DIGITAL COMPUTER NEWSLETTER

The purpose of this newsletter is to provide a medium for the interchange among interested persons of information concerning recent developments in various digital computer projects. Distribution is limited to government agencies, contractors, and contributors.

OFFICE OF NAVAL RESEARCH · MATHEMATICAL SCIENCES DIVISION

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Approved by
The Under Secretary of the Navy
16 August 1954

COMPUTERS, U.S.A.

NAVAL AIR TEST CENTER (PATUXENT RIVER, MD.)

The ElectroData Corporation Datatron computer was delivered to the Naval Air Test Center on January 10, 1956. Acceptance tests were initiated on Thursday, 19 January and the computer accepted on Monday, 23 January. The initial installation includes photo electric perforated paper tape input equipment and Flexowriter output equipment. A magnetic tape control unit and one magnetic tape storage unit are on order and delivery is expected in September 1956. The first magnetic tape storage unit will be used as an auxiliary memory with a capacity of 400,000 computer words. Plans for future additions to the initial installation include a second magnetic tape storage unit to be used as an input device for magnetic tape prepared by remotely located data recording equipment. It is also planned to add an ElectroData floating decimal point control unit to provide built-in floating point commands, eliminating the use of floating point sub-routines.

The computer is currently operated for a single 8-1/2 hour shift, plus overtime as required. The first hour of the shift is used for scheduled preventive maintenance. The operating statistics for the first three calendar months of operation are as follows:

	FEBRUARY		MARCH		APRIL	
	hours	%	hours	%	hours	%
Useful Time	144.7	94.5	208.7	96.9	221.1	95.5
Down Time	8.5	5.5	6.7	3.1	10.5	4.5
Total Time	153.2	100.0	215.4	100.0	231.6	100.0
	BREAKDOWN OF USEFUL TIME					
Code Checking	56.2	36.7	125.4	58.2	123.2	53.2
Production Computing	18.7	12.2	39.2	18.2	62.0	26.8
Demonstrations	1.8	1.2	3.4	1.6	1.1	0.5
Scheduled Preventive Maintenance	18.0	11.8	25.0	11.6	23.5	10.1
Idle	50.0	32.6	15.7	7.3	11.3	4.9
	144.7	94.5	208.7	96.9	221.1	95.5

DAVID TAYLOR MODEL BASIN (BUREAU OF SHIPS)

In May 1956 the Applied Mathematics Laboratory of the David Taylor Model Basin added a second UNIVAC I to its computing facilities. This computer, which is the twenty-fifth UNIVAC to be delivered, is rented from Sperry-Rand Corporation and is maintained by the Engineering Research Associates Division of Sperry-Rand. Ten uniservos were delivered with the computer. The existing input - output auxiliary equipment of the Applied Mathematics Laboratory will be used for the computer, as required.

The new UNIVAC, designated UNIVAC B, was placed in operation on a three-shift per day basis on 17 May 1956. This machine will be assigned primarily to the solution of Nuclear Reactor problems for the Department of the Navy. Present plans call for a subsequent conversion of this computer to UNIVAC II design on or about 1 March 1957.

ERMA COMPUTERS TO BE MANUFACTURED BY GENERAL ELECTRIC CO.

Agreement between Bank of America and General Electric Company's Electronics Division, Syracuse, New York, for the manufacture of ERMA electronic computers has been announced. Manufacture of ERMA equipment will be a major addition to G-E's Industrial Computer Section program.

The prototype ERMA built by Stanford Research Institute and slated for installation by the Bank of America in San Jose, California, covers a 4,100-square foot area, has approximately 8,200 vacuum tubes and 34,000 diodes.

Manned by a staff of eight operators and clerks on a two-shift basis, ERMA sorts checks and deposit slips and enters the amounts to the individual account of each customer. It remembers details of all transactions, maintains customers' correct balances, accepts stop-payments and hold orders and immediately notifies the operator of an overdrawn balance. Each machine will perform the daily bookkeeping tasks for 55,000 commercial checking accounts.

General Electric will direct ERMA's continuing development and production program, in cooperation with Stanford Research Institute, which will continue to make major contributions to that effort.

FERUT (UNIVERSITY OF TORONTO)

Ferib, a card input-output unit has been operating with Ferut for the past year. This unit consists of an I.B.M. type 514 reproducing punch modified by Ferranti Electric Company of Canada. It makes use of the small magnetic drum, high speed Ferranti Type 200B first used in this system.

During the past winter the Canadian National Railways have provided the free use of teletype lines between the Computation Centre and the Department of Physics, University of Saskatchewan. There have been fortnightly runs in which input tapes (programs and data) prepared in Saskatoon are sent by teletype and the output tapes transmitted back the same evening.

Ferut is still being maintained under a service contract with Ferranti of Canada. At present there is maintenance available from 7 a.m. to 2 a.m. five days a week. During the night and on week-ends under special arrangement programmers use the machine without a maintenance engineer on hand, if the work load warrants it.

A summary of machine time hours for the past two years is given below:

Machine Time - Hours.

	1954	1955		1956 First Quarter	
Atomic Energy of Canada Limited Defense Research Board National Research Council	814	1042		280	
University of Toronto	124	366		243	
Outside Companies	641	468	596	111	198
Outside Universities		128		87	
Library	169	184		29	
Available	624	440		129	
Total Programmer Use (Good Time)	1748	2188		750	

FLAC (FLORIDA AUTOMATIC COMPUTER) PATRICK AIR FORCE BASE, FLORIDA

FLAC operating time for the period 27 February to 20 May 1956 was as follows:

	Hours	% of Schedule	% of Total
1. Problem Running	968.1	60.1	50.3
2. Code Checking	230.4	14.3	12.0
3. Good Idle Time	64.6	4.02	3.35

	Hours	% of Schedule	% of Total
4. Scheduled Engineering	158.9	9.87	8.25
5. Unscheduled Engineering (Computer)	115.4	7.17	5.75
6. Unscheduled Engineering (Auxiliary)	9.3	.59	.48
7. Preventive Maintenance	64.0	3.95	3.32
8. Unscheduled Computer Time	319.5	-	16.55
9. Totals	1930.2	100.00	100.00

Average Computer "good time" - 88.9%

Scheduled engineering is machine time spent developing new ideas, adding new input-output devices, performing modifications and developing new marginal checking techniques. No maintenance or down time is included in this category.

Percent "good time" is defined as the sum of items 1, 2, 3, 4 and 6 divided by items 9 minus 8.

