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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TABLE OF CONTENTS

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NAVEXOS P-645

COMPUTERS AND DATA PROCESSORS, NORTH AMERICA

COMPUTING LABORATORY - BALLISTIC RESEARCH LABORATORIES - ABERDEEN PROVING GROUND, MARYLAND

EDVAC. A Floating Point Arithmetic Unit has recently been added to the EDVAC System. The unit operates with the four-address code of the EDVAC, thus making it compatible with fixed point instructions.

The first ten bits of the floating point number word are used to express the exponent of 2, and its sign. The next 33 bits of the EDVAC 44 bit word are used to express the fractional part of the number. The resulting range for the fractional part is from $-(1-2^{-33})$ to $+(1-2^{-33})$. The exponential part ranges from 2^{+511} to 2^{-512}.

The unit will execute addition, subtraction, multiplication and division commands. At the completion of all operations, the unit will normalize the results, i.e., make the fractional part of the number always have the most significant bit.

The unit has error detection equipment for the following conditions:

1. Overflow, which occurs when the number exceeds 10^{157}.

2. Divisor is 0, which occurs when an attempt is made to divide a number by zero.

3. Number not normalized (except absolute zero). Although the unit will operate on some numbers which are not normalized, it is felt that it is important to know that an operand is not normalized, since some accuracy might be lost in the problem. The unit will halt the EDVAC when an unnormalized number is detected.

The average time required for operations are:

Addition and Subtraction	1956 Microseconds
Multiplication	1100 "
Division	2300 "

The design was accomplished by using plug in units with regeneration at every amplification stage. The units are similar to those used on the SEAC and MIDAC Systems.

Operating experience to the present time has proved the unit to be a very reliable piece of equipment.

RECOMP II - AUTONETICS - DOWNEY, CALIFORNIA

Autonetics, A Division of North American Aviation, Inc. has placed on the commercial market an all-transistor portable, general purpose digital computer, designated Recomp II. The basic features of the military version (Digital Computer Newsletter April 1957) have been retained. However, new and important changes have been incorporated. The computer is serial, single address, internally binary, has 18 arithematic instructions, 21 logical and transfer instructions, and 9 input output instructions. Fixed and floating point instructions are built in. The magnetic disk memory capacity is 4096 words. Each word can contain 2 instructions or 40 binary bits including sign. Average access time to main memory is 8.7 milliseconds and to the high speed loops .91 milliseconds. Operation times, excluding access time are: .52 milliseconds for add-subtract, 10.4 milliseconds for multiply-divide, and 0.78 milliseconds for transfer control. Input to the computer is provided by the control panel, electric typewriter, or a photo-electric tape reader whose speed is 400 characters per second. The output can be in the form of a visual decimal display on the control panel, or typewritten copy of teletype paper tape. The cost of the basic computer is $79,500.

BANKING AUTOMATION DEVELOPMENTS - BURROUGHS CORP. - PAOLI, PENNA.

The Bank Management Commission of the American Bankers Association has approved a recommendation for the adoption of magnetic ink character recognition as the common machine language most suitable for check handling. Data are imprinted in Arabic characters in almost conventional appearance style. Printing in magnetic ink overcomes the problems of obliteration and mutilation which harass optical character recognition systems and the close tolerance requirements of pattern systems and, at the same time, embraces the advantages of both systems. Moreover, the ABA Committee, the equipment manufacturers, and printers have decided that across the bottom of paper checks will appear a row of numbers, printed in magnetic ink, which will, electronically, tell the bookkeeping and proof departments of the future how to list, sort, post and otherwise account for the item.

In view of the above banking automation trend, Burrough's automation program embraces a variety of equipment. The system includes the Todd Magni-Chek Imprinter-Coder, the Sensimatic Proof and Distribution machine, the Burroughs Magni-Chek Amount Imprinter, the Burroughs Magni-Chek Transpose Document Sorter, the Sensitronic Bank Bookkeeping machines, the Auto Reader, and the ElectroData DATATRON 220 Computer system.

The Todd Magni-Chek Imprinter prepares deposit accounting media in common language ink, ready for varying degrees of subsequent automatic processing. It enables the imprinting right on the bank premises of such data as account names and numbers, ABA transit and routing numbers, transaction codes and check serial numbers. An advantage of the Magni-Chek Imprinter-Coder is that not only can it imprint with conventional ink but it also possesses exclusive features which enable easy transition to the magnetic ink coding concepts.

Sensimatic Proof and Distribution machine is comprised of a Master Unit, a 27-pocket Sorting-Endorsing Unit, and a 27-tape Listing Unit with provisions for the attachment of a common language document inscribing unit for future automatic processing routines. There are facilities for by-product magnetic amount post-printing. A Selective Operation Control Panel makes possible almost unlimited programming. It provides automatic control, by classification, of proving, sorting, endorsing and float accumulation. Improved accuracy in the proof operation is afforded by simplified and enforced error correction procedures, including direct subtraction from the cross-footer and all registers. Enforced sorting assures that all documents arrive at their destination, and positive sorting protection assures accuracy of sorting. Should an item fail to reach the designated pocket, the machine locks.

The Magni-Chek Amount Printer, is designed to print in common language ink the amount of the item processed. The listing facility provides input for amount printing, and list and grand totals for proof purposes. The prototype of this device prints with a conventional inked ribbon, however, the production models will be adapted to magnetic ink printing.

The Magni-Chek Document Sorter achieves automatic, high-speed sorting of documents into desired sequences. Utilized with other automation devices, the Sorter furnishes read-sort input for a fully automated system. The first prototypes were based on fluorescent code and are being modified to magnetic ink common-language specifications.

The Sensitronic Bank Bookkeeping Machine is of special interest to the banking profession for it is the only device geared to verify the posting and printing of every item (checks and deposits) to the correct account. This printer and bookkeeping machine, in a rapid, true single posting run, eliminates the duplication of effort which traditionally has been necessary for attaining true verification, assuring each item being posted to the correct account. The Sensitronic is available with either single or dual printing sections. It functions electronically to perform the following operations: Alignment of forms at the proper printing position; correct pickups of old balances; and verification of postings to the correct account. In a single posting run the Sensitronic processes and completes an original-print combination statement-and-ledger—with analysis data. It utilizes an advanced magnetic stripe technique to store the account number, item count, account balance with sign, line selection, alert notice and code checking information. This data is swiftly and electronically accessible.

