CNR Files Retained CNR-437

(1)

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 · PHYSICAL SCIENCES DIVISION

Vol. 8, No. 2 Editor: Albrecht J. Neumann April 1956

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Approved by
The Under Secretary of the Navy
16 August 1954

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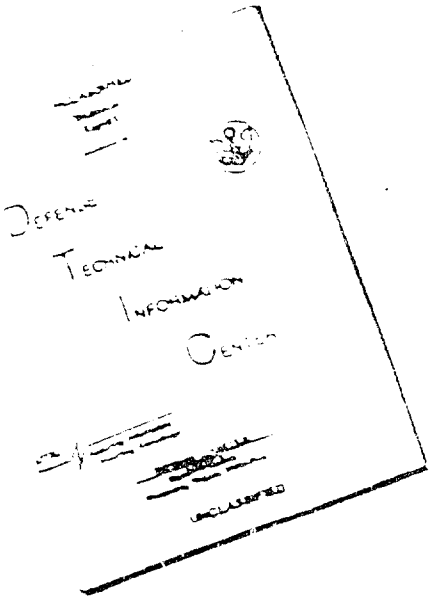
DISCLAIMER NOTICE



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COMPUTERS, U.S.A.

AIR FORCE ARMAMENT CENTER - EGLIN AIR FORCE BASE, FLORIDA

The ERA 1103 Electronic Computer System installed at the Air Force Armament Center is the second such system produced by the manufacturer. The system presently has provision for manual, paper tape and punched-card inputs; and paper tape, Flexowriter, punched-card and display oscilloscope outputs. To accomplish read-out at higher speeds, a High-Speed Computer Output Printer (Typer) is currently under development and will be delivered by 1 May 1956. This printer will be capable of printing alphanumeric outputs at rates up to 72,000 characters per minute.

Plans are being made to replace the present 1024-word electrostatic storage system with a 4096-word magnetic core memory. Also, certain other internal modifications and additional items of terminal equipment are being seriously considered. These include: (1) magnetic tape input and output facilities, (2) a high-speed output plotter, (3) magnetic tape units of an improved variety to replace present magnetic tape units which are a part of the storage system of the computer, (4) intervention switches, (5) a magnetic-core buffer to increase the input flexibility of the computer system, and (6) Charactron output display units.

Some associated equipments currently under development include: an analog-to-digital conversion and buffering system to convert analog (voltage) data from a telemetering system or other data source into suitably-coded digital form for direct insertion into the computer; a Doppler Data Translator to convert velocimeter magnetic data records into form suitable for direct entry into the computer; and other similar items.

BENDIX G-15

The Bendix Corporation has announced a new medium price, general purpose Digital Computer. It is characterized by a flexible command structure, where each command consists of eight independent parts. These parts are source, destination, characteristic, single or double precision, immediate and deferred commands, timing number, next command, break point.

Interpretive codes are available and may be entered into the computer on tapes together with the problem tapes, by means of preloaded tape magazines and a high speed tape reader.

Punched tape readers and punches are used and a typewriter controls all computer operations. A command indicator panel facilitates check out of new programs, by indicating the last command after the computer has stopped.

A variety of input-output equipment is available. Standard accessories are Electric typewriter input and output, high speed photoelectric paper tape reader, and paper tape punch. Provisions have been made to add one to four magnetic tape units and punched card equipment.

A digital differential analyzer attachment is available which widens the applicability of the G-15. Graph plotters and graph followers may be used with this equipment.

The specifications are given below:

Addition: Single Precision - 0.54 msec., Double Precision - 0.81 msec
Subtraction: Single Precision - 0.54 msec., Double Precision - 0.81 msec
Multiplication: Single Precision - 16.7 msec., Double Precision - 33.1 msec
Multiplication of arbitrary precision is possible; the factors may be up to 57 binary digits plus sign with the operation time equal to 0.27 msec for command access plus 0.54 msec per digit of the multiplier.
Division: Single Precision, 16.7 msec., Double Precision, 33.1 msec
All times include Minimum access to Command.
Shift and normalize: Automatic tally for convenient floating point operation

Extract and assemble - Conditional transfer of control based on: Sign of accumulator, Arithmetic overlow, State of input/output system, Presence or absence of any digit or digits in a word or group of words
Number storage: Absolute value and sign, Word length of 29 or 58 binary digits

Internal Memory

Magnetic drum with high speed all electronic switching
General store: 2160 words, Random access time 14.5 msec (average)
Quick access store: 16 words, Random access times 0.54 msec (average)
Arithmetic registers: Three 2 word, One 1 word

External Magnetic Tape Memory

Optional, one to four units
Capacity: 300,000 words per reel
Tape: Standard 1/2" width, maximum 10-1/2" dia. NARTB reel
Block length: Arbitrary to 108 words
File length: Arbitrary number of blocks
Read/write speed: 7-1/2" per sec.
Search speed: 45" per sec.

