a sale announcement was made and sealed bids accepted for Bizmac. Their system includes the main frame, 182 tape stations, 294 patchboards, paper and mag tape duplicators and transcribers, and 2,000 reels of mag tape, largely in useable condition.

The new owner of Bizmac is the Petrof Trading Co., Berkeley, Calif. Petrof's purchase price: $6,789. An attempt is presently being made to sell or lease the system; no price has been established although the new owner told DATAMATION he is entertaining



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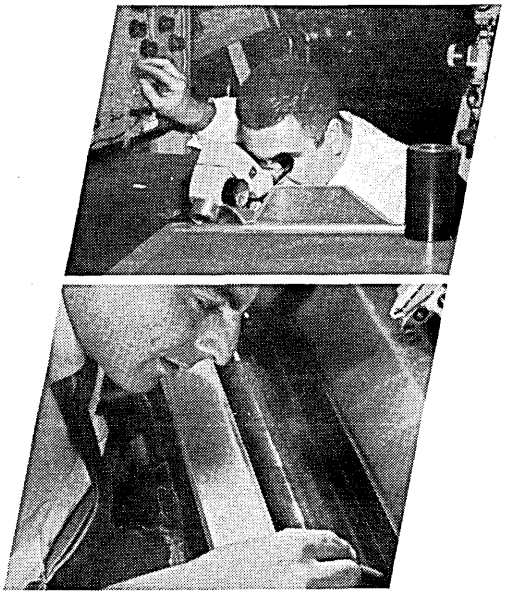

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the possibility of RCA maintaining Bizmac if a lessee is found. A more caustic alternative is offered by an inventive DATAMATION reader who suggests hollowing it out and living in it or, for that matter, opening an apartment development.

Another used-computer owner of note is the Life & Casualty Insurance Co. of Tennessee which has recently acquired the Univ. of Pennsylvania's Univac I, a microminiaturized machine compared to Bizmac.

Present cost of the one megabuck U-1 was $75K, although G. Dudley, president of the firm, states that the actual purchase price was $10K. Additional costs were for dismantling, moving, reassembly, and various installation costs.

Petrof Trading Co.--take heed!

THE 1004: A UNIVAC SURPRISE

Now in full production with their hottest number since the cordless razor, the Univac division of Sperry Rand has over 1,500 orders for the 1004 card processor. For Univac management, this burgeoning order rate is unquestionably a welcome whopper of a surprise.

In an original estimate of the card processor's market, just prior to announcement of the 1004 in June of last year, Univac optimistically projected a figure of 300 sales. Production of the machine at their Utica plant will soon reach 44 per week, and over 200 per month.

In celebration of their first production model, Univac president Louis Rader explained, "Our major competitor spread the word throughout the country that Univac has fallen on its face many times before and will never get this out." A doubling of the present 1004 order rate is expected, although one of the division's current concerns is in interesting the sales force in such comparatively mundane hardware as 1107s, U-IIIs, and an occasional solid state.

Still a happy puzzler for Univac is the fact that IBM has shown no specific appetite for this sub-1401 market.

WHATSA COMPUTER, MR. FRITZ?

Occasionally an entrepreneur of modest proportion will introduce a gadget to accomplish a minor mathematical task, and affix the handy label of "computer" to encourage a fast sale. In general, the technique has proven ineffective, and the company soon regresses to its earlier trade of producing children's toys, anchors for sail boats, or ceramic ash trays.

In the past, exploitation of the term, "computer," has seldom emanated from responsible citizens in the profession. Last month, however, a "pocket-sized computer" was announced by M.M. Sales, Montrose, Calif., to solve PERT equations. The "PERTOMETER Computer," as it is called, was developed and marketed by George T. Mundorff, executive assistant to the president of the Commercial Computer Div. of General Precision Inc.'s Information Systems Group.

In the sixth paragraph of his news release, Mundorff describes the "computer" as consisting of three concentric plastic discs and a transparent cursor. Unquestionably the most reasonable "computer"

commercially available, sale price is $2.50 plus 25¢ for postage.

Asked by DATAMATION why he chose to label his device a "computer," Mundorff replied that it was classified as such by the U.S. Patent Office; that the legal or Webster's definition of a computer is "one who or that which computes; a calculator," and finally, the IRE Standards on Electronic Computers (published in Sept. '56) appears to support the aforementioned definitions with equal vagueness.

Considering the fact that the glossary subcommittee of the American Standards Association, now chaired by W. Barkley Fritz, has yet to produce an alternative definition, DATAMATION congratulates Mr. Mundorff as the winner of our "Cheapest Computer Alive" contest inaugurated this month.

NANOSECOND PANEL PROJECTS CIRCUIT COSTS

Regardless of the commercial availability of nanosecond hardware within two years, three experts in this field prognosticated some strikingly low cost figures for the production of tunnel diode circuit modules last month.

At a panel discussion during the Pacific Computer Conference, GE's William Peil estimated a per-module cost of $25-30 for a parallel, nanosecond circuit module with a fan-in and fan-out of approximately six, a figure very much in line with present circuit costs. IBM's chief systems designer, Gene Amdahl, suggested that his firm could produce it for less than an eye-opening $5.

J. Presper Eckert, Univac, added a final note of special interest. A transistor of nanosecond speed is soon forthcoming, Eckert said, and, of course, would be preferable to the tunnel diode.

FACTS ON UNEMPLOYMENT

Factual reporting on the unemployment problem is unquestionably one of the most difficult chores in U.S. journalism. Not only are accurate statistics in scarce supply but the implications drawn from available data are generally highly partisan which casts considerable doubt on the veracity of the input mechanism. One bearer of some pessimistic but reasonably reliable statistics is Edgar Weinberg, chief of the Division of Technological Studies in the U.S. Labor Dept.'s Bureau of Labor Statistics.

Speaking before the Washington, D.C. chapter of the Systems and Procedures Assoc. last month, Weinberg noted that since 1947 one of the effects of automation has been an overall increase in output per man hour averaging three per cent each year.

This would mean, he said, that with 70 million workers and other factors remaining somewhat stable, the loss in jobs would total about two million per year. In the 1960's, the labor force will increase by one to two million workers each year, indicating an increase in unemployed of three to four million workers annually.

However, in the area of clerical labor where edp has had a specific influence, the Labor Dept.'s Manpower Report published in March states, "Compared with 9.8 million clerical workers in 1960, by 1970 clerical employment may rise to 12.8 million and by 1975 may reach 14 million, an increase of 45 per cent over the 1960-75 period."

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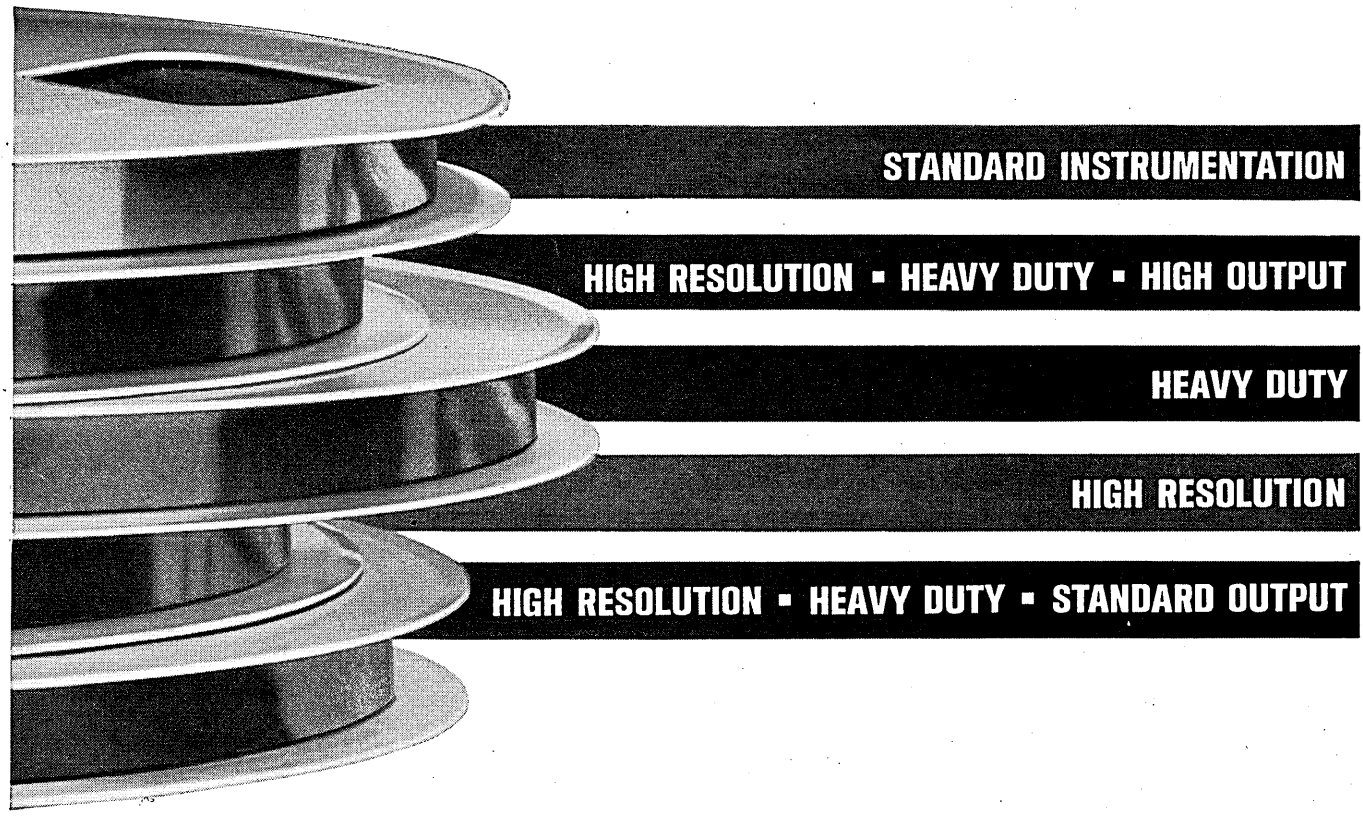

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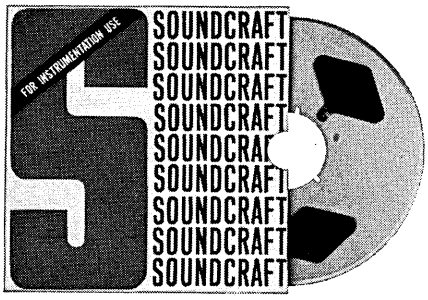

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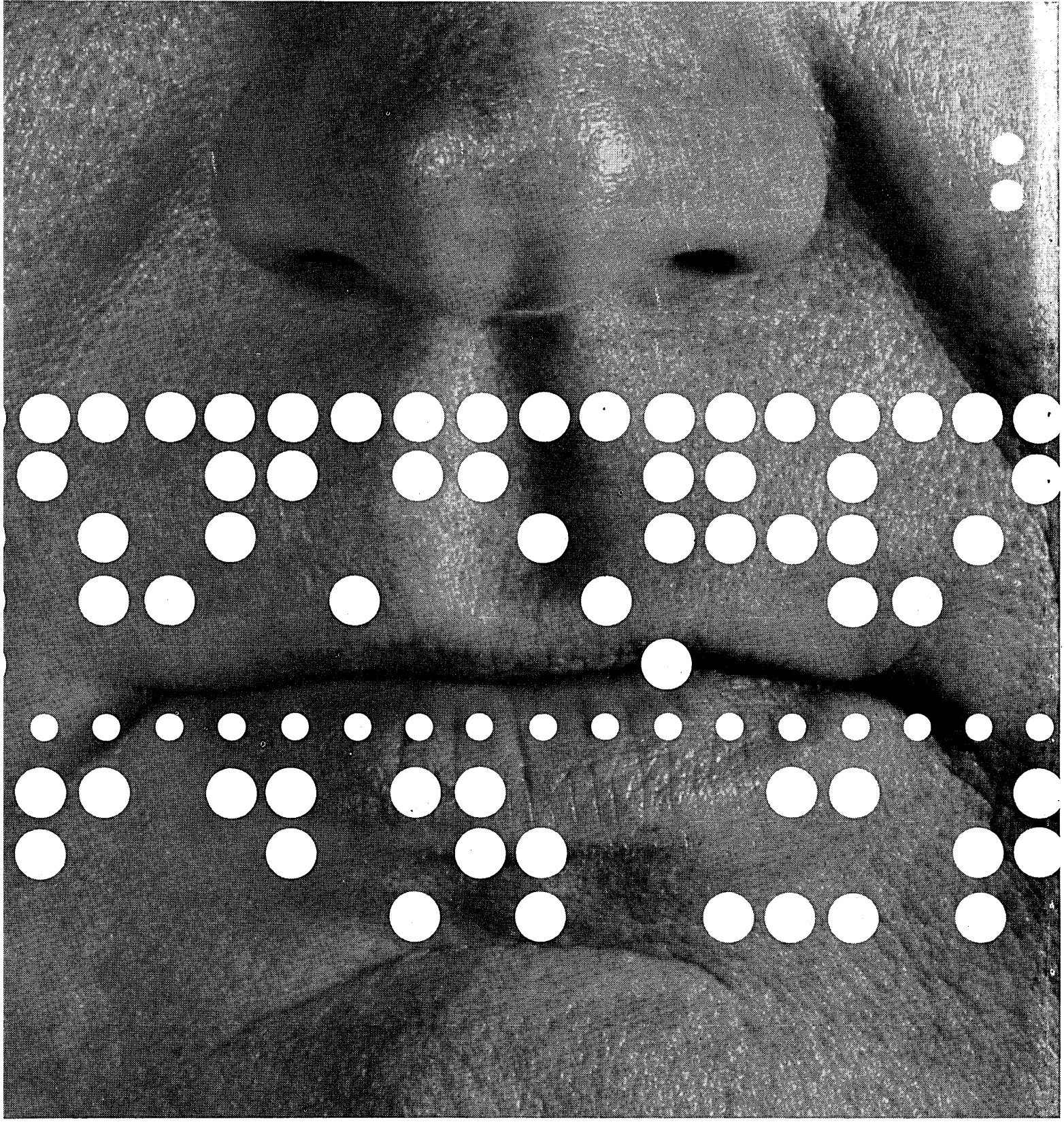

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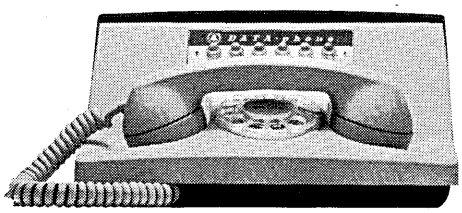

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EDITOR'S READOUT

ANGELS, PINS & LANGUAGE STANDARDS

Since their inception in 1960, U. S. standards activities in information processing (particularly work in programming languages) have been tagged by a vocal group of "insiders" with a variety of indelicate labels indicating that in large measure, this effort has served as a vehicle for philosophical bantering and political in-fighting.

To "outsiders", academic descriptions of the activities of various committees and sub-committees have not mitigated the confusion arising from the mushrooming quantity of numericaly designated functions (e.g., X3.4, X3.4.2, X3.4.4, etc.). Equally puzzling of course, has been the lack of a single, specific accomplishment.

To individuals active in the sundry deliberations of standards groups, caution and prudence have been deemed co-virtues in the methodical nature of organizing their work and establishing reasonable goals; at least, this has been their publicized contention.

For background on the specific goals and progress of the language standards group, the following selected quotes should be of interest:

At the ASA's Houston conference in October, 1961, R. E. Utman reported,[1] "Having selected ALGOL and COBOL as candidates, X3.4 is now involved in technical review of the present form of their specifications. The need is so urgent that the evaluation of their specifications and potentiality for standardization cannot wait for the orderly definition of standard procedures and specification languages. In this case, it may be necessary to propose a specification . . . . as soon as possible, and prior to the completion of their current widespread implementation, scheduled as early as mid-1962. This provides only a few months to achieve a considerable and pioneering standardization effort."

Early in 1962, initial ambitions were reevaluated. Dick Clippinger explained,[2] "The mechanism for working with the COBOL committee and the ALGOL committee is yet to be worked out. Clearly, hard work and good intentions will not suffice to arive at satisfactory standards in a short time."

And in February, 1963, Clippinger noted,[3] "X3.4 had selected three lan-

1. *Language Standards . . . A Status Report*, R. E. Utman, RemRand Univac, & Chairman Pro Tempore, ASA Sub-Committee X3.4 (Languages), p. 26, *Datamation*, November, 1961.
2. *The Standards Outlook . . . Objectives Set*, Richard F. Clippinger, p. 35, *Datamation*, January, 1962.
3. *ALGOL: a growing glow*, R. F. Clippinger, EDP Div., Minneapolis-Honeywell, & Chairman, ASA Sub-Committee X3.4 (Languages), p. 15, *Datamation*, February, 1963.

guages for processing as American standards: ALGOL, FORTRAN, and COBOL. Work is just starting on FORTRAN; will soon start on COBOL." He also added that the ALGOL effort was proceeding well overseas.

One obvious conclusion which may be drawn from the preceding chronology of progress is that the U. S. standardization effort in programming languages has actually moved backward. This fact is indeed, difficult to comprehend considering the countless meetings during past years of individuals with considerable stature in the computing fraternity.

Until last month, meetings in this area have not been attended by the press. On March 7th, however, DATAMATION was invited as an observer to X3.4's discussions in Los Angeles. As chairman of the meeting, Dick Clippinger began the day-long session by stating that this was normally an "unexciting" event in which the full committee heard reports of sub-committee chairmen regarding work currently in progress. He was wrong!

One of the first reports presented was from Dick Utman, now chairman of X3.4.2. His committee had prepared the following resolution: "It is premature to adopt any available language as a standard programming language of broad utility. However, useful purposes will be served by specifying ASA standard versions of certain artificial languages, e.g., ALGOL, FORTRAN and COBOL."

The discussion which followed revolved about several questions including: What is a standard? What is a standard programming language? Is standardization permissible on more than one language? Should standards in this area be accomplished now? Should the committee wait until all three languages are wrapped up in one package? What is a programming language and in what respects does it differ from a publication language? What does the resolution as presented really mean?

One aspect of the discussion concerned the relative virtues of standardizing on ALGOL and FORTRAN because of the apparent conflict in utilization of the two languages. It was also suggested that with a good compute verb, COBOL might also be used for scientific data processing. A comparison was drawn to the variety of ASA standards for screw threads which might be interpreted as permitting standardization on a variety of languages for a similar purpose.

A principal contributor to the ALGOL vs. FORTRAN issue was Charles Katz of G. E.'s Computer Division. Katz was one of the original members of the ALGOL-58 committee which defined the language.

When ALGOL was defined, Katz said, it was sensible to do so as a compromise solution to the many dialects existing at that time. Today, there is a greater exchangeability in FORTRAN which exists for almost all machines. He strongly urged the committee *not* to consider ALGOL as a standard because "there's no need for it." Katz described himself as "one of the last to get off the ALGOL bandwagon." FORTRAN, he reiterated, should be the only standard for scientific data processing. Two of the questions following Katz's remarks were simply phrased as "Which FORTRAN?" and "Whose FORTRAN?"

After the debate had proceeded for some time, Howard Bromberg, RCA EDP and chairman of X3.4.4, suggested to the group that the meeting had hit an all-time low in its deliberations and that "a standardization tutorial" should be planned as a separate session which he would definitely not attend. "I've flown 3,000 miles for this meeting," Bromberg added, "and it's silly!"

Chairman Clippinger replied that the discussion "was not worthless. Maybe it is somewhat amorphous," he added "but it is not a waste of time. What we decide here is important!"

The following excerpts summarize the balance of the committee's deliberations:

Katz: "I resigned over a year ago from this committee because of this type of discussion."

Clippinger: "Do you propose no more work on ALGOL?"

Utman: "Charlie only said that there was no concern domestically for ALGOL."

Clippinger: "We should go home and think about ALGOL."

Katz: "Defining a standard will not make people use it. Our concern should be on defining what people will use. Customers are demanding that FORTRAN and COBOL be implemented and the same thing will happen in Europe . . ."

Tom Steele (SDC): "No one has discussed the criteria by which languages should be judged for standardization."

Bromberg: "Let's do *something!*"

One specific action of the committee was the passage of the resolution in question. Therefore, for the present and immediate future, no programming language will be adopted as a U.S. standard.

To conclude this editorial report on a more constructive note, the following excerpts are offered from a letter written in January, 1961 to Bob Bemer, then chairman of X3.4.2, by DATAMATION editorial adviser, Bob Patrick. The occasion of the letter was to decline an invitation to join Bemer's committee.

After explaining that his present work schedule did not afford him sufficient time to participate in the ASA activity, Patrick added, "We have seen in the past few years, several committee activities which, though they were well intended such as this one and organized by competent individuals such as this one, had basic deficiencies and ended in failure. . . .

"Unfortunately, I have some reservations as to the success of your new venture because I believe that I see a basic deficiency of philosophy which cannot be overcome simply by dedicated individuals pledging themselves and their hopes in trying to solve the problem.

"In my opinion the basic difficulties are 1) conflict of interest; 2) lack of rapport between the participants; 3) extreme difficulty of communication along the frontier of the art.

"The only hope I see for the solution of these problems is in the funding of an independent institute by the interested individuals, companies, universities and manufacturers. After this institute is funded and established, then people such as you have invited can be placed on loan to the institute and their families moved so that these individuals are in close geographic proximity and housed in the same building during working hours.

"Only in this way, in my opinion, can we break down the primary loyalties of an individual to his parent corporation, the idiosyncrasies of language idiom and the basic conflict of interest brought about by the fact that the very men you wish to draw upon are carrying heavy loads in key positions in their present corporations.

"At first glance this solution may appear to some to be too severe, but three or four round trip air fares across the country are approximately equivalent to shipping a house load of furniture from Los Angeles to Washington, D.C. If we are truly to set standards for our young industry which will be held inviolate for more than a fortnight or so, this must be done by learned individuals working in complete concert and free of the conflict of interests that usually accompanies privileged knowledge. . . . " ■

A pre-publication copy of this month's Editor's Readout was submitted to Dr. Clippinger for his comments, and the following note was addressed to DATAMATION. It is published as a rebuttal to the editorial.

PROGRESS IN LANGUAGE STANDARDS

by RICHARD F. CLIPPINGER, Chairman, X3.4 Subcommittee on Programming Languages, American Standards Association

As the butt of your humor, it is not easy for me to be enthusiastic. On the other hand, this is a free world and I am inclined to think that making us look ridiculous will not have much influence in the long run, on the work of X3.4. Having been closely associated with this work since its inception, I, of course, do not see it at all the way you do. Standards have always been slow to achieve. Even in fields where the subject matter has been relatively simple. You and Bob Patrick must certainly realize that the field of programming languages is extremely complex and that there are no easy solutions.

It has taken FORTRAN 10 years to evolve to the point where it is today. And certainly everyone is aware that the form FORTRAN has on the 50 different machines for which it has been implemented is not identical. On the other hand, despite significant differences in computer construction, word length, arithmetic, I/O media, etc., it is very much easier to move a problem from Machine A to Machine B if it is written in FORTRAN than if it is written in assembly language. It is therefore a very healthy thing for the user that FORTRAN exists because he is to some extent, freed from the tyranny of being restricted to one machine. X3.4 feels that the FORTRAN committee, acting to define FORTRAN II and FORTRAN IV in an official fashion, with give and take by all sides will lead to revisions of FORTRAN which manufacturers will implement, making it even easier to transfer problems from Machine A to Machine B. The FORTRAN committee, X3.4.3, is hard at work on this task which is slow because it is complex. But it is making progress and I do not believe any other group could do it any faster or any better. Because this work has value both to the manufacturer and to the user, it will proceed whether we are held up to ridicule or not. But it would perhaps be recognized as a worthwhile activity a little sooner if it were not ridiculed so bitterly.

In the COBOL area, this is how I see things. First of all, COBOL in general, forgetting standards. COBOL was slow to be defined and early compilers were implemented on machines too small to handle it. It is no surprise that customers were not pleased with the result. The COBOL committee of CODASYL has doggedly continued to clarify and extend COBOL, and new compilers being implemented are getting better. Compiler times are improving, and object code is improving. The language is therefore becoming more useful. But it took FORTRAN five years to achieve any noticeable usefulness, and it is certainly no shock to me that it will take COBOL as long. Furthermore, the CODASYL executive committee made little effort to require different manufacturers to implement COBOL in any standard way. There is therefore a lot of variations between the sets of features chosen by various manufacturers to implement. Clearly here also, there is need for standardization work. The COBOL committee, X3.4.4, was founded only recently because we wanted to establish good relationships with CODASYL. The work is slowly gathering momentum and the program is laid out in such a way as to insure results. It is my belief that the work of X3.4.4. will result in greater similarity between implemented COBOLs of various manufacturers. It is further my belief that COBOL therefore will gather momentum and become more and more important to data processing users. It will do this, however, more as a result of the fact that it saves the users money, both in original problem preparation and in moving the application to different machines than as a result of superficial advertisements or jibes by critics.

A single American standard programming language: At the backs of the minds of many participants of X3.4 and also non-members of X3.4 who have thought about this subject, such as Chris Shaw and his article in DATAMATION, has been the thought that it should be possible to have a good programming language suitable for all purposes. This is probably not true for little machines, where it might be too complex and, therefore, too slow to compile. It might be true for large machines. However, it is

not now a fact. There may be no prohibition against American standards bodies developing new things but certainly I do not expect X3.4 to be good at developing such a language. Therefore, X3.4 has steered away from such activities, although this has not prevented discussions arising many times. We are therefore working on a standard set of nested standards for specific languages, namely FORTRAN and COBOL. You are aware that we have done some work on a similar set of nested ALGOLs. There is much less pressure for this in the United States, and it could happen at the next meeting that we might drop it as an American objective. It was revived for discussion at our last two meetings because of feedback from the progress of X3.2 coded character sets through X3. However, I think the issue is now temporarily settled and, as a matter of fact, I think it unlikely that X3.4 will ever propose "an American standard programming language." Leading now to your editorial, I would like to make some specific comments about specific paragraphs, although it would be much easier if you were simply to write a more friendly editorial.

In the first paragraph, you refer to "political in-fighting." I don't know what this refers to. I may be blind, but I know of very little political in-fighting in X3.4.

In the second paragraph, last sentence, I cannot see why it is "puzzling" that we do not have a specific accomplishment yet. FORTRAN now is making good progress, but considering all that has to be done I would not anticipate that it would be processed through ASA before 1965. The work will have its influence long before that, however. For example, Honeywell, among others, is building a syntax-directed FORTRAN IV using syntax tables which are being modified as fast as X3.4.3's work progresses.

The ninth paragraph. As pointed out earlier in my letter, this is the general conception in X3.4 that our only good work can be done in the field of languages which people are using, rather than dream languages which might be conceived.

Regarding the 10th paragraph, we look a little foolish asking such questions about what a standard is after 2½ years of existence, but the facts are that different people have different ideas of what a standard programming language is, and consequently there will continue to be such discussions of these points. Therefore, I see no harm in mentioning it.

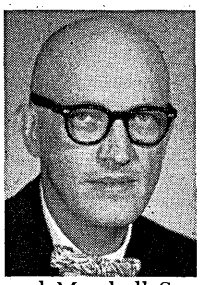
Although Howard (Bromberg) said what you've reported in the 15th paragraph, I think it is really taking advantage to quote him. It is necessary in most committees to have a certain redundancy of discussion which becomes frustrating and leads people to make such statements. If it is a worthwhile goal to ridicule us, this is certainly useful material.

The last part of your editorial is said to be in a more constructive mood. It is rather interesting that I made a similar suggestion to the COBOL committee about a year before Bob Patrick's suggestion to Bob Bemer. It is certainly true that certain aspects of this proposal make it appear desirable—namely the continuity of the efforts of the individuals working full time rather than part time. It might or it might not work. It would certainly take a lot of selling and a lot of diplomacy to get it set up. The questions of under whose auspices the work should be done, who would fund it, is the work acceptable to the sponsors, would it achieve any more acceptance than the current procedures are, of course, unanswered. ■

ALGOL ON THE 7090

SHARE reports four installations on the air

by JACKSON W. GRANHOLM, Thousand Oaks, Calif.



On Ash Wednesday, Feb. 27th, in San Diego, Calif., the ALGOL Committee of the SHARE organization reported in open tutorial session. Gist of their report: ALGOL '60 is running on four 7090 installations.

The installations described are Rocketdyne, Canoga Park, Calif.; General Atomic, San Diego, Calif.; Oak Ridge National Laboratory, Oak Ridge, Tenn., and Marshall Space Flight Center, Huntsville, Ala.

SHARE ALGOL is the work of the Committee of the same name. This Committee has had a long and varied history. It was first formed in 1960 under the chairmanship of Mort Bernstein of The RAND Corporation. Bernstein was later succeeded by Bernie Rudin of Lockheed Missile and Space Division, Sunnyvale, Calif. Rudin and his associates wrote the translator for I/O which is used in SHARE ALGOL.

Mrs. Marjorie Lietzke became the third and present Chairman of the ALGOL Committee. Under her Chairmanship the goal of the SHARE ALGOL Committee was defined as the implementation of classic ALGOL '60.

Since the work on SHARE ALGOL was accomplished in remote places by existing FORTRAN users, a piece-by-piece approach had to be used. The ALGOL compiler was hooked to the existing SOS system. It uses the FORTRAN II monitor.

ALGOL program input looks much like FORTRAN to the system except for the special flags which mark it as ALGOL. Additional delimiters are defined for ALGOL, however. Formats in and out are identical to those of FORTRAN.

Mrs. Lietzke and her associates at the Oak Ridge National Laboratory wrote the syntax checking routines which function under the FORTRAN monitor. The FORTRAN user must make only minor changes in his monitor system to use SHARE ALGOL.

Certain differences exist between SHARE ALGOL and ALGOL '60 as classically defined. Lists for example, are handled differently. The name of each list appears as an argument to the I/O subroutines. Recursive subroutines are not allowed. There is no call of arrays by value. All parameters and procedures are specified by type. There is ordering of declarations. A block may not use a variable until it is declared.

The programmer writes in canonical ALGOL '60 symbols. Keypunching of his statements is somewhat involved. At Oak Ridge, for example, a transliteration converts some symbols into successive card rows. At Rocketdyne, a Division of North American Aviation, Inc., a method has been devised, using overpunching, to establish a one-to-one correspondence between each ALGOL symbol and each card column. ALGOL cards are run into a 1401 which outputs a SHARE standard tape for use on the 7090.

A considerable contribution to the progress of SHARE ALGOL came from IBM, beginning under Robert Bemer, now with UNIVAC. In particular, two IBM softwaremen, Rex Franciotti, and Julien Green, have contributed significantly to the work of the SHARE ALGOL committee.

Current members of the SHARE ALGOL committee are Marjorie Lietzke, Oak Ridge National Laboratory, chairman; Dr. Marius Troost, General Atomic; Jack Gysbers, Rocketdyne; Julien Green, IBM, and Allan Nichols, General Electric Corp., Huntsville, Ala.

Considerable help and encouragement to the SHARE ALGOL Committee has been provided by such computermen as Dr. George Forsythe of Stanford University, Dr. Alston S. Householder of Oak Ridge National Laboratory, and Dr. John Carr III of the University of North Carolina, Chapel Hill.

The master tapes of the SHARE ALGOL committee have been distributed to SDA and, hence, are now available to any SHARE member. At Oak Ridge National Laboratory, due to the work of Mrs. Lietzke and her associates, a single system tape carries FORTRAN, ALGOL, and FAP. At Huntsville the work of Al Hirsch and Allan Nichols has resulted in a current effort, near fruition, to put SHARE ALGOL under the IBSYS system.

The work done with SHARE ALGOL by Jack Gysbers and his associates at Rocketdyne is particularly interesting. The programmer writes in canonical ALGOL '60 symbols. As has been mentioned, keypunching of his statements is somewhat involved, requiring overpunching, but it results in a one-column-per-symbol system. The ALGOL cards are run into a 1401 which outputs a tape for use on the 7090. This tape is a SHARE standard tape.

Rocketdyne has on its premises an SC4020, the microfilm-and-hardcopy output device marketed by General Dynamics/Electronics. A by-product of ALGOL compilation on the Rocketdyne 7090 is a tape for the SC4020. The character generator program which produces this tape was written at Rocketdyne. It makes use of none of the standard matrix characters of the SC4020. Every ALGOL character is generated.

The SC4020 is operated off-line. It is fed by an IBM 729 Mod II tape servo. The ALGOL character generator at Rocketdyne which makes tapes for the SC4020 was written by a group headed by Jack Gysbers.

The ALGOL programmer at Rocketdyne therefore gets back a complete listing of his program as it was entered into the 7090 at compiling time. The listing is in book ALGOL '60. This is an excellent debugging aid. Since SHARE ALGOL contains a syntax checker and a number of diagnostics, the programmer is advised in short time of "stupid-type" errors in problem statement language.

One of the continual objections to machine implementations of ALGOL has been the character set of mechanical printers. Its use of a very general character set has been cited as proof of the impracticability of ALGOL. Gysbers and his associates seem to have gone a long way toward removing this objection.

The work of the Rocketdyne people may be a step toward the combining of programming and program write-up in one document, one of the goals of the CODASYL compiler at Los Alamos.

ALGOL, named by the Arabs, is a fixed star in the constellation Perseus. It was among the first of stars noted for its periodic variation in brightness, due to eclipse by a dark satellite. Its name, in Arabic, signifies "The Demon".

On last Ash Wednesday in San Diego, ALGOL may have proven not only to be a demon, but to be a genii, rising with astounding magic from the bottle wherein it had been securely corked by its critics. ■

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

ATTITUDES TOWARD INTELLIGENT MACHINES*

Part Two: Soviet progress

by PAUL ARMER, The RAND Corp.,
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Our examination thus far has been Western in origin; in view of the impact that achievement of the goals of research on artificial intelligence would have on the technological posture of the United States vis-a-vis the Soviet Union, it might be interesting to look at Soviet attitudes toward intelligent machines. As one might suspect, Soviet attitudes have been quite similar to Western ones. Positivists and negativists exist, and each camp advances the same sort of arguments as their Western counterparts. For example, there are negativists who advance the obedient slave argument. Academician S. A. Lebedev, head of the Institute of Precise Mechanics and Computational Techniques and host to the U.S. Exchange Delegation in Computers which visited the USSR in the last two weeks of May, 1959 (of which I was a member), on two occasions dismissed my questions concerning his attitude toward intelligent machines with the statement "Machines can do no more than they are instructed to do."

Their literature is filled with discussions of comparisons between men and machines. In 1961, an entire book, *Philosophical Problems of Cybernetics*,[31] was published on this topic. It was obvious from the questions asked of our delegation by the Russians about Western attitudes that it is a hotly debated issue. In the USSR, research on artificial intelligence is a part of cybernetics, the term coined by Wiener[32] and now a household word in the Soviet Union. Cybernetics is also used as an umbrella term for research in automatic control, automation, computers, programming, information retrieval, language translation, etc. It is universally recognized as an area related to both men and machines, and the requirement for an interdisciplinary (engineering, mathematics, computing, biology, psychology, physiology, physics, chemistry, linguistics, etc.) approach to such research is also recognized.

As in the West, the use of the term "giant brains" in the late 1940's resulted in a massive revulsion among the Soviet scientific community, and universal rush to the defense of the human mind. The degree of the revulsion was such that several Soviet writers have blamed it for the fact that Russia presently lags the U.S. in the digital computer field.[33] One finds frequent references in the Russian literature to the existence of a negative attitude towards cybernetics, and to the persistence of this attitude for a period of about ten years.

Soviet literature on cybernetics frequently gives credit to Wiener, von Neumann, and other Westerners for pioneering the field. It also contains many references to the work of Pavlov and mixes in much political discussion of communism vs. capitalism, and even of Marx and Lenin. For example, we have:

"Karl Marx was the first to make use implicitly and

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

anticipatingly of cybernetical ways of thought, or to express it more pointedly, Karl Marx was the first cybernetician! . . ."[34]

There are some strong positivists in the USSR. For example, I. A. Poletayev has stated "nothing except prejudice and superstition allow one to deny with assurance today the possibility that the machine will pass, in the end, that limit beyond which consciousness begins."[35] Other strong positivists include S. L. Sobolev (an academician and a well-known mathematician) and A. A. Lyapunov.[36] We also find:

". . . Thus, the perfecting of computer machines involuntarily leads us to the need to create a model of the brain . . . Also, one of the most effective methods of studying intra-cerebral processes involve experiments carried out in electrical models of the brain. But cybernetics has its critics too. These are skeptics. One can find them among scientists and among ordinary citizens, at times also among administrative personnel. These skeptics reject this branch of science and deny it the right of existence . . . In rejecting this science, they generally state that the very thought of comparing a machine to a human being is an insult."[37]

The majority of Soviet workers appear to recognize (implicitly, at least) the continuum discussed in this paper, and argue that while there does exist an upper bound above which machines cannot go, it is not possible to determine the location of that bound. For example:

"As a result we arrive at the conclusion that a machine can perform all the intellectual human functions which can be formalized . . . But what can be formalized? . . . Upon brief reflection we conclude that it is impossible in principle to answer this question."[38]

where do the Russians stand?

