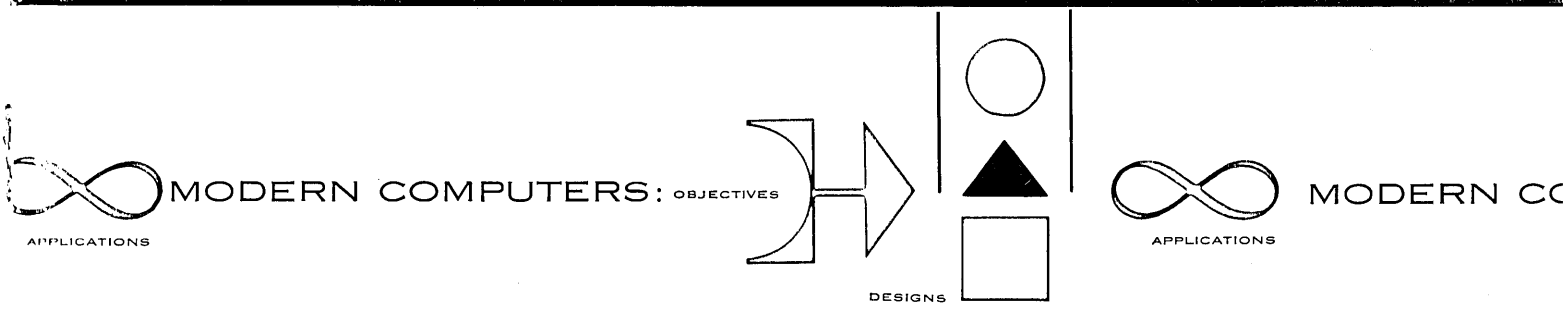
The Magazine of

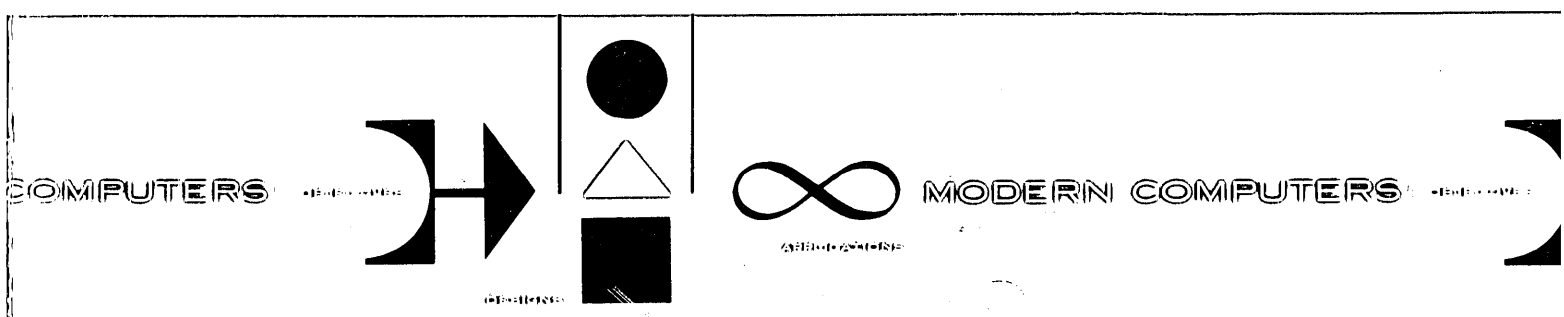
DATAMATION 58

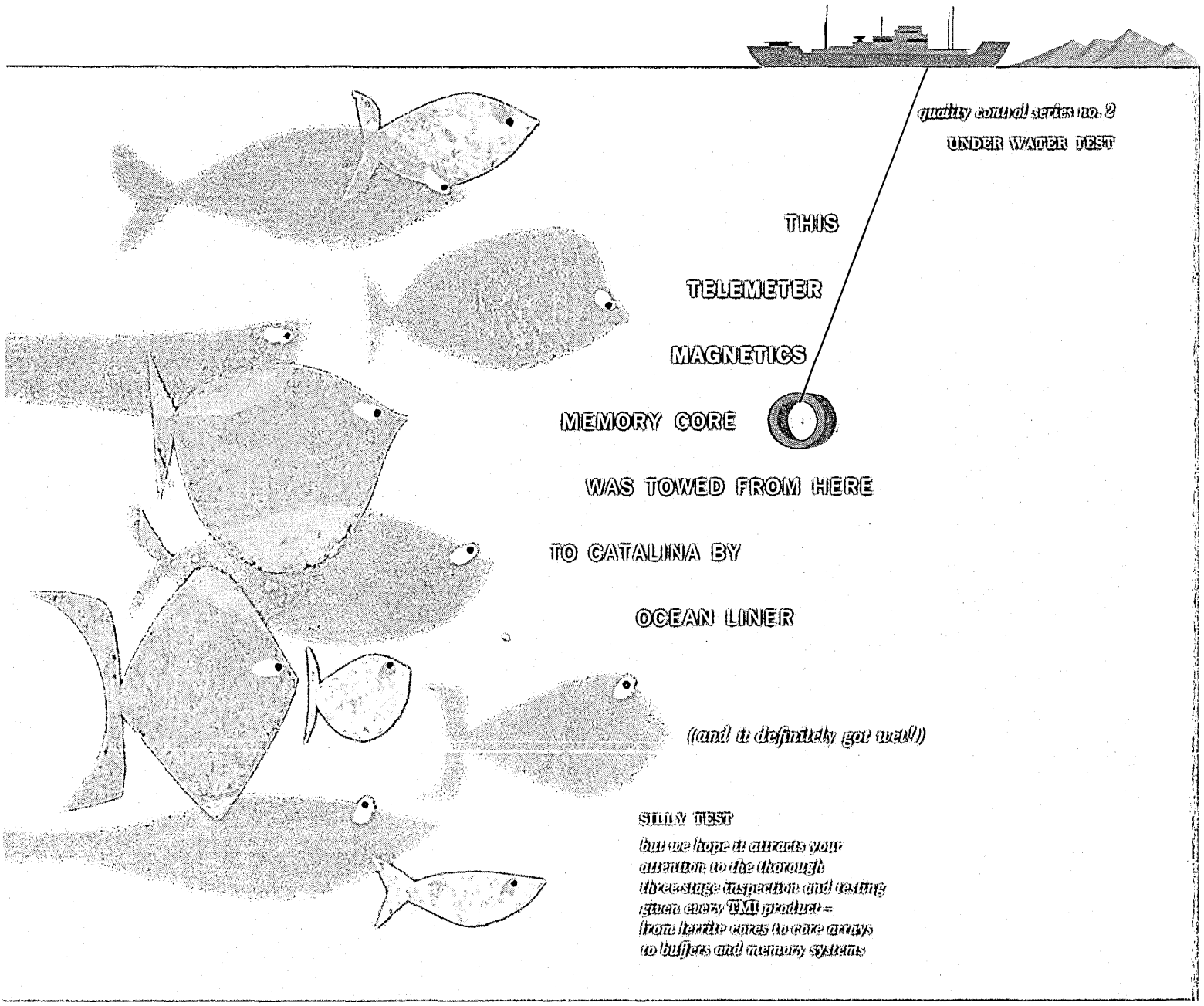
November/Dec[illegible]

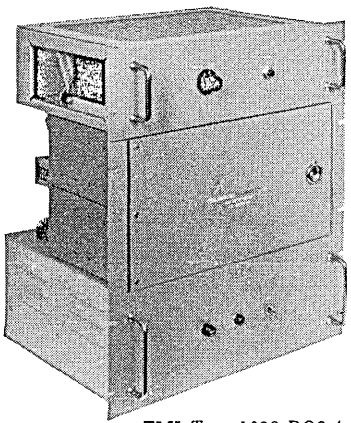
Research & Engineering

page 5 EASTERN JOINT COMPUTER CONFERENCE ISSUE









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DATAMATION 58

EASTERN JOINT COMPUTER CONFERENCE

the automatic handling of information

volume 4, number 6

FEATURES

ARTICLES

DEPARTMENTS

OVER 24,000 CIRCULATION

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R/E, The Magazine of DATAMATION, welcomes manuscripts of three general types: application articles dealing with small, medium and large electronic data processing systems; articles covering the design of components, sub-systems and systems; and other general articles of interest to the data processing industry. Material submitted should be accompanied by pictures and illustrations when possible. Unsolicited manuscripts to be returned to writer should include return postage but editor assumes no responsibility for their safety or return (although all reasonable care will be taken).

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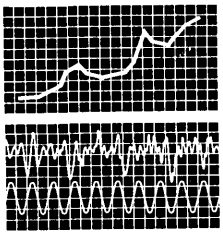


DATAMATION *in business and science*

IT&T SELECTED FOR $150 MILLION AF ORDER

International Telephone and Telegraph Corporation has been selected by the Air Force as the production source for a world-wide control system for the Strategic Air Command. As a result, IT&T has established a new unit, International Electric Corporation, to manage production of the system. IT&T president Edmond H. Leavey explained that the datamated electronic system is designed to transmit, process and display information required by the commander-in-chief, SAC, and his staff, in the planning, direction and control of SAC's global operation. The $150 million system, designated 465-L by the Air Force, consists of communications, data-processing and data-presentation subsystems.

An Air Force Source Selection Board solicited proposals from 18 companies representing a broad segment of the electronics industry. Fifteen companies were represented in the eight proposals finally submitted to the board. IT&T will utilize the capabilities of a number of other U. S. companies in carrying out this assignment.

FIRST 220 EDPS GOES TO HOFFMAN VIA SRI

First installation of a Burroughs 220 EDPS was completed in October for the Hoffman Laboratory Division, Hoffman Electronics Corp. Billed by Burroughs' ElectroData Division as "an intermediate-priced computer with giant-system capabilities," the 220 will be temporarily installed at Stanford Research Institute for fulfillment of an Air Force Contract. The contract, AN/ALD-3--code name, "Tall Tom" -- calls for the development of a highly classified electronic reconnaissance system by Hoffman and a team of seven other companies.

Two more 220's are slated for immediate installation at General Electric, Syracuse, N. Y. and Tactical Air Command, Langley Field, Va.

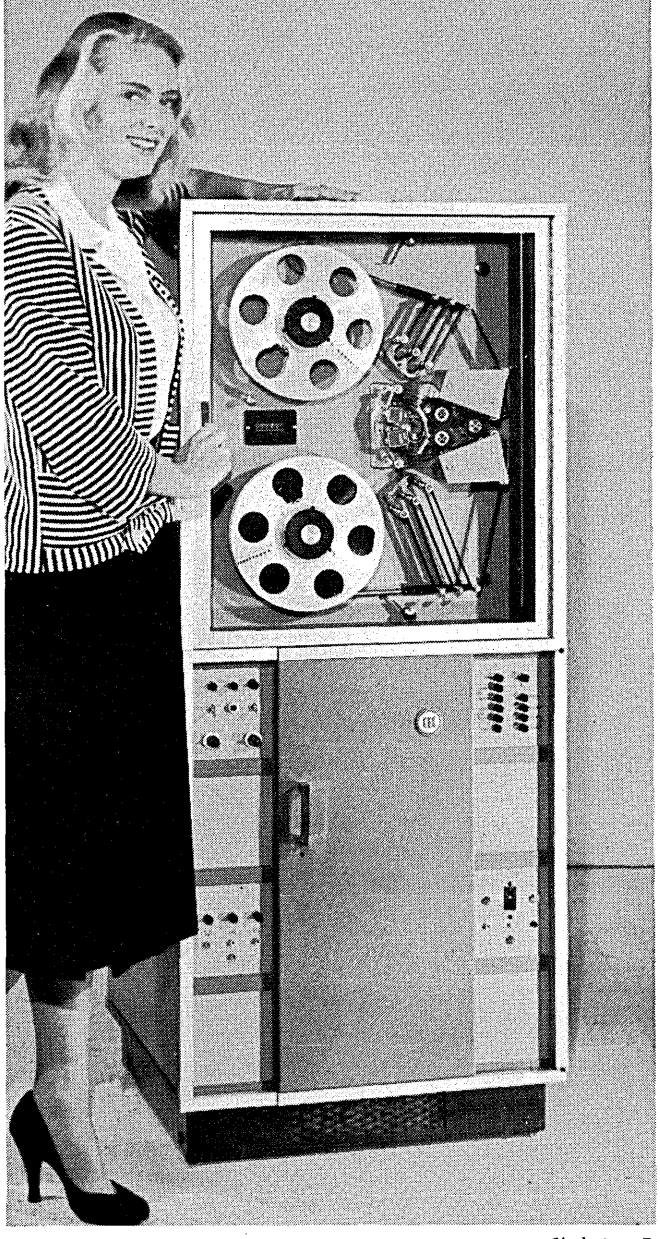
CONTRACT LET FOR MISSILE TELEMETRY

A $1 million prime production contract for a transistorized telemetry system has been awarded to United ElectroDynamics of Pasadena by the Air Force's Air Materiel Command Ballistics Missile Center. This award follows an earlier contract under which United ElectroDynamics designed and developed this system for the Atlas, Titan and Thor ballistics missile programs.

G-15 USERS GATHER FOR THIRD MEETING

Approximately 200 members of the Bendix G-15 Users Exchange Organization gathered in Chicago for their third national meeting in September. General sessions were held on the 25th, followed on the 26th by workshops. Exhibit rooms were set up at the Drake Hotel for the demonstration of the PR-2 special photo-reader and CA-2 punched card coupler.

new speed in digital data processing



Encompassing the latest in packaging and reliability, Consolidated's new MicroSADIC commutates and converts up to 10,000 analog inputs per second. Outputs are recorded on digital magnetic tape in pre-selected formats compatible with most computers and peripheral equipment. Digitizing may be in either bipolar binary, bipolar binary-coded decimal, or unipolar binary-coded decimal form. Completely transistorized, the system is packaged in modular "slices" for unusual flexibility. Write for complete story in Bulletin CEC 3004-X4.

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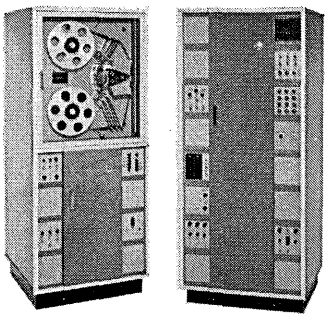

The basic MicroSADIC consists of a commutator, digitizer, system programmer, time programmer, and digital tape unit. All-transistor circuitry on printed boards results in low power consumption and trouble-free operation.

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EDITORIAL

MODERN COMPUTERS: OBJECTIVES, DESIGNS, APPLICATIONS

Our conference theme, modern computers, is the basis for the Conference sessions – Keynote, Reliability and Components, Impending Revolution in Computer Technology, Organization and Processing of Information, Design Techniques, New Computers, Special Applications.

These seven sessions describe exciting new applications of present day computers, the existing design of new computers and the current basic research which will help realize present and future computer objectives. What is the status of the transistors, cryotrons, thin-film memories, and other devices? How will they affect the possible obsolescence of your present computer? What are the new devices appearing on the computer horizon? How do they affect you, as a user of modern computers? Are we teaching computers to learn? You will learn the answer to these and other interesting questions at the 1958 Eastern Joint Computer Conference.

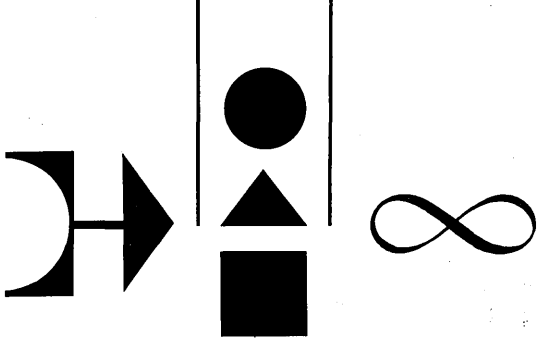
Irrespective of whether you are a computer engineer, programmer, mathematician, active user, or only remotely connected with data processing equipment, you will find several sessions of this Conference of direct interest to you.

DR. FRANK M. VERZUH
Chairman, Program Committee
Eastern Joint Computer Conference

Dr. Frank M. Verzuh, Assistant Director, Computation Center, Massachusetts Institute of Technology, Cambridge, Mass., joined the staff of MIT Center of Analysis in 1940 after receiving a B.S. in Electrical Engineering from the University of Denver that same year. He designed and constructed components for analog and digital computers and learned to apply both analog and digital equipment to the solution of engineering problems. After being appointed Director of Statistical Services in 1950 he began to set up computing services to fulfill the needs of the MIT educational and research projects.

In 1956, Dr. Verzuh was appointed to the position he now holds at M.I.T. where he is in charge of the operation of the IBM Type 704 EDP machine. He is concerned with the solution of scientific and business data processing problems for the MIT family and several New England colleges and universities.

Dr. Verzuh, who also holds an M.S. (1946) and Sc.D. (1952) in Electrical Engineering from MIT, has, during the past seven years, been employed as a consultant by various business concerns and the Federal Government to assist them in studies dealing with application of automatic computing equipment to business and scientific computing problems. He has written a number of papers describing the utilization of computers for the solution of engineering and administrative problems and is currently completing a textbook entitled "Machine Computation."



EASTERN JOINT COMPUTER CONFERENCE

BELLEVUE-STRATFORD HOTEL

PHILADELPHIA, PENNSYLVANIA

DECEMBER 3, 4 AND 5

From the moment the keynote session commands the attention of delegates on the morning of December 3 to the final closing of exhibits on Friday evening, December 5, the eighth annual Eastern Joint Computer Conference promises to offer something for everyone interested in the automatic handling of information.

Seven technical sessions will explore a wide range of problems and possibilities in datamation while an 82-booth exhibit area will display the hardware of some 50 exhibitors.

As in past years, this conference is being sponsored by the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Association for Computing Machinery, with participation by the National Simulation Council.

A two-hour conference registration period will begin at 7 p.m. on the evening before opening day in the Bellevue-Stratford. Advance registrants who have met the November 22 deadline will be provided conference kits containing badge, final program, social events tickets and last minute notices.

Conference registration will be held from 8 to 10 a.m. on December 3 in the hotel's Burgundy Room. At 10 a.m., the registration desk will be moved to the Ballroom entrance lobby and remain there for the rest of the conference.

Fees for registration at the conference are $4.00 for association members and $5.00 for non-members.

Chairman of the 1958 EJCC is John Broomall. He is being assisted by Technical Program Committee Chairman Dr. Frank M. Verzuh, Local Arrangements Committee Chairman Peter Raffa and Publications Committee Chairman Arnold A. Cohen.

Assisting Dr. Verzuh are the chairmen of the technical sessions: N. P. Edwards, R. Rice, W. Orchard-Hays, F. Tendick, E. L. Harder and T. H. Bonn. Details of these sessions are outlined on pages 11, 12 and 13 of this issue.

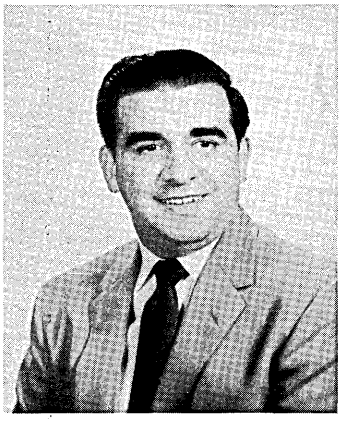
The exhibit area is located on the 13th floor of the Bellevue-Stratford. Admission is free and the area may be visited by the general public.

Exhibits will be open at these times: Wednesday, Dec. 3, from 10 a.m. to 9 p.m.; on Thursday, Dec. 4, from 10 a.m. to 6 p.m.; and on Friday, Dec 5, from 10 a.m. to 5 p.m. For a list of EJCC exhibitors and a map of the exhibit area, please turn to pages 14 and 15.

A luncheon, featuring a luncheon speaker, is planned for all three conference days. See page 8 for details.

On Thursday, Dec. 4, a cocktail party will highlight the less formal conference events. It will be held in the Ballroom of the Bellevue-Stratford at 6 p.m. and the fee will be $3.50. A hospitality hour beginning at 5 p.m. will precede the cocktail party in the hotel's Hunt Room.

A copy of the Conference Proceedings, including the complete text of all papers and discussion from the floor, will be sent at no charge to all conference registrants. Additional copies of the Proceedings may be ordered at the conference or from the sponsoring societies' headquarters at a cost of $3.00 including postage.



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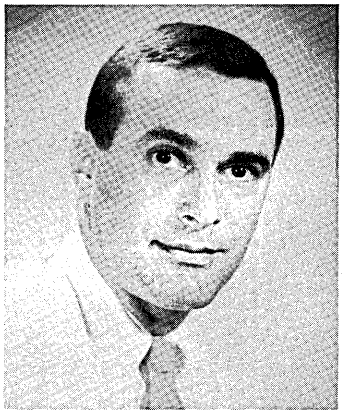
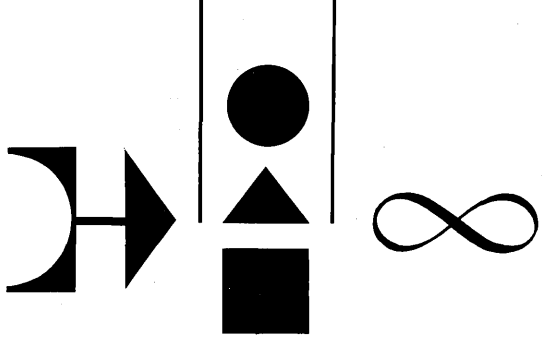




A MESSAGE OF WELCOME . . .

The increasing uses of the "modern computer" in business, industry and government is exemplified by the intense interest of computer equipment manufacturers in the 1958 Eastern Joint Computer Conference. Here they are afforded the opportunity of displaying their newest products and techniques to potential buyers and users. With over 50 major companies and organizations in the industry exhibiting, and more than 3,000 scientists, engineers and mathematicians from the U. S. and abroad expected to attend, this conference is developing into one of the largest and most interesting of the seven previous Eastern meetings.

With this single meeting of the people who control the progress of the art, the theme of the conference, "Modern Computers – Objectives, Designs, Applications," presents the direction of current and future ideas and techniques. It also affords a sounding board for reports of the transformation of existing principles into usable hardware. And it gives an indication of the multiplicity of applications for the modern computer tool on the American and world-wide scenes of business, science and social activities.

The very magnitude of the theme indicates that regardless of whether you are active in the planning, design or operation of a computer, or whether you are an active or potential user, the 1958 EJCC will provide a stimulating background for the exchange of useful ideas and methods.