Input/Output

Number system: Decimal or sexadecimal
Standard Equipment: Master writer - 8 characters per sec.; Paper Tape Punch - 17 characters per sec.; Photoelectric Tape Reader - 200 characters per sec. from paper tape magazine
Punch Cards: Serial punch card equipment may be coupled to the G-15
Input: 17 characters per sec
Output: 11 characters per sec With type 526 card equipment
Input/Output Commands: Type out; Punch paper tape; type and punch paper tape; Type out accumulator; Write on magnetic tape; Punch cards; Type in; Read punched paper tape; Read magnetic tape; Read punched card; Search magnetic tape forward; Search magnetic tape backward; Reverse paper tape
Computation proceeds during input/output

PHYSICAL SPECIFICATIONS

Basic G-15 Computer

Size: 32" deep x 27" wide x 61" high
Weight: 850 pounds
Power Input: 3.8 KVA, 110-120 volts, 60 cycles, single phase
Cooling: Internal forced air
Plug-in etched circuit packages: 180 tube packages; 300 diode packages

Magnetic Tape Unit

Size: 22" deep x 24" wide x 60" high
Weight: 175 lbs.
Power Input: 640 VA, 110-120 volts, 60 cycles, single phase
Cooling: Internal forced air

Digital Differential Analyzer

Size: 22" deep x 24" wide x 60" high
Weight: 300 pounds
Power Input: 1 KVA, 110-120 volts, 60 cycles, single phase
Cooling: Internal forced air

ELECOM FILE PROCESSOR (UNDERWOOD CORPORATION)

The ELECOM File Processor is a special-purpose computer designed to sequence, collate, select, collate and select, and separate items of data recorded on magnetic tape. (Fig. 1) In performing these operations, it relieves a digital computer, such as the ELECOM 125 Digital Computer, of much of the routine and repetitive work in commercial data processing.