The Auto Reader, in combination with one or more Sensitronics, electronically processes coded accounts for trial balances and balance transfers. The Auto Reader automatically feeds forms and reads balances electronically from magnetic stripe coded forms and transmits data to the Sensitronic for listing output and transfer to new statements.

The DATATRON 220 General Purpose Computer system, for banking applications, will use as input an automatically prepared punched paper tape representing previously processed coded data. This data will be in the form of random accounts, compared and updated by the computer with standing account tapes in sequenced order. Fully processed output includes updated balance tape, reportable items, printed journal ledgers and account analysis forms. Printed statements may be rendered in the form of daily or monthly statements, or abbreviated form statements.

MANIAC III - UNIVERSITY OF CHICAGO - CHICAGO, ILLINOIS

The University of Chicago has expanded its permanent research facilities with the organization of the Institute for Computer Research. The Institute became active at the beginning of the autumn term this year.

Dr. Nicholas Metropolis, who formerly led the computer research activities at the Los Alamos Scientific Laboratory, with MANIAC I and MANIAC II, has been appointed director of the Institute. Mr. Walter Orvedahl, also formerly of the Los Alamos Scientific Laboratory, is chief engineer. Mr. John McGiveran of the University of Chicago has joined the Institute as an assistant engineer.

The Institute has begun the construction of a digital computer which will be derived from the MANIAC types and which will probably be called MANIAC III.

DATAMATIC 1000 - DATAMATIC - NEWTON HIGHLANDS, MASSACHUSETTS

First Installation. The first DATAmatic 1000 large scale, general purpose electronic data processing system has been delivered to Michigan Hospital Service, Detroit, Michigan, the nation's second largest Blue Cross - Blue Shield service. It will be used to maintain the subscriber records for 3-1/2 million Michigan residents, keeping them up to date on a daily basis. Daily file activity averages 25,000 transactions including new subscribers, premium receipts, hospital entrance requests and a host of record changes, such as name or address, new dependents, different coverage and others.

The system will update the master record file, incorporating the entire 25,000 transactions in less than two hours of processing per day. Following the processing run, high speed DATAmatic output equipment is used to print a wide variety of forms and reports. This high processing speed allows ample time during single shift operation to handle various other applications such as billing, statistical compilation and payroll plus affording considerable capacity for growth.

In addition to this first installation, a number of systems have been ordered and will be installed in various locations in 1958 including Boston, Baltimore, Minneapolis, Los Angeles, Detroit and Parkersburg, West Virginia.

General Description of DATAmatic 1000. The DATAmatic 1000 is a product of DATAmatic, a Division of Minneapolis-Honeywell Regulator Company. The Division was originally formed by Honeywell and Raytheon Manufacturing Company to build and market the DATAmatic 1000, successor to RAYCOM, an early business data processing system. Honeywell subsequently acquired full ownership.

A general purpose system, the DATAmatic 1000 incorporates many new features and techniques specifically tailored to large volume business applications. One of the most important of these is the use of three-inch-wide magnetic tape containing 31 parallel recording channels. Information is recorded and read horizontally along all 31 channels

simultaneously in alternate blocks of fixed length. Inter-record blocks are used for starting and stopping as the tape moves from one end to the other. However, when the end of tape has been reached, it automatically reverses, and data is recorded in the blocks previously used for starting and stopping. This provides maximum utilization of tape capacity and eliminates rewinding since a tape that has been completely traversed, ends up back at the starting point.

High operational speeds and capacities are utilized through an extensive and flexible set of instructions. Several of these were designed specifically for faster, more efficient sorting and file maintenance. Moreover, these instructions may be automatically assembled into complete programs by the DATAmatic 1000 Automatic Business Compiler (ABC-1).

Model 1400 High Speed Output System. The Model 1400 High Speed Output System includes a special printer. Operating at a rate of 900 lines per minute, as used with the 1000, this printer will print up to 120 characters over a range of 160 possible print positions per line. Many forms, for example, can be printed side by side, effectively doubling the number of documents that can be printed in a given time period.

SELECTADATA - FRIDEN CO., INC. - SAN LEANDRO, CALIF.

The boundaries for the use of punched tape have been expanded by the development of the Friden Selectadata. The equipment can be described as providing simple facilities which enable new kinds of data processing to be performed in peripheral areas where documents and data originate.

The Selectadata is a completely self contained machine which includes a selective tape reader, and in certain models, a Manual Data Selector is also provided. The tape reader has the ability to skip through portions of a specially prepared punched tape at high speed until a pre-selected address code is read. Codes following this address code are then read at normal speed to control operation of the Flexowriter.

The Manual Data Selector, although included as an integral part of certain models, is actually a functionally independent feature. Its primary purpose is to supply semi-variable data to the Flexowriter and includes ten manually operated controls, each having eleven different control positions plus an off position. The various control positions select binary codes associated with the ten numeral characters plus the space code. In response to an automatic control from either the Flexowriter reader or the Selectadata reader, the ten codes selected by the manual controls are transmitted in proper order to automatically control operation of the Flexowriter. The Selector can be used to automatically insert a limited amount of numeric information both fast and accurately. A common example of such use is the automatic insertion of dates in document writing on the Flexowriter.

The tape reader operates with eight-channel punched tape where the normal character and function codes are exactly the same as in tapes used in the Flexowriter reader. The only special requirement in tapes is the insertion of address or classification codes at the beginning of each item or block of information, plus a single switching code inserted at the end of all items. Address or classification codes differ from normal character codes by always including a code hole in the eighth channel. This provides 127 different address codes. Master tapes can be prepared on the Flexowriter where special provisions are made for punching address codes, or by-product tapes can be produced during production operation of a Programatic Flexowriter where address or classification codes are automatically inserted by non-print operation from a program tape or edge punched cards.

The Selectadata is provided with seven manual switches which can be operated in various combinations to select any one of the 127 different address codes. In reading the tape, all information preceded by other than the selected address code will be skipped at high speed. In certain models, provisions are made for either selecting address codes by the manual switches or for selecting the same address codes automatically from the Flexowriter reader.

Provisions have been made for two somewhat different types of operation by a duplex control switch arranged to determine which one of the two functions is to be performed upon

reading the switch code at the end of a selected item. When this duplex control switch is ir its operated position, the switch code causes the reader to stop and transfers control to the Flexowriter reader. However, when the duplex control switch is in its normal position, the switch code retains control in the Selectadata reader and automatically initiates a high spe search operation for the next item preceded by the same address code. This control switcl can then be used to provide either a single item searching operation with duplex control of Flexowriter or can provide repeat searching operation for all items having the same addre codes, thus enabling a new type of sorting and listing to be accomplished.

