Who can give you stacks of stacks?

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.
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 offline 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 4,096 words (optionally expandable).

Simplicity, maintainability, user convenience are factors of design. Regulated power supplies and power failure protection preserve integrity of computer. 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/s.max.
- Multiply floating point: 99μ/s.
- Add double precision fixed: 55μ/s.
- Add double precision floating: 181μ/s.
- Multiply double precision fixed: 263μ/s.
- Multiply double precision floating: 371μ/s.

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 1/0 buffer registers interrupt lines eight level hardware interrupt priority system additional sense lines output control pulses parallel I/O channels.

1/0 control units for maximized interlace and truly simultaneous operation:
- direct memory access control unit with unlimited channels
- fully buffered 1/0 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 2C. Modular construction is with S-PAC digital logic modules. Based upon a million S-PAC-hours of life test without failure the DDP-24 calculated MTFB is over 400,000 hours.
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.
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

CIRCLE 6 ON READER CARD
April 1963

Feature Articles
26 Progress in Language Standards, by Richard F. Clippinger
28 ALGOL on the 7000, by Jackson W. Granholm
29 Attitudes Toward Artificial Intelligence, Part Two, by Paul Armer
33 The 301 & 1401: A User’s Critique, by Ed Yasaki
35 Corporate Policies for the Computer Executive, by Roger A. MacGowan
39 Problems in Scientific User Relations, by Melvin Klerer
42 Perspective on AFIPS, by Willis H. Ware
44 An Evaluation of Computer Conferences
45 Improving the Current Format: A Conference Evaluation, by J. Don Madden
47 Reexamining Basic Objectives: A Conference Evaluation, by Gerhard L. Hollander
48 It’s Elmer’s Turn: An Interview, by Harold Bergstein
53-74 ’63 Spring Joint Computer Conference: A Special Section
57 CDC-Bendix Acquisition Finalized
101 IBM Announces New Banking Hardware
112 The Dying Programmer’s Lament

Departments
7 Important Dates in Datamation
13 Letters to the Editor
17 Datamation in Business and Science
23 The Editor’s Readout
32 People in Datamation
79 News Briefs in Datamation
89 New Products in Datamation
97 Component Products in Datamation
99 New Firms in Datamation
107 New Literature in Datamation
119 Advertiser’s Index

THIS ISSUE—46,929 COPIES

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.

Circulation audited by Business Publications Audit

Member, National Business Publications

DATAMATION is published monthly on or about the tenth day of every month by F. D. Thompson Publications, Inc., Frank D. Thompson, president, Executive Circulation and Advertising offices, 141 East 44th St., New York 17, N.Y. (Murray Hill 7-5180); Editorial offices, 1830 West Olympic Blvd., Los Angeles, 6. Published at Chicago, Ill. Circulated at Columbia, D. Form 3379 to be sent to F. D. Thompson Publications, Inc., 201 N. Wells St., Chicago 6, Ill. Copyright 1963, F. D. Thompson Publications, Inc. Printed by Beslow Associates, Inc.
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.
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, AIEEE, 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.

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.
choice of the experts

FORMSCARD®

still the only continuous tab cards with NO medial waste strips

CONTROL DATA CORPORATION is one of America's foremost manufacturers of computer systems and peripheral equipment. Efficiency is their business. That's why Control Data has been using FORMSCARDS since 1960 for high-speed processing on their own 166 Printer, of their own payroll and accounts payable checks. They know FORMSCARDS are unique... unmatched for dependability, flexibility, accuracy.

If speed and efficiency are important in your business, take a tip from the experts and use FORMSCARDS.

Available with vouchers of any size at side, top or bottom
Easily separated manually or on any burster
Can be part of multiple part sets
Available pre-punched
Operate efficiently over any printer... at any speed

Phone: OLefield 9-4000/Area Code 215 • Willow Grove, Pa.

Manufacturers of line-hole continuous business forms. Samples on request—sales representatives in principal cities.
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.

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

April 1963
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

(An Equal Opportunities Employer)
AGOL abroad

Sir:
The article "AGOL 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 AGOL compilers are in general use; practically all manufacturers are offering such translators.

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.

agiing the console lights

Sir:
"Sprightly Packaging," as your insult compliments in the February editorial indicates, is symptomatic of the requirements of a highly competitive industry (like enlarged memory modules, floating point option and AGOL). 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.

Like 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 "Data-mation", (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.

Outraged

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.

Inputted

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

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

New output from Prentice-Hall - -

- SIMSCRIPT: A Simulation Programming Language
Developed at The RAND Corp., SIMSCRIPT gives detailed instructional formats on how to profitably approach real Air Force problems. Generates sub-routines automatically for batch and multiprogramming, provides a library of pre-compiled FORTRAN sub-routines, and allows subcontractors to any depth. By H. M. Markowitz, H. W. Korn, both Gulf Analyses Center, Inc. & B. Hausner, The RAND Corp. 134 pp., illus. (paperbound) $5.

- COBOL: A Self-Instructional Programmed Manual

- MATRIX ITERATIVE ANALYSIS
An up-to-date study of the use of iterative techniques for the solution of elliptic partial differential equations on large computers. Surveys the basic results on cyclic iterative methods, using the Perron-Frobenius theory of non-negative matrices as a basis for the material. By Richard S. Varga, Consultant Mathematician to Westinghouse and Gulf Research Labs. 322 pp., illus., $16.

- THE LOGIC DESIGN OF TRANSISTOR DIGITAL COMPUTERS
Features the newest, usable concepts in circuit design uniquely combined with the latest logic design methods. Emphasizes NOR and NAND circuit connects and shows you how to implement NOR logic. By Gerald A. Maley & John Earle, both of IBM. 336 pp., 340 illus., $13.

Other NEW Self-Instructional Programmed Manuals
- Programming the IBM 1401
Provides quick insight into techniques and short-cuts usually discovered only after long experience. By James A. Saxon & William S. Pletie, United Research Services, Inc. 208 pp., illus., $9.

- Programming the IBM 1620
Also includes the SPS, FORTRAN, GOFTRAN, and IPS programming systems. By Clarence B. Germain, Coll. of St. Thomas, 208 pp., illus. (paperbound) $5.

- Programming the IBM 7090
Also applicable to the newest 7094 and to a lesser degree to the 704 computer. By James A. Saxon. 210 pp., illus., $9.

- 10-DAYS' FREE TRIAL USE

Prentice-Hall, Inc., Englewood Cliffs, N.J.
Send me book(s) checked below for 10-day examination on approval. In 10 days I will remit for book(s) I keep plus a few cents for postage and insurance. And return unwanted book(s). NOTE—We pay postage and insurance costs if you remit with this coupon—otherwise return privilege.

Markowitz et al.—SIMSCRIPT, $5.
Saxon—COBOL, $6.
Saxon—Prog. the IBM 1401, $9.
Germain—Prog. the IBM 1620, $5.
Saxon—Prog. the IBM 7090, $9.

Name __________________________
Address __________________________
City Zone State
Send free Catalog
Free Quarterly Bulletins

D-0000-Gq
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.

For complete details on peripheral equipment, leasing and other configurations see your Packard Bell representative or write for Data File C15-7.
DESIGN
makes the difference*

"HI-STYLE 400"
The Truly Modern Accent

designed to provide the utmost in operational efficiency, while furnishing a perfect blend of matching decor in computer installations—

*ALL Systems Metal Products are unconditionally guaranteed for FIVE YEARS, under normal usage.
Your SYSTEMS Representative can show you the difference in full detail.

SYSTEMS SALES COMPANY
DIV. SYSTEMS MANUFACTURING CORPORATION
EXECUTIVE OFFICES and PLANT: 13 BROAD ST., BINGHAMTON, N.Y.
— Finest Quality Data Processing Accessories Since 1945 —

April 1963
ANOTHER NEW PRODUCT FROM DAYSTROM

636

the full-size computer that doesn’t limit your problem-solving capability

Here is the general purpose computer specifically designed to meet the challenge of today’s complex computing applications. In fact, the more complex the problem — the more you need the 636.

If you have ever outgrown a desk-top or medium-size computer, you already realize how complex even the apparently “simple” jobs can become. A case in point: Daystrom’s last 15 on-line computer applications averaged 22,000 words — considerably more than the maximum capacity of smaller computers in the 636 price class. For on-line applications, the 636 can be expanded to 294,912 words, more than ten times this average.

Optimally designed for real-time data acquisition and control, the 636 also has the greatest, most economical expandability for off-line use in its class. Consider the 636 for any of these applications: on-line monitoring and control . . . off-line conversion . . . engineering and scientific problem-solving . . . telemetering . . . any application requiring a full-size computer.

Compare these sample 636 features to any other computer in its price class.