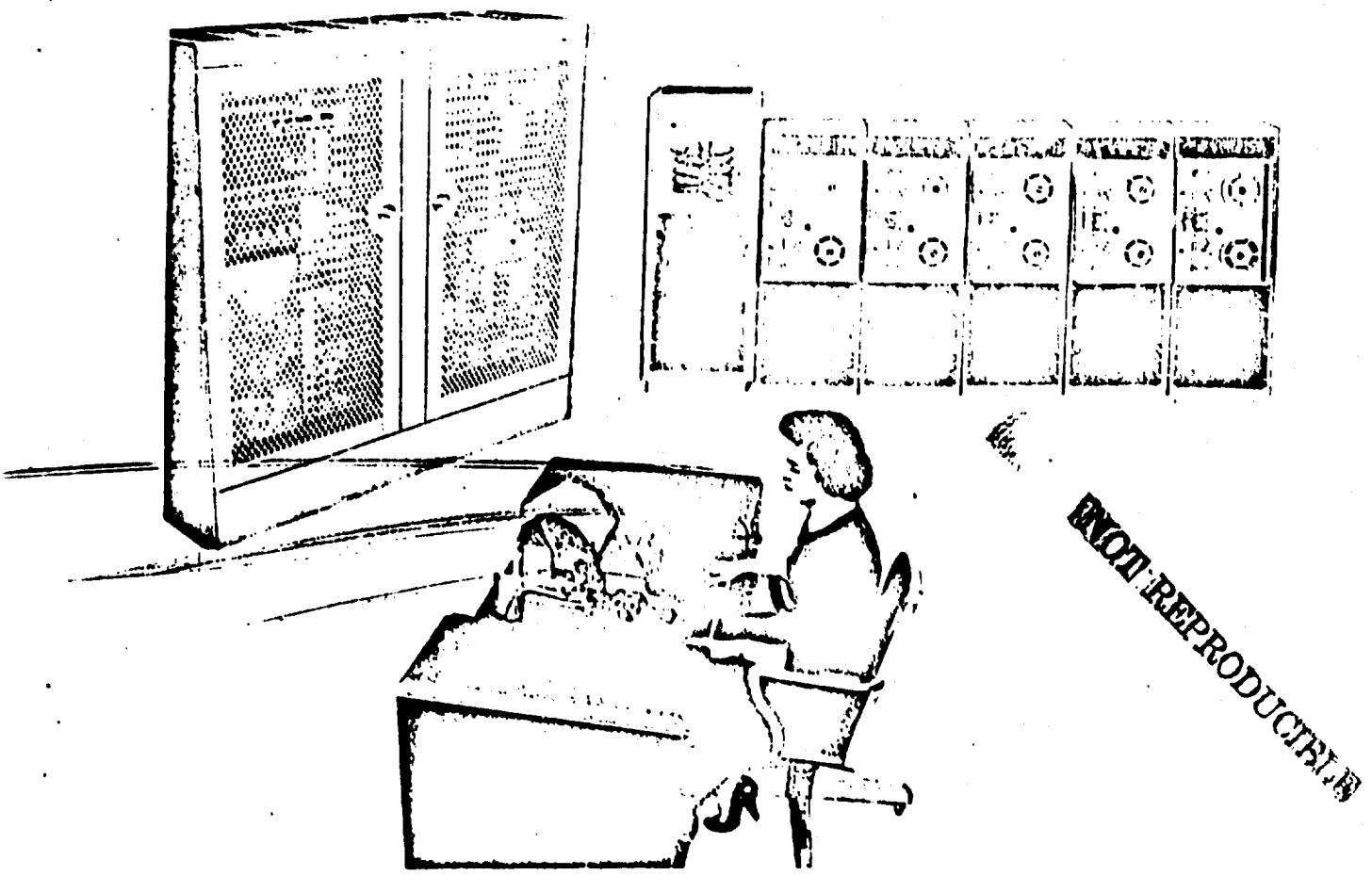

Figure 1 - ELECOM File Processor. The power supply, which is not shown is housed in a cabinet slightly smaller than that of the parent unit

Data to be handled by the ELECOM File Processor are stored on magnetic tape. File or other data are divided into "items," each item corresponding, say to one account or inventory item. Items may be of any length and there is no need for all items on one tape to be of uniform length. Longer items are divided into "blocks" of 200 digits or less (counting each numeral as one digit, each alphabetic character as two digits).

Having selected one of the above modes of operation for the File Processor, using a switch on the control panel, the operator introduces a "pattern" by means of punched-tape reader or typewriter keyboard which "keys" the File Processor as to which digits in an item are significant for the operation about to take place. The pattern is never more than 220 digits long and takes 22 seconds to introduce using a punched-tape reader. Speed of introduction by keyboard depends on the speed of the typist.

Operation from this point on is automatic except for any necessary changing of tape reels.

Results are written on output magnetic tape which can be fed to a high-speed printer for subsequent visual examination or to the ELECOM digital computer where they may be used in the course of computation.

Maintenance of an inventory file serves to illustrate a typical application of the ELECOM File Processor. Such a file may contain entries for thousands of items, and a considerable amount of information may be recorded for each item. A day's shipments, however, might involve only a handful of items, and the only operation necessary may be the correction of the stock balance for each of the few items. The problem, therefore, is to select from this voluminous file only a few items, and in each of these items to change only one figure. This operation is readily accomplished with the File Processor.

FLAC (FLORIDA AUTOMATIC COMPUTER)

FLAC has now been in operation for approximately three years, processing the full data computation load at the Air Force Missile Test Center. The Data Reduction Facility at the center is operated by the RCA Missile Test Project. Recently an Air Force contract was signed with the International Telemeter Corp. for a 4096 word high speed magnetic core memory to replace the 512 word acoustic delay line unit now in operation. Each word will be 44 binary bits plus sign and the new memory will have an access time to any word of approximately 50 microseconds.

Improvements to increase read-in and read-out speeds are being accomplished by new punched paper tape readers capable of speeds of 300 to 600 characters per second. The first two of these units employing an entirely new reading principle have been delivered and are now in the process of being mated to FLAC.

Missile position data recorded in the field directly on magnetic tape in binary coded decimal can now be read into FLAC for immediate computations. The future trend at this center will be toward recording raw data on magnetic tape directly in FLAC format so as to greatly reduce the data processing cycle.

For the four week period 28 November - 23 December 1955 FLAC operating time was distributed as follows:

Problem Running	223.6 hours
Code checks	73.8
Good idle time	.9
Scheduled Engineering	65.4
Unscheduled Engineering (computer)	18.6
Unscheduled Engineering (auxiliaries)	3.1
	385.4 hrs.

Scheduled Engineering includes marginal checking and computer time used for testing of new input-output devices, etc. Average "good time" for FLAC for the last six months was 88 percent. FLAC is currently operated in a five day week utilizing two to three shifts as the workload requires.