The automatic searching capabilities can be used in other ways for special applications For example, compound searching is possible whereupon a stop code would be read so that second search for a sub-classification would be manually initiated. These same sub-classification codes could be repeated within each of the different main classifications. Thi may in certain instances provide an automatic look-up system where a master tape can be used containing information which can have either a logical or illogical relation to two or more variables which are represented by the major and sub-classification codes.

The Selectadata will eventually be used with many types of Friden IDP machines, but it will first be available for use with various new models of the Flexowriter. Older models of the Flexowriter do not contain the necessary control features for use with the Selecta-data, but new models being currently announced include provisions for cable connection to any one of various models of the Selectadata.

705-III - INTERNATIONAL BUSINESS MACHINES, CORP. - NEW YORK, N.Y.

The Data Processing Division of International Business Machines Corporation has announced the 705-III system, which will have greatly increased capabilities over the 705-I series.

One of the features of the new system is a completely transistorized magnetic tape unit, the IBM 729 Model III. Listed below are some comparative specifications with the earlier Model I.

	729-I	729-III	
Tape Density	200	534	Char. per lineal inch
Data Transfer Rate	15,000	60,000	Char. per second
Read-Write Speed	75	112-1/2	Inches per second

The system also utilizes the new 767 Data Synchronizer which controls magnetic tape input and output so that the 705-III can read, compute, and write simultaneously. A single Data Synchronizer forms one transmission channel for a maximum of 10 tape units, and up t 6 synchronizers may be attached for simultaneous and independent operation.

A 40,000 character magnetic core storage is provided as a basic 705-III memory, and this can be enlarged to 80,000.

MONROBOT IX - MONROE CALCULATING MACHINE CO. - MORRIS PLAINS, NEW JERSEY

The MONROBOT IX is the first low priced, desk size, all electronic business computer. This office computer is designed to handle both the simple and the complex billing operations encountered in large and small companies. However, its flexible control-program unit will permit its use for many other general accounting functions.

The command structure is unusually flexible for a machine of its price range (approxi-mately $11,000). It offers 15 separate operations including all basic arithmetic operations.

The machine operates under control of line programs selected by the operator. A line program determines format control, print-out of alphanumeric data, automatic spacing, tabulating, carriage return and line feed, and decimal point.

The input output device is a standard IBM electric typewriter. All necessary operating controls are included on the input output unit. Any format may be followed, and also the typewriter may be used independently.

The system has a total of approximately 50 vacuum tubes, 1000 diodes, and requires 750 watts of power.

Automatic Features: Calculation with any fraction or fractions without reference to decimal equivalents; Printout of repetitive alphabetic and numeric detail; Printout of daily totals accumulated from invoice details; Decimal point alignment of printout; Consecutive numbering and dating; Tabulation; Roundoff; Constant percentage calculations, such as sales tax, discount, etc.; Calculation of group or chain discounts without reference to decimal equivalents.

Specifications.

Arithmetic Operations:	Addition	Subtraction	*Multiplication **Division
Commands:	Halt	Transfer	Shift left
	Input	Divide	Space
	Input & multiply	Add	Tab
	Print	Subtract	Carriage return/line feed
	Store	Shift right	Decimal point
Storage:	Magnetic drum with 14 registers; each register 62 binary bits in length (18 decimal digits). Registers may be subdivided to provide a greater number of smaller ones. Example: Could be programmed to furnish 42 six digit registers.		
Program Capacity:	8 programs with 52 instructions per program (via plugboard). 6 instructions per program can be modified by depression of a program selection key.		
Programmed Alphabetic Output:	Automatic print out of any fixed, repetitive letters, symbols, words, or sentences.		

* Multiplier must be introduced via keyboard,
** Quotient is outputted and must be re-entered for further manipulation.

SEAC - NATIONAL BUREAU OF STANDARDS - WASHINGTON, D. C.

SEAC Experiments in Pattern Recognition. A scanning system SADIE (SEAC Automatic Digital Input Eye) has been added to SEAC as a research facility for use in character and pattern recognition experiments. This equipment combines automatic scanning input, the processing power of a general purpose digital computer and an output display, making it possible for SEAC to accept automatically, under program control, an image from a photograph into its memory and to reproduce a copy of that image either as it was read in or as it has been modified by subsequent processing. Computer programs include various experiments in performing logical operations on pictorial and graphic information for such purposes as counting and recognition of key objects in a photograph, drawing or map, simulation of automatic character recognition devices, and the automatic encoding of graphic information.

Recent Modifications. SEAC's preparation to handle data searching, pictorial recognition and real time system simulation in conjunction with the laboratory's analog equipment, necessitated a number of modifications in its internal units and additions in peripheral hardware.

In input output equipment, SEAC has added 1 Flexowriter, 1 high-speed punch, 1 Potter perforated tape reader, 8 Ampex magnetic tape units, 1 picture scanner, SADIE (SEAC's) Automatic Digital Input Eye), 1 input serializer with 352 possible inputs, and 1 output staticizer which scans a preselected portion of the mercury memory continuously. Considerable speed gain is accomplished in the 8 multi-channel Ampex units by the feature of individual positioning control concurrent with computation, a 6 channel buffer, and recording data blocks in variable sizes.

Other modifications include an expansion of the memory to 2048 words and installation of two new orders, a SHIFT and an EQUALITY order.

NAVAL AIR TEST CENTER - U. S. NAVAL AIR STATION - PATUXENT RIVER, MARYLAND

The capabilities of the Electronic Computer Unit of the Naval Air Test Center (NATC) have been increased by the installation in October of an automatic Floating Point Control Unit and a second Datareader for use with the Datatron Computer. Following are the operating statistics for the Datatron installation at the NATC for the three month period ending 31 October 1957:

Analysis of Computer Time

	August		September		October	
	Hours	%	Hours	%	Hours	%
Production	147.3	89.3	72.4	48.3	202.2	117.2
Code Checking	41.4	25.1	38.2	25.5	23.9	13.9
Idle	3.2	1.9	5.3	3.5	1.0	0.6
Down Time	2.9	1.8	34.1	22.7	8.5	4.9
Total	194.8	118.1	150.0	100.0	235.6	136.6

The first hour of each work day is utilized for preventive maintenance. The remainder of the work day, 7-1/2 hours, is used as the basis for the computation of the operating statistics. Percentages in excess of 100 arise when the computer is used for production or code checking after the regular work day. Idle time includes time lost during the basic 7-1/2 hour day due to power failure or air conditioning malfunction. The large amount of down time during September occurred during the installation of the Floating Point Control Unit.