John Broomall
Chairman, 1958 EJCC

THREE LUNCHEON MEETINGS

This year's Eastern Joint Computer Conference will offer a set of three luncheon meetings. They will be held from noon to 2 p.m. in the Burgundy Room of the Bellevue-Stratford Hotel, on each of the three days of the conference, December 3, 4 and 5. It has been arranged that at each of the two-hour luncheon meetings a speaker will deliver an address on a subject of certain interest to conference attendees. The fee per luncheon – $3.00.

wednesday

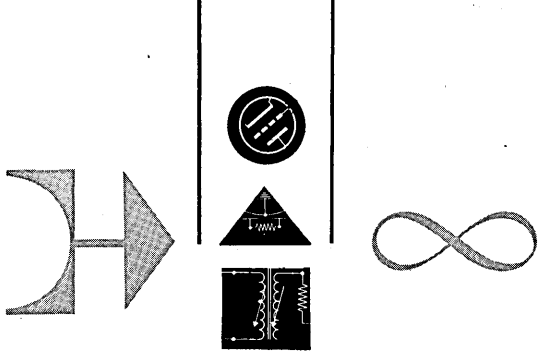
The selected subject and the speaker for the first meeting, on Wednesday, had not as yet been chosen as this issue was published. Both were to be announced by the program committee chairman.

thursday

On Thursday, J. H. Felker, Director of Systems Engineering II at Bell Telephone Laboratories, Murray Hill, New Jersey, will speak on "A Knot Hole View of Russian Technology." Felker is well known for his pioneering work in the fields of transistors and transistorized computers. At Previous Eastern Joint Computer Conferences, he has described several of his transistorized computers – the TRADIC, to mention one.

friday

On Friday, J. C. R. Licklider of Bolt, Beranek and Newman, Inc., Cambridge, Massachusetts will speak on "Man-Computer Symbiosis." Dr. Licklider is a supervisory engineering psychologist and Head of the Engineering Psychology Department at Bolt, Beranek and Newman, Inc. Holding various degrees from several Eastern universities, Licklider was Associate Professor of Psychology and Communication at the Massachusetts Institute of Technology from 1950 to 1957.



Three speakers, representing industry, government and education will join Dr. Frank M. Verzuh, chairman, in the opening or keynote session of the Eastern Joint Computer Conference. The three — Benjamin W. Taunton, assistant comptroller, First National Bank of Boston; Wilfred H. Tetley, Colonel, USAF, Hdqrs. ADSID, Hanscombe Field, Lexington, Mass.; and Dr. Jay W. Forrester of the M.I.T. School of Industrial Management.

The initial topic will be "Data Processing in Banking and Other Service Industries." In treating this subject, Taunton will draw upon extensive backgrounds in the data processing field and in all phases of banking.

Taunton is in charge of the electronic programming department in his bank. This department has the responsibility of planning for and installing the DATAmatic 1000, a large-scale computer. Research in the field of electronics is another responsibility.

He has attended Boston University, the American Institute of Banking, M.I.T. (digital computers), IBM Customer Administration School (702, 650 and 705), and Remington Rand's Univac

KEYNOTE SESSION

WEDNESDAY, DECEMBER 3, 1958

10 A.M.—NOON

Programming classes. He is the author of the text book "Electronic Processing for Business" and has written numerous articles which have appeared in various technical magazines and periodicals. He has also prepared many technical papers.

"Role of Computers in Air Defense" is Colonel Tetley's subject.

As Deputy Commander for Engineering at Hanscombe Field's Air Defense System Integration Division, he is concerned with basic engineering in air defense weapons systems.

Col. Tetley is a U. S. Military Academy graduate and has an MS in Aeronautical Engineering (Michigan, 1947). He has done advanced graduate work both at Michigan and M.I.T. As part of his assignment in ADSID, he has prepared a government publication entitled "Cybernetics and Logistics" which describes many of the problems in the air defense control system.

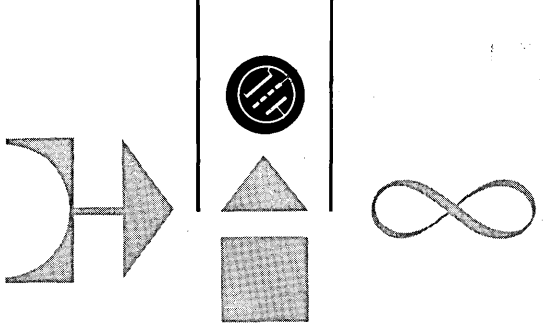
The third topic, "New Frontiers," will be covered by Dr. Forrester who is a Professor of Industrial Management at M.I.T. In this capacity, he is directing a research and teaching program in the use of computers for data processing and for analyzing business problems.

He graduated from the University of Nebraska in 1939, received an M. S. degree in Electrical Engineering at M.I.T. in 1945 and was honored by his alma mater in 1954 when he received the honorary Doctor of Engineering degree at the University of Nebraska.

Prior to 1956, he was head of the Digital Computer Division of the M. I. T. Lincoln Laboratory, which guided the technical design of the Air Force SAGE (Semi-Automatic Ground Environment) system for continental air defense, one of the most extensive applications thus far of digital computing techniques.

From 1946-1951, as Associate Director of the M.I.T. Servomechanisms Laboratory, Dr. Forrester was responsible for the design and construction of Whirlwind I, M.I.T.'s first high-speed digital computer which later became the prototype and testing ground for many SAGE developments.

(A brief biography of Dr. Verzuh will be found on page 5.)



TECHNICAL SESSIONS

opening session

10:00 a.m.–12:00 noon Wednesday, December 3, 1958

Chairman: Dr. F. M. Verzuh, Massachusetts Institute of Technology (See page 9)

session II

2:00 p.m.–5:00 p.m. Wednesday, December 3, 1958

RELIABILITY AND COMPONENTS

Chairman: N. P. Edwards, IBM

Component developments and machine organization techniques which have been applied in the last few years have resulted in marked improvements in both machine performance and reliability. Three papers covering significant facets of recent reliability developments are intended to indicate the importance of reliability to the computer user and to highlight the developments which give reliability improvements. The second half of the section presents three papers on representative new component developments or improvements.

PART A. RELIABILITY OF DATA PROCESSING EQUIPMENT

ATHENA COMPUTER: A RELIABILITY REPORT

Speakers: G. A. Raymond and L. W. Reid, Remington Rand

A large, general purpose digital computer used in the ground-based guidance system for the ICBM TITAN is described. The philosophy and methods that have resulted in this high reliability are outlined in the paper together with the operational history of three systems.

PHILOSOPHY OF AUTOMATIC ERROR CORRECTION

Speaker: R. M. Block, Datamatic Division of Minneapolis-Honeywell

A system for automatic error correction — Orthotronic Control — has recently been developed. This system is reviewed with particular attention given to the correction of errors occurring in the input-output trunk system of data processors.

THE SYSTEMS APPROACH TO RELIABILITY

Speaker: H. D. Ross, IBM

Techniques for achieving high reliability in very large military electronic systems have advanced markedly in the last few years. This paper will review the reliability concepts incorporated in the design of one large system (SAGE) and the operational experience to date.

PART B. MODERN COMPUTER COMPONENTS

IMPULSE SWITCHING OF FERRITES

Speaker: R. E. McMahon, Massachusetts Institute of Technology, Lincoln Lab.

The need for increased speed of memory elements which has led to the development of impulse switching of ferrites is treated here. By controlling the amplitude and width of the drive currents normally slow (1 microsecond) S1 ferrite cores will switch in less than one-tenth microsecond for both the read and write intervals.

A HIGH SPEED, HIGH CAPACITY PHOTO MEMORY

Speaker: C. A. Lovell, Bell Telephone Laboratories

A random access, word organized, photo memory has been developed by Bell Telephone Laboratories. The capacity of this memory is capable of extension to at least 135,000 80-bit words. Tentative proposals are made for use of this type of memory as direct access memories for input, internal, and output purposes in digital computers.

DESIGN CRITERIA FOR LONG-WEARING COMPUTER TAPE

Speaker: J. W. Wenner, International Business Machines Corporation

This paper describes the technical aspects of a new magnetic recording tape specifically designed to extend the performance of data processing equipment.

session III

9:00 a.m.–12:00 noon Thursday, December 4, 1958

THE IMPENDING REVOLUTION IN COMPUTER TECHNOLOGY

Chairman: Rex Rice, I.B.M. Research Center, Poughkeepsie, New York

The advent of cryogenic, thin film magnetic, and other new devices promises to immensely reduce the physical size and cost of logical elements used in digital systems. Current research work has demonstrated feasibility of the individual devices and much emphasis is being placed on mass production processes for microminiaturization. It may be anticipated that at least 10,000 logical elements may be placed on one square inch of surface. The impact of this type of device on the technology promises to approach revolutionary proportions. This panel discussion is in two parts. The first will cover some interesting aspects of present research leading to the next generation of machines. Each speaker will present his views on the effect of the new technology in the field with which he is particularly concerned. In the second part each speaker will speculate on how to use these new tools.

PART I–STATUS OF PRESENT RESEARCH

INTRODUCTION

Speaker: R. Rice, I.B.M. Research Center, Poughkeepsie, New York

A broad picture relating proramming, components, circuits, system logic and manufacturing methods to total design is outlined so that the following discussions may be understood as a part of the complete picture.

COMPUTER DESIGN FROM THE PROGRAMMER'S VIEWPOINT

Speakers: Walter F. Bauer, Space Technology Laboratory, Ramo-Wooldridge Corp.

An analysis of the present coding systems is made to develop the programmer's view of the desired logical structure in machines. Based on this foundation, it is assumed that this logical level may be obtained as "machine language" and the extrapolation into the next generation of coding language schemes is discussed.

DEVICE, CIRCUIT AND LOGICAL ELEMENT TRENDS

Speaker: Dudley Buck, Massachusetts Institute of Technology

The requirement for large numbers of logical decision elements in a machine system has led us to look for a batch of processes. The quest for components which are simple enough to be made in large numbers has led to a study of construction methods involving photographic or electron beam processes. This discussion develops and illustrates the concept that fast switching, relatively low power dissipation and small size go hand in hand with mass production techniques.

NEW SYSTEM DESIGN TECHNIQUES

Speaker: R. K. Richards, Consultant

With the fusion of device, circuit and logical units into single complete machine elements, the methods utilized for design will change. The relation of block diagrams, logical equations, and machine methods in design and manufacture of systems utilizing the new technology is discussed.

PART II–SPECULATION ON FUTURE

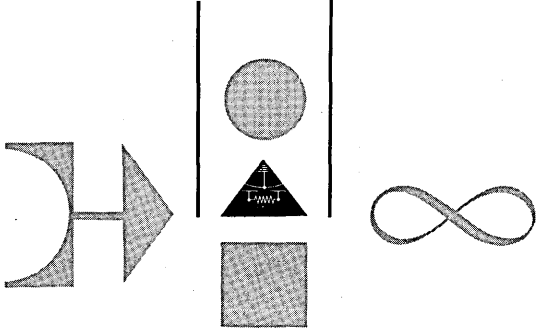
Should we abandon the general purpose coding and machine concepts?

Programming Perspectives
W. F. Bauer

System Design
R. K. Richards

Devices Leading to Self Organizing Systems
Dudley Buck

The speakers will present their views on what the future potential for new machine systems may be.



session IV

2:00 p.m.–5:00 p.m. Thursday, December 4, 1958

ORGANIZATION AND PROCESSING OF INFORMATION

Chairman: W. Orchard-Hays, Corporation for Economic and Industrial Research

One of the most important problems facing the technical world in the mid-twentieth century is the efficient handling, analysis and retrieval of information. Today's giant computers or data processing systems have opened up the vista of very fast and sophisticated mechanized file systems. The apparent ease of applying these machines to such a task is only an illusion, however. Not only are there many engineering problems yet to be solved, but it now appears that we are woefully lacking in any adequate theory. This session will point up some of the logical and engineering problems. One of its main purposes is to stimulate people to theoretical studies of data handling techniques.

PART A. ORGANIZATIONAL AND PROGRAMMING METHODS

AN INFORMATION FILING AND RETRIEVAL SYSTEM FOR THE ENGINEERING AND MANAGEMENT RECORDS OF A LARGE-SCALE COMPUTER DEVELOPMENT PROJECT

Speakers: G. A. Bernard III and Louis Fein, Ampex Corporation

This paper describes the organization of the paper file and retrieval system developed for use on a large-scale engineering project—the development of the ERMA Mark I.

FILE PROBLEMS CONNECTED WITH A NATIONAL MENU STUDY

Speaker: Phil M. Thompson, Market Research Corporation of America

This paper covers the logical problems of organizing a magnetic tape file of variable length information and constructing a compiler to permit easy Boolean interrogations.

DATA PROCESSING AND INFORMATION PRODUCTION

Speakers: Robert H. Gregory and Martin Trust, Massachusetts Institute of Technology

Presented in this paper is the theory that the function of information selection can successfully be delegated to mechanized elements in the system such that the output is automatically screened for management significance. Rather than generating fixed volumes of reports, each period covering all items under consideration, the idea is that the report volumes will fluctuate to cover only those items requiring management action.

INTERMISSION

PART B. HARDWARE AND SYSTEMS METHODS

NBS MULTI-COMPUTER SYSTEM

Speaker: A. L. Leiner, W. A. Notz, J. L. Smith and A. Weinberger, National Bureau of Standards

The new NBS systems designed for use on a wide range of experimental applications—ranging from automatic search and interpretation of Patent Office records to real-time control of commercial aircraft traffic — is described.

DATA HANDLING BY CONTROL WORDS

Speaker: G. A. Blaauw, International Business Machines Corporation

Explained in this paper is the programming logic of Stretch which makes it possible to refer to data in such a way that the programmer need not concern himself with actual memory addresses. Control words are used for input-output control, indexing operations, and tagged data sort.

session V

2:00 p.m.–5:00 p.m. Thursday, December 4, 1958

(Parallel Session)

DESIGN TECHNIQUES

Chairman: F. H. Tendick, Bell Telephone Laboratories

Mushrooming growth of technology and continually increasing needs of military and business for larger, more complex data processing systems have placed tremendous pressure on design engineers. The dilemma is not only must these systems perform complex functions with extreme reliability, but they must be designed on abbreviated time schedules with minimum amount of man effort. Papers in this session present a number of integrated steps toward a solution. In the exploratory design phase, simulation and evaluation of new system and circuit ideas with the aid of existing computers gives greater, faster insight to problems and engineering decisions. In the final development phase computer automation of the generation and checking of manufacturing information decreases errors, relieves engineers for design, and provides results in less time. In between the initial and final design phases the use of systematic design techniques and increased asynchronous circuit organization lead to improved performance, reliability, and cost.

SPECIAL PURPOSE COMPUTER DESIGN BY SIMULATION

Speaker: P. L. Phipps, Remington Rand Univac, St. Paul

This paper describes several interesting case studies in which the UNIVAC 1103 computer was used to study, design, build and evaluate the "Athena" computer.

LOGICAL DESIGN TECHNIQUES FOR CG-24 A GENERAL PURPOSE REAL TIME COMPUTER

Speakers: G. P. Dineen, I. L. Lebow and I. S. Reed, M. I. T., Lincoln Laboratory

The systematic design of the CG-24 was accomplished by means of a set of generalized transfers describing the operation of the machine. This technique provides a detailed description of the system in a concise form convenient for circuit engineers. The sequence of transfers specifying the machine operation were written without detailed knowledge of the logical circuitry which was to be used.

DESIGN CRITERIA FOR AUTOSYNCHRONOUS CIRCUITS

Speakers: J. C. Sims, Jr., Sylvania Electric Products, Inc., and H. J. Gray, University of Pennsylvania

The circuits and organization of present computers are such that possible operating speeds are lower than the capabilities of the components. The speed limitations of such synchronous computers will be described and design criteria for higher speed operation set forth.

ANALYSIS OF TRL CIRCUIT PROPAGATION DELAY

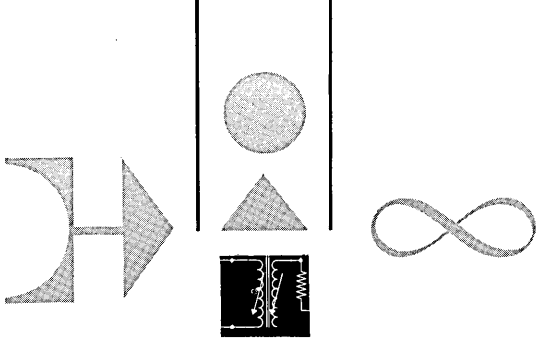
Speakers: W. J. Dunnet, E. P. Auger and A. C. Scott, Sylvania Electric Products, Inc.

A program to design TRL circuits and compile TRL propagation delay tables on a digital computer is presently under way at the Sylvania Data Processing Laboratory. This paper points to the need for such a program and describes transistor and TRL circuits studies that have resulted in the basic relationships being programmed.

THE RECORDING, CHECKING AND AUTOMATIC PRINTING OF TRANSISTOR LOGICAL DIAGRAMS

Speakers: P. W. Case and M. Kloomok, IBM

A program of automation of design—the use of general-purpose computers for the conversion of logic design data from hand sketches to punched card records, the computer checking of the associated logical design, followed by automatic printing of the resulting transistor logic diagrams is described in this paper.



session VI

9:00 a.m.–12:00 noon Friday, December 5, 1958

SPECIAL APPLICATIONS

Chairman: E. L. Harder, Westinghouse Electric Corp., Pittsburgh, Pa.

Computer progress in the field of automation is dependent on the development of accessory data handling devices; matching capabilities of the computer to the job to be done. These accessory devices, both digital and analog, together with the techniques used in the computer itself, constitute a "bag of tricks" from which much practical automation is being accomplished short of the full computer.

SYSTEM EVALUATION AND INSTRUMENTATION USING SIMULATION EQUIPMENT

Speakers: A. J. Strassman & L. H. Kurkjian, Hughes Aircraft Co., Fullerton, Cal.

To ascertain the system feasibility of integrated units it is necessary to do either of two things: 1) duplicate the entire system and use it as one master test fixture to evaluate each individual functional unit; or 2) provide individual test facilities for evaluation of each functional unit. The second approach requires simulated or actual inputs providing the necessary control and data to completely check out the individual unit. It will be presented that this approach offers the greatest advantages for large military special purpose digital computer systems.

APAR–AUTOMATIC PROGRAMMING AND RECORDING

Speakers: G. R. Bachand, J. L. Rogers, T. F. Marker, Sandia Corp., New Mexico

This paper describes the general characteristics of a device to be employed in atomic weapons systems and components testing to automatically acquire in a digital machine language variables information transduced from force functions to common analogs of voltage and frequency.

AUTOMATIC PROGRAMMING SYSTEM FOR TRANSLATION OF RUSSIAN TO ENGLISH

Speaker: V. E. Giuliano, Harvard Computation Laboratory, Cambridge

At the present time it is exceedingly difficult to evaluate linguistic rules proposed for Russian-English machine translation, because of the absence of any practical means for testing these rules automatically, on large bodies of text. An automatic programming system, for the automatic testing of translation algorithms, is proposed and described.

DYANA–DYNAMICS ANALYZER-PROGRAMMER

Speaker: T. J. Theodoroff, General Motors Corp., Detroit

Part one of this paper deals with the types of physical systems which can be handled by DYANA, a program developed for the IBM 704, the language or symbolism used to describe the systems, and the FORTRAN program or the solution of the behavior of the systems. Part II covers salient features of the internal structure and functioning of DYANA.

UNIVAC AIR LINES RESERVATIONS SYSTEMS

Speakers: C. W. Fritze, V. E. Herzfeld, D. K. Sampson, Remington Rand Univac, St. Paul.

This paper will deal with the incorporation into a system of a general purpose computer by means of the design of a family of peripheral equipments. Description will be made of presently-available equipments which provide a two-way communications link between the computer and agents remote from the computer site via standard telecommunications facilities.

HIGH-SPEED TRANSISTORIZED ANALOG TO DIGITAL CONVERTER

Speakers: R. C. Baron, T. P. Bothwell, Epsco, Inc.

Operation of a fully transistorized, reversible, high-speed data converter using the programmed successive approximation technique is explained in this paper. Conversions are performed at 5 microseconds per bit or 16,000 conversions per second for an 11 bit binary code.

session VII

2:00 p.m.–5:00 p.m. Friday, December 5, 1958

NEW COMPUTERS

Chairman: T. H. Bonn, Remington Rand Univac, Philadelphia, Pa.

The radical improvements in computer techniques which the invention of the transistor promised a decade ago are finally being realized in business machines. In this session a number of new computers, all of them transistor machines, are decribed . . . most of them for the first time in a public meeting. A broad range of applications can be handled by this equipment. General purpose machines which can perform a wide variety of business and scientific calculations and one machine especially designed to handle the peculiar problems of banks, are described.

THE SIEMENS DIGITAL COMPUTER–2002

Speaker: Dr. Heinz Guzin, Siemens & Halske, A. G., Munich, Germany

The Siemens Digital Computer 2002, a medium-scale transistorized computer being developed by the Siemens and Malske AG, Munich, Germany, will be discussed. The 2002 is a general purpose decimal machine with a word length of 12 decimals plus sign and an average speed of 2000 operations per second.

DESIGN OF THE RCA 501 SYSTEM

Speakers: T. M. Hurewitz and J. G. Smith, Radio Corporation of America

The RCA 501 system was designed specifically for data processing applications. The requirements for this type of application are reflected both in construction and in performance capability. This paper describes the manner in which problem requirements have affected the balance of design emphasis in the RCA 501.

THE IBM 7070–DATA PROCESSING SYSTEM

Speakers: R. W. Avery, S. H. Blackford and J. McDonnell, International Business Machines Corporation

The IBM 7070 is a completely solid state data processing system with both tape and random access memory. With the addition of floating point arithmetic, its speed and memory are such that it is also applicable to scientific work. A comprehensive set of automatic programs, of the compiler type, have been prepared for simplified programming.

PERFORMANCE ADVANCES IN A TRANSISTORIZED COMPUTER SYSTEM THE TRANSAC S-2000

Speakers: R. J. Segal, J. L. Maddox and P. Plano, Philco Corporation

The Philco Transac S-2000 system is the first fully transistorized large scale data processing sytem in quantity production. This paper presents the general structure of the S-2000 system with emphasis on those features which constitute performance advances in the computer art.

PROGRAMMING DESIGN FEATURES OF GAMMA 60 COMPUTER

Speaker: Philippe Dreyfus, Cie Des Machines Bull, Paris, France

The original design of the main control unit of the GAMMA 60 results in a particular coding structure, described in this paper. The size of the instruction is variable enabling the specification of a variable number of addresses.

THE G. E. 2B100

Speakers: H. J. Levinthal, J. Weitzenbaum, R. Hagopian, G. E. Computer Lab. Mountain View, Calif.