ILLIAC, UNIVERSITY OF ILLINOIS

The Illiac continues to be used on a regular 24-hour basis in the Digital Computer Laboratory for research and teaching at the University of Illinois. The approximate distribution of Illiac time may be noted from the following table:

Hourly Use of Illiac During December 1955

Regular Maintenance and Illiac Engineering	43 hours
Unscheduled Maintenance or Repair	13 "
Read-Around Memory Tests	5 "
Leapfrog - Machine Test Routine	79 "
Wasted	1 "

Use by Departments

Digital Computer Laboratory	29 hours
Physics	79 "
Control Systems Laboratory	74 "
MURA (accelerator study)	114 "
Structural Research	9 "
Psychology	1 "
Electrical Engineering	3 "
Chemistry	23 "
Agriculture	11 "
Economics	3 "
Theoretical and Applied Mechanics	2 "
Institute of Communications Research	1 "
Classes	12 "
Demonstrations	1 "
Miscellaneous	9 "

A total of 24 errors or interruptions of the machine at non-scheduled times were noted during the same period of December 1955. Twelve of these difficulties were associated with reading and punching paper tapes.

During the Summer of 1955 the circuits for an auxiliary memory using a magnetic drum were checked out. During the Fall these circuits have been installed in a final frame in the room with the Illiac. Tests are being made now on the completed circuits which will provide 12,800 words of auxiliary memory. The circuits provide vacuum tube switching to permit switching from one track to another between words as readily as reading successive words from the same track. Transfers are one word (40 bits) per order or instruction in Illiac. The circuits use the non-return-to-zero magnetic recording system as well as a logical detection scheme to prohibit some kinds of reading errors.

Active work is under way in the Digital Computer Laboratory in the following areas:

1. The preparation of new routines for the library of routines, including recently, new routines for using the drum memory, floating address and compiling routines, multiple regression routine for statistical analysis and improvements in differential equation routines.

2. Research in the algebras of switching circuits, particularly those with application to asynchronous circuits.

3. Research in some partial differential equations particularly important in hydrodynamics.

4. Research in direct-coupled asynchronous circuits in the fastest speed ranges.

The University offers four separate courses in the field of computers or computing. Over 100 students have taken advantage of these courses.

JOHNNIAC (RAND CORPORATION)

There have been no major additions or modifications to the JOHNNIAC computing system during the past three months. Presently the computer is being operated on a 120-hour per week schedule. Normally the machine is available for code checking or production 22 hours per day, the remainder being used for scheduled maintenance periods.

Performance figures for the major sections of the machine in terms of mean free time between errors during the past two months are as follows:

Arithmetic and Control	180 hours
Core Store	225 "
Drum Store	83 "
Input-Output control, Console, Supervisory control, Power Supplies and Air conditioning	72 "
High-speed Printer	42 "
Punched card equipment	19 "

The mean free time between errors for the entire system is approximately ten hours. The overall performances of the arithmetic, control and core store are quite satisfactory since the modest amount of machine errors caused by these sections are the results of permanent type component failures (i.e., open heaters, shorts, etc.). The probability of random type errors in these sections is almost zero.

LITTON 20 DIGITAL DIFFERENTIAL ANALYZER

A new digital differential analyzer, with twenty integrators, has been announced by Litton Industries, Beverly Hills, California. Each integrator is capable of summing inputs from all integrators, provides for sign reversal, and integrates with respect to a variable.

The total volume of the machine occupies less than two cubic feet, and it weighs 79 pounds and requires 320 watts of power. The small size is a result of arrangement of the data (initial conditions, register lengths, and programming) stored so as to minimize electronic equipment external to the main storage.

The machine is shown in Figure 2. It contains 46 tubes, including a small cathode ray tube and 520 silicon junction diodes. The maximum register length is 18 binary digits. There are 10 flip flops and the main storage is on a 7 inch diameter magnetic drum. The pulse rate is 100 KC and iteration rate is 62 per second.

Accessories include a plotter, a plotter follower which will operate as both a plotter and a curve follower for arbitrary function inputs, a tape punch and fill unit which provides a means of automatic insertion of all information and also an easily repeatable record of the program, and a typewriter to tabulate data in decimal form.

Specifications

Size: 15 x 26 x 10 inches
Weight: 79 pounds
Power: 320 Watts - 110 volts A.C. - 60 cycles
Inputs: (a) keys on front of computer;
(b) paper tape reader;
(c) graph follower.
Computational Elements: 20 integrators
Integrator Features:
(a) automatic summation of "dy" inputs;
(b) summation of "dx" input in lieu of "dy" inputs;
(c) direct sign reversal of the output from an integrator;
(d) every integrator can communicate with all other integrators or with itself;
(e) any number of multiple inputs to each integrator.
Integrator Connections: Integrator connections are made by keyboard programming and not by plug boards.
Iterative process: All integrators are iterated 60 times each second.
Accuracy: Controlled by program - up to one part in 250,000 without resorting to double precision programming.
Outputs:
(a) digital information displayed on cathode ray tube on front panel of computer;
(b) any set of variables direct to Graph Plotter.
Maintenance: Plug-in circuitry provides rapid maintenance.