TRANSAC S-2000 - PHILCO CORP. - PHILADELPHIA, PENN.

The Philco TRANSAC Newsletter, November 1957, lists revised specification and information on their S-2000 computing system. Copies of the newsletter may be obtained from the Government and Industrial Division, 4700 Wissahickon Avenue, Philadelphia, Pennsylvania.

FLAC I AND II - RCA SERVICE COMPANY, INC. - PATRICK AIR FORCE BASE, FLORIDA

FLAC I. Operating record for the period 22 August to 20 November 1957:

Category	No. of Hours	Percent of Manned Hrs.
Data Running	954.0	60.0
Code Checking	273.3	17.18
Analysis	7.3	.46
Library Maintenance	20.3	1.27
Power Failure	34.7	2.18
Idle Time	1.4	.08
Preventative Maintenance	189.3	11.90
Unscheduled Maintenance	110.2	6.93
Total Manned Hours for Period	1590.5	100.00

FLAC I continues to be scheduled 24 hours each day for five days each week processing missile test data.

FLAC II. The Central Computer, console, power supplies, memory and a part of the programmed input output equipment have been installed for FLAC II. De-bugging and engineering evaluation has been in progress since approximately 15 October 1957.

On 5 November 1957, the first production data was reduced on the computer. One 8 hour shift per day is now available for data processing. Engineering evaluations and the addition of various peripheral equipments will continue for the next several months. With the advent of FLAC II there now exists at the Air Force Missile Test Center identical and duplicate computing facilities for data processing.

UDOFT AND MOBIDIC - SYLVANIA ELECTRIC PRODUCTS INC., - WALTHAM, MASS.

The UDOFT computer now being developed by Sylvania for the U. S. Naval Training Device Center is a special purpose, high speed, digital computer designed to accomplish the real time control of operational aircraft flight trainers. The original systems, logical design, and preliminary circuit design of the computer system were done by the staff of the Moore School of Electrical Engineering, University of Pennsylvania, under contract with the U. S. Navy.

In the flight trainer application the computer will replace most of the operational control functions currently being accomplished with analog computers. The digital computer is well suited for this application because of its inherent flexibility in the simulation of the flight characteristics of different types of aircraft. This can be done by changing the equations of flight, requiring only a change in the computer program. The characteristics that make the UDOFT computer satisfactory for this specific control problem also make it suitable for other applications of real time control. Inherently, it is a large scale, general purpose computer, but under the present program only special input output equipment is provided.

The computer is a parallel-sequential, single address, binary, synchronous, digital computer. Numbers are represented in the computer by 22 binary digits—20 digits representing absolute magnitude, one digit for the sign, and one digit for the parity check. Instructions are represented by 20 binary digits—12 digits representing the operand address, seven digits for the order type (including one spare digit), and one digit for the parity check. The master clock has a frequency of 1.2 megacycles and includes five phases. The circuitry is of the dynamic type (SEAC, DYSEAC) with low level diode gating (pulses are of 5 volts magnitude).

A unique feature of the UDOFT is the parallel-sequential mode of operation. In this mode the number memory operates in parallel, but the information is presented to the arithmetic unit sequentially. That is, the arithmetic unit is parallel, with each stage delayed one phase from the preceding one. In this way the arithmetic operation times are made independent of generated carry digits.

Another special feature is the incorporation of two independent, random access, magnetic core memories. The use of two memories, one exclusively for instructions and one exclusively for numbers, permits the use of an extremely fast instruction cycle since the instruction

memory can be used to decode an instruction at the same time that the number memory presents the operand from the preceding instruction. Thus, each instruction requires only one access to each memory. The capacity of each memory is 4096 words, and each has a read-write time of 5 microseconds.

The computer input system, except for the initial memory loading by a card reader, consists mainly of analog inputs from controls located in the trainer. The analog inputs are converted to digital form at the point of generation by code wheel converters. There are also discrete inputs from toggle switches in the trainer and at the instructor's console.

The computer output system is almost the inverse of the input system. The analog outputs are converted in a digital to analog converter and are multiplexed out to locations specified by the computer. These outputs operate the trainer instruments. The discrete outputs are used to light indicators located in the trainer and at the console.

1. Arithmetic Operation Times (including memory access time):

Add	5	microseconds
Subtract	5	"
Multiply	10	"
Divide	105	"

2. Number of Instructions: 27

MOBIDIC is a high speed, mobile digital computer being developed for the U. S. Army Signal Engineering Laboratories. It is intended for field use by the Army and its design is characterized by a high degree of flexibility allowing it to be adapted to many classes of data processing and computational problems. The major characteristics are:

Mode of Operation	Fixed point, parallel, internally binary, single address, synchronous.
Word Length	37 bits plus 1 parity bit.
Arithmetic Representation	Sign plus magnitude.
Memory Size	4096 words expandable to 28,672 words in units of 4096 words.
Memory Access Time	8 microseconds for complete read-write cycle.
Order Repertoire	Eleven arithmetic orders Eight transfer orders Twenty one logical orders Nine input-output orders.
Operating Speed (including memory access)	Addition 16 microseconds Subtraction 16 " Multiplication 86 " Division 88 "
Input-Output Speed	Input-output is simultaneous with computation and proceeds at the rate of the input-output device; no interruption of computation occurs unless both require simultaneous memory access, then, computation is delayed by one memory cycle.
Internal Addressable Registers	10 (expandable to 32)

Index Registers	4 (expandable to 7)
Input-Output Devices	Up to 64 input-output devices (magnetic tape units, paper tape units, line printers, typewriters, card handling units, etc.) with up to 8 operating simultaneously. Also capable of accepting and delivering full computer words at a rate up to 125,000 words per second.

The first computer will be installed in a 26-foot standard Army van which will include air conditioning equipment for the comfort of the operators. Transistors are used throughout. Delivery will be in 1959.