* Unlimited number of elapsed time counters. The 636 utilizes any number of memory cells as elapsed time counters without program intervention. * Wide range of instructions — 131 including partial operand, square root, Gray-to-binary, 45 branches, 15 Boolean algebraic logic manipulations. * Direct access to memory. Direct communication between the core memory and peripheral devices gives advantages of multiple computer installations. For example, the following functions can be executed in parallel with the normal program without any loss of computer time: random event counting . . . elapsed time counting . . . reading and writing on the auxiliary drum . . . reading and writing on magnetic tape . . . acceptance of digitized data up to 880,000 bits/sec . . . direct drive of output devices and displays at the same rate. * Ten programmable registers, including two additive index registers and an operand address register. * Sorting of an infinite number of events on a priority interrupt basis. * Expandable memory: core up to 32,768 words — auxiliary drum to 262,144 — tape up to 32 tape handling units. * Basic 636: $95,000.

Get this comprehensive booklet on the 636 by circling the reader service number, or call your local Daystrom office.

DAYSTROM, INCORPORATED
CONTROL SYSTEMS DIVISION
Miramar Road, La Jolla, California • Telephone: 454-0421 Area Code 714

CIRCLE 15 ON READER CARD
Melpar, a leader in electronics research, development and manufacture is undergoing full scale conversion to EDP which has created immediate openings for Senior Programmers for Business and Scientific Systems including:

- Accounting Systems
- Production Control Systems
- Material Control Systems
- Scientific and Research Applications
- Fortran Machine Language Applications

Requirements include experience on IBM 1401, 1410 or 7000 series equipment and two or more years' experience in analysis of problems, block diagramming, flow charts and checking of coding for reliability. A degree in Mathematics desired.

For an expense paid visit, send detailed resume to:
John A. Haverfield
Manager—Professional Placement
MELPAR, INC.
A Subsidiary of Westinghouse Air Brake Company
3369 Arlington Blvd.
Falls Church, Virginia
(a suburb of Washington, D. C.)

an equal opportunity employer

---

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...
Things happen fast at Anelex. Paper can travel 333½ inches a minute and make up to 2000 discretely positioned stops on the way. Print Rolls revolve 16½ times a second. The movement of Print Hammers is measured in milliseconds and timed to a few microseconds. At Anelex, the synchronizing of these mechanical motions with electrical impulses is under constant study with modern research equipment. The purpose, of course, is to make the finest High Speed Printer Systems even better. For your next data processing project, be sure you choose the finest High Speed Printer System...choose Anelex.

BRENTEN
The Service for ULTRA SOPHISTICATES
(Sophisticates, take no offense—our clients need to be用车)

COMPUTER CAREERS

The need for Managers and Seniors in the $10-20,000 class is critically urgent for many of our National clients in N.Y., N.J., Calif., Fl., Boston, Ohio, Wash., D.C., Huntsville, Houston & Dallas, with background and proven abilities in the following areas.

APPLIED SYSTEMS
- Compilers
- Assemblers
- Automatic Languages
- Utilities

SCIENTIFIC COMPUTATION & ANALYSIS
- PhD in MATHEMATICS—NUMERICAL & MATHEMATICAL ANALYSIS
- REAL TIME—OPERATIONAL OPERATIONS RESEARCH SYSTEMS DESIGN
- INFORMATION RETRIEVAL DIAGNOSTICS
- DIGITAL AND LOGICAL DESIGN

Brenten's unique concept in professional placement in the computer field pays off for you. We combine personalized attention with a systems approach to career development. Our permanent staff of 4 graduate engineers meets regularly to discuss your career objectives in an effort to place you in the position best suited to your abilities and requirements.

DIRECTOR OF OPERATIONS RESEARCH SPACE SYSTEMS... to $25,000

PAY-DIRECTOR SPACE COMPUTATION CENTER... to $22,000

Our Fees are Paid By The Companies We Serve. Write in confidence, outlining Parameters or call (collect) Mr. Frank Jones 201 MARKET 2-0915

E.D.P., National Search Div.

CIRCLE 16 ON READER CARD

DATAMATION

CIRCLE 86 ON READER CARD
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!

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.

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.

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.

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."
Your instrumentation tape supplier should be a complete source.

Soundcraft is!

With Soundcraft Instrumentation Tapes, you can meet every data recording need. Sixteen combinations of coatings and base materials are available to fulfill the recording time, resolution, wear-life and output characteristics required by your data recording equipment.

Common to each instrumentation tape is Soundcraft's technical competency. This is demonstrated by the unique oxides and binder systems which are engineered to provide superior physical and magnetic qualities for all recording applications. The Soundcraft plant is one of the newest and best-equipped in the industry—where advanced manufacturing processes and control methods produce superior instrumentation tapes. Reliable data recording is assured.

In military and space facilities... among industry leaders... Soundcraft Instrumentation Tapes are meeting the most exacting performance standards. They can meet yours, too.

Soundcraft Instrumentation Tapes are available from stock for immediate delivery. Write for literature.
YOU DON'T HAVE TO SAY A WORD to send great masses of business data to any location by telephone. New Bell System DATA-PHONE service is the reason why.

Machines do the talking—16 times faster than people can talk.

Almost any kind of word or figure data in any amount can be transmitted immediately any time you want—at regular telephone rates.

There's no faster, safer and more economical way to ship data than by DATA-PHONE service. Have a talk with one of our Communications Consultants about it. Just call your Bell Telephone Business Office and ask for him.
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 numerically 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 arrive at satisfactory standards in a short time."

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

---

languages 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 one 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 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, 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 ALCOLs. 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

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 piec-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. Key punching 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 software men, 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 Cysbers, 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 computer men 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 Cysbers and his associates at Rocketdyne is particularly interesting. The programmer writes in canonical ALGOL '60 symbols. As has been mentioned, key punching 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 Cysbers.

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. Cysbers 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.
ATTITUDES TOWARD INTELLIGENT MACHINES*

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

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, 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 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. 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.
There are some strong positivists in the USSR. For example, I. A. Polotayev 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." Other strong positivists include S. L. Sobolev (an academician and a well-known mathematician) and A. A. Lyapunov. 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."  

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."  

**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. 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 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, 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. Birukov in the Sechenow Physiological Journal of the USSR calls specifically for this goal."  

A recent visitor to the USSR reports that Soviet psychologists 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. Gutman, 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 President 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 legitimize such research as being in harmony with communism. For example, recall the earlier quote about Marx.

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. 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. Gel'fand, 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 President of the Academy. 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 "Frizzell," 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 said that he thought...
INTELLIGENT MACHINES—Part Two

the prediction conservative; it would happen sooner.

Conclusions

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.

References

37. Moiseyev, K., Man and the "Thinking" Machine, Joint Publications

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.

Irvin 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.


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 $2,150. 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."

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."

Kurzenknabe and the modular 301
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

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.
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

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 solvable. Of course, not all problems that are solvable 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 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 obtained 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 impatiently 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—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 was forced, as a heavy-handed or business 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 engineering 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 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 that man, who sees no one but the 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-dimen-
sional 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
closedly 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 line 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
he was to compute had some interesting transformation prop-
erties. 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 dis-
play 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 con-
tribution of the staff member was that he had reduced
the computational results to a manageable and compre-
hensible 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
member of the computing staff notices it, sometimes, it
will be quite convincing 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 spec-
trum 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 marvel-
ous, 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 (scienti-

cally speaking) users.
Another, I think it is a common 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 be-
gun 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

1

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 con-
troversy can thus develop somewhat apart, and not im-
peding, 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 cumber-
some use. This is usually seen in the requirement that sub-
scripts or superscripts be written on the same line as the
quantity subscripted or superscripted. That such a restric-
tion can be obviated is indicated by the recent announce-
ment of the Subscripting-Superscripting-Typewriter-Key
Punch, in use at Los Alamos (K. C. 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 allows the user more
than one drawback. The practical and widening use of computers both
in the business and scientific community.

The advent of a fully flexible optical scanner that could
identify the usual characters found in scientific and non-
scientific 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 con-
cern 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
statement such as: $x + y = z$ always begins with some
presumably simple and constructed language letting the nonprofessional
computer user take
fuller advantage of machine capabilities than is now permitt
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 serv-
ic, 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
shoppers, 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.

April 1963
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 its 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 publishing 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.,

April 1963
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.

AMERICAN FEDERATION OF INFORMATION PROCESSING SOCIETIES

Chairman,
Board of Governors
Dr. Willis H. Ware
The RAND Corp.
Santa Monica, Calif.

Chairman-Elect,
Board of Governors
Mr. J. D. Madden
System Development Corp.
Santa Monica, Calif.

Executive Committee
Dr. Arnold A. Cohen — IRE
Univac
St. Paul, Minn.

Dr. Morris Rubinfen — IEE
Moore School of Electrical Engineering

Dr. Allen J. Perlis — ACM
Carnegie Institute of Technology
Pittsburgh, Pa.

Dr. William H. Buchholz — IRE
IBM Development Laboratory
Poughkeepsie, N.Y.

Dr. Frank E. Heat — IRE
Lincoln Laboratory
Lexington, Mass.

Mr. John E. Sherman
Simulation Councils Inc.
Arlington, Va.

Dr. Morris Rubinfen — AIEEE
Moore School of Electrical Engineering

Dr. Allen J. Perlis — ACM
Carnegie Institute of Technology
Pittsburgh, Pa.