First of all, let us look at what they are doing in those disciplines upon which research in artificial intelligence depends: computing devices, mathematics, psychology, and physiology. With respect to computers, I can speak with first-hand knowledge, for, as mentioned earlier, I spent two weeks in 1959 visiting Soviet computer installations. In my opinion, they are somewhat behind us in the actual construction of machines, particularly with respect to input/output equipment and to numbers of machines.[39, 40] However, there is nothing fundamentally lacking in their state of the art. The quantity of machines is not as important to research as an offhand comparison of numbers of machines might indicate, since none of their machines is devoted to such things as social security records, subscription fulfillment, or airline reservations. In assessing a comparison of this kind, one always wonders how much of the iceberg we do not see. When visiting the IBM plant in California, Khrushchev said about computers, ". . . for the time being we're keeping them a secret."

The Russians started work on computers after we did, but they have certainly narrowed the gap. Furthermore, they are giving high priority to the computing field. In their announcement concerning the decentralization of responsibility for research, an exception was made for computers, along with fusion, space activities, high temperature metallurgical research, and certain areas of chemistry; these research areas remained centralized under the cognizance of the Academy of Sciences. Of course, the Russians are interested in spurring the computer field for reasons other than intelligent machine research. There is no reason to believe that future Russian research on intelligent machines need be hampered by the computer tools available to them, although machine time is in short supply today.

In mathematics the Russians have had an outstanding reputation for many decades. In computer mathematics I have no doubts that, in general, they excel the west. One of the things which impressed our delegation, and other delegations before ours,[41] was the number of outstanding mathematicians now working in the computer field. Unfortunately, many U.S. mathematicians view computers as a glorified slide rule of interest only to engineers, or as an expensive sorting device of interest to businessmen with clerical problems.

Since psychological research on mental processes and neurophysiological research on structure and activity of the brain both play a vital suggestive role in the attempt to construct intelligent machines, progress by the Soviets in these disciplines is of considerable interest. Although psychology was severely inhibited during the Stalin era, a renaissance of impressive proportions has taken place within the last decade. Physiology, less inhibited in the previous era, is in even better shape. The best available evidence indicates that Russian neurophysiology is dynamic, innovative, and up-to-date. The researchers are competent and generally sophisticated; their laboratories are modern and well-equipped.

The Soviets have demonstrated a knack for focusing talent and resources on important applied problems. I believe that the Soviets regard artificial intelligence as one such problem area, and that the best of modern Soviet psychology and neurophysiology will be recruited into the search for solutions. With respect to physiological research, the following is of interest:

"Essentially, we (the Western World) have not found the physiochemical principles of neural activity, whereas the Russians have not seriously sought them. However, the current 7-year plan for physiology as presented in a recent editorial by D. A. Biriukev in the *Sechenov Physiological Journal of the USSR* calls for precisely this goal."[42]

A recent visitor to the USSR reports that Soviet physiologists appear to be under pressure to produce explanations for human behavior which can be incorporated into machines. He further reports that their work is apparently under security wraps.

Russian emphasis on artificial intelligence research

I went to the Soviet Union convinced they were putting a great deal of emphasis on research in artificial intelligence. Possibly this predisposition influenced what I thought I saw. I also want to emphasize that *I was impressed, not by any substantive results, but by their apparent conviction that this was an important research area.*

In one institute, in response to my question about the problem of simulating the brain with a computer, I was told "It is considered *the* number one problem." The emphasis on "the" was the speaker's; the statement was made in English. At another institute, when Professor L. I. Gutenmacher, head of the Laboratory for Electrical Modeling, told us that the charter of his laboratory was the modeling of human mental processes, I asked him if he had difficulty obtaining financial support for such exotic research. His response was "No, not at all; the President of the Academy of Sciences is convinced that this is an important field for research." There is evidence that he has been given ample support. I was told that his laboratory, which was formerly (and still is ostensibly) a part of the Institute of Information Sciences, had all the status of an Institute, being separately funded and reporting directly to the Presidium of the Academy of Sciences.

Gutenmacher's laboratory is apparently responsible for mechanizing the functions of the Institute of Information Sciences, which is a large, centralized, information retrieval system for scientific information from all over the world.

Despite much effort, our delegation was unable to visit Gutenmacher's laboratory. To my knowledge, no Westerner has done so; in fact none had met Gutenmacher before our delegation. Some in the U.S. have concluded from this denial of entry to his laboratory that there was nothing to be shown. However, its work may be classified, as Khrushchev indicated. But whether or not anything is being accomplished is not pertinent to the point that the President of the Soviet Academy of Sciences, a man with much power and resources, believes that modeling human mental activities is possible, that he recognizes the importance of research in this field, and that he is devoting considerable resources to this end.

What are some of the other indications about Soviet attitudes toward research on intelligent machines? As previously mentioned, cybernetics is a household word in Russia. Much is being written on the subject, in journals and in the popular press. There appears to be an effort in the popular writings to legitimatize such research as being in harmony with communism. For example, recall the earlier quote about Marx.[34]

With respect to professional writing on machine intelligence, a journal entitled *Problems of Cybernetics* was started in 1958; seven hard cover volumes have appeared to date.[43] Since 1955, seminars on cybernetics have been held at the University of Moscow. These seminars are aimed at bringing together scientists from various disciplines. Similarly, the editors of *Problems of Cybernetics* state that their aim "is the unification of the scientific interests of those working in different fields of science concerned with cybernetics."

There seems to be widespread recognition for the necessity of an interdisciplinary approach to problems of cybernetics. Article after article appeals to personnel from the various disciplines to get together. How much effect these appeals and seminars have is unknown. During our visit to the Soviet Union, we were told that some 500 physicists had been transferred to the biological sciences. We talked with I. M. Gelfand, a world famous mathematician now working in the physiological field. He began studying the brain but switched to the heart, which he believes to be much simpler. With knowledge gained from studying the heart, he will return to the study of the brain. We were also told that other mathematicians were working on psychological and physiological problems.

Within the Soviet Academy of Sciences, there exists a "Scientific Council on Cybernetics." This council is headed by A. I. Berg and apparently reports directly to the Presidium of the Academy.[44] To my knowledge, there is no evidence of any effect this Council may be having in coordinating, controlling, or encouraging research in cybernetics. Outside of Moscow, individual researchers appear to operate entirely on their own, with little communication with other such researchers, and with only meager support. However, one does occasionally encounter references to the formation of new groups and laboratories for such work.

There is some evidence that machine time (until recently in critically short supply) has been made available for work in this area. *Moscow News* of August 12, 1961 has an article on musical composition and medical diagnosis on a computer while the issue of September 2, 1961 discusses chess playing by machines and the deciphering of ancient Mayan manuscripts.

In closing this topic, a quotation which appeared in the February, 1959 issue of *Fortune* is pertinent. Frank Pace, Jr., then President of General Dynamics Corporation, in warning us not to overlook nor be surprised by Russia's capacity to concentrate in specific areas, said:

> "If the area has real military or psychological value to them, they'll put massive concentration on it, and achieve results all out of proportion to the general level of their technical ability."

the importance of research in artificial intelligence

I have indicated my feeling that research aimed at pushing machines further out in the continuum of intelligence is very important. Today's computers are helping advance the frontiers of man's knowledge in many fields; computers now pervade almost all scientific disciplines. (The fact that they pervade the field of research on intelligent machines means that such research will feed on itself.) The use of computers in research has been a key factor in the explosion of knowledge we have witnessed in the last decade. Their contribution to date has stemmed largely from their speed in doing arithmetic and the reliability with which they do it. As we move out in the continuum of possibilities, new dimensions and contributions will become important. A machine which retrieves information from a large store by complex associative processes like those inherent in Willis Ware's output of "Frizell," but which exceeds Dr. Ware in speed, reliability, and memory capacity, would be crucial in aiding scientists to cope with the flood of research results presently inundating science.

The large amount of money spent on machines today is evidence of the value placed on the computer's abilities along the dimensions of speed and reliability. If the machine's capabilities can be extended in additional dimensions, would it not be of great importance? Suppose that the boundary (if it exists at all) beyond which machines cannot go lies fairly close to the human brain in the dimension related to the sophistication of the information processing techniques used. Since it is known that the machine can exceed the human in speed and reliability, and probably in amount of memory, such a machine would approach the status of being "super-human." Of course, this is speculation; the boundary may be much lower.

We have been examining the question of the technological importance of research in artificial intelligence in the context of advancing the frontiers of knowledge for the sake of technological and scientific advancement. In such a context, there is little cause for any concern or action; progress in the field is being made at a fairly rapid pace in this country. However, since we are engaged in a technological race with the USSR, action becomes important, particularly since, in my opinion, the Russians appear to be putting much more emphasis on research in artificial intelligence than we are. Even if the Russians were not competing in this particular event of the "technological Olympics," it is an event well worth the running, in that we will learn more about man and in that better machines will contribute to advancing the frontiers of knowledge in almost every discipline.

timing

Before closing, a comment on the question "when?" It is one thing to say it is possible to push machine capabilities way out in the continuum of intelligence, but it is another thing to say when. It was over four hundred years from da Vinci to the Wright brothers. But the sands of time in the scientific world have been flowing much more rapidly of late. Advances now made in a decade compare with earlier steps which took a century. Few would have believed in 1950 that man would hit the moon with a rocket within ten years. Gutenmacher, when told recently of the Simon and Newell prediction that a machine would be chess champion within ten years[45] said that he thought

the prediction conservative; it would happen sooner.

conclusion

It is hoped that the definition of research on artificial intelligence as an effort to push machines further out in the continuum of intelligent behavior will reduce some of the semantic difficulties surrounding discussions of such research. I feel that such research is very important to our country and that we must expand our efforts therein. To do so implies that more researchers from the related disciplines are needed. The success of our efforts will depend on how well we do in bringing the various disciplines together and on the number of well qualified scientists who are attracted to this research area.

ACKNOWLEDGMENTS AND APOLOGIES

I would like to acknowledge many long discussions of this topic with W. H. Ware, M. E. Maron, F. J. Gruenberger, E. A. Feigenbaum, A. Newell, J. C. Shaw, and H. A. Simon, and the influence of the research efforts of the latter four on my thinking. In this paper I have quoted many people. In so doing I have strived to avoid quoting out of context. However, one runs this risk when only a portion of a man's statement is repeated. If I have misrepresented the intended meaning of anyone in this paper, it has been accidental. ■

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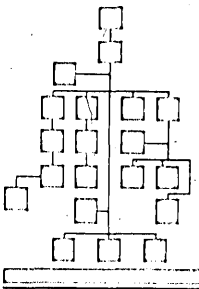


people IN DATAMATION

■ Maurice W. Horrell, who joined Univac in February, 1962, as director of Engineering and Manufacturing, has been appointed VP. Prior to joining Univac, Horrell was general manager of the Bendix Computer Div.

■ Irwin J. Fredman has been named manager, Systems Dept., Philco Computer Div. He was formerly with RCA.

■ George M. Sokol has been appointed manager, Computer Programs, Sylvania Electronics Systems. He will be responsible for the development and manufacture of multi-function, military digital computers. Before joining Sylvania in 1951, Sokol was with the Oceanographic Institute, Woods Hole, Mass., and the U.S. Navy Ordnance Lab.

■ Wesley S. Melahn, manager, Air Defense Div., System Development Corp., Santa Monica, Calif., has been appointed VP. He will continue to direct SDC's efforts in air defense, air traffic integration, and system training. He has been with SDC since its inception, and was with its predecessor, The RAND Corp., from 1948.

■ Philip Sopinsky has been named manager, Systems and Data Processing, Institute for Scientific Information, Philadelphia, Penna. He was formerly assistant manager, Data Processing Dept., Curtis Publishing Co.

■ With the realignment of the research and engineering staff at Packard Bell Computer Div., P. R. Gilson has been named manager, research and advanced development, and D. L. Pickens is manager, systems engineering. R. Nalley has been named group manager, analog techniques, and R. Lampton is standard product coordinator. In systems engineering, four project managers have been named: S. Young, J. M. Mitchell, R. L. Snyder, and C. S. Haines.

■ George J. Stock has been appointed senior programmer of Informatics Inc., Culver City, Calif. Associated recently with the design and programming of display devices in DOD, Stock was formerly with TRW.

■ Systems Programming Corp., Santa Ana, Calif., has expanded its staff to include Kenneth Richardson, formerly with McClellan Air Force Base; Leonard Rosenblum from RCA, and Clovis White from Space Technology Laboratories.

■ Luther A. Harr Jr. has been appointed assistant to the board chairman of The Teleregister Corp., Stamford, Conn. For the past two years, he had been director of Univac operations for Europe, Africa, and the Middle East.

THE 301 & 1401— A USER'S CRITIQUE

with vinegar

by ED YASAKI, Assistant Editor

A comparison of two disparate, yet competitive, computer systems was made recently by the president of a service bureau which has an RCA 301 and an IBM 1401 operating back-to-back. Occupying the distinctively rare position of being able to compare the two in the course of daily operations is Richard E. Kurzenknabe, Tabulating Consultants Inc., Los Angeles, Calif.

"The modular concept and the accessibility of components for rapid repair and preventive maintenance make the 301 stand out far above the 1401," Kurzenknabe says. "There are no covers to unlock, no straps to take down, no part of the unit to be pulled out of the receptacle. To replace a circuit card, you open a door, reach in, pull it out, and push another in. Testing to find where a unit is defective is simplified with accessibility from the face of the processor."

The design of the 301, he says, is vastly superior to the 1401. "To get at the units you need to work with on the 1401, and to actually work with them seems to be quite a task. Everything on the 1401 is packed tightly together in a sort of miniaturized setup."

On the positive aspects of his IBM hardware, Kurzenknabe states, "I think IBM manufactures the best electromechanical equipment that's made. For example, the RCA 330 card reader-punch is nothing more or less than an IBM 1402 which has been modified and made compatible with the 301 system. In the printing area, I don't think anybody makes a device that prints with better fidelity than IBM's 1403."

In the matter of service however, he says RCA conducts all preventive maintenance off shift, while IBM demands four hours per week during the morning or afternoon. "RCA will install additional features on their equipment on an overtime, weekend, or holiday basis, but IBM requires that such installations be made during our normal work day."

Kurzenknabe, however, is not a disillusioned newcomer to IBM equipment. His 1401 is a progression from a 604,

608, 609, and 1401 card system; he now has two 1401 tape systems.

If he had it to do over again, he would select the same computers, he says. "We never would have gone any way other than to the 1401 as long as we were IBM users. We'll retain IBM equipment because I think we're always going to have a heavy element of overload requirement from IBM users."

The 301 feature, other than cost, which sold this system to Kurzenknabe was its modular expansibility. Its processor cabinet has space for the addition of components as they are needed or introduced, he explains, avoiding the cost and delay of an old system out and a new one in. In contrast, the 1401 requires a separate unit for expansion beyond 4K positions of core.

In addition, the RCA 381 tape unit, is designed for ease of maintenance, he adds. An engineer can pivot out any of the six drives and work on them without interrupting those being used. The same concept, he says, applies to the 330 card reader-punch.

"While we were still operating on a Friday, RCA installed one whole rack for the 330 without any hindrance of our work. When we finished our work schedule, they pulled out the two racks that were in the machine, already controlling the reader and the punch unit, and inserted two additional racks. So, they were performing approximately 20 hours of the installation while we were doing our normal, everyday work. This is an illustration of the difference in design of the two companies' systems."

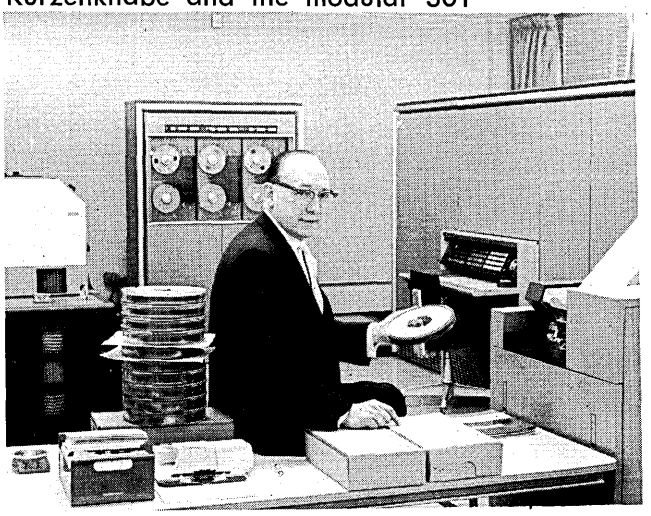
Returning to the 381 tape unit, Kurzenknabe says, "Although it runs at half the speed of the IBM 7330 tape drive, has a reel size half of IBM's, and although it packs 333 bits per inch rather than 556, the 381 provides approximately 30 per cent superior performance over the 7330."

Rental for *four* IBM 7330 drives, including the processor gear, is $2,180. The RCA 381, with *six* drives and processor gear, leases at $1,895.

"The 7330s work with a vacuum column which, as far as I'm concerned, sucks up and concentrates dirt and oxides at the tape loop point in the column—which causes reading problems. The 381, on the other hand, has a vacuum on either side of the head which avoids this. The threading is automatic, and there's no need to open or even touch the head. So there are other advantages, aside from net performance characteristics; it's also how much labor time is involved in setup, handling, and attrition of reruns.

"Another example of flexibility," Kurzenknabe continues, "is the 301's standard capability to handle either binary-coded decimal or binary input. This means that by the addition of one 729 IBM tape drive to our 301 system, we can process tape output from all IBM 1400, 700, or 7000 series equipment directly into the 301 system and produce either standard or FORTRAN printout. The same procedure can be used to feed taped output from other manufacturers' equipment into the 301. The 301 also reads either IBM or RemRand punched card input, and will handle input from cards partially punched with IBM's rectangular holes and partially punched with RemRand's round holes."

Kurzenknabe and the modular 301



As a result, Kurzenknabe says, "I don't have to reprogram everything I do. I can modify the program that exists to take advantage of an additional feature and continue performing my current work, thus giving me a chance to re-analyze my job and see if I can take better advantage of the sophistication of my data processing equipment by reprogramming. If so, I'll do it. But in my business I must be able to operate from day to day. The customer doesn't understand that because I changed a piece of gear, he is going to get his report late."

Among his programmers are those who say they can program a 301 in 80-90 per cent of the time it takes on the 1401, although one says it takes 20 per cent longer.

"I would say that the two machines break approximately even on the programming effort," Kurzenknabe adds. "There are some very powerful instructions on the 301 that the 1401 doesn't have, and vice versa. For example, the 'edit word' function on the 1401 is built into the hardware. The 301 requires the use of standard packaged subroutines, but it is considerably faster than the 1401."

In contrast, he points out, the 301 has a single-instruction command used in every branching operation, similar to saying high, low, and equal on one pass. This requires two instructions on the 1401.

"On the 301, I can translate any kind of sequence or printout regardless of the input with the table translate instruction, which is exclusive with RCA. I can sort my tape records into any sequence merely by punching a card from left to right in the order in which I want the alphanumeric or special characters to be sequenced.

"In the same fashion, if an error is made by the keypunch department and a 'Q' appears in a particular column of an identifiable group of cards, the table translate function will make that 'Q' print any other alphabetic letter, numeral, or special character. This is a very powerful instrument in our business because, unfortunately, we can make mistakes and this gives us the rapid recovery we need."

Acquisition of the 301 in September, 1962, necessitated the retraining of the bureau's programmers; classes were conducted by RCA at the shop in the evenings. Today, with eight 1401 programmers, five of whom are also 301 programmers, more than 100 programs are operative. The file control processor is used for the 301, Autocoder on the 1401.

"Do we ever intend to use COBOL? No, sir," he says. "If you're going to talk about COBOL relating a program from one manufacturer's equipment to another, I doubt if it will ever be done efficiently. There is no reason why any manufacturer should restrict the capability of his equipment to make it compatible with another's. I don't mean to indicate that I'm opposed to COBOL within a system; it's between systems."

Kurzenknabe concludes, "If someone is smart enough to devise a completely compatible translator between the two systems—which will handle 70 per cent or more of existing programs—I think the long-term view will result in RCA's picking up a substantial amount of IBM's present computer business. I've had a lot of people tell me that this is impossible, but I know that ultimately it will be done in one fashion or another." ■

The following quotes from one executive's notebook may prove helpful to those executives who have recently acquired (or are about to acquire) a computer facility. Often an executive who has had no direct personal contact with computers will be given the responsibility for a facility. To keep him from relying completely on EDP specialists, committee studies, accountants or low level personnel of unproven judgment, the following entries are made. Because of the high order of knowledge required by the computer executive, the author uses the hypothetical title of "vice president for computing," an uncommon designation today but one which may find increasing acceptance.

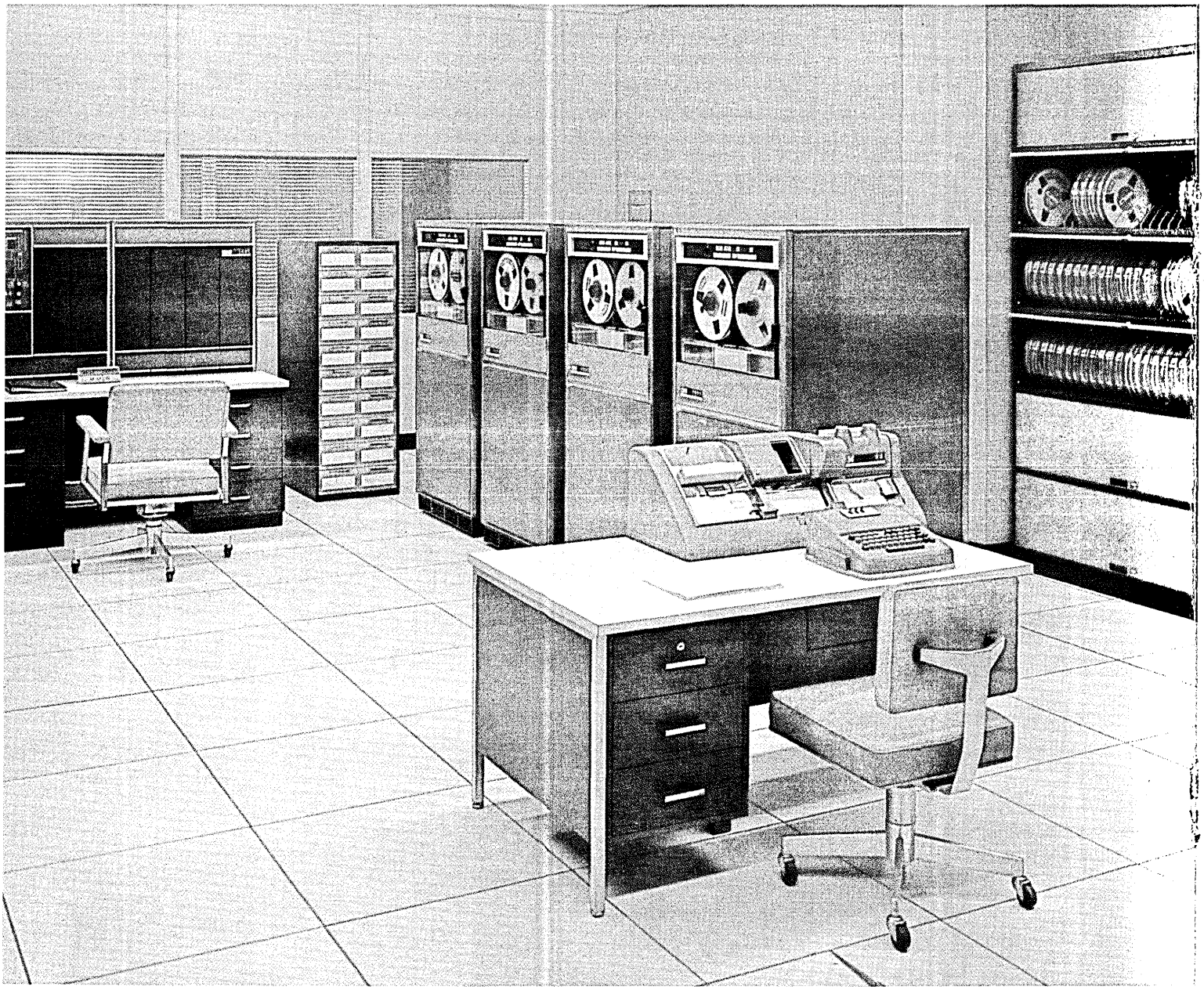
CORPORATE POLICIES FOR THE COMPUTER EXECUTIVE

a guide toward self-sufficiency

by ROGER A. MacGOWAN, Army Missile Command Computation Center, Huntsville, Alabama

1. The acquisition, discontinuance, or move of any computer, whether analog, digital, special purpose, or general purpose, will be approved by the vice president for computing.
2. The acquisition, discontinuance, or move of any data processing equipment, such as analog to digital convertors, digital to analog convertors, EAM equipment, data transmission equipment, digital plotters, etc., will be approved by the vice president for computing.
3. The acquisition, discontinuance, or move of any engineering equipment capable of generating data for reduction, or requiring input control data will be approved by the vice president for computing.
4. Large scale, general purpose, digital, analog, and hybrid systems will be maintained by centralized computation centers.
5. The computation centers will be located as closely as possible to the largest user.
6. Small scale, general purpose, digital and analog computers, or transmission equipment with related input-output devices, will be located in decentralized locations where the workload is sufficient.
7. Changes in computer hardware should be minimized when large numbers of symbolic programs exist.
8. Integrated systems of software provided and maintained by the computer manufacturer will be utilized whenever possible.
9. Software systems which are in widest general use are preferred.
10. Whenever both scientific and business computers are required, the business computers should be kept heavily loaded, and the scientific computers should be kept light to moderately loaded, so that excess, high priority, and peak load business programs may be run on the scientific computer.
11. The operational managers of the computer centers shall have organizational control of the decentralized computers in their geographic area.
12. At present, the use of FORTRAN programming is to be encouraged for both programmer specialists and engineer users, and symbolic programming is to be minimized.
13. Engineer users should be discouraged from using symbolic programming and from doing programs for others, unless they join a computing center.
14. Detailed documentation, including flow charts, should be kept up to date at all times, even during initial programming.
15. Engineer users should be discouraged from becoming directly involved in programming complex systems of programs.
16. Provision should be made for the development by professional programmers of flexible, *general purpose*, applications programs pertaining to corporate problems.
17. Both minimum and conditional levels of performance evaluation should be established for the selection or promotion of computer personnel.
18. Both minimum and conditional levels of aptitude should be established for the selection or promotion of computer personnel.
19. Both minimum and conditional levels of education should be established for the selection or promotion of computer personnel.
20. Both minimum and conditional levels for personality factor evaluation should be established for the selection or promotion of computer personnel. ■

Is your DP department this attractive and efficient?



MIEHLE-GOSS-DEXTER, INC., CHICAGO

Exclusive No. 1—COLOR. Dull, drab, monotonous colors may be acceptable for machines, but not for people. Perhaps, this is one reason why Datacase has been so enthusiastically received. Datacase auxiliaries (and only Datacase, we might add) come in a bright array of colors—23 in all—each with a tough acrylic finish that shrugs off hard use, stays like-new for years. Inevitably, this combination of color, pleasing design, and built-in efficiency has the effect of making your people—and your department—that much more productive. So, when you think of beauty *and* efficiency, you have to think of Datacase. And, that's not a bad thought at that!

PROBLEMS IN SCIENTIFIC USER RELATIONS

a commentary on over-computing

by MELVIN KLERER, Hudson Laboratories Computing Facility, Columbia University, N.Y.

Sometime ago, one of our staff engineers came to us with a problem that required a substantial amount of sophisticated analysis and computer programming. I would estimate that the computing facility staff spent about six man weeks of programming effort on this problem. I distinctly remember wincing when I read the technical report—based largely on the results of the numerical solution of this problem—where I encountered the leading sentence . . . "the computer *solved* this problem and *its* answers are listed . . ." There was no other acknowledgment in the report.

In the published literature there are so many variations of this attitude, often more subtly phrased, that I have considered approaching the American Mathematical Society or the American Physical Society with the proposition that they establish a special award, called the "Distinguished Order of Solvers." This would consist of a brass plate, suitably inscribed, in the center of which would be an eternally lit neon bulb. This plate would be placed on the console of those computing machines that had demonstrated their accomplishment as good "solvers."

Of course, the idea that a computer actually solves a problem is often intertwined with the idea that *all* problems can be solved, given a vast enough and big enough computer—with, of course, the qualification that the problem be mathematically or logically statable. Of course, not all problems that are statable mathematically or logically are computable problems. But we do not wish to split theoretical hairs. We are more concerned with the naive assumption that a computer will effect a practical solution to a complex and dynamic problem when the problem is such that in *principle a method of solution is not known, or even whether the problem is solvable, that is, computable, or even if it is possible to obtain all the necessary input data in the case where the possibility of a solution exists.*

The naivete of this approach hopes that the presence of a computer together with its upkeep price of a million dollars a year, by some mysterious means, will shed light where darkness previously existed. Thus there are people—not so much in vogue now, as they were two or three years ago—who think that a solution to the national deficit, or the solution to the business cycle, or that the decisions involving war or peace would all be easily effected if Washington would only buy a bigger and better computer, put in adequate air conditioning, a fancy display board in the visitor's gallery, a few hundred thousand remote data transmission channels, and a rocking chair for the console operator.

However, the feeling that somehow a computer can solve any problem is not encountered just among simple cretins. One finds it, also, among complex and intelligent cretins. Those who have administrative responsibility for rendering a scientific and engineering computational service need be fully armed against the practitioners of this doctrine. These men are not too difficult to recognize. Their forte is *over-computation.* Their slogan is, "compute, but it must be a hundred times too much."

Over-computation can take many forms. One type of "computer customer" will attempt a series solution to a problem that he believes is not solvable in a closed form. Thus, he will enter the computing establishment bearing a series of anywhere from 100 to 10,000 complicated terms, each to be evaluated one million times. A responsible analyst will immediately examine the series to see if significance can be expected to be lost in the final answer. Occasionally, after about ten minutes' consideration, the responsible (and competent) analyst may be struck by the flashing realization that these 100 or 10,000 terms form terms in a geometric progression and that all that need be computed is *one* summation term.

The analyst's first experience with this sort of phenomena tends to leave him speechless and slightly numb for at least several hours. After all, should he tell the "customer" that he has committed a blunder, that the calculation which had been scheduled to run for 150 machine hours—and which time allotment had been duly approved and budgeted by upper management—could be done by the machine in four minutes—or perhaps three minutes, if the programmer were really clever. After all, the customer is always right. If he were offended, he might take his business elsewhere or perhaps feel that computers weren't all that they were cracked up to be, and then return to the old reliable slide rule.

And consider upper management: they had budgeted $75,000 for machine time on this project. They had even issued a purchase order! Of course purchase orders can be revised. But even when you are running a multi-million dollar business, an extra $75,000 budget excess can sometimes prove more embarrassing than an equal deficit.

Personally, I am not entirely sure what procedure would

be best for this case. Naturally, one wants to be tactful and not offend the customer. On the other hand, there are such factors as professional integrity and honesty. Certainly, one should not close one's eyes—at least not completely! Each situation of this type merits its own individual solution. A tactful, inoffensive and mutually educational solution is the mark of a competent and humanly realistic computing professional. A sense of humor also helps.

Much more difficult is the customer who arrives with the proper authorization for 150 hours of machine time, a series of 100 terms, each to be repetitively computed for a wide range of parameters, which series cannot be easily reduced by some flash of insight. Many of these cases, probably the majority, are, of course, legitimate computations which represent the best and most practical way of arriving at the desired result; one that could not be obtainable except for the aid of a computer. However, there does exist a numerically significant class of users who, when analyzing a complex physical situation, believe they could make such a situation viable by the use of an equally complex model. To put it crudely, the philosophy goes this way: "Let me include all the effects, that is, terms, that could possibly contribute to the results. Then, since I have included *all* the effects (that is, terms) the answer *must be correct.*" With this philosophy, experimental confirmation of the computed result can be regarded as a mere formality!

A genetic variant of this breed is the person who innately prefers an expression that contains complicated admixtures of Bessel, Hankel, and Legendre functions of esoteric order and kind over an equivalent and equally adequate one of more prosaic form. It is, of course, sometimes, nigh impossible to persuade these people that these fancy expressions—which they often copy out of a handbook—may, because of loss of numerical significance, lead to a worse approximation than the version based on a simplified physical model.

I will concede that in these cases the educational process is difficult. The user must be educated to the fact that—sometimes—adding on many small terms will degenerate rather than improve a result. The concept of the loss of numerical significance, rounding and truncation errors, and other errors resulting from over-computing must be explained in a persuasive and tactful manner. The difference between actual operations on a limited set of numbers of finite precision as compared to theoretical operations on the class of real numbers of arbitrary precision must be conveyed.

Usually these factors can be illustrated by actual example. It is not too difficult to show that the motion of the planet Neptune, which in principle does have some effect on the angle a plumb line makes with the surface of the earth, can be safely neglected if one is doing ordinary land surveying. But, in this connection, it is most difficult to propagandize on the philosophy that most times—*not all* but most times—a simple physical model is to be preferred to a complex one. The simpler model is easier to compute, is less subject to computational error, but of eminent importance is that the essential, non-trivial, dynamic aspects of the physical situation are more easily comprehensible and revealing when the mechanics of the model are simple. Using a computer to simulate a real process is of meager value if the only result is some complex function of multiple parameters and if no insight into the mechanics of the situation is gained.

Of course, one cannot solve the problem of the user. After all, it is his problem and the Magna Carta of science and engineering does entitle him to solve his problem, his way. If one does step in and actually assist in solving the problem by some fundamental contribution, then one assumes the status of a colleague and contributor—something apart from the responsibilities in rendering a professional computing service.

However, there are many things one can do to assist the user toward a proper and efficient solution of his problem. One can certainly make proper consultation available to him. The average user in the large and still growing aerospace industry, for example, could benefit by consulting computing staff members who are sufficiently knowledgeable to assess whether the problem could actually benefit by being processed on a computer; second, who could *quickly* and correctly assess a practical—not necessarily the most efficient—but a practical, easily manageable numerical procedure; and third, who might be sufficiently articulate, and scientifically well-rounded, so that they could at least inspire in the user a tendency toward simplification. Naturally such an atmosphere would be self-defeating if it were not voluntary, or if it were administered in a heavy-handed or busy-body fashion, or if it gave the user the impression that someone was always looking over his shoulder gleefully on the alert to spot his mistakes.

At this point, I must emphasize that I am not making a strong argument for any special attitude. I am however, arguing against an attitude that can only harm the computing profession, in the long run. This attitude was expressed once by a man in administrative charge of a corporate internal computing center. He said, that his responsibility was simply to operate his center and encourage people to use it. This he did by offering engineeers courses in programming, using an easily learned compiler. Upon their successful completion of the course he gave them a ticket which entitled them to use the computer for one hour—*free*. Boy, he said, when they see how easy it is to generate a truckful of answers, *well, then they're hooked!* Of course, some people might worry that most of what is coming out might be garbage. But, he regarded this as the responsibility of the department manager who authorized the use of the computer; that is, it was the responsibility of the individual engineer or his superior to look into the merits of the problem, not that of the computing center's director.

Today this man runs a very successful and profitable business, profitable to himself, profitable to the computer manufacturer who is getting excess rental, and perhaps profitable for the job security of his own computing staff. But it is certainly not profitable for the overall aims of his corporate organization. It is this type of service center manager who exemplifies, in the extreme, the Adam Smith version of an individual entrepreneur operating within the modern, large corporation; his personal slogan being that the corporation be damned!

However, there are a number of specific, constructive suggestions for a responsible administrator who may offer a tactful and helpful service and environment to the user who has had neither extensive training nor experience in computation. There are certain rough rules, and from experience we can add to these and continually change them as the situation warrants. (These may even be applicable to the other extreme of the man so competent and conscientious who will think so much and so long about the most efficient way to use a machine that he will never get around to actually running his problem!)

First, one can educate by example, by voluntarily adding on a bonus service. If the computer user requests a detailed listing and if this runs to an amount of paper requiring a ten-ton truck for delivery, give it to him—at least the first time. But at the same time, even though the user expresses no interest, supply an intelligible and meaningful display of the results, whether what is indicated is a simple, single valued graph, a set of histograms, or some complicated nomograph. There are some people who go so far—and I

applaud them—as to construct complicated, three-dimensional displays of a solution surface. Not that this will give them any new design information, but it can reveal for others, the dynamic essentials of the physical model. For example, I would think it is much wiser to use a high speed printer to produce a graph three miles long rather than a listing of numerical results one-half mile long. There is some possibility that one can comprehend the salient features of a curve even three miles long, but there is no possibility that one can read on the order of 2500 closely printed pages of numerical results and hope to see any sort of subtle pattern in the maze of numbers.

Of course, one can push a good thing too far. I know of an incident where a "sophisticated" user made a very definite point of requesting that his results be presented in graph form. However, there was one drawback. The range of parameters was such that about 2000 graphs were required. This particular installation processed a fine and expensive high speed plotting device and the user did have an approved purchase order for the computing time. But he would have been swamped with the task of looking at, not through, 2000 graphs and trying to determine the overall trend—and its rate—as the many parameters of the problem changed. Fortunately for the user, a bright, young member of the computing staff noticed that the function to be computed had some interesting transformation properties. In fact, they were of such a kind that by making an appropriate nonlinear transformation of the computed results, plotting on transparent sheets which could be overlaid and shifted relative to each other, one could display the entire result in a composite of 10 graphs. The point is not that 1,990 sheets of paper were saved or that the expense of plotting 1,990 graphs was saved. In a sense this was only a minor consideration. The real contribution of the staff member was that he had reduced the computational results to a manageable and comprehensible form. The user could not possibly comprehend the dynamic relations contained in the 2,000 graphs. But he could comprehend—with a pointedness that was not available before—the useful features of this computation as he varied parameters simply by shifting, relative to each other, a maximum of 10 transparent graphs.