EXHIBITORS

Aeronutronic Systems, Inc. 28
Sub. of Ford Motor Co.
Ford Road
Newport Beach, Calif.

AMP, Inc. 20, 22
Harrisburgh, Pa.

Ampex Corp. 53, 54
934 Charter St.
Redwood City, Calif.

Bel Air Industries, Inc. 36
Baltimore, Maryland

Bell Telephone Co. of Penn. 44, 45
1329 Chestnut St.
Philadelphia 7, Pa.

Bendix Computer Division 7, 8
Bendix Aviation Corp.
5630 Arbor Vitae St.
Los Angeles 45, Calif.

Burlingame Associates, Ltd. 70, 72
510 S. Fulton Ave.
Mt. Vernon, N.Y.

CG Electronics Corp. 14
15000 Central East
Albuquerque, New Mexico

C. P. Clare & Co. 69
3101 W. Pratt Blvd.
Chicago 45, Ill.

Computer Control Co., Inc. 21
92 Broad St.
Wellesley 57, Mass.

DATAmatic 46, 47
Div. Minneapolis-Honeywell Reg. Co.
151 Needham St.
Newton, Mass.

DATAMATION 11
Research and Engineering
103 Park Ave.
New York 17, N. Y.

Digital Equipment Corp. 16
Maynard, Mass.

Elco Corp. 39
M St. below Erie Ave.
Philadelphia 24, Pa.

ElectroData 62, 63
Div. of Burroughs Corp.
460 Sierra Madre Villa
Pasadena, Calif.

Electronic Associates, Inc. 48, 49
Long Branch Avenue
Long Branch, N.J.

Electronic Engineering Co. of Calif. 58
1601 E. Chestnut
Santa Ana, Calif.

Ferranti Electric, Inc. 82
95 Madison Ave.
Hempstead, N.Y.

General Ceramics Corp. 17, 19
Keasbey, N.J.

General Electric Company 27
Light Military Electronic Equipment Dept.
French Road
Utica, New York

Hughes Aircraft Co. 13, 15
Florence & Teale Sts.
Culver City, Calif.

Kenneth E. Hughes Co. 23, 25
4808 Bergenline Ave.
Union City, N.J.

IBM Corp. 40-43
590 Madison Ave.
New York 22, N.Y.

Laboratory for Electronics, Inc. 65, 66
Computer Products Div.
141 Malden St.
Boston 18, Mass.

Micro Switch 24
Div. Minneapolis-Honeywell Regulator Co.
151 Needham St.
Newton, Mass.

Mid-Century Instrumatic Corp. 80, 81
611 Broadway
New York 12, N.Y.

Minnesota Mining & Manufacturing Co. 34
Magnetic Products Div.
900 Bush Ave.
St. Paul 6, Minn.

The National Cash Register Co. 64
Dayton 9, Ohio

Nytronics Group 9
New York Transformer Co., Inc.
Third Avenue
Alpha, N.J.

George A. Philbrick Researches, Inc. . . .35
285 Columbus Ave.
Boston 16, Mass.

Potter Instrument Co., Inc. 74, 76
Sunnyside Blvd.
Plainview, L.I., N.Y.

Powers-Samas Accounting Machines, Ltd. 78, 79
Ferranti Electric, Inc.
95 Madison Ave.
Hempstead, N.Y.

Radio Corporation of America 10

Reeves Soundcraft Corp. 4
10 E. 52nd Street
New York 22, N.Y.

Remington Rand 55, 77
Div. Sperry Rand Corp.
315 Fourth Ave.
New York 10, N.Y.

Rese Engineering, Inc. 5, 6
731 Arch St.
Philadelphia 6, Pa.

The I. E. Robinson Co. 18
7404 W. Chester Pike
Upper Darby, Pa.

Rotron Mfg. Co. 12
Schoonmaker Lane
Woodstock, N.Y.

Royal McBee Corp. 29, 30
Westchester Ave.
Port Chester, N.Y.

Soroban Engineering, Inc. 52
Box 1717
Melbourne, Fla.

Sprague Electric Co. 71
Marshall St.
North Adams, Mass.

Stromberg-Carlson-San Diego 73, 75
P. O. Box 2449
San Diego 12, Calif.

Sylvania Electric Systems 1
Div. Sylvania Electric Products, Inc.
100 First Ave.
Waltham 54, Mass.

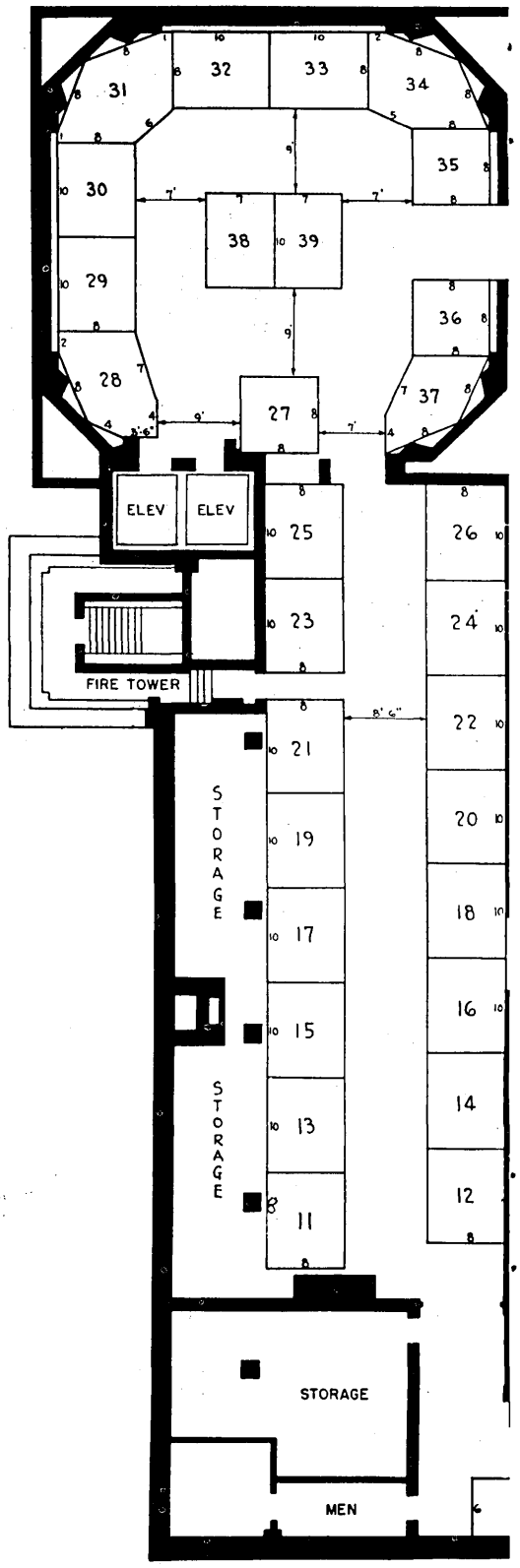
Tally Register Corp. 59, 60
5300 14th St., N.W.
Seattle 7, Wash.

Technitrol Engineering Co. 67, 68
1952 E. Allegheny Ave.
Philadelphia 34, Pa.

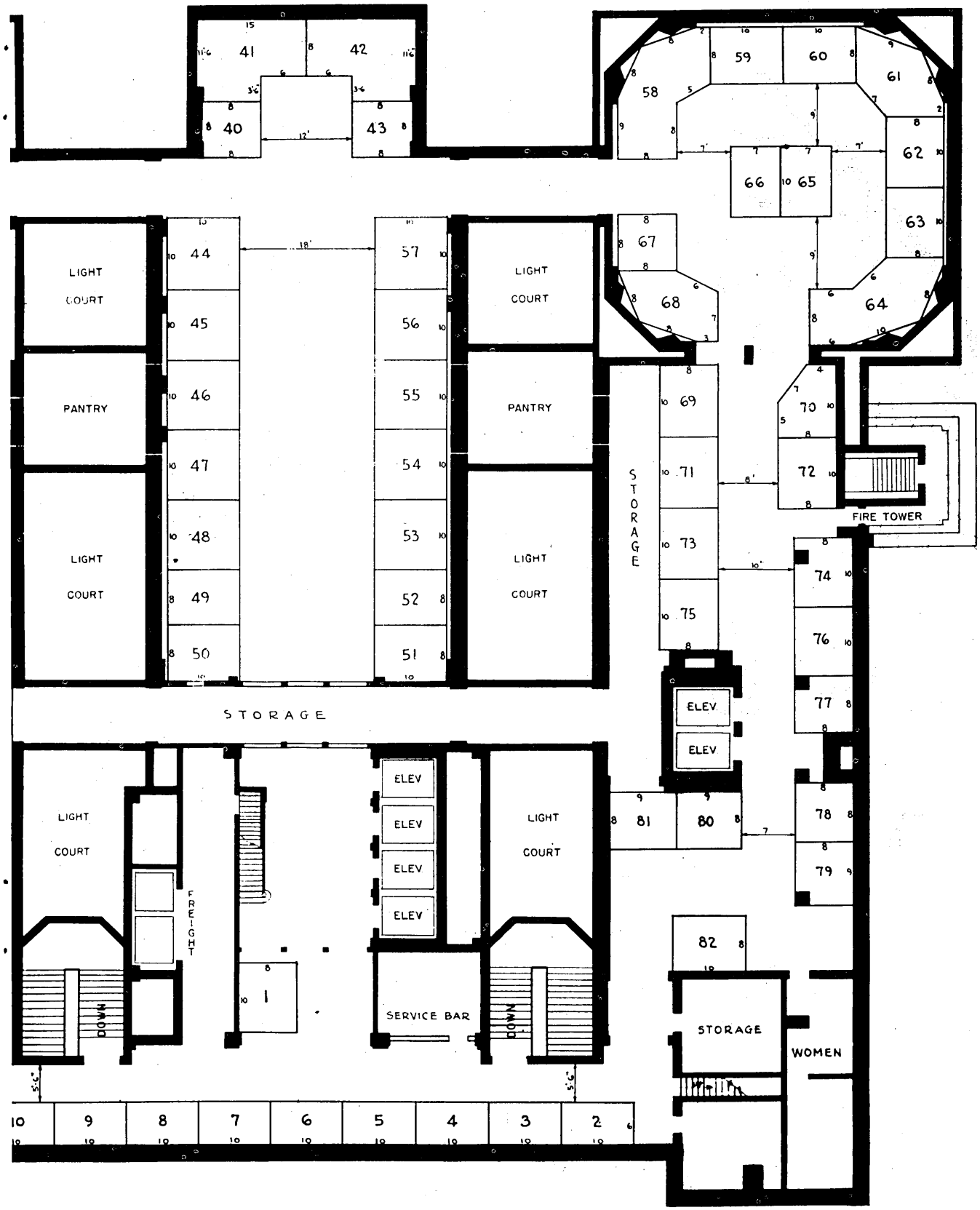
Telemeter Magnetics, Inc. 32, 33
2245 Pontius Ave.
Los Angeles 64, Calif.

Union Switch & Signal 26
Div. Westinghouse Air Brake Co.
Braddock Ave.
Pittsburgh 18, Pa.

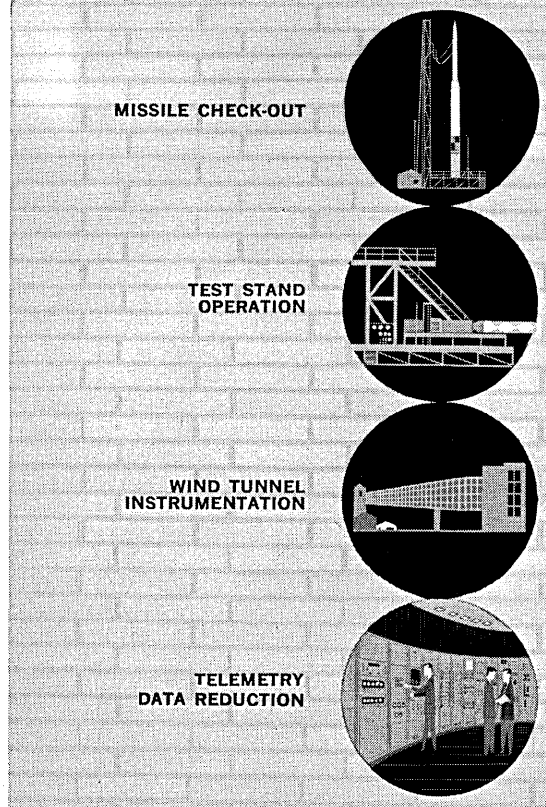
John Wiley & Sons, Inc. 37
440 Fourth Ave.
New York 16, N.Y.



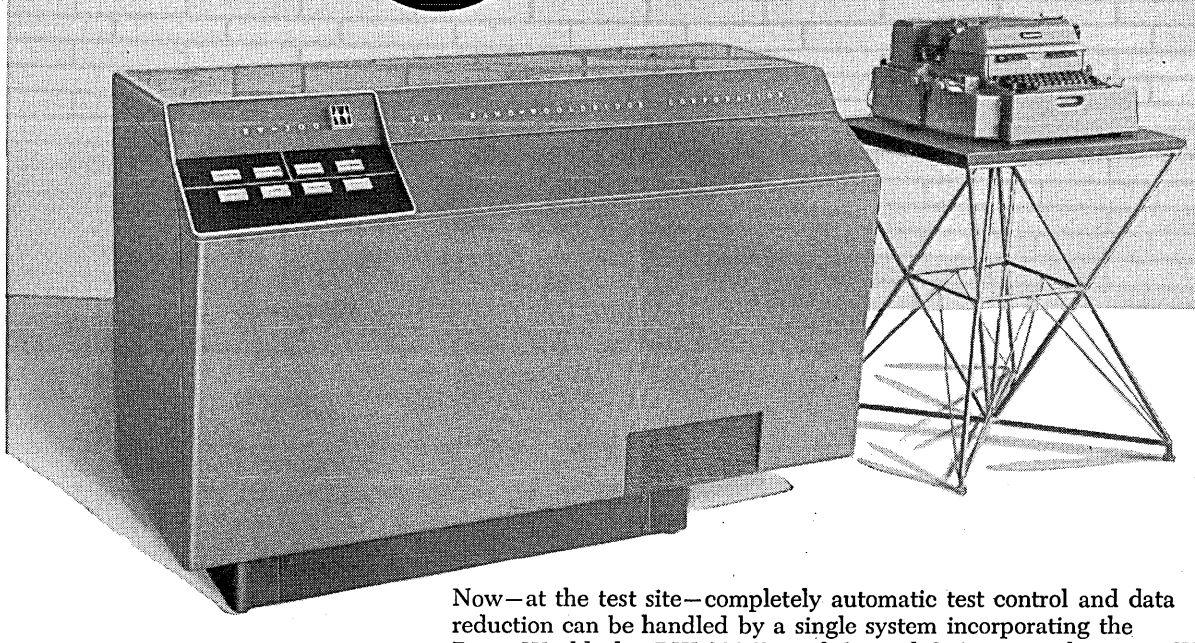
EJCC EXHIBIT AREA



18TH FLOOR, BELLEVUE-STRATFORD HOTEL

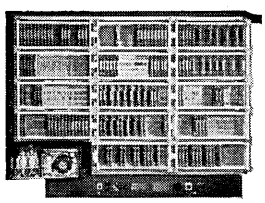


The RW-300 is the first digital computer for test control and data reduction



Now—at the test site—completely automatic test control and data reduction can be handled by a single system incorporating the Ramo-Wooldridge RW-300 Digital Control Computer. The new RW-300 can schedule and closely control test routines, and it can collect, analyze, and record test data.

The versatile RW-300 utilizes input data as feedback to modify control actions, thus substantially shortening many test routines. In addition, the RW-300 directly logs both instrument data and complex relationships among these data. Thus, test results are available immediately. The time-consuming task of processing raw data through a separate computer, often remote from the test facility, usually can be eliminated.



For technical information on automatic test control and data reduction with the RW-300 and with special digital systems which utilize solid-state components exclusively, write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P.O. Box 90067, Airport Station, Los Angeles 45, California, or call OSborne 5-4601.

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY

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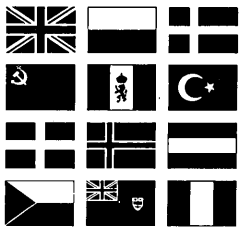


DATAMATION *abroad*

LONDON SHOW FEATURES NEW EQUIPMENT

European office equipment exhibitions have recently shown a marked trend to feature more and more data processing equipment. Some of it has done the Milan-Hanover-Utrecht-Stockholm-Paris circuit and will be shown at the Electronic Exhibition in Olympia Hall, London, November 28 to December 4. Here is a special report about two pieces of equipment which will be featured. A report on still another product to be exhibited in London will be found on page 38.

OLIVETTI AUDIT-TELEBANDA -- the firm Ing. C. Olivetti & C., S.p.A. of Ivrea, Italy will feature this new teletape. As input it can use an Olivetti Audit 322 with magnetic perforator, or an Olivetti Audit 332 with alpha-numeric perforator. The tape thus obtained is of an original design. It uses no sprocket hole because of the reader speed, and the punching gives square holes. The present system uses an electronic reader capable of reading a minimum of 600 codes per second, the handling limit of the connected reproducer.

BULL GAMMA 3B COMPUTER -- this French system can be used both for accounting and mathematical purposes. It has four standard registers, three input registers, two output registers and 32 program steps. Word length is twelve decimal digits. Access time to memories is 0.17 milli-seconds. Accessory equipment which can be used with the 3B include model AEP program and storage extension unit, model AMS storage units and model AET magnetic drum extension unit.

ATOMIC CENTERS ORDER BRITISH MERCURY

Mercury, a British computer claimed by its manufacturer to be the most advanced yet produced in Western Europe, has been ordered by the Belgian Atomic Energy authorities. Six other European atomic centers (in Geneva, Paris, Oslo, Stockholm, Harwell and Risley) have ordered the Mercury, produced by Ferranti, Limited. Calculations are involved which include computation of formulae necessary for the design of nuclear power reactors. Mercury was introduced twelve months ago and is said to be the first computer system outside the U.S. especially designed for large scale scientific research work.

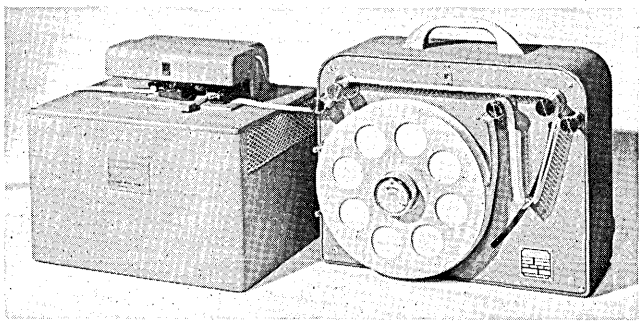
SAS TO SWAP IBM 650 FOR NEW 7070

Scandinavian Airlines System (SAS) have signed a contract for the delivery, in about two years, of an IBM 7070. SAS has been using a 650 with a 533 and a 537. Officials felt that converting the 650 to magnetic tape would not provide them with a fast enough unit. It has been used for technical statistics, and traffic, crew and flight planning.

EJCC PRODUCTS AND SERVICES ON EXHIBIT

tape reader—booth 82

The TR5 tape reader is a new unit using solid-state electronic circuits throughout. All amplifiers, break control circuits and power supplies are self contained and the user

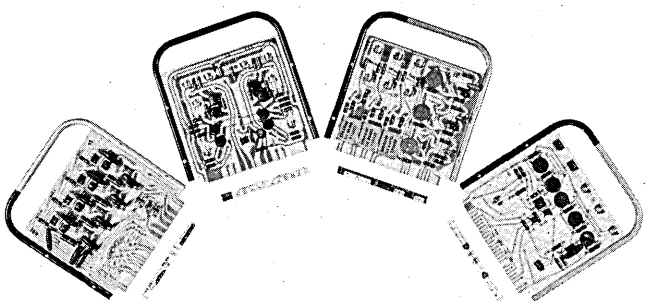


needs only to supply the appropriate stop-start signals and 115 volt, 60 cps power. TR5 shows a family resemblance to the TR2 and uses the same feed mechanism but at an increased speed of 300 characters per second still stopping on the stop character. For more information write FERRANTI ELECTRIC, INC., 95 Madison Avenue, Hempstead, New York, or use reader service card.

Circle 150 on Reader Service Card.

memory packages—booth 21

Transistorized plug-in packages, specifically designed to handle core matrix driving and sensing circuits are incorporated in a new magnetic core memory system for use

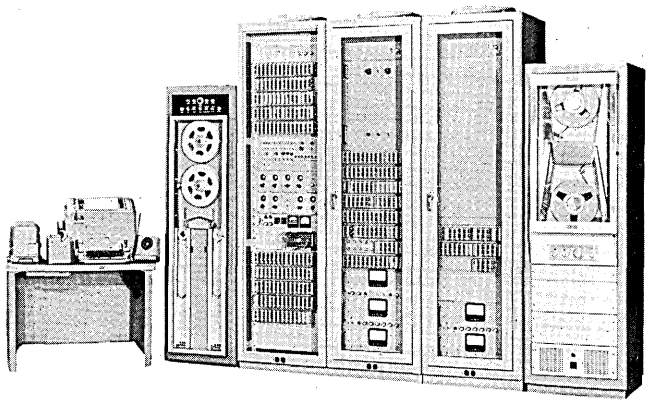


with digital data handling equipment. Random access memories of 4,096 word capacity and 40-bit word lengths are now possible with the flexibility of this modular construction. Access time is four microseconds to any address, and cycle time between successive address locations may be as short as eight microseconds. The basic core memory building blocks consist of sensed amplifier, current driver, inhibit driver, and selection switch packages. These new components are completely compatible with all 3C standard logic building block elements, making possible assembly of special purpose and general purpose core memory systems. Also on EJCC exhibit — transistorized plug-in static DC to 100 AC digital computer components, transistorized plug-in dynamic one megacycle digital computer components, transistorized plug-in acoustic memory, plug-in tester for a logical element, special purpose digital systems, coincident current random access core memory systems, and mathematical services. For more information write COMPUTER CONTROL COMPANY, INC., 92 Broad Street, Wellesley 57, Mass., or use reader card.

Circle 151 on Reader Service Card.

language translator—booth 58

Model ZA 100 computer language translator performs specialized translations for system integration of computers and data processing equipment. Both format and media



conversions are accomplished without interfering with normal computer operations. The translation function is performed separately and independently as either an off-line operation, or in-line operation. Full utilization of computer and data processing systems can be made possible with this translator, the manufacturer states. For more information write ELECTRONIC ENGINEERING COMPANY OF CALIFORNIA, 1601 E. Chestnut Avenue, Santa Ana, California or use reader service card.