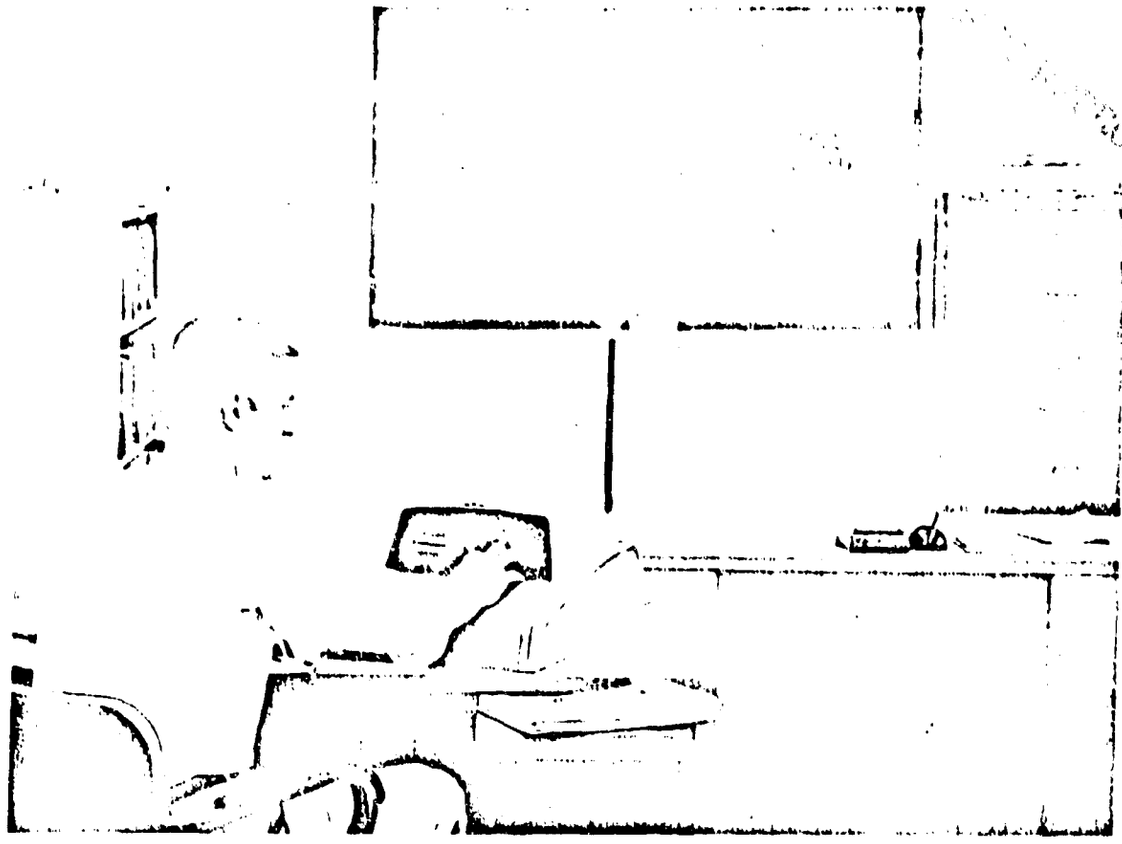

Figure 2 - Litton 20 Digital Differential Analyzer in operation

AUXILIARY EQUIPMENT

Combination Paper Tape Punch, for pre-recording input data, and Paper Tape Reader for filing input data to computer.
Size: 18 x 12-1/2 x 8-1/2 inches
Weight: 30 pounds
Power: 65 watts
Speed: 15 characters per second

Graph Plotter or Graph Plotter/Follower

Size: 19 x 18 x 9 inches
Weight: 45 pounds
Power: 100 watts
Plotting resolution: 0.01 inch

NORC (NAVAL PROVING GROUND DAHLGREEN)

Operation of the NORC on a 24 hour per day, 6 day per week schedule continues. During the month of January, the calculator was available for 323 hours which is 86 percent of scheduled operating time. On an average day portions of 30 different problems are run, representing a variety of problem sponsors.

To increase the versatility of the NORC, preliminary plans are being considered for the procurement of additional internal storage of large capacity to supplement the present Williams tube and magnetic tape storage systems. High speed printing and plotting facilities are also planned.

Aiken Dahlgreen Electronic Calculator (ADEC) and Aiken Relay Calculator (ARC) operations will continue on 40 hour per week schedules.