When one has made this type of point to a user and a mutual confidence has been generated, then sometimes a direct plot of the *input* data will be mutually convincing as to whether *any computation at all is warranted!*

A demonstration which is fairly easy for anyone with experience in the field, is to plot a sample of the input data when a power spectrum analysis is requested. Sometimes—not all the time and not even most of the time—the data is of such a character that one can draw the power spectrum to 10 percent accuracy before actually doing the computation. If one refrains from crowing too loud, or flapping one's wings too hard, then one finds that user confidence has been easily generated through seeing a mere human anticipating the results spewed out by this marvelous, expensive electronic device.

On the other hand, I must give equal prominence to the dangers of trying to be too cute, of being too efficient, or of playing the role of the omniscient and zealous custodian of this marvelous piece of machinery and guarding its purity from the transgression of uncouth and unwashed (scientifically speaking) users.

Another important problem is the case of the user who is overawed, not just by the hardware, but by the professional programmer's mumbo-jumbo, overawed to the point that he will accept computer output without critical examination. This type of user in his crudest form, will be satisfied no matter what his problem is if he is given a listing of random numbers; preferably 3,000 pages long.

The real fault for the generation of this type of user lies with the computer profession. Unfortunately, we have begun to adopt the use of the special lingo for things that are essentially simple and easily understood. Of particular relevance in this connection is the current discussion and controversy over which is the best compiler language and what are the best methods of analyzing syntactical and semantical structures of these meta-languages.

I think that the bulk of this problem can be side-stepped, at least from the point of view of the user. I also think that the legitimate theoretical aspects involved in this controversy can thus develop somewhat apart, and not impeding, the practical and widening use of computers both in the business and scientific community.

As a specific example, one of the major limitations of nearly all algorithmic compilers is the linear nature of their character set which makes for a restrictive and cumbersome use. This is usually seen in the requirement that subscripts or superscripts be written on the same line as the quantity subscripted or superscripted. That such a restriction can be obviated is indicated by the recent announcement of the *Subscripting-Superscripting-Typewriter-Key Punch*, in use at Los Alamos (K. G. Balke & G. Carter, Digest of Technical Papers, ACM Conference, Sept. 1962) and I believe it is not a relatively difficult task to develop a typewriter-like input device that would code a more extensive and useful character set than that specified even in ALGOL. Since it is no great trick to design a compiler to call in a subroutine, then it is equally no more difficult to design a compiler to recognize that the code for a special character, such as the definite integral operator, is meant to call in the appropriate integration subroutine.

The advent of a fully flexible optical scanner that could identify the usual characters found in scientific and nonscientific publications would virtually eliminate the user problem generated by restricted and artificial character sets and inflexible source language. Nor do I exclude as too remote or too visionary the possibility of *talking* a program into a computer. A good deal of the present concern with the design and structure of compiler language arises from a confusion between hardware and software problems. Consider a device that could read *or* could be used to code and print a mathematical-logical expression in a form closely allied to normal usage; for example, a string (but not restricted to one line) of operators, operands, subscripts, superscripts, constants, etc. Then most of the source-language design problems would disappear, at least for the user! In fact, the problem will have been shifted to where it belongs, away from the user and to the designer of a compiler. Thus in a fundamental sense, the user need is a hardware need, the hardware that would permit a simply structured, but highly powerful *operator* language letting the nonprofessional computer user take fuller advantage of machine capabilities than is now permitted by present compiler languages. The fact that we have introduced a decision problem into the design of compilers is something that justly can be transferred to the province of the professional compiler writer.

conclusion

Participating in a computational service is a professional activity, with professional responsibilities. If the user or the parent institution does not recognize the necessity for professional practice associated with computing center service, then the service will of necessity be grossly inefficient, even to the point of being absurdly inefficient. Likewise, if the members of the computing profession ignore or sidestep the professional responsibility associated with this service activity and become mere vendors of computing time, mere schedulers, mere advocates of the theme "the more shifts, the better," then they will justly merit their ultimate relegation to the purgatory of the semi-skilled. ■

PERSPECTIVE ON AFIPS

a commentary for tomorrow's planners

by WILLIS WARE, Chairman of the Governing Board, American Federation of Information Processing Societies

At the Western Joint Computer Conference in May of 1961, the American Federation of Information Processing Societies became an officially chartered and recognized organization. I was privileged to become the first chairman of its Governing Board and in May 1963 will have completed two terms of office. In these two years, I have been able to view AFIPS from a privileged position, and I have seen probably a broader overview of its activities than anyone else. Speaking now personally rather than as the AFIPS chairman, I want to discuss some of the problems which AFIPS as an organization faces, and what its future role might be.

First, what is the position of AFIPS relative to other organizations in the data processing field? Presently, there are three domestic organizations serving major needs. The Business Equipment Manufacturers Association has industrial members, and represents companies manufacturing office equipment as well as data processing equipment: BEMA is concerned with the needs and interests of its individual company memberships, and gears its national conferences, its public information programs, and its operating committees to this basis. The Data Processing Management Association (formerly the NMAA) has individual memberships principally of accountants, tabulating people, and people concerned with business methods and their mechanization. The members of DPMA have grown into data processing through the manual and punched card systems which developed to support business management. Recently the DPMA has embarked upon an aggressive campaign to bring the professional status of their members in line with the public image of the computer programmer. The program to certify that a programmer has met some minimum standards of accomplishment and training reflects DPMA's responsibility to its membership. The certification program and its associated educational activities not only offers opportunities to DPMA members to increase their knowledge, but it also provides guidance to people interested in data processing as a career.

AFIPS, as the third entity, reflects the interaction of the two major technical societies serving the data processing field—the Association for Computing Machinery and the Institute of Electrical and Electronics Engineers (formerly the Institute of Radio Engineers and the American Institute of Electrical Engineers plus the Simulation Councils). AFIPS, therefore, has a different kind of member; its members are other professional societies for which it coordinates certain activities or for which it discharges certain obligations. DPMA, as a society of individuals, is eligible for membership in AFIPS and may, one day, decide to join. Because its responsibility is to other societies rather than to members with certain fields of interest, the AFIPS operating committees, the nature of its conferences, and its policies reflect this different view.

I think it fair to say that AFIPS represents the intellectual activity of the entire field of information processing. There is no other organization with such a universal goal. The IEEE is largely the hardware population of the computing field, and the ACM, largely the software population which has grown into information processing through scientific computing. The Simulation Councils, an affiliate member of AFIPS, represents the analog and mixed analog-digital aspects of computing. There is naturally some overlap in the fields of interest of AFIPS members, but largely each operates in a fairly well defined area and serves the particular needs of its members. From the point of view of functions to be performed, there is of course an apparent overlap between AFIPS and all its members. AFIPS and its members are all interested in educational matters; they are all interested in public information matters; they are all interested in standardization matters, and in abstracts, and reviews. But each of them discharges the function with the needs of a particular kind of membership in mind.

The predecessor to AFIPS—the National Joint Computer Committee—was formed in 1951 expressly for one purpose: to sponsor technical meetings at which all members of the

computing field—software and hardware—could meet and exchange ideas and information. The NJCC operated with many restrictions on its scope of activities, and was never in a position to go much beyond the sponsorship of the Joint Computer Conferences. To many who were active in NJCC, it became more and more apparent that a separately chartered and duly constituted organization would be a more appropriate framework for joint interaction between professional societies. In 1961 AFIPS finally came into existence to provide an organization that could function across several societies, and that could assume obligations that extend beyond the purview of a single society or that are difficult for a single society to carry out. An excellent example of such an obligation is that of public information. A technical society is responsible to its members for the dissemination of technical information; it must, therefore, devote a substantial budget to the publication of technical journals, reviews, and periodicals. AFIPS as a Federation of societies does not have a direct responsibility for disseminating technical information; hence, it can support public information services at a significantly larger financial level than can its member societies and can concentrate on communicating with various publics outside the profession.

Given, then, that AFIPS must serve its member societies and they in turn serve their members, the next question becomes: what efforts are more effectively or more efficiently handled by the Federation than by an individual society? In what areas should AFIPS assume the dominant role; in what areas should it simply coordinate between societies; in what areas should it simply lend additional support to the work of one or more of its members?

Much of the resolution of this question has yet to be settled. In my opinion, the role of information source to various publics will, for a long time to come, be the major obligation of AFIPS. Prior to these two years as chairman, I had heard mentioned, but did not really appreciate, the intense need for objective, accurate, timely, and understandable information relevant to data processing as a profession, to the people who practice the profession, and to the interaction of data processing with other disciplines and with the structure of society. I am convinced that this is an AFIPS role because it is a central and not secondary theme of its existence. AFIPS can devote a concentrated effort to the matter and can support it financially.

The AFIPS role in educational matters is not yet clear. Each of the member societies has an educational program of its own, but I personally feel that there is, so to speak, a supra-role which AFIPS can play—perhaps only as coordinator, perhaps a more active one. In any event, an ad hoc committee chaired by George Heller is studying this problem and will shortly recommend a position. It follows, of course, that the AFIPS activities will be fully coordinated with and agreeable to its members. My vision is clearer on the matter of standards, however. Here I believe it appropriate for AFIPS to be simply a clearing house for information, acting to keep all parties informed in standardization matters. It is, however, also being studied by an ad hoc group.

A potentially more ticklish area is that of conferences. AFIPS now sponsors the twice-annual Joint Computer Conferences and draws most of its financial support from the proceeds of the conferences. On the other hand, the member societies also hold technical meetings of their own, sometimes with exhibits, and sometimes competing fairly directly for technical papers. I happen to feel that it is valuable for there to be two occasions each year at which the entire field can interact and exchange information. I think that this is especially so since the conferences each year are sited on opposite sides of the country, and since roughly half the attendance at each conference is from the local area. Nonetheless, there are unresolved problems with respect to the relation of Joint Conferences to those of AFIPS members. These will have to be faced and resolved; AFIPS is acting on them through an ad hoc committee chaired by Jack Moshman.

Where have we come in two years? In the first year, I was generally pleased with the progress. It was largely a year of organization— completion of the bylaws, establishment and charging of committees, resolution of operational problems. Such internal effort is not particularly obvious to an outside world, but a great deal of time and effort was given by dedicated people.

I had hoped that our second year would see us further along. It is clear, however, that we did progress as fast as we had man-hours available. At the moment AFIPS is operating completely with volunteer support, except for a part-time public information officer. A great deal of time is required just to keep AFIPS functioning, much less moving forward; for example, there are currently eleven standing committees, and three ad hoc committees operating. At any time, there are two joint conference committees functioning; they interact very intensively with the AFIPS Conference Committee chaired by Keith Uncapher. Some of the talent normally available to AFIPS is currently concerned with merger problems of the IEEE; much of our talent in the greater New York area is now actively supporting the IFIP Congress 65 international meeting.

In the next few years, the rate of growth of AFIPS will be directly related to the amount of time that talented individuals can contribute. We can optimize the contributions of professional people by supporting their efforts with full-time leadership in certain areas. There is by now enough day-by-day routine business that it should be lifted from the volunteer support. The conference committee chairmanship is a very heavy burden; the public relations chair—now held by Don Madden—is also a heavy burden. Our growing public information program is a direct consequence of the part-time public information officer, Phyllis Huggins.

We need to increase the scope and amount of information that can be made available to various segments of the public. We are practitioners of the science of information processing; as such, we can expect our work to influence all who use information. Computer technology is singular in that it affects all phases of our national life. We must continue with even greater activity to communicate with all who ask for objective, accurate, timely and understandable information. I also think it appropriate for AFIPS to assume the responsibility for considered opinions on issues in which our technology affects professional or national matters. AFIPS represents the people who are qualified to speak and who have an implicit obligation to speak. If AFIPS does not speak on such matters, then who will? We are not unique in this point; other scientific disciplines are feeling the pressure of this responsibility and are acting to establish a source for reliable information. It just happens that ours is a greater obligation by virtue of the far reaching implication of information processing technology.

Modern society levies heavy demands on professional people who are willing and able to contribute their time to activities outside their strict scientific disciplines. To capitalize on the valuable contributions of individuals who are willing to share their professional life, I hope that AFIPS in the near future, will see fit to establish a permanent staff that can assist in the public relations area, in conference management, and in support of AFIPS officers. I also hope that the presently unresolved problems—some knotty but none unsolvable—between AFIPS and its members will quickly be settled so that AFIPS and its members can each perform their obligations with maximum efficiency and harmony. ■

AN EVALUATION OF COMPUTER CONFERENCES

In the preceding article, AFIPS Board Chairman Willis Ware emphasizes, ". . . there are unresolved problems with respect to the relation of Joint Conferences to those of AFIPS members. These will have to be faced and resolved . . ."

Several of these problems were raised briefly in DATAMATION's March editorial, "The Great Conference Debate" (page 25). However, to provide readers with a more complete exposure, two representative professionals in the computing fraternity were invited to address themselves to this timely issue. Their responses are presented on the following pages.

DON MADDEN is presently chairman-elect of AFIPS and director of the association's public relations effort. He is employed at System Development Corp., Santa Monica, Calif., where he heads the Information Processing Directorate.

GERHARD HOLLANDER serves as a director of AFIPS and as vice chairman of the IEEE Computing Devices Committee. He is president of Hollander Associates, Fullerton, Calif.

The differing opinions of Madden and Hollander do not reflect the views of AFIPS, its participating organizations, or their respective corporations, but are presented as personal reflections of two informed members of computing's leading professional societies whose considerable influence will be exercised in future deliberations on this question.

Readers attending next month's Spring Joint (see pages 53-74) will have a first-hand opportunity to evaluate the specifics of a major computer conference as related to the comments of Madden and Hollander. Letters to the Editor are especially solicited.

IMPROVING THE CURRENT FORMAT

by J. DON MADDEN, Chairman Elect, AFIPS

Over the last several months, increasing concern has been expressed by persons from the information processing community regarding the whys and wherefores of computer conferences. Such questions are being heard as: "Aren't there too many conferences?" "Are there papers of interest to both computer engineers and computer programmers?" "Should all conferences have exhibits?" "Can't the diverse meetings be integrated into a unified package?" "Shouldn't we be examining the reasons for conferences?"

This article is an attempt to deal with these questions. It is based on the writer's experience with numerous computer conferences in the roles of attendee, participant, organizer, and chairman. The conclusions reached and suggestions made are far from final; the problem of computer conferences is a perplexing one, which deserves the considered and intensive study of a panel of experts.

Aren't there too many conferences? Probably not. The information processing community has little reason for pride in the degree to which we keep one another informed of developments in the field. For a fraternity, one of whose specialties is the handling of information, we do a poor job. Consistently, very similar developments are occurring simultaneously at various places around the country. Much of this duplication could be avoided with better dissemination of information. The field is moving too fast and the shortage of competent manpower is too great for us to be duplicating these accomplishments. Some developments are, of course, proprietary. However, many are destined for early admission to the public domain and their entry should be expedited.

While it is true that much of the information can be disseminated through publications, these do not provide the setting for the rapid, free interchange of ideas that results from papers followed by discussion at a conference. If our goal is the sharing of information, and we agree that meetings enhance our ability to do so, then there are *not* too many conferences.

Are there papers of interest to both computer engineers and computer programmers? In the opinion of the writer, there are, since he is apt to attend hardware sessions even though his background is in programming. The software and hardware aspects of computers are becoming so closely interrelated that it is increasingly important for specialists in one area to understand the other. Papers that treat in depth one or the other area should be reserved for meetings of the societies of specialists. On the other hand, the Joint Computer Conference program committees should recognize that they have a mixed audience and should tailor their programs to accommodate this audience. Papers can be pitched at the appropriate level to interest and inform both engineers and programmers.

Should we have exhibits at all conferences? In the last analysis, the exhibitors will decide whether or not they are willing to buy booths at meetings. If we go back to the major reason for conferences—sharing information—then it is clear that exhibits contribute to this goal since they provide a kind of information difficult to obtain by other means. In comparing exhibits at meetings of the individual societies with those at Joint Computer Conferences, there may be criteria similar to those for papers; i.e., general exhibits could be used at the JCC's and more specific ones at meetings of the individual societies. This principle should not be carried too far, however, since much data on components, systems, and services are of general interest. Another fact not to be overlooked is that many meetings and some societies are financed largely by the proceeds from exhibits at conferences. If we believe in the value of conferences, then we should not give up exhibits as long as the exhibitors are willing to participate.

Can't the diverse meetings be integrated into a unified package? On this point, a suggestion which came to the author from two independent sources deserves some consideration. Perhaps we should organize a central paper-exchange agency to which papers from the information processing community could be sent. This agency would carefully screen all papers submitted and distribute them on request, making sure that all outstanding papers were placed on some program with appropriate timing—e.g.,

papers of transitory value would be placed quickly. The inherent delay in this scheme might be compensated for by the assurance that all good papers would be presented. The suggested agency would also facilitate the sponsorship of information processing sessions at meetings of other societies with interests peripheral to our field. Sponsorship of such sessions is a convenient and effective way to carry the word of information processing outside the community.

Shouldn't we be examining the reasons for conferences? Of course, we should. The major reason for computer conferences is the sharing of information among members of the community. At one time it was the opinion of the writer that the most fruitful setting for this exchange was in two-, three- or four-man discussions outside of the regular conference functions. Since that time this opinion has changed to where exhibits and formal-paper sessions enjoy the same importance as do the informal discussions. This has come about with continual improvements in exhibits, which are showing more operational hardware, and also in the quality of the papers presented. The answer lies not in curtailing the number of conferences but rather in improving their content. Toward this end, several suggestions occur.

1. Recognize and identify the purpose of each paper session.
2. Include more survey or tutorial sessions in the JCC meetings.
3. Brief the speakers on the characteristics of their audience and insist that they gear their presentations to the appropriate level to reach their audience.
4. Set the paper submission due date as late as possible to increase the probability of presenting current information.
5. Screen and select papers more carefully to increase their quality.
6. Use all means possible, including the enlistment of professional assistance, to increase the quality of presentation.
7. Use more panel discussions where forceful, knowledgeable moderators assure that controversial points are aired from all points of view.
8. Arrange for sufficient lounge area to hold the essential two-, three-, and four-man discussions.
9. Increase the use of what the Association for Computing Machinery calls "Halls of Discussion" where an attempt is made to draw the audience into participation.
10. Select and influence composition of exhibits to assure maximum transfer of information through this medium.

It may not be possible to implement all of these suggestions at each conference. Some pairs may appear to be contradictory. However, they represent measures of which any combination should increase the effectiveness of a conference.

One final word on conferences. The most favorable time for the information processing community to get the attention of the largest segment of the press is during a computer conference. It is important to have the field represented fairly and accurately to various publics, and conferences provide an important springboard to accomplishing this goal. This point alone provides a strong case for careful consideration before any of the conferences currently held are discontinued. ■

a conference evaluation

REEXAMINING BASIC OBJECTIVES

by GERHARD L. HOLLANDER, AFIPS Director, & Vice Chairman, IEEE Computing Devices Committee

The explosive expansion of the computer field demands a reexamination of the Joint Computer Conferences (JCC); not merely their mechanics, but their objectives. The JCCs are so prominent that such reexamination affects all professional members and societies in the computer community.

In 1951, Joint Computer Conferences were conceived as a means for concentrating the presentation of computer papers. This provided a larger audience for the author and allowed computer people to hear more applicable papers. The initial charter specified a "selected theme in the computer field" for each conference, leaving the ordinary current publications to the sponsoring societies.

By tradition these conferences have developed certain characteristics that must be reexamined:

1. Conferences have few, if any, parallel sessions. This imposes the requirement that the papers be of broad interest to the rather divergent group of conference attendees.
2. The themes became more general, because an exhaustive examination of a narrow subject would not interest a heterogeneous group. Often, the theme was omitted or broadened to "New Developments."
3. By the late 1950s, the JCCs were the main outlet for oral presentations of computer papers.
4. The two Joint Computer Conferences publish fewer than 100 papers each year.
5. Each conference program is planned independent of all other conferences under local control by a fresh program committee.

When the field was small, and each man was interested in all aspects of computers, this mode of operation was satisfactory. But during the last twelve years, the number of professional workers identified with computers has grown from a few thousand to over 100,000. This nearly hundredfold increase cannot possibly be served under the old system. Granted, the number of worthwhile papers does not increase in direct proportion to the number of workers; but they also do not stay static when the field expands so much. However, the type of contribution has changed. No longer does the average engineer have a grasp of the entire computer field. He specializes in one facet, be it programming compilers or designing thin-film memories; and his contribution, though important to his specialty, is limited to his specialty. The generalist of 12 years ago may consider these specialized contributions insignificant, but they are crucial to the specialist.

The constituent societies of AFIPS often sponsor their own conferences to cover exhaustively new or rapidly advancing sub-specialties. During recent years, the IEEE predecessor societies have held multi-day special conferences on gigacycle computers, control computers, spaceborne computers, computers for communication switching, and application of computers to artificial intelligence. Most of these meetings were of interest to only a few hundred people; but to them, they were the high point of the year. The current format of the Joint Computer Conferences cannot satisfy this need; neither are the specialists serviced by presenting two or three of their best or broadest papers at one meeting with the rest at another.

The computer community is faced with several alternatives to the publication of their papers:

1. The Joint Computer Conferences can be expanded with many parallel sessions to handle most needs of the computer field.
2. Each society can publish its own papers, while the Joint Computer Conferences concentrate on interdisciplinary activities, particularly interactions with fields such as medicine, law, and the social sciences.
3. The Joint Computer Conferences can provide a meeting place at which each society programs its own papers. This method, adopted by the Joint Automatic Control Council (JACC), places the responsibility for selection, programming, and publication in the hands of the societies, but provides the advantage of fewer meetings.
4. Finally, the Joint Computer Conferences could be special conferences on a specific topic each year, similar to the IEEE artificial intelligence and gigahertz computer meetings. Of course, in this case the attendance would hardly warrant the large exhibits.

But exhibits too should be reexamined. They are an important adjunct to the meeting, and they offset the deficits from technical and other activities of the meetings, AFIPS, and the constituent societies. However, the computer community indirectly pays for this revenue. The addition of exhibits precludes the use of inexpensive accomodations on university campuses. Recent expansion of the exhibits have limited the choice of meeting places to the more expensive hotels, and even to convention centers not easily accessible to most junior members. Our success has built-in feedback. The cost of the conferences rises, if not in direct registration fees, then in indirect costs of expensive hotels and reduced local attendance. Do we want to pay this price?

The need for reexamining the objectives of the Joint Computer Conferences has been recognized by the AFIPS Board of Governors, and a committee will examine the many alternatives. The need for service to the computer community exists. The method should be responsive to produce efficient dissemination of all meaningful contributions in the field, either through AFIPS or through the constituent societies. ■

As the buffer in DATAMATION's three-pronged interview series with prominent executives in consulting, Elmer Kubie expresses a broad gamut of opinions including several on competitors CSC and CEIR. The views of CSC's Fletcher Jones appeared in DATAMATION's March issue (p. 39), and an interview with Dr. Herbert Robinson and George Dick of CEIR has been scheduled for the May issue. So that no competitive edge could be provided to the interviewees, all of the sessions were taped prior to publication of the first article and of course, transcriptions were not passed about for comparison. To further preserve truth, goodness, and other virtues, order of appearance is based on alphabetical arrangement of corporate designations.

IT'S ELMER'S TURN

an interview with Elmer Kubie, president, Computer Usage Corp.

by HAROLD BERGSTEIN, Editor

Q: The first question is always the easiest. Would you provide us with a brief history of the firm?

A: The company was started by John Sheldon and myself in April, 1955, to assist people in the use of computers, without a fixed commitment to any particular equipment. It was not a consulting service; the major service was to assist people in the use of the equipment rather than give them advice – which we would do as well, but this would play a minor role in our operation. It was really rather unique at that time. It was started with the premise that what people needed was help rather than advice, and that this help could best be given by an organization which did not have any strong commitment to any specific equipment.

Initially we did nothing but work on the development of applications in the scientific area. I felt that we would have to build a staff that was broader, and a staff that was not a new group, to work in the area which has a much greater communication problem; namely, the area of business applications. And so we initially did work only in the scientific area where difficulties in problem definition are much less severe. Later on, in fact about a year later, we undertook our first work in the business application area. In 1956, we also started to work in a third area, the development of software. We now work in all three areas. About 50-60% of our development work is in the business application area, 20-30% in software, and the remainder in scientific applications.

Q: What were some of the first contracts that you had when the firm was started?

A: We did some work in fluid flow for one of the major oil companies; some programs that we developed were used extensively in oil reservoir engineering. We did some work on the 701 that was used for orbit studies of the first American satellite before it was put up. We also did substantial work in the atomic reactor field.

Q: What were some of your software contracts in that period?

A: One of the first was in assisting IBM in developing Print I for the 705. In fact, I suppose that was the first. I'm not sure of the year but I think it was 1956. Then we wrote a rather simple and somewhat restricted assembly system for the Burroughs 220 when it first came out. Of course we also wrote such systems as the algebraic compiler for Honeywell, and an assembly system for ISI 609, Card Argus for Honeywell and several versions of Tabsol.

Q: You started off originally with yourself and John Sheldon. How many people do you have now?

A: We have about 160 in our offices in New York, Boston, Los Angeles, and Washington, D.C. About 140 of them are professional employees.

Q: Several years ago you entered the time brokering business. Could you explain your reasons for this decision?

A: I felt that there was a need for a service, not just to the purchaser but also to the seller of machine time. We had the idea that the purchaser needed to acquire time at a reasonable cost, and he needed to acquire it flexibly and with a certain amount of services provided. This was difficult for him to do unless he bought machine time from

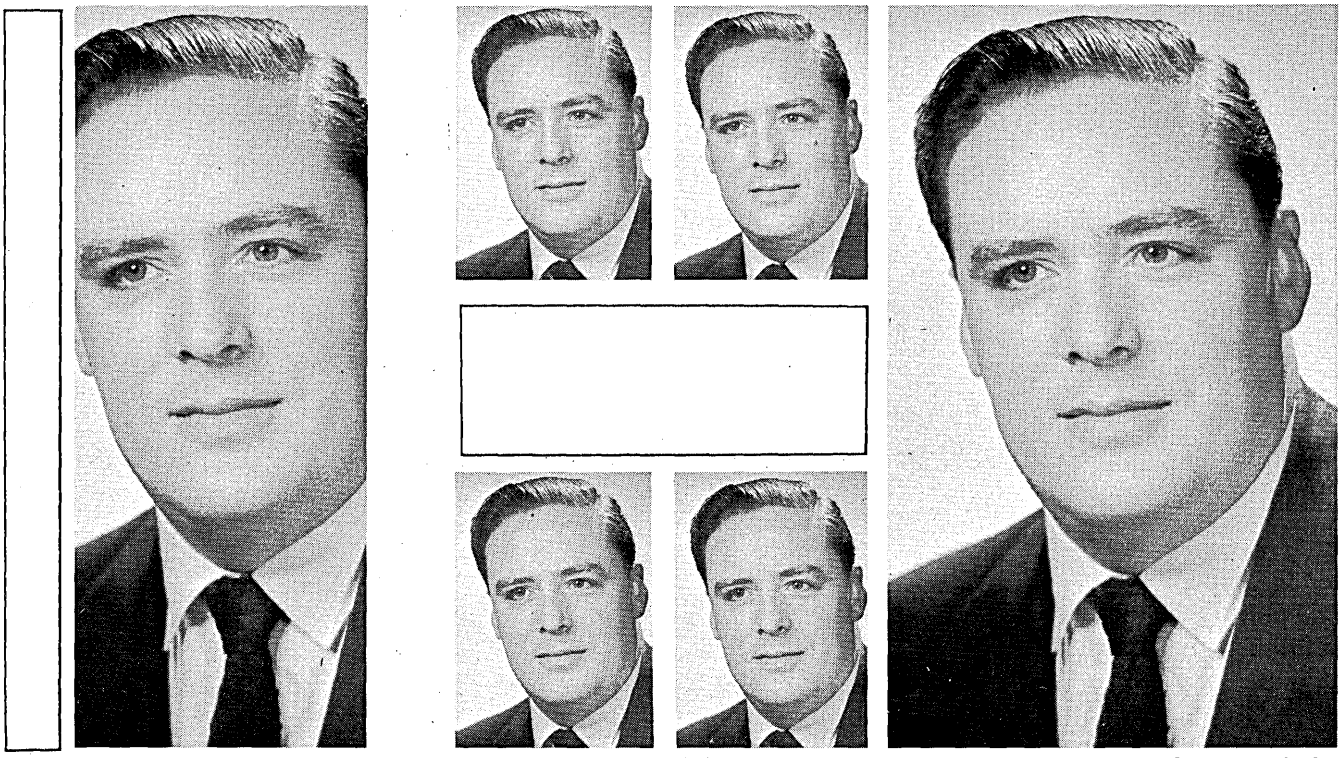
a service organization rather than someone who had excess time. I could observe that the price of machine time was being driven down considerably, and the reason for this was not, in my opinion, the competition among service organizations but rather the competition from non-service organizations. Early in our history, we bought machine time from service companies; as time went on, we used them less frequently, and the machine time that we had to purchase for the checkout of our programs was from non-service companies that had the equipment installed but weren't using it on a full-time basis.

The trouble with this concept is that the seller is not in a position to promote the sale of machine time because he has a single installation and limited time available. Also, he has only one machine, which puts him in a position of possible conflict in priority with users. The load on the machine is not even, and he reaches a point when he has to decide whether to deny machine time to someone he has promised it to and use it himself, or to defer his own work and allow the person to whom time was sold to use the equipment; it seemed to me that neither of these alternatives was a good one. Further, the fellow who is selling the time has a charter within his organization to develop applications of the equipment, and use that equipment for the benefit of his organization. But through sale of machine time, he would often get into a situation where his staff was being interfered with by people who were purchasing time — who would ask questions and want assistance. Even if this were minimal, it would constitute some interference with his internal progress.

Another point is that there is a contracting difficulty often occurring in a situation such as this because we're talking about large equipment which is, usually, installed by large companies. Equipment time is often purchased by large companies. So we have the difficult problem of getting the proper attorneys together and ironing out a contract for the sale of this time.

It seemed natural to step in the middle and provide a service where we would rent time on any of the equipment that we have under contract from the seller's side. The buyer can deal through a single source and obtain machine time; the seller doesn't have to contract with every organization that is individually making use of his equipment.

Q: What percentage of your present gross income would you attribute to brokering?
A: Roughly 10% of our income is commission income. We do not report gross sales volume on machine time sold.
Q: What is your gross income or present earning?
A: In the first year we did less than $200,000 in service fees. In our last year we did over $2 million. We earned something like $10,000 in the first year, and more than $60,000 last year.
Q: Computer Sciences Corp. has just announced a departure from the normal prime shift concept with which I'm sure you're familiar. What do you think of this concept?
A: If I understand it correctly, rates are established after a month is over, depending on how you requested machine time. I think it will be difficult to administer. The concept may be fine because the cost to a service company, in selling time, is very dependent upon how well the requests for machine time are managed by the client. If you could somehow go back and look at his requests for time and set a rate on that basis, this would be very nice. But it seems to me it will be difficult to maintain good client relationships when administrative conflicts arise due to this post-mortem procedure.
Q: Do you foresee any further departures from the prime shift concept?
A: Well, I think there can be discounts and lower rates for guaranteed use. You already see this in, for example, the data centers of IBM. If you guarantee the use of the equipment you want on a prescheduled basis, you get a rate that's lower than if you asked for it on a hit-and-miss basis.
Q: Do you see any general trends in the growth of the consulting or service field?
A: I think the field is much bigger today than I thought it would be five years ago. Literally hundreds of small service organizations have been started. The problem is that as an organization grows, it requires both technical and management competence, as well as increased financial resources and sufficient work to support its staff. If a group intends to have a small practice, it probably can subsist for some time as long as it limits that growth. As soon as it tries to expand, to establish more than one office and set up a



management structure which will allow it to control costs, sales and technical achievement, it has a problem of a different order of magnitude from the fellow who has a single, small office. It's an entirely different thing to run a business and to run a practice; what we see today is the establishment of many practices, and most of these men will try to build businesses out of their practices. As a result, many of them will fail.

Q: One of the larger firms, specifically CEIR, has had a great deal of financial difficulty recently. What reason is there, in your opinion, for this happening to a company of that size when as you have indicated, the field has grown considerably in recent years?

A: I would say that they have tried to service, in a sense, the same need as we have tried to serve. But their approach has been at right angles to ours. Their orientation has been, in the past, the installation of the largest, most expensive piece of equipment they could get, and hope the world would come to them. I have always felt that this was the wrong concept, that the right thing to do was to develop the strongest capability you could and go to the world.

Q: CUC has just installed a 1401. For what purpose?

A: It's used principally as a peripheral device. We have 7070's and 90's in our Time Sales Division, equipment that is difficult to schedule without also scheduling the 1401. With our own 1401, we can do the peripheral operation and have full-time control over its scheduling. Also, virtually everything we do today involving IBM equipment requires the 1401.

Q: There has been much concern over the competence, or the lack of it, among management-oriented accounting firms in the dp field. Does this problem exist?

A: I think it does exist to some extent. These firms have obtained their positions over a period of time for services in other fields. It is difficult for them to judge and develop a staff in an area in which they have very little competence. I think that a service company in data processing must be managed by people who come from data processing.

Q: How could a user judge the competence of a consulting firm?

A: The best method that I know of in judging a service organization is a review of what it has accomplished. Some of the work that a service company has done will be generally available and this makes it quite easy. This is certainly true in the software area; talk to people who have made use of the software developed by the firm. It's of course much more difficult to appraise work that is done for a single client; very often opinion will depend on who is contacted at the client's office, what his responsibility is, and whether he has an axe to grind.

Another way, and in some respects a simpler way, is to determine what kind of repeat business the firm obtains. If it has developed software for a manufacturer, has the manufacturer continued to give it additional contracts? This, of course, is a surface validation that the firm has produced something of value to the manufacturer. The same is true with old clients. We've found that close to 80% of our work is repeat business.

Q: I've often heard the expression that you represent a company which is going to "honest" itself out of the business, that you are one of the more reputable firms in the field and this actually hurts your business. Would you care to comment?

A: I disagree with this wholly because otherwise we wouldn't follow the practice you describe. We really are trying to do as good a job as is possible for anyone to do. We're doing this intentionally. We are a young company; I feel that, in the long run, the company that does everything it can will earn a reputation through good performance. I think that because the field has been growing so dynamically and rapidly, it has been possible to build on failure, but in the long run, the field is going to mature, and it's the firm that has a record of outstanding achievement that will succeed.

Q: What is your feeling about COBOL as both a common and efficient compiler?

A: Let me try to answer the question by going around the barn, so to speak. I think we're going to see, in time, more and more software packages which are less general. I think efficiency is important — that is, compiling efficiency, and especially processing efficiency if the computer field is going to reach the small user. One of the problems today is that some of the more elaborate programming languages are designed so that the company with a limited or virtually no staff, supposedly, can effectively employ the equipment. A small organization cannot afford to go to a great deal of expense to develop its applications or to process data. The problem with this organization is that it requires extreme efficiency in programs that must be created by a weak staff. Therefore, this is sort of a paradox. If you were successful in developing a language that allows someone with less training to employ the equipment, it also has to be a language which will result in highly efficient processing. To date, I don't think there is such a language.

Q: How do you feel about the influence of the government in the development of this language?

A: I think the reaction as well as the influence of the government will be felt in time. When we talk about efficiencies in data processing, we should talk about efficiencies right across the line, in terms of processing performance and development costs for applications; you can't ignore either of the two. If it were possible to develop generalized, easy-to-use languages which would be convenient for people to use in writing programs for a great breadth of applications, and if these languages would also result in highly efficient systems while processing, and also were very convenient for debugging, and very fast compilers were available and so forth, that would be one thing, but this isn't the case; we're substituting one cost for another. It's possible to substitute machine time for a language that is quite broad.

In respect to standards I think there is a need, but I don't know if it isn't too early, and I don't know that this standard should be in the English language at all.

Q: I'm repeating this question, but in a specific sense, do you think that the application of COBOL to date has shown promise? At the first meeting of CODASYL, it was suggested that this would be both common and efficient. Has it met any of these requirements at the present time?

A: What I personally feel is needed is some sort of symbolic language. Mathematics was developed through the heavy use of symbolism. I think that symbolism is going to be found necessary in stating business applications, and the day will come when it will be developed. The trouble is that the language of mathematics took thousands of years to develop, and the language of business applications is something we've tried hard to develop only in the last 10 years. I don't think you can use English because it is inefficient, it's ambiguous and, as I put it, you have to replace programmers with lawyers. Lawyers are harder to train than programmers.

Q: Since you do not have any vested interest with any particular manufacturer, what do you feel about the general economic condition of computer manufacturers at the present time and in the near future?

A: I think many of them have the same problem as many

of the users in that they're dealing with an over-promoted, under-developed field. I think many of the manufacturers have somehow gone down the same road as many of the users (this is something they "ought to be in because of their image"), and spent a tremendous amount of money on the basis of promotion by one or a few individuals interested in this field who made great promises of how successful they would be in acquiring sales. I hope the number of manufacturers doesn't decrease. I think there will be more regrouping than dropping out.