FLAC is currently being modified to incorporate a new high speed input-output selection system. With this modification it will be possible to select under control of the computer any one of 50 different input-output addresses. Multiple magnetic tape inputs and outputs, multiple high speed paper tape readers, multiple high speed paper tape punches and a multiple bin type magnetic tape device which will be an external memory unit will be incorporated. All of these units are currently programmed and Air Force procurement contracts are now in force.

These multiple input-output modifications will permit multiple field recorded data sources to be introduced directly into the computer without first requiring some form of processing. Collation, if required, such as in the case of multiple theodolite solutions, can be accomplished at computer speeds.

INSTITUTE FOR ADVANCED STUDY

The new 12,288 word magnetic drum has been installed and debugging has nearly been completed. It is anticipated that it will be ready for use sometime during the month of June.

A major change in staff and performance will become effective by July 1, 1956. Emphasis in the past has been mostly on the logical and engineering design of computer equipment, together with the solution of a few large-scale problems. In the future, however, the machine will more and more serve as a general scientific tool, and a great variety of problems of various lengths and complexities will be solved. Dr. H. Maehly will assume the post of Acting Director of the Electronic Computer Project on 1 July 1956. Dr. H. Goldstine will return, as a permanent member, to the Institute for Advanced Study.

INTERNATIONAL BUSINESS MACHINES CORPORATION

As of June 1, 1956, IBM had delivered seventeen 704's and sixteen 705's, thus bringing deliveries of large-scale 700 series data processing systems, including the 701 and the 702, to a total of sixty-six. This is in addition to more than three hundred installations of the type 650 intermediate data processing systems of which deliveries are being made at the approximate rate of one and one-half every working day.

Announcement has been made of the 774 Tape Data Selector which provides a direct link with conventional punched card and printer equipment with the magnetic tapes used by any of the 650 or 700 series systems. Thus, magnetic tape records may be conveniently converted to punched cards or the printed page. This component also permits complete editing and rearrangement of the record simultaneously with transcription.

650 systems can now be provided with up to six magnetic tape units and multiple card reader-punch-printer input-output stations. Three independent indexing accumulators are now

available for automatic address modification and subroutine control, thus speeding problem execution time through reduction of programming steps required. Automatic floating decimal commands may now be specified. Such commands eliminate the need for subroutines ordinarily required.

SEAC (NATIONAL BUREAU OF STANDARDS)

In May 1956 the National Bureau of Standards Electronic Automatic Computer (SEAC) completed six years of successful operation. Although the machine was first conceived and built to fill an interim need for large-scale high-speed computer, the demand for its services has required continued operation on a 168 hours per week schedule. The system reliability for the entire computing installation has leveled off at 86%. The average operating efficiency for the entire six years of scheduled operation is 77%.

Of the total time available, 25 hours per week are scheduled for engineering and machine maintenance. The engineering group is presently engaged in redesigning the input-output control circuitry to make possible the addition of an alphanumeric printer, high-speed perforated paper tape punch, high-speed perforated paper tape reader, and multi-channel magnetic tape handlers. The magnetic wire cartridge input-output units will remain a part of the system.

During the six years of operation, over 300 separate problems were run on SEAC, varying in running time from a few minutes for some to several hundreds of hours for others.

A new photoelectric card reader for the SEAC computing facility has been installed. This equipment is capable of reading IBM cards for direct input to a computer or for indirect input as temporary storage on a magnetic recording. It scans the 80 columns per card sequentially and yields a four- or six-bit serial-binary output.

The reader can be utilized either as a means for preparing and feeding routines, or for recording information which is already in existing card files. The cards may contain descriptive information as well as data fields, and the two may be in any order. The equipment will read only the data fields, with the cards themselves acting as the controlling factor in determining which columns are to be inhibited. The system is asynchronous and there is no clocking channel for control. All timing and circuit functions are generated on a column-by-column basis.

The equipment uses a modified Pitney-Bowes counting machine for moving the cards, and at present operates at 200 cards per minute. This speed is compatible with the SEAC wire drives. For tape recording or direct input, the card speed can be 400 to 600 cards per minute.

A new base code, "Base 11," has been completed. It is intended to be used for small problems involving integrals. It contains a two-word "integrate" order specifying an integration of the form $\int_a^b f(x)\,dx$ except for the coding of f(x). By use of three integrate orders, expressions of the form $\iiint f(x, y, z)\,dxdydz$ can be coded using only two words to specify each integration and the coding necessary to compute the integrand. The integration rule used is Gaussian quadrature, and 2-, 4-, 8- and 16-point rules may be specified for any interval. In addition to the integration routines, "Base 11" also contains all of the service routines and subroutines of "Base 01," including square and cube roots, elementary transcendental functions, solution of a (non-linear) equation, in-out service routines, iterator and others.

Another base code, now under development, is intended for problems requiring several types of operations on matrices. To the present time, the operations of matrix addition and multiplication and evaluation of determinants, each of them specified by a pseudo-instruction, have been incorporated. The code is similar to "Base 00" and uses most of the operations of the latter, in addition to the matrix operations.

SWAC (UNIVERSITY OF CALIFORNIA, LOS ANGELES)

The applications of SWAC which will consume considerable SWAC computing time in the near future and which depart in type from most other recent applications include Monte Carlo type calculations in studies involving freeway traffic, containerization of ship's cargo, and queueing theory.

During the first quarter of 1956, the average down time of SWAC was 5.3 percent. The total useful computing time was 802 hours, of which about 200 were for computations primarily mathematical in nature and 600 were applications of the computer to scientific problems originating mainly at the University of California at Los Angeles.

SWAC University Computing Facility

The SWAC computing facility, supported by the Office of Naval Research on the Los Angeles campus of the University of California, is available for extensive computing originating at any campus of the University. The primary mission of the computing facility is the furtherance of numerical analysis research. Other problems have access to the facility with priority more or less depending on the extent to which they contribute to this primary aim of applying numerical analysis and electronic computation to important scientific research problems. Some time is available for demonstrations.

The Numerical Analysis Research group can offer no coding or operating aid other than occasional classes in machine coding and in operating the equipment. Each department must furnish all material (cards for punching, etc.) required in the proposed calculations. Charges for the machine will be the actual cost of operation—probably in the neighborhood of fifty dollars per hour. However, the Office of Naval Research will frequently waive charges for computations originating from meritorious research. Any acceptable computation arising from research sponsored by the Office of Naval Research on any University of California campus will be done without charge.