Mr. J. D. Madden
System Development Corp.
Santa Monica, Calif.

Dr. Werner Buchholz — IRE
IBM Development Laboratory
Poughkeepsie, N.Y.

Mr. Frank E. Heat — IRE
Lincoln Laboratory
Lexington, Mass.

Treasurer
Mr. Frank E. Heat
Lincoln Laboratory
Lexington, Mass.

Public Relations Chairman
Mr. J. D. Madden
System Development Corp.
Santa Monica, Calif.

Public Information Director
Mrs. Phyllis R. Huggins
Malibu, Calif.

Board of Governors
Mr. G. L. Hollander — AIEEE
Hollander Associates
Fullerton, Calif.

Mr. C. A. R. Kagan — AIEEE
Lincoln Laboratory
Lexington, Mass.

Mr. W. M. Carlson — ACM
Office Sec. of Defense
Washington, D.C.

Dr. Harry D. Huskey — ACM
U. of Calif. Computer Center
Berkeley, Calif.

Mr. H. T. Marcy — AIEEE
IBM Corp.
White Plains, N.Y.

Mr. W. L. Anderson
General Kinetics Inc.
Arlington, Va.

Secretary
Miss Margaret R. Fox
Nat'l Bureau of Standards
Data Processing Systems Div.
Washington, D.C.

* IEEE as of Jan. 1, 1963
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 inter-disciplinary 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 accommodations on university campuses. Recent expansion of the exhibits has 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

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 equip­
ment 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 orga­
nization 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 depart­
ure 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
machine 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 relation­
ships 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 manage­
ment 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

April 1963
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 re-programming 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. If 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.
BOTH THESE MAGNETIC TAPES HAVE A POLYESTER BASE
...BUT ONLY ONE IS MYLAR® (8 YEARS PROVEN)

Eight years ago computer tape of Du Pont MYLAR® polyester film appeared on the scene and set new standards of reliability. Naturally enough, people whose needs called for a magnetic tape of highest performance couldn’t risk a tape other than MYLAR. Now, other polyester films are beginning to appear. They are not all the same: MYLAR is a polyester film, but other polyester films are not MYLAR. In the past you could safely assume you were getting MYLAR when you specified "polyester base". Today you cannot. There's only one way to be sure you're getting the MYLAR you've used and trusted for magnetic tapes of proven reliability: specify MYLAR by name. E. I. du Pont de Nemours & Co. (Inc.), 10452 Nemours Bldg., Wilmington 98, Delaware.

*Du Pont's registered trademark for its polyester film.
Actual working speed—meaningful speed—in a computer is a combination of many factors. Consider our ASI-210. Its short 2-microsecond total memory cycle is important, but even more important are the design features that make it possible to use this speed in normal operations.

ASI-210 is proving in actual use that its overall computer speed is unsurpassed in its size and price range. We planned it that way by building in adequate memory capacity, convenient instructions, a full complement of arithmetic commands, fast and easy communication with peripheral devices — plus user-oriented software.

The result is an exceedingly useful and versatile computer. It is available at an eminently reasonable price. We'd like to tell you more about our ASI-210, and we'd like to tell you about new resources and new capabilities that have become available through our recent acquisition by Electro-Mechanical Research, Inc., Sarasota, Fla.

Write for our ASI-210 bulletin, or ask an ASI representative to tell you how the newly combined technical resources of ASI and EMR can solve your specific computation problem. Contact Advanced Scientific Instruments, 5249 Hanson Court, Minneapolis 22, Minn.

ASI-210 FEATURES: Completely solid state, 2-microsecond total memory cycle, parallel operation, 21-bit words, 4096-word randomly addressable core memory expandable in modules to 32,768 words, 6-microsecond add time, 50-microsecond multiply time, high speed I/O simultaneous with computation.

Trapped program interrupt, indirect addressing, multiple index registers, built-in multiply and divide, Fortran compiler, assembler and complete diagnostic routines, paper tape system included.

Power consumption under 1750 watts, standard 110/220 volt 60 cycle AC. No special temperature or humidity control needed. ASI equipments are IBM compatible.

PERIPHERAL EQUIPMENT: Options include magnetic tape units, typewriters, punch card units, line printers, additional assembly registers, converters and plotting equipment.

EXCITING OPPORTUNITIES for computer-oriented professionals continue to exist in our rapidly growing organization. Write or call today.

MORE COMPUTATION PER DOLLAR
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.
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.
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.

---

*April 1963*
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:
A. D. Hestenes, General Motors Corp., Detroit, Mich.

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
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
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:
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
**WHAT IS BENSON-LEHNER?**

**benson-lehner** n. (bĕn-son-lay-nur)

1. A company manufacturing: readers (OSCAR-BOSCAR-LARR-TDT) to digitize graphics; printer/plotters (ELECTROPLOTTER, MINI PLOTTER, MICROFILM PRINTER/PLOTTER) to graphitize
digits.
2. Specializing in pre-natal and post-natal machine care.

In other words the largest Company devoted to the specialty of feeding
graphics into computers and getting graphics out—simple isn’t it?

**DIGITIZE GRAPHICS**

**INPUTS**

- FILM
- STRIP-CHARTS
- CONTOUR MAPS
- ENGINEERING DRAWINGS

**READER INPUT CAPABILITIES:**
- 8mm to 140mm film
- strip charts
- drawings to 60" x 60"
- maps - aerial photographs
- accuracy to 10 microns

**WE CONVERT**

- Position
- Angle
- Voltage
- Profile
- Time
- Amplitude
- Thrust
- Flow
- Motion
- Acceleration
- Reflection
- Pressure
- Temperature
- Vibration
- Azimuth
- Stress
- Strain
- Axial Forces
- Bending Moments
- Precipitation
- TO DIGITS
- AND GRAPHICS

**GRAPHITIZE DIGITS**

**OUTPUTS**

- WE PRINT
- WE PLOT

**PRINTER PLOTTER OUTPUT CAPABILITIES:**
- finished drawings to 60" x 60"
- microfilm
- accuracy to 0.125
- speed of 60,000 points per second
- 62,500 characters per second

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

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

© benson-lehner corporation / 14761 califa street / van nuys, california
R. N. Thompson and A. J. Wilkinson
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. Boyle
E. Fredkin
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.
H. Meissinger, Space Technology Laboratories, Redondo Beach, Calif.

4.1: DYSAC—A Digitally Simulated Analog Computer
J. B. 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.

April 1963

4.2: DAS—A Digital Analog Simulator
R. A. Gaskill and J. W. Harris
Martin Company, Orlando, Fla.
A. L. McKnight
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. Windenuecht
Space Technology Laboratories, Redondo Beach, Calif.
The feasibility of an orbital docking system, comprised of a manned astrovichelle (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:
M. J. A. Arnow, MIT Lincoln Laboratory, Lexington, Mass.

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.
Now look at a user-designed computer

Before you choose a computer, take a hard look at the GE-225. Is it user-oriented? Naturally. It was designed by the company that pioneered the use of computers in industry.

General Electric is using more than 110 computers
every day on a wide range of problems. It would be hard
to imagine an application in durable goods manufactur-
ing, for instance, that hasn’t been computerized in one
G-E operation or another. Production control, inventory
control, payroll, accounts receivable, business forecasting,
resources planning, you name it.

If you’re not in a position to design your own com-
puter, why not look at a computer that was designed by
a user—a user with the same problems you have. Get all
the facts on the GE-225 now. Write General Electric
Computer Department, Section J-4, Phoenix, Arizona.

Progress Is Our Most Important Product

GENERAL ELECTRIC
Command Systems profoundly influence the outcome of military missions. Successful operations require systems which provide military leadership with information to make decisions... with communications to transmit commands.

The pace of modern warfare... vastly different from Gettysburg... requires computer controlled systems such as the Air Force Command and Control System 473L. TECH/OPS programmers are playing a key role in providing the complex programs to make this System operational. When completed, 473L will supply Air Force planners and decision makers with vital information needed to make timely and accurate decisions for any military emergency.

TECH/OPS work on 473L is typical of the Company's work in the System Sciences... CORG, OMEGA, COMSAT, TRAG, VALOR — to name a few other programs. Programs which have a direct influence on military and government planners and decision makers. If you would like to work in an environment where your individual contributions count, we would like to hear from you. Our present staffing requirements are described on the facing page.

**TECHNICAL OPERATIONS**

Research

*An Equal Opportunity Employer*

---

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

R. H. Spitzer 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 1030-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
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 

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. Campagne, 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 re­ 
cent 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 

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

Positions are available for programmers 
at TECH/OPS’ Washington, D. C. Research 
Center to work in a variety of fields. Some 
of them are described below.

COMMAND AND CONTROL SYSTEMS 

In this area we are writing operational programs 
for one of the largest and most complex command 
systems being developed in the country. When com­ 
pleted the system will provide military planners and 
decision-makers with a system for very short-time 
reaction to almost any military emergency. For this 
program we are seeking programmers with about 
three years of experience preferably in systems pro­ 
gramming on large-scale computers.