Q: What changes do you portend for the near future as far as the systems themselves are concerned?

A: I think the greatest need, and probably the place where the emphasis is going to be put in the near future, is in attaining greater efficiencies. It's needed. I think that people are going to strive for faster compiling and operating speeds, and more effective debugging features.

Q: Do you think changes in hardware design will be postponed for a number of years because of the programming problem?

A: On the contrary, maybe the programming problem stimulates the development of improved hardware. Because of the attempt to attain convenient languages, which also tend to lose efficiency, manufacturers may try to make up for this through improved hardware performance. This may stimulate the development of better hardware, and quite often we have seen a piece of equipment that is much more powerful replace equipment that would not have to be replaced had it been used as effectively as possible. So, you're making up in hardware what you lack in software. Maybe this is good; in an industry sense, maybe we can thank part of our development to the problems we've had in software.

Q: One of the principal problems in the development of software has been the shortage of qualified people, which I'm sure you're aware of. Do you feel there's any solution in sight?

A: Yes, but I don't think we'll live to see it. I think this is the direct result of the explosive growth of the field. The field has grown so rapidly with such a tremendous amount of publicity and glamour that it has attracted many people. Only a percentage would be in the field if their entering and staying in the field were truly decided on a competitive basis. I feel that if you could take everyone presently in this field, and increase their competence to the top 100 people who are in this field, we would have enough programming manpower for this generation.

Q: In addition to the government's influence in directing the development of a compiler, namely COBOL, the government is also directly influential in the purchase of a great variety of machines for similar operations — to preserve, I believe, our free enterprise system. Would you comment on the advisability of this practice?

A: Well, I think in the past this has been a good thing. I think there has been equipment developed with new and original ideas that may not have been developed if it weren't for this kind of subsidy, if you want to think of it as that. I think this is becoming less and less valuable to us, as a nation, and I think that today government must think more in terms of what it will get for its dollar. It shouldn't be purchasing equipment in the sense of trying to prime the pump in development of the computing field. Twelve years ago, it was necessary and desirable that the government buy a variety of equipment to aid in the development of this kind of equipment because it was important to the nation. I think today this is less so; I think it should become more cost conscious, and if it can get along with a machine of a certain size to do a job, it ought to stay with that machine rather than to upgrade it simply for the sake of upgrading. In other words, the government should act more like a commercial purchaser.

Q: But if the government improves its purchasing policies and considering the eminence of IBM in the computing field at the present time, and the problems incurred in reprogramming and converting, it would seem that most of the other companies would be driven out of competition. Would you care to comment?

A: That would be the worst thing that could happen to IBM. I feel that IBM's growth has been stimulated by competition and that if the level of competition becomes much less than it is today, this would actually tend to reduce the development of the field as a whole. IBM is a great counterpuncher.

Q: What would you consider as the principal problem in the industry today?

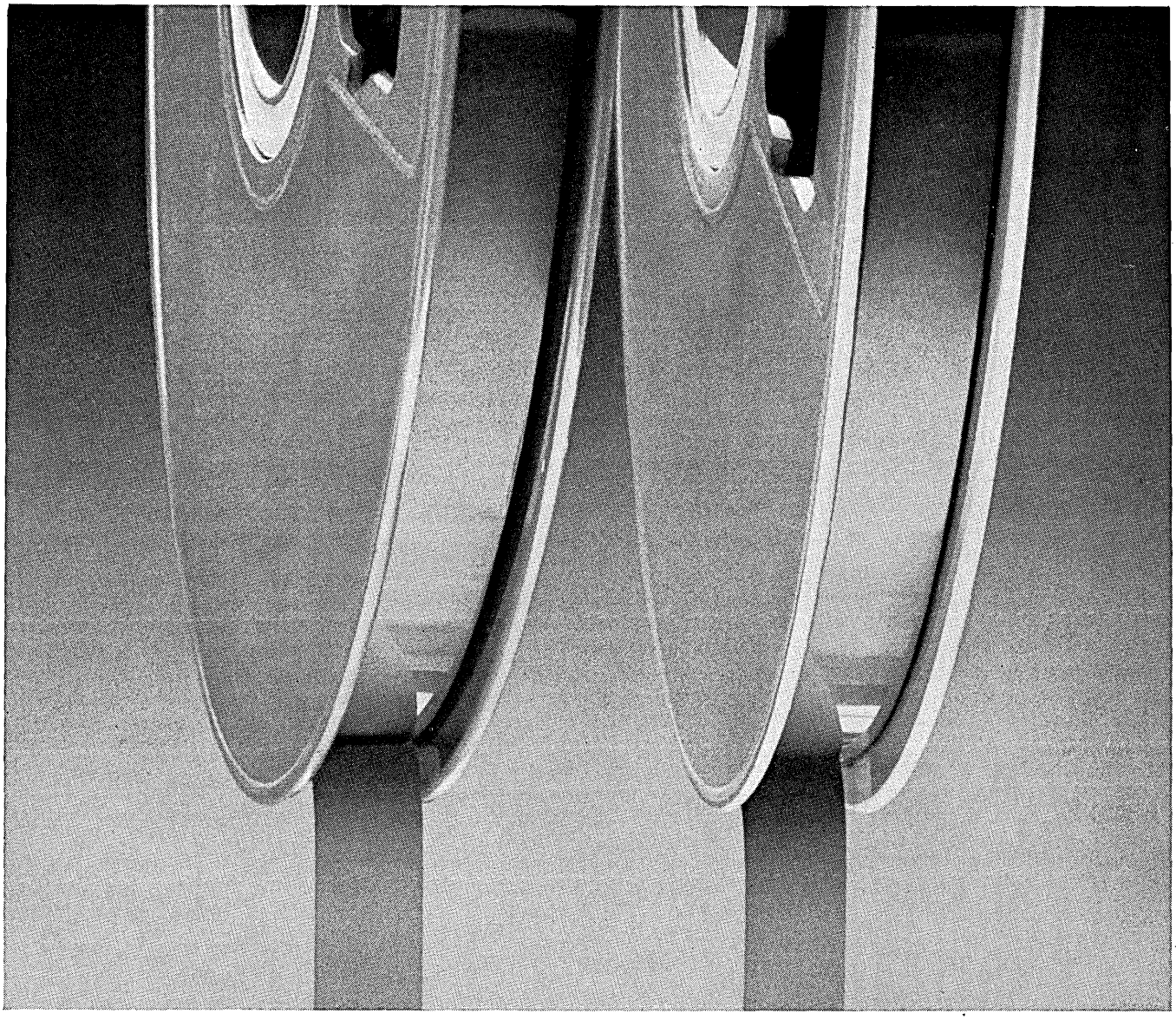
A: The matching of talent with growth. The field has grown so rapidly that the problem of selection and training of personnel has been a rather haphazard process. As a result, I am sure there are many people who should be in the field who aren't in the field; I'm also sure there are many people in the field who shouldn't be in the field, and you really can't lay blame at any doorstep. This is just a function of the very fast rate of growth the field has had in its selection and creation of staffs — really in desperation.

We could go out tomorrow and hire a hundred people or more, but we wouldn't do this. It doesn't make sense because you can't control the quality of your staff if you do this; you have to, it seems to me, absorb them gradually and try to assign them to relatively non-sensitive areas, and watch them closely. If they haven't got it, get rid of them. This is a time-consuming, slow process; you just can't build good staffs overnight.

One might attempt to build a staff quickly by raiding, but this isn't wise for many reasons. For one, if you could select people who have already demonstrated a great deal of competence by work they have done formerly, you can't hire them and be sure to achieve the same kind of results that they may have achieved individually; they may be incompatible as a group. There is a certain amount of compatibility required in a project team. The people must know each other, know the strengths and weaknesses of each other, and be organized for optimum performance. So, if you did select a large group of people who had demonstrated competence elsewhere, it doesn't necessarily follow that they are going to perform well as a group when you bring them together.

The second point is that you may be doing a disservice to the industry. In this business you can't have too many friends. If you act irresponsibly by stealing all of the key people from an installation, you are damaging someone who, in our business, might be a potential client. You, obviously, don't want to do this.

The third reason, which is perhaps the most important, is that if you have a panic-hiring campaign and try to get the best people from a number of organizations with very short notice to the current employer, this hurts not only him and his projects severely — but it also hurts you and the individual. It hurts the individual because he is compromising his professionalism by doing this. We insist, with anyone who joins us, that he meet all his current commitments with his past employer, and this is a painful thing to do sometimes. But if we don't ask him to fulfill those commitments to his present employer, how can we expect any different treatment if he ever decides to leave us? And if you are a responsible service organization, you have commitments to complete projects. The fact that someone left you makes this difficult, but you still have this responsibility as an organization. You can go to a man and say "Look, I've got this big contract. Join me the day after tomorrow." Should he do so, how can you expect any different treatment once he's in your organization? You set the style of performance. ■



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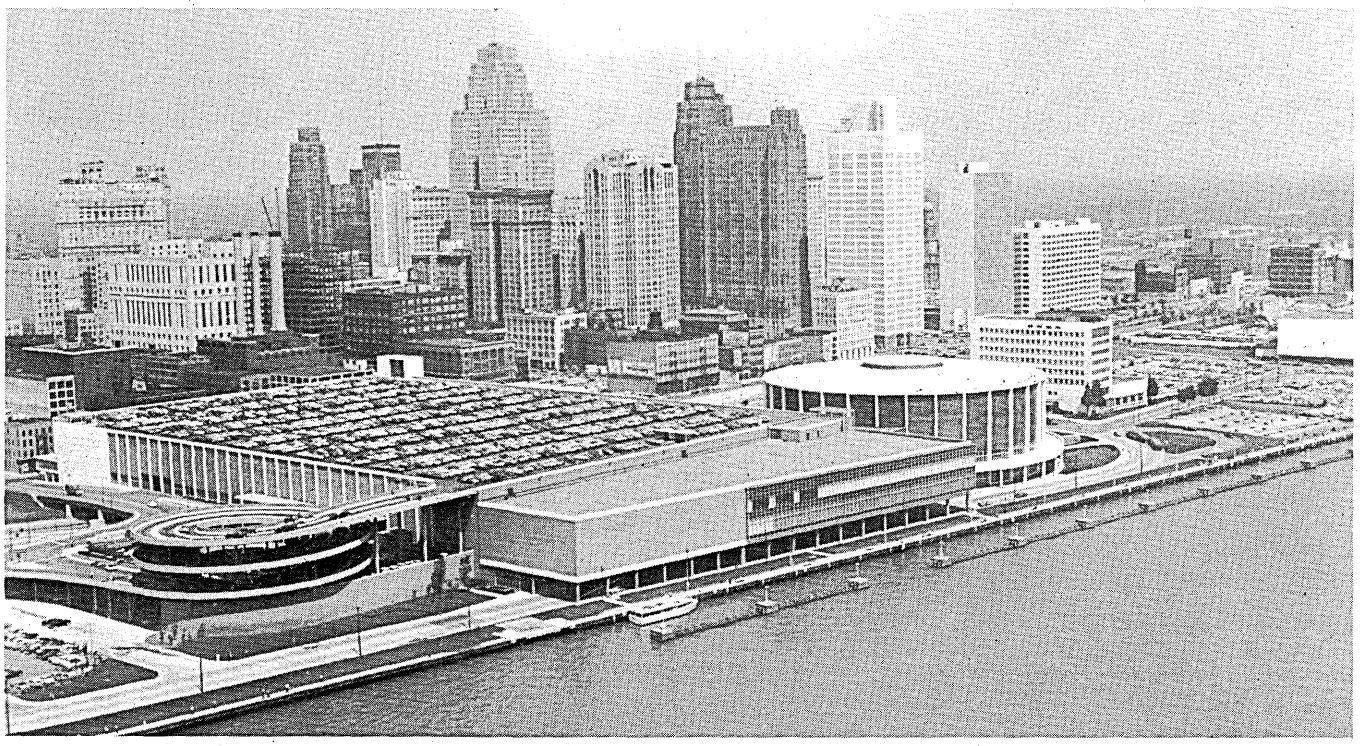
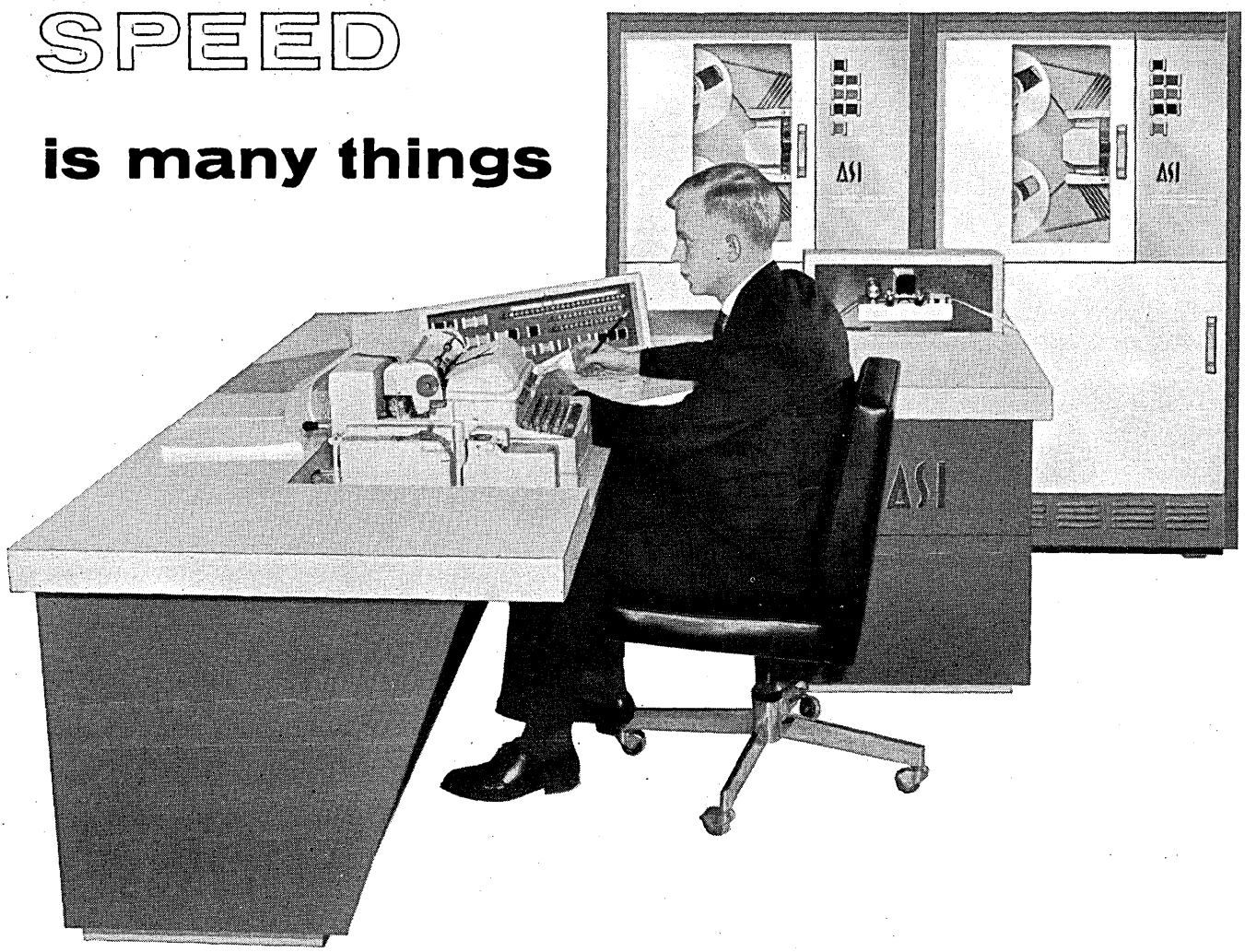


SPEED

is many things



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CIRCLE 23 ON READER CARD

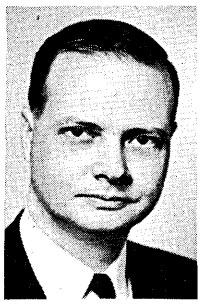
CONFERENCE WELCOME

by CALVIN JOHNSON, 1963 SJCC Chairman

This spring the Joint Computer Conference departs from tradition in two significant respects. In the interest of getting the customary East Coast and West Coast locations better in tune with the weather, a Midwest location — Detroit — has been selected for a transitional meeting.

A unique opportunity is thus provided for the growing number of computer professionals in the Midwest area to participate in what continues to be the top national meeting in the information-processing field. In addition, the "old faithfuls" will have a chance to meet in a new environment, where the machinery of the production line and the information processing and control capability of the computer have much to offer each other.

The other departure from tradition is the use of a full-scale convention center as the setting for the Conference. The new Cobo Hall in Detroit, for a welcome change, provides all the exhibit space we can use, together with plenty of room left over for meetings, lounges, eating facilities, and elbow-room in general. An unusual dose of professional stimulation, as outlined elsewhere in these pages, should thus be available in relative comfort. ■



E. Calvin Johnson is manager, Information & Control Systems Laboratory, Research Laboratories Div., Bendix Corp. He joined the company in 1951 after receiving a doctor of science degree from MIT, and is responsible for five departments whose work ranges from basic component and technique studies to the development of large-scale hardware systems.

the TECHNICAL PROGRAM

its composition

by BRIAN W. POLLARD, 1963 SJCC Program Chairman

As a natural consequence of the broadening influence of data processing, the 1963 Spring Joint Computer Conference technical program features a wide and diversified representation.

There are 38 papers on the agenda, represented by authors from 30 organizations who are members of universities, government agencies and industry in this country, as well as from the United Kingdom, Canada and Australia. Including session chairmen and panelists, there are 60 organizations involved.

Happily, it is no longer simple to anticipate from what direction, person or organization useful, interesting papers will emerge. Choice of the most qualified papers was thus difficult. The screening of 113 complete papers submitted, to the final 38 accepted, was completed by each session chairman, with two referees of his own choice and, additionally, a third referee named by the program committee. Session chairmen were chosen prior to the call-for-papers from a tentative sessions list.

It is noteworthy that nearly every paper submitted resulted from the call-for-papers; very few were a result of direct invitation.

Session chairmen, each with his referees, reviewed papers germane to his session from among all papers submitted. They were guided by instructions to judge each paper on the basis of quality only; not to fill a session because it was on the tentative schedule. Papers that happened to be the best in the group on a particular topic, but did not satisfy requirements for timely, valuable and interesting subject material, were discarded. We did, in fact, cancel three sessions, tentatively scheduled in advance, because they would have affected the stature of the entire program. We believe that the resulting program and its participants will bear out the quality of the selections. ■

Brian W. Pollard, director of engineering, Data Processing Systems, Burroughs Corp., joined the company in 1959 as assistant to the general manager, ElectroData Div. Prior to joining Burroughs, Pollard was manager, Computer Dept., Ferranti, Ltd. He is a member of the ASA X-3 committee on Computers and Information Processing, and was chairman of the X-3.1 subcommittee on Optical Recognition Standards from July 1960-October 1961.

CONFERENCE PARTICULARS

The 1963 Spring Joint Computer Conference will be held Tuesday, Wednesday and Thursday, May 21-23 in Cobo Hall, by the Detroit River near downtown Detroit, Mich. The conference sponsor is the American Federation of Information Processing Societies (AFIPS).

fees

Registration fees for the SJCC are $8 for members of sponsoring societies (ACM, IEEE, SCI), $10 for non-members, and $2 for students. The registration desk, in Exhibit Hall B, will be open on Monday, May 20, from 7-11 p.m.; on Tuesday and Wednesday, May 21, 22, from 8 a.m.-5 p.m., and on May 23 from 8 a.m.-noon.

program

Thirty-eight technical papers will be presented. The 10 technical sessions, plus three panel discussions, will be held on all three days. General subject areas to be covered are algorithms in business dp, machine organization, analog and hybrid systems, data acquisition, transmission and display, information retrieval, computer-aided design, and a critical analysis of the current state of the art. The panel sessions will cover manned space simulation, prospects for list processing, and the future of biomedical computing activities.

On the opening day of the conference, George W. Romney, governor of Michigan, will speak. Keynoting the meeting will be Ray R. Eppert, president, Burroughs Corp. This session will be held in the Ballroom (room 2001-A), as will the conference luncheon on May 23. The luncheon speaker will be Prof. Walter A. Rosenblith, Communications Biophysics, MIT.

proceedings

Proceedings of the SJCC will be published in cloth-bound form, and will be available at the conference at no charge to registrants (members and non-members); students desiring copies may purchase them at the regular price of $4.

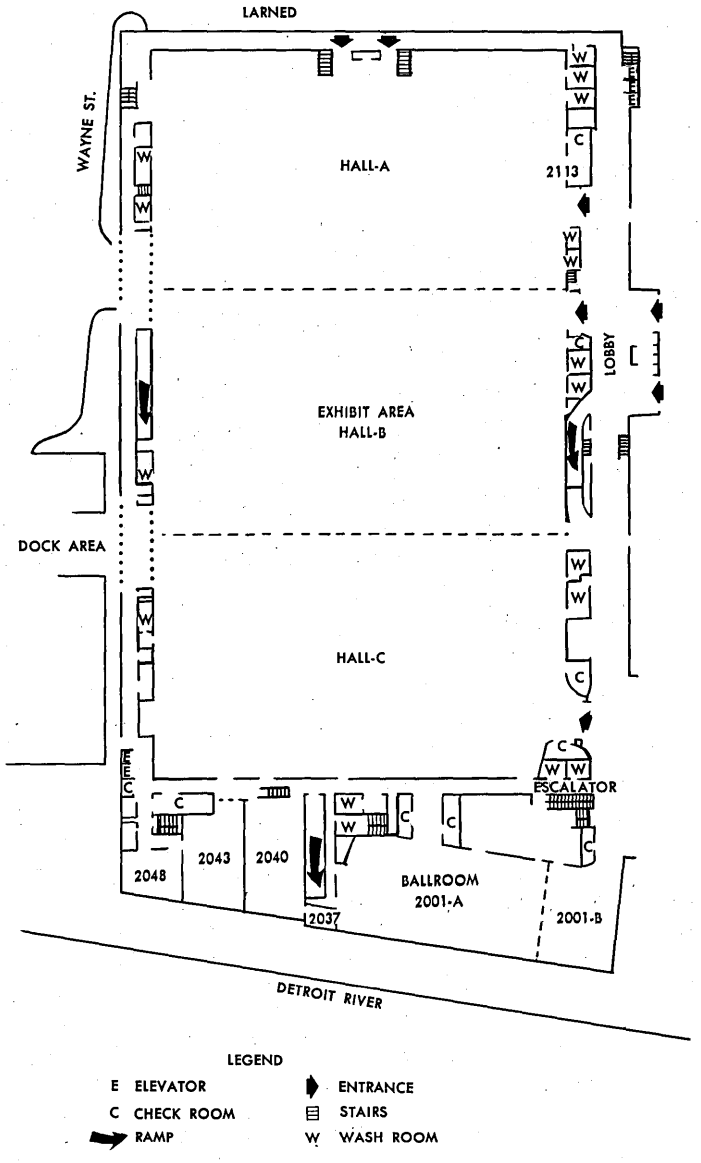
exhibit

More than 100 exhibitors will be displaying 12 megabucks of equipment, components, and accessories from 170 booths. Exhibit hours are from 11 a.m.-6 p.m. on May 21; from 10 a.m.-8 p.m. on May 22, and from 10 a.m.-5:30 p.m. on May 23.

special events

Social events include the conference luncheon, for which a $4.50 fee will be charged, and a cocktail party on May 21 at the Statler Hilton Ballroom, from 6-7:30 p.m. Fee for the cocktail party is $4.50. No banquet is scheduled.

COBO HALL CONFERENCE AREA



THE PROGRAM

Tuesday, May 21....10 A.M. to Noon **Ballroom (Room 2001-A)**

SESSION 1:
Formal Opening

Welcoming Remarks
B. W. Pollard, Burroughs Corp., Detroit, Mich.
Program Chairman

Introductory Comments
E. C. Johnson, Bendix Research Laboratories, Detroit, Mich.
Chairman of Conference

Sponsoring Society Report
W. H. Ware, The RAND Corp., Santa Monica, Calif.
Chairman, Governing Board
American Federation of Information Processing Societies (AFIPS)

Invited Addresses

Computers Here and Overseas:
An Appraisal of our International Technological and Marketing Responsibilities
Ray R. Eppert, President, Burroughs Corporation, Detroit, Mich.

Research In The State of Michigan
George W. Romney, Governor, The State of Michigan

Tuesday, May 21, 2:30 to 5 p.m., Room 2040

SESSION 2:

Algorithms in Business Data Processing

Chairman:
HOWARD BROMBERG
Radio Corporation of America
Cherry Hill, N. J.

Panelists:
R. W. Bemer, Univac Div., Sperry Rand Corp., New York City, N.Y.
R. F. Clippinger, Minneapolis-Honeywell Reg. Co., Wellesley Hills, Mass.
A. D. Hestenes, General Motors Corp., Detroit, Mich.
L. L. Van Oosten, Allstate Insurance Co., Skokie, Ill.

2.1: Determining Fastest Routes Using Fixed Schedules
B. M. Levin and S. Hedetniemi
National Bureau of Standards, Washington, D.C.
In determining routings between locations with no direct connections, one usually selects the most desirable routing from a timetable. Now available is a program which determines routings using speed and cost as criteria. This paper will discuss this solution, which has been applied to airmail routing; its relationship to the "shortest route problem" will also be covered.

2.2: Equitable Distribution
J. A. Gosden
Auerbach Corp., Philadelphia, Pa.
In distribution networks, where one management is in control of all the sites to which distribution is being made, it is often necessary to ration supplies or to allocate surpluses. This paper will offer a principle

of distribution where stock levels at all sites are equal when measured in units of the rate of consumption at each site.

2.3: RAMPS—A Technique for Resource Allocation and Multi-Project Scheduling

J. Moshman, J. Johnson and M. Larson
C-E-I-R, Inc., Washington, D.C.

A report on an automated technique, using the critical path scheduling concept, through which business and industry management can allocate limited resources to competing activities in one or more projects, related only by their reliance in a common pool of resources. As a management tool, RAMPS can help to decide when and where men, machines, materials, and money should be assigned and how much of each will be required as a function of time.

Tuesday, May 21, 2:30 p.m., Ballroom (Room 2001-A)

PANEL A:

Manned Spacecraft Simulation

Moderator:
JOHN H. McLEOD
General Dynamics/Astronautics
San Diego, Calif.

Panelists:

R. S. Buchanan, Major, USAF, Chief, Research Pilot Division, Aerospace Research Pilot Schedule, Edwards AFB, Calif.

S. Deutsch, Chief, Systems Research and Analysis, NASA, Washington, D.C.

W. R. Laidlaw, Vice President—Advance Systems, Space and Information Division, North American Aviation, Inc. Downey, Calif.

W. B. Luton, Supervisor, Manned Aerospace Flight Simulator, Ling-Temco-Vought, Inc., Dallas, Tex.

J. M. Hunt, Senior Vice President/Technical Director, Simulation and Control Group, General Precision, Inc., Binghamton, N. Y.

P. M. Fitts, Professor of Psychology, University of Michigan, Ann Arbor, Mich.

J. Stroud, Engineering Psychologist, Pacific Missile Range, Point Mugu, Calif.

W. E. Woodson, Engineering Psychologist, General Dynamics/Astronautics, San Diego, Calif.

As space missions and equipment become more complex, the importance of manned spacecraft simulators will increase. This panel will discuss the present state of the art and future trends as viewed by the simulation designer, system designer, and astronaut. The values and problems *associated with* manned space simulators will also be considered.

Wednesday, May 22, 9 a.m. to noon, Ballroom (Room 2001-A)

SESSION 3:

Machine Organization I

Chairman:
DAVID C. EVANS
University of California
Berkeley, Calif.

Panelists:

N. R. Scott, University of Michigan, Ann Arbor, Mich.

A. W. Lo, IBM Corp., Poughkeepsie, N. Y.

W. Wattenburg, Lawrence Radiation Laboratories, University of Calif., Livermore, Calif.

3.1: Time Sharing on the Ferranti-Packard FP6000 Computer System

M. J. Marcotty, F. M. Longstaff and A. Williams
Ferranti-Packard Electric, Ltd., Toronto, Ontario, Canada

This paper will discuss various methods of achieving efficiency in a computer system offering reasons which lead to the choice of a time-sharing system. Described will be a medium-sized computer system, with particular reference to the method by which time-sharing operation may be implemented. By the use of a supervisory routine, EXECUTIVE, and a minimum amount of hardware, it is possible to operate a time-sharing system so that a faulty program cannot damage any other program in the computer.

3.2: Automatic Operation and Scheduling Program for the D825 Computer System

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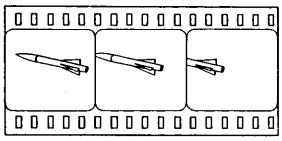

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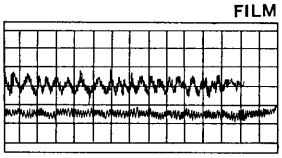
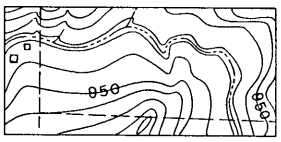
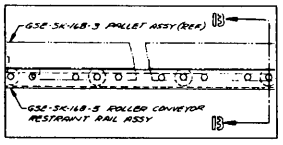


STRIP-CHARTS



CONTOUR MAPS



ENGINEERING DRAWINGS

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maps • aerial photographs
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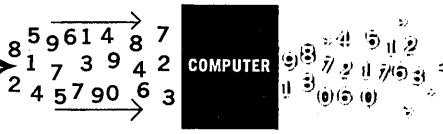

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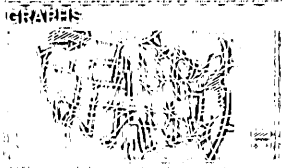
Acceleration
Reflection
Pressure
Temperature
Vibration
Azimuth
Stress
Strain
Axial Forces
Bending Moments
Precipitation
TO DIGITS AND GRAPHICS

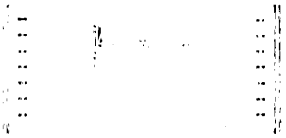
GRAPHITIZE DIGITS

OUTPUTS

GRAPHS



WEATHER & GEOPHYSICAL



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CIRCLE 24 ON READER CARD

R. N. Thompson and A. J. Wilkinson
Burroughs Corp., Paoli, Pa.

This paper will describe an Automatic Operating and Scheduling Program (ASOP) for a modular data processing system which employs freely-inter-connected, functionally independent, multiple processor, memory, I/O control, and I/O device modules. ASOP, an operating system program stored in totally-shared memory and available for execution by any processor module, welds the various functional modules into a coordinated system.

3.3: A Time-Sharing Debugging System for a Small Computer

S. Boilen
Bolt Beranek and Newman Inc., Cambridge, Mass.
E. Fredkin
Information International Inc., Maynard, Mass.
J. C. R. Licklider
Advanced Research Projects Agency, Department of Defense, Washington, D. C.
J. McCarthy
Stanford University, Stanford, Calif.

A system, SIMBUG, which permits five users at five typewriters to debug and run programs simultaneously on a small computer has been developed; additionally, a new language for controlling programs from the typewriter has been created. This paper will describe the hardware and programs of the system, the language and some of the applications of this kind of time-sharing.

3.4: Experience with the Atlas Scheduling System

D. J. Howarth
Ferranti, Ltd., London, England

A review of the salient features of the scheduling system used on the Ferranti Atlas computer will be offered. The program, which forms part of the supervisor system, has been designed to function with any configuration of core and drum store, magnetic tapes and peripheral equipments. Experimental changes in the algorithms used for scheduling have also been made, and the algorithms will be discussed in light of the experience presently obtained.

Wednesday, May 22, 9 a.m. to noon, Room 2040

SESSION 4:

Analog and Hybrid Systems I

Chairman:
ROBERT M. HOWE
Dept. of Aeronautical and Astronautical Eng.
University of Michigan, Ann Arbor, Mich.

Panelists:
L. Warshawsky, Aero Systems Division, Wright Patterson AFB, O.
R. Favreau, Electronics Associates, Inc., Princeton, N. J.
H. Meissinger, Space Technology Laboratories, Redondo Beach, Calif.

4.1: DYSAC—A Digitally Simulated Analog Computer

J. R. Hurley
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
J. J. Skiles
University of Wisconsin, Madison, Wis.

Analysis of the DYSAC program, written for the CDC 1604, which simulates a large analog system with an unusually large complement of nonlinear components will be presented. Computation is performed in 48-bit floating point arithmetic, virtually eliminating the need for amplitude scaling of problems. Solutions appear as tabulated values of the variables as functions of time and in continuous curves when plotted on a digital plotter.

4.2: DAS—A Digital Analog Simulator

R. A. Gaskill and J. W. Harris
Martin Company, Orlando, Fla.
A. L. McKnight
Thompson-Ramo-Wooldridge, Inc., RW Div., Fort Huachuca, Ariz.

DAS is a programming technique which makes it possible for a digital computer to operate much like an analog computer. The application of the technique to programming an IBM 7090 will be described. A DAS input program is essentially a description of an analog-style block diagram of the problem to be solved. Thus, DAS is similar to DEPI, but DAS uses a more basic set of components and a simpler procedure for writing the input program.

4.3: Six Degree-of-Freedom Simulation of a Manned Orbital Docking System

J. C. Fox and T. G. Windeknecht
Space Technology Laboratories, Redondo Beach, Calif.

The feasibility of an orbital docking system, comprised of a manned astrovehicle (chaser) and an earth-orbiting target vehicle, is largely dependent upon the pilot's correlation of guidance and control functions in terms of displayed information. In this paper, such a system will be considered from the minimum display aspect, since several desirable features of the manned system versus the automatic system are determined by weight and reliability advantages.

4.4: Application of Hybrid Analog and Digital Techniques in the Automatic Map Compilation System

S. Bertram
Thompson-Ramo-Wooldridge, Inc., Canoga Park, Calif.

This paper will cover an automatic Map Compilation System designed to obtain precision map data from stereo aerial photographs. It produces, to a desired map scale, a chart showing the terrain elevation contours and a new photograph in which the image elements have been moved to make possible precise horizontal measurements. The system includes a small digital computer and various analog positioning, scanning and correlating components. These operate to match image elements on the two photographs to their proper geographic location.

Wednesday, May 22, 2 to 5 p.m., Ballroom (Room 2001-A)

SESSION 5:

Data Acquisition Transmission and Display

Chairman:
KENNETH M. UGLOW, JR.
Electro-Mechanical Research, Inc.
Sarasota, Fla.

Panelists:
C. W. Adams, Charles W. Adams Associates Inc., Bedford, Mass.
M. J. A. Arnow, MIT Lincoln Laboratory, Lexington, Mass.
P. Sehnert, Directorate of Flight Tests, Air Force Flight Test Center, Edwards AFB, Calif.

5.1: Automatic Reading Machine for Telegraph Service

W. D. Buckingham
The Western Union Telegraph Co., Water Mill, L. I., N. Y.

In the field of optical character reader research, emphasis has been placed on the development of high-speed, costly readers capable of handling large quantities of information at speeds sufficient to meet the input requirements of data processing. Equipment of this type has been found to be unsuitable for telegraph service, load concentrations generally being insufficient to permit economic usage of reader capacity.

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the Program

To meet the anticipated requirements of the telegraph industry, a low-cost optical reader, which operates at 162 words-per-minute, has been developed. This paper will describe this equipment.

5.2: A Research Laboratory for Processing and Displaying Satellite Data in Real Time

R. H. Spitler and B. K. Kersey
Lockheed Missiles and Space Co., Sunnyvale, Calif.

Equipment configuration, diagnostic programming operations philosophy developed to meet the need for a research laboratory capable of simulating the processing of satellite data in real time will be described in this paper. The equipment comprises various types of telemetry input devices which drive an IBM 7090. The processed data is displayed on newly developed display devices.

5.3: A Real Time Multi-Computer System for Lunar and Planetary Space Flight Data Processing

T. B. Miller, W. Hoover and A. Arcand
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.

Requirements, criteria, and design for an on-line central data processing system for the support of all JPL spacecraft missions will be detailed in this report. The data processing system, scheduled to be operational in July, 1963, is a large multi-computer complex with a basic configuration of an IBM 7040 for input-output processing, a 7094 for the main analysis processing, and two 1301-II disc units shared by the two computers.

5.4: Ground Operation Equipment for the Orbiting Astronomical Observatory

A. G. Ferris and E. J. Habib
NASA Goddard Space Flight Center, Greenbelt, Md.
H. W. Cooper
Westinghouse Electric Corp., Baltimore, Md.
R. L. McConaughy
Grumman Aircraft Engineering Corp., Bethpage, N. Y.

This paper will cover the ground operation equipment for the Orbiting Astronomical Observatory, a precisely stabilized NASA satellite capable of being pointed to an accuracy of a fraction of a second of arc and designed for a useful orbiting life-time in excess of 1 year. The ground operation equipment at remote control stations transmits operating commands which have been verified on an operational simulator that includes a large scale digital computer. Suitable safeguards are incorporated to prevent irreversible commands to be transmitted by the remote control operator.

5.5: Error Detection Correction and Control

R. Steeneck
Data Systems Div., Western Union Telegraph Co., N. Y. C., N. Y.

Methods used in accounting systems for the protection of data from human errors can often adequately protect a data handling system from all types of errors. This paper will describe recently developed error detecting codes that include redundancy bits in every character either through the addition of one or more parity bits or the use of code combinations that always contain a fixed ratio of ones and zeros.