Status of Drum

The new 8192 word magnetic drum memory has been operating at a reduced capacity of 4608 words since January 21, 1956. A redesign of the logic has been undertaken since then with the aim of improving stability and dependability of operation. New circuits for the read amplifiers and the clocking signals have been developed.

The drum is expected to be operating at full capacity with the new circuitry by the end of June 1956.

Display Scope

A cathode ray tube and associated circuitry have been attached to SWAC as an auxiliary output device of the visual display type. The installation is incomplete pending the construction of voltage regulators for the supply voltages of the device.

The resolution of the raster on the CRT is one part in 256 at present, but the circuitry has been designed to permit expansion to 1024 points along each axis. A five-inch cathode ray tube is installed in the present experimental unit, but expansion to the larger raster will include a larger tube.

Provision has been made for photographing the patterns with a Polaroid Camera.

UNIVAC AF/CRC MAGNETIC COMPUTER

The Remington Rand UNIVAC Division of the Sperry Rand Corporation, Philadelphia, Pa. has recently demonstrated the new, compact Remington Rand Univac AF/CRC Magnetic Computer, which has been designed and built for the Air Force Cambridge Research Center at Lawrence G. Hanscom Field, Bedford, Massachusetts. (See Figure 1.)

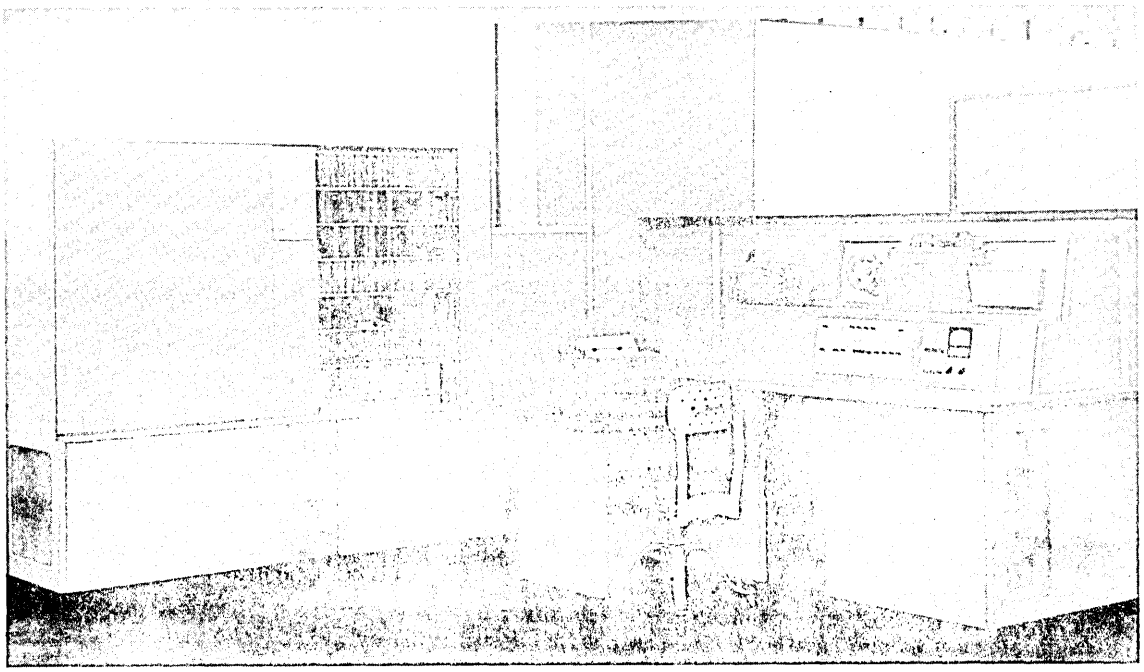

Figure 1 - The Remington Rand Univac Magnetic Computer and Operating Console

The machine can be housed in about 250 square feet. Its computer unit is six feet high, six feet, six inches long and 18 inches deep. Its desk-sized console, housing the operator controls, the paper tape, input-output unit and the direct entry typewriter, is four feet, six inches high, six feet long and three feet deep.

The "Univac Magnetic" employs "Ferractor" pulse amplifiers in its internal magnetic-core circuitry and a five-by-three inch magnetic drum, running at 16,500 rpm.

The Ferractors represent a five-year pioneering search by scientists for an efficient, reliable substitute for the space-consuming vacuum tubes of earlier computers.

Two Ferractors, each replacing a vacuum tube, are sealed within a casing like a miniature pill box, about five-eighths of an inch in diameter and a little less than a quarter of an inch thick. Four "pill boxes" are mounted on thin plastic cards, each about the size of a postcard, along with a number of resistors and a line of midget diodes, tiny electronic fittings.

The cards fit into the front of the computer, set edgewise. Each card terminates in a plug which fits into a "jack" in the interconnecting rack. About six hundred such cards, plus a few ordinary transistors, form the main working portion of the computer along with the high speed magnetic drum.

The magnetic drum memory of the Univac Magnetic was also specially developed by Remington Rand engineers to meet the speed and power requirements of the new computer. The drum consists of a cylinder, five inches in diameter and three inches in length, spun by a small motor at 16,500 rpm. Its bearings are ground to a mirror finish within one ten-thousandths of an inch. The drum coating is a nickel-cobalt alloy. The head spacing is .001 inch. The whole drum is sealed in a metal casing about a cubic foot in size and filled with helium. The helium "atmosphere" lessens frictional resistance and transfers heat developed at a far greater speed than ordinary air, which permits running of the drum at considerably lower temperature than it would in air.

The computer unit contains a pair of electric exhaust fans to insure cool operation as a protection to heat-sensitive units and circuits anywhere in the machine. The arithmetic unit

uses a "parallel bit serial digit code at a 660 kilocycle per second bit rate, which allows the addition of two 10-digit numbers in 90 microseconds, over 11,000 additions per second, and multiplication in from .3 to 1.7 milliseconds, over 3000 multiplications per second."

Input and output is by typewriter and paper tape.

UNIVAC AIRLINES RESERVATION SYSTEM

An electronic computing system designed to control passenger reservations automatically, by storing, adjusting and reporting all space and related data almost instantaneously, has been introduced by Remington Rand UNIVAC, Division of Sperry Rand Corporation, St. Paul, Minnesota.

Initially developed for air travel operations and named the UNIVAC Airlines Reservations System, the new computing device is adaptable to rail and bus transportation as well as to other reservation functions, the firm reports.