COMPUTING CENTERS

AIR FORCE ARMAMENT CENTER - ARDC - EGLIN AFB, FLORIDA

Acceptance tests have been completed on the newly installed Charactron-Manual Intervention System for the Univac Scientific 1103, and the equipment is being incorporated in the Digital Flight Test Instrumentation and Data Reduction System for B58 Fire Control Evaluation. Magnetic tape recordings of digitized data are being played directly into the Univac Scientific Computer and such final answers as hit probabilities are the output. Graphical output, and program monitor and control are the functions of the Charactron-Manual Intervention equipment.

The Teledata System of leased wire communications between Eglin Air Force Base, Florida; Kirtland Air Force Base, New Mexico; and the Ballistic Test Facility, Pasadena, California, has been accepted and is now in use.

A data processing center called TELEMAG, for the handling of analog and digital magnetic tape and telemetered data, has been initiated. First construction and installation will take place in January 1958. TELEMAG will, through existing equipment and an EPSCO Datrac analog-digital converter, have direct connections with the Univac Scientific 1103 Computer. Editing, "quick look" facilities and analog recording will be featured, and the system will accommodate FM, PDM and PAM telemetry.

WESTERN DATA PROCESSING CENTER - UNIV. OF CALIFORNIA - LOS ANGELES, CALIF.

The University of California and IBM announced jointly recently that the machine to be furnished to the Western Data Processing Center will be a type 709, instead of a type 705, as previously announced (Digital Computer Newsletter July 1957).

COMPUTING CENTER - CALIFORNIA INSTITUTE OF TECHNOLOGY - PASADENA, CALIF.

The California Institute of Technology recently reorganized and expanded its machine computing activities with the conversion of its analysis laboratory. It has just moved into a new building housing these facilities, which include a Datatron with floating point arithmetic and two tape units, a large Direct Analogy Electric Analog Computer developed by the Institute, a Librascope LGP-30 and an IBM 705.

The activities of the Computing Center comprise three general areas: 1. Basic research in applied mathematics and computer development, 2. Student training through a core of basic courses and student research, and 3. Provision for a service facility for all campus research.

Current research in the field of numerical analysis includes a study of random numbers used in digital computation, flutter analysis by digital computers, solution of polynomial equations, and three-dimensional Fourier synthesis for such applications as crystal structure analysis in physical chemistry. Research in machine design and evaluation includes such subjects as micro-programming in the design of medium sized computers, research in externally programmed computers, application of computers to supersonic and transonic flutter analysis of delta and low aspect ratio wings, application of digital and analog computers to nuclear reactor design and other engineering problems involving diffusion equations.

A number of important additions have been made to the technical staff of the Computing Center, whose principal members now include Dr. G. D. McCann, Dr. C. H. Wilts, Dr. Joel Franklin, Dr. Robert Nathan, Mr. C. V. Ray and Mr. Kendrick Hebert.

RAYDAC - U. S. NAVAL AIR MISSILE TEST CENTER - POINT MUGU, CALIF.

New input equipment is now being used with RAYDAC. Programs and constants are read directly from paper tape at 200 characters per second. IBM cards are used for data input and for corrections to programs, at rates up to 240 cards per minute. Telemetry data is processed from digital storage tape at rates up to 1,000 samples per second.

A high-speed output system is expected to be in operation by 30 April 1958. This system will use an IBM 407 tabulator, IBM 523 card punch and a Talley digital plotter, for either on line or off line output operations.

ELECTRON COMPUTER BRANCH (CODE 280) - BUREAU OF SHIPS - WASHINGTON, D. C.

Applied Mathematics Laboratory, DTMB. The most significant problems solved on the UNIVAC systems at the Applied Mathematics Laboratory, David Taylor Model Basin in the first half of the calendar year are:

1. Development of routines for the generation of contour maps of neutron fluxes both for the automatic point plotter and the line printer.

2. Calculation of the stresses, moments, and displacements of a quarter-torus seal used in one design of pressurized water reactors.

3. Calculations relating to the analysis and prediction of submarine motion.

4. Reduction of tactical data acquired on full-scale ship trials.

5. Calculations relating to the formulation of design specifications for a pair of contra-rotating propellers, such as are used on torpedoes and certain submarines.

6. Numerical evaluation of a two-dimensional integral involving six parameters, relating to the accurate location of a mine whose approximate position was previously known.

7. Calculation and automatic point plotting of a set of charts based on azimuthal equi-distant projection, to be used in the solution of problems relating to the propagation of radio waves over long distances.

8. Simultaneous solution of a pair of first-order differential equations occurring in a theoretical analysis of the pressure buildup in a vented magazine containing a burning propellant. The results were used in the design of storage magazines for rocket motors.

Significant engineering modifications were made in the Unityper Model 1 at the Laboratory to enable it to be used as a paper tape to magnetic tape converter. This modification involved the design, installation, and testing of conversion circuitry necessary to make the input from a punched paper tape reader acceptable to the Unityper in place of its keyboard signals.

LARC. Several changes have been made in the LARC system as now on order by the Bureau of Ships for use at David Taylor Model Basin. The system now consists of the following components:

30,000 words high speed memory
One computer unit
One input output processor
Alphameric high speed on line printer
Four tape read/write synchronizers
Two drum read synchronizers
One drum write synchronizer
12 drums
16 UNISERVO II
72 A & B registers
Flexowriter and paper tape input/output unit
One operating console
One engineering console

In view of the high speed and large memory capabilities of the LARC system, the concept of programming the LARC is still under study. Whether all the changes as enumerated above will provide the best balance in machine capabilities, will not be known until some years after the computer is installed and operating. Certainly the concepts in computer programming as utilized in present day machines will have to be radically changed. Automatic programming is being developed, as an aid to rapid solution of large problems.

COMPUTER CENTER - NAVY ELECTRONICS LABORATORY - SAN DIEGO, CALIFORNIA

Improvements in the physical organization of existing computers and the installation of a Datatron 205 were both accomplished at NEL during October 1957. The center now occupies the entire top deck of wing 1, building 33 — some 3,400 square feet of air conditioned floor space, exclusive of programmer offices.

The center now includes the EASE, a 30 channel general purpose analog, the REAC, a 40 channel, 8 servo general purpose analog, the MADDIDA, an 80 channel digital differential analyzer, a TELEREADER, TELECORDEX and OSCAR for digitization and automatic data plotting, as well as the DATATRON with its peripheral equipment for card, paper tape and magnetic tape input and output, tabulating and collating.