THE ORACLE (OAK RIDGE NATIONAL LABORATORY)

Improvement of the Oracle Magnetic Tape Unit has greatly increased the speed of operation, reliability and storage capacity. Operational speed has been increased by doubling the pulse packing density. Reliability has improved by obtaining good mylar base magnetic tape having long life and requiring less than 1 percent of the tape to be discarded due to impurities. The magnetic tape reading amplifiers have been re-designed to use transistors. The Magnetic Tape Unit now can store approximately 2-1/2 million full machine words per reel of tape. Total unit storage capacity is approximately 10 million words.

Detailed characteristics are as follows:

Four drives - Total capacity 10 million machine words
42 channel heads - 40 information channels, 1 word control channel, 1 parity bit channel
Read and write forward and backward
Hunt forward and backward
Read and write arbitrary number of words; hunt arbitrary number of blocks
Tape speed: 50"/sec
Tape packing density: 200 pulses/inch
Fixed block: 256 wds/block, block control-photoelectric
Loading speed: 10,000 machine words per second (word 40 binary bits)
Start: 5 ms
Stop: 2 ms
Tape life: At least 30,000 passes
Tape Characteristics: 3 mil mylar base, 1 mil magnetic coating, 2000 ft. lengths maximum.

A photographic output device has been added to the Oracle which enables rapid output of graphical or digital data. The cathode ray plotting tube is 3" in diameter. There are 1024 possible spot locations in each row and column which make up the roster; however, only about 200 spots across any one line are discernible. The accuracy of the system is approximately 1 percent.

A special circuit arrangement is used to enable rapid digital plotting. A plotting speed of about 2,000 characters per second can be attained. Individual points can be plotted in about 100 microseconds including the extraction of plotting orders from the memory. The camera has a machine controlled film advance with a capacity of 200 frames.

The Oracle electrostatic memory has been converted for use of RCA 6571 storage tubes. These tubes are impurity free so that a redundant storage scheme is no longer necessary. Hence, the full storage capacity of 2048 words is now realized. The inspection scheme was changed to the Illiac system to improve read-around performance.

WHIRLWIND I
For October, November and December 1955

Applications

During the past 3 months, the Scientific and Engineering Computation Group, in conjunction with various departments at MIT, processed 85 problems for solution on Whirlwind I. These problems are described in the Project Whirlwind Summary Reports submitted to the Office of Naval Research and cover some 17 different fields of applications. The results of 16 of the

problems have been or will be included in academic theses. Of these, 13 represent doctoral theses and 3 represent master's. Thirty-one of the problems have originated from research projects sponsored at MIT by the Office of Naval Research.

Systems

The following are some figures on computer reliability during the period 23 September 1955 to 31 December 1955.

Total computer operating time	2222	hours
Total lost time	51	hours
Percentage operating time usable	97.7%	
Average uninterrupted operating time between failures	20.6	hours
Failure incidents per 24-hour day	1.17	
Average lost time per incident	28.3	minutes
Average preventive maintenance time per day	1.75	

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

The following statistics give the percentages for the "average" RAYDAC week in 1954 and 1955.

Description	1954	1955
1. Problem set up and code checking	48.7%	43.7%
2. Production	12.3%	20.6%
3. Scheduled unavailability	6.6%	11.8%
4. Unscheduled unavailability	29.4%	23.9%
5. Number of weeks	46	42
6. Total RAYDAC operating time	2285 hours	2689 hours

COMPUTING CENTERS

RICH ELECTRONIC COMPUTER CENTER

Georgia Tech's Rich Electronic Computer Center was formally dedicated on December 2, 1955. Principal speakers for the occasion were Dr. Howard H. Aiken, Director, Computation Laboratory, Harvard University; Dr. Howard T. Engstrom, Vice President, Remington-Rand Division, Sperry-Rand Corporation; and Mr. C. L. Keenoy, Vice President for Engineering and Product Development, The National Cash Register Company.

Operating experience with the Remington-Rand ERA-1101 during the four months of October, November, and December 1955 and January 1956 was as follows:

	Hours	Percent
Total scheduled ERA-1101 Operating time	767.8	100
Scheduled maintenance	141.3	18
Unscheduled maintenance	27.8	4
Idle, available for use	171.4	22
Use for production	427.3	56
Total time available for use	598.7	78

The percentage of hours used for productive purposes has risen from 53.7% in October to 63.0% in January 1956.

Productive time on the ERA-1101 has been utilized on problems arising in connection with:

(a) research done by the Engineering Experiment Station;

(b) research done by Georgia Tech students and faculty;

(c) the development of a library of subroutines;

(d) research and problems proposed by institutions other than Georgia Tech.;

(e) the training of Georgia Tech. students and personnel.