Nearly ten years in development, the first complete system has been ordered by Northwest Orient Airlines.

The system combines a centrally located master unit linked either directly or by communications lines—depending upon distance—to small "agent" sets in each reservations or ticket office. (See Figure 2.) When an agent receives a reservation request he uses his Agent Set to determine flights servicing the destination, their scheduled dates, times and similar information. This data is stored within the Agent Set on specially coded timetables. Once initial flight information has been determined, the agent addresses an "inquiry" to the system's master control by means of punch keys on his set. An almost instantaneous reply is received showing space availability and flight information.

The system can transmit facts on as many as eighty flight legs in a single reply.

After a flight has been selected by the passenger, the agent records the "sell" transaction with other keys on the set. This "sell" transaction is transmitted to the master control which automatically and immediately adjusts data related to the selected flight to show its altered status.

The main functioning member of the reservation system is a UNIVAC File Computer, specially adapted by means of peripheral equipment to meet general air transportation and individual airline requirements. Magnetic storage drums, each with a capacity of 180,000 characters of flight information, are utilized by the computer. This means a storage capacity of approximately 9000 flight legs. Up to ten of these drums can be incorporated in the reservation system for a total storage capacity of nearly two million characters.

The system's large capacity, means that flight data can be stored for long periods in advance. In addition, the many special coding and reporting features of the unit permit it to perform other secondary functions for later analysis such as the gathering of sales information, the number of transactions by city, number of cancellations, average number of passengers or number of unsold seats for a particular flight leg during a specified period.

Control of the system is maintained by a master set located near the computer. Schedule changes, future schedules, altered flight information and other data are introduced into the system by this set. An electric typewriter is used for checking and for the various, specialized reporting functions that the unit can perform.

Accuracy of the reservation system is assured by virtue of the self-checking characteristics of the system. Extreme flexibility is obtained by means of a variable program control. Scheduled operations and special functions can be easily varied from day to day or month to month, in order to meet changing requirements. In addition, the system's storage capacity can be easily expanded to fulfill future needs.

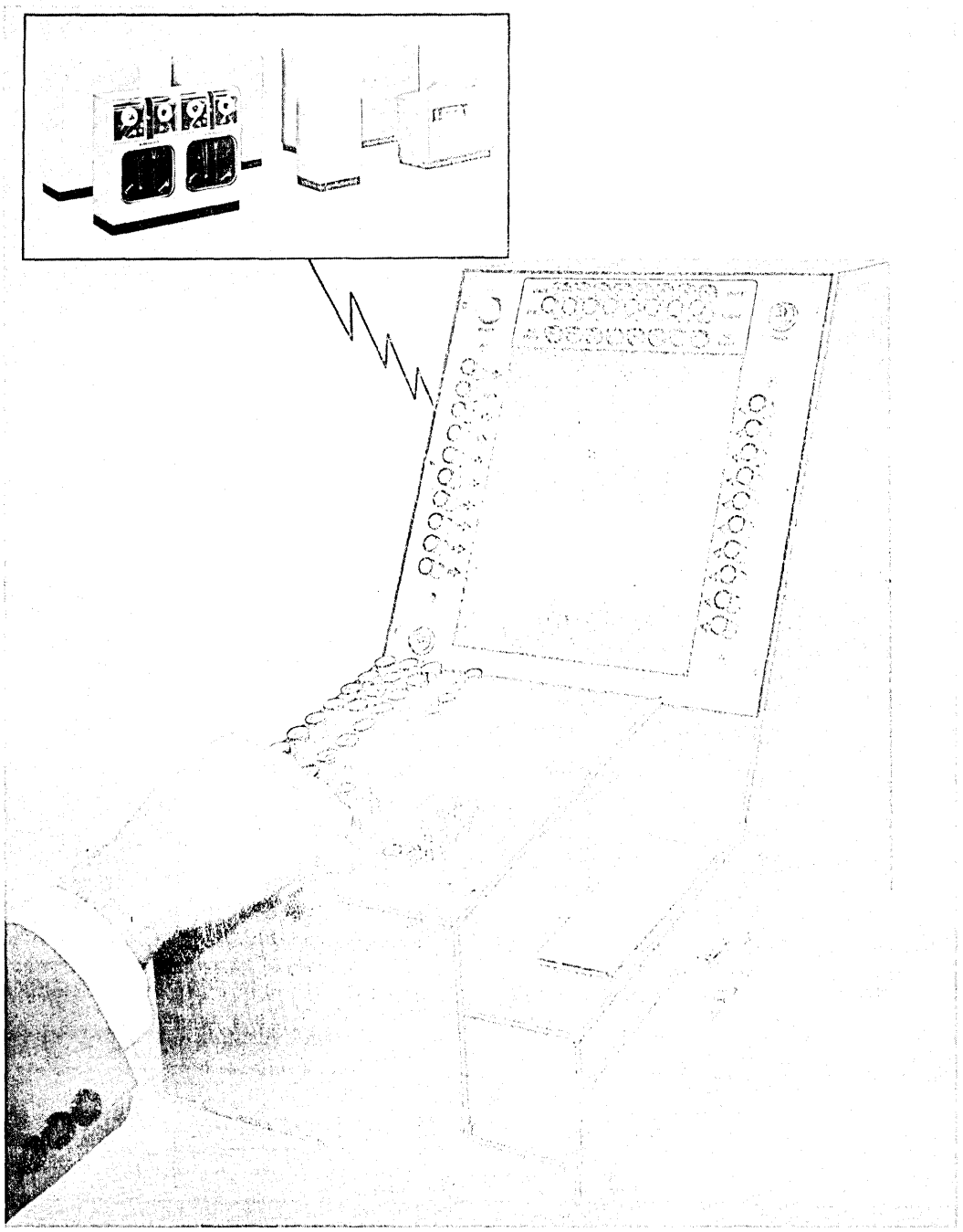

Figure 2 - Agent Set, Univac Airlines Reservation System

The UNIVAC Airlines Reservation System is the result of years of research by Remington Rand UNIVAC. In 1946 Engineering Research Associates, now a part of the Univac Division, became interested in the airlines reservation problem. During the period from 1946 to 1953 contacts were made with most of the major American airlines to study the application of electronics equipment to their reservations problems.

According to a Univac spokesman, these studies supplied information leading to development of the File Computer. This unit is intended to meet the operating requirements of numerous businesses as well as to serve as an integral part of such specialized applications as the Airlines Reservation System and other similar inventory and storage functions.