COMPUTER WAR GAMES 

 TECH/OPS has long been a leader in “gaming” tech­ 
niques starting with two-sided player-participation 
map games developed several years ago. At present, 
our work in this field ranges from computer simu­ 
lations of large-scale global air war battles to semi­ 
automated limited war operations. We are seeking 
experienced programmers who are interested in 
computer war games.

TECH/OPS has several intangibles that are worth thinking 
about if you are seeking a new position. We have 
a somewhat informal atmosphere that provides an 
environment that encourages an individual to do his best 
work. An individual’s progress is tied to achievement 
and not length of service. We like to think we operate 
with a minimum of red tape and spend our efforts solv­ 
ing problems rather than generating organization charts, 
administrative memoranda and the like. Lastly, we have 
a reputation for doing good work and maintaining a 
high-caliber staff. Write:

Mr. James L. Jenkins, Director 
Washington Research Center 
3600 M St., N. W., Washington, D. C.
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.

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. Pryves
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, 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.
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

The widespread use of numerically-controlled manufacturing techniques has given special impetus to the application of computers in design.
He's expecting a lot from his RCA 301 computer, and he'll get it! The 301 will handle his routine processing without taking a deep breath. Then creative programming direction by RCA will enable him to marshal trends, sort facts, forecast sales and make incisive management decisions involving a multitude of problems.

Thus the 301 aids in making money as well as saving it. Added to this versatility is exceptional hardware reliability as well as built-in expandability—an RCA design concept that cuts down costly reprogramming.

Expecting a lot from EDP? You'll raise your expectations when you check out the RCA 301.

RCA ELECTRONIC DATA PROCESSING, CHERRY HILL, N. J.

The Most Trusted Name in Electronics
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. Rodriguez
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
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.

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 yields 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. Schaetier 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
The Associative or Context-Addressed Memory is attractive from the logician's 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.

Thursday, May 23, 2 to 5 p.m., Room 2001-B
SESSION 10:
Machine Organization II
April 1963
Now Audio introduces a new computer tape . . .

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

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

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

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

*Du Pont trademark for its polyester film.
DATAMATION
BOUND VOLUMES

The publishers of DATAMATION are setting aside a limited
supply of each issue of DATAMATION for 1963 and will
bind to order the twelve issues of 1963 with a sturdy
maroon cover insuring years of lasting use. Ideal for li-
braries, company references, personal files, etc.

16.50 each, plus postage, or Two Copies
for 30.00

Purchaser's name may be stamped on spine at
5c per letter extra.

DATAMATION Magazine .................. 307
1830 W. Olympic Blvd.
Los Angeles 6, Calif.
141 E. 44th St.
New York 17, N. Y.

Data Products Corp. .................. 612-618
8535 Wernor Dr.
Culver City, Calif.

Data Systems, Inc. .................. 324
20535 MacC Ave.

Digital Equipment Corp. ............... 106-112
146 Main St.
Maynard, Mass.

Digitronics Corp. .................. 309-313
10 E. 40 St.
New York 16, N. Y.

E. I. duPont.de Nemours & Co., Inc. .. 301-303
Wilmington, Del.

Dymec-Div. of Hewlett-Packard Co. .... 331
395 Page Mill Rd.
Palo Alto, Calif.

Electronic Associates, Inc. .............. 511-517
Long Branch Ave.
Long Branch, N. J.

Engineered Electronics Co. ............. 122-124
1441 E. Chestnut Ave.
Santa Ana, Calif.

Fabric-Tek, Inc. .................. 507-509
P.O., Box 645
Amery, Wisc.

Ferranti Electric, Inc. .................. 401-405
Industrial Park #1
Plainview, L. I., N. Y.

Floating Floors, Inc. .................. 508-510
22 E. 42nd St.
New York 17, N. Y.

Complete Access Flooring

Plus . . .

at Booths 119 and 120
DPMA Conference
Cobo Hall, Detroit, Michigan
June 25-28, 1963

electronic flooring systems, inc.
474 mulberry street, newark 14, new jersey
area code 201/telephone no. 248-6866

CIRCLE 30 ON READER CARD
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.
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
◆ Does not affect punch pin wear
◆ Repels foreign matter pickup
◆ Does not form deposits

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.
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.
... 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.

**Once Upon A Time**

There was a young & eager computer programmer...
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 breakthrough 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; 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).

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 20-60 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 2.3-5.5 “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


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.

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
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.
NEWS BRIEFS...

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 accordance 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 $20-$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,
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" x 17", 30" x 30", and 45" x 60" 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
NEWS BRIEFS . . .

Flexowriter, and tape punch is priced from $43,000-$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 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 835K 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 computer will be mounted. North America's Autonetics Divs., 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-

TEST YOUR KNOWLEDGE
OF SCIENTIFIC AND ENGINEERING COMPUTERS

Know the facts — and you will know the one sure way to find the computer that suits you best

The fastest computer is the most efficient.

TRUE ( ) FALSE ( )

False, if by "fastest" is meant computing time only. Usually it represents only about 10% of the total time required to solve a problem. Base your judgment on "total problem-solving time," remembering that programming is often 90% of the job. The Recomp® line of small and medium-scale computers is designed to save, not microseconds in computing, but hours in problem solving. They are simple to program, easy to operate, have exceptionally large memories.

Comparably priced computers are about alike.

TRUE ( ) FALSE ( )

False. Computers vary rather widely in efficiency, and vary in ways they can be used. And true cost isn't always reflected in the price tag. Make sure, when you buy, you are getting the entire working system your job requires. For example, the Recomp III, a complete engineering computer system, is ready to start solving problems when you plug it in. It leases for just $1,495 and is an ideal small-scale computer. For medium-scale needs, Recomp II can be leased starting at $2,495.

Computer operation requires special personnel.

TRUE ( ) FALSE ( )

True or false, depending on your computer choice. Some do — a factor to consider in connection with cost. But here is another important consideration. Computers which require programming personnel for operation double the communication time between the originating scientist or engineer and the computer. Direct contact between the computer and the user increases efficiency and reduces chance for error. Engineers with less than eight hours instruction have been able to use Recomp computers profitably.

There is no simple way to judge a computer.

TRUE ( ) FALSE ( )

True. However, a feasibility study aimed at determining which computer best suits your company's needs can help you make a sound choice with a minimum of wasted effort. Incidentally, no feasibility study is complete without consideration of the Recomp line of solid-state computers. Would you like to learn the "shortcuts" of studying computer values? We will be happy to send you a free copy of the interesting "Management Guide to a Computer Feasibility Study." Use the handy coupon below.

RECOMPS

Recomp is a product of Autonetics
Industrial Products

Autonetics is a Division of
North American Aviation

Recomp
Dept. 54, 3400 East 70th St., Long Beach, Calif.
Please send me copy of "Management Guide to a Computer Feasibility Study."

Name ____________________________
Position ____________________________
Company ____________________________
Address ____________________________
City ____________________________ Zone ______ State ____________________________

CIRCLE 39 ON READER CARD
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'

Niagara Falls, New York • Park Ridge, Illinois • Denton, Texas • Emeryville, Calif. • Over 500 offices and factories in North America

Moore Business Forms Inc.
NEWS BRIEFS...

Scientific research, education, and computational 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.

CIRCLE 107 ON READER CARD

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 108 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.

April 1963
“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.

“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-
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 18" 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.

**Datcase/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
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."

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.

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.

Don't worry your pretty head, Penelope. Every single reel of Computape is individually pre-tested to guarantee delivery of 556 or 800 bits per inch with no dropout in severest computer applications. Every reel is recorded and read throughout its entire length — and any defect large enough to cause 50% drop in the signal strength of a single bit is cause for rejection.
optical reader
The Videoscan accepts documents from 2¼-8½" 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

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 202 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 203 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

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.

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.

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

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 Shanes 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.

April 1963
BENNETT
Are you presently exploring new job opportunities? Then the name to remember is:
BENNETT!

MGR: COMPUTER SYSTEMS $18,000
MS in EE with applicable exp. Equipment exp. on Univac 1105 & IBM 7090.
SR. PROGRAMMERS $11-15,000
Responsible for overall planning & supervision of computer programs. Assign & coordinate work. Exp. in AN/FSC-7NM, IBM 700 Series or Phico 200.
SYSTEMS PROGRAMMER $9-16,000
Advanced programming techniques. Emphasis on IBM equipment—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.
APPLIED MATHEMATICIANS to $22,000
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 comm and/or Ind Liaison exp with data processing or equipment field.
SALES ENGINEERS to $15,000
Eng’g deg + 4-5 yrs sales exp in any phases of DDP field.

BENNETT ASSOCIATES
Commercial Trust Bldg. • Locust 3-4830 • Philadelphia 2, Pa.