UNIVERSITY OF ROCHESTER, COMPUTING CENTER

The University of Rochester has established a University Computing Center which will include a Burroughs E 101 machine, and an IBM 650 electronic computer, to be received next summer. The University will initiate a whole new computing group and a training program which will serve the University community as well as local industry.

The project was authorized by representatives of the university and of local companies in the optical, banking, retail, machine tool and electronic fields after a five-year study of computer equipment and techniques, and of programs at other institutions.

Credit and non-credit courses for both undergraduate and graduate students will be offered in the College of Arts and Science, University School (extension), and in summer sessions. These will include numerical methods and electronic computing, and numerical analysis, both already in the college curriculum, and new offerings in programming and data processing.

Dr. Thomas S. Keenan has been named administrator of the new University of Rochester Computing Center.

UNIVERSITY OF WISCONSIN, ARMY MATHEMATICS RESEARCH CENTER

The Department of the Army has announced plans for the establishment of a Mathematics Research Center at the University of Wisconsin to conduct research in mathematics and high speed computation theory.

The general objective in establishing the Center is to provide a nucleus of highly qualified mathematicians who will carry on investigations in mathematics of interest to the Army and who can be called upon for advice on specific problems beyond the capability of Army facilities. In addition to fulfilling an Army need, the Center will aid the national effort in mathematics research and increase the availability of trained mathematicians.

The following functions will be fulfilled by the Center: (1) Assemble a high-quality mathematical group for the Army, (2) Supplement the research work of existing Army activities, (3) Provide a source of advice and assistance on mathematical problems, (4) Serve as a facility where fresh scientific contact between Army research and development personnel and other scientists will be made possible, (5) Provide a means of acquainting academic mathematicians with the interests of the Army, (6) Create a reservoir of mathematicians familiar with military problems of vital significance in the event of mobilization, and (7) Contribute an important activity to the mathematics research community.

The Center will fulfill research requirements in the following areas: (1) numerical analysis, including the engineering physics of high speed computers, (2) statistics and probability, (3) applied mathematics and analysis and (4) operations research, including linear and nonlinear programming, game theory and its applications, decision theory, information theory and optimization problems.

The Center will employ a resident staff under the direction of Dr. R. E. Langer, Professor of Mathematics; will train groups of specialized applied mathematicians, provide an opportunity for graduate students at the University to perform advanced research and will be equipped with a large-scale high-speed computer facility.

It is expected this Center will provide the mathematics complement to the support of long range research intended to produce major capability improvements and inspire confidence in new approaches and ingenious applications of new ideas.

COMPUTERS, OVERSEAS

PERM (Institut fur elektrische Nachrichtentechnik und Messtechnik) Technische Hochschule München

The PERM (Programmgesteuerte Elektronische Rechenanlage München) has recently been put into regular operation. This machine has been constructed by a computer group at the Technische Hochschule München under the direction of Prof. Hans Piloty and Dr. Robert Piloty. It is a medium sized (2400 tubes) and medium speed (300 op/sec) binary parallel machine with automatic (wired in) floating point and high speed (15000 rev/min) drum memory of 8090 words capacity. Input: is by punched tape via a photo-electric tape reader. Output: is at present by teletype. Magnetic tape output buffers will be installed. A comprehensive order list and facilities for automatic address change are included to allow the use of a library or subroutines in an invariant form. Details of the computer are published in "Nachrichtentechnische Zeitschrift" (NTZ) Heft 11 und 2/1955.

With the beginning of next year the computer will be operated in the form of a separately managed computing center within the Technische Hochschule. Limited computing facilities will be available for users outside the Technische Hochschule.

SEA - CAB SERIES COMPUTERS (Scciété D'Electronique et D'Automatisme)

Two series of large scale, general purpose, binary digital computers have been developed: the first series comprises a modified version of the CAB-2.000 computer, the second comprises a computer with new characteristics and is labelled CAB-3.000. CAB means "Calculatrice Arithmetique Binaire."

The computers of both series are serial machines. Printed standard component plugs are used in both series and provide great flexibility regarding the numbers of digits per words and numbers and capacities of the stores.

CAB 2.100 -

Master clock frequency - 100 KC/s.
Length of one word (either number or instruction):
CAB 2.122 - 22 significant digits plus 1 gap digit (one minor cycle = 0.23 mS.)
CAB 2.132 - 32 significant digits plus 1 gap digit (one minor cycle = 0.33 mS.)
CAB 2.140 - 40 significant digits plus 1 gap digit (one minor cycle = 0.41 mS.)
One major cycle (one revolution of a magnetic drum) = (128 minor cycles)
Instruction Code - of the single-address type; Conditional transfer instructions, 26 Function Letters, Symbolized operations, B - box index
Number Code - Binary point fixed at the left end of a word, Positive numbers in true binary, Negative numbers in two's complement
Arithmetic Unit - includes two accumulators and one register, computes in fixed binary point (a denominational shifting instruction enables computation in floating binary

point), add and subtract in one minor cycle, multiply, divide, extract square root in n minor cycles, n being the number of significant digits in a word, shift to the left and to the right at a rate of 1 minor cycle per one digit shift.