Wednesday, May 22, 2 to 5 p.m., Room 2040

PANEL B:

Prospects For List Processing

Moderator:
JOSEPH WEISENBAUM

Computer Laboratory
General Electric Co.
Sunnyvale, Calif.

Panelists:
J. McCarthy, Computation Center, Stanford University, Stanford, Calif.
A. Newell, Carnegie Institute of Technology, Pittsburgh, Pa.
A. Opler, Computer Usage Co. Inc., New York, N. Y.
J. N. Smith, RAND Corp., Santa Monica, Calif.

List processing systems have been part of the programming inventory for over half a decade. They were first created in connection with attempts to write heuristic programs and to simulate cognitive processes. The freedom with which complex command and data structures could be manipulated within such systems led to their use in attacks on other complex problems. Today, many programs in natural language manipulation, compiling, simulation of business processes, and in the modeling of a wide variety of behavioral theories depend on them. Still, many in the general computer community regard list processing as applicable mainly to those esoteric problem areas responsible for its creation. This panel will establish perspectives within which an assessment of the present and prospective validity of this point of view may be made.

Wednesday, May 22, 8 to 11 p.m., Ballroom (Room 2001-A)

SESSION 6:

Critical Analyses of the Current State of the Art

Chairman:
EDWARD L. GLASER
Burroughs Corp.
Paoli, Pa.

Panelists:
H. Campaigne, Department of Defense, Jessup, Md.
M. V. Wilkes, University of Cambridge, Cambridge, England
O. G. Selfridge, MIT Lincoln Laboratory, Lexington, Mass.

6.1: State of the Art in Scientific Computing

R. W. Hamming
Bell Telephone Laboratories, Inc., Murray Hill, N. J.

Because scientific computing has a long history with formal mathematics in the background, its development over the past decades has been fairly orderly. This paper will review many problems awaiting solution, and various methods of attack available.

6.2: State-of-The-Art of Programming

R. S. Barton
Consultant, Altadena, Calif.

The present state of the programming art will be surveyed, presenting a practical view of what is currently attainable though seldom achieved and a cursory view of some relevant history, with some commentary on the professional status of the programmer. The paper will also detail the design and construction of programming systems, with emphasis on recent developments. The presentation will underscore the fact that the formal development of programming is becoming urgent and thus the organization of computing machines must evolve to better represent the structural features of program and data.

6.3: Computer Applications for Industry and the Military: A Critical Review of the Last Ten Years

D. F. Blumberg
Pennsylvania Research Associates, Philadelphia, Pa.

This paper will be focused on the applications of computer and data processing systems, and offer a critical analysis of the development process.

the Program

Thursday, May 23, 9 a.m. to noon, Room 2040

SESSION 7:

Analog and Hybrid Systems II

Chairman:
L. MILTON WARSHAWSKY
Aero Systems Division
Wright Patterson AFB, O.

Panelists:
M. C. Gilliland, Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
R. M. Howe, Dept. of Aeronautical and Astronautical Eng., University of Michigan, Ann Arbor, Mich.
R. T. Harnett, Aero Systems Division, Wright Patterson AFB, O.

7.1: Automatic Parameter Optimization as Applied to Transducer Design
M. Howell
Martin Co., Orlando, Fla.
A discussion of the methods and circuits for a search technique for parameter optimization as applied to sonar transducer design will be presented in this paper. Using a repetitive-operation mode computer, six parameters have been optimized in approximately one minute. The directivity, error criterion, and model will be compared for the before and after optimization cases.

7.2: Hybrid Computer Solution of Time-Optimal Control Problems
E. G. Gilbert
University of Michigan, Ann Arbor, Mich.
This talk will describe programming procedures for hybrid computer solution of time-optimal control problems. The control systems to be considered have plants described by time-variable linear differential equations and have a constraint on the amplitude of the control signal. The theory of such systems will be reviewed, and a hybrid computer involving both analog and digital devices described.

7.3: Multiple Integrals on a Non-Repetitive Analog Computer
A. Hausner
Diamond Ordnance Fuze Laboratories, Washington 25, D. C.
Techniques for evaluating integrals will be presented in this paper, showing derived formulas requiring a continuous scan on general purpose, non-repetitive analog computing equipment. Extensions to higher order integrals will be made and a computer diagram for a general third order integral shown.

7.4: Hybrid Techniques for Analog Function Generation
W. E. Chapelle
Bendix Research Laboratories, Southfield, Mich.
This paper will discuss techniques for combining analog and digital circuits for generation of arbitrary functions, emphasis being on generation of analog functions of two or more variables. The techniques have bandwidth capabilities comparable to conventional diode-function generators and the programming procedure is more direct. The major advantage, however, is that the techniques can be efficiently applied to multivariant function generation, employing digital techniques for storage of the defining values.

Thursday, May 23, 9 a.m. to noon, Room 2001-B

SESSION 8:

Information Retrieval

Chairman:
WILLIAM B. KEHL
University of Pittsburgh
Pittsburgh, Pa.

Panelists:
W. Hoffman, Wayne State University, Detroit, Mich.
E. M. McCormick, Office of Science Information Service, National Science Foundation, Washington, D. C.
J. Belzer, Computation Center, Western Reserve University, Cleveland, O.

8.1: Automatic Stratification of Information
D. Lefkovitz and N. S. Prywes
The Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa.
A process, based upon informational content only, which attempts to discover a non-explicitly stated inherent structure of an information file will be detailed in this paper. The appropriately programmed machine can then *learn* by example. Two underlying principles are used for partitioning a descriptor vocabulary; namely, whether they do or do not co-occur in descriptions of a file document. Stratification results first in constituting a relatively small number of groups, where the descriptors within any group do *not* co-occur in any description. The process has been simulated on an IBM 7090, and an application to information retrieval will be described.

8.2: A Computer Approach to Content Analysis: Studies Using the General Inquirer System
P. J. Stone
Laboratory of Social Relations, Harvard University, Cambridge, Mass.
E. B. Hunt
University of Sydney, Sydney, Australia
In the spring of '61 a *General Inquirer System* was developed at Harvard for the content analysis of written materials. An IBM 7090 was used to read key-punched alphanumeric text, remove regular word endings and dictionary lookup serves to classify the words with one or more category labels specified by the investigator. Dictionaries have been prepared for a behavioral science research attempt to categorize expressed or assumed values, underlying types and intensities of motivation, perceived demands of the environment, and institutionalized structuring of both demands and actions. The sentences, together with their labels have been stored on binary tape for repeated use in inquiry procedures. If the keypunched text is marked with a simplified form of syntactic coding, the user can make inquiries not only about the co-occurrence of certain text words and/or category labels, but can also specify the syntactic relationships that must appear between them. This report will review this development and recent extensions that include artificial intelligence procedures for finding near optimal retrieval specifications for discriminating between two sources of text.

8.3: Selective Dissemination of Information: State of the Art in May, 1963
C. B. Hensley
Advanced Systems Development Div., IBM Corp., Yorktown Heights, N. Y.
The selective dissemination of information developed from the conceptual work of Hans Peter Luhn in 1958 to a number of operating systems in 1962. Earlier systems demonstrated its feasibility, and newer systems have been exploring the feasibility of integrating this technique with other functions for retrieval, automatic indexing, library catalog card preparation, automatic updating of user interest profiles and others.

8.4: Computer Control Printing

M. P. Barnett, D. J. Moss, D. A. Luce and K. L. Kelly
Cooperative Computing Laboratory, MIT, Cambridge, Mass.

A programming system that produces punched paper tape to control a Photon photo-composing machine will be described. Examples of output produced from input to the computer punched on Flexowriter tape and Hollerith cards will be offered. The format may be controlled by codes included between square brackets in the text, or which are provided before the text when the points at which they are to take effect can be determined by the computer.

8.5: On the Solution of an Information Retrieval Problem

B. H. Sams
Data Systems Center, RCA, Bethesda, Md.

This paper will discuss an information retrieval problem and some implications of its solution on indexing, data structure, retrieval procedures, and programming. To demonstrate the design complexity required to achieve fairly modest retrieval capabilities, examples will be offered.

Thursday, May 23, 9 a.m. to 12 noon, Room 2048

PANEL C:

The Future of Biomedical Computing Activities

Moderator:
JOHN A. JACQUEZ
Depts. of Physiology and Biostatistics
Schools of Medicine and Public Health
University of Michigan
Ann Arbor, Mich.

Panelists:
O. Schmitt, Biophysics Group, University of Minnesota, Minneapolis, Minn.
J. W. Sweeney, Computer Center, Tulane University, New Orleans, La.
B. Waxman, Advisory Committee on Computers in Research-Division of Research Grants, National Institutes of Health, Bethesda, Md.
L. H. Peterson, Dept. of Physiology—School of Medicine, University of Pennsylvania, Philadelphia, Pa.
T. D. Sterling, Medical Computing Center—College of Medicine, University of Cincinnati, Cincinnati, O.

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Thursday, May 23. . . . 12:00 Noon **Ballroom (Room 2001-A)**

Computers and Brains: Competition and/or Coexistence

Walter A. Rosenblith
Professor, Communications Biophysics
Massachusetts Institute of Technology, Cambridge, Mass.

The performance and structure of computers and human brains have been compared and contrasted from a variety of viewpoints. Some have emphasized analogies with respect to symbol manipulation (such as theorem proving or chess-playing), while others have focused upon the all-or-none characteristics of the componentry. Most of the comparisons, it will be noted in this talk, seem to neglect the fact that the human brain has been the product of a long evolutionary process in which the massive handling of abstract symbols is only one of the more recently acquired functions of a complex nervous system. Computers, on the other hand, have not and probably need not be designed with the aim of manipulating the world in relation to basic biological necessities. Hence, attempts to use computers in conjunction with human, body-bound brains should aim at making these two complex systems cooperatively supplement each other, instead of making them act as pale and often mismatched competitors for each other.

Thursday, May 23, 2 to 5 p.m., Room 2040

SESSION 9:

Computer-Aided Design

Chairman:
NORMAN H. TAYLOR
Itek Corp.,
Lexington, Mass.

Associate Chairman:
DOUGLAS T. ROSS
Electronic Systems Laboratory, MIT
Cambridge, Mass.

Panelists:
C. Engelbart, Stanford Research Institute, Menlo Park, Calif.
C. W. Adams, Charles W. Adams Associates Inc., Bedford, Mass.
J. C. R. Licklider, ARPA—Behavioral Sciences and Command and Control Research, Washington, D. C.
A. Newell, Carnegie Institute of Technology, Pittsburgh, Pa.
F. Engel, Computation Laboratory, Harvard University, Cambridge, Mass.

9.1: An Outline of the Requirements for a Computer-Aided Design System

S. A. Coons
Mechanical Engineering Dept., MIT, Cambridge, Mass.

The widespread use of numerically-controlled manufacturing techniques has given special impetus to the application of computers in design.

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This paper will review the iterative and unpredictable nature of the design process, establish broad requirements of evolutionary flexibility which a *Computer-Aided Design* system must meet, and describe several applications indicating that such a broad, general system is practicable.

9.2: Theoretical Foundations for the Computer-Aided Design System

D. T. Ross and J. E. Rodriquez
Electronic Systems Laboratory, MIT, Cambridge, Mass.

For an evolutionary *Computer-Aided Design* system to become a reality, it must be built on a cohesive, rigorous foundation. This paper will describe the application of the *Algorithmic Theory of Language* and its companion *Theory of Operators* to the problem. It will be shown how algorithms of the *Language Theory* transform statements made in graphical or verbal language into the corresponding *First-Pass Structure*, which explicitly exhibits the syntactic and semantic structure of the statement. Operators then transform the meaning into the *Modelling Plex*, which represents the problem to which the statement referred. Successive operators then generate further models or statements so that a common approach to all aspects of the *Computer-Aided Design* system is achieved.

9.3: Man Machine Console Facilities for Computer-Aided Design

R. Stotz
Electronic Systems Laboratory, MIT, Cambridge, Mass.

To match the man to the machine in *Computer-Aided Design*, a display scope and a light pen has been incorporated into a console in conjunction with conventional on-line typewriter, and various switches. A problem in the design of such a console is to strike a proper balance between the data-processing load carried by the main computer and that carried by specialized equipment in the console itself. This paper will review the conventional light pen and display scopes of today and how they are used. In addition, a new display system being built will be described. This system has been designed to generate and display an axonometric projection of three-dimensional curvilinear figures, with rotation, translation, and scale change.

9.4: Sketchpad . . . A Man-Machine Graphical Communication System

I. E. Sutherland
Consultant, MIT Lincoln Laboratory, Lexington, Mass.

This paper will cover the *Sketchpad System* which provides a light pen drawing language by permitting arbitrary picture elements to be defined from any collection of line segments, circle arcs, or previously-defined elements. The system stores the topology of a drawing so that the user may move and change the shape of picture segments, while maintaining all specified connections. Geometrical and other conditions may be superimposed on the drawing elements, singly or in combination, and the system will modify the drawing automatically to satisfy these constraints. *Sketchpad* has been used for electrical, mechanical, scientific, and mathematical drawings, and to investigate motion of linkages.

9.5: Sketchpad III . . . A Computer Program for Drawing in Three Dimensions

T. E. Johnson
Mechanical Engineering Dept., MIT, Cambridge, Mass.

This paper will describe a programming system which permits scope, light pen and control knobs to be used in a flexible manner to draw three-dimensional, straight line, *wire-frame* pictures. Three orthogonal views complement a perspective view to permit simultaneous observation from several vantage points to increase depth perception. Techniques for pen tracking in three dimensions will also be detailed.

Thursday, May 23, 2 to 5 p.m., Room 2001-B

SESSION 10:

Machine Organization II

Chairman:
NORMAN R. SCOTT
Dept. of EE
University of Michigan
Ann Arbor, Mich.

Panelists:
D. C. Evans, Dept. of EE, University of California, Berkeley, Calif.
A. W. Lo, IBM Corp., Poughkeepsie, N. Y.
W. Wattenburg, Lawrence Radiation Laboratories, University of California, Livermore, Calif.

10.1: Key Addressing of Random Access Memories by Radix Transformation

A. D. Lin
General Products Div. Dev. Lab., IBM Corp., San Jose, Calif.

A unified, data-oriented address conversion procedure for large capacity random access memories will be described. The technique affords a radix transformation on the binary array of the unique keys of the records to produce a randomized set of elements. Truncation of these elements yield a Poisson distribution of records over memory locations, permitting prediction of overflow and minimization of the number of seek cycles of the access mechanism for the average record. System benefits include a unified solution that is independent of key length, human language source alphabet and machine language code. No pre-analysis or pre-editing of a keyset is required.

10.2: ADAM—A Problem-Oriented Symbolic Processor

A. P. Mullery, R. F. Schauer and R. Rice
Thomas J. Watson Research Center, IBM Corp., Yorktown Heights, N. Y.

A study of the general area of problem solving with a digital computer has revealed characteristics of data that are essentially ignored or suppressed in conventional systems. In an attempt to increase the capability and flexibility of a digital system, a new, high level language, which utilizes these data characteristics, has been defined. A machine organization, which implements this language as a machine language and yet imposes no restrictions on the use of the language has been proposed. This paper will describe such a processor with the following characteristics: complete symbolic addressing on variable field length data; list and string operations; high to low-order numeric processing; dynamic storage allocation; and automatic input-output.

10.3: Associative Techniques with Complementing Flip-Flops

E. S. Lee
Electro Data Div., Burroughs Corp., Pasadena, Calif.

The *Associative* or *Content-Addressed Memory* is attractive from the logicians' point of view, but development in the field has apparently been hindered by technical and economic problems. This paper will demonstrate that the majority of technical problems can be eliminated by building memories with solid-state associative cells. An integrated circuit could eliminate the economic problems.

10.4: Physical and Logical Design of a Highly Parallel Computer

J. S. Squire and S. M. Palais
Information Systems Laboratory, University of Michigan, Ann Arbor, Mich.

An organization for a parallel processing computer will be proposed and its capabilities and limitations discussed. Simultaneous random access can be accomplished by logical circuitry which makes a step-by-step connection of paths from operands to arithmetic units. Additionally, many priority problems, which arise from parallel processing, can be eliminated by a logical structure with processing units as the vertices of an n-dimensional cube and interconnections between processing units along the edges of the n-cube. To demonstrate programming techniques, which utilize the highly parallel-processing capabilities, a program for matrix inversion will be given.

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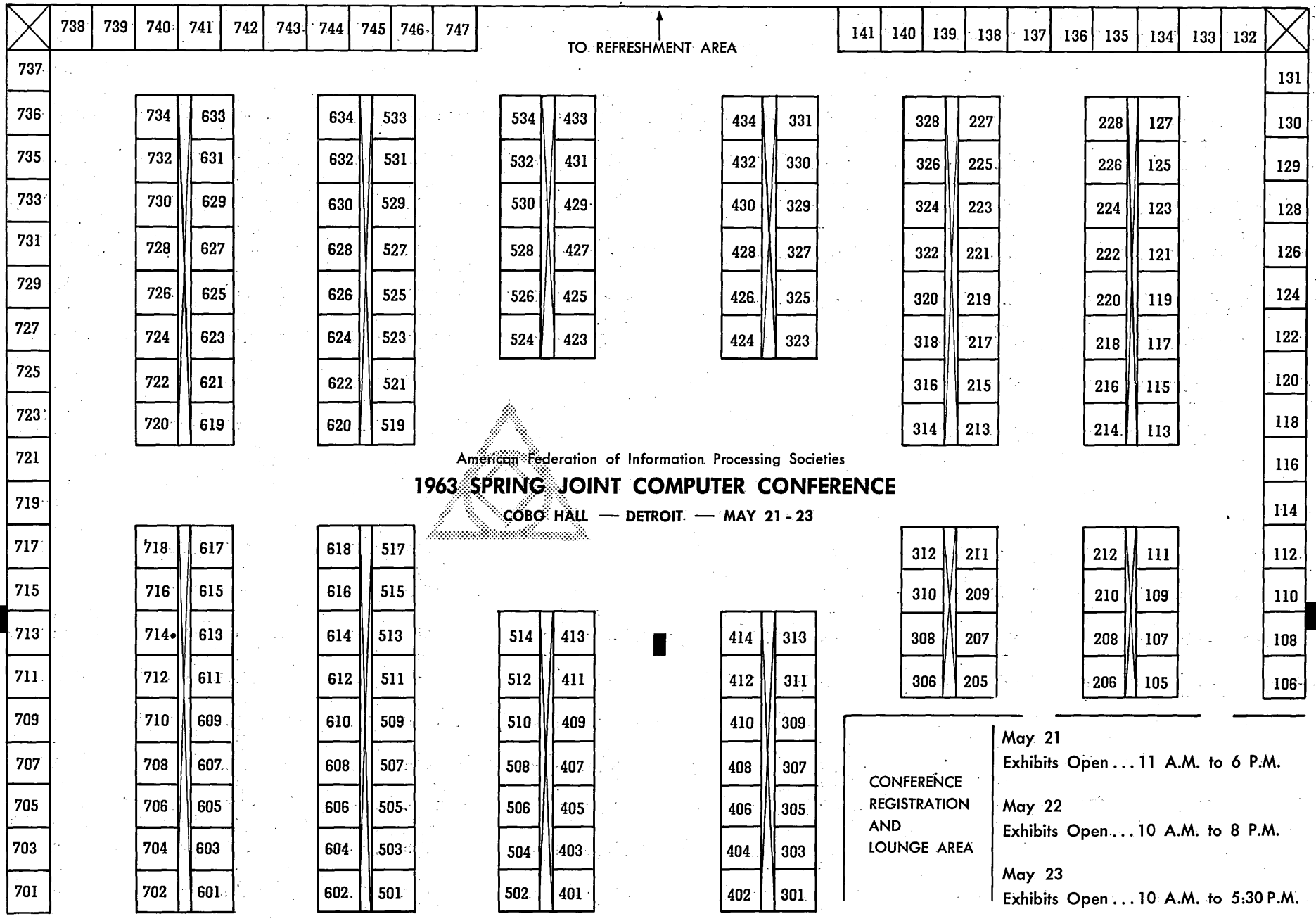

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San Diego 12, Calif.

General Electric Computer Dept. 138-141
13430 N. Black Canyon Hwy.
Phoenix, Ariz.

The Gerber Scientific Instrument Co. . 219-221
P.O. Box 305
Hartford, Conn.

Holley Computer Products Co. 512
11955 E. Nine Mile Rd.
Warren, Mich.

H-W Electronics, Inc. 123
14 Huron Dr.
Natick, Mass.

Indiana General Corp. 226-228
Crows Mill Rd.
Keasbey, N. J.

Information Storage Systems, Inc. 223
222 Wanaque Ave.
Pompton Lakes, N. J.

Information Systems Group 323-327
General Precision, Inc. 424-428
808 Western Ave.
Glendale, Calif.

International Business Machines Corp. 213-217
590 Madison Ave.
New York 22, N. Y.

John Wiley & Sons, Inc. 433
440 Park Avenue South
New York 16, N. Y.

LFE Electronics 528-530
Div. of Laboratory For Electronics
985 Commonwealth Ave.
Boston 15, Mass.

Liskey Aluminum, Inc. 134-135
P.O. Box 506
Glen Burnie, Md.

Litton Systems, Inc. 329
336 N. Foothill Rd.
Beverly Hills, Calif.

Lockheed Electronics Co. 619-621
Avionics & Industrial Products Div.
6201 E. Randolph St.
Los Angeles 22, Calif.

Memorex Corp. 120
1180 Shulman Ave.
Santa Clara, Calif.

The National Cash Register Co. 113-115
Main & K Sts.
Dayton 9, Ohio

Navigation Computer Corp. 125
Valley Forge Industrial Park
Norristown, Pa.

Omnitronics, Inc. 222-224
Sub. of Borg-Warner Corp.
511 N. Broad St.
Philadelphia 23, Pa.

Packard Bell Computer Corp. 611-617
1905 Armacost Ave.
Los Angeles 25, Calif.

Philco Computer Div. 205-211
Ford Motor Co. 306-312
Industrial Park
Fort Washington, Pa.

Photocircuits Corp. 406-408
31 Sea Cliff Ave.
Glen Cove, N. Y.

Potter Instrument Co., Inc. 430-434
151 Sunnyside Blvd.
Plainview, L. I., N. Y.

Prentice-Hall, Inc. 133
Englewood Cliffs, N. J.

RCA Semiconductor & Materials Div. 127
Route 202
Somerville, N. J.

Raytheon Co. 136-137
101 River St.
Waltham 54, Mass.

Recordak Corp. 320-322
770 Broadway
New York 3, N. Y.

Rheem Electronics Corp. 117
5200 W. 104th St.
Los Angeles 45, Calif.

The Service Bureau Corp. 505
425 Park Ave.
New York, N. Y.

Soroban Engineering, Inc. 326-328
P.O. Box 1717
Melbourne, Fla.

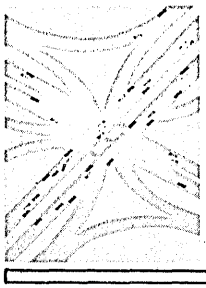
Sprague Electric Co. 502
Marshall St.
North Adams, Mass.

Tally Register Corp. 501-503
1310 Mercer St.
Seattle 9, Wash.

Teletype Corp. 214-216
5555 Touhy Ave.
Skokie, Ill.

Warner Electric Brake & Clutch Co. 404
Beloit, Wisc.

FIELD TRIPS SJCC



Seven tours have been organized for one day only—Wednesday, May 22. A limited number of free admissions will be available to conference registrants. Buses will leave Cobo Hall at 8:30 for the following laboratories, plants and other sites of special interest:

1—Bendix Industrial Controls: Continuous path numerical control equipment, which receives its instructions from a computer-processed control tape, will be demonstrated.

2—Burroughs Corporation: The manufacture and testing of B200 systems and B5000 card readers and punches will be shown. A B250 system, combining punched card and MICR document processing with printed ledger output, will be demonstrated.

3—Bryant Computer Products: Disc file manufacturing and testing facilities will be shown. The tour will also include a display of a disc file operating on life test.

4—General Motors Technical Center: An automatically monitored IBM 7090 computer will be demonstrated Also included will be visits to the research laboratories and the styling lobby display areas.

5—Michigan Bell Telephone Company: An on-line large scale random system (7074's, RAMAC's, 1301's), which handles customer telephone service requests "on demand", will be shown. The tour will be preceded by a talk outlining Michigan Bell's long-range "Single Information Flow" plans.

6—National Bank of Detroit: Magnetic ink character recognition (MICR) sorter-readers being used as input to two GE 210 computers will be shown. Equipment is used in processing one-quarter million checking accounts.

7—Ford Motor Co.: The Philco 211 processing business and operations research programs will be shown. In addition, a tour of Ford automobile production and assembly facilities will be conducted.

SJCC 1963 COMMITTEE

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Vice-Chairman: Donald E. Hart, General Motors Research Laboratories, Warren, Mich.

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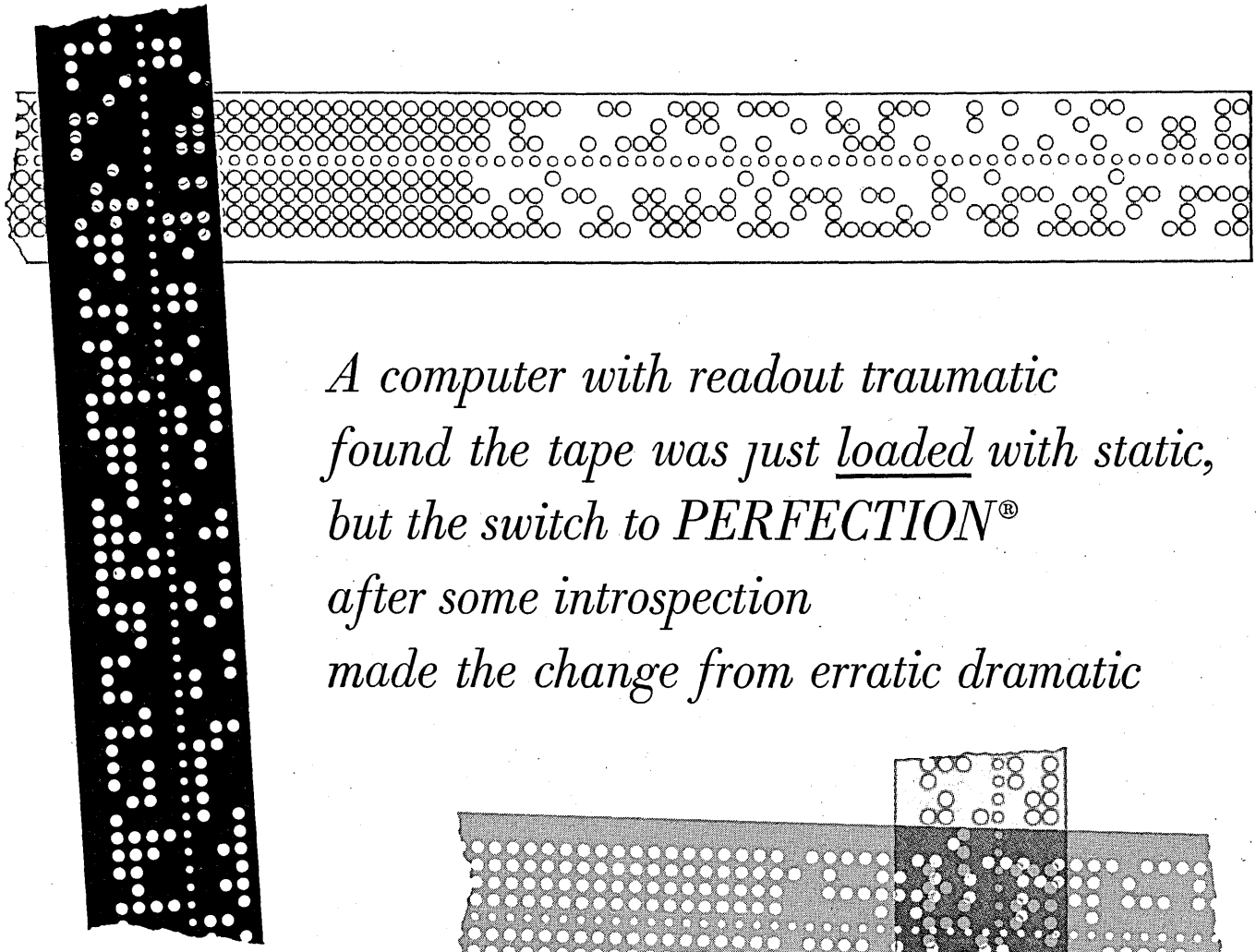

A computer with readout traumatic found the tape was just loaded with static, but the switch to PERFECTION® after some introspection made the change from erratic dramatic

The accumulation of static electricity on perforator tapes, which has caused problems in the Communication and Data Processing fields can now be reduced.

PERFECTION® Antistatic Perforator Tape contains a specially developed additive which . . .

- **Minimizes the effect of static electricity**
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Try PERFECTION® Antistatic Perforator Tape today. You'll be ecstatic! Available from leading paper distributors everywhere. Ask for the name of the supplier nearest you.

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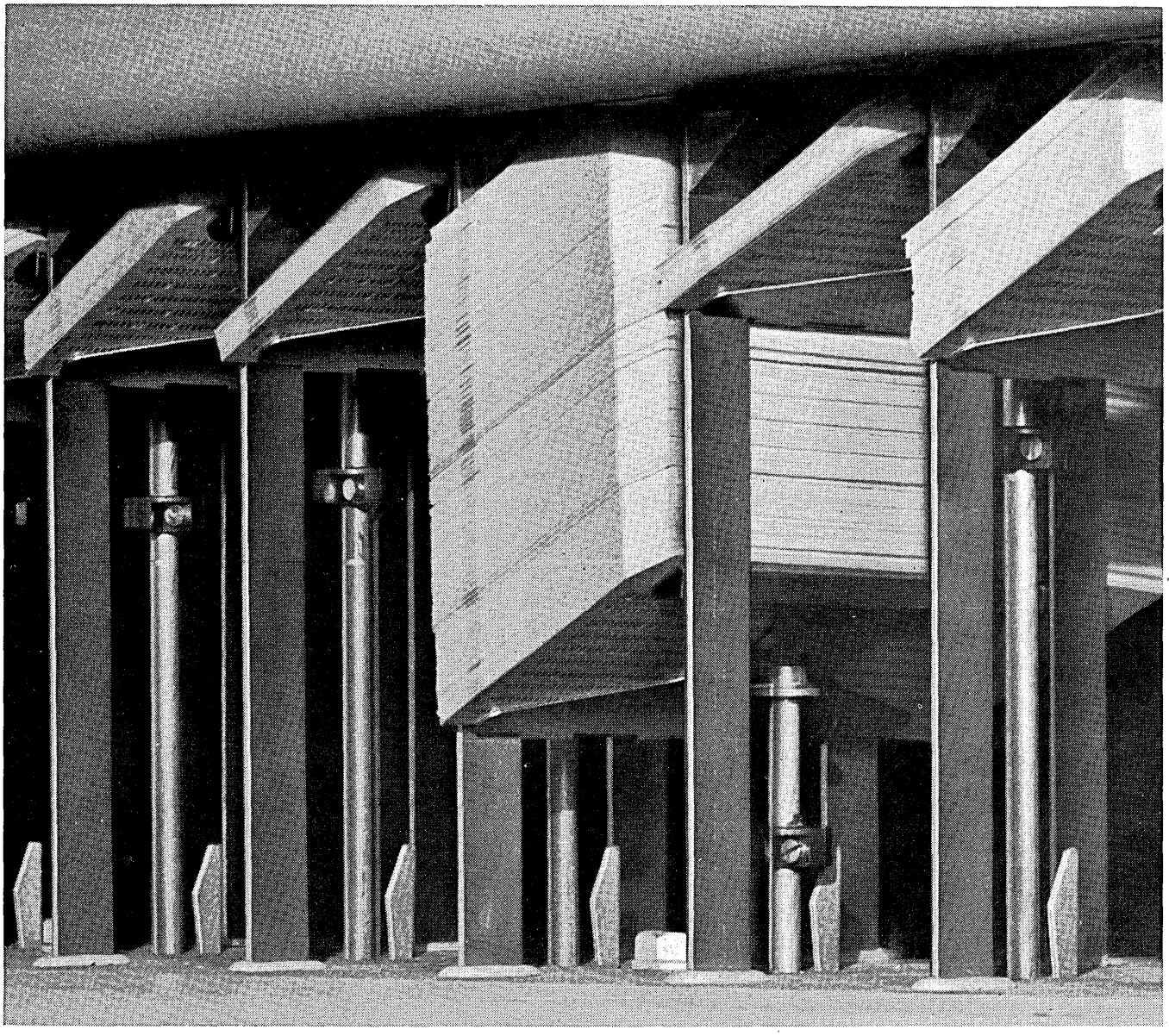
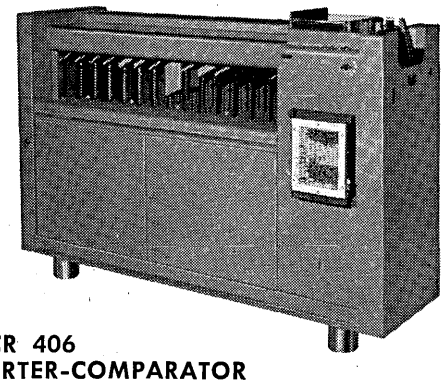
PERFECTION®

CIRCLE 32 ON READER CARD



NOT JUST ANOTHER SORTER!



NCR 406
SORTER-COMPARATOR

YES, the NCR 406 is NOT just another 80-column-card sorter.

NO, we are not trying to confuse you with double talk. We just want you to know that we are now marketing a remarkable, new machine designed to reduce card handling costs in tabulating departments and data processing installations. And it's completely compatible with existing 80-column punch card installations.

The NCR 406 combines, in one unit, features that are normally associated with more than one piece of equipment. Some of these standard features are: an electronic memory, dual reading stations, and 14 sorting pockets.

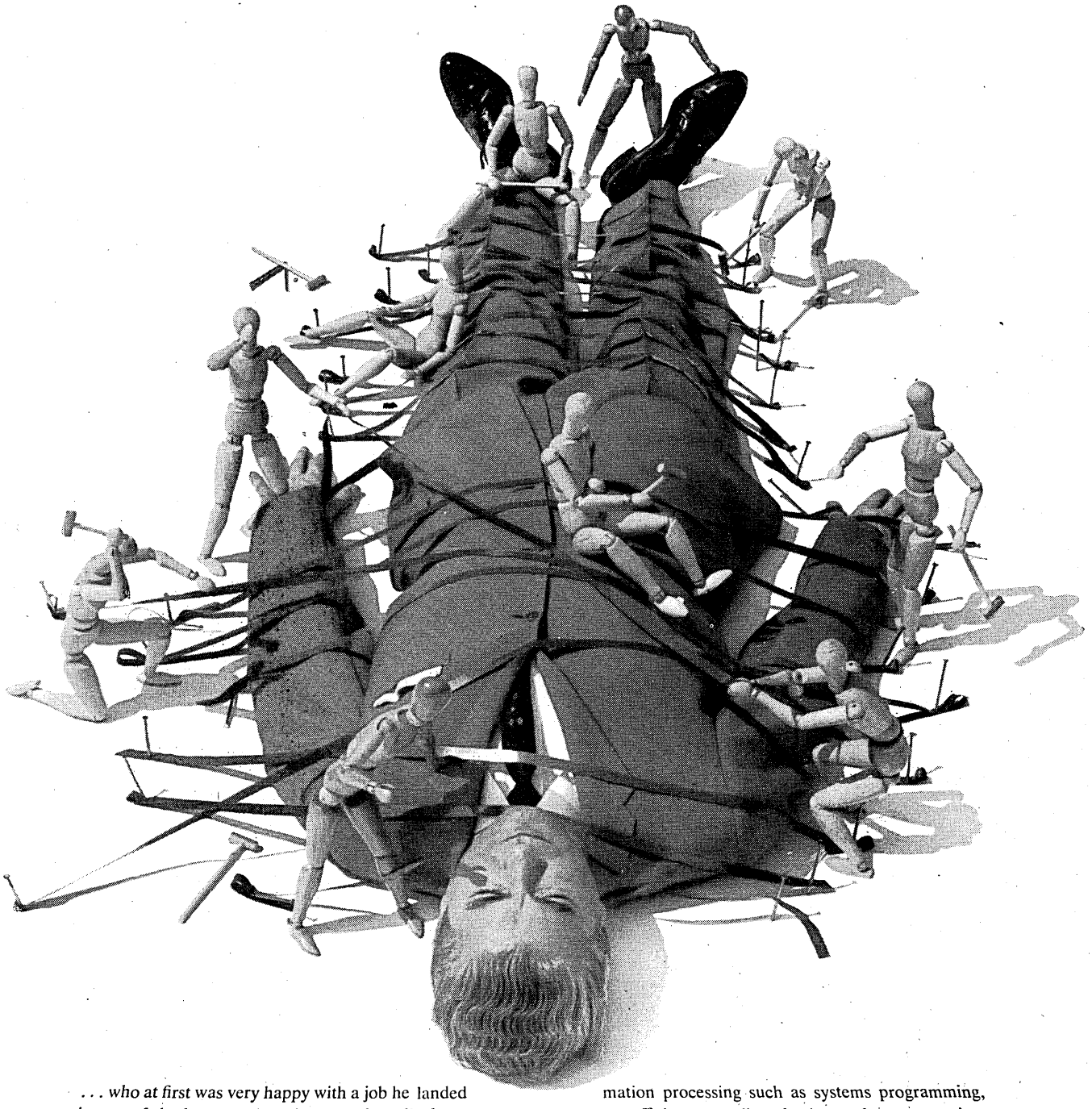
All the features of the NCR 406 Sorter-Comparator are explained in a comprehensive brochure prepared especially for data processing managers who are interested in reducing card handling costs and improving card processing techniques.