CIRCLE 79 ON READER CARD

computer
careers

NATIONWIDE CHOICE

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

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

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

☐ Scientific Computation and Analysis — Will work on unusual Aerospace applications. IBM 7090 type experience & strong Mathematics

☐ Real Time—Operational

☐ Software Development—Language Development, New Compilers

☐ Operations Research—Linear Programming plus Computer Applications

☐ Systems Design & Analysis

☐ Systems Planning

☐ Programming—Large Scale Computers

☐ Digital & Logical Design

☐ Command & Control Systems

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

Ph.D.—MATHEMATICAL RESEARCH
To $24,000

MANAGER—DIGITAL SYSTEMS
To $23,000

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

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

a&n
ALBERT. NELLISSON, INC.
Leading Consultants to Management in the Data Processing Field

510 MADISON AVENUE, N.Y. 22, N.Y.

CIRCLE 80 ON READER CARD

DATAMATION

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 advanced circuit designs for feedback amplifiers and control electronics, write to: E. C. Knapo, Ampex Computer Products Company, 9920 West Jefferson Blvd., Culver City, California. An equal opportunity employer.
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 bidirec-
tional 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 charac-
ters 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 avail-
able 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/TY
PE, 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 sys-
tem utilizes 556 bits per inch tape
and has been designed for off-line
digital plotting of output data from
large-scale computers. The system in-
cludes 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
IMMEDIATE OPENINGS
COMPUTER ENGINEERS
SOPHISTICATED SYSTEMS
Leading company in the development of communication
and data processing systems has immediate need for
scientists and engineers who desire to use their skills in
the further development of all-purpose computers offer-
ing the utmost in flexibility, using unusual memory and
switching techniques.

SPECIFIC OPENINGS EXIST IN THE FOLLOWING AREAS:
Systems Applications Systems Analysis
Logic Circuitry Design Memory Storage Design
Tape Transport Design Data Transmission Design
Sonic Delay Lines High Speed Trunking
Magnetic Tape Units Signal Amplifiers
Programmed Logic Storage Line Printers
Hardware Design Software Programming
Microprogramming Applications Analysis

Starting salaries are above industry average. Company
encourages and supports graduate programs.

Expenses paid for relocation to moderate cost living
area where suburban living is at its best.

Please submit resume to:
MR. JOSEPH McELROY
Technical Director

ROBERT M. HOLM ASSOCIATES
1530 Chestnut Street, Philadelphia 2, Pa.
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

"Roundicator" chart of a 1-in. standard used to check micrometers. Diameter is constant to within 11 micrometers, but die is out of round by 23 micrometers.
logic kit
The Facologic 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’nstrip surfaces, measure 30" x 54". Price of matte is 88, of cut’nstrip 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

DATAMATION

COMPUTER

RESEARCH SCIENTISTS

SALARIES $10,000 TO $20,000 +

Our client is a leading nonprofit organization, located in the Washington, D.C. area, whose end product is reports.

They are comparatively new in the computer sciences field, although very well established as an organization and in other activities. This comparative newness, in conjunction with their determination for excellence, requires new programs and new approaches on their part, and provides exceptional opportunities for advancement and development for those joining them.

Since they are new in this field, they need outstanding professionals to head up and give direction to their work in the areas noted below.

Actually, two types of computer scientists are needed.

Common denominators will be the interest, determination, and ability to push back, if not to hurdle, the frontiers of the “state of the art” in computer science.

A. One group of professionals will work independently on programs that they themselves take the lead in developing and formulating.

B. The other group will be just as imaginative and creative, but will work in sponsored areas, with goals laid out a bit more.

Areas of interest include, but are not limited to:

1. Machine problem or procedure oriented languages
   - Pattern recognition
   - Programmed learning
   - Artificial intelligence
   - On-line programming
   - To work on research in computer science

2. Compiler development for problem or procedure oriented languages. Experience on 7090 machine languages and in machine war gaming useful. To work on compiler for war game oriented languages.

3. Model making and programming of machine war games, machine simulation of military operations, or other military computer applications. Experience in construction and/or maintaining operating systems and compilers desirable, for work on a war game oriented language and compiler study.

4. Developing scientific computer applications. Emphasis in machine language coding for IBM 709 or 7090. Will assist in design, development and maintenance of an operating system for IBM 1401-7040. Will also provide consultation and/or instruction in computing techniques and processes.

Desired backgrounds should include graduate degrees in Mathematics, Engineering, or the Physical Sciences. Candidates, particularly for level A., should also be capable of successfully making verbal and written presentations, and of communicating effectively with non-computer scientists as well.

Interested parties who are not planning to attend are also invited to submit their resumes at the earliest possible date. Interview arrangements will be made for Washington, D.C., and possibly several other major cities.

We have other positions of a basically similar nature, as well as openings covering every phase of the electronic data processing field, with other clients coast to coast. Resumes should be as complete as possible. Indicate the type of work sought and include current salary, salary requirements, and geographic areas you will not consider.

All inquiries treated confidentially. All charges and relocation expenses are paid for by our client company.

Contact: Herbert Halbrecht
Herbert Halbrecht Associates, Inc.
322 South Michigan Avenue
Harrison 7-2876
Chicago 4, Illinois

11691 National Blvd.
Los Angeles 54, Calif.
Phone: 478-8637

CIRCLE 82 ON READER CARD

April 1963
NEW...Subminiature

ILLUMINATED

PUSHBUTTON

SWITCHES

and matching

Indicator Lights

DIALCO—your single source for Switches and Indicator Lights. Assures uniformity, high reliability, and economy. Units are compact, made for single hole (keyed) mounting in panels up to 3/16" thick...Switches are of the silent, momentary type, requiring light pressure for a smooth, positive action. Contact arrangement is S.P.S.T., normally open or normally closed. Ratings: 3 amps, 125 V A-C; and 3 amps, 30 V D-C (non-inductive). The switch mechanism is completely enclosed and independent of the lamp circuit. The light source is the T-13/4 incandescent lamp, available in voltages from 1.3 to 28 Volts.

Units are designed for a wide range of control and readout applications—in computers, dataprocessing, communication, and remote control equipment; in automation, etc. For complete data, request our 8-page, full-color Catalog L-169.

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. RADIA-TION INSTRUMENT DEVELOPMENT LABORATORY, INC., 4501 W. North Ave., Melrose Park, Ill. For information:

CIRCLE 223 ON READER CARD

digital pressure encoder

The 1D 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

HOGAN FAXimile recorders are available with up to 2000 individual styli for simultaneous recording. A wide range of stylus spacings is offered—up to 100 to the inch for high-speed facsimile, television and radar recorders and high resolution printers and plotters. Chart widths to 30" and feed rates to 50" per second.

Hogan specializes in electrolytic techniques for event, spectrum analysis, oscillograph and facsimile recording, frequency time analysis and special purpose binary and gray scale record applications. Hogan electrolytic recording papers provide a permanent high contrast black on white record which is reproducible on most conventional office duplicators.

Whatever your recording problem may be—contact HOGAN FAXimile, a subsidiary of TELautograph Corporation, 635 Greenwich Street, New York 14, N.Y.

HOGAN FAXimile Corporation • 635 Greenwich St., New York 14, N.Y. A SUBSIDIARY OF TELAUTOGRAPH CORPORATION
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.

North American Aviation's Space and Information Systems Division has challenging positions available in

SCIENTIFIC PROGRAMMING FOR MANNED SPACECRAFT

Long range space programs that will extend into the next decade have created several openings in the Space and Information Systems Division's Scientific Programming Department.

PROBLEM AREAS INCLUDE:

- Aerodynamics
- Combined Analog-Digital
- Control Systems
- Data Reduction
- Flight Dynamics
- Ground Support Equipment
- Guidance and Navigation
- Information Retrieval
- Life Systems
- Math Analysis
- Performance
- Propulsion
- Radiation-Shielding
- Real Time Simulation
- Reliability
- Structural Dynamics
- Systems Integration
- Telecommunications
- Thermodynamics
- Trajectories

These positions require a bachelor degree in engineering, math, physics, or a related field, and two years applicable experience.

Several positions are available which require advanced degrees in applied mathematics and numerical analysis.

To learn more about the opportunities at S&ID, please send your resume to Mr. E. D. McKenzie, Employment Services, Department 020, Downey, California.

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

SPACE AND INFORMATION SYSTEMS DIVISION
NORTH AMERICAN AVIATION

April 1963
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.
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®
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"
IBM asks basic questions in programming

How can we make computers more accessible?

Existing systems which process programs sequentially may take considerable time to return processed results. Therefore, IBM is exploring a theoretical system which would cycle several programs through the central processing unit (CPU) at extremely short intervals. This approach could achieve superior user response time by effectively giving each program immediate access to the CPU. The proposed system combines multiprogramming and multiprogramming techniques. It would use an IBM 7090, together with a programmed multiplexing system, to transfer messages in and out of core memory without bothering the CPU. Built-in protection would keep programs in memory from being destroyed by programs using the CPU. Drum storage units with fast access time would store partially executed programs with a disk file providing auxiliary storage.