Circle 152 on Reader Service Card.

design automation—booths 40, 41, 42, 43

Design automation will be the highlight of this manufacturer's EJCC display. Similar to the simulation techniques used to test complex equipment prior to actual construction, this exhibit will show how present computers are used in perfecting even more sophisticated computers of the future. All routine phases of design — the recording, analysis, and checking of logic and component details — are performed automatically according to rules laid down by design engineers. From the engineers' sketches to the machine printed logic diagrams and wiring layouts, a large-scale computer coordinates and checks the work of many engineers while simultaneously producing comprehensive records of every design phase. Also included in this display will be a type 729 III magnetic tape drive, a standard modular system, and description of the 7070 data processing system. For more information write IN-

TERNATIONAL BUSINESS MACHINES CORP., Data Processing Division, 112 East Post Road, White Plains, New York, or use reader service card.
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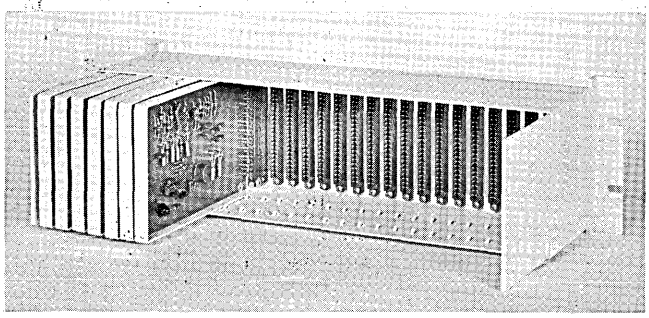
building blocks—booth 16

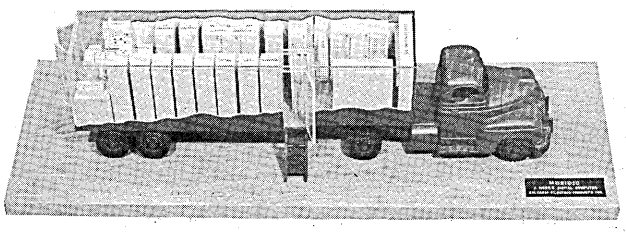
These system building blocks are transistorized digital circuits intended for use in making digital systems. They feature units which are said to be economical for use at



high and low frequency and have compatible signals. Static flip-flops, have output levels of ground and minus three volts. Pulses are 70 millimicroseconds wide and 2.5 volts in amplitude. Power voltages are plus 10 volts and minus 15 volts. Physical dimensions of each building block are ½ in. by 4½ in. by 7 in. They will operate at temperatures up to 120°F. without any cooling required. Also displayed will be digital test equipment (building block type). For more information write DIGITAL EQUIPMENT CORPORATION, Maynard, Mass., or use reader service card.
Circle 154 on Reader Service Card.

mobile computer—booth 1

Featured among this manufacturer's products will be a model of MOBIDIC, mobile digital computer. A general-purpose computer, MOBIDIC is designed to solve military



problems ranging from battle strategy and tactics to logistics. The first all-transistorized mobile digital computer will function in extreme climates and under battle field operating conditions. It fits into a trailer and is designed with an application flexibility which the manufacturer claims represents a marked advance in computer design. For example, MOBIDIC can accept up to 63 input-output devices. It has operating speeds, including memory access, of from 16 microseconds for addition to 88 microseconds for division. The basic memory capacity is 4,096 38-bit words. Other data processing products to be exhibited at EJCC include standardized computer plug-in units, low power indicators for transistorized computers, and computer coils. Data processing services which will be featured include computer design and development services, computer assembly services, and computer programming and analysis services. For more information write SYLVANIA ELECTRIC PRODUCTS, INC., 1740 Broadway, New York 19, New York, or use reader service card.
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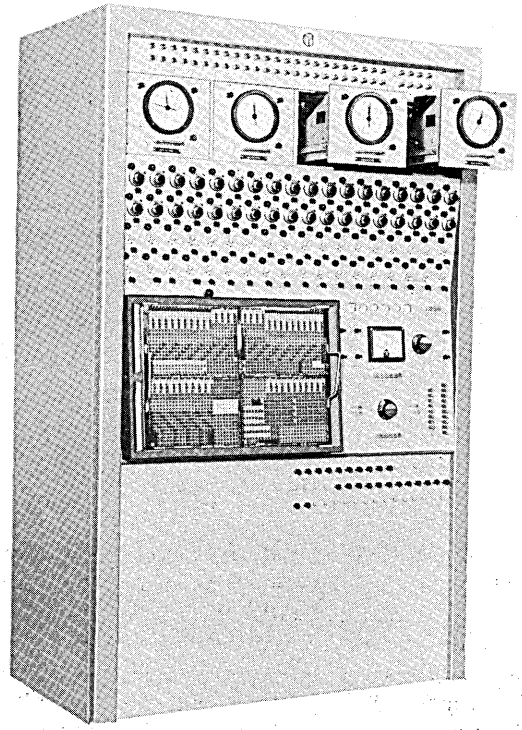
analog computer—booths 80, 81

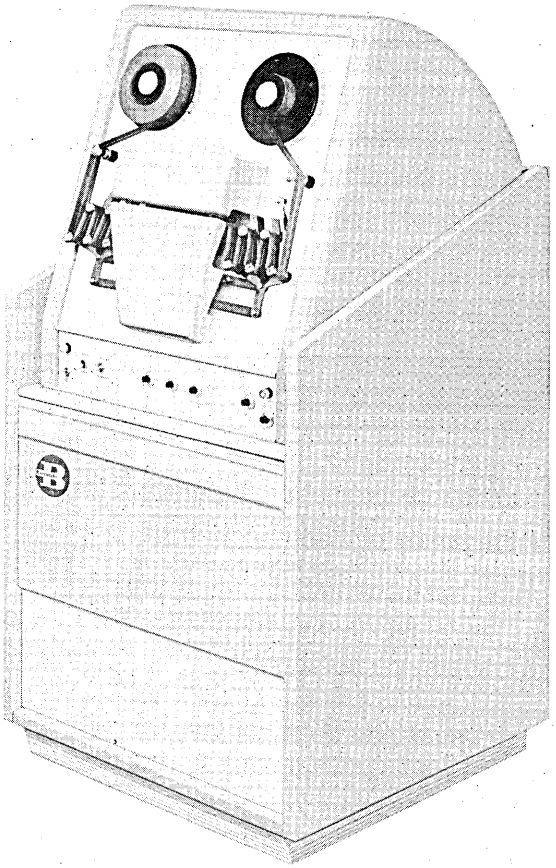
MC-5800 analog computer with 50 cps repetitive operation will be shown at the conference for the first time. The packaging features an equipment door on which all



operational and control components are mounted. For maintenance, the equipment door swings clear of the enclosure to provide unobstructed access to components. MC-5800 offers building block flexibility so that such complementary systems as diode function generators, electronic multipliers, servo-set potentiometers, punched and printed tape read-out and control, etc., may be added in the field by means of plug-in assemblies without rewiring or mechanical modifications. Also on display will be a diode function generator, power supply unit, XY plotter, and six-channel recorder with rectilinear recording conversion kit. For more information write MID-CENTURY INSTRUMATIC CORP., 611 Broadway, New York 12, New York, or use reader service card.
Circle 156 on Reader Service Card.

photoreader—booths 62, 63

Model 220 photoreader accepts information from standard-width commercial tapes at the rate of 1,000 characters per second. Despite this rapid reading rate, it will stop on a



single stop-character. Maximum time required to read the character following the stop-character is five milliseconds. Other features include automatic rewind and end-of-tape sensing, and automatic reel-breaking and servo shutoff system, simple straight-line coding and local or remote control. Tapes of 350 or 700 feet are housed on disposable plastic reels which may also provide inexpensive storage. Also featured at this EJCC exhibit will be a magnetic tape storage unit and scale models of the 205 and 220 EDP systems. For more information write BURROUGHS CORPORATION, ElectroData Division, 460 Sierra Madre Villa, Pasadena, Calif., or use reader service card.

Circle 157 on Reader Service Card.

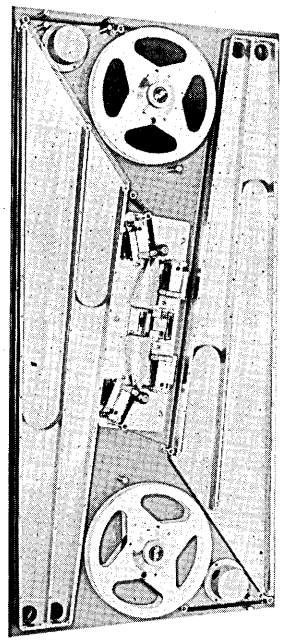
random access store—booths 5, 6

Model 3122 has a capacity of 512 eight binary digit characters, with random access for both writing and reading. Read and write access cycles may be arbitrarily mixed, and synchronous internal timing, or synchronous or asynchronous external timing may be employed, depending on requirements. The 3122 uses solid state circuitry throughout and is the first commercially available memory system to use the RCA standard apertured ferrite memory plate for the storage medium. Using a proprietary topological technique, the output signal to noise ratio of the plate read-out signals is comparable to that usually associated with coincident-current core memory planes. Also featured at the EJCC will be a millimicrosecond current pulse generator, programmed current pulse generator, flux-reset core tester, precision voltage-current calibrator, and digital systems engineering (service). For more information write RESE ENGINEERING, INC., 731 Arch St., Philadelphia 6, Penna. or use reader service card.

Circle 158 on Reader Service Card.

mag tape transport—booths 74, 76

Model 908 digital magnetic tape transport is completely transistorized and designed for complete freedom from programming limitations at speeds up to 150 ips, with 1

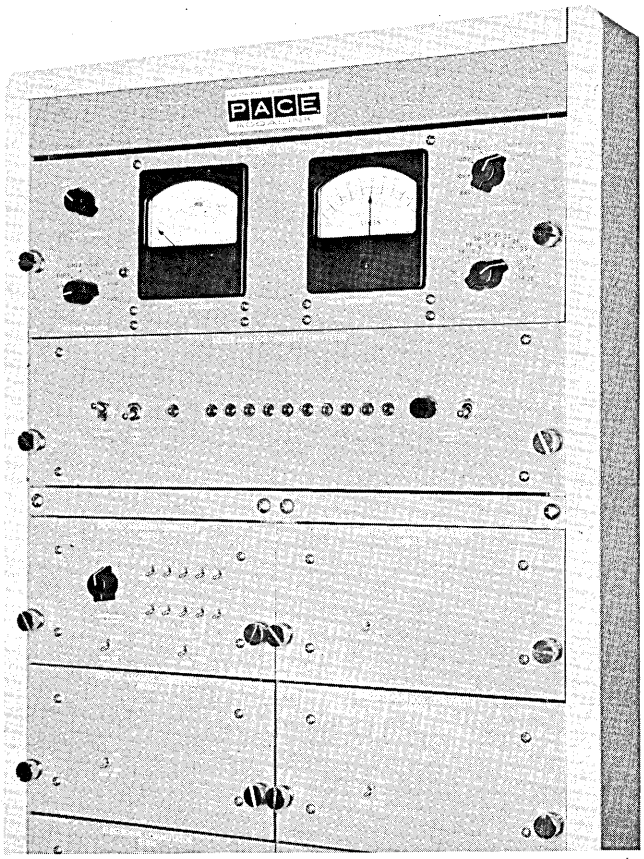


in. tape on 10½ in. reels. A new tape guide system maintains tape skew to much closer tolerances than was heretofore possible. Designed for rack mounting, the 908 is 24 in. wide, 48 in. high, 27 in. deep and weighs approximately 350 pounds. Features include bi-directional tape drive, fast stop/start mode with no programming limitations, 300 ips constant speed rewind, 3 msecs start time, 1.5 msec stop time and .125 nominal stop distance at 150 ips. Also on exhibit will be the 905 and 906 digital magnetic tape transport, a 903 perforated paper tape transport and a 3260 high speed alpha numeric printer. For more information write POTTER INSTRUMENT COMPANY, INC., Sunnyside Boulevard, Plainview, Long Island, New York, or use reader service card.

Circle 159 on Reader Service Card.

computer linkage—booths 48, 49

A new system, known as Addalink, can be used to link a medium or large-scale digital computer with an analog computing facility for process control studies, flight simu-



lation, reactor control simulation, and computations necessitating accurate, coordinate transformations or long term integrations. This equipment optimizes the capabilities of analog and digital computers in their respective areas of problem solution, according to the manufacturer. Addalink systems employ solid-state circuitry throughout, and are assembled in modular fashion from printed circuit building blocks. With delivery of the first unit to a major computer manufacturer now completed, this firm is ready to manufacture Addalink equipment in production quantities for this rapidly growing market. Also on display at the EJCC will be a magnetic tape data plotter, portable high-speed printer, model 1100E variplotter, transistorized variplotter and digital voltmeter. For more information write ELECTRONIC ASSOCIATES, INC., Long Branch, New Jersey or use reader service card.

Circle 160 on Reader Service Card.

digital indicator—booth 26

Digital characters 0 to 9 and two blank spaces are arranged in sequential ascending order. The indicators may be provided with or without internal back lighting. The unit uses a motor developed and manufactured for this application. Ball bearings and enclosure permit use under environmental conditions specified by military requirements. The modular unit measures ½ in. wide, 1-7/16 in. high and 5¼ in. long. The characters are 3/16 in. high. The individual sealed unit overall thickness is 9/16 in. by 1⅝ in. high at the front piece and 5¼ in. long. Weight is less than 7 oz. for the complete individual sealed units. Other products to be displayed include a one inch character digital indicator, an alpha numerical indicator, and miniature relays for operation at 200° C. For more information write UNION SWITCH AND SIGNAL, Division of Westinghouse Air Brake Company, Swissvale, Pa., or use card.

Circle 161 on Reader Service Card.

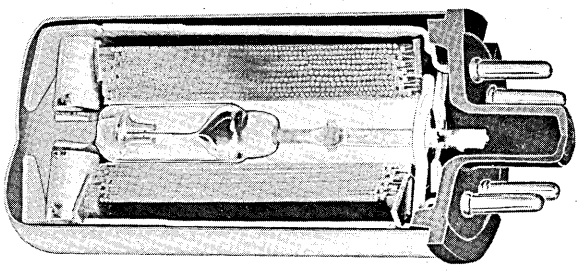
analog computer—booth 35

The K5 analog computer has been especially designed to fulfill the needs of the mathematical equation solver, according to the manufacturer. Because of its modular nature, the K5 may be as large or as small as budget permits. It is suitable for the solution of sets of algebraic or differential equations, and non linear equipment is available in suitable variety for the solution of a wide range of non linear problems. The computer will operate repetitively or single shot at high or low speed. Readout can be performed by any method of choice, including the manufacturer's electronic graph paper, a form of calibrated multiple channel oscilloscope display. In addition, this EJCC exhibit will include operational amplifiers, dc power supplies, non linear auxiliary equipment for analog computers and several publications including the Palimpsest on the Electronic Analog Art. For more information write GEORGE A. PHILBRICK RESEARCHES, INC., 230 Congress Street, Boston 10, Mass., or use reader card.

Circle 162 on Reader Service Card.

contact relay—booth 69

Type HGS relay has mercury film contact surfaces and an operating life in excess of one billion cycles. It offers uniform low contact resistance and attainable operating



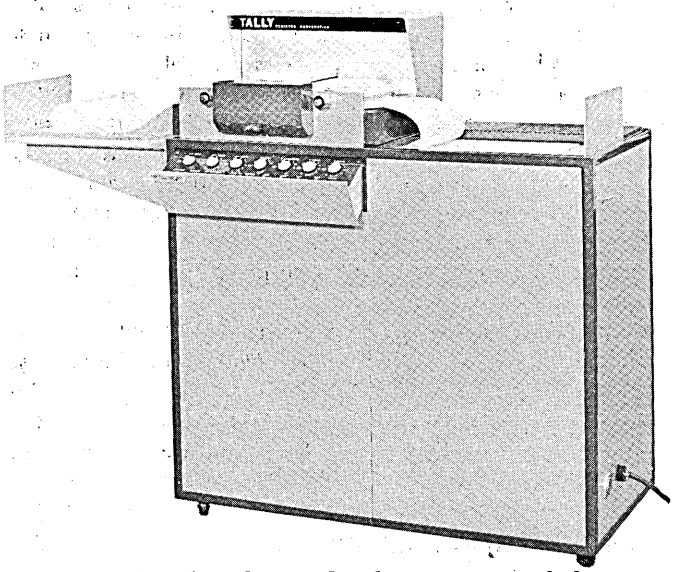
frequencies of 200 cps or more. This relay has no contact bounce and virtually no contact wear, according to the

manufacturer. It has a standard sensitivity adjustment of five milliwatts and operate and release times of one to two milliseconds. Its SPDT (Form D) contacts are rated at two amperes or 500 volts at a maximum product of 100 volt-amperes. The relay is biased by permanent magnets in accordance with a wide variety of customer requirements. Also to be featured at the EJCC are other types of mercury-wetted contact relays — types HG, HGP, and multiple-element types — plus a large display of custom built and subminiature relays, spring-driven stepping switches, and lever keys, push keys and turn keys. For more information write C. P. CLARE AND COMPANY, 3101 Pratt Boulevard, Chicago 45, Illinois or use card.

Circle 163 on Reader Service Card.

digital plotter—booths 59, 60

Model 201 high speed digital plotter plots visibly at speeds up to eight points per second with four symbols, or up to twenty per second with random symbols. Results of com-

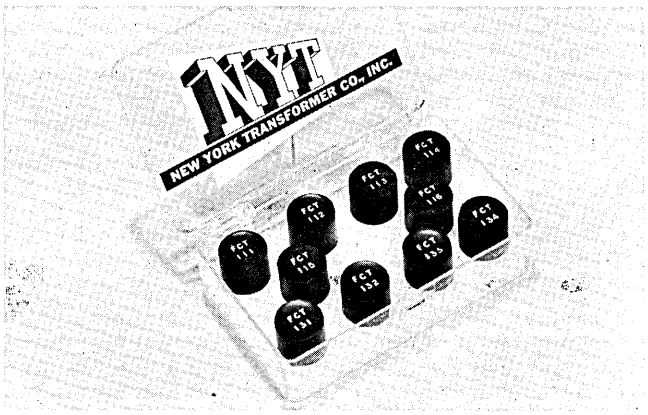


puters can be plotted immediately so as to spotlight performance without delay. The plotted result is a series of mechanically generated printed impressions on paper or vellum. The act of plotting is a complex of mechanical actions performed by a series of subsystems. The selection of symbol, plotting value, paper position, etc., are all performed along the principles of a digital servo. Values and instructions are entered into the secondary buffer. Upon receipt of an instruction signal the mechanical systems are motivated until their position is in agreement with the contents of the secondary buffer. After this, the act of printing occurs and the secondary buffer is reset. Also on display at the EJCC (connected to the 201 plotter) will be a 424 paper tape reader and a 274 data control unit. For more information write TALLY REGISTER CORP., 5300 14th Ave., N. W., Seattle 7, Washington or use card.

Circle 164 on Reader Service Card.

transformer kit—booth 9

This set of pulse transformers for the laboratory engineer and experimenter is a valuable aid in assisting designers in the selection of the required characteristics for pulse

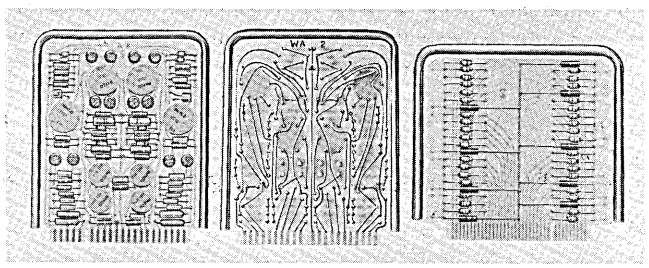


transformer circuitry, states the manufacturer. These are three winding transformers with the first two windings being figured 1:1 ratio. The third winding has three specially selected taps which provide a multitude of ratios over a 10:1 range. The set will cover a minimum pulse width range of .1 to 10 microseconds. These are ideal for computer circuits. High permeability, low loss cause are used providing maximum inductance, minimum droop and high efficiency. Winding configurations are arranged for best high frequency performance. This is a product of the New York Transformer Company, Inc. Essex Electronics will feature high reliability modular delay lines at the EJCC. Sutton Electronic Company will exhibit printed circuit assemblies. For more information write NYTRONICS GROUP, Product Development Division, New York Transformer Co. Inc., Third Avenue, Alpha, N. J.

Circle 165 on Reader Service Card.

digital components—booth 28

Mutually compatible proven components from diode gates to memory drums, designed around solid-state elements and pulse gated techniques, can be the answer to digital



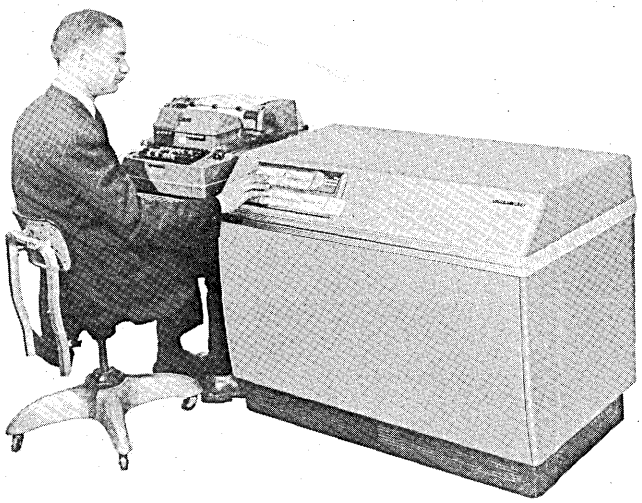
circuit problems. To provide a solid basis for its digital computer development work, the manufacturer's computer laboratory developed a set of basic electronic digital computer circuit packages which include these features: re-

liability, ruggedness, light weight, small size and low power consumption. These components include the following: flip-flops, diode logic boards, read amplifiers, write amplifiers, blocking oscillators, magnetic drums, power supplies and mounting racks. Also to be exhibited – the digital system simulator. A short movie will feature ASI Flight Data Entry. For more information write AERONUTRONIC SYSTEMS, INC., a subsidiary of the Ford Motor Company, 1234 Air Way, Glendale, Calif., or use card.

Circle 166 on Reader Service Card.

desk-size computer—booths 7, 8

LGP 30 is a single address, fixed point, binary, stored program automatic computer. Its integrated logical design utilizes fewer components that serve for many operations.