To supplement the work of the assigned programmers, a series of programming courses have been held to instruct scientific personnel in open shop use of the computers. In operation two weeks, the installation has already analyzed data for underwater sound studies, for atmospheric signal propagation, and obtained results in probability detection problems.

NAVAL ORDNANCE COMPUTATION CENTER - U. S. NAVAL PROVING GROUND - DAHLGREN, VIRGINIA

The 16,000 character-per-second cathode ray tube printer, which is being developed by the Stromberg-Carlson Corporation for on line use with the Naval Ordnance Research Calculator (NORC) is now scheduled for delivery in January, and is expected to be operating by April 1958. Features of the printer include alphanumeric characters, elaborate editing under program control, and point-plotting in rectangular coordinates. Of the two 35mm cameras which record the characters, one contains equipment for processing and projecting the film within 8 seconds after exposure. Auxiliary apparatus for making paper prints is also being installed.

A Naval Proving Ground Technical Memorandum (No. K-10/57) has been published giving a preliminary description of the Universal Data Transcriber (UDT), a stored program device being designed to make possible rapid off line communication between NORC and various input and output devices, as well as other computers.

Computing Services. Interested organizations and activities with defense contracts are reminded that some NORC computing time is expected to be available in 1958 at a cost of less than $200 per hour. Programming, mathematical research and analysis, and consulting services are also available at cost. Further information may be obtained from Director, Computation and Exterior Ballistics Laboratory, U. S. Naval Proving Ground, Dahlgren, Virginia.

COMPUTERS, OVERSEAS

ERMETH - EIDG. TECHNISCHE HOCHSCHULE - ZURICH, SWITZERLAND

At the Swiss Federal Institute of Technology, the electronic computer ERMETH is now in operation under the direction of Professor E. Stiefel. The computer has floating decimal arithmetic (3 decimals for the exponent, 11 decimals for the mantissa), but can compute as well with fixed point arithmetic (14 decimal digits). The storage is a 10,000 word magnetic drum with 6000 rpm, but only 4400 storage positions are in operation at the present time. Input and output goes via keyboard, electric typewriter and punch card equipment. As special features we have 9 Index registers (B-line) for the simplification of address-modification and the Q-sign which is a mark to label the last number of a sequence of numbers and allows to avoid counting operations in certain induction loops. Moreover the computation of elementary functions like

$$\sqrt{x},\ e^x,\ \ln x,\ \sin x,\ \cos x,\ \text{arctg}\ x$$

is carried out upon a simple shift of control (unconditional call) to fixed programs.

Programming for the ERMETH is very simple and can be done by beginners; infact a large proportion of the total computing time is used by outsiders who do their own programming.

At present the following library programs are available:

LR-Transformation
Gauss Elimination
Development into Tschebyscheff series
Gill's method to integrate Differential Equations
Quotient-Difference-Algorithm

For more details see:

1. Mitteilungen aus dem Institut fur angewandte Mathematik. "Die mathematischen Grundlagen fur die Organisation der elektronischen Rechenmaschine der Eidg. Techn. Hochschule" by J. R. Stock (Birkhauser Verlag, Basel/1956)

2. Scientia Electrica. "Die elektronischen und magnetischen Schaltungen der ERMETH" by A. Schai (FABAG - Fachschriftenverlag und Buchdruckerei, Stauffacherquai, Zurich/1957)

COMPUTING MACHINE LABORATORY - UNIVERSITY OF MANCHESTER - MANCHESTER, ENGLAND

Unsteady Flow Past a Circular Cylinder, by Professor R. B. Payne. To investigate the cross flow round a yawed projectile travelling at high speed through the air, Helmholtz's vorticity equation has been integrated for the incompressible flow in two dimensions. This parabolic partial integro-differential equation with three independent variables is solved by the method previously developed by the author. For the starting flow an interesting variation in the drag is encountered, the drag coefficient subsiding to the known value for the steady flow.

A Multi-track Magnetostatic Head, by Professor D. B. G. Edwards. An unconventional magnetic tape reading head, capable of reading digital information from either stationary or moving magnetic tape, is being used as the basis of several convenient auxiliary computer equipments at Manchester University.

One of these equipments is a Computer Output System, which records computer output on magnetic tape at any rate up to a maximum of 1000 characters per second. A character corresponds to a line of 5 or 6 binary digits written in parallel tracks across the tape. The information may be recorded over a wide range of tape speeds (including zero), but is laid down on the tape at the uniform density of 100 binary digits per linear inch. The information is read and checked character by character as it is recorded. Erroneous information is appropriately marked and re-recorded until correct.

The system utilizes 8 reading heads arranged in a block of 8 tracks across standard 1/2-inch magnetic tape. In each track, and separated by .005" from the associated read head, is the "write" head.

The reading head operates on the principal of reluctance modulation. The reluctance of the head itself is varied at a definite rate causing a variation in the flux linkage between the head and the magnetic tape. The resultant changes in flux produce a read "signal" which provides a measure of the leakage flux from the tape and its polarity. This signal is present even if the tape is stationary. This type of head detects any type of magnetic field including a d.c. field, and hence it has been made minute in order to intercept as little stray field as possible.

The resultant head can be used without screening under laboratory conditions since it has a signal to earths field ratio of about 15:1.

Immediately after information is recorded by the "write" heads of the block, it passes under the associated read head. No further information is recorded on the tape until a read signal occurs. The spacing of the information is thus dependent only on the separation between the read and write heads, and is independent of tape speed.

A Tape Editing Equipment, using a block of reading heads, is used to convert the information from the output tape to the printed page. This equipment operates with the tape moving at speeds slow enough for direct printing by mechanical teleprinters. There is, of course, no loss of read signal.

Other equipments envisaged are a Magnetic Tape Input Equipment, and a Magnetic Tape Preparation Equipment.

MAILUFTERL - DER TECHNISCHEN HOCHSCHULE - VIENNA, AUSTRIA

*MAILUFTERL is the Transistorized Digital Computer of the Institut fuer Niederfrequenztechnik, University of Technology, Vienna, Austria. The model is being developed at the Institute for purposes of the Institute's research. The material is a gift from Austrian and foreign industrial companies. Approximately 3000 low frequency transistors (Philips OC71 and OC76) and 5000 germanium diodes are the switching and amplifying components; no tubes or relays are used.

MAILUFTERL is a fixed point serial decimal machine using the Stibitz-code. Floating point can be programmed. Logical operations on alpha-numerical data can be performed.