NAVAL PROVING GROUND (DAHLGREN, VIRGINIA)

During the first four months of 1956, the Naval Ordnance Research Calculator (NORC) availability averaged 87 percent of scheduled operating time. The performance statistics for the month of April are:

(1)	Scheduled engineering and preventive maintenance	98 hours
(2)	Good operating time	359 hours
(3)	Machine down time	48 hours
(4)	Down time not attributable to machine	18 hours
(5)	Machine efficiency	88 percent

The Card-Controlled Printer (CCP) has been received, installed and is operating. This printer is an IBM Type 407 Tabulator modified to allow complete control of format from NORC cards without changing plugboards. Programmed editing on the NORC produces control cards interspersed among data cards which are interpreted by the CCP to print the desired output. In addition to providing programmed format control, this method also permits the printing of alphanumeric characters from the pure numerical output of the NORC.

More detailed plans for the proposed new high speed printing and plotting facility have been completed.

The Aiken Dahlgren Electronic Calculator (ADEC) continues on a 40-hour per week schedule and the Aiken Relay Calculator (ARC) is on a demand schedule as needed.

RAYDAC, NAVAL AIR MISSILE TEST CENTER (POINT MUGU, CALIFORNIA)

The RAYDAC Computer located at the U. S. Naval Air Missile Test Center is operated and maintained by the Computer Control Company, Inc.

An intensive on-the-job training program for technician type personnel was initiated early in 1955. This training program has proved very successful and approximately 70% of the maintenance and troubleshooting activity on the RAYDAC is performed by technician type personnel. Prior to the training program, all troubleshooting activity was carried out by engineering personnel.

A contract has been awarded to Computer Control Company, Inc. for the installation of a second high speed memory unit to RAYDAC. This unit is identical to the mercury delay line memory now used in RAYDAC. The high speed storage capacity will be increased to 2048 words with an average access time of 150 microseconds. It is anticipated that the second memory unit will be placed in operation in July 1956.

COMPUTING CENTERS

AEC COMPUTING FACILITY - NEW YORK UNIVERSITY

TOSPY, a general reactor code for the numerical solution of the two dimensional diffusion equation by the multi-group method, is being developed. The code allows for non-uniform mesh spacing, multiply connected regions, various boundary conditions and several geometries. Up to nineteen energy groups (or nineteen coupled linear elliptic equations) can be handled.

Studies are being made on the application of the Monte Carlo method to reactor problems, in particular to the determination of resonance capture and thermal utilization.

The comprehensive NYU service routine called Omnibus which incorporates all the common Univac service routines has been in use for some time at many Univac centers. This routine has recently been expanded and rewritten as a new version called Omnifax which includes many new useful options. A report on Omnifax has been issued.

A report describing the computing center's matrix routines: eigenvalue-eigenvector code, matrix inversion, etc., has also appeared recently. The report discusses the mathematical methods used and gives operating instructions for the codes.

The library of subroutines is continually being expanded. A subroutine to integrate a set of n coupled ordinary differential equations using Milne's method and allowing for halving or doubling of the interval of integration has been completed. Several fast routines for calculating elementary function (to limited accuracy) have also been added.

An oscilloscope graph plotter has been built for NYU's Univac.

THE FRANKLIN INSTITUTE LABORATORIES FOR RESEARCH AND DEVELOPMENT

A complete Univac system is being installed at the Franklin Institute Laboratories in Philadelphia, Pa. Peripheral equipment will include a Card-to-Tape Converter and a High Speed Printer. The installation is expected to be completed in late summer and full scale operation will begin in October 1956.

Complete analytical and programming services for scientific and engineering computations will be performed by the Laboratories on a contract basis. In addition the computer will be available as a service within the Laboratories to perform computations growing out of other research and development contracts.

Already in operation at the Franklin Institute are other computing facilities which include an Advanced Time Scale Analog computer and the Alternating Current Network Calculator.

In addition, the Laboratories are engaged in design and construction of special purpose analog computers and components for large scale digital data processing systems.

RICH ELECTRONIC COMPUTER CENTER

The Georgia Institute of Technology expects to install, early in July, in its Rich Electronic Computer Center an IBM 650 Magnetic Drum Data Processing System. The addition of the IBM 650 will provide expanded facilities for academic research and increased laboratory tools for courses now being offered in numerical analysis, programming, data processing, quality control, and operations research.

As is the case with the Rich Electronic Computer Center's UNIVAC SCIENTIFIC Computer (formerly known as the ERA 1101), the IBM 650 will be available to agencies other than Georgia Tech on a service basis.

COMPUTERS, OVERSEAS

ELLIOTT BROTHERS LIMITED, LONDON - ELLIOTT 402F DIGITAL COMPUTER

This machine is a new development from the well-known Elliott 402 Computer (described in the April, 1955 edition of the Digital Newsletter) incorporating fixed or floating point operation under program control. Numbers are stored in the 402F in the form of a 7-digit binary exponent together with a 25-digit argument. All arithmetic operations are rounded.

Operating times are as follows:

Addition, subtraction, etc. (fixed or floating point)	204 microseconds
Multiplication and division (fixed or floating point)	3.3 milliseconds

The storage of the 402F has been increased from that of the original 402 and now includes 3,968 words on a magnetic drum together with 16 immediate access registers and an accumulator. Input may be paper tape or punched cards; output by paper tape.

Elliott 405 Business Computing System

The first 405 System was completed in January, 1956, and is now engaged on service work for outside organizations including the payroll and wages cost analysis of Elliott's own factories. A number of 405's are on order and delivery will commence later this year of production models.

FINAC - (ISTITUTO NAZIONALE PER LE APPLICAZIONI DEL CALCOLO)

A parallel, high-speed printer is being added to the machine. It is expected to be operating in the first days of June. It will be able to print 150 lines per minute, 64 characters per line, corresponding to 48,000 bits per minute.

Routines have been developed for the computation of eigenvalues of matrices and for interpretive schemes.

Good operating time of the machine during this year has been 89% of the total operating time.

PEGASUS (FERRANTI LTD., ENGLAND)

The first Ferranti Pegasus Computer has now been in regular operation at the London Computer Centre for three months.

The specifications are as announced in the Digital Computer Newsletter, Volume 7, Number 2 for April 1955, with the following changes:

Output. Now 33 characters a second in place of 25.

Checks. Parity checks are provided on the Drum and High Speed Nickel Line stores.

Formal acceptance tests are still being agreed. A full statistical analysis is waiting for a longer period of operation: isolated facts are trouble free runs of 50 hours and average good time around 90%.