Governed by a supervisory multiprogramming system, programs would cycle between memory and the drum storage, receiving a "slice" of processing time each time they reached the head of the queue. The supervisor would allocate memory space, maintain work schedules, assign vacated processing facilities, and monitor the interrupt system. By overlapping input-output operations and time-sharing the CPU, systems like this may make future computers more convenient to use as well as more efficient to operate. If you are interested in making important contributions in programming systems or other fields in which IBM scientists and engineers are finding answers to basic questions, write to: Manager of Employment, IBM Corporation, Department 701D1, 590 Madison Avenue, New York 22, N.Y. IBM is an Equal Opportunity Employer.
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: CIRCLE 130 ON READER CARD

PSUEDO RANDOM DIGITS: For use in system's 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. STATISTICAL TABULATING CORP., 1333 Westwood Blvd., Los Angeles 24, Calif. CIRCLE 131 ON READER CARD

TELETYPING DECALS: Self-adhesive reproductions of Teletype equipment may be used in preparing data communications flow charts and systems layouts. TELETYPING CORP., 5555 Touhy Ave., Skokie, Ill. For copy: CIRCLE 132 ON READER CARD

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: CIRCLE 133 ON READER CARD

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: CIRCLE 134 ON READER CARD

DATA DISPLAY: This six-page booklet has specifications and applications of the CRT 30 display device. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy: CIRCLE 135 ON READER CARD

TRANSPORTER REFERENCE CHART: A six-page booklet describes various types of transporters 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: CIRCLE 136 ON READER CARD

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: CIRCLE 137 ON READER CARD

NEW! OFFSET PLATES FOR HIGH SPEED PRINTERS

When zeros begin to look like:

000 instead of this: 000

When characters begin to droop-squat or tilt—
or get that FEAHERY look

it's time to change to REPLICA'S all new HI/SPEED OFFSET PLATE

WHEN IT IS A QUESTION? OF QUALITY...

IN HIGH SPEED PRINT-OUT...THE ONE SURE ANSWER IS REPLICA'S HI/SPEED OFFSET PLATES!

This latest development from REPLICA eliminates feathery, bleeding, distorted copies on high speed printers. REPLICA'S HI/SPEED OFFSET PLATES in combination with REPLICA'S NEW HI/SPEED RIBBON can give you what you want...the very best in high speed reproduction...Write today for details. Replica Offset Plates are available through your favorite forms manufacturer.

REPLICA PRODUCTS CORPORATION
22-42 JACKSON AVE., L.I.C. 1, N.Y.

GENTLEMEN:
I am interested in offset plates for the (model) ___________high speed printer.
Please send details.

Name ________________________________
Company ________________________________
Address ________________________________
City __________________ State __________________
RAPID GROWTH AT CONTROL DATA CREATES OPPORTUNITIES IN MANY KEY PROFESSIONS

- Systems Engineers
- Circuit and Logic Design Engineers
- Computer Sales Engineers
- Systems Programmers
- Systems Analysts
- Applications Analysts

MARKETING DIVISION — Nationwide Locations

COMPUTER SALES ENGINEERS: Openings exist now for persons with digital computer experience in sales, engineering and/or applications programming.

APPLICATIONS ANALYSTS: Positions include consulting with customers to analyze their problems for computer applications. Experience required in scientific programming for medium or large-scale computers. Knowledge of FORTRAN or other scientific compilers is helpful.

SEND RESUME TO H. E. TRADER, MARKETING DIVISION, 8100 34TH AVENUE SO., MPLS. 20, MINN.

SYSTEM SCIENCES DIVISION
Los Angeles Location

PROGRAMMER ANALYSTS: Programmers needed to work with our System Sciences Division to provide support in the area of computer and data systems analysis. Specific contract research and development of mathematical and statistical processes and programming systems.

Qualifications: A minimum of 3 years scientific programming experience is required. College degree is necessary.

SYSTEMS ENGINEERS: To work with a small group of highly specialized individuals involved with developing an integrated capability in all phases of systems technology and computer application.

Qualifications: EE with a minimum of 2 years systems engineering experience.

SEND RESUME TO: A. D. TSCHIDA, CONTROL DATA CORPORATION, 8100 34TH AVE. SO., MPLS. 20, MINN.

DATA CENTERS DIVISION
Minneapolis, Palo Alto and Washington Locations

SALES REPRESENTATIVES: To sell computer time and programming and analysis services for our Data Centers Division. The centers now in operation are located in Palo Alto, California; Minneapolis, Minnesota and Washington, D.C. Other locations to be announced.

Qualifications: A minimum of 2 years direct experience and a familiarity with programming techniques. A college degree is preferred.

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

Qualifications: You must have a minimum of 2 years direct programming experience with large scale systems and some experience in software development.

SEND RESUME TO: A. D. TSCHIDA, CONTROL DATA CORPORATION, 8100 34TH AVE. SO., MPLS. 20, MINN.
Because of Control Data's continuing growth as a designer and manufacturer of complete digital computer systems and peripheral equipment, the company is expanding its software program and marketing effort to an extent greater than ever before. Outstanding opportunities now exist for programmers and other computer specialists with varying degrees of experience.

**Computer Division**  
**PALO ALTO LOCATION**

**SYSTEMS PROGRAMMING:** Participate in the development of advanced programming systems including compiler development, monitor and executive routines, problem oriented systems and language analysis. Digital computer experience and BS degree required.

**SYSTEMS EVALUATION:** Participate in the development of appraisal techniques for general purpose programming systems. These positions require a good understanding of systems programming techniques and creative imagination. Large scale computer experience and BS degree required.

**SOFTWARE DOCUMENTATION:** Development of reference manuals, teaching aids, sales aids and other forms of documentation for programming systems.

**TECHNICAL APPLICATIONS:** Technical programming for applications such as nuclear reactors, general simulation, information retrieval, linear and non-linear programming.

**Nationwide Location**

**INSTALLATION SUPPORT:** Technical representative at customer site. Responsibilities include orientation, training, programmer consultation and systems analysis for large scale Control Data 3600 and 1604 computer customers. (Various locations in continental United States.) Large scale computer experience and BS degree required.

**SEND RESUME TO:**  
M. D. WALTER, CONTROL DATA CORPORATION, 3330 HILLVIEW AVE., PALO ALTO, CALIF.

If you plan to be in Detroit for the Spring Joint Computer Conference, write us now and we will arrange to meet with you. If it's not convenient for you to contact us now, plan to stop in and see us at the Careers Center.

*An equal opportunity employer*
## COMPUTER SYSTEMS

- **TRW-130 AN I UYK-1 Data Processing System**
- **TRW-330 Industrial Control Computer**
- **TRW-340 Core / Drum Industrial Control Computer**
- **TRW-530 Business and Scientific Computer**
- **TRW Automatic Map Compilation System**

## APPLICATIONS

- Image Interpretation Data Reduction
- Navigational Orbital Calculations • Scientific and Engineering Computation • Business Data Processing • Satellite Navigation • PCM Telemetry • Long-Range High-Precision Impact Prediction • Great Circle Computation
- Command and Control • Inertial Systems
- Automatic Radar Acquisition • Satellite Injection • ELINT Data Processing • Message Composing • Tracking Station Data Reduction
- Computer Simulation • Automatic Map Compilation • Least Square Curve Fitting
- Personnel Record Processing and Inventory Control • On-Line Scientific Computation
- Computer-Aided Search • Military Situation Displays • Machine Tool Automation
- Automatic Aircraft Vectoring • Range Safety
- Oceanographic Instrumentation
- Spaceflight Data Reduction • Spaceborne Data Reduction • Shipboard Instrumentation and Headway Correction • Air Defense Target Tracking • Radar Data Processing • Pattern Determinations • System Simulation • Electric Power Generation • Cement Production • Fire Control Trainer and Simulator • Fire Control and Trajectory Computation • Petroleum Processing • Missile Testing • Traffic Control
- Hydrographic Analysis and Ocean Mapping • Preventive Maintenance Calculation
- Applied Research • Pilot Plant Control
- Weather Forecasting • Television Program Switching • Nuclear Plants • Message Formatting and Code Conversion • System Checkout • Servo Loop Control

## COMPUTER-DRIVEN DISPLAYS

- **TRW Computer Communication Console**
- **TRW Display Analysis Console**
- **TRW-80 Series Control / Display Consoles**
- **TRW Automatic Full Color Group Display System**

---

### COMPUTER DESIGN ENGINEERS • SYSTEMS ANALYSTS • PROGRAMMERS • LOGIC/CIRCUIT DESIGNERS

**QUALITY CONTROL ENGINEERS • RELIABILITY ENGINEERS • FIELD ENGINEERS**

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.

If you would like to discuss some of our immediate openings with us, call Mr. Robert W. Rogers or send your résumé to him at

**TRW**

Thompson Ramo Wooldridge Inc. • 8433 FALLBROOK AVENUE • CANOGA PARK, CALIFORNIA • DIAMOND 8 320
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.

Staff expansion is under way at GMRD to meet the range technology needs of the next 15 years. You are invited to inquire about career opportunities for:

**Systems Engineers**—EE’s, Physicists capable of assuming complete project responsibility for new range systems.

**Instrumentation Planning Engineers**—EE’s, Physicists to be responsible for specific global range instrumentation concepts.