Organization. The word length is 48 bits or 10 decimal digits plus one sign digit and one operational digit. Negative numbers are represented by the true complement. The single address system is used. Instruction word: 4 decimal digits for address, 2 decimal digits for index, 16 functional bits, one decimal digit for conditions, and one operational digit. The free combination of the 16 functional digits (2^{16} possibilities) provides maximum flexibility in programming. The operational digit distinguishes between numbers and instructions and between marked and unmarked words; it also detects one bit errors in the memory.

Control Unit. A Stibitz-adder makes automatic address modifications (index operations, address substitutions or both). A register stores the return instruction during subroutines.

Arithmetic Unit. It includes 3 registers, one normal accumulator, one accumulator for special purposes and one storage register, all with operational checking flip-flops. Multiplication and division are done by subroutines on the drum. 5 logical operations are binary (change from Stibitz-zero to 0000).

Memory. 1. Magnetic drum: 7" diameter bronze cylinder of 16" length; 3000 r.p.m. AGFA coat. 200 tracks of 50 words each, addresses numbered from 0000 to 9999.

2. Immediate access core-matrix for 50 words (corresponding to one track), addresses numbered from 0050 to 0099 (extension to 9999 possible; distinction between drum and other addresses by a functional bit; addresses 0000 to 0049 give access to registers etc. and to input and output devices).

Input Output. 1. Tape readers and teletype writers.
2. Manual switch input for two words, optical display for one word; any address can be read out or written in manually.

Speed. Basic frequency 132 kc/s, pulse duration 4 microseconds.
Word duration 0.4 milliseconds.
Instruction (reading and executing) 0.8 milliseconds.
Multiplication program (2 ten digit numbers) 26 milliseconds.

DC power consumption. 400 watts.

Time scale. Development of circuits started in Spring 1956.
Construction started May 1957.
Construction will be finished in December 1957.

*"MAILUFTERL" is a friendly Viennese spring-time wind. The name indicates the distance from "whirl-winds" and "typhoons."

WEIZAC - THE WEIZMANN INSTITUTE OF SCIENCE - REHOVOTH, ISRAEL

WEIZAC, the computer at the Weizmann Institute, has completed its second year of operation. For the first year, the memory was a home made drum; during the second year, the ferrite-core memory manufactured by Telemeter Magnetics, Inc. of Los Angeles, was in operation, allowing the high-speed of the arithmetic organ to be fully utilized. Measured operation times for major orders are as follows:

Addition or Subtraction	50 microsecs.	
Multiplication	750 "	average
Division	850 "	
Store	25 "	

these times include memory access.

Computation time was allocated to the various users one week in advance, additional shifts being added by request. A summary of hours of operation is given below.

A Teletype high speed paper punch was put in operation in October 1956 and has been working since. A magnetic tape system has been developed for intermediate speed, high capacity storage, which is now undergoing its final tests.

Month	Code Checking		Production		Total Computation Time		Idle Time		Scheduled Engineering and Development		Unscheduled Breakdowns	
	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Min.	Hrs.	Mins.	Hrs.	Mins.
Oct. 56	72	30	51	-	123	30	-	-	50	-	34	25
Nov.	42	40	61	15	103	55	8	15	46	-	52	20
Dec.	37	-	87	-	124	-	7	45	38	50	33	-
Jan. 57	52	-	60	20	112	20	35	45	50	40	12	10
Feb.	44	35	79	30	124	05	8	30	65	50	34	10
March	50	-	141	30	191	30	6	35	54	15	23	40
April	68	-	76	30	144	30	8	25	53	40	4	20
May	79	30	132	-	211	30	4	10	45	-	12	15
June	103	45	224	45	328	30	5	15	38	45	6	15
July	83	-	356	25	439	25	6	45	57	05	26	55
Aug.	81	-	265	45	346	45	10	15	50	30	14	45
Sept.	83	-	224	-	307	-	6	55	48	10	32	30
	797	-	1760	-	2257	-	107	45	607	45	286	45

COMPONENTS

HANDWRITTEN CHARACTER READER - BELL TELEPHONE LABORATORIES - NEW YORK, N. Y.

Bell Telephone Laboratories has announced a device that can read handwritten numerals or identify numerals as they are being written. With some modifications the equipment could be used to read handwritten letters. The machine may eventually become a valuable addition to telephone offices, and it could be important in any situation where it is necessary to write and identify large quantities of numerals.

The machine recognizes numbers as they are being written on a specially-prepared writing surface using a metal stylus. Two dots, one above the other, are used as reference points. Seven sensitized lines extend radially from these two dots. Numerals are recognized by the machine, depending on which lines are crossed. To recognize previously written numerals, such as those on a long distance ticket, it is necessary to write with a pencil containing a conductive lead. The ticket is then inserted in the machine into a special slot under a plate that has seven sensitized lines. The machine then uses the same principle for recognizing numerals already written as it does for the ones written on the machine with the stylus. That is, it determines which sensitized lines have been crossed. This information could be transferred to an accounting machine, computer or other data processing device.

In order that written numerals may be read with a minimum possibility of error, mild restrictions must be placed on their size and form. The constraints consist of two vertically-aligned dots, around which the numerals must be formed. Three radius vectors extend out from each of these dots, and a seventh joins the two. Numerals are then sensed by determining which of these radius vectors are crossed.

Information as to which vectors have been crossed is transmitted to a translator, which contains transistorized logic circuits. Since each numeral has a corresponding set of crossings which is unique, the translator needs only to be able to distinguish each of the sets in order to produce a different output for each numeral. The outputs are employed in the utilization circuit to illuminate a number, operate a teletypewriter, feed the information to a computer, or perform any other desired operation.

To recognize written numerals, a specially-prepared plate is employed on which each radius vector appears as a closely-spaced, insulated parallel set of conductors. The numerals must be written with a conductive pencil on a sheet of paper or a card. When this writing is superimposed on the printed plate and properly oriented, the appropriate sets of conductors are shorted out. The information thus obtained is fed to and analyzed by the translator and logic circuit, which determines the proper number and transmits the identification to the utilization circuit.

To recognize numerals as they are being written, a writing surface is provided on which there are two guide dots and in which seven radius vectors, made of conducting material, are embedded in plastic. The writing is done with a metal stylus on the writing surface. Whenever a conductor is crossed, the information is fed to the translator and logic circuit. As necessary crossings are made for a particular numeral, the translator again sends the proper information to the utilization circuit. To clear the system for the start of the next numeral, a conducting plate is touched by the stylus.