Write for your copy today! Address: NCR, Dayton 9, Ohio.

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

NCR

CIRCLE 33 ON READER CARD

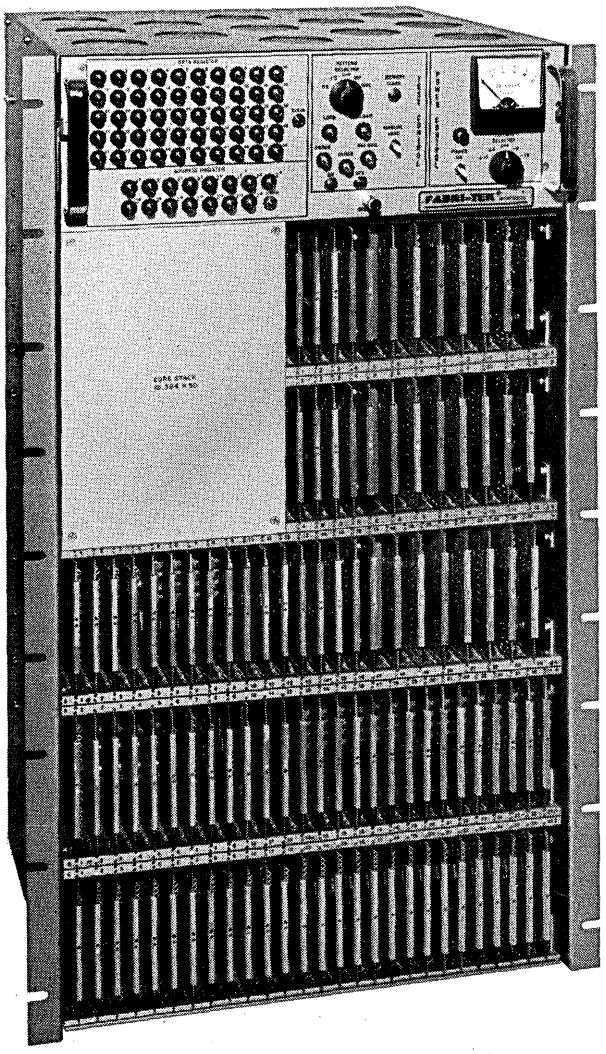


ONCE UPON A TIME

. . . who at first was very happy with a job he landed in one of the larger companies . . . after all, the pay was good and he hoped to grow with the organization . . . but, alas, young Gulliver soon began to feel tied down by little things . . . what with all the magnetic red tape, he couldn't seem to get his career off the ground . . . and, what he'd hoped would be a job with broad horizons proved too confining . . . so he lay there, otherwise a giant of a man, pinned down by the despair of job frustration . . . then he heard about Computer Concepts, Inc., a young organization staffed with seasoned veterans of the computer industry; a group which offers promising young programmers an opportunity to develop new techniques and to explore new areas of information processing such as systems programming, computer efficiency studies, business data processing, packaged computer programs, machine translation, and advanced scientific and logistic programming . . . Right now, Computer Concepts has immediate openings for Senior and Medium-level programmers with a minimum of two years experience on IBM 704/709/7090 computers. CCI salaries are commensurate with talents. An equal opportunity employer, CCI pays relocation expenses . . . So forthwith, young Gulliver struggled free of his bonds and contacted: the Personnel Department, Computer Concepts, Inc., 1012 14th Street, Northwest, Washington 6, D. C. . . . and now, with his talents untied, he's living happily ever after . . .

there was a young & eager computer programmer . . .

CIRCLE 304 ON READER CARD



A million bits you can bet on

Proven reliability of magnetic core memories is now available in the mass memory field in Fabri-Tek Series MM memory systems.

Our new million-bit core memory represents a real break-through in memory technology. Now, for a new, low price, you can have the greater reliability and greater speed of magnetic cores in a mass memory device.

Forget mechanical problems that are inherent in rotating devices.

Increased reliability results from the elimination of these mechanical problems and from the use of proven components and circuitry. Self-testing circuits are built in. Of course, new Series MM systems are manufactured to traditional Fabri-Tek standards of quality.

Compact, lightweight Series MM systems fit into standard 19″ racks. Electronic specifications can be tailored so a Fabri-Tek Series MM can be incorporated into any existing or future system.

Three standard sizes are available: 16,384 x 25, or 409,600 bits; 16,384 x 50, or 819,200 bits (illustrated) and 32,768 x 32, or 1,048,576 bits. Custom models can be designed to meet unusual requirements.

Four operational modes are available: sequential non-interlaced, sequential interlaced, random access and general purpose (combination of all three).

Find out more about Fabri-Tek magnetic core mass memories before you specify your next large-capacity system. Our price will surprise you. Contact Fabri-Tek, Incorporated, Amery, Wisconsin. Phone: COngress 8-7155 (Area code 715). TWX: 715-292-0900.

FABRI-TEK

CIRCLE 35 ON READER CARD

NEWS BRIEFS

MANCHESTER ATLAS LINKED TO AUSSIE COMPUTER SHOW

As an unusual demonstration of long-distance data communications and the computational ability of large-scale hardware, the Manchester Univ. Atlas in England was linked by International Telex radio to the National Computer Conference, Melbourne Univ., Australia, Feb. 26-March 1. At a distance of over 10,000 miles, problems written in machine code by visitors to the Ferranti stand were answered within 30-60 seconds.

In addition to computing future population estimates of Australian cities up to the year 2000, the Atlas solved other problems written in Mercury Autocode, including a calculation in crystallography. The Ferranti stand also included a Sirius computer which operates from a five-amp. power socket.

A second Atlas is scheduled for installation this year at London Univ., and the third will go to the National Institute for Research in Nuclear Science, Harwell, England, in 1964. Price of the Atlas is from 2-3.5 "megaquid" (5.6-9.8 megabucks).

AIR FORCE CENTRALIZES COMPUTER SELECTION

The evaluation and selection of business and scientific computers by the Air Force has been centralized with the establishment of the EDP Equipment Office under the Electronic Systems Div., Air Force Systems Command.

Involved are equipment valued at more than 100 megabucks per year including NORAD and SAGE systems. Excluded are EAM equipment, and computers used in weapons systems. The office will also advise the industry on Air Force needs three-five years hence.

Heading the office is Col. Edward McCloy, former chief, Data Systems Planning, Air Force Logistics Command.

$240K ANALOG COMPUTER CLAIMED WORLD'S FASTEST

A 24-foot-long, $240K analog computer is being built by Applied Dynamics, Inc., Ann Arbor, Mich., for the Lear Siegler Instrument Div.'s aerospace development center, Grand Rapids, Mich.

Reportedly having the largest problem-solving capacity of any analog device sold to date, the AD-256 will be used in simulation studies to check electronic flight systems. Designers of the computer also claim that it is an order of magnitude faster than comparable conventional hardware.

CIRCLE 100 ON READER CARD

NCR SALES SET RECORD; NET INCOME DROPS 5%

National Cash Register Co., Dayton, Ohio, reported a sales increase of nine per cent in 1962 over the previous year. Net income of 20.6 megabucks, second highest in company history, was five per cent below 1961 earnings. Per share earnings also were down, from $2.72 to $2.49.

Record installations of computers, most of which are rented, reportedly account in part for reduced earnings. By the end of the year, 700 computers had been installed and on order, approximately twice as many as in 1961.

NELIAC USERS FORM EXCHANGE COUNCIL

A NELIAC Implementer's Council and Exchange (NICE) was established recently at the third annual NELIAC symposium, Ft. Huachuca, Ariz. From among 37 members, a committee of five was appointed to develop details of the organization.

Fifteen NELIAC compilers for as many different computers exist today, it was reported, in addition to 10 program translator compilers. Nine compilers presently are being developed.

TRW TO MANUFACTURE 530 COMPUTER IN JAPAN

The TRW-530 gp computer will be manufactured and marketed in Japan as the MELCOM 1530 under a recent agreement between TRW and Mitsubishi Electric Ltd. An initial production rate of one per month is expected to be increased late in 1963.

The two firms have organized a joint company for the manufacturing and marketing of computers and semiconductors in Japan and Southeast Asia.

TELEREGISTER PLANS FINANCIAL DP CENTER

The Teleregister Corp., Stamford, Conn., is establishing a computer-based financial service center in New York City to provide brokers with portfolio evaluation, on-line market information, buy-sell order processing, and off-line accounting services.

The new facility will also have an

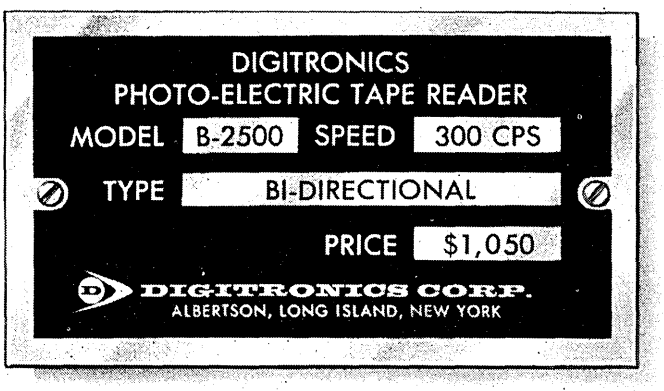
3,000 EXPECTED AT DPMA CONFERENCE, JUNE 25-28

More than 3,000 registrants are expected at the Data Processing Management Association conference, June 25-28, in Cobo Hall, Detroit, Mich. In addition, more than 200 exhibitors are scheduled to display their wares. Seminar speakers and panel members of the Executive Forum include:

Charles A. Phillips, director, Data Processing Group, BEMA, "COBOL Experience Reviewed;" Daniel D. McCracken, McCracken Associates, Ossining, N.Y., "Introduction to Software;" H. Peter Luhn, IBM, "Information Retrieval;" Samuel Alexander, National Bureau of Standards, "New Directions in Computer Equipment;" Gomer Redmond, Chrysler Corp., Detroit, Mich., "Computer Evaluation;" Dr. Arvid Jacobson, Detroit Research Institute, "Operations Research;" Andrew Allot, U.S. Army Materiel Command, "Sequence of Installation Procedures;" and C. Robert McBrier, Woodward & Lothrop, Washington, D.C., "Retailing."

Among panel members of the Executive Forum will be John Diebold, Diebold Group Inc., New York, and William Devine, Southern Railway. It will be moderated by Edward C. Bursk Sr., editor, *Harvard Business Review.*

The meeting will be keynoted by Ray R. Eppert, president, Burroughs Corp., and the luncheon speaker will be Dr. E. Dana Gibson, professor of office management, San Diego State College, who has recently completed an edp study abroad during a nine-month tour.



A price on the nameplate?

Not really. But, since tape reader prices more and more have become engineering information, it almost belongs there. Particularly for our new Model B2500, the bi-directional version of our well-known Model 2500. Reads at speeds up to 300 characters per second. Photo-electric, of course, like all Digitronics perforated tape readers. And priced at only $1,050. *The Model B2500 will be demonstrated for the first time at the Spring Joint Computer Conference. Be sure to see it at Booths 309-313.*

DIGITRONICS
Photo-Electric Tape Readers

CIRCLE 36 ON READER CARD

automatic voice response stock quotation system, with a vocabulary of 60 words, for the American Stock Exchange. It will utilize on-line computers to report market information over the phone to subscriber-brokers. With auxiliary drum storage, this system will be capable of handling up to 72,000 inquiries per hour, and answer 750 calls simultaneously. No hardware specifications have been announced.

CIRCLE 101 ON READER CARD

225 PROGRAM SIMULATES INVENTORY CONTROL SYSTEM

A GE-225 software package to aid in the design and implementation of inventory control systems has been developed by the General Electric Computer Dept. Called TRIM, it is a model of a company's operating system, simulating 50 time periods of activity in less than five minutes.

TRIM consists of six subroutines which are performed in sequence: processing customer demands, estimating future requirements, placing and receiving replenishment orders, purging over-age inventory, and cancelling over-extended back orders. It also balances customer service, ordering costs, and inventory carrying charges in acordance with pre-established values.

CIRCLE 102 ON READER CARD

HONEYWELL ANNOUNCES MODIFIED 800, 1800

The incorporation of an I/O control center in the central processor has resulted in the Honeywell 800-II and the 1800-II. All other operating characteristics of the modified models have been retained.

The I/O center is capable of controlling a card reader-punch, printer, and up to four mag tape units in on-line, off-line or combination mode. A buffering unit permits simultaneous operation of any three peripheral devices.

Rental costs range from $17-$32K for the 800-II and from $26-$50K for the 1800-II. Initial delivery is expected in July, 1964.

CIRCLE 103 ON READER CARD

● Packard Bell Computer Div., Los Angeles, Calif., has been awarded a $500K contract by the Sperry Div., Sperry Rand Corp. for the third and fourth Computer/Interface systems to train nuclear submarine crews. The system, based on a PB250, simulates submarine navigation and Polaris firing conditions.

Reduced prices of the Packard Bell 250 have also been announced. A configuration with 3K words of memory,

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

EAI

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

CIRCLE 38 ON READER CARD

Flexowriter, and tape punch is priced from $43,100-$45,000, a reduction of $3,100. Rental is $1,295-$1,350, down $145.

CIRCLE 104 ON READER CARD

● The fourth installation of a CDC 3600 is scheduled for delivery in August to the Argonne National Laboratory near Chicago, Ill. The 4.9 megabuck configuration will include four 160-A's, 24 606 mag tape units, and three printers. Applications will include atomic energy and biological research, and physics experiments.

● A new computing facility in Los Angeles, Calif., was recently established by Control Data Corp.'s System Sciences Div. Hardware includes a 1604A/160A system with eight mag tape units, a card reader, and a punch. The facility will be used for analysis and simulation in the division's projects, including research in machine learning and adaptation.

● Scientific Data Systems, Inc., Santa Monica, Calif., has entered an agreement for the marketing of SDS products in Japan by F. Kanematsu & Co., Ltd. The firm will introduce the SDS 910 and 920 computers to the Japanese market.

● Univac is producing 23 Digital Trainers for the armed services' use in classrooms. Contracts in excess of $800,000 call for installation and checkout of the $35K computers, and on-site training of military instructors. The Army will receive 5, the Air Force, 10, and the Navy, 8 machines.

CIRCLE 105 ON READER CARD

● RCA's Data Systems Div., Van Nuys, Calif., has been awarded a one megabuck contract for 300 chassis on which D-17 airborne computers will be mounted. North American's Autonetics Div., makers of the D-17, will use the chassis in its Minuteman missile program. An integral part of the missile's flight readiness, the computer processes ground instructions to steer and stage commands during flight.

● The first hardware to be installed at the International Computation Center, Rome, Italy, is an Olivetti ELEA 6001. The configuration includes 10K decimal positions of storage, two mag tape units, paper tape, and teleprinter units. The 6001 will be used for scien-

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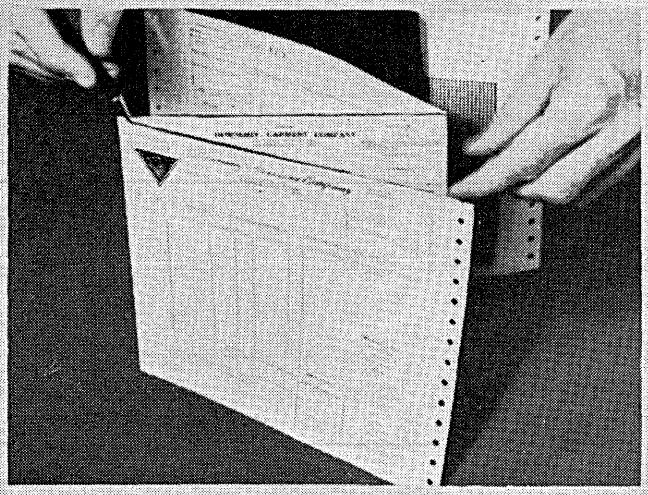
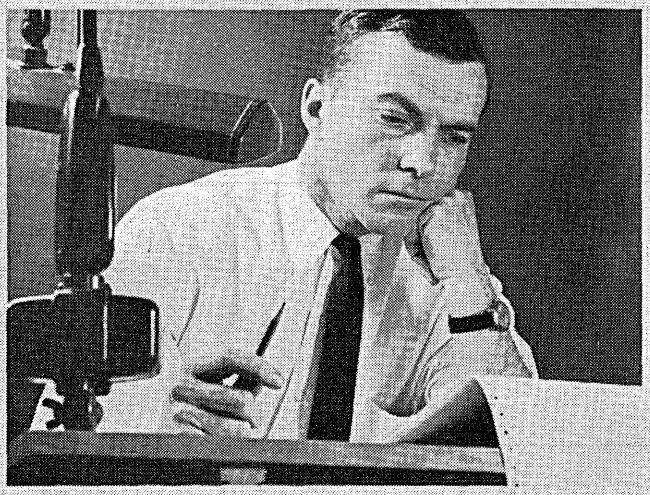


SPECIALIST IN FORM FUNCTIONS—He knows how forms are constructed, how they can be designed to do your job efficiently, economically.



SPECIALIST IN LAYOUT—He can design the form that's right for you—in parts, paper, styling, function, construction and appearance.

SPECIALIST AMONG SPECIALISTS—He gets team help from Moore in systems problems, forms design and the workability of his ideas.

an 'employee' not on your payroll

He's someone working for you, applying specialist talent to saving your time, your effort and the false starts that are easy to make when designing forms. He works so close with you, or your men, and puts so much expertness into the work, he's practically an employee—but not on your payroll.

Only a man so carefully schooled and skillfully equipped could offer so much systems experience and forms know-how. Backing him are Moore's manufacturing science, its advanced equipment and research, its 32 modern plants. If you work with forms, we can show how to make forms work for you.

'The right business form for every form of business'

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MOORE BUSINESS FORMS INC

CIRCLE 40 ON READER CARD

tific research, education, and computation services on an experimental basis.

● A computer-based totalizer system with on-line ticket-issuing machines and infield display board is operating at Roosevelt Raceway, Westbury, N.Y. A product of the Digitronics Corp., Albertson, L.I., N.Y., the system utilizes two gp computers to calculate odds and possible payoffs, and end-of-race and end-of-day accounting. Other hardware include dual electronic aggregators, auxiliary core storage, paper and mag tape units, and printer.

CIRCLE 106 ON READER CARD

● The South Carolina Tax commission is using an NCR 315 with three Card Random Access Memory units to process the state's income, sales, and use tax forms. The computer is expected to process about 1½ million returns this year, in addition to preparing the bi-weekly payroll for about 550 employees.

● A contract for two 2 usec, coincident current memory systems for the Weizmann Institute, Rehovoth, Israel, has been received by the Electronics Div., Indiana General Corp., Valparaiso, Ind. Each unit has a capacity of 8.2K 75-bit words. The memory systems will be part of the Golem computer which will be built by the Institute's Applied Mathematics Dept.

CIRCLE 107 ON READER CARD

● A symposium on Banking Automation will be held June 6-7 at the Palmer Motor Inn, Princeton, N.J. The sponsor is National Computer Analysts Inc., Princeton. A call for papers has been issued, with abstracts and manuscripts in duplicate requested before May 3 by John J. Sheehan, National Computer Analysts Inc., RFD 3, Princeton, N.J. There is no fee for the symposium, but advanced registration is required.

● A summer seminar on computational linguistics, to be held at The RAND Corp., Santa Monica, Calif., July 8-August 30, will be attended by linguists from universities in Europe and the U.S. Supported by a grant from the National Science Foundation and the Air Force Project RAND, the seminar will cover computational linguistics, including machine translation.

● A Philco 211 is on the air at the parent Ford Motor Co., Dearborn, Mich. About 20 major applications are planned for the system.

"Our purpose is to apply the CONTROL DATA® 3600 with a software library ... THAT MATCHES THE COMMANDING POSITION THE 3600 HOLDS IN THE COMPUTER INDUSTRY.

"Control Data's programming staff is developing a broad range of programming systems for the **Control Data** 3600 Computer with two basic goals in mind: to provide a solid base in higher level programming languages (FORTRAN, COBOL, ALGOL) and to broaden applications programming that will effectively solve specific problems. For example, in advanced linear programming, nuclear codes, and other industrial applications.

Dr. Clair E. Miller, Director of Applications, Control Data Corp.

"In compilers, FORTRAN '63 incorporates all the advantages of earlier FORTRAN'S plus important extensions beyond the most advanced competitive systems. These refinements are: high object code efficiency without sacrificing speed of compilation; new statements allowing data manipulation and input/output transmission of long strings of information; accommodations allowing the user to write his own arithmetic beyond the usual types, (real, integer, complex, double logical) e.g., writing in BCD or triple precision; complete mixed-mode arithmetic within a statement with real, complex, double precision variables all in one statement; all subscripts may be any expression, and subscripting to any level provides for optimum use of the massive 3600 memory.

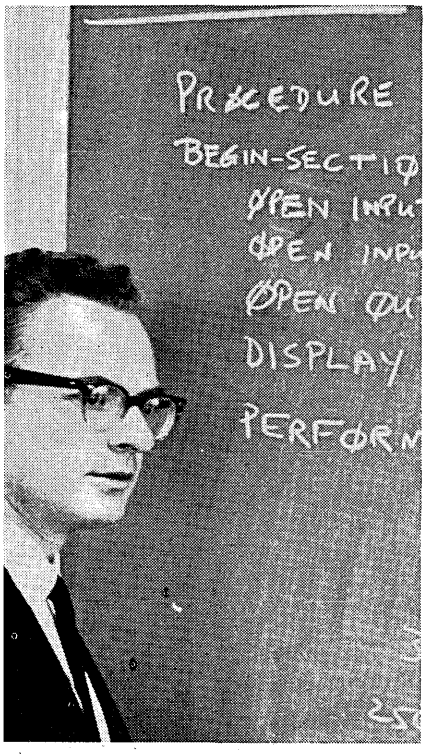
"Control Data's COBOL and ALGOL development is aimed at providing the widest versatility of the 3600 for use in scientific applications and data processing. The 3600 COBOL implements a larger number of elective features to take advantage of the high internal speed and more versatile I/O provisions of the 3600.

"The ALGOL 60 compiler for the 3600 will provide a flexible, efficient programming system for solving the problems of the research scientist and engineer.

"The complete operating system for the 3600 is called SCOPE. It simplifies programming and operation of the 3600 and at the same time retains job processing speeds. Compilations, assemblies, scientific problems and data processing applications are handled with equal facility. The significant advantages of SCOPE include sequential job processing permitting any number of runs; convenient I/O and internal/external interrupt control; automatic I/O equipment assignment; program and library subroutine loading; incorporation of debugging aids at run time; complete library maintenance; and a loader that links together routines written in all of the 3600 source languages so that they may be run as a single program.

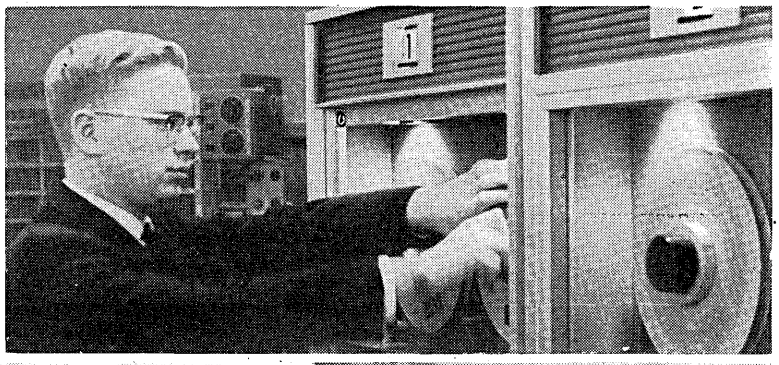
"Control Data's software development is focused squarely on applications programming. For exam-

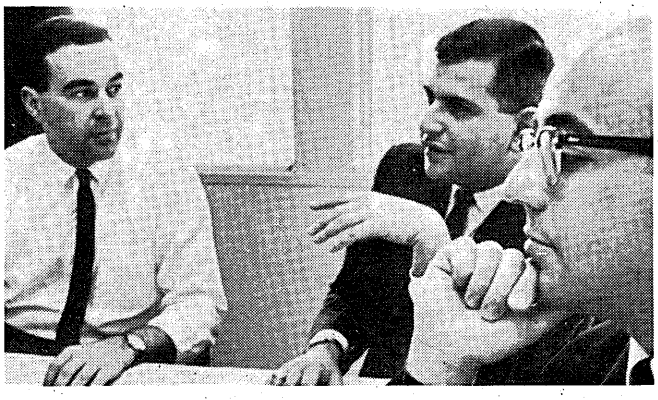
Bill Rosenstein explains how the 3600 Cobol implements a large number of elective features.



C. T. Casale at the 3600 Console.

Control Data 606 magnetic tape handler used with the 3600.

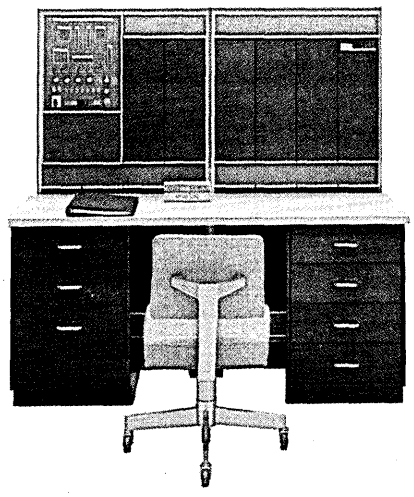




Part of task group assigned to optimization programs is developing available "public domain" system to allow both linear and non-linear optimization.

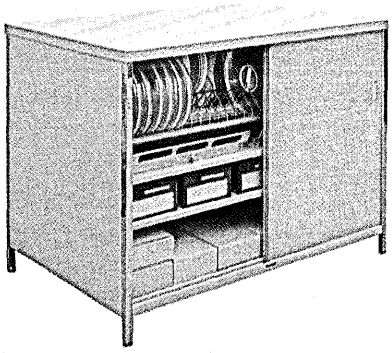
Drs. Clair Miller and Richard Zemlin are shown discussing advanced 3600 programming goals.

If you can't honestly say "Yes," it will pay you to learn about these six exciting new Datacase exclusives!



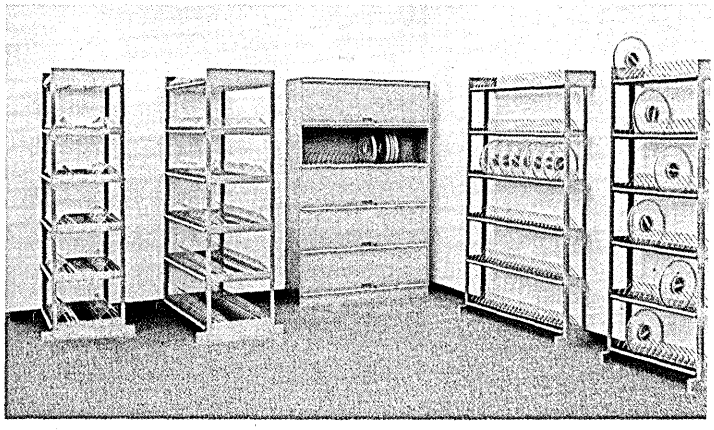
Exclusive No. 2—COMPUTER CONSOLE. A superb combination of comfort and efficiency. Mounted on glides. Six box drawers for card decks, paper tapes and personal belongings. File drawer for written programs. 60" x 19" top provides needed working area but does not interfere with operator's access to control panel. Model 7214.

Exclusive No. 3—KEY PUNCH CONSOLE. So completely new that it literally makes other key punch desks obsolete. The one-piece, self-edged plastic laminate top attaches to the key punch to provide a single, integrated work station. The pedestal is sound-deadened, comes in a variety of drawer arrangements. Model 7205.

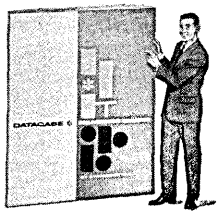


Exclusive No. 4—DATACENTER. A fresh new design that provides needed work surface and storage space adjacent to machines. Tough plastic laminated top, edged with stainless steel, is positioned at correct counter height. Adjustable heavy-duty shelves hold control panels, cards, tape reels, card boxes and forms. With or without doors.

Exclusive No. 5—MAGNETIC TAPE STORAGE. The most flexible units on the market. Receding door wall cabinets can also be stacked as room dividers or work surface units. Available with flat shelves for forms storage. Open shelf tiers can be combined to form wall or island units of any height or width. Adjustable dividers hold reels of any thickness.



Exclusive No. 6—LOCAL SERVICE. Datacase is sold, installed and serviced by the Steelcase dealer in your area. His knowledge of the broad line of Datacase products and his planning experience can be invaluable when you are ready to expand or amplify your DP department. He's in the Yellow Pages. Call him today for your free copy of our new full-color Datacase brochure—or write to us at Dept. D. Steelcase Inc., Grand Rapids, Michigan; Canadian Steelcase Co., Ltd., Don Mills, Ontario.



DATACASE/BY STEELCASE

PUTS ANALOG SIMULATION IN YOUR ENGINEERING LAB

The TR-48 is a fully transistorized analog computer providing more computing capacity, accuracy and operating convenience in a compact, medium-priced package than any design previously available. ■ The TR-48 is surprisingly simple to program and operate. No specially trained operating or maintenance staff is required. It draws as little power as the average light bulb — just plug it into any ordinary electrical outlet and it is immediately ready for computation. No cooling, cabling or other installation problems with the TR-48. Placed on a mobile stand, it moves readily from one lab location to another as required. ■ Here, then, is a computer designed (and priced) for every engineering or research laboratory, a computer which permits the individual engineer to personally conduct valuable design simulations and vastly increase his overall effectiveness.

A few important operating features of the TR-48 are: ■ *Forty-Eight Operational Amplifier Capacity — Cabinet is completely pre-wired to accept "plug-in" expansion to maximum equipment complement.* ■ *Real Time and Repetitive Operation — A combination that vastly reduces computer time.* ■ *Iterative Solution Capability — Permits the computer to operate sequentially, in a manner previously restricted to digital machines.* ■ *Digital Voltmeter Readout System — Drastically reduces problem setup time.* ■ *Color Coded Pre-Patch Panel — Simplifies programming and multiplies computer utilization.*

Convenient rental plans are also available to assist you in fitting the TR-48 into your operating budget. We will be pleased to provide further information upon request.

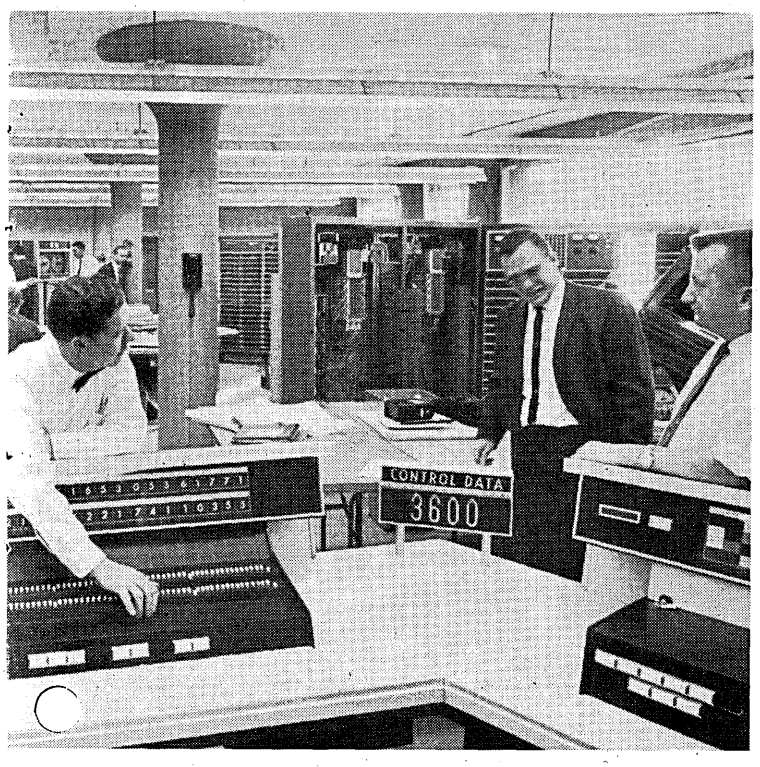
EAI ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

CIRCLE 20 ON READER CARD

ple, a task group is developing large, problem-oriented programs in fields related to nuclear physics in cooperation with present users in this field. This group is developing a basic set of nuclear codes, modifying some existing reactor codes for more effective application using FORTRAN '63, creating others for specific nuclear requirements, and engaging in original development jointly with key nuclear groups.

"With the growing interest in linear programming, Control Data is also developing optimization programs for large-scale computer systems, particularly the 3600. For example, CDM-3, a linear programming code of advanced design, includes a valuable feature that allows non-linear programming. Using the 'separable programming' technique developed in the oil industry and heavily used by several major oil companies, Control Data has produced an available 'public domain' programming system that allows both linear and non-linear optimization.

"Control Data's intention, already evident in developed software tailored to the user's problem, is to continue close coordination with a wide range of user applications while supporting them with a strong base of system programming—for problems arising in the military, scientific and commercial communities."



3600 Computer System

CDC-BENDIX ACQUISITION FINALIZED

Robert D. Schmidt has been named manager of the former Bendix Computer facility in Los Angeles, Calif., concurrent with the formal acquisition on March 21 of Bendix Computer by Control Data Corp., Minneapolis, Minn. Purchase price is reportedly less than 10 megabucks.

The sales and service organizations of both companies will be merged, and servicing will be continued on present and future installations of the renamed Control Data G-15 and G-20. Presently, more than 300 installations in the past five years are reported, including 20 G-20s.

According to William C. Norris, CDC president, the acquisition is part of the company's plan to broaden its market areas and product lines in the business/engineering dp area. "Since Control Data desires to increase its sales in this market and in these application areas, generally, the availability of the Bendix Computer Div. to Control Data was most fortunate at this particular time," Norris said.

CDC also announced the commencement, on March 6, of the trading of its stock on the New York Stock Exchange. Listed were 4.7 million shares of which 3.9 million are outstanding among 18,000 stockholders. The company has paid no cash dividends on its common stock to date, and has no current plans to do so, according to Norris. ■

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

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

COMPUTRON INC.
122 Calvary Street, Waltham, Massachusetts

CIRCLE 44 ON READER CARD

NEW PRODUCTS

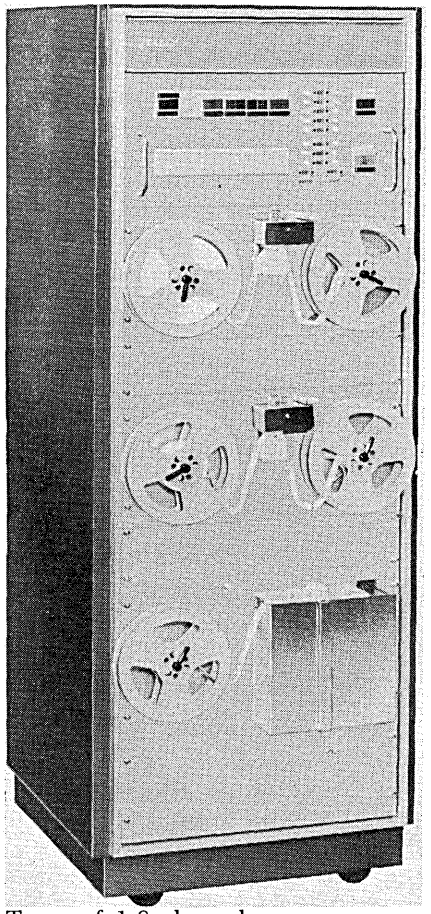
optical reader

The Videoscan accepts documents from 2½-8½″ in width, 2½-4″ in height. It utilizes a vidicon tube to recognize numbers, letters, and special symbols, handling up to 79 characters on a line. It can be operated on-line with a 301, processing up to 90,000 documents per hour, or off-line to segregate copies. RCA EDP, 30 Rockefeller Plaza, New York 20, N.Y. For information:

CIRCLE 200 ON READER CARD

paper tape preparation

The Mark 20 systems include tape duplicators, verifiers, and verifier-duplicators operating at up to 75 cps.