The Initial Orders for Pegasus provide comprehensive input, assembly and checking features. The standard way of using the computer calls for two tape-readers; one of these is used as usual for the program and numerical data, and the other for the tape bearing the library of subroutines. This library tape now contains over 20 tested routines; the Initial Orders scan this tape and select the routines required, incorporating them automatically in the program.

Subroutines at present available include the usual set of elementary functions, some input and output routines and a few others; more are being written. A large Matrix Interpretive Scheme is now in regular use; it permits floating-point operations on matrices to be easily programmed by a person unfamiliar with the ordinary programming techniques. An interpretive scheme is also being developed for double-precision floating-point operations. Programs are now available for aircraft stressing problems.

Regular courses on programming for Pegasus are now being held in London for the staff of actual and prospective customers. A computing service is now available using the machine at the London Computer Centre.

COMPONENTS

BALLISTIC FILM ANALYZER AND RECORDER

Benson-Lehner Corporation of Los Angeles has recently announced the availability of its new E, J, and N series BOSCAR's (ballistic film analyzer and recorder). Figure 3 shows a BOSCAR Model E2. These machines are for the analysis of film records such as high speed motion photography, theodolite data, or a wide range of other photographic records. The machines combine both optical and measuring systems and have interchangeable film movements which can handle any of the following types of film: 8 mm., 16 mm., 35 mm., single frame, 35 mm. double frame, 70 mm.

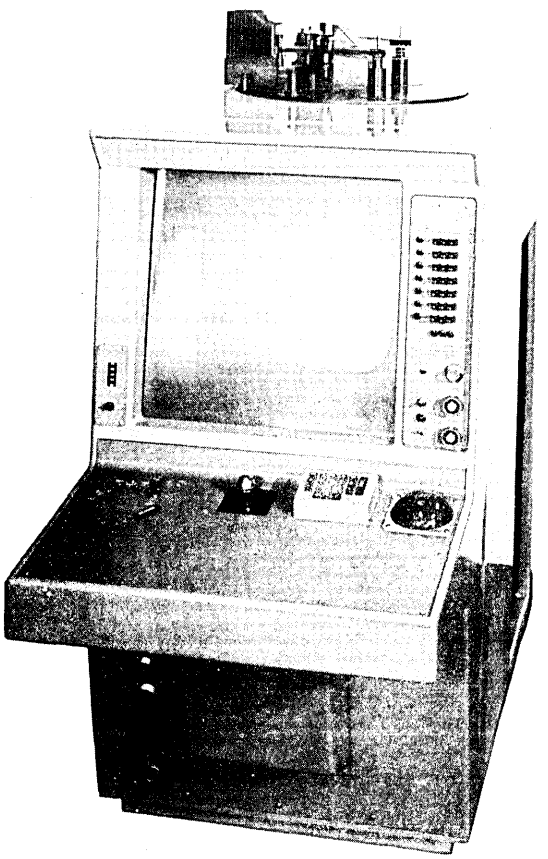

Figure 3 - Ballistic Film Analyzer and Recorder (Boscar Model E2)

Various measurement and output systems are available giving analog or digital output from either a stick flying spot control or a spheroid cross-wire control. The stick controls the X, Y and angular position of a moving reference on the screen and provides the operator with a measuring system in the medium accuracy range (one part in 1,500). The spheroid control allows for positioning of two precise crosswires, giving an output accuracy of one part in 5,000 with a resolution up to one part in 10,000. Angular measurement of images may be from either the stick or the projector rotation.

Various automatic outputs are available such as output to remote typewriters, card punching or paper tape punching machines, and/or automatic plotting boards. The film movements provide for frame-to-frame film advance with film registration of ±0.0005" at the film plane.

Because the semiautomatic analysis of film records involves the continual repetition of a relatively small number of operations, the efficiency of each operation has a very large effect on the productivity of the overall system. For this reason a great deal of attention has been paid to the design of the machine from the point of view of the relationship between the machine and the operator.

MAGNETIC CORE STORAGE UNIT

Telemeter Magnetics Inc. have announced a new self contained magnetic core buffer unit. The 1092-BU-7 Coincident-Current Magnetic Core Storage Unit has unique properties which make it suitable for application as a temporary store, buffer or delay unit in data-processing, computing and automation systems. It has a capacity of up to 1092 characters, each of which may be up to 7 binary digits in length. The 7 bits of each character are loaded and unloaded from the memory in parallel. The characters are introduced into the store sequentially and are immediately available at the output in the same sequence as the loading sequence. In other words, the store has the unique feature of always being ready to deliver the earliest stored character regardless of whether the total number of characters in the store is 1 or 1092.

Blocks of information, as the above description indicates, may be of any size from 1 character to 1092. Minimum time for loading or unloading operation is 14 μs per character with 6 μs being required to switch from a loading to an unloading operation or vice-versa.

A block may be continuously loaded at any rate up to 70 kilocycles. After the minimum transition period of 6 μs, unloading of the block is able to begin with the characters being delivered to the output in the same sequence in which they were loaded and again at a rate up to 70 kilocycles.

There is, of course, no necessity that the entire block be unloaded. At any time, the operating mode may be switched back to "load" and more information can then be put into the store. In fact, load and unload cycles may alternate at a 25 KC rate.

If, as the result of any such sequence of load and unload operations, the store should become filled with the maximum 1092 characters, a "FULL" signal will be emitted as a character is inserted into the last available storage cell. All subsequent attempts to load information into the storage unit will result in the emission of the same signal until storage cell space will again become available. Conversely, an "EMPTY" signal will be emitted as the last character is unloaded from the unit and whenever an attempt is made to unload information from an empty storage unit.

The available capacity can be increased beyond 1092 characters by combining these units with the CU-7 Control Unit. In this way, capacities of integral multiples of 1092 characters can be achieved. In another arrangement of these modular units, the character length can be increased from 7 to 14 or to other integral multiples of 7 bits.

DETAILED SPECIFICATIONS

STORAGE CAPACITY

This capacity has been chosen to cover a wide range of applications at a minimum cost per bit. The unit has been designed so that any block length from 1 to 1092 characters is permitted. Any character length up to 7 binary digits can be accommodated to permit use of binary coded alphanumeric information including a parity digit. The unit is a true buffer storage unit in that not only is capacity variable, but also the stored information is available in the original sequence upon demand and without delay.