**Advance Planning Engineers**—EE’s, Physicists to evaluate and project the state-of-the-art in all applications of range instrumentation.

Experience in one or more of these areas: Pulse radar, CW techniques, telemetry, infrared, data handling, communications, closed circuit TV, frequency analysis, command control, underwater sound, timing, shipboard instrumentation.

Why not write us today, describing your interests and qualifications in any of the areas above. Address Dr. Charles Carroll, Dept. 21D, Pan American World Airways, Inc., P.O. Box 4465, Patrick Air Force Base, Florida.

PAN AM is now creating the range technology for launches of DYNA-SOAR, GEMINI, APOLLO, ADVANCED SATURN BOOSTERS
Time is money
This time totalizer saves both
Automatically records usage time on 1401, 1410, 1620, 7Q88 and others. Tells you the exact amount of time your computer is in use. Can be used for accurate billing and usage studies. Total cost is usually less than one day's rental of the computer! Installs in 20 minutes. No solder connections. Lease plan available.

Advance Data Systems Corporation

Write or call collect
Equipment Dept. D-4 2037 Granville Ave. Los Angeles 25, Calif. Telephone 478-0245
CIRCLE 15 ON READER CARD

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.

—RUSCH CHAUVENET
(January 1963)

FREE LATEST EDITION OF OUR CAREER OPPORTUNITIES BULLETIN
... a listing of positions with 611 select companies in the field of DATA PROCESSING

SALARY RANGE: $6,000 to $25,000
Programmers ISR Specialists
Mathematicians Project Directors
Systems Analysts Engineers, Sr. & Jr.
Systems Designers Executives

NO CHARGE TO YOU FOR OUR SERVICES EMPLOYER PAYS OUR FEE
Employers: we will include your current listings in our new "Career Opportunities Bulletin"—write today!

USED IBM 705 MODEL 2 FOR SALE

WRITE SUITE 311
141 EAST 44th STREET
NEW YORK 17, N.Y.

CIRCLE 302 ON READER CARD
MANAGER E.D.P. SYSTEMS  
$15-$18,000 TO START  
EXCELLENT OPPORTUNITY FOR FUTURE ADVANCEMENT IN BOTH POSITION AND SALARY. EMPHASIS IS PLACED ON ABILITY RATHER THAN EDUCATION OR EXPERIENCE.

ASSISTANT TO PRESIDENT  
$12-$16,000 TO START  
KNOWLEDGE OF E.D.P. REQUIRED. WILL MAKE SURVEYS AND INSTALL CHANGES FOR ONE OF AMERICA'S LARGEST COMPANIES. EXCEPTIONAL SPOT FOR YOUNG COLLEGE MAN INTERESTED IN THIS FIELD.

YOUNG PROGRAMMER For Staff Position  
$9,000-$12,000  
ABOVE AVERAGE YOUNG COLLEGE MAN WITH A MINIMUM OF ONE YEAR OF PROGRAMMING EXPERIENCE. THIS IS A CHANCE TO LAND A STAFF POSITION WITH AN UNLIMITED FUTURE.

COMPANIES PAY ALL EXPENSES  
NO OBLIGATION TO YOU.  
SEND RESUME IN COMPLETE CONFIDENCE TO MR. BRUCE MONTVILLE.

SHAMROCK  
145 Tremont St.  
Boston 11, Mass.  
HU 2-9365

FREE Data Processing Opportunities Bulletin  
Shows the positions you could have in the field of Data Processing.

Cadillac Associates, the nation's largest executive and professional placement service, represents the majority of the nation's top companies in Data Processing. Their best jobs, at salaries from $6,000 to $75,000 appear in our monthly Data Processing Opportunities Bulletin.

Both the Bulletin and our completely confidential placement service are available to you absolutely free of charge. Client companies pay our fees.

For your free Bulletin without any obligation, circle Subscriber Service Card No. 94. Please use home address only.

LON D. BARTON  
President  
Cadillac Associates, Inc.*  
29 E. Madison Bldg.  
Chicago 2, Illinois  
Fl 6-9400

*WHERE MORE EXECUTIVES FIND THEIR POSITIONS THAN ANYWHERE ELSE IN THE WORLD

In Los Angeles—Lon Barton Associates 3275 Wilshire Blvd.

REAL-TIME PROGRAM ANALYSTS  
ADVANCED SYSTEMS ANALYSTS  
SENIOR SCIENTIFIC PROGRAMMERS  
SYSTEMS AND TECHNIQUES PROGRAMMERS

Analyze your needs—compare them to General Electric opportunity in the development of large-scale electronic aerospace, shipborne and underwater warfare defense systems!

NEEDED NOW: Experienced professionals with capability and the desire to broaden their programming knowledge while contributing creative effort to:

- Military Data Processing Systems
- Aerospace Defense Systems
- Undersea Warfare Systems

Particular emphasis is placed on these problem areas: Trajectory Analysis; Re-entry Physics; Threat Analysis; Systems Evaluation.

To become a member of this professional General Electric systems team you must hold a degree, preferably an advanced degree, plus a minimum of three years' work experience on 704, 709, or 7090 computers in the areas mentioned above.

Investigate the diversified challenge and opportunity you'll find at General Electric by sending your resume in confidence to A. A. Conway, Systems Operation T-22, Heavy Military Electronics Dept., General Electric Co., Court St., Syracuse, New York.

GENERAL ELECTRIC  
AN EQUAL OPPORTUNITY EMPLOYER

CIRCLE 95 ON READER CARD  
CIRCLE 93 ON READER CARD

April 1963
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.

Computer Programmers, Numerical Analysts and Applied Mathematicians will discover interesting and demanding job assignments open to them at STL's Computation and Data Reduction Center. If you would like to obtain additional information concerning career opportunities in the Southern California region, you are cordially invited by STL to contact Dr. R. C. Potter, Department M-4, One Space Park, Redondo Beach, California. Your letter of inquiry will receive our prompt attention. STL is an equal opportunity employer.
an invitation and a challenge to:

SENIOR PROGRAMMERS
ANALYSTS
PROGRAMMING ENGINEERS ... from

C-E-I-R INC.

C-E-I-R, the international problem-solving firm, is the world’s most experienced in computer services, electronic data processing, and operations research, among other capabilities. Because of the dynamic expansion of its consulting activities, C-E-I-R has major openings in both the Washington Center and the New York Center.

WASHINGTON: Positions for senior scientific analysts—programmers who can assume managerial responsibility. Requirements include M.S. or Ph. D. in applied mathematics, statistics, engineering, or related fields, and considerable programming capability.

NEW YORK: Positions for programmers with 4-5 years of experience, with at least one year of experience on the IBM 7090. Backgrounds in PERT or Critical Path Methods are desirable.

IBM 7090 and 1401 computers are on our premises. Examples of C-E-I-R’s applications include reliability systems, celestial mechanics, medicine, operations research, information retrieval, and management sciences.

Salaries are commensurate with education and experience.

Submit resumes, in confidence, to:

Mr. R. H. Meyer
Director of Personnel
C-E-I-R, Inc.
One Farragut Square South
Washington 6, D. C.

An Equal Opportunity Employer

Your choice: standard memory devices or complete memory systems customized to your requirements...

... or anything in between: that’s the straight off-the-shelf story from LFE today. Ready-made complete memory packs now available in capacities from 10,000 to 777,200 bits. Everything is standard in these systems—each with the capability to interface with any logic level—panel or drawer mount, perfect for any 19" cabinet or module; card cages, printed circuits, recirculating registers, pre-written clocks and timing tracks. At the same time, every memory pack is infinitely flexible—infinitely adaptable to your precise data storage requirements. And each one embodies the cumulative experience of LFE Electronics—one of the oldest names in the field of memory devices — — since 1953.

Send for these technical data bulletins by circling the return card number at the bottom of this page or get quick answers to your specific questions by writing to Marketing Manager, Computer Products Division, LFE Electronics, 1079 Commonwealth Avenue, Boston 15, Massachusetts.

LFE ELECTRONICS
A DIVISION OF LABORATORY FOR ELECTRONICS, INC.
Boston 15, Massachusetts

Memory Systems, Devices and Components including: Bernoulli Disks, HD File Drums, Circuit Modules, and Read-Write Heads.

CIRCLE 62 ON READER CARD
...consider the excellent growth environment at NCR. Extensive company backed R & D; new facilities—expanding laboratory space in 1963 and 1964; advanced programs encompassing major sciences integrated for practical results; excellent employee benefits; an aggressive management group; professional advancement encouraged through company sponsored programs.

We have openings at this time as listed below for Dayton, Ohio.

- Senior Circuit Designer: familiar with solid state circuitry; creative; desire to work at advanced development stage.*
- Thin Film: materials research; device development.*
- Chemists-Research: project leader capability; background in polymer chemistry.
- Logic and Circuit Design—Computer and Systems Development.
- Mechanical Design Engineers: Expert in small mechanical systems design.
- Speech recognition—specialized work in advanced Military R & D.
- Operations Research—Commercial applications.*
- Integrated Electronics—Advanced concepts for Computer Development.*

*These positions are not limited to any special level. Ph. D. background is preferred for many, and some areas of responsibility involve Management or Technical Director potential.