The manufacturer states that this design principle has resulted in a computer of substantial capacity that can be housed in a desk-size unit. LGP 30 dimensions are 26 in. deep, 33 in. high, 44 in. long, exclusive of electric punched paper tape typewriter and shelf. The unit weighs 800 pounds, operates from a conventional wall outlet and requires no special installation or external air conditioning equipment. LGP 30 is marketed and serviced by the data processing division of the ROYAL McBEE CORP., Port Chester, N. Y. Write them for more information or use card.

Circle 167 on Reader Service Card.

digital controls—booths 13, 15

What is described as "the nation's first all-electronically controlled line of machine tools" operated from punched tapes and controlled by transistorized digital computers will be on display at the EJCC by means of a motion picture. In the film, the line is producing vital parts for the manufacturer's Electronic Armament Control Systems which are "heart and brains" of all American and Canadian Air Force all-weather interceptor airplanes. One company official claims "what we have here is the nucleus of the nation's first electronically automated factory." This firm will also exhibit a memoscope-oscilloscope model 104, typotron character display storage tube for high speed computers, readout, diodes, transistors, capacitors and rectifiers. For more information write HUGHES AIRCRAFT CO., Culver City, California or use reader card.

Circle 168 on Reader Service Card.

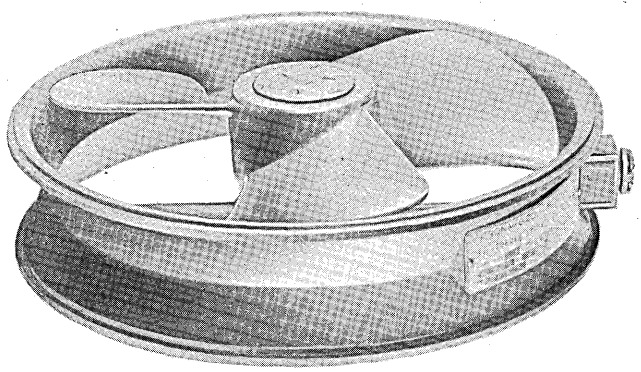
output printer—booths 78, 79

Each individual character in this output printer is formed by traversing a single stylus some 15 times across the width of one character above the printing paper. As the paper moves forward at a uniform speed, 140 styluses are continuously oscillated. Thus each stylus produces a scanning effect in much the same manner as the spot on a television screen scans the picture area. The actual print is produced by pulsing the styluses onto an inked ribbon or carbon paper at appropriate times during the scanning cycle. The dots caused by pulsing the styluses can be produced at any point on the scan to form solid, distinct printed characters. For more information write POWERS-SAMAS ACCOUNTING MACHINES, LTD., Ferranti Electric, Inc., 95 Madison Avenue, Hempstead, N. Y. or use reader service card.

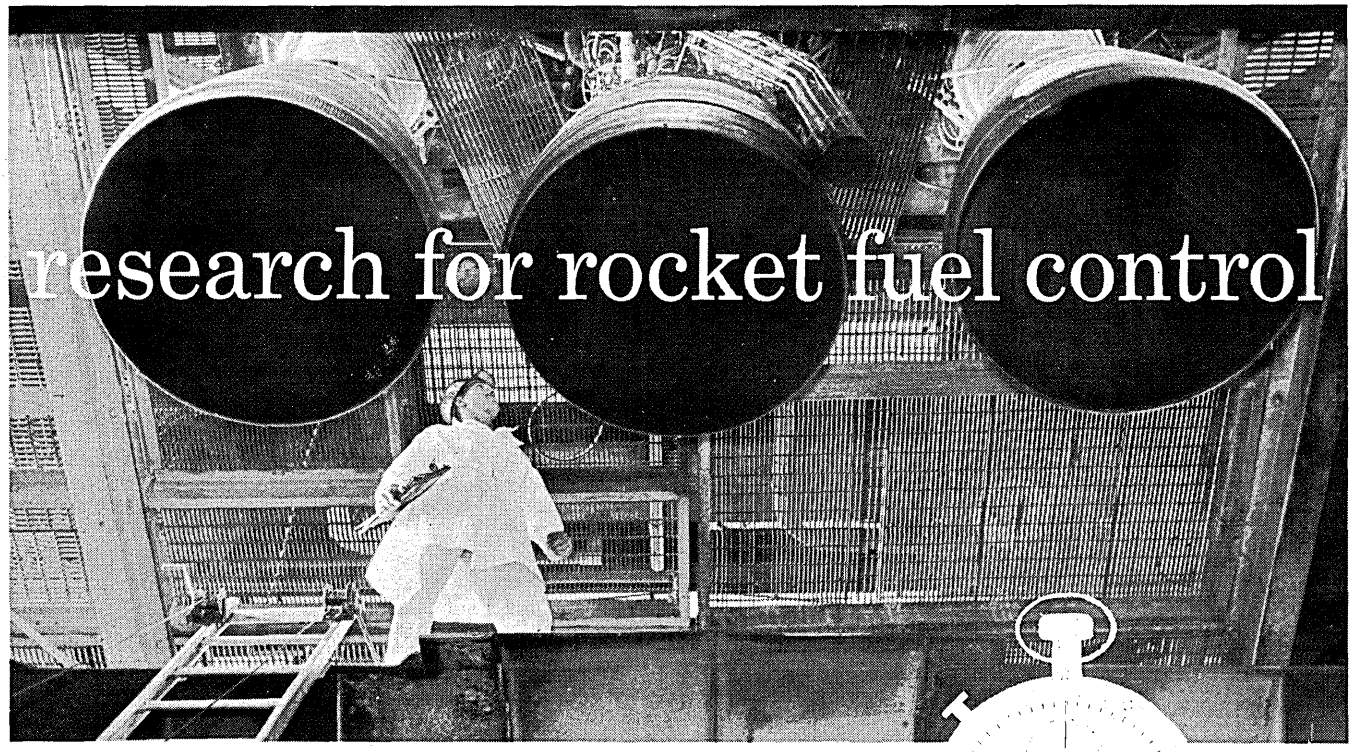
Circle 169 on Reader Service Card.

computer fan—booth 12

A saucer shaped fan developed expressly for cooling of electronic console equipment represents an entirely new concept in design, according to the manufacturer. The



electrical driving motor is entirely built into the propeller hub reducing the axial length of the fan to no more than the thickness of the propeller. The fan measures approximately 7 in. by 2½ in. and weighs 1 lb. 9 oz. Air delivery is 260 CFM against zero static pressure. In cooling applications this results in a temperature rise of only 25°F. for 2 KW heat dissipation inside a cabinet. Supplied for operation on 115 volt AC, 50–60 cps, 1 power supply only, this fan will meet all government specifications for high humidity, fungus and altitude requirements. Also on dis-



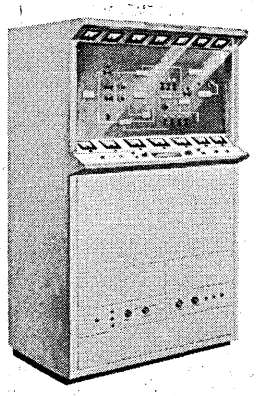
Pumps, turbines, cryogenic hardware and fuel systems—everything short of firing the rocket—will soon be tested by a CEC process control system. Working with dangerous propellants and limited time, the system will provide complete, automatic programming, rapid control, and data in 30 seconds. Write for the complete story in Bulletin CEC3016-X2.

systems division **Consolidated Electrodynamics**

300 N. Sierra Madre Villa, Pasadena, California / Offices in Principal Cities Throughout the World

FOR EMPLOYMENT OPPORTUNITIES
in this progressive company, write Director of Personnel.

From a central block house, the operator controls and reads air pressure, exhaust temperature, turbine speed, flow rate, pump suction pressure, and receiver tank pressure. The system automatically corrects for rates of change of test parameters to insure maximum data in limited time.



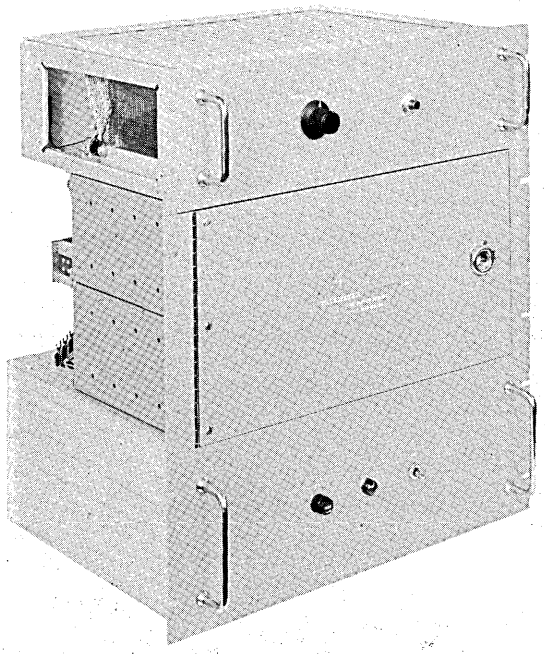
Circle 6 on Reader Service Card

play will be axial flow fans of varying sizes and performance ratings for flushing computer consoles, miniature 400 cps fans for cooling airborne computers, centrifugal blowers for spot and remote cooling in computer consoles and high pressure or vacuum multistage blowers for computer tape slack control. For more information write ROTRON MANUFACTURING CO., Schoonmaker Lane, Woodstock, New York or use reader service card.

Circle 170 on Reader Service Card.

buffer storage—booths 32, 33

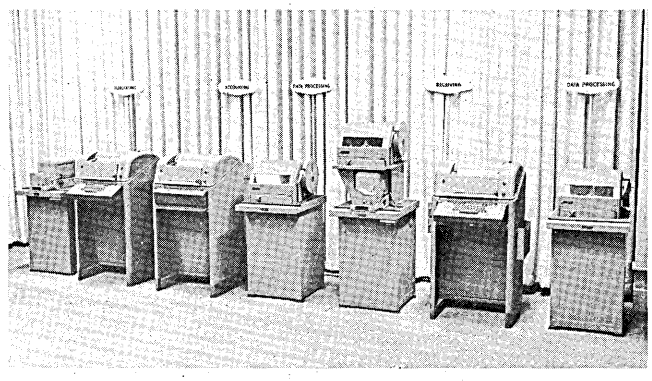
A new core storage buffer designated type 1092-BQ8A, stores up to 1,092 characters of eight bits each and operates at a 100 kc rate. Characters are loaded and unloaded sequentially with all bits of each character being handled simultaneously. Solid-state elements — ferrite cores, transistors and diodes — are used throughout and a high reliability is claimed. The unit features interlaced load and unload, internal checking circuits, integral power supply, expandable capacity and installation ease, the manufacturer states. Also to be exhibited — examples of core and core array products. Supplementing this manufacturer's EJCC exhibit will be a series of symposia on selected subjects. "Word Selection System," "Application Problems For Core Storage Buffers," and "High Speed Transistorized Core Memories" will be discussed. The symposia will be held at the Bellevue-Stratford beginning at 9:30 a.m. each morning of the conference. For more information write TELEMETER MAGNETICS, INC., 2245 Pontius Avenue, Los Angeles 64, Calif. or use card.



Circle 171 on Reader Service Card.

teletypewriter service—booths 44, 45

This exhibit will demonstrate the application of the manufacturer's private line teletypewriter service for a typical IDP order entry procedure. Operating at high speed (100 words per minute, 75 bits per second) it will show how the automatic reproduction of the order data from the receipt of an order up to its billing and the delivery of the data to a computer will reduce clerical labor and time by as much as 80%, practically eliminate human error, and provide up-to-the-minute administrative and inventory control reports, the manufacturer states. Master, by-product and selective tapes will be used in the demonstration. Also to be demonstrated is the dataphone, a new product developed to offer high speed transmission (up to 800 words per minute, 600 bits per second) and usage over regular telephone lines on either a per message or private line basis. For more information write BELL TELEPHONE COMPANY OF PENNSYLVANIA, 1401 Arch Street, Philadelphia 2, Pa. or use reader service card.



Circle 172 on Reader Service Card.

computer flooring—booth 36

This computer flooring withstands uniform loads in excess of 200 pounds per square foot and nominal caster loads of more than 1000 pounds. It permits 360° freedom in placement of cables and ducts and provides interchangeable and removable panels to permit instant access to intercabling and duct work. Fire resistant, the flooring meets building codes. For more information write BEL AIR INDUSTRIES INC., 8125 Pulaski Highway, Baltimore 6, Maryland.

Circle 173 on Reader Service Card.

representative—booths 23, 25

This firm will present the products of the companies listed below, at the conference: Elgin Metal Formers, Corp.—modular enclosure system. Engineered Electronics Co.—plug-in circuits and transistorized indicators. McLean Engineering Laboratories — cooling fans and blowers for electronic cabinets. Erie Instrumentation, division of Erie Resistor Corp.—digital instruments and timers. Hycon

Eastern, Inc.—tape indexing equipment and ultra stable oscillators. Electromath Corp.—precision potentiometers. Milman Engineering Co.—digital and message readouts. Precision Specialties, Inc.—motorized tape punch. R D Instruments—automatic multiple switch. For more information write KENNETH E. HUGHES CO., 4808 Bergenline Avenue, Union City, N. J. or use reader service card.

Circle 174 on Reader Service Card.

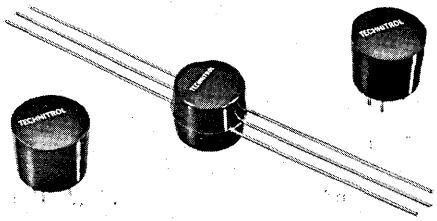
high speed printer—booths 73, 75

The S-C 5000 high speed electronic printer utilizes a Charactron shaped beam tube and a Haloid XeroX, Inc., copyflo printer for printing at rates up to 5,000 lines per minute. When used with the M-10 registration buffer this unit is capable of printing on pre-printed forms such as invoices, stock records, premium notices, and checks. Also on EJCC exhibit will be direct viewing displays, bright displays, high speed communications printers, high speed micro film printers and high speed electronic printers. For more information write STROMBERG-CARLSON, a Division of General Dynamics Corp., 1895 Hancock St., San Diego 12, California, or use reader service card.

Circle 175 on Reader Service Card.

pulse transformers—booths 67, 68

New blocking oscillator and inner stage coupling pulse transformers have been manufactured by a completely new technique utilizing a compression moulding process.



The new transformers offer improved electrical and physical design features over industry-standard epoxy encapsulated transformers, the manufacturer states. Pulse widths available from 0.1 to 25 useconds, for transistor or vacuum tube operation; total pulse energy is six watt-useconds maximum; pulse repetition rate to 10 mc. The unit is moisture resistant, has plug-in or pigtail leads, one or two secondaries, and wound inverting or non-inverting. It surpasses most MIL-T-27A specifications. This firm will also display its line of pulse test equipment – in particular a new pulse power amplifier for testing magnetic switch cores. For more information write TECHNITROL ENGINEERING COMPANY, 1952 E. Allegheny Avenue, Philadelphia 34, Pennsylvania, or use reader service card.

Circle 176 on Reader Service Card.

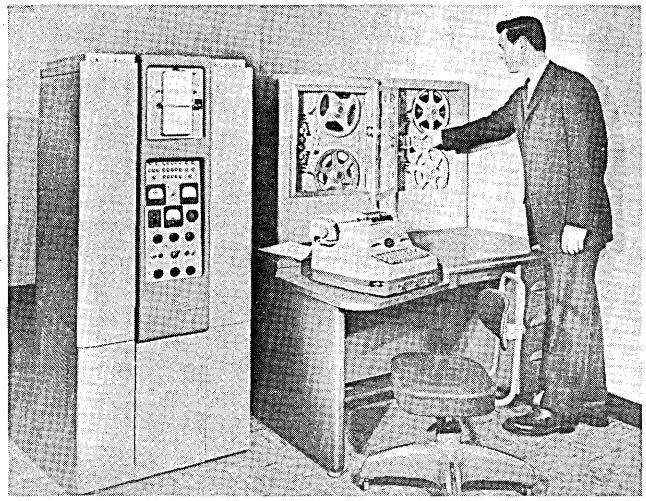
double throw switches—booths 20, 22

This new line of multiple pole double throw switches, shielded and nonshielded, are available in a range of 80 pole double throw to 1500 pole double throw. These switches are manually operated by a lever mechanism and are recommended for instrumentation applications requiring low resistance, noise free, long life contacts. The manufacturer states that these switches can replace high quality telephone type relays in many applications. Other products to be displayed include shielded wire termination, printed circuit edge connector locks, components, tips, paper pins, harness connectors, test probe connectors, large cable connectors and cable wrapping. For more information write AMP, INC., Harrisburg, Penna., or use card.

Circle 177 on Reader Service Card.

medium size computer—booths 7, 8

Housed in the top of the G-15 general purpose computer is a tape punch and high speed, magazine loaded, photoelectric tape reader. The paper tape equipment and the

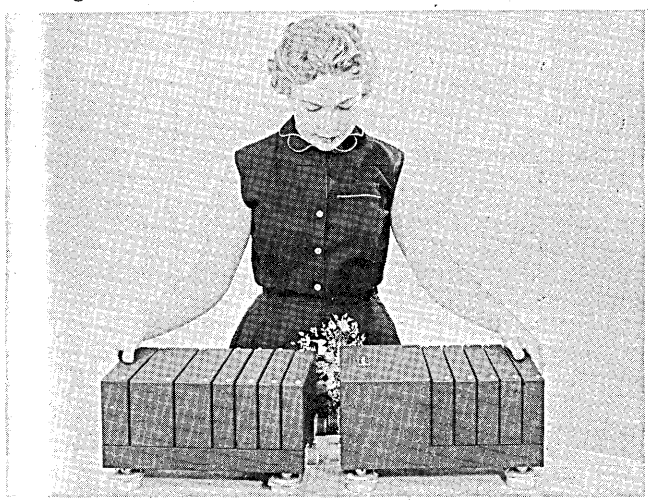


input/output control typewriter are supplied as standard equipment. An important feature of the G-15 is plug-in use of accessory equipment. Introduced in September was the CA-2 coupler which processes punched cards at 100 cards per minute and has a print-out speed of 100 lines per minute. Cards can contain alpha-numeric and special characters. Other input/output operations may take place simultaneously with the CA-2 operation. Another accessory is the PR-2 high speed photoreader. The PR-2 permits any code punched on 5, 6 or 7 channel tape to be read into the computer. Tape speed is 400 characters per second and will stop on a character. On display with the G-15 at the conference will be a magnetic tape unit and a digital differential analyzer. For more information write BENDIX COMPUTER DIVISION, 5630 Arbor Vitae Street, Los Angeles 45, California, or use reader card.

Circle 178 on Reader Service Card.

increment computer—booth 27

Gevic, a new variable increment computer combines rapid solution rates of the general-purpose digital computer with the high iteration rates of the fixed increment type. Small



and light (less than 2 cu. ft., 70-90 lbs. including input-output equipment), Gevic has the speed and capacity to provide the central computer functions for typical advanced fighter-bombers, or the pre-launch computations for inertially guided missiles. For more information write GENERAL ELECTRIC CO., Defense Electronics Div., Light Military Electronic Equipment Dept., French Road, Utica, N. Y.

Circle 179 on Reader Service Card.

representative—booths 70, 72

This display at the EJCC will feature the following products of the companies listed: Brush Instruments—direct writing oscillographs for computer readout. Donner Scientific Company — analog computer. ElectroInstruments — digital voltmeters and analog-to-digital converters. Electro Pulse—precision pulse generators and core testing equipment. Magnetics Research—cores, pulse storage and control components. NJE—solid state computer power supplies. For more information write BURLINGAME ASSOCIATES, LTD., 510 S. Fulton Avenue, Mount Vernon, N. Y.

Circle 180 on Reader Service Card.

enclosures—booth 39

"Varipac" is a printed circuit board enclosure designed to be adapted to any packaging technique utilizing printed or etched circuitry; and to provide maximum density from shelf stocked parts. It holds boards and printed circuit connectors in alignment and when used in conjunction with special printed circuit connectors and etched wiring boards, it can automatically replace the technicians soldering time of approximately 40 hours per card cage, according to the manufacturer. Also on EJCC display will be a full line of tube sockets, shields, printed circuitry components and connectors. For more information write ELCO CORP., M St. below Erie Ave., Philadelphia 24, Pa.

Circle 181 on Reader Service Card

SELECTING

ELECTRONIC DATA PROCESSING EQUIPMENT

by MYRON B. SOLO
Chief, Electronic Data Processing Division
County of Los Angeles

The following is a case study describing the procedure used in selecting electronic data processing equipment for the County of Los Angeles. The same procedures, perhaps with less formality in obtaining bids, could apply to industry. The conclusions reached will be of value to all groups selecting EDP equipment.

The County of Los Angeles followed a conventional pattern of preliminary study (1) by surveying the data processing activities of the County for areas where conversion to EDP might pay off, (2) by thoroughly studying the area selected, and (3) by establishing an EDP division as a result of management approval of the proposal submitted. Equipment selection was not attempted during this period.

There were four basic steps in the process of selecting computer equipment:

(1) A relatively small but typical part of a major application was chosen as a "benchmark" problem.

(2) The benchmark problem, together with a set of specific questions, was submitted to interested and reliable manufacturers in the form of a request for bid. The principal questions were: the time each manufacturer's system required to perform the benchmark problem, and the cost of that system.

(3) The manufacturer's data was inserted in a formula to obtain, for each system, the cost of processing the benchmark problem.

(4) The costs of each system were also extrapolated to the time 10 years hence when all of the planned applications will be converted to the electronic system.

The file maintenance of the County Assessor's basic file of all assessed properties was chosen for the representative problem. The problem consisted of the daily recording and key punching of 7500 transactions of 13 principal types concerning changes in ownership, in land value, new subdivisions, inquiries, etc. There was a need for weekly conversion of 37,500 transactions to magnetic tape, followed by sorting of this data; and monthly maintenance of a file of more than 1,800,000 records of variable length. A printed report of every record in the file was required during two of the monthly file maintenance runs each year, requiring 100 percent processing of the file. During the remaining 10 months only a 10 percent collation ratio occurs with 134,000 documents needed each month; 1,937,000 documents are printed in each of the two remaining months. The sorting requirements are several; the overall annual load was simulated by two large sorts of 600,000 items of 175-character records.

The request for bid-proposals required the bids to include provision for a brief training course for the County's EDP staff before bids were due. The basic criterion for selection was cost-per-unit of work processed; also considered were programming ease, reliability and the ability to handle the total data processing load as extrapolated from the benchmark problem by the County.

The benchmark problem was described in the request and detailed information was given. Manufacturers were not allowed to modify the output format in any way. The total assessor-tax collector problem was described briefly, as background.