MODES OF OPERATION

Loading - The information is presented to the storage unit on 7 parallel lines in the form of DC levels. When the levels have settled, a "LOAD SYNC" pulse is transmitted to the unit whereupon a load operation is performed.

The information lines must be completely settled within 1 μs after the synchronizing pulse starts and must remain static for at least 12 μs. If the unit is not performing a loading operation, these lines may fluctuate in any manner without affecting the stored information. "LOAD SYNC" signals should be separated by a minimum of 14 μs.

A "FULL" pulse is provided from the unit at the time the last available storage cell is filled. If loading continues after this, a "FULL" pulse is provided from the unit on every load operation.

Unloading - In order to obtain information from the unit, an "UNLOAD SYNC" pulse is transmitted to the unit whereupon an unloading operation is performed. The output information is presented on 7 parallel lines in pulse form. If the stored information was ONR, a pulse occurs on a line 8 μs after the synchronizing pulse. The output pulse duration is 2 μs.

"UNLOAD SYNC" signals shoudl be separated by a minimum of 14 μs. An "EMPTY" pulse is provided at the time the last occupied storage cell is emptied. Thereafter as in the case of the "FULL" signal, an "EMPTY" signal is emitted in response to each "UNLOAD SYNC" signal.

Transition - A period of 6 μs is required to change from one mode to another. As a result, the minimum interval between a "LOAD SYNC" pulse and an "UNLOAD SYNC" pulse is 20 μs.

Random Loading and Unloading - The unit has been designed for operation with systems in which it is desirable to perform loading and unloading at random. This feature makes it

possible to start extracting information from the storage unit immediately after input has commenced. The input data stream may then continue indefinitely provided that the storage capacity is not exceeded. The rate of information flow will vary, depending upon the frequency with which the operating mode is changed. In the worst possible case, when characters are alternately loaded and unloaded, the maximum rate of information flow is 25 Kc/s.

Multiple Storage Operation - In some applications storage capacities in excess of 1092 characters will be required. To meet this need the type CU-7 Control Unit has been designed which may be used to couple two storage units together. The operation is then that of a double capacity unit which retains the same properties in all other respects as the standard unit. Any number of storage units may be coupled in this manner.

SIGNAL LEVELS AND IMPEDANCE

Input - The positive input levels should be between +5 and +30 volts and the negative input levels between -5 and -30 volts. A negative level represents a ZERO. The input impedance is 5,000 ohms and is resistive.

Synchronizing Pulses - These pulses may exist at any reasonable DC level. In order to initiate a load or unload operation they should rise 10 to 20 volts in not more than 1 μs and remain at that level for 2 μs.

Output, Full and Empty Pulses - "ZERO level" is at -5 volts. The pulses rise to +5 volts in 1 μs and remain at that level for at least 2 μs. They will drive a capacitive load of 0.002 μf. and will provide a current of 2mA. into a resistive load.

POWER SUPPLY

The equipment requires 115 volts, 60 cps, 2 amperes. An indicator lamp indicates when power is on and the unit is available for use as soon as power is switched on. Information will be destroyed in the event of power failure or shut-down.

CLEARING

A manual control is provided which can cause the loading operation to proceed to a zero address in the store. Another control can cause the unloading operation to proceed until the last occupied storage cell has been emptied.

CHECKING

A manual control causes control of the storage unit to be switched to an internal oscillator. The unit then loads and unloads alternatively at 25 Kc/s. This may be used to check that the input data is reproduced at the output. Other manual controls permit marginal checking to be performed by increasing the rate of the oscillator and by variation of the supply voltages.

PHYSICAL CHARACTERISTICS

Environment - The equipment is designed to operate under normal room conditions.

Components - No vacuum tubes are employed, and all components are derated according to the best computing equipment practices. Best quality materials and workmanship are used throughout to ensure that the highest possible reliability is obtained.

Mechanical Features - The equipment is supplied as an integral unit housed in its own cabinet. If desired, it may be mounted in a standard relay rack. The unit is cooled with ambient air and cooling is from the sides and back in order to facilitate the mounting of other equipment above and below the unit. All connections are made by means of plugs and sockets with mechanical retaining devices.

SUMMARY OF SPECIFICATIONS

CAPACITY: Any number up to 1092 characters.

CHARACTER LENGTH: Up to 7 binary digits.

OPERATING MODE: The bits of each character are loaded and unloaded in parallel. The characters are loaded and unloaded sequentially.

CONTROL LINES AND SIGNALS: Input, 7 lines, "zero" -5 volts, "one" +5 volts
Output, 7 lines, "zero" -5 volts, "one" +5 volts*
Load Sync, 1 line, 10 volt positive pulse*
Unload Sync, 1 line, 10 volts positive pulse*
Empty, 1 line, not empty -5 volts, empty +5 volts*
Full, 1 line, not full -5 volts, full + 5 volts*

*Pulse duration 2 μs.

MINIMUM TIME BETWEEN LOAD SYNC PULSES: 14 μs.

MINIMUM TIME BETWEEN UNLOAD SYNC PULSES: 14 μs.

MINIMUM TIME BETWEEN A LOAD SYNC PULSE AND AN UNLOAD SYNC PULSE OR VICE-VERSA: 20 μs.

POWER SUPPLY: Self-contained, 115 volts, 60 cps, 2 amperes

MULTI-MILLION BIT STORAGE SYSTEM

International Telemeter Corporation has announced the signing of a contract with the United States Air Force for the development of a new type of large capacity, photographic information storage unit which is to aid in automatically translating Russian into English.

The contract was awarded by the Rome Air Development Center at Griffiss Air Force Base at Rome, New York. The "photoscopic" storage unit development is under the supervision of Dr. Gilbert King.

The single problem of translating Russian technical journals and papers from Russian into English has been an enormous one, but with the new Telemeter photoscopic storage unit, the work can be speeded up a thousandfold. For instance, 100 girls, none of whom understood one word of Russian, could sit down at 100 typewriters and copy the Russian words as fast as they could type, and instantly on adjoining automatic typewriters English equivalents of these Russian words would be typed.

Information is held photographically on a transparent emulsion coated disc. The information appears coded on this disc as microscopic black and white squares arranged in concentric tracks. To read the information, the disc is rotated while a light beam shines through these information tracks of black and white squares. A phototube picks up the light that goes through the disc and converts the sequence of light and dark to electrical signals. Incidentally, the squares on the disc are only 0.0003 inches on a side, or 6 million per square inch.