The technique has been extended to permit the identification of handwritten letters. To properly read such letters, it appears that a four-dot constraining system with 12 radius vectors is necessary. However, to identify letters as they are being written is somewhat simpler, since advantage can be taken of the order in which the radius vectors are crossed. By utilizing this additional information, it is possible to identify either letters or numbers as they are written by employing the 2-dot constraining system used for numerals.

ROLLAFOLD - BENSON-LEHNER CORP. - WEST LOS ANGELES, CALIF.

The Rollafold is a portable folding machine for producing neat, accordion folds in a long strip or roll of paper, such as the chart from an oscillograph or pen and ink recorder.

Some of the advantages which result from folding long rolls of paper into an accordion fold are:

1. They are more easily handled for analysis. Unrolling and re-rolling are eliminated. Any part of the record is readily available for examination—as easy as opening a book.

2. They may be stored in conventional folders and file cabinets. Thus they may be kept with other information concerning the test.

3. They may be bound into reports and transferred or mailed in conventional envelopes.

An operator can fold charts five to ten times faster with a Rollafold than by hand. Neatness and accuracy of fold spacing are far superior. Operation is simple and requires no special training.

The body of the machine is supported by four legs and a tubular frame in a manner which provides space for the folded chart to accumulate. All moving parts are enclosed, and the construction is of the highest quality. Sintered bronze and sealed anti-friction bearings are used throughout. All gears and drive arms are pinned to their shafts to preclude the possibility of slippage. The feed roller is surfaced with neoprene and ground to size. It may be readily removed, if cleaning becomes necessary. The machine is quiet in operation and is designed for many years of daily usage.

Overall Size	18 in. w. x 20 in. l. x 21 in. h.
Net Weight	45 pounds (approximately)
Fold Spacing	Continuously adjustable—6.5 to 12.5 inches
Fold Rate	One fold per second (approximately)
Power Required	115 vac, 60 cps, 1.7 amp (maximum)
Chart Size, Model B	Up to 13-1/2 inches wide Any core diameter Up to 6 inches outside diameter
Model Variations	Larger chart size available on special orders
Price, Model B	$1,275.00

NEW STORAGE UNITS AND DATA TRANSLATORS - TELEMETER MAGNETICS, INC. - LOS ANGELES, CALIF.

144 Series Magnetic Core Storage Units. These units have capacity for 144 characters. The 144 BQ-8 stores 8-bit characters, and the 144 BQ-4 stores 4-bit characters. Both units are identical in all other respects. The bits of each character are loaded in parallel. Characters are loaded and unloaded in a sequential pattern - i.e., the first character loaded is the first one unloaded, and loading and unloading are performed in a nonsynchronous manner. The two operations may be interlaced in any order desired, and there is no time delay in changing from loading to unloading. Characters may be loaded or unloaded at any rate up to one complete character every 14 microseconds.

The 144 series use transistors and other solid state elements exclusively - no vacuum tubes are required - giving these units a very low down time factor. Control and logic circuitry are mounted on plug in etched boards for ease of maintenance. All driving circuitry and a complete power supply are contained with the unit in a single package no larger than a portable phonograph.

Input pulse requirements are:

One	5 volts
Zero	-5 volts
Load Sync	10 volts
Unload Sync	10 volts

Output pulses available:

One	5 volts
Zero	-5 volts

THE DATA TRANSLATOR. "Common Language" is a concept of which so much has been said and so little has been done. However, Telemeter Magnetics, Inc. has done something to provide compatibility among computer systems of the various manufactures. The Data Translator System has been evolved for this purpose and can accomplish the following conversions:

IBM 704 ⟷ Univac Scientific
IBM 705 ⟷ Univac I & II
IBM 650 ⟷ Univac File Computer
Datatron 205 ⟷ IBM 650, IBM 705, Univac I & II

Special input/output conversions such as: Magnetic tape to printer, punched card to magnetic tape, magnetic tape to punched paper tape, punched card to paper tape.

The Data Translator System uses magnetic core storage and is completely transistorized providing very low down time equipment. Logic is contained on etched board plug-ins for ease of maintenance.

MISCELLANEOUS

COMPUTER USAGE COMPANY, INC. - NEW YORK, N. Y.

The Computer Usage Company, 18 East 41st Street, New York 17, N. Y. entered its third fiscal year of operation 1 October. As of December, CUC had in process or completed major business and scientific assignments for 26 different companies throughout the United States.

Business applications developed and in operation include inventory control, linear programming, file maintenance, and scheduling.

Scientific and technical services are offered in the general areas of engineering and applied physics. The organization provides personnel for analysis, programming, and testing at selected computing facilities. Work has been successfully completed on such widely varying assignments as nuclear reactor design, oil reservoir exploitation, heat transfer, orbits of an artificial satellite, and highway design.

Two major reactor design codes have been developed. CURE: a generalized two-space-dimension multigroup coding for the IBM 704. Sponsored by the AEC through KAPL, CURE has been released and is currently in use by more than twelve reactor design organizations. BORE: a two-dimensional evaluation of neutron diffusion equations and heat balance equations in a boiling reactor, developed for the Atomic Power Equipment Department of the General Electric Company.

Unit merchandising control on the IBM 650 was developed for Hartfield Stores, Inc., a chain of more than forty women's apparel shops. This system completed 20 months of continuous successful operation on 1 January, 1958.

Present staff numbers 45 full time employees, with experience in the IBM Types 701, 702, 704, 705, 650, RAMAC, and NORC; UNIVAC Systems; DATATRON; and BIZMAC. Since application development, rather than repetitive processing of data, is the primary function of CUC, it does not operate its own machine facility. Instead, programs are developed for the machine most suitable to the client.

CONTRIBUTIONS FOR DIGITAL COMPUTER NEWSLETTER

The Office of Naval Research welcomes contributions to the NEWSLETTER. Your contributions will assist in improving the contents of this newsletter, and in making it an even better medium of exchange of information, between government laboratories, academic institutions, and industry. It is hoped that the readers will participate to an even greater extent than in the past in transmitting technical material and suggestions to this Office for future issues. Because of limited time and personnel, it is often impossible for the editor to acknowledge individually all material which has been sent to this Office for publication.

The NEWSLETTER is published four times a year on the first of January, April, July, and October and material should be in the hands of the editor at least one month before the publication date in order to be included in that issue.

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