Specific information requested by the County included:

- Equipment recommended by the manufacturer.
- Specifications of this equipment.
- The time required by each component of the equipment to do the benchmark problem.
- Price of recommended equipment; rental and purchase.
- Delivery date.
- Level of reliability (percent down time and mean error-free time).
- Cost of maintenance contracts.
- Operating personnel required.
- Power and space required.
- Cost of magnetic tape, and estimated rate of tape wear.
- Cost of installation.
- Availability of another identical system for use during emergencies.
- Ease of programming.
- The actual code for a portion of the benchmark problem.

Preparation of the Request for Bids took two months. Manufacturers were given two and one-half months to prepare their proposals.

The six proposals received were analyzed by the EDP staff.

The times incurred on the four acceptable proposals for doing the various runs for the benchmark job are shown in Table 1.

(Note: All specific data shown applies to the County problem only. It is given only as an example of the technique.)

formulas used to determine costs

(1) **Annual Operating Cost.** The numerous costs which go into the operation of an EDP system were put into a formula in order to derive an overall annual cost to operate an EDP system for one shift. This formula is shown as Formula I.

(2) **Cost of Doing a Representative Workload.** The times to do the various runs of the benchmark problem were multiplied by the equipment costs for each kind of equipment used in each "run" to give the cost of the benchmark workload. Formula II is used to determine this operating unit cost.

A 10-year depreciation period was allowed.

1 TABLE 1—COMPARATIVE TIMES FOR BENCHMARK PROBLEM RUNS

RUN	MACHINE A	B	C	D
Input Card-to-Tape	15.0	8.3	4.7	7.8
Batch Check	a	0.7	1.0	1.1
Sort Transactions	3.7	1.5	1.0	6.4
Merge Transactions	0.9b	0.5	0.1	0.7
Low Density File Maintenance	13.6	12.4	6.4c	16.8
Normal File Maintenance (Hrs./Month)	33.2	23.4	13.2	32.8
Low Density Printing (Hrs./Month)	4.1	3.7	2.2	3.4
High Density File Maintenance or Extra Edit Run for Special Reports	26.3	33.1	11.0	32.1
High Density Printing (Hrs./Year)	1,022.1	1,126.9	709.3	1,361.1

a—included in sort
b—includes 0.5 hour of misc. printing
c—includes 0.1 hour of low density edit

I FORMULA I

$$\text{Annual operating cost of EDP system for primary shift} = \frac{\text{Purchase price of system minus 10\% residual value}}{\text{10-year overall life}} + \text{Freight, 4\% sales tax, insurance} + \frac{\text{Total physical installation costs}}{\text{10-year overall life}} + \text{Annual space cost} + \text{Annual power cost} + \frac{\text{Tape cost}}{\text{10-year use}} + \text{Annual maintenance costs (primary shift)} + \text{Operating personnel costs}$$

II FORMULA II

Cost of doing benchmark work = *Sum of cost of doing the representative workload on each component of the system*

$$= \text{Sum Of} \left[\text{Ratio of Component price to total price}^{*} \times \text{Annual operating cost of EDP system for one shift (from 1)} \times \frac{\text{Actual time used on the component for the benchmark problem}}{\text{The number of hours available annually during one shift}} \right]$$

For each component of equipment

*Apportioning annual operating cost in proportion to equipment purchase (or rental) cost was felt to be sufficiently accurate.

Tape costs were based on the initial stock of magnetic tape required for all applications contemplated.

Depreciation and installation were written off in the first shift. For computing the costs when renting, the first term of Formula I is replaced by the annual rental costs.

The results of Formula I are shown in Table 2. The results of using this data in Formula II are shown in Table 3. At this point, the purchase of Machine C appears to be indicated.

Formula II calculations for Machine C are shown in more detail in Tables 4 and 5.

The EDP staff had estimated, based on size of files and amount of activity, that the complete property assessment and tax collection problem represented a workload of about 6 times the benchmark problem.

An adjustment of 60 percent was added to all workloads for these factors: downtime, reruns, setup, engineering changes, program debugging, scheduling difficulties.

Then other applications were judged in relation to the property tax problem. This study indicated that the total County EDP applications represents 15.0 times the benchmark problem, including an allowance for growth over 10 years of 1.2 units (such functions as registration of voters, Bureau of Public Assistance records, and some engineering work were considered). It was assumed that these applications will be programmed and concerted to EDP at a uniform rate over a 5-year period. Based on this, a 10-year plan could be developed, indicating that the cost of owning System C was the least over the 10-year period, as shown in Figure 1, page 32.

other factors and final selection

There are four factors the above-mentioned formulae do not cover:

(a) The reliability of the equipment manuacturer.
(b) In the case of machines not yet field tested (B and C were in this category), assurance that the machine will perform as specified.
(c) Programming costs.
(d) Legibility of printed output (from high-speed printers).

Study of these factors largely based on judgment, previous experience, and analysis by consultants with engineering experience, lead to the conclusion that all manufacturers still under consideration must be judged as equivalent on these points.

These four factors then, did not change the selection of Machine C, for which an order was placed.

evaluation of the relation procedure

If this group had to go through another equipment selection program, below are the points we feel would be retained and those we might change from the procedure actually used. These points are discussed here as an aid to others selecting EDP equipment:

1. The use of a carefully prepared "benchmark" problem is an excellent way to pin down the wide variety of claims made by the manufacturers in regard to special features, such as overall data processing speeds, prices, and specific contractual proposals. In this way hardware and programming "gimmicks" are tested to see how useful they actually are and what they mean in dollars and cents in a specific situation.

2. The formulae for developing the cost-per-benchmark process appear sufficiently accurate for the purpose, in view of the many judgment factors involved.

2

TABLE 2–COMPARATIVE ANNUAL OPERATING COSTS FOR PURCHASED EDP SYSTEM (FORMULA I)

COST FACTORS	MACHINE D[b]	C	A	B
Primary Shift, Total	$398,648	$561,166	$444,239	$408,636
Purchase Factor[a]	163,182	236,155	219,265	195,607
Installation ÷ 10	20,099	32,561	12,898	12,400
Space	10,500	15,900	10,500	10,500
Power	6,410	9,150	6,340	11,070
Tape ÷ 10	10,430	24,800	10,320	8,804
Primary Maintenance	137,772	187,065	134,661	120,000
Personnel	50,255	55,535	50,255	50,255

(This analysis was made for each shift, for lease as well as purchase)

(a)–Purchase factor equals (90% of Purchase Price plus Freight & Ins. plus Sales Tax) divided by 10.
(b)–Certain modifications of this proposal were made by the manufacturer which resulted in lower costs. These are not reflected in the figures for the "D" system. For the purposes of the example these are not significant.

3 TABLE 3–RESULTS OF FORMULA II

COST TO DO BENCHMARK WORK IN DOLLARS PER YEAR

	MACHINE			
	A	B	C	D
Rental	83,800	76,900	61,400	not estimated
Purchase	61,200	56,700	44,500	74,600

4 TABLE 4–TIME DATA FOR MACHINE C–HOURS PER YEAR (If Purchased)

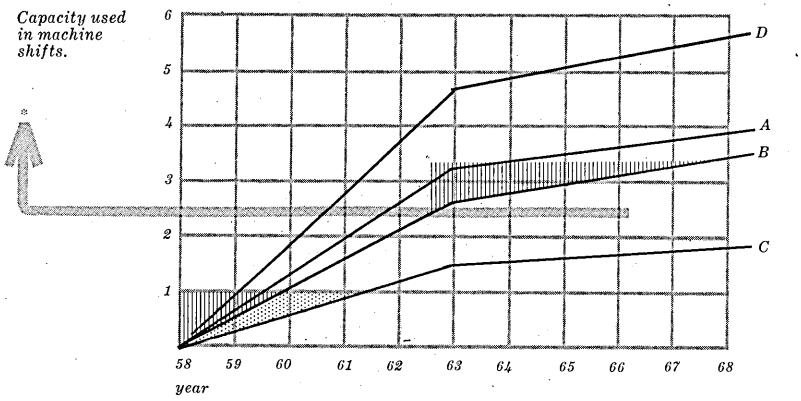
	No. Times Per Year	Computer	Tape Unit		Card-To-Tape	Printer	
			No.	Total Hours		No.	Total Hours
Input	12		1	56.4	56.4		
Batch Check	12	11.6	4	46.4			
Sort	12	12.0	8	96.0			
Merge	12	1.3	6	7.8			
Low Coll. Ratio File Maintenance	12	75.7	8	605.6			
Low Coll. Ratio Edit	12	1.4	5	7.0			
Edit Preprint & Map Book	2	22.0	8	176.0			
Printing (Regular)	12		1	26.4		1	26.4
Printing (All Records)	1		1	709.3		3	709.3
Large Sort	1	10.5	6	63.0			
Total Hours/Year (to do benchmark work)		134.5		1793.9	56.4		735.7

5 TABLE 5–FORMULA II DATA FOR MACHINE C (Purchase)

	A	B	C	D	E	F	G	H
UNIT	Unit Cost	Total Cost	Ratio A/B	Annual Cost (1)	Annual Cost Per Unit (CXD)	Annual Hours (2)	Ratio F / 2080 (3)	Cost Per Unit (EXG)	Total Cost (4)
Computer	985,000		.3949		221,604	134.5	.0647	14,338	
Tape Units	61,745 ea.		.0247 ea.		13,861 ea.	1793.9	.8625	11,955	
Input Converter	185,000		.0742		41,639	56.4	.0271	1,128	
Printer	215,000		.0862		48,373	735.7	.3537	17,110	
		2,494,200		561,166					44,531

(1) from Formula I
(2) from Table 5
(3) 2080=hours per shift per year
(4) sum of column H

1 FIGURE 1



*second machine required over 2.5 shifts/day

similar data was estimated for printing and conversion

shaded areas show capacity which must be acquired at one time (1st shift of each machine)

3. The preparation of a detailed request for bids was believed justified, at least for a governmental agency, wherein impartiality is especially important. The preparation and evaluation of the bid was educational since a number of ways of designing this EDP system were proposed both formally and informally, during the equipment selection program. After the "benchmark problem" formulation, the extreme importance of careful design of the real system could genuinely be appreciated by the EDP group.

4. The training presented by manufacturers before due date for submitting proposals was valuable but the trainees do not come to really appreciate the problems of programming such as: handling variable length records and editing for unusual formats. The programming courses should revolve around actual difficult problems and not examples that show how the machine is "easy" to use.

5. Making a 10-year estimate of work-load is well worthwhile if it aids in selecting the most efficient computer. Otherwise the entire systems study and equipment selection has to be repeated in three to five years.

6. The time allowed manufacturers for preparing bids should be extended from 3 to 3½ months.

7. Care should be taken to see that all details of the benchmark problem are very clear; a briefing session for bidders would be helpful.

8. The exact data which the manufacturer is expected to submit should be listed in one place in the request for proposals.

9. Care should be taken to see that the manufacturer is not proposing to obtain a high speed of operation by methods that require extremely tricky programming or a "loop" based on precise and critical timing. One should carefully evaluate the programming problems and possibility of timing errors involved in techniques such as: multi-programming, use of buffers in special ways, methods of "packing" data with fixed word-length machines, and the use of complex programs with many sub-routines, switches, etc. Manufacturers should be pre-warned that estimated processing times that result from critical use of complex programming will not be considered by the user, and that safety factors may be added to these times.

10. Manufacturers should be asked to program and code in detail both a section of the file maintenance flow diagram and the "traffic and control" loop permitting the passage of a "no-hit" record from the old master tape to the new, updated, master file.

11. The user must define in advance the audit control system he wants to keep on magnetic tape. EDP machines can be programmed to make continuous trial balances of a file to check against group control records as they occur throughout the file. To some extent, the proposed file control system to be used will make some machines less attractive than they appear on paper.

12. The assistance of a qualified consultant to assist in making the systems study, preparing the economic justification and selecting equipment can be helpful.

summary

By a careful study of the data processing requirements of an organization it was possible to prepare a typical benchmark problem. This problem then formed the basis of a request for proposals from equipment manufacturers which allowed a fair, quantitative evaluation and comparison of the proposed systems.

In this paper it has not been possible to give all of the details of the selection procedure. It is hoped that enough data is given to allow other groups to develop similar quantitative selection procedures for their own organizations. (Also note reference 1, below.) We feel that this approach has merit for selecting EDP equipment for any application, industrial or governmental, although for industry a formal bid may not always be required.

references

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2. *H. S. Levin, OFFICE WORK AND AUTOMATION, Wiley, 1956.*
3. *ELECTRONICS IN BUSINESS, a descriptive reference guide, Controllership Foundation, Inc., 2 Park Avenue, N. Y. 16, N. Y. (a good general bibliography).*
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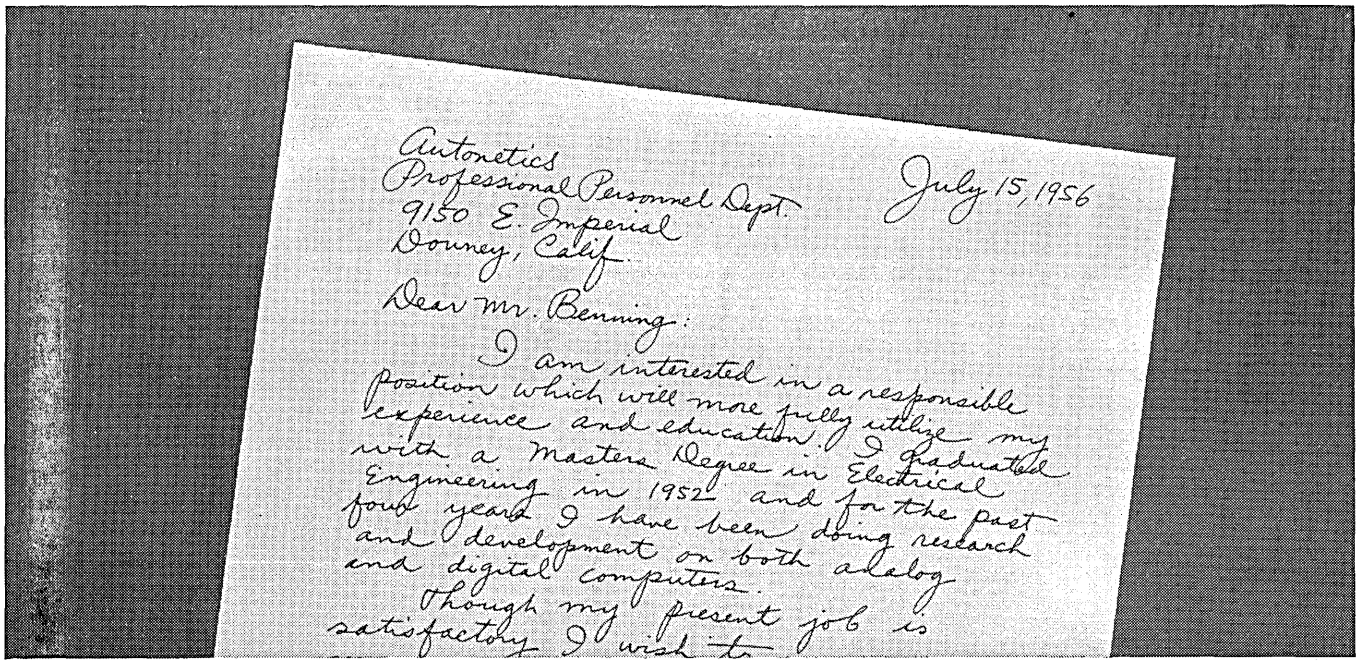
5. *"Release to Manufacturers Inviting Bids on Electronic Data Processing System," County of Los Angeles, Board of Supervisors, Dec. 1956, (on file, copies not available).*
6. *See also "Factors to Consider in a Contract for a Large-Scale Electronic Computing System," Data Processing Digest, Vol. II, #11, (Nov., 1956) p. 15-18.*
7. *Evaluation of Bids for an Electronic Data Processing System," County of Los Angeles, Board of Supervisors, May 7. 1957, (on file, copies may be available from Los Angeles Business Electronics. Round Table, 2700 So. Grand St., Los Angeles, Calif., price $5.00).*
8. *THE AUDITOR ENCOUNTERS ELECTRONIC DATA PROCESSING, by Price, Waterhouse & Co., available from IBM.*



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THE ROLE OF LARGE MEMORY IN SCIENTIFIC COMMUNICATIONS

by DR. MORTON M. ASTRAHAN
Manager, Systems Research
IBM Research Laboratory, San Jose, Calif.

The words **large memory** imply, for me, a store of at least a million alphanumeric-coded machine-readable characters, or a million reduced picture images. Automatic access is implied for the coded characters, although manual access may be suitable for the picture images. The access may be directly to a specific body of information, called a record, with little or no scanning, or it may involve scanning the entire file. Records may be identified or addressed by their physical location or by their content.

coded memories

Access speed is an important characteristic of coded memories. Random access time is the time required to reach any desired area of the memory and read out a record. Serial scan time is that needed to read all the records.

Present commercially available large coded memories range from 15-million-bit (binary digit) drums with 1/5 second random access time to 40-million-bit disk arrays with ⅔ second random access time, and on to reels or strips of magnetic tape which require many seconds for random access to hundreds of millions of bits.

High-speed tapes are available which can be read at a rate of ¾ million bits per second on 31 parallel channels. If used for continuous serial scan, a 2700-foot reel containing ¼ billion bits could be searched in 5½ minutes.

The current state of the art of magnetic and photographic recording, as well as the descriptions of laboratory models of large memories which have been presented, make it evident that it is now technically feasible to produce memories of 1 to 10 billion bits with random access times of less than a second. Economic feasibility is, of course, another question and one which I do not propose to discuss.

High density of recording is an important key to achieving high capacity, high speed, and low cost. Let us examine the densities that seem achievable. It appears that the density limitations in both magnetic and photographic recordings will be due for some time to the reading and writing apparatus rather than to the resolution of the medium. For both media 100,000 bits per square inch is achievable now in the laboratory and a goal of a million bits per square inch is regarded as achievable for a practical machine. Theoretically attractive techniques for achieving a hundred times higher densities have been suggested, but not yet critically evaluated. I will come back to all these numbers later in describing applications.

Scanning speed is another important property, since a complete scan of a file is a straightforward way of achieving an associative access, that is, one based on the content of a record. A complete scan is certainly not aesthetically neat compared to direct associative access, but it definitely is technically attractive if the scanning speed can be made sufficiently high. For magnetic stores, we can expect to achieve scanning speeds of 10 million bits per second for a single reading head. This same rate can be achieved optically, using flying spot scanners. One attractive possibility for use in searching a photographic file for exact matches is the use of mask comparison for the searching data. This technique leads to severe registration problems at the densities I am bandying about, and it also leads to format restrictions, but it can greatly increase the searching speed with a single searching element.

All these speeds can, of course, be greatly increased by parallel reading heads, at greater cost.

I have deliberately not discussed writing rates, since these are less important in the applications I will consider. The rate of duplicating a whole file for distribution is of interest, and here the possibility of high resolution contact prints makes optical recording attractive.

picture storage

For storing picture images, there is microfilm, which can put several thousand frames on a 100 foot reel. There are also systems available for putting several page images on a film card. At present, one hundred-to-one reductions are possible for sheets containing typed text. This results in a storage density of a hundred pictures per square inch. One thousand pictures per square inch is a reasonable goal for a practical machine. Devices which have been demonstrated include Minicards, with a 60:1 reduction and 12 frames plus coding to a card about ⅝ in. X 1¼ in.,

Dr. Morton M. Astrahan was recently appointed functional manager of small systems and machines research at IBM's Research Laboratory, San Jose, Calif. After obtaining his PhD from Northwestern University in 1949, Dr. Astrahan joined IBM and participated in the planning and logical design of the 701 computer. He was in charge of systems planning on the AN/FSQ-7 computer for the SAGE air defense system and directed input-output development and prototype testing for AN/FSQ-7. In 1956, he became manager of the lab's systems research.

He was first chairman of the IRE Professional Group on Electronic Computers during 1952 and 1953. Dr. Astrahan is now chairman of the National Joint Computer Committee.

and the National Bureau of Standards system which provides direct access to any of ten thousand frames on a piece of film 10 inches square, which is a 100:1 reduction. In the latter, each frame represented an individual character, and so did not involve a high reduction.

indexing

The most evident application of large memory to scientific communication involves communication by means of written information. In the category of written information, I include photographs and drawings. Large memories will help answer the following questions:

1. What is written?
2. Where is it?

Large memories will also help to carry out the following orders:

1. Get it.
2. Translate it.

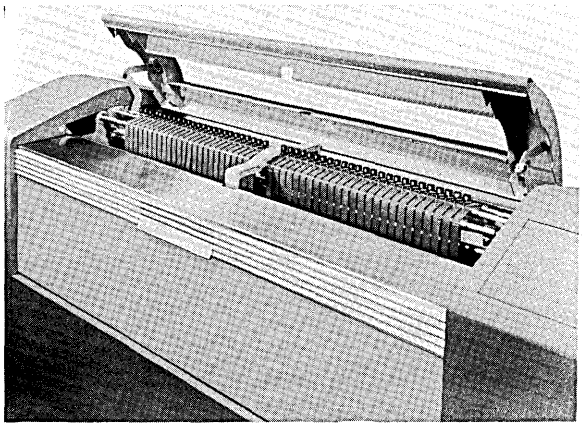
The other category of scientific communication involves spoken information, and here too, large memory can play a role.

Probably the most pressing application is getting the answers to the two questions. "What is written," and "Where is it." Variations of this problem are called Information Retrieval, Literature Search, Indexing, and other similar names. The problems described with these names cover a wide range of complexity. An example of the simplest kind of problem would be the following. Given a set of research reports, each defined by a unique number, find the location of the report corresponding to a specific given number. An example of the most complicated kind of question would be the following. "What has ever been written concerning the photoconductive properties of materials in a specified incident radiation frequency range?"

For purposes of considering large memory requirements, we can describe a general problem which covers the whole range of problems. And following this tack, I will call the general problem the Indexing problem, thus avoiding the need for naming variations of it. Any

two U. S.-made memory units

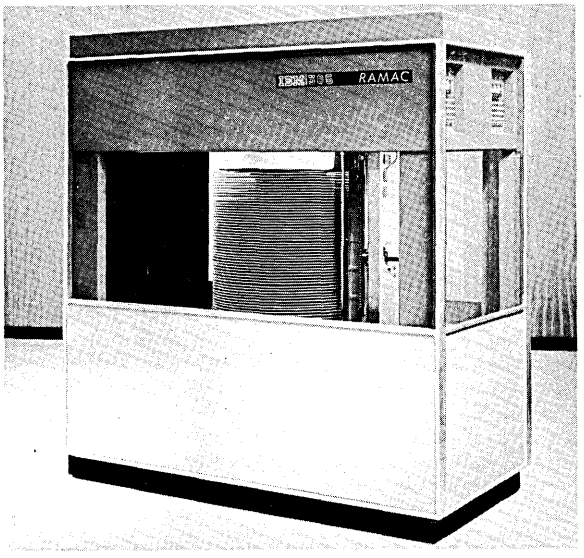
ElectroData's Datafile system is used in conjunction with a Burroughs 205 computer. Each Datafile stores 20-million characters in a single memory unit the size



of a deep-freeze. Up to 10 Datafiles can be integrated into one computer system providing a memory of some 200-million characters.