The reading station consists of a cathode ray tube, a lens that projects an image of the spot on the tube into the information track, and a photomultiplier tube behind the disc. Deflection of the electron beam in the cathode ray tube moves the light spot radially so that it illuminates any one of 600 tracks.

The disc to be used in the U. S. Air Force machine will be able to store 30 million bits, equivalent to five million characters or several books. This will be achieved with the disc spinning at a speed of 1,200 rpm, so that information is read at a rate of 1 million bits per second. The access time to any item chosen at random is the time of one revolution, or 50 milliseconds, and this time can be further reduced by using several reading heads.

Development of this principle has proceeded under partial sponsorship of the Office of Naval Research for more than two years. The first use of the device will be for translating material from Russian into English, but it may have many other uses which will be of great interest to U. S. businesses with large filing problems, and in many military applications. For instance, it will be possible to put the entire contents of a large mail order catalog on a few glass discs. Other possible uses would be in connection with businesses where enormous lists of names are used constantly such as telephone books, huge publishing circulation lists, etc. The advantage of this type of storage is that any part of the information is almost instantaneously available and that information can be very rapidly and inexpensively accumulated.

International Telemeter Corporation is a subsidiary of Paramount Pictures, and has developed other types of computer storage including the rapid access memory for the Rand "JOHNIAC" computer, the first commercially constructed static magnetic memory. (See also Telemeter Magnetics, Inc.)

MISCELLANEOUS

OFFICE OF NAVAL RESEARCH EXPANDS COMPUTER ACTIVITIES

With an ever increasing need for computers and computer like devices in Naval Systems and in the armed services in general, it has become increasingly important to intensify encouragement and stimulation of research and to initiate new research tasks and projects in this field. The OFFICE OF NAVAL RESEARCH, in recognition of this need, has recently established an "Information Systems Branch" to provide a distinct organizational unit to further these objectives. The Branch will continue and expand the functions of the old "Computer Branch" which has pioneered in the support of many of the early, large scale digital computers and computer projects, and which has been instrumental in the advance of the art. The Branch is located in the Mathematical Sciences Division, under the general direction of Dr. F. J. Weyl, Dr. F. D. Rigby is branch head and A. J. Neumann is program officer with the responsibility for technical administration of the Branch program.

COAST AND GEODETIC SURVEY, AUTOMATIC DATA LOGGER

The Coast and Geodetic Survey of the U. S. Department of Commerce has placed an order with the Fischer & Porter Company for an Automatic Data Logger to record Tide Table predictions.

The Survey publishes tide tables, which give time and magnitude of sea fluctuations a year in advance for principal seaports throughout the world. The Tide Predicting Machine, which is located in the Department of Commerce Building in Washington, D. C., has been in operation since 1019. Up until now, however, the predictions had to be read from dials and then manually logged on the tables.

The Logger will take the information from the output shafts of the Tide Predictor and automatically type out the maximum and minimum water heights (to the nearest tenth of a foot) with the times at which they occur. In addition, the Logger will also record slack water time and the maximum velocity of both the ebb and the flood current.

Tides are caused by the attraction of heavenly bodies (mainly the moon and the sun). The hydrographic structure of the ocean floor also has an effect, since underwater contours can retard the water movements.

To predict tides for any particular location, an actual tide history must first be obtained. A graph of this past record is also made. It is possible to resolve the tide observed at any place into a number of simple constituent tides, each of which is represented by a simple sine

curve with a period related to some movement of the sun or moon relative to the earth. The period of these simple constituents being known from astronomic considerations, a harmonic analysis of the tide observed at any place permits the determination of the amplitudes and phases of the constituent tides at that place. These amplitudes and phases can be calculated for any day of any future year. The values are set on the Tide Predicting Machine which takes account of 37 simple constituent tides. An operation of the machine then shows automatically the times and heights of the successive high and low waters that will occur at that place during the year in question.

The key to converting dial position of the Predictor to a typewritten log sheet is F&P's Digi-Coder analog-to-digital converter. This unit is capable of converting shaft position into discrete electrical contact combinations. The electrical contacts then can operate various output devices such as electric typewriters, tape punches, card punches, or magnetic tapes.

THE MOORE SCHOOL OF ELECTRICAL ENGINEERING - (UNIVERSITY OF PENNSYLVANIA)

A group at The Moore School is studying the feasibility and design problems of a fully-electronic automatic telephone-switching system of moderately small capacity for the U. S. Signal Corps. Basic electronic switching philosophies and techniques have been formulated for an office using semiconductor diodes and triodes to the maximum possible extent.

The design which appears most attractive at the present time consists of a lockout-matrix talking-path network using negative resistance crosspoints such as avalanche transistors and special two-terminal devices. The talking-path network is controlled by a slow-speed control network in which calling-line registers are not used. A skeleton version of the lockout matrix has been tested successfully. The logic of the control network has been completed; it is planned to mechanize the controls and test the switching and transmission performance of the complete working model within the coming months.

RECORDED COMPUTER LECTURES

The J. B. Rea Company has prepared a series of recorded lectures and slides on the basic principles of computer operation. These lectures assume a minimum mathematical and technical background, and cover basic information useful for the understanding of computers. These lectures are offered free-of-charge, to Colleges and Universities for short periods of time. If an institution wishes to do so, it may purchase these lectures for a permanent educational tool to be used in their mathematics courses. Organizations may rent these unusual and enlightening lectures and slides for programs at a nominal fee.

The lectures are prepared by Mr. W. V. Neisius, Director of Computer Applications at the J. B. Rea Company.

NEW COMPANY, TELEMETER MAGNETICS, INC.

International Telemeter Corporation, a subsidiary of Paramount Pictures Corporation, formally announces the organization of a new subsidiary, Telemeter Magnetics, Inc. The new corporation was formed as the result of a merger of the magnetic memory development project of International Telemeter Corporation with Wendt-Squires, Inc., of Buffalo, New York.

The Company is engaged in the development and production of special purpose data processing machines; memory systems and components of all kinds, particularly those utilizing magnetic cores; drivers, reading amplifier and other modular electronic components for data handling; and high-speed completely automatic core testing equipment. In addition, the new corporation continues the work of International Telemeter Corporation in the production of large high-speed memories such as have already been completed or are being completed for the Rand Corporation, Argonne National Laboratory, Aberdeen Proving Ground, Weizmann Institute of Science, Wright Air Development Center, and the Florida Automatic Computer at Patrick Air Force Base.

CONTRIBUTIONS FOR DIGITAL COMPUTER NEWSLETTER

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