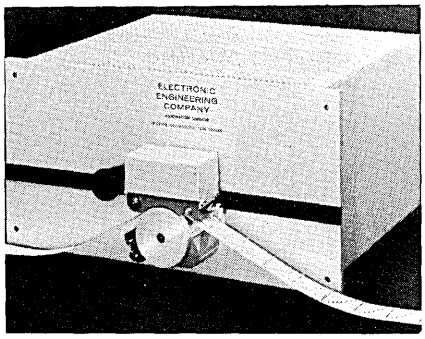


Tapes of 1-8 channels are accommodated. Prices begin at $4,565. TALLY REGISTER CORP., 1310 Mercer St., Seattle 9, Wash. For information:

CIRCLE 201 ON READER CARD

paper tape readers

The 4000 series includes 10 models with five block sizes in bi-directional or uni-directional units. Up to 160



characters and five, 10, 12, 16, or 20 lines of eight-level punched tape can be read. Prices begin at $974. ELECTRONIC ENGINEERING CO. of CALIF., Box 58, Santa Ana, Calif. For information:

CIRCLE 202 ON READER CARD

card reader

The 2224 uses punched cards to program sequences in automated process batching operations and production testing of electrical components and systems. Weighing nine lbs., it can be panel mounted in a cutout 5¼″ x 8 11/16″. DREXEL DYNAMICS CORP., Horsham, Pa. For information:

CIRCLE 203 ON READER CARD

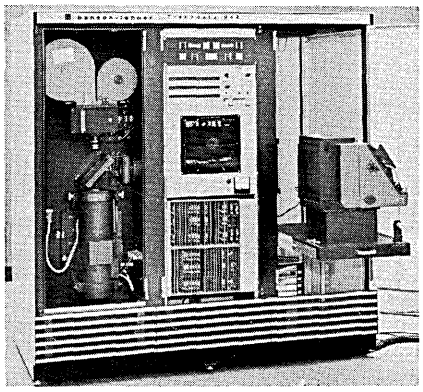
edge card punch

This edge card punch and reader provides automatic first code registration. It starts, reads, and ejects cards automatically. The unit is also designed for tape use. DURA BUSINESS MACHINES, INC., 32200 Stephenson Highway, Madison Hts., Mich. For information:

CIRCLE 204 ON READER CARD

photographic readout

The 944 reads from computer or mag tape, translates data into curves, lines or characters on a cathode ray tube, and records on microfilm or photo-



PROGRAMMED DATA PROCESSOR 4

FORTRAN II COMPILER Including debugging and floating point program packages.

HIGH SPEED OPERATION Basic instructions require only 8 or 16 microseconds to be completely executed.

REAL TIME IN-OUT CONTROL Provides complete buffering and control for 8 input and 8 output devices, 11 program interrupt inputs, and a real time clock.

MULTIPLE AUTO-INDEXING Eight Auto-Indexing Memory Locations greatly simplify the programming of routines requiring address modification.

STANDARD IN-OUT OPTIONS Magnetic Drums, Display Scopes, Magnetic Tape, Line Printers, Punched Cards, Punched Tape, and Analog Converters.

ECONOMICAL MEMORY EXPANSION Prices for increasing core memory capacity are:

Expansion from 4K to 8K words is $14,500
Expansion from 4K to 16K words is $53,500

EXTENDED ARITHMETIC UNIT (OPTIONAL) Adds 23 instructions to a Standard PDP-4 including Multiply (88 microseconds), Divide (200 microseconds), and Normalize (40 microseconds).

PRICE $65,500 for a complete, Standard PDP-4 Computer System including 4K core memory, perforated tape reader and punch, typewriter, and real time in-out control.

digital EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

Los Angeles Washington Parsippany, N.J. Ottawa Munich

CIRCLE 46 ON READER CARD

NEW PRODUCTS . . .

graphic paper. It plots 33K points per second, reads 62.5 cps. Price is $79.9K. BENSON-LEHNER CORP., 14761 Calisa, Van Nuys, Calif. For information:

CIRCLE 205 ON READER CARD

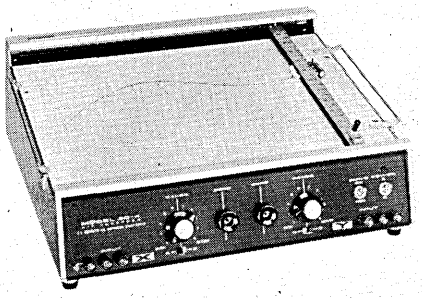
digital plotter

The 3500 Dataplotter operates on-line as well as from card or paper tape readers, and plots points, symbols, or lines at 200 points or 120 lpm. Point plotting accuracy is ±0.05 per cent of full board width; accuracy for line plotting is within 0.015″ of straight line interpolation with .05 per cent of board width for end points. Prices begin at $21K. ELECTRONIC ASSOCIATES, INC., Long Branch, N. J. For information:

CIRCLE 206 ON READER CARD

x-y recorders

These devices will draw cartesian coordinate curves from two related sources of DC electrical information on standard graph paper. Ten calibrated input ranges from 0.5 mv-10 v per division may be selected from the

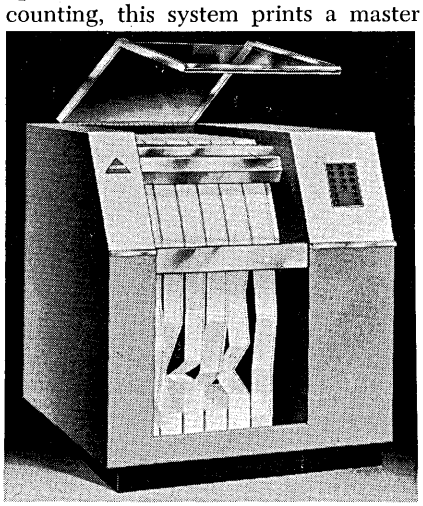


front panel. Model 135C, with a writing area of 7 x 10″, is priced at $1,190; model 2D-4, 10 x 15″, is $1,490. F. L. MOSELEY CO., 409 N. Fair Oaks Ave., Pasadena, Calif. For information:

CIRCLE 207 ON READER CARD

multiple tape lister

Designed for proving and clearing operations in demand deposit accounting, this system prints a master



ANOTHER CASE HISTORY FROM GKI

MEMO TO: **Users of computer tape**

FROM: **General Kinetics Incorporated**

SUBJECT: **Pre-testing tape to ensure perfect data recording in Saturn booster test program**

Here is how a tape reliability problem is being solved at NASA's Marshall Space Flight Center, Huntsville, Alabama:

PROBLEM: To assure 100 per cent reliability in digital recording of Saturn booster test firing data.

SOLUTION: Digital magnetic tapes to be used in the Saturn test program are now pre-tested on GKI's Tape Preventive Maintenance (TPM) system to guarantee reliability in the data reduction process. Before every static firing, each digital tape to be used is cleaned and error-tested on GKI equipment.

The GKI KINESONIC Tape Cleaner and Model 7 Tape Tester installed at the George C. Marshall Space Flight Center's Computation Division are employed routinely to assure digital tape quality and to repair used tapes for reliable re-use.

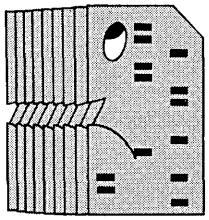
Individual units of the GKI system are available separately, including Tape Testers, KINESONIC Tape Cleaners, Programmed Tension Tape Winders and Bulk Tape Erasers.

Write or call today.

GKI®

GENERAL KINETICS INCORPORATED
2611 Shirlington Road, Arlington, Va.
Phone: (703) 671-4500

CIRCLE 47 ON READER CARD



Let's cut the cards

(like out)

EECO'S computer tape conversion service converts directly from tape to tape

EECO'S Computer Tape Conversion Service converts data directly from format to format at one-eighth the cost of conversion via cards! And it's as fast as moving paperwork from your IN to your OUT tray! Eliminates the needless cost and time of punching and reading cards. EECO is equipped to accept tapes from any of the following computers and directly convert them fast and economically to a format designed for any of the others:

Paper Tape
5-, 6-, 7-, or 8-level tape, including Friden-Flexowriter, Teletype, NCR and IBM 1620 Paper Tape. (Any coding can be read or punched.)

IBM 650/705, 704, 705, 7070, 709, 7090, 1401, 1410

Burroughs
205, 220, B5000

RCA 501, 301/501 compatible, 601/501 compatible

Remington Rand
Univac I, II, 1103 Scientific Series, 1105, Solid-state 80 and 90

Of course, we can accept and generate IBM 80-column cards with Hollerith coding, too.

Keith Smith, CTCS Applications Engineer, is the man to call, wire or write to for further information.

EE 2-57R

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of California

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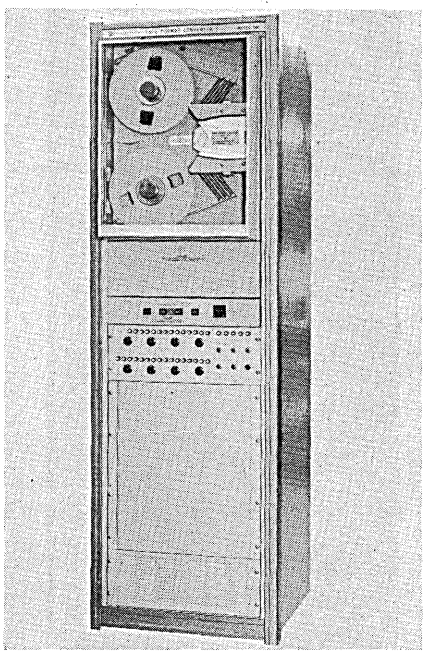
CIRCLE 48 ON READER CARD

list, four transit lists, and one miscellaneous items list in a single pass through a sorter-reader. It prints up to 2K lpm on one-three parts sets. ANELEX CORP., 150 Causeway St., Boston 14, Mass. For information:
CIRCLE 208 ON READER CARD

tape format converter

The 310 prepares an IBM-compatible mag tape in binary or BCD format from cards, mag tape, or digitally available data. Provision is made for



parity checking, recording special synchronization, clock signals, controlling and indexing the number of data blocks, records, and files. DIGITAL ELECTRONICS, INC., 2200 Shames Dr., Westbury, N.Y. For information:
CIRCLE 209 ON READER CARD

forms handlers

The 1700 line includes modular business form bursters, trimmers, trimmer-imprinters, and card bursters. The form burster operates at 115-250′ per minute, the card burster at 23.5K per hour. The trimmer, taking 1-12 fastened copies, operates at 115-170′ per minute. UARCO INC., West County Line Rd., Barrington, Ill. For information:
CIRCLE 210 ON READER CARD

mag tape cabinet

This line of single and double-depth Unistoralls is for mag tape reels and other supplies. Cabinets have plastic laminate work surface top, lift-up doors, and locks. BARRY WRIGHT CORP., 160 Gold Star Blvd., Worcester, Mass. For information:
CIRCLE 211 ON READER CARD

instrumentation printer

Model ITR-7 prints on-line, real-time data in numeric form on 1″ paper

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MS in EE with applicable exp. Equipment exp. on Univac 1105 & IBM 7090.

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Responsible for overall planning & supervision of computer programs. Assign & coordinate work. Exp. in AN/FS2-7N8; IBM 700 Series or Philco 200.

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Advanced programming techniques. Emphasis on IBM equipment exp—especially 700 series. Develop programming languages with exp. in SAP, Fortran & Cobol.

SCIENTIFIC PROGRAMMERS **to $16,000**
Deg + exp. in programming analysis; simulation programming; real-time programming, personal & professional growth. All Areas.

INFORMATION SYSTEMS PROGRAMMING **$12-18,000**
Scientific programming exp with problems in Aerodynamics; math analysis; telecommunications and Systems Integration.

PROGRAMMERS **$9-13,000**
Linear programming; matrix operations; statistics & differential equations. Tasks are in coding/checking/documenting. Bachelor or advanced deg determine starting salary.

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PhD in applied Math + 5 yrs exp in missile, space or aircraft industries. Thoroughly exp in math & numerical methods used for solution of problems.

TECHNICAL WRITER—ANALYST **$11,000**
Analyze & document in manual form the complex internal logic of a programming system. Include research of existing program documentation to prepare flow charts; block diagrams, tables etc.

TECHNICAL WRITERS **$9,000**
BS Degree in Journalism/Engineering with three to five years' applicable publications experience, preferably in the aerospace industry.

CUSTOMER ENGINEERS **Potential $15,000**
Any deg + 3 yrs exp with comml and/or Ind'l Liaison exp with data processing or equipment field.

SALES ENGINEERS **to $15,000**
Engr'g deg + 4-5 yrs sales exp in any phases of EDP field.

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BENNETT ASSOCIATES

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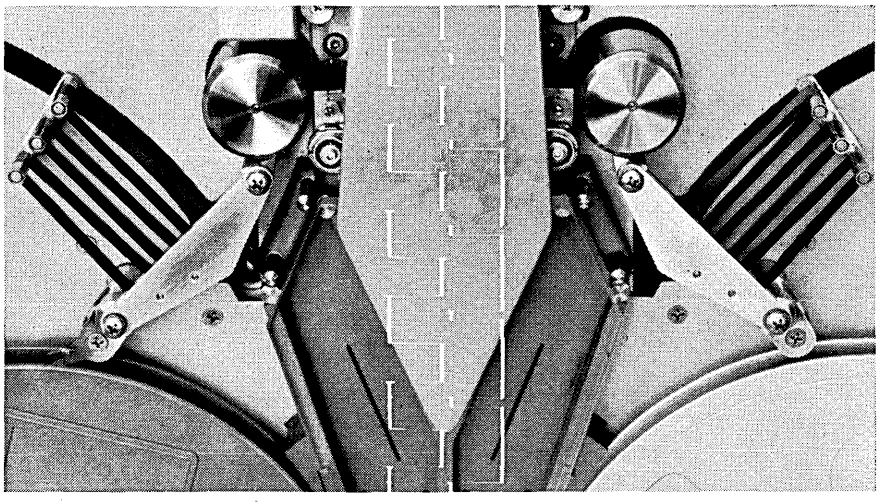

wanted: the development engineer who can advance this advanced digital transport

We're looking for the engineer who's looking for a challenge. Is that you? If so, at Ampex, you have room to conceive, design and develop your ideas into working models. Room to grow. At Ampex there's stability: nearly all of our multi-million dollar development programs are company sponsored. And you'll work in one of the finest areas anywhere: either Redwood City, near San Francisco, or Culver City, near Los Angeles. If you have a degree in electrical engineering, physics, or engineering physics and would like to supervise the conception, analysis and experimentation of new high-speed servo mechanisms and control devices, electro-mechanical accessing digital memories, or advance circuit designs for feedback amplifiers and control electronics, write to: E. C. Knapp, Ampex Computer Products Company, 9920 West Jefferson Blvd., Culver City, California. An equal opportunity employer. AMPEX

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computer careers

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

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CIRCLE 80 ON READER CARD

NEW PRODUCTS . . .

tape at a longitudinal spacing of five lines per inch, and up to five numeric characters per line. It prints at 60 ips in synchronous operation, and at 6 ips in asynchronous. OMNITRONICS, INC., 511 N. Broad St., Philadelphia 23, Pa. For information:

CIRCLE 212 ON READER CARD

tape unit

The D-2020 series includes transport, low and dual density signal electronics and a complete group of accessories. It is fully IBM compatible for tape formats of 200 and 556 bits per inch and has a 30 inches-per-second bidirectional drive with five millisecond start and stop times. DATAMEC CORP., 913 Kifer Rd., Sunnyvale, Calif. For information:

CIRCLE 213 ON READER CARD

teleprinter

This high-speed system, the TP-3000, is capable of printing 3,000 words per minute, and accepts six-bit codes, translates these to a print code and prints decoded alphabetic, numeric and symbolic characters on high-contrast electromarking paper. The printer has a line length of 72 characters at five lines per inch. MOTOROLA INC., 1450 N. Cicero Ave., Chicago 51, Ill. For information:

CIRCLE 214 ON READER CARD

symbols and tapes

This new line of pressure sensitive symbols and tapes conforms to PERT specifications. The 18 symbols available include circles, broken circles, ellipses, I/O markers and rectangles plus connector points and critical path and activity arrow tapes. The base stock is a matte transparent material with adhesive backing. MICO/TYPE, INC., 6551 Sunset Blvd., Los Angeles 28, Calif. For information:

CIRCLE 215 ON READER CARD

tape reader

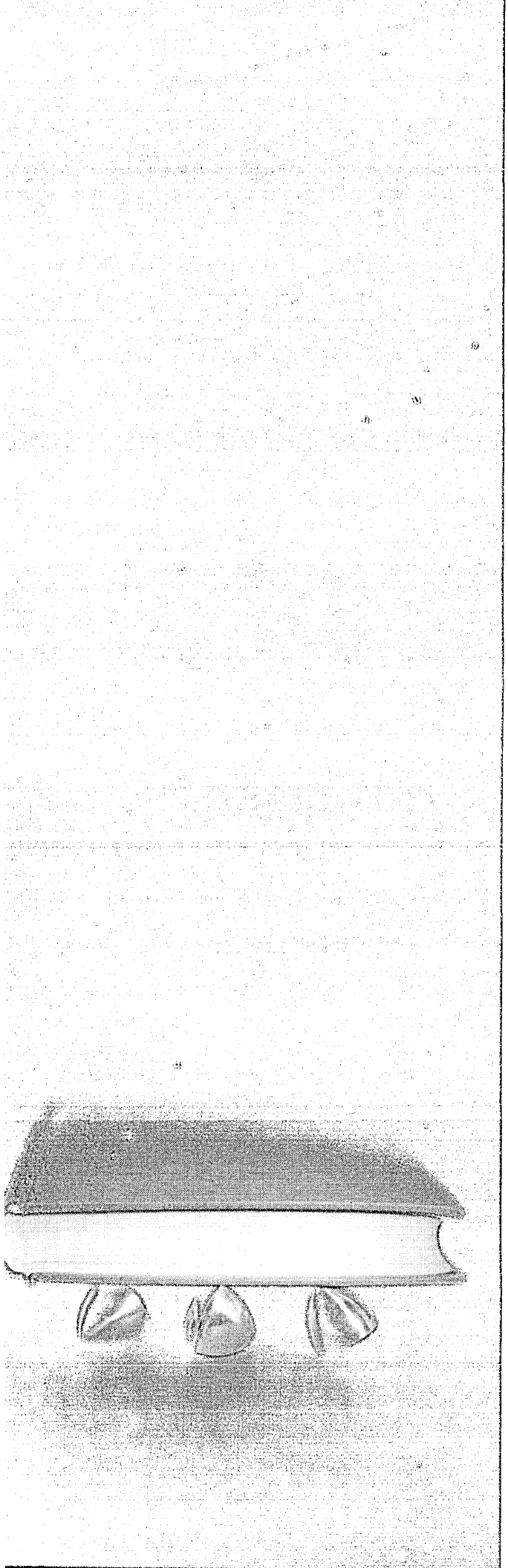
Model 3000 photoelectric perforated tape reader is a bi-directional unit which is able to read 300 characters per second. The 3000 can read any 5, 7 or 8 channel paper or Mylar tape without adjustment. Basic read head plus electronics package is $975. DATA SYSTEMS INC., 20535 Mack Avenue, Grosse Pointe Woods 36, Mich. For information:

CIRCLE 216 ON READER CARD

plotting system

The 580 magnetic tape plotting system utilizes 556 bits per inch tape and has been designed for off-line digital plotting of output data from large-scale computers. The system includes a 565 plotter which produces fully annotated plots up to 120 feet long and 11 inches wide at 18,000 line segments per minute. CALIFORNIA COMPUTER PRODUCTS, INC., 8714 East Cleta St., Downey, Calif. For information:

CIRCLE 217 ON READER CARD



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

How do you know it's round?

The objects at left are not round.

But lay a heavy book on them and push. The book glides smoothly with no vertical component of motion.

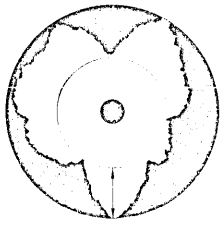
Or measure them with a micrometer caliper. Like a sphere, their "diameters" are everywhere constant.

They are members of a family of surfaces having constant width. It's their less brazen cousins that are troublesome, though. Many machined parts, for instance, may be constant in diameter but out of round. Bearing balls. Journals. Holes. You name it. A smidgen of out of roundness would remain invisible to the eye and undetectable by two-point measurements.

Prompted by automotive and space-age needs, engineers at our Research Laboratories have been developing new techniques for measuring, analyzing, and specifying these subtleties of surface geometry. For example, they built a special roundness measuring instrument about a precision spindle. Called the Roundicator, it detects roundness deviations of less than 1 millionth of an inch on parts up to 18 inches in diameter. Scaled up some 30 million-fold, that's about a 3-foot dimple on an Earth-size ball.

These pioneering studies of roundness and its ramifications are typical of how General Motors engineers are finding a better way—through research in depth.

General Motors Research Laboratories
Warren, Michigan



0.000053 in.

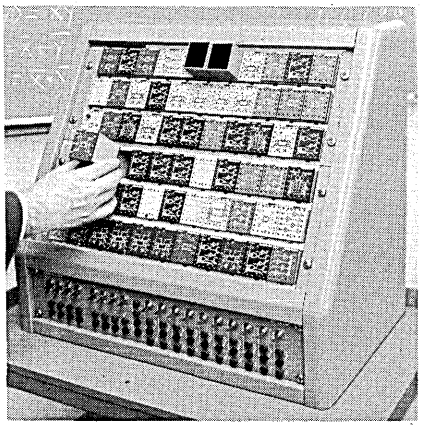
"Roundicator" chart of a 1-in. standard used to check micrometers. Diameter is constant to within 11 microinches, but disc is out of round by 53 microinches.

CIRCLE 49 ON READER CARD

COMPONENT PRODUCTS

logic kit

The Facilogic Laboratory Kit K-6001 has 33 digital logic plug-in modules, power supply, 50 color-coded leads, frame and rack. Each module has a



built-in indicator light which shows the logical state of the circuit. Price: $1.5K. HARMAN-KARDON, INC., Plainview, N.Y. For information:

CIRCLE 218 ON READER CARD

10 mc flip flop

Designed for gp applications, the SE 124 has twice the fan-out capability of others in the company line without sacrifice in speed or power requirements. It is available in modified TO-5 or modular glass-Kovar package. Price for more than 100 is $66.50. SIGNETICS CORP., 680 W. Maude Ave., Sunnyvale, Calif. For information:

CIRCLE 219 ON READER CARD

drafting film

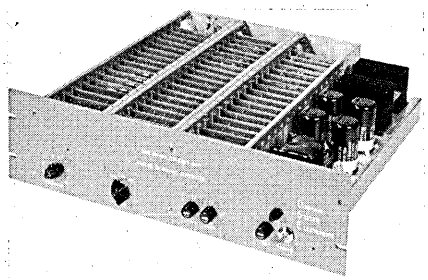
Polyester sheets for making computer circuit layouts are imprinted with 220 pin circles to indicate micrologic units plugged into the circuit board master. Sheets, available in matte and cut'n' strip surfaces, measure 30″ x 54″. Price of matte is $8, of cut'n'strip is $15.50. KEUFFEL & ESSER CO., Hoboken, N.J. For information:

CIRCLE 220 ON READER CARD

multiplexer, adc

The ADC-5M is a combination multiplexer and analog-to-digital converter plus P.S. It operates at up to 12.5K channels per conversions per second at a rated accuracy of 0.1 per cent.

COMPONENT PRODUCTS . . .



DYNAMIC SYSTEM ELECTRONICS, 2321 E. Washington, Phoenix 34, Ariz. For information:

CIRCLE 221 ON READER CARD

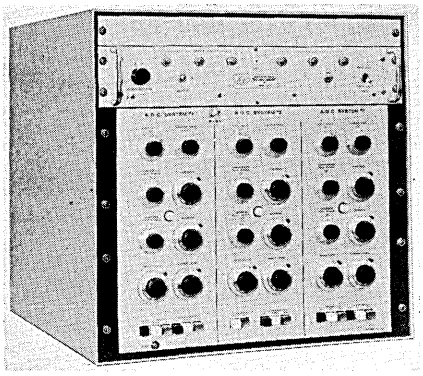
multiaperture cores

These ferrite logic cores available in nearly any configuration are being fabricated in small and volume quantities, reportedly at a fraction of the cost of the die-press method. MOTOROLA SOLID STATE SYSTEMS DIV., 3102 N. 56th St., Phoenix, Ariz. For information:

CIRCLE 222 ON READER CARD

a-d converter

The model 22-02 is a triple analog-to-digital converter with common prompt gate for external coincidence, common delayed (two usec) gate for external



coincidence, and full parallel data format from all systems. RADIATION INSTRUMENT DEVELOPMENT LABORATORY, INC., 4501 W. North Ave., Melrose Park, Ill. For information:

CIRCLE 223 ON READER CARD

digital pressure encoder

The TD series includes 3, 5, and 8-bit units with pressure ranges up to 10K psi and provision for use with standard pressure fittings and electrical connectors. GLASSCO INSTRUMENT CO., 777 S. Arroyo Parkway, Pasadena, Calif. For information:

CIRCLE 224 ON READER CARD

binary decoder

The BIP-8201 is a self-decoding readout driver module mounted on a printed circuit card, and measures 2" x 2½" x ¾". Price is $75 in quantities of 100. BURROUGHS CORP., ELECTRONIC COMPONENTS DIV., P.O. Box 1226, Plainfield, N.J. For information:

CIRCLE 225 ON READER CARD

NEW FIRMS & mergers in DP

■ Bill Orchard-Hayes, VP, CEIR Inc., Washington, D.C., and six others have left the organization to form Systems Programming Inc., Arlington, Va. Among others leaving CEIR, and their new positions, are David M. Smith, VP; R. W. Rumsey, secretary; David M. Carstens, and Sheldon T. Katz. The new firm will be engaged in specialized "applications systems and programming for both commercial and scientific purposes."

■ Two Boston data processing service organizations, Research Calculations, Inc., and Data Systems, Inc., have merged. Over 100 persons will be employed in the new firm offering both business and scientific services in the Greater Boston area.

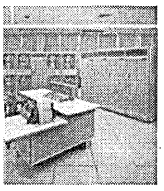
■ Control Data Corp., Minneapolis, Minn., has formed Meiscon Corp., Chicago, Ill., with a staff from Meissner Engineers, Inc. Formation of the civil and industrial engineering consulting subsidiary is part of CDC's expansion into industrial and commercial markets. James D. Harris of CDC has been named president and director of Meiscon.

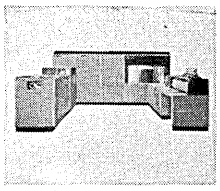
It is the intent of Meiscon to use CDC equipment in automating highway and industrial design procedures.

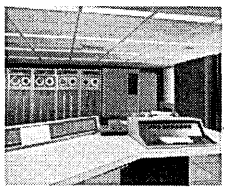
■ Core Laboratories Inc., petroleum engineering and consulting firm of Dallas, Tex., has acquired Electronic Management Systems, Inc., Dallas. G. B. Spaulding and T. W. Swafford, former president and VP, respectively, of EMSI will direct Core Lab's diversification into management systems and operations in data processing.

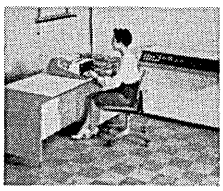
■ Audio Devices, Inc., New York, has purchased Olympic Record Co., Santa Monica, Calif., manufacturers of recording discs, and will adopt the latter's proprietary manufacturing process.

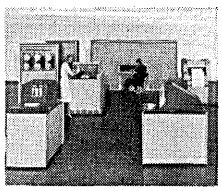
■ A new Management Sciences Division has been formed by the Auerbach Corp., Philadelphia. Under John Sayer, the division has four groups: Business Information Systems, Product and Market Planning, Programmed Teaching, and Computer System Analysis.

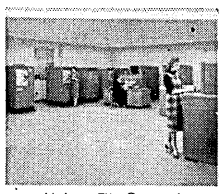

GE-210


IBM Ramac 305 I

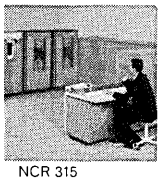

Honeywell 1800


General Prec. RPC-4000

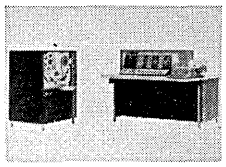

RCA 301

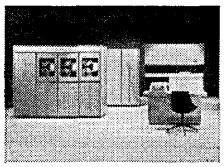

Univac File Comp. 1


NCR 390

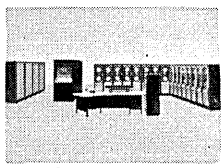

NCR 315

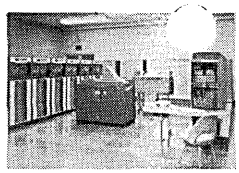

Teleregister Telefile


IBM 1620


ITT 7300 ADX System

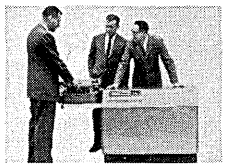

Adv. Scientific ASI 210

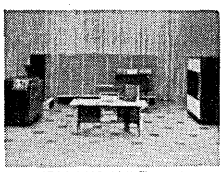

Philco Model 212

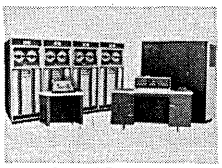

IBM 7044

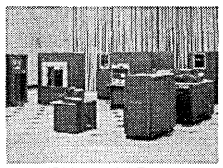

GE 225

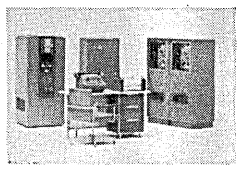

Univac 1101


General Prec. LGP-30

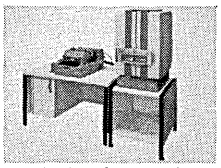

IBM 1410 (All Types)

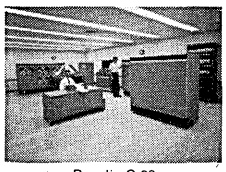

Control Data 924

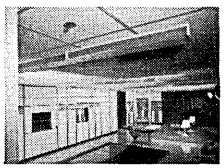

IBM 650 (All Types)

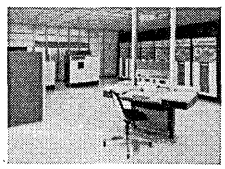

Bendix G-15

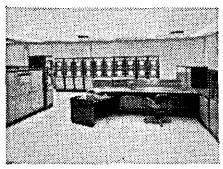

IBM 7094

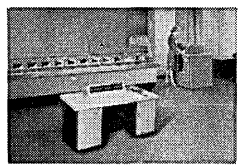

Packard Bell PB 250


Bendix G-20

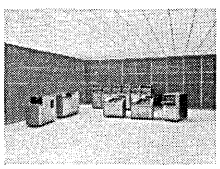

Univac 490

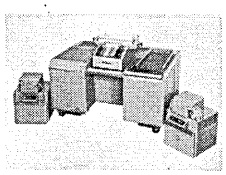

Univac 1107

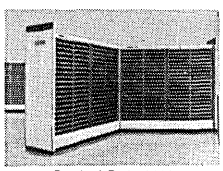

Philco Model 211

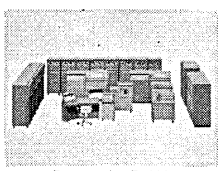

NCR 310

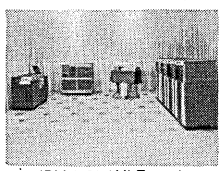

NCR 304

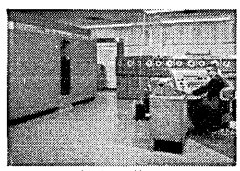

Burroughs B280


Burroughs E103

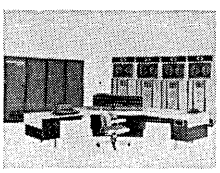

Control Data 3600

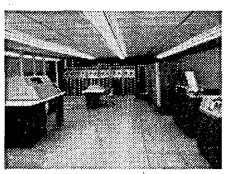

Burroughs B5000

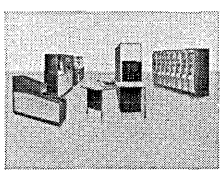

IBM 1401 (All Types)

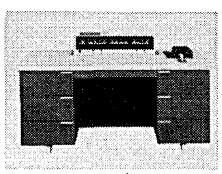

Univac II


RCA 501


Control Data 1604-A


Honeywell 400


Philco 1000


Control Data 160

Univac III

IBM 7090

IBM 7040

Univac 1105

Monroe Monrobot XI

Control Data 160A

Philco Model 210

Honeywell 800

Alwac III-E

What do these 49 computers have in common?

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

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

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

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

CIRCLE 61 ON READER CARD

IBM ANNOUNCES NEW BANKING HARDWARE

A new bank transit dp system has been developed by IBM specifically for Federal Reserve and commercial banks handling a high volume of checks. The IBM 1420 system has three interconnected units: a 1421 bank transit processing unit, 1442 card read-punch, and 1403 printer with selective tape listing.

The 1421 processor combines the reading, sorting, instruction, and storage control features of a magnetic character reader and a gp computer. Storage from 4-16K is available. Core storage cycle time is six usec, the speed increased further with simultaneous processing and reading of checks. The 1421 can sort MICR-encoded checks and documents at a rate up to 1.6K checks per minute. It can also read for balancing purposes 51-column cards, such as postal money orders, at speeds up to 1.9K per minute. And every MICR document can be imprinted with the bank's endorsement, reportedly at no reduction in handling speed.

The processor is loaded with a 1442 card read-punch which reads 80-column cards at up to 400 per minute, punches at 80-160 columns per second.

The 1403 printer with a selective tape listing prints either eight detail tapes or a master (control) tape and six detail tapes. Rated output of the printer is 1,285 lpm. Both numeric dollar listings and alphabetic cash letters can be printed at 600 lpm.

As checks are sorted by the 1421, the printer prepares individual tapes containing single-spaced listings of amounts of checks directed to certain high-volume "kill" pockets in the 1421.

The typical configuration rents for $5,870 per month, and sells for $284,875. First delivery is scheduled for early 1964.

Now: 5 different DISCfILE™ memory systems... 155 million to 920 million bit capacity...and simultaneous dual access

DISCFILE—most thoroughly "on-line" proven mass random access disc memory—has been expanded to accommodate up to 920 million bits with unique dual accessibility so two computers can utilize a single DISCFILE system at the same time. That's because two logic elements and one-per-disc linear head positioners provide simultaneous access to any two discs in the system—effectively doubling transfer rate while cutting access time in half.

Never before have you been offered such flexibility in a disc memory system. You can choose according to your needs... and as your requirements increase, expand the system with additional DISCFILE units installed on-site. All the while you're assured of using a system proven by more than two dozen successful field installations. DISCFILE, applied to any digital data system, multiplies capacity by orders of magnitude while simultaneously shrinking space requirements.

So check the DISCFILE system that best fits your immediate needs. Then contact us for the complete story:

dp/f-5020 155 million bit storage on 16 discs... 400 bpi ... one logic element

dp/f-5024 230 to 920 million bit storage... one to four 16-disc units... 600 bpi... one logic element

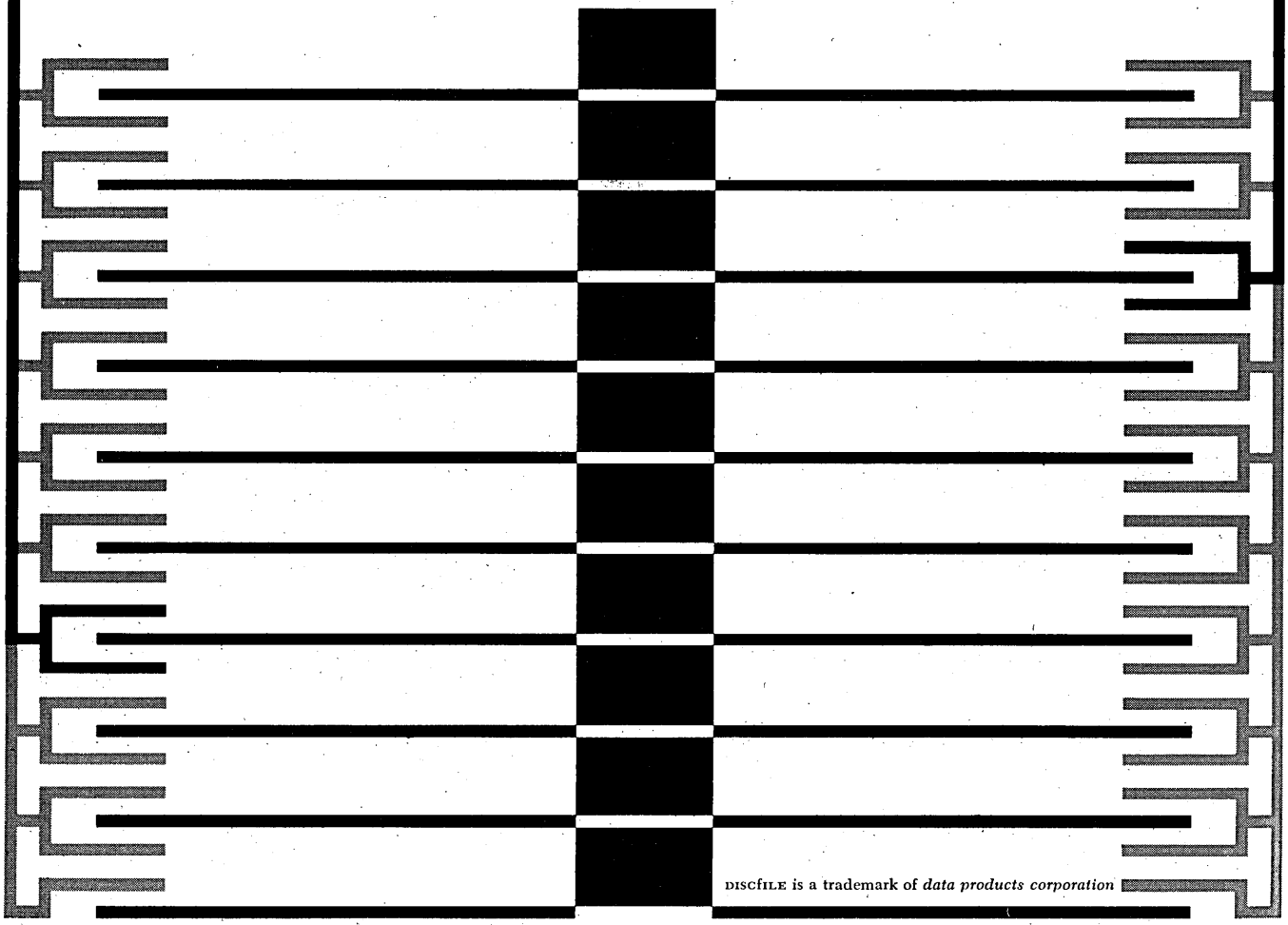
dp/f-5025 230 to 920 million bit storage... one to four 16-disc units... 600 bpi... two logic elements... *simultaneous dual access*

dp/f-5034 460 to 920 million bit storage... one or two 32 disc units... 600 bpi... one logic element

dp/f-5035 460 to 920 million bit storage... one or two 32-disc units... 600 bpi... two logic elements ... *simultaneous dual access*

Write: Room 434 / 8535 Warner Drive / Culver City / California / Phone: 837-4491

data products corporation



DISCFILE is a trademark of *data products corporation*

Decision-Making: Logistics Support, What, Where, When?