The unit's design concept physically "segmentizes" information by eliminating convential tape reels. This principle not only affords large file capacity but achieves high processing speed, according to the manufacturer. Fifty 250-foot tapes inside each unit magnetically store the business records at hand. Information is calibrated into addressable blocks of 200 characters each. The tapes, housed in static-free metal bins, move backward or forward over guide rods at 60 inches per second.

Shown here is the disk memory unit of the IBM 305 RAMAC, with 50 magnetic disks capable of storing five million alpha-numeric characters of information.



Data is recorded on or read from each side of the disks by a rapidly-moving electronic "arm."

indexing problem involves a finite set of documents, **D** in number. In the most general case, **D** might be the total number of documents ever written. In a very restricted case, it might be a set of numbered reports issued by a laboratory. I define the word document as being a unit of written information which I am willing to search through if there is a high probability that the information I am looking for is somewhere within it. This means to me the length of the usual article in a technical journal or a chapter in a book.

In any specific problem there is an average number of characters, **C** per document, including all the text tables, titles of pictures, mathematical symbols, chemical formulas, texts on graphs, etc. I take a character to be 7 to 8 bits, including a check bit.

choosing terms

All of the indexing techniques I have heard used or proposed involve choosing one or more index terms for each document from a set **T** of all possible index terms. These terms may be just an identification number, or they might perhaps be chosen from a catalog of suitable index concepts for the subject being considered, or they might be derived from the words in the article using more complicated logical analyses. (**DC**/10), which is 10% of the total number of characters in all the documents, is probably a good upper bound to the number of characters that might be needed for complete indexing. This is my guess based on work done by Phyllis Baxendale of this lab on determining index terms automatically from original text by use of rules based on language structure. I believe that these techniques offer the only hope of achieving high speed searching equivalent to the questioner's reading all the searched documents.

Any inquiry will be expressed by means of the index terms, either directly, or perhaps through a logical analysis of an inquiry statement similar to the analysis used in indexing the documents. The indexing process then involves searching the file of index terms for matches with the inquiry terms. The output is the identification and location of documents, and possibly abstracts. The matches could be exact or they might involve other logical rules, such as those which would result in selecting the closest matches.

There are two general ways that a large memory can be organized for Indexing. If the memory has direct access, we can organize the memory into a unit record for each index term and store in each of these records the identification of the documents which are characterized by that index term. We then search only the records for the inquiry terms. With a serial scanning memory, we organize the memory into a record for each document, where each record contains the index terms for that document, and inquiry then requires a search through all the records. If the document numbers, which are repeated for every appropriate index term in the first case, average the same number of characters in length as the index terms, which are repeated for every appropriate document number in the second case, then the same file capacity is required for indexing in both systems. Systems exist today using 5 million character magnetic tapes or Ramac Disk Files which can accommodate tens of thousands of documents with several manually assigned concepts or index terms for each document.

I will mention a few of these that have been reported.

At the Naval Ordnance Test Station at China Lake, California, over 14,000 reports on magnetic tape have been searched. Chemical structure searches on tape were tried at Dow and Monsanto. Our experimental system using a Ramac now contains 5,000 documents I tried it in preparation for this paper and got a long list of references. Of course, I got most of my information by the proven method of asking people who know.

FOSDIC 2 should also be mentioned here. It was developed by the Bureau of Standards and provides for selective reproduction of punched card images stored at a density of 13,000 card images to a 100-foot reel of 16 mm microfilm. It searches at 4,000 cards per minute. The experimental model is being delivered to the Air Weather Service at Asheville, N. C. for evaluation. They have a file of 300 million cards to search.

Two other jobs are worth mentioning as examples of Indexing. These are the use of magnetic tape systems in the preparation of a Bible Concordance and in the indexing of the Dead Sea Scrolls.

future needs

I will now indulge in speculative mathematics about memory sizes that might be needed in the future for Indexing. I have found a second-hand reference* which states that there are approximately 60 million pages of technical literature currently published every year throughout the world. From other references, I have gotten figures of almost 2 million magazine articles and more than 60 thousand technical and scientific books published each year. Together, these probably would account for about 25 million pages, so I will accept the 60 million figure. Let us assume that we wish to search this whole mess and ignore everything but the memory requirements. I will assume that there are an average of 500 words per page, so my 10% rule calls for 50 index terms per page. This comes to a total of about 3 billion index terms, or about 300 per document if we assume 10 million documents. The index store will thus require about a 150 billion bits, assuming 50 bits per term. This could be halved with better coding, but more tables and less

(please turn to page 38)

* Vagtborg, H., *Tomorrow Through Research*, 7, No. 1, p. 1, Feb. 1955, Southwest Research Institute.

electronic carrousel memory

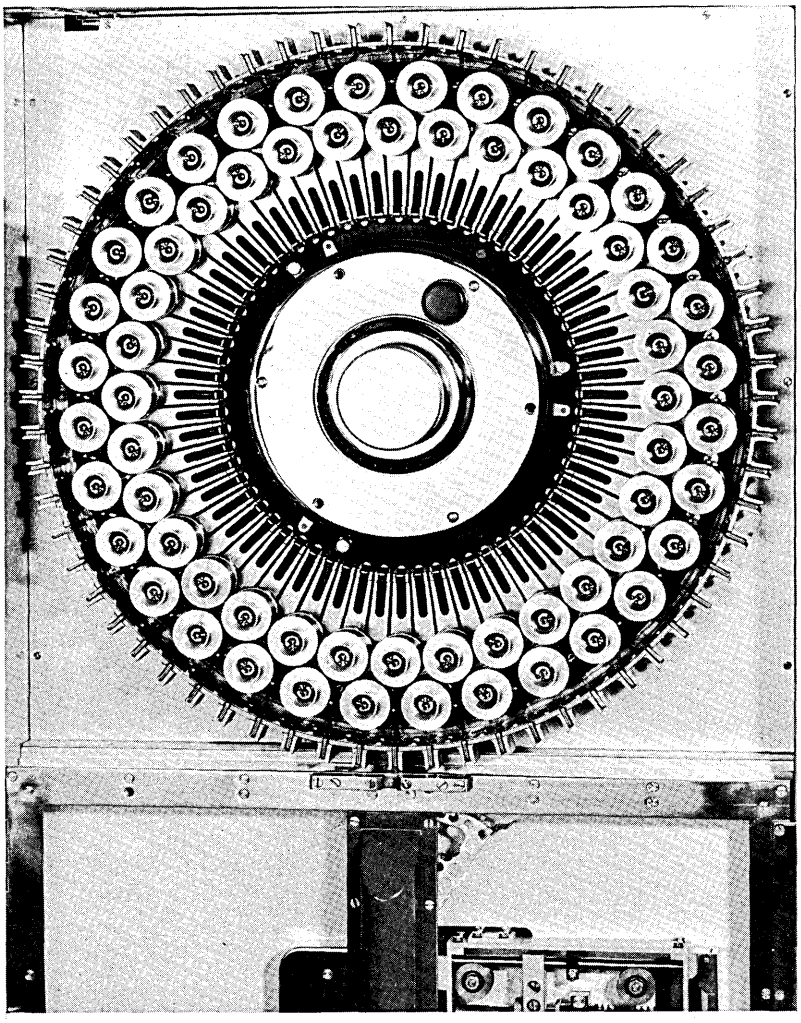
One of the newest developments in random access memory systems is covered in a report from our Swedish correspondent, Etienne Guerin. His subject – the ECM-64 FACIT Random Access Memory.

ECM-64, which stands for Electronic Carrousel Memory is the result of three years of research, under the direction of engineers, Erik Stemme and Sven-Erik Wallstrom. In order to reduce access time, individual magnetic tape lengths are wrapped around 64 individual spools, which are extruding from a large wheel rotating on a horizontal axis. The spools and the wheel are both easily removed.

Code symbols on the wheel axis designate the contents of the spool tapes, and by indicating the symbol desired the wheel is activated toward the reading/recording head, which is located below the center of the wheel. The design permits the wheel to rotate left or right, whichever is the closest for the spool to reach the head. Here it is stopped, a weight at the free end of the tape is released and the tape unreels downward in a serpentine movement into a tank. The speed is self-regulating, both in the downward movement and for rewinding, varying from 0.5 to 2 seconds according to the length traveled by the tape before the selected block of information has been reached. The snap-back does not encroach on machine time.

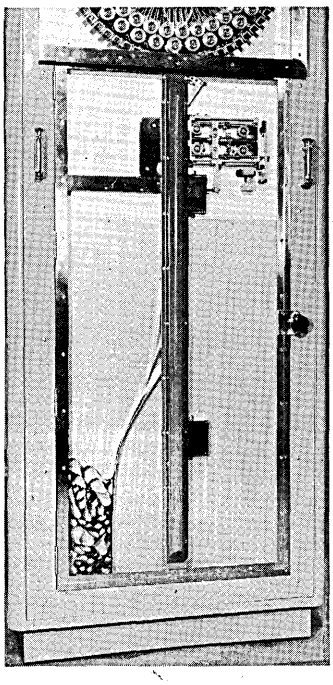
As this memory is an external apparatus, the time required for the electronic selection of the desired program depends on the central unit. Once this selection has been made, the memory handles the remaining processing in from 0.6 to 3.2 seconds.

Tape speed is 5 meters/sec., tape width ⅝ in. There are 8 channels of which one is for checking and seven for code. Time displacement error between the outermost channels is less than 5 microseconds. Rewind time is about 2 seconds (uneven – faster at the start, slower at the end). Average time to select a spool: 1 second maximum, ½ second average. After selecting a spool, the first information block is reached in 0.6 seconds, 1.9 seconds average access time for one or more blocks. The amplifier is fully transistorized.



With the ability to rotate left or right, the carrousel wheel can automatically stop its rotation. A weight at the free end of the tape is released in the center guide pulling the tape. After it passes the reading head and photocell, it unreels downwards in a serpentine movement into the tank (see below).

The complete wheel weighs 4,700 grams and file size is 44 x 44 x 7 cms., with a thickness of 63 mm. and a diameter of 430 mm. Each station can house two wheels and they measure 166 x 62 x 87 cms. The spools, of special aluminum, when brought into position are activated by an electric motor moving forward inside the spool core. Each spool houses about 8.5 meters of tape. Each tape can hold 8,192 words of 40 bits, divided into 128 blocks of 64 words. A fully loaded wheel contains more than 3.1 millions alpha-numeric characters or alternatively more than 5.2 millions decimal figures. Two photocell readers have control functions on the operation.



Track width is 1.5 mm., gap length 1/100th mm., track spacing is 2 mm. Air gap between head and tape (to obtain higher reliability) is 1/100th mm.

The amplifier has an input voltage from the head of five millivolts. Write current is 80 milliamps.

redundancy in the search matching would result.

At a million bits per square inch, we could put 150 billion bits on a recording surface one inch wide and 12 thousand feet long. A series scan of the whole memory at 10 million bits per second would take 4 hours. If we could afford to be in a hurry, we might provide a hundred parallel channels and a hundred comparing circuits and run the tape at a thousand inches per second. The search would then take about 2 minutes. If the inquiry only takes about 10 words, however, it would be profitable to make a memory with more direct access. For example, the one-inch-wide surface mentioned previously could be divided into a 120 hundred-foot strips. Assuming 10 seconds to select a strip and 10 seconds to run an average of 25 feet out and 25 feet back to the center of the strip, each access would take 20 seconds, and the whole search would take about 3 minutes. Using 12,000 one-foot strips we might be able to cut this down to 1 second per access, with a total of 10 seconds for the search. Other arrangements on disks and drums could just as well have been considered.

Consider the Library of Congress. Dr. King once estimated that it contains 10^{14} bits. Using the same indexing factor of 10% that I used before, we come out with about 30 to 100 times as much storage required as in the preceding example. Thus, it would not take too much further improvement in resolution and speed to make possible a practical single store for all of this information.

now available?

Of course, if we had these memories today, we would not be able to make use of them.We do not really know how to use the large memories available today. There are many successful punched card special purpose indexes in use, but hardly any magnetic tape systems. What tape systems there are, are mostly experimental. One reason is that there are many other techniques that need to be developed. These involve input methods and searching logic.

Manual assignment of index terms and preparation of the machine-readable index entry for a document is costly and of limited value. We must have means for automatically entering text information and for automatically generating the index terms from it which are independent of the opinions of a human cataloguer. Character sensing readers which will read all type styles might be achievable at a cost which would make them practical, if used in conjunction with people to point out the things to be read and the proper order. I think that machines to do this whole job, so that you could hand them a magazine or a book and come out with indexed documents, are further off than the index memories themselves. Thus, for some time our systems will be limited largely by the input problems. We can at least hope that in the next few years it will be possible to begin having all published technical information produced in a machine-readable form in addition to the human-readable form. A lot of work is going into the automatic indexing problem and it seems reasonable to hope that solutions to this problem will be available when needed. With automatic entry and automatic indexing, it will become practical for central agencies to maintain up-to-date indexes in special areas. These might contain a hundred thousand documents, at 1000 index terms for each document. A basic billion character memory would be needed, and it would be revised regularly, either by the addition of supplementary units or by complete replacement of the storage element.

document store

You will notice that I have kept the job of indexing separate from the job of retrieval of the document, which is the answer to "get it." We can imagine picture storage memories in which rapid mechanical access to any of a large number of pieces of film is available. Each piece of film would have pictures stored on it at a density of between 100 and 1000 pictures per square inch. The coded index files would provide the information concerning the specific location of any desired picture. The first justification for such systems will be in terms of access time. With improved print-out and display techniques, these systems will compete on a cost basis with manual access. We might someday look forward to a system whereby libraries have mainly an indexing search machine and a document file. We might further hope for remote display and print-out at many locations, or we might provide each individual with a complete set of hundreds of thousands of picture images with manual or even automatic access, along with a viewer and copier. In either case, a searcher would call the library to find where to look, and would do the actual reference work at his own desk.

translation

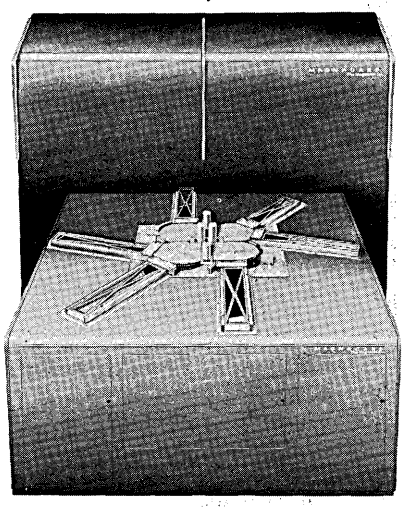
Language translation is another area which will be helped by large memory. Here again, current memory techniques are ahead of our knowledge of the logic of the problem. Most present systems use dictionaries which translate single words into their alternative translations, leaving the reader to make sense out of the resulting mish-mash. Automatic production of a clean translation, such as a good human translator could produce, will require more storage to hold the language structure and idioms. Even so, memories of one to ten million characters with random access in one-tenth second should be able to handle realtime translation, when the language structure and data input problems are solved.

voice recognition

Speaking of realtime translation, brings us to one other means of communication which should be considered,

datamation details on magnacard

Magnacard System, developed by The Magnavox Company, stores data on 1 in. by 3 in. magnetic cards, which can be processed at rates up to 100 per second. Cards are transported by means of rotating vacuum drums. The four-drum array shown is the Magnacard

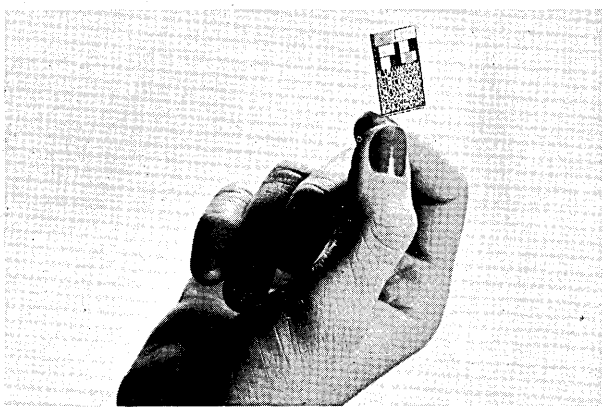


handling unit, capable of performing all basic card-handling operations.

Shown behind this unit is a file block with a capacity of 300,000 cards or a total of 1 5 billion bits of information. A wide variety of machines form the Magnacard system, including sorters, collators and large-file access units.

minicard

A piece of film the size of a postage stamp known as the Minicard film record is the "memory" of the Eastman Kodak Company's Minicard System (marketed by a subsidiary, Recordak Corporation). In the area 16 by 32mm the Minicard film record has a storage capacity of five times the code information contained in a tabulating card. By "filing" documentary information with the indexing code the film is a complete unit record, makes single searching automatic. Once the coded film records are retrieved electronically (speed:



1000 film records a minute) the information is immediately available for reference, dissemination and reproduction into hard copies, original size. In lieu of punched holes, the record utilizes clear and opaque areas for binary code, exposed as square "dots" in the film emulsion.

Up to twelve, legal-size documents can be reproduced on a single record and space remains for 294 bits, or 49 characters, of alphanumeric code. If the documentary information consists of only six written or printed pages, maps, charts, photographs the code pattern can be increased to 1554 bits, or 259 characters.

namely, voice communication. Voice recognition for purposes of translation, control, or recording for printing will eventually be handled with the aid of large memories in a manner similar to the language translation problem. Schemes for building up words by recognizing individual phonemes will be replaced by systems wherein whole words at a time are recognized by an indexing process. The index terms will be characteristics such as energy distribution of various frequencies for a succession of phonemes. Simple language structure rules will make it possible to distinguish between words which sound the same but are spelled differently. The indexing rules would probably have to call for nearest matches, rather than for exact matches. A vocabulary of ten thousand words would probably be quite satisfactory for a voice operated letter writer. A million-character memory completely scanned several times a second, would handle this job and is certainly achievable within the density and speeds mentioned earlier.

Large memories provide automatic reference to millions of words of machine-readable coded information or to millions of images of document pages. Higher densities of storage will make possible low-cost memories of billions of words with access to any part in a few seconds or complete searches in minutes. These memories will serve as indexes to the deluge of technical literature when the problems of input and of the automatic generation of classification information are solved. Document files will make the indexed literature rapidly available to the searcher. However, memory capacity is currently well ahead of our ability to use it, and much work remains in this area. Machine translation of languages and recognition of spoken information are two other areas which will require fast, large memories.

INTERNATIONAL COMPUTATION MEETING HELD

Second meeting of the preparatory committee of the International Computation Center was held in Rome in late June. In attendance were participating committee members from UNESCO, Belgium, Ceylon, France, Italy, Japan and Mexico. Observers were present from Greece, the German Federal Republic and the United States (Professor S. Cairns). Representatives of UN specialized agencies, international scientific unions and Italian institutions and private firms also attended.

Following are five of the 15 resolutions submitted as part of the group's scientific program:

- A number of public and private institutions will become corresponding members of the International Center. As such, they will undertake to inform the center of the problems with which they are concerned and the methods of solution which they have studied or tested. In turn, when these institutions encounter new problems, the center will provide all available documentation dealing with them.
- The center shall collect all existing terminology relating to its own field with a view to publishing a multilingual glossary covering the principal languages.
- A special scientific symposium will be held in Rome in late January, 1959 (see Dates).
- The committee will encourage exchange of personnel between various institutions.
- The committee entrusted the executive secretary to continue negotiations with the manufacturers of computers with a view to installing one or two medium-size machines at the Center in 1959, provided this could be done without excessive commitments. Also, the secretary was instructed to inform interested states that following the committee's next meeting (see below) the Provisional Center should be in a position to conclude long-term agreements for the installation of computers on the Center premises.

The committee will meet again in Rome on January 26 and 27, 1959 (see Dates).

WJCC SESSIONS, CHAIRMEN

San Francisco's Fairmont Hotel will be the headquarters and meeting place for the 1959 Western Joint Computer Conference, March 3, 4 and 5. Joint sponsors of the conference are the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Association for Computing Machinery.

Theme of the 1959 Western Joint Computer Conference is, "New Horizons with Computer Technology." The chairman of the complete technical program, Richard W. Melville of Stanford Research Institute, recently announced the twelve regular program sessions to be held and their respective chairmen, as follows. Inquiries regarding the technical program should be directed to Melville at Stanford Research Institute, Menlo Park, California.

"New Components and Circuits," C. L. Wanlass, Aeronutronic Systems, Inc., Santa Ana. "Information Retrieval and Language Translation," Charles P. Bourne, Stanford Research Institute. "Computer Communication," Hardy C. Martel, California Institute of Technology, Pasadena. "Education and Training for Use of Computers," George W. Brown, University of California at Los Angeles. "Achieving Reliability in Operation Control," Louis Fein, Palo Alto. "Learning Concepts and Pattern Analysis," Patrick Suppes of Stanford University. "New Machines and Systems," Michael Montalbano, Kaiser Steel Corp., Oakland. "Computer Applications in Business Environments," Roger R. Crane of Touche, Niven, Bailey and Smart, Detroit, Michigan. "Numerical Analysis," Richard D. Levee, University of California Radiation Laboratory, Livermore. "Blue Sky," Louis N. Ridenour of Lockheed Missile Systems Division, Sunnyvale. "New Applications of Computer Technology," Harry D. Huskey, University of California, Berkeley. "Philosophy and Responsibility of Computers in Society," Ralph W. Tyler, Center for Advanced Study of Behavioral Sciences, Stanford.

NEW DATAMATION LITERATURE

PRECISION ANALOG COMPUTER: A fully illustrated eighteen page brochure and folder describes this company's new 80-amplifier precision analog computer MC-5800. The folder photographically illustrates how the computer may be instantly "unzippered" from its cabinet for unobstructed access during maintenance. Other features covered – the circuit logic required for building-block flexibility, adaptability for high speed repetitive operation, bivariable function generation, automatic problem check. For copy write MID-CENTURY INSTRUMATIC CORPORATION, 611 Broadway, New York 12, New York or use reader service card.
Circle 200 on Reader Service Card.