Don't wonder what may be present for you. Drop us a line describing your background and interests. We'll contact you to arrange for more detailed discussion.

Send your personal letter to:
T. F. Wade, Technical Placement
The National Cash Register Company
Dayton 9, Ohio

an equal opportunity employer
SCIENTIFIC APPLICATIONS:
• Program Analysts • Mathematicians • Analog Programmers • Digital Programmers

HERE'S THE LARGEST CONCENTRATION OF COMPLEX PROGRAMMING PROBLEMS

You Are Likely to Find In One Organization Anywhere

A whole series of unusual programming problems must be solved to insure the planned progress on a tight time schedule for the giant SATURN boosters for the nation’s man-in-space project. One series is related to static firings and dynamics structural tests at Huntsville, Alabama; another with launchings at Cape Canaveral.

OPENINGS ON DIGITAL PROJECTS
• Heat Transfer
• Fuel Sloshing
• Circuit Analysis
• Numerical Integration
• Inertia Math Characteristics

OPENINGS ON ANALOG PROJECTS
• Flutter Analysis
• Dynamic Pressure
• Weights Analysis
• Matrix Inversion
• Eigenvalue Computations

The analog engineering and programming projects are directed toward the total analysis and simulation of the Saturn missile. Through the development of mathematical models and the implementation of engineering problems on unique engineering equipment, projects are developed in the following areas:
• Saturn Control Systems Simulation
• Orbital Docking Simulation
• Lunar Logistic Vehicle Studies
• Surveyor Vehicle Vibration Analysis

REQUIREMENTS: Experience in analog circuitry, instrumentation for analog computer display and control. Experience in mathematical modeling, network theory, heat transfer problems, stochastic processes, variation calculus, orbital trajectory analysis and control theory. BS or MS in EE, ME Physics or Math.

The above programs include real-time applications, feasibility and experimental studies directed towards the analysis of a missile with full dynamics. Units are concerned with developing machine compatibility, advanced program languages and the development of subroutine libraries.

Requirements: Minimum 2 years' scientific programming experience; training in numerical analysis highly desirable.

One of the most comprehensive assemblages of computer equipment available anywhere in the nation is at your disposal: GE-225, IBM-7090, 704, 1401, 1410, Pace Analog, Trice Analog, the Bendix Flight Simulator.

Please write in strict confidence to Mr. R. Greaney,
General Electric Huntsville Operation, Room 56D,
Post Office Box 988, Huntsville, Alabama.

GENERAL ELECTRIC
An Equal Opportunity Employer

April 1963
CIRCLE 300 ON READER CARD
At Lockheed Missiles & Space Company, a dedicated team of scientists devotes its entire attention to problems in interplanetary navigation. Of particular interest are problems attendant to the guidance of a manned vehicle to another planet. With many successful accomplishments to their credit (such as the Polaris and various Agena missions), this group faces every new challenge with confidence.

A promising means for manned spacecraft guidance includes taking celestial and planetary optical sightings, feeding that information into an onboard computer, and computing the spacecraft's position and velocity to predict its future course. The computer will then calculate the predicted destination planet error, decide if a correction is necessary, and compute its value. These procedures would be repeated continually until the planet is reached. The optimum timing and magnitude of correction, in view of the information obtained from the observations, is the subject of continuing study.

Even before work on hardware for an interplanetary mission is begun, orbit characteristics must be determined to set the requirements to be built into the spacecraft. An optimum trajectory must be shaped for the specific mission, in order to realize ultimate effectiveness. An outstanding accomplishment by Lockheed scientists is the computation of some 250,000 different orbits to Mars and a similar number to Venus. Each orbit varies as to speed, fuel, departure, arrival, and elapsed time.
ADVERTISERS' INDEX

Adage, Inc. .................................. 11
Advance Data Systems Corporation ........ 112
Advance Scientific Instruments Subsidiary of
Electro-Mechanical Research ............... 54
Albert, Neillisen, Inc. ..................... 94
Alexander Hamilton Institute ........... Cover 3
American Telephone & Telegraph Co. .... 22
AmpeX Corporation .......................... Cover 2, 94
Analex Corporation .......................... 18, 89
Audio Devices, Inc. ....................... 70
Autonetics, A Division of North American Aviation, Inc. 83
Bellcomm, Inc. .............................. 120
Bennett Associates ......................... 94
Benson-Lehner Corporation ............... 60
Brenten Employment Agency .............. 103
Burroughs Corporation ..................... 6
Cadillac Associates, Inc. ................. 113
C-E-I-R, Inc. ................................ 115
Chrono-Log Corp. ........................... 87
Columbus Division of North American Aviation, Inc. 119
Computer Concepts, Inc. .................. 77
Computer Control Company, Inc. ........ 1
Computron Inc. ............................. 88
Control Data Corporation .................. 86, 87, 108, 109
Data Concepts ................................ 101
Data Processing Employment Service ...... 112
Data Products Corporation ................. 102
DATAMATION Magazine ..................... 71
Daystrom, Incorporated ..................... 16
Diaglith Corporation ....................... 98
Digital Equipment Corporation ............ 90
Digitronics Corp. ........................... 80
P. J. Donaldson & Assoc. .................. 91
E. I. du Pont de Nemours & Co. (Inc.) ...... 52
Electronic Associates, Inc. ............... 38, 82
Electronic Engineering Company of California 7, 92
Electronic Flooring Systems, Inc. ........ 71
Fabri-Tek, Incorporated .................... 78
Ferroxcube Corporation of America ...... Cover 4
Forms Inc. .................................. 10
Friden, Inc. .................................. 85
General Dynamics/Electronics ............. 8, 9
General Dynamics/Fort Worth ............. 101
General Electric Computer Department .... 62, 63
General Electric Huntsville Computer Center 117
General Electric, Heavy Military Electronics 113
General Motors Research Laboratories .... 96
General Kinetics Incorporated ............ 92
Herbert Halbrecht Associates, Inc. ...... 97
Hogan Faximile, A Subsidiary of Telautograph Corporation 98
Robert M. Holm Associates ............... 95
Honeywell Electronic Data Processing Division 2, 3, 91
IBM Corporation ............................ 106
ITT-International Electric Corporation .... 93
Ingersoll Products Division of Borg-Warner Corporation 81
Laboratory for Electronics, Inc. .......... 115
Lockheed Missiles & Space Company ...... 118
Melpar, Inc., A Subsidiary of Westinghouse Air Brake Company 104
Moore Business Forms, Inc. .............. 84
The National Cash Register Co. .......... 76, 116
Packard Bell Computer A Division of Packard Bell Electronics 14
Pan American World Airways, Inc., Guided Missiles Range Division 111
Paper Manufacturers Company .......... 75
Prentice-Hall, Inc. ......................... 13
Potter Instrument Company, Inc. ........ 4
RCA Electronic Data Processing .......... 68
Reeves Soundcraft Corp. ................. 21
Replica Products Corporation ........... 107
Shamrock .................................... 113
Space and Information Systems, A Division of North American Aviation, Inc. 99
Space Technology Laboratories, Inc. ..... 114
Spartan Books .............................. 73
Steelcase, Inc. ................................ 36, 37
System Development Corporation ......... 105
SYSTEMAT division of National Personnel Center 101
Systems Sales Company .................... 15
Technical Operations Research .......... 64, 65
Teletype Corporation ...................... 100
Thompson Ramo Wooldridge Inc. .......... 110
Transdata .................................. 27
UNIVAC ..................................... 12

DATA PROCESSING

Computing Engineers for research and development of mathematical models. Degree in math or physics with two years of experience.
Applied or Utility Programmers to program integrated data processing systems applied to EDPM 709-7090-1401. Degree in math or accounting or equivalent in directly related experience.

Please write to:

NORTH AMERICAN AVIATION, INC.
The Professional & Technical Employment Office
Box DAMA-591
4300 East Fifth Avenue
Columbus 16, Ohio
Attn: H. Keever, Manager

An equal opportunity employer.
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.
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.

FREE "FORGING AHEAD IN BUSINESS"

If you want to avoid the thorny barriers to success—if you're ambitious, determined to move up fast—send today for the Institute's 48-page descriptive booklet, "Forging Ahead in Business".

It explains what a man must know today to make $15,000 or more a year...what he must do to accumulate this knowledge. It tells why men of equal ability fare so differently in the race for better jobs and bigger salaries. It analyzes the causes of failure...the reasons for success. And it outlines an executive-training program which is so complete and so scientific that each day subscribers are brought a little closer to a mastery of business procedures.

There's no charge for "Forging Ahead in Business." And no obligation...other than the obligation to read it thoughtfully, and decide for yourself whether the training it describes is meant for you. To obtain your complimentary copy, simply fill out and return the coupon. It will be mailed to you promptly.

ALEXANDER HAMILTON INSTITUTE
235 East 42nd Street, New York 17, New York
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.