Centuries ago the critical factor in logistics support was providing basic supplies—food, armaments, raw materials for simple industries. A few decades ago, carrying capacity—sea and land transportation—ruled as the decisive element. Within the last decade, a new critical element in logistics support has emerged. It has been created by the complex, interfacing governmental, industrial and military structure of today. This new factor is up-to-the-minute information—gathered from afar, varied in content, immense in volume.

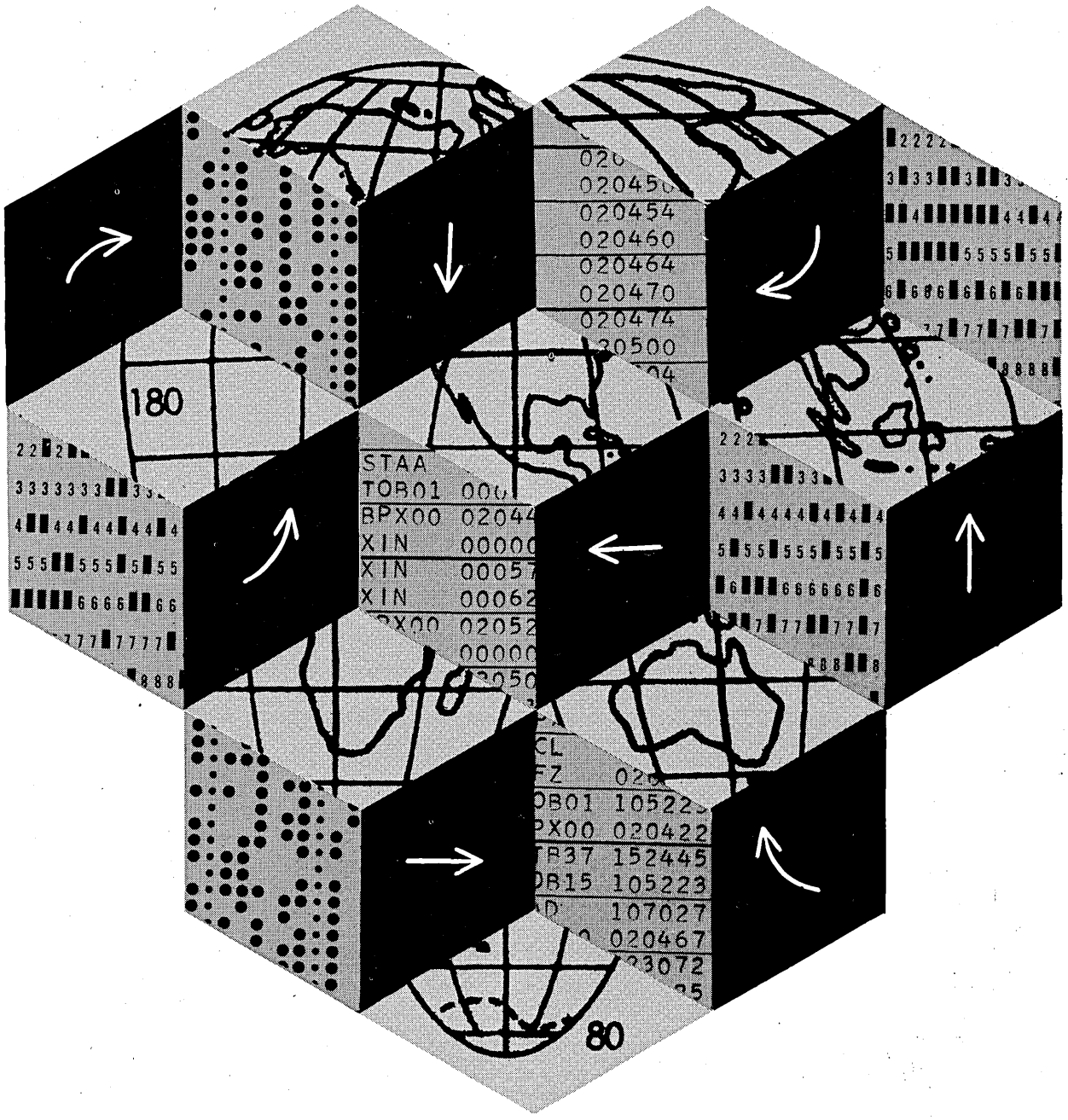
To help provide and control this flow of information, SDC scientists, engineers and computer programmers have helped create a new technology: information systems which aid managers in determining the "what, where and when" of logistics support for world-wide and continental activities and forces.

In developing these systems which provide information processing assistance, SDC scientists, engineers and computer programmers have evolved an interdisciplinary approach. Teams of computer programmers, operations research scientists, engineers and human factors scientists work together in these major system development steps: analyzing the system, synthesizing the system, instructing computers within the system, training the system, evaluating the system—and helping adapt the system to the changing needs of its users. The system itself, not the hardware within the system, is their concern.

Computer programmers, scientists and engineers interested in joining this growing field, are invited to write Mr. A. H. Granville, Jr., SDC, 2401 Colorado Ave., Santa Monica, California. Positions are open at SDC facilities in Santa Monica; Washington, D.C., Lexington, Massachusetts; Paramus, New Jersey; Dayton, Ohio. "An equal opportunity employer"

SDC

System Development Corporation



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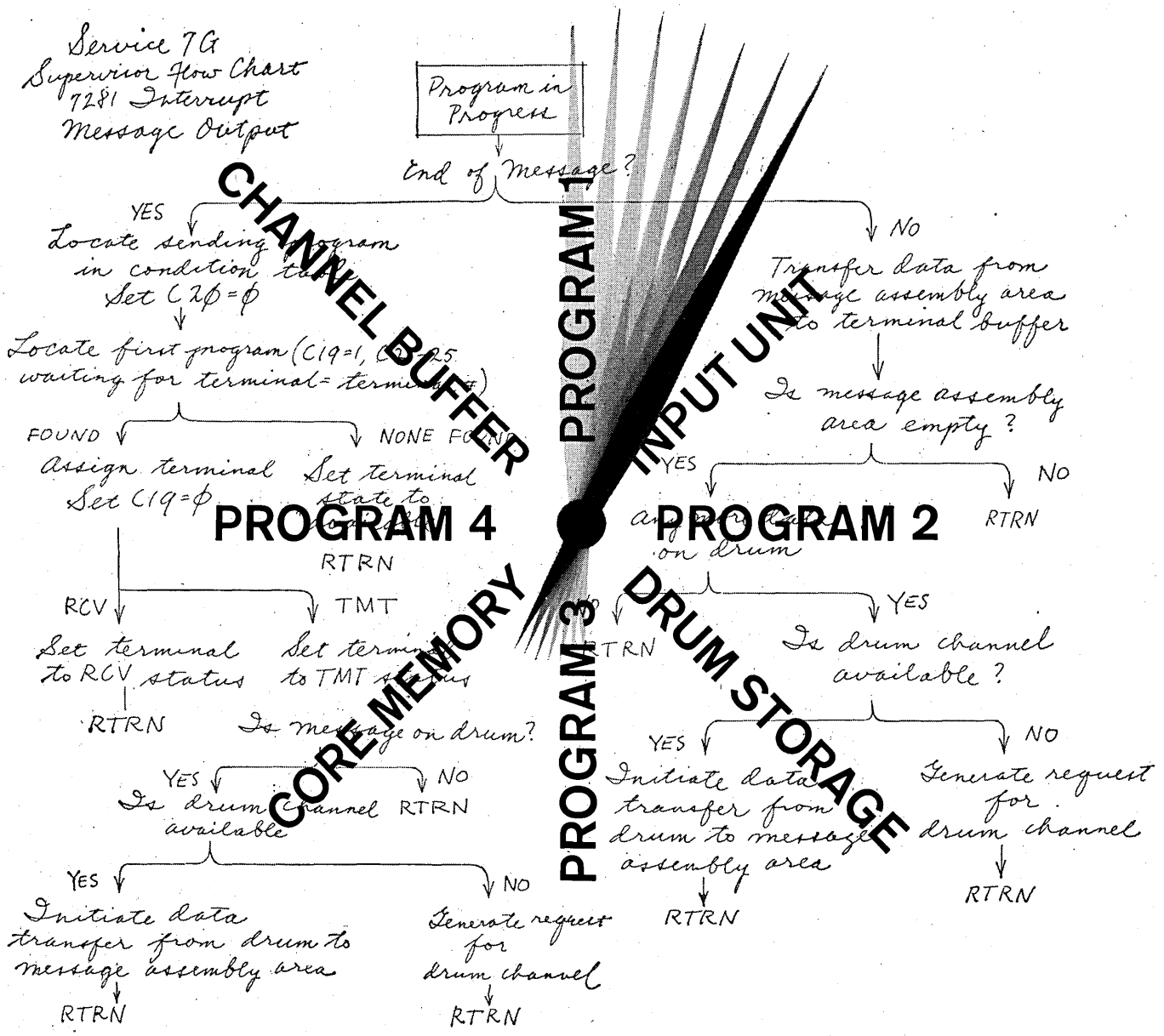
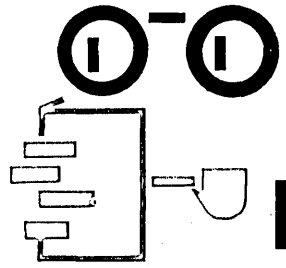
CIRCLE 88 ON READER CARD





NEW LITERATURE

MARKET RESEARCH TABULATIONS: This booklet describes CAMRA, a programming system for processing market research tabulations — straight-count tabulations in addition to descriptions and percentages. STATISTICAL TABULATING CORP., 104 S. Michigan Ave., Chicago 3, Ill. For copy:
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PSUEDO RANDOM DIGITS: For use in system simulation studies, 100,000 psuedo random digits appear in this 60-page, spiral bound pamphlet. Also included are the recursion formula and the 7090 FORTRAN program used. Price is the printing cost, $3. PLANNING RESEARCH CORP., 1333 Westwood Blvd., Los Angeles 24, Calif.
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TELETYPE DECALS: Self-adhesive reproductions of Teletype equipment may be used in preparing data communications flow charts and systems layouts. TELETYPE CORP., 5555 Touhy Ave., Skokie, Ill. For copy:
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INTRODUCTION TO SCERT: This booklet explains SCERT (Systems and Computers Evaluation and Review Technique) and its application in the evaluation of hardware, software, and system applications. COMRESS INC., 2916 V St., N.E., Washington 18, D.C. For copy:
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COMPUTER PRINCIPLE LESSONS: This series of booklets on "Binary Logic" utilizes programmed teaching techniques. Principles taught apply as well to pneumatic, hydraulic, electrical, electronic, mechanical, and optical controls. The first six lessons are currently available without charge. FRONTIER ELECTRONICS DIV., 4600 Memphis Ave., Cleveland 9, Ohio. For copy:
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DATA DISPLAY: This six-page booklet has specifications and applications of the CRT 30 display device. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:
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TRANSISTOR REFERENCE CHART: A six-page booklet describes various types of transistors for medium, low, and high speed switching applications and high current video amplifiers, chopper and control uses. SEMICONDUCTOR SPECIALISTS, INC., 5700 W. North Ave., Chicago 39, Ill. For copy:
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ADJUSTABLE POTENTIOMETERS: This technical data sheet covers the 310 series of subminiature trimming potentiometers. Modification possibilities also are shown. WESTON INSTRUMENTS & ELECTRONICS DIV., 614 Frelinghuysen Ave., Newark 14, N.J. For copy:
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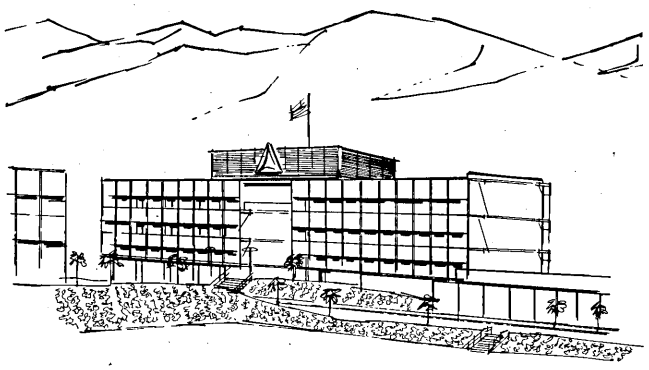

To maintain its advanced position in the field of computers and related devices, TRW has a continuing requirement for qualified specialists in a broad range of technical disciplines.

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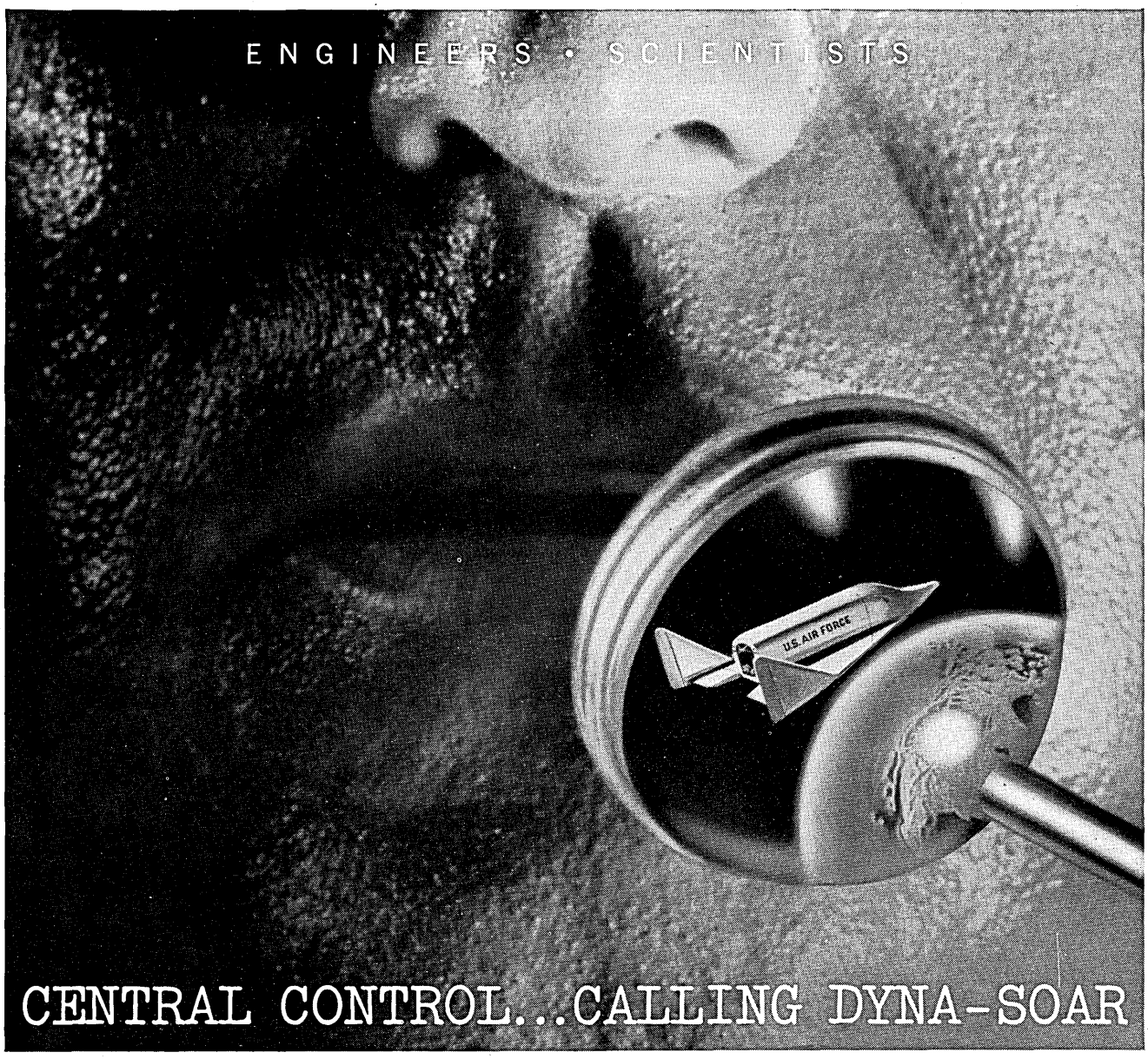

A practical solution to the problem of communications with the X-20 pilot—during launch and on his orbital path over the Atlantic Missile Range—has already been outlined by the engineers and scientists of PAN AM's Guided Missiles Range Division at Cape Canaveral.

Already a special staff of Engineering Program Managers at GMRD is preparing master plans for range development—encompassing facilities and instrumentation systems for tracking, telemetry and communications support of the X-20 space glider program. Working closely with the Air Force and X-20 contractors, they are tailoring range specifications to match the demanding requirements of orbital rendezvous and docking techniques by a manned space glider.

As contractors for the development, engineering and operation of the Atlantic Missile Range for the Air Force, GMRD presents recommendations for new equipments, then writes the specifications for authorized new instrumentation and facilities, and monitors their development by industry, their installation and acceptance testing.

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THE DYING PROGRAMMER'S LAMENT

The programmer spoke in a fading voice,
"That diamond shows it's a multi-choice,
And a loop is seen where the line returns
And a block is cleared, but my fever burns:

"O, pin me not to a completion date
Where the machine is down and the assembly late,
O, think of the errors I might have made
And the debug sessions so long delayed,

"The symbolic deck with the cards transposed,
Subroutines opened, that were not closed,
The card Operations dropped on the floor,
The Sponsor's shadow beyond the door.

"Yet I fought the fight. It will surely run
At the next debug, or the next but one."
So we buried him on his completion date,
When the machine was down and the assembly late,
And we sighed for the errors he might have made
And the debug sessions so long delayed.

—Russ Chauvenet
(January 1963)

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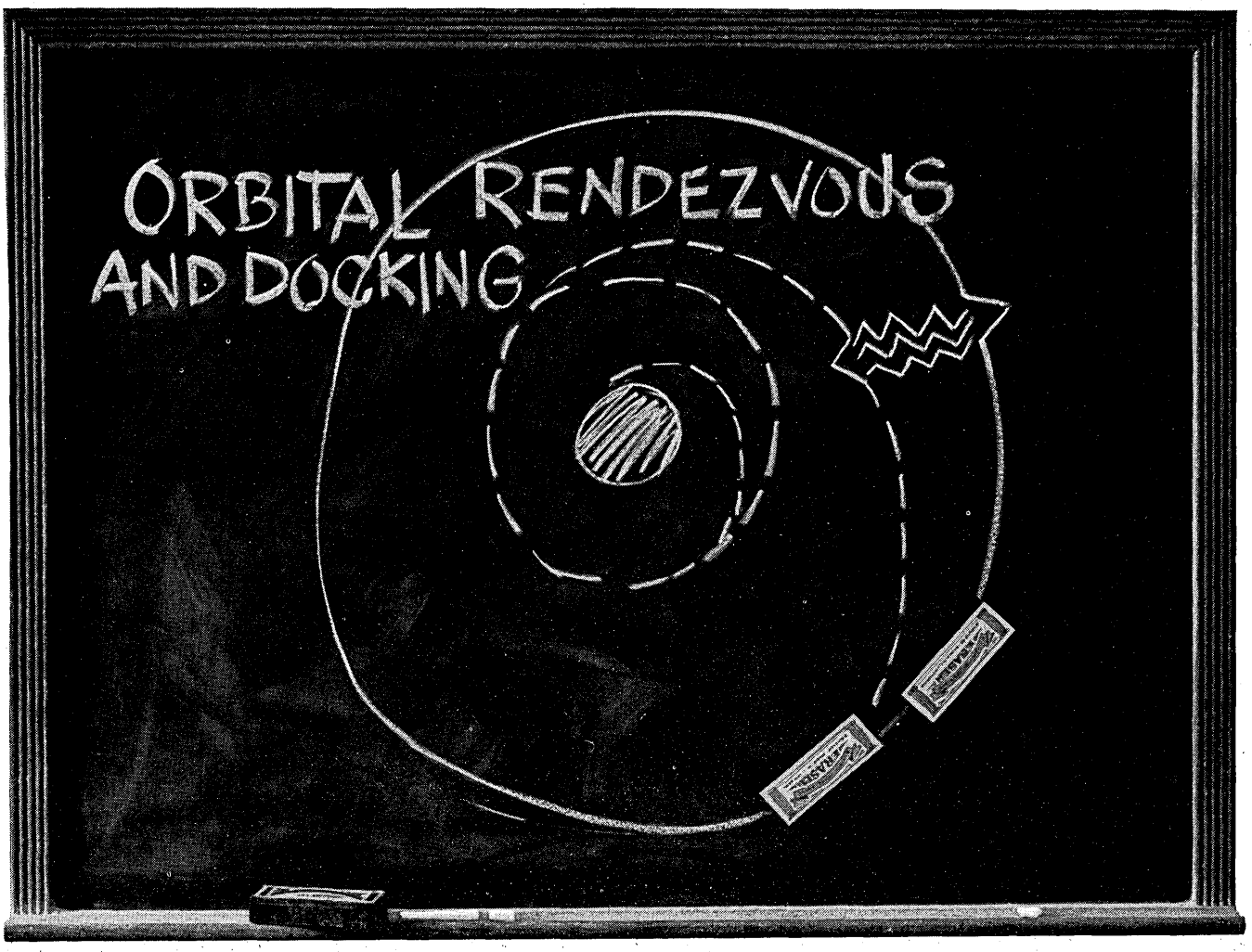

For Project Gemini, STL is conducting trajectory studies and mission and error analyses using analytical and computational techniques. Applying these same methods to its continuing investigations in space kinetics, STL has completed rendezvous and docking studies for Saturn-based systems, also under contract to NASA. Included among company sponsored work are rendezvous and docking preliminary design, orbit determination, mission and trajectory analyses, and ascent and terminal simulations and analyses.

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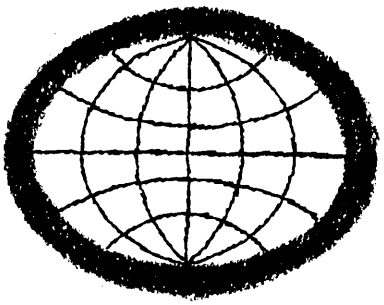

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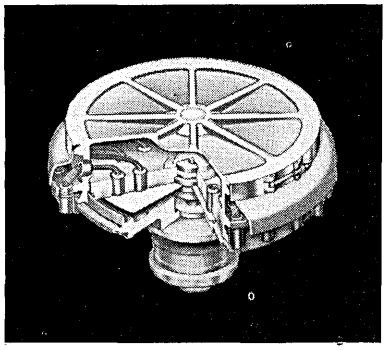

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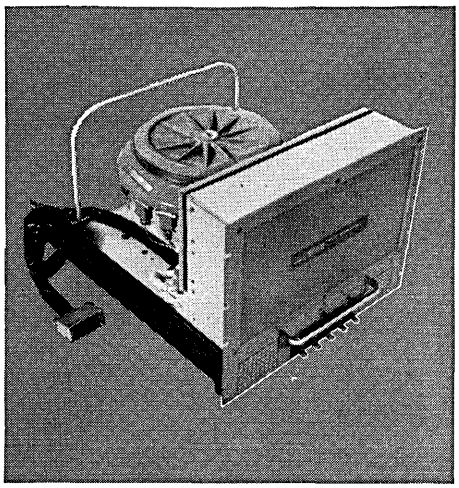

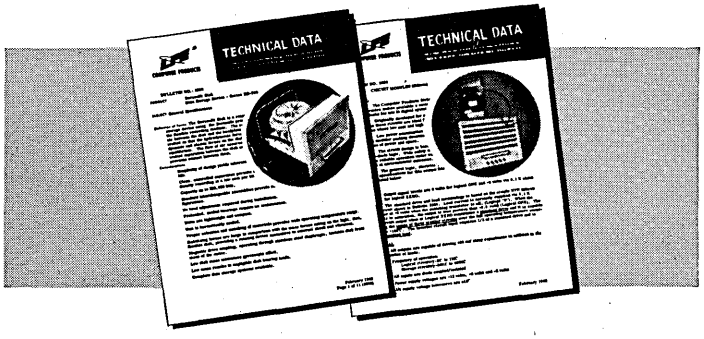

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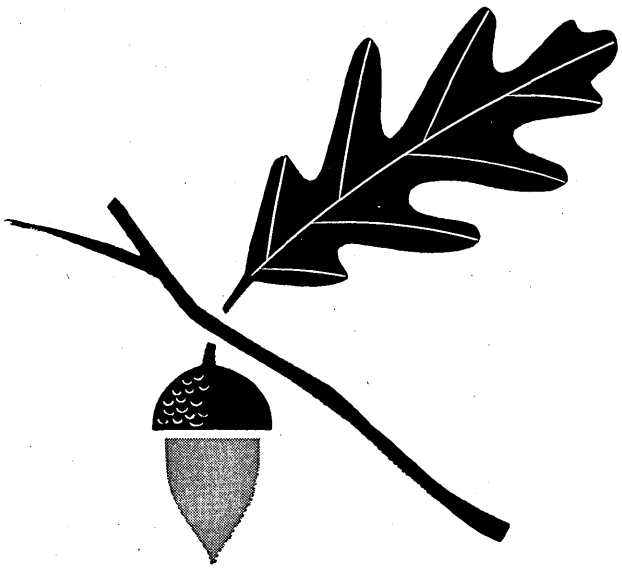

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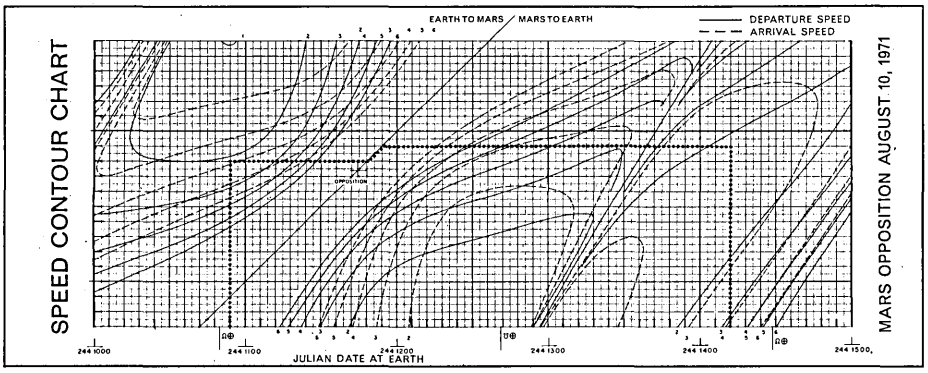

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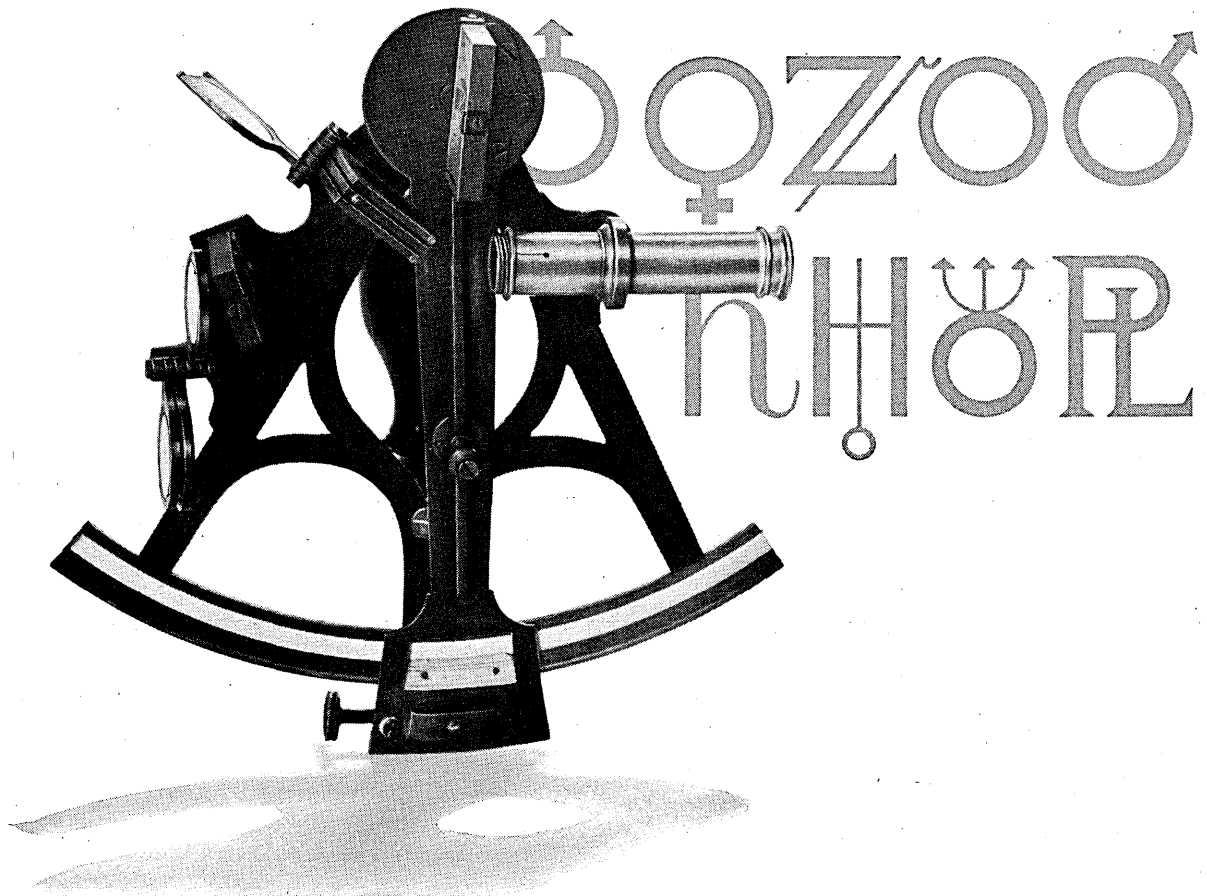

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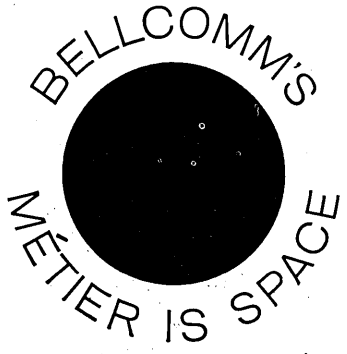

LITTLE BY LITTLE, SPACE IS YIELDING its mysteries to man's inspection... the previously unknown is becoming knowledge to help attack further unknowns. • One important attack is NASA's manned space flight program leading to exploration of the moon. Bellcomm was formed by the Bell Telephone System to carry out systems planning and evaluation for this exciting effort. • This new company offers fine opportunities to experienced men in such fields as computing and programming, physics, mathematics, engineering, man-machine relationships, aerodynamics and aeronautical engineering. • The work is creative, the staff is highly professional, and the location is stimulating. Bellcomm, an equal opportunity employer, works in Washington, D. C. Interested? Bellcomm will give your résumé prompt and thoughtful study. It should be sent to Mr. W. W. Braunwarth, Personnel Director, Bellcomm, Inc., Room 1100T, 1100 17th Street, N. W., Washington 6, D. C.

BELL SYSTEM

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CIRCLE 305 ON READER CARD

University surveys indicate:

STARTING SALARIES OF ENGINEERS ARE DECEPTIVELY HIGH

By James M. Jenks

TWO SEPARATE STUDIES of the salaries made by college graduates appear to contradict the commonly held belief that engineers today make out better financially than their classmates who major in non-technical subjects.

Both surveys were conducted by large universities. The first polled graduate engineers; the second, company executives. And both resulted in identical findings! That is, the average engineer today – despite a deceptively high starting salary—climbs fast but not far.

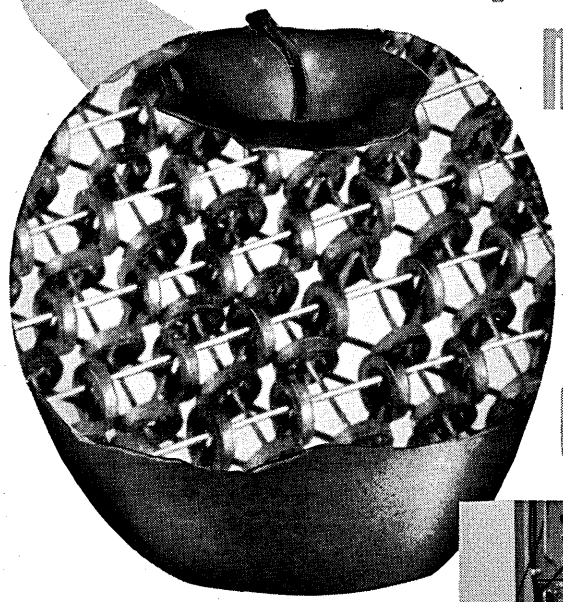
The need for technically trained men in recent years has exceeded the supply to such an extent that companies have been forced to bid for their services—to actually set-up "recruiting" offices on college campuses all over the country. Thus, starting salaries have gone up and up. But the income ceiling for these technically-trained men is lower than that for managerial personnel.

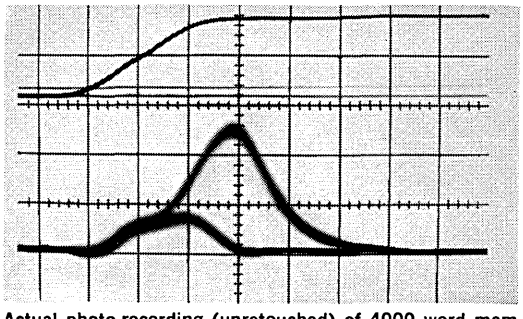
Despite the substantial head start engineers have, the differential in money earned over a ten-year period averages out at $7,000 more for the management man.

And from the tenth year on, the administrator's salary obviously outstrips that of the engineer by a wider and wider margin.

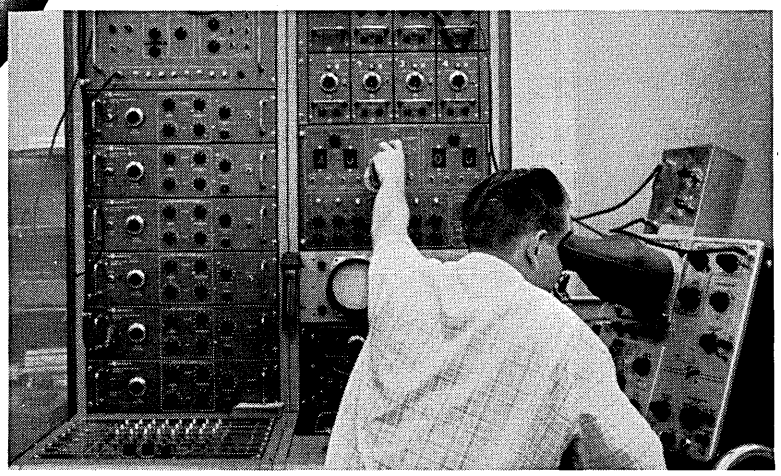
This, of course, is not to say that engineering students would be wise to shift to the study of business administration—or that working engineers face a bleak future. Quite to the contrary, the continuing growth of technology means that men with technical backgrounds are as ideally qualified for the highest rewards industry has to offer—*if they also have a knowledge of the underlying principles of business.*

we get to the core of performance in memory planes and stacks to assure maximum system operating margins





Actual photo-recording (unretouched) of 4000 word memory plan utilizing 30FC01 cores. Worse case pattern.



Some very good memory cores are thrown out at Ferroxcube simply because they do not meet the extra stringent requirements of performance in or out of the memory plane assembly. Only the best. closely matched to overall electrical requirements of the plane and stack, are delivered to our customers. Ferroxcube makes cores under precise batch kiln conditions and individually tests each core before assembly. After wiring in planes, cores are again submitted to advanced techniques of performance evaluation. Cores not up to Ferroxcube's specifications are replaced, until the entire assembly provides the **operating margins of performance** that means better overall memory characteristics, longer service life, and surprisingly, **you benefit by lower costs.**

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CIRCLE 3 ON READER CARD