ANALOG COMPUTATION CENTERS: An illustrated, twenty page booklet, Bulletin No. CC-821, details this company's analog computing equipment installed at their computation centers in Princeton, N. J.; Los Angeles, Calif.; and Brussels, Belgium. The staffs supporting these centers are identified and a substantial list of problems suitable for solution by analog computation are included . . . for the benefit of firms exploring the possible application of analog simulation to their engineering problems. For copy write ELECTRONIC ASSOCIATES, INC., Technical Literature Group, Long Branch, New Jersey or use reader service card.
Circle 201 on Reader Service Card.

INFORMATION RETRIEVAL: Pamphlet UC 892 entitled "Basic Concepts of Information Retrieval" is the first of a series of papers aimed at providing a broad theoretical foundation for the problem of information retrieval of electronic computers. Designed to help fill the need for a standardized point of view from which to evaluate different systems or design new systems satisfying given requirements, it is the result of research being conducted by Dr. John W. Mauchly, Director of Univac Applications Research Center. Future

NEW LITERATURE

papers will cover standard models of information retrieval systems, representation and storage of information, etc. For copy write REMINGTON RAND DIVISION, Sperry Rand Corp., 315 Fourth Avenue, New York 10, N. Y. or use reader service card.
Circle 202 on Reader Service Card.

DIGITAL COMPUTER: The use of the LGP-30 digital computer in creating heat exchanger designs for an Ohio company, is described and illustrated in this application report No. S-449. A sample problem is illustrated by a typical data load sheet for programming the input data, the solution is diagrammed, as computed by the LGP-30, and the output report is illustrated. For copy write ROYAL McBEE CORPORATION, Data Processing Division, Port Chester, N. Y.
Circle 203 on Reader Service Card.

ELECTRONIC READING AUTOMATION: A sixteen page, fully illustrated booklet defines the ERA (electronic reading automation) machine, described by the manufacturer as a roll reader. Designed to recognize printed characters and to convert this information for use by standard punched-card or computer installations, it reduces the cost of feeding information to computers, states the manufacturer. For copy write SOLARTRON, INC., (Eastern Division), 530/532 Cooper Street, Camden 2, New Jersey.
Circle 204 on Reader Service Card.

EDP ECONOMY: A special 170-page report entitled "Cutting the Cost of Your EDP Installation," attempts to provide efficient, economical, tested solutions to the problems of physically installing a computer. Contending the installation, and preparation of personnel areas involves one of the largest outlays of cash, over the shortest period of time, it points out the direct benefit to be derived from the experience of other firms in reducing costs. For copy write CANNING, SISSON AND ASSOCIATES, 1140 South Robertson Boulevard, Los Angeles 35, California.
Circle 205 on Reader Service Card.

Important dates in DATAMATION

Nov. 17-18: Federal Govt. Accountants Association's 8th Annual Symposium. Theme: "Management and Electronic Data Processing." Contact Martin C. Powers, 1523 L. St., N. W., Washington 5, D. C.

Nov. 17-20: Fourth Annual Conference on Magnetism and Magnetic Materials, Sheraton Hotel, Philadelphia, Penna. Sponsored by AIEE. Contact John Leslie Whitlock Associates, Exhibition Managers, 6044 Ninth St., North, Arlington 5, Virginia.

Nov. 19-20: Northeast Electronics Research and Engineering Meeting, Mechanics Hall, Boston, Mass. Sponsored by IRE. Contact J. J. Faran, General Radio Company, 22 Baker Avenue, West Concord, Mass.

Nov. 20-21: Conference on Electronic Computation, Kansas City, Missouri. Sponsored by the Kansas City Section and the Committee on Electronic Computation of the Structural Division, ASCE. Contact Secretary, Steven J. Fenves, 203 Civil Engineering Hall, University of Illinois, Urbana, Illinois.

Nov. 20-21: American Mathematical Society Meetings; Pomona, Calif.; and Nov. 28-29: Northwestern University, Evanston, Illinois; and Durham, North Carolina.

Nov. 28-Dec. 4: National Physical Laboratory Symposium and Electronic Computer Exhibition, London, England. Contact C. V. Wattenbach, Deputy Managing Director, Dictograph Telephones, Ltd., London, England.

Dec. 3-5: Eastern Joint Computer Conference, Bellevue-Stratford Hotel, Philadelphia, Penna. Contact John M. Broomal, Burroughs Corp., Paoli, Pa. (conference chairman) or Dr. F. M. Verzuh, MIT Computation Center, Cambridge 39, Mass. (program chairman). (See coverage, this issue).

Dec. 9-10: Mid-America Electronics Convention, Municipal Auditorium, Kansas City, Missouri. Contact Wilbert O'Neal, The Vendo Co., 7400 E. 12th, Kansas City, Mo.

1959

Jan. 20-22: American Mathematical Society—65th Annual Meeting, U. of Penn., Philadelphia, Pa.

Feb. 12-13: Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa. Sponsored by the PGCT, the AIEE and the University of Pennsylvania. Contact Arthur B. Stern, General Electric Co., Building 3, Syracuse, N. Y.

Jan. 26-27: Provisional Committee of the International Computation Center, Rome, Italy. Third meeting. For information contact J. A. Mussard, Executive Secretary, Palazzo degli Uffici, zona Dell'E.U.R., Rome, Italy.

Jan. 29-30: Symposium on the Numerical Treatment of Partial Differential Equations with Real Characteristics, Rome, Italy. Sponsored by Provisional International Computation Center, Rome. Contact Prof. A. Ghizzetti.

Mar. 2-6: Western Joint Computer Conference, Fairmont Hotel, San Francisco, Calif. Sponsored by PGEC; AIEE; and ACM. Contact M. L. Lesser, IBM Research Laboratory, San Jose, Calif.

May 5-6, 1959: Interdisciplinary Conference on Self-Organizing Systems, Museum of Science and Industry, Chicago, Illinois. Sponsored by Information Systems Branch of Office of Naval Research and Armour Research Foundation of Illinois Institute of Technology. Contact Scott H. Cameron, Electrical Engineering Research Dept., Armour Research Foundation, 10 W. 35th St., Chicago 16, Illinois.

May 6-7: Electronic Components Conference, Ben Franklin Hotel, Philadelphia, Pa. Sponsored by PGCP; AIEE; EIA; WCEMA. Contact Gen. E. R. Petzing, Lane Tech. School, Board of Education, 2501 W. Addison St., Chicago 18, Illinois.

May 6-8: IRE Seventh Regional Conference and Trade Show, University of New Mexico, Albuquerque, New Mexico. Contact Mr. H. S. Westcott, Jr., Hoover Electronics Co., 1122 C. San Mateo, SE, Albuquerque, New Mexico.

May 11-13: Joint Conference on Automatic Techniques, Pick-Congress Hotel, Chicago, Illinois. Sponsored by PGIE, AIEE, ASME. Contact Mr. W. R. Thurston, General Radio Co., Cambridge, Mass.

June 15-20: International Conference on Information Processing, Paris, France.

Summer, 1959: ACM National Conference 1959, M. I. T. Contact F. Verzuh, Massachusetts Institute of Technology, Cambridge, Mass.

"It's not office problems that's creating all the interest, chief! . . . They're having it estimate the size of their Christmas bonus! . . ."

NUMBER SYSTEMS, MEN AND COMPUTERS

by BRUCE K. SMITH
Executive Product Analyst
Epsco Incorporated

We are exposed to a surprising variety of number systems in everyday life and have learned to either cope with them or to make use of them, depending on their value to our existence.

Many of the systems which have been forced upon us by tradition may ultimately be scrapped in favor of a more rational form of expression. New systems of measure and numerical notations have already gained widespread acceptance in scientific circles because of the expanded dimensions of modern technology and the computational requirements of this technology. The "why" of new systems is, perhaps, best prefaced by defining number systems in general then taking a closer look at some of the ones we now take for granted.

A number system is a method by which one or more different symbols are employed to designate an equivalent quantity of linearly related values. Since magnitude is related to the unique level of zero, it is usually convenient to reserve one of the symbols for that condition. Thus, while there are ten symbols in Arabic decimal notations, we can denote only nine non-zero levels with one symbol and must employ two or more of them for magnitudes greater than nine. Each additional symbol position multiplies the number of values which can be designated by a factor equal to the number of symbol varieties. This factor is, of course, ten in conventional decimal arithmetic.

systems and rules

All number systems obey the same rules for addition, muliplication and other arithmetic operations. However, the complexity of applying those rules goes up rapidly with the number of different symbol values (number base). If our sole concern was simplicity, we would continue through life using the system of notation which formed the basis of our mathematical training. This is the "base 1" or "unitary" system wherein a symbol (finger, mark etc.) has the exclusive value of one unit and the magnitude is the sum of the number of symbols. The fact that we do not use that system for tasks other than keeping bridge scores and comparable counting operations is due, first of all, to our inability to look at a large number of marks and rapidly comprehend their magnitude. Furthermore, the space requirements of such a notation are prohibitive in most filing or identifying applications.

The "worth" of a number system, therefore, depends on the complexity of doing arithmetic with it, the number of symbol positions which must be used to denote a specific range of values **and** the importance of each of those factors in a particular application. Any choice must represent a compromise. For most human computation and identification requirements the compromise at base 10 is probably at or near optimum.

But, what about our method of telling time? The base 60 number system used for seconds and minutes hardly permits the decimal symbols to be used in their appropriate decimal fashion and the base 24 used for hours is even less reasonable. The latter is further complicated by an alternative notation of base 12, multiplied by base 2 – the binary choice of am or pm. From this we progress both to a week scheme of base 7 and to a month scheme which is sometimes base 30, sometimes 31 and (except for leap year) occasionally base 28. No wonder we need calendars!

Our system of measuring distances in inches, feet, yards, miles and miscellaneous other units is only slightly more rational and certainly much less decimal than the European metric standard. Why? Perhaps because we are too busy doing arithmetic in these systems to find the time to change them.

numeric base

A high numeric base is distinctly advantageous where we are interested in identifying and **not** computing (except in the sense of sorting). Similarly, a low numeric base holds very definite interest in applications where computational simplicity is more important than the factors of magnitude recognition (by humans) and conventional file storage. These situations are, in large part, responsible for the widespread use of both the unitary and binary number systems in electronic digital computations. Since digital circuitry is intrinsically an "off" or "on" proposition, any numeric character greater than 2 must be represented by more than one symbol position. Consequently, the usual considerations of number size do not apply and the advantages of simplified computation assume a much more significant weight in the design.

The following paragraph provides a brief introduction to one of the most interesting of the simpler schemes of notation – the binary or base 2 system.

binary number system

Number Base: 2
Permissible Integers: 0, 1
Integer Multipliers:

$2^{-\infty}$ = zero

$2^{-4} = 0.0625$
$2^{-3} = 0.125$
$2^{-2} = 0.25$
$2^{-1} = 0.5$
$2^{0} = 1$

$2^{0} = 1$
$2^{1} = 2$
$2^{2} = 4$
$2^{3} = 8$
$2^{4} = 16$

2^{∞} = Infinity

Example: Decimal 732.625 into Binary

	Binary	Decimal
= 1 x 2^9	or 1000000000	512
+ 1 x 2^7	or 10000000	128
+ 1 x 2^6	or 1000000	64
+ 1 x 2^4	or 10000	16
+ 1 x 2^3	or 1000	8
+ 1 x 2^2	or 100	4
+ 1 x 2^{-1}	or 0.1	0.5
+ 1 x 2^{-3}	or 0.001	0.125
	1011011100.101	732.625

examples of binary arithmetic

ADDITION

The Rules:

$$0 + 0 = 0$$
$$1 + 0 = 1$$
$$0 + 1 = 1$$
$$1 + 1 = \text{Two}$$
$$= 0 + \text{carry}$$
$$= 10$$
$$1 + 1 + 1 = (1 + 1) + 1$$
$$= 10 + 1$$
$$= 11$$

Example: Decimal 491 + 118

$$\begin{aligned} 1 + 8 &= 9 \\ = \quad 9\,0 + 10 &= 00 + \text{carry } 100 \\ 400 + 100 + (100) &= 600 \\ & \overline{609} \end{aligned}$$

The Addition

$$= \begin{cases} \text{(carries } 1111111) \\ 111101011 \\ 1110110 \\ \hline 1001100001 \end{cases}$$

Which Equals:

$$\begin{aligned} 2^9 \text{ or } &512 \\ + 2^6 \text{ or } &64 \\ + 2^5 \text{ or } &32 \\ + 2^0 \text{ or } &1 \\ &\overline{609} \end{aligned}$$

As Before

MULTIPLICATION

The Rules:

$$0 \times 0 = 0$$
$$0 \times 1 = 0$$
$$1 \times 0 = 0$$
$$1 \times 1 = 1$$

Example: Decimal 24 x 3

$$= \left\{ \begin{array}{r} 24 \\ \times\ 3 \\ \hline = \quad 24 \\ +\ 24 \\ +\ 24 \\ \hline = \quad 72 \end{array} \right.$$

The Binary Equivalents Are:

$$24 = 11000$$
$$3 = \quad 11$$

The Multiplication

$$= \left\{ \begin{array}{r} 11000 \\ 11 \\ \hline 11000 \\ +\ 11000 \\ \hline = 1001000 \\ \text{answer} \end{array} \right.$$

Which Equals:

$$2^6 \text{ or } 64$$
$$+\ 2^3 \text{ or } 8$$
$$72$$

As Before

DIVISION

The Rules:

Accept 1 if subtraction is positive
Reject 1 if subtraction is negative
(Absolute Values)

Example: Decimal $25 \div 5$

= Not 9, since $9 \times 5 = 45$
Not 8, since $8 \times 5 = 40$
Not 7, since $7 \times 5 = 35$
Not 6, since $6 \times 5 = 30$
But 5, since $5 \times 5 = 25$

The Binary Equivalents Are:

$$25 = 11001$$
$$5 = \quad 101$$

The Division:

$11001 \div 101$

Try	Test	Accept
100	1 1 0 0 1	
−	1 0 1	
=	0 0 1 0 1	100
10	0 0 1 0 1	
−	1 0 1	
(−)	1 1 0 1 1	
=	(− three)	reset
1	0 0 1 0 1	
−	1 0 1	
+	0 0 0 0 0 =	
1		

101 = answer = 5, as before

MORE ICIP DETAILS GIVEN

grabbe to head u. s. exhibits committee

As announced in DATAMATION's July/August issue, the First International Conference on Information Processing, sponsored by UNESCO, will be held in Paris in June, 1959. Details of this first global computer conference have now been disclosed by the United States Committee for ICIP (IRE, ACM, AIEE representatives) in Washington. The overall conference program will include both technical sessions and corollary background reports, survey reports of work in each country, symposia, and technical presentations in conjunction with a major equipment exhibit.

Commencing June 15, 1959, the conference will continue for six days and the exhibit, expected to attract visitors and equipment from all over the world including Communist countries, will span ten days from June 13 to 22. The technical meetings will be held in the new quarters of UNESCO House – now being completed – but the exhibit, due to its size, will be housed in a nearby exhibition hall.

exhibits chairman

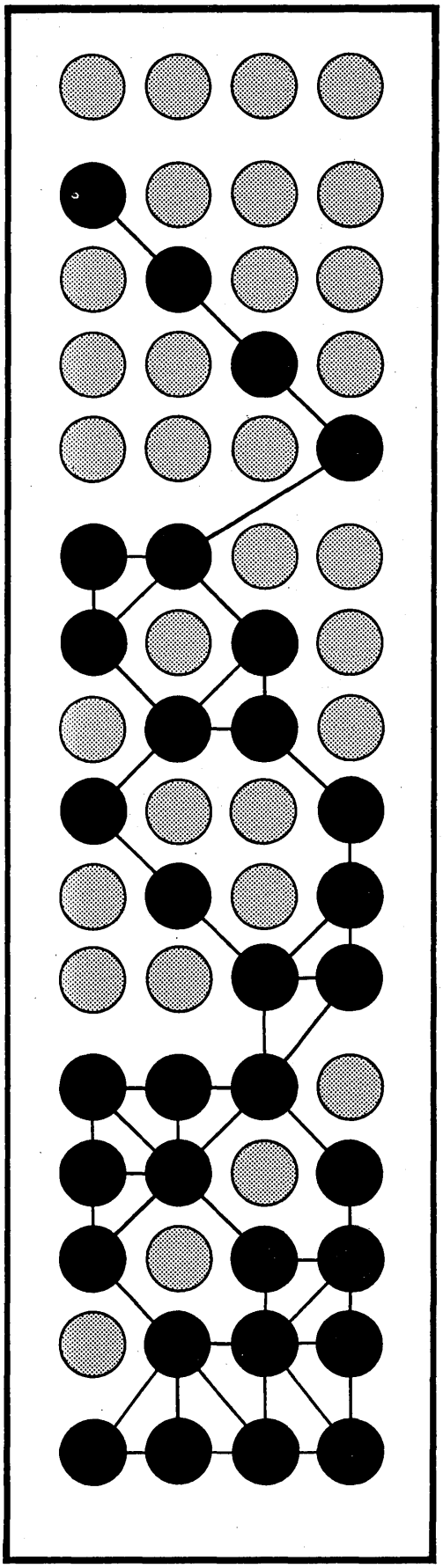
Dr. Eugene M. Grabbe, senior staff consultant on automation for the Ramo-Wooldridge Corporation, has been selected to head the Exhibits Committee, it was announced by Isaac L. Auerbach, Chairman of USICIP. As chairman of the Exhibits Committee, Dr. Grabbe will be responsible for coordinating the exhibits of United States firms which will be participating. Dr. Grabbe, currently in Moscow with a group of American automatic control specialists, will be remembered as the project head for the first airborne digital computer for automatic flight control. In handling U. S. exhibitor arrangements, he will be assisted by L. David Whitelock, Navy Department, Bureau of Ships, as vice chairman; Ralph Mork, IBM World Trade Headquarters; Paul A Dennis, Bendix Computer Division; and David Weinberg, Ramo-Wooldridge Corporation.

A U. S. Program Committee has been set up under the chairmanship of Dr. Alston S. Householder, Dr. Arnold A. Cohen, vice chairman, and is now contacting U. S. computer specialists for papers to be presented at the technical sessions. The U. S. Program Committee is eliciting the best possible contributions from this country and the papers are to be essentially devoted to techniques and applications, rather than hardware (which will be covered in the technical equipment presentations). A preliminary selection will be made late in October from abstracts before them at that time. Suggested length for the abstracts is about 300 words – can be more or less. From these abstracts authors will be invited to submit full papers, to be in by January 15, and the final selection will be from among these.

six major topics

Papers may deal with any of the following six major topics and should represent original, unpublished, personal contributions to the field: 1. Method of digital computing. 2. Logical design of digital computers. 3. Common Symbolic language for digital computers (includes automatic programming). 4. Automatic translation of language. 5. Collection, storage, and retrieval of information. 6. Pattern recognition and machine learning.

This international conference will feature 11 plenary sessions of 3 hours each, beginning Monday, June 15 and ending Saturday, June 20, when a total of about 66 papers from international authors will be presented, allotting a half hour to each paper. The Program Committee will soon refer several quality papers to a group of UNESCO consultants for evaluation which may involve an invitation to the authors to speak at symposia.



ADVANCING THE ART

Digital Computers

Data Communications

It's not every day that a great engineering organization like International Telephone and Telegraph Corporation is challenged to develop and produce a world-wide electronic control system . . . a system which will transmit, process and display information required in military operations—global, in seconds. We have accepted this challenge.

This requires new concepts, new solutions, which will come only from engineering imagination . . . first-rate thinking by first-rate engineers. We have many such men, but we need more to help us open up new horizons in the art.

International Electric Company has been formed as an ITT subsidiary, to serve as systems and project manager. We are seeking experienced engineers of highest technical competence, comparable to senior project engineers, with engineering management backgrounds. These are positions of great responsibility, with corresponding reward.

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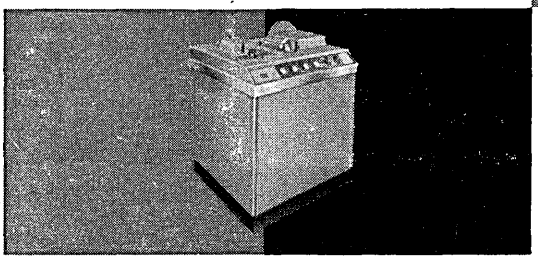

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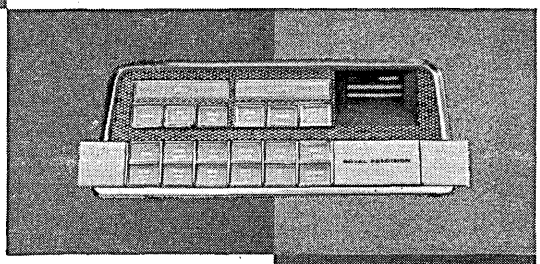

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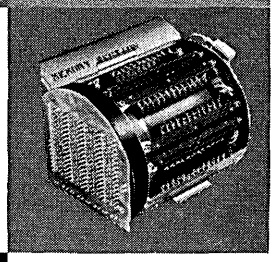

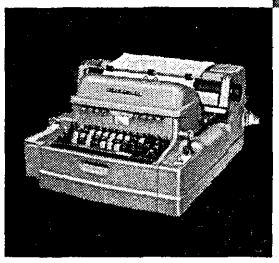

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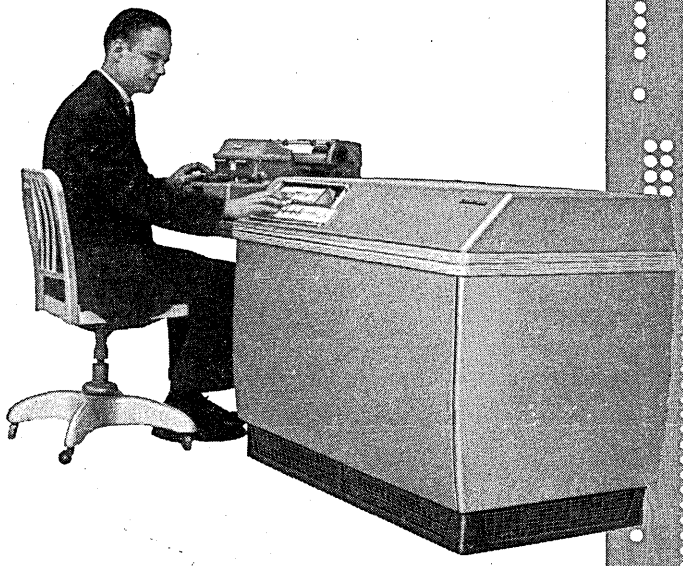

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