Stores - a) Fast access stores (access time lower than 1 pulse period) Ferrite core matrices, each of 64 words capacity: 1 Store for Number-words, 1 store for Instruction-words.

b) Slow access store: 1 magnetic drum 64 or 128 magnetic tracks, of 128 words each (8,192 or 16,384 digits).

Exchanges of informations between fast and slow access stores are made in blocks of 32 or 64 words.

Input-Output - through multiple equipment; each provided with a special address. Normal Input (address 0): reads a perforated tape, Normal Output (address 0): perforates a tape. Additional equipments (addresses ranging from 1 to 15) according to clients' request being: Further tape readers and perforators, magnetic tape readers and recorders, Analog-to-Digital and Digital-to-Analog converters, "ENAC" recorder and "Numerograph" photographic recorder.

"ENAC" is an automatic recorder, adapted to the mapping of four sets of data, given each as a time-distributed series of discrete digital values. In simultaneous recording operation, its rate is 1 point per 0.8 sec. For separate recording operations, its rate is 1 point per 0.4 sec.

"NUMEROGRAPH" is an ultrafast automatic recorder using standard 35 mm. film, at a minimum speed of 2.000 characters per second, 100 characters and spacings per line.

Two CAB 2.022 computers are now in normal operation for scientific purposes.

A series of CAB 2.022 are under manufacture, one of which is intended for the automatic preparation of sales statistics in an important French Company (Sté Monsavon-l'Oreal).

CAB 3.000 -

Master clock frequency - 100 KC/s

Length of one word (either number or instruction):

CAB 3.024 - 24 significant digits plus 2 gap digits, one minor cycle = 0.26 mS

CAB 3.032 - 32 significant digits plus 2 gap digits, one minor cycle = 0.34 mS

CAB 3.040 - 40 significant digits plus 2 gap digits, one minor cycle = 0.42 mS

Instruction Code - single address kind with the inclusion of a restricted, second address, From 26 to 32 Function letters, Symbolized operations, B- box index, Instruction - check index, Conditional transfer instructions

Number Code - Binary fixed point at the left of a word, Positive numbers in true binary, Negative numbers in four's complement

Arithmetic Unit - includes four accumulators, and overflow testing circuits, computes in fixed binary point, and in floating binary point when a stored sub-routine is called for. Add and subtract in one minor cycle, multiply in two minor cycles, divide in n minor cycles, n being the number of significant digits in a word.

Stores - a) Fast access internal stores: Ferrite core matrices - 2 matrices each of 256 or 512 words, of n digits each; if requested, each matrix may contain up to 1024 words. Access time lower than 1 pulse period.

b) Slow access external store: 1 magnetic drum, of 64 or 128 magnetic tracks, each of 128 words (8,192 or 16,384 words). Exchange of information between internal and external stores in blocks or groups each of 32, 64 or 128 words is possible; internal computation is not interrupted.

Input-Output: Same as for CAB 2.000 with a maximum of external input and output equipments up to 64. Word-by-word input or output to or from the arithmetic unit, Grouped input or output to or from each one of the fast access stores (each group of 32 or 128 words), Input and output operations do not break the course of internal computation, when using the fast access stores.

A series of CAB 3.000 is being manufactured, two of which are intended for military and scientific purposes, and one of which (of the CAB 3.024 kind) will be used by the "Institute National de la Statistique et des Etudes Economiques."

CAB 5.040 - a new computer under development, comprising special provisions with respect to the other CAB 3.000 of which the general organization is retained.

Arithmetic Unit: adapted both for computation with floating binary point and fixed binary point. Fixed point, 40 Significant digits. Floating binary point: 32 significant digits, exponent from -128 to +127
Master clock frequency - 200 KC/s
One minor cycle = 210 microseconds
Fixed point operations - add and subtract in 0.21 mS, multiply in 0.21 mS, divide in 8.82 mS
Floating point operations - add and subtract in 0.42 mS, multiply in 0.21 mS, divide in 7.14 mS, conditional sequence break in 0.42 mS
This computer is in the development stage.

NUMEROGRAPH S.E.A. -

Ultra-fast alphabetic and numerical display recorder, for use as an output equipment for digital computers. The displays appear upon the screen of a cathode ray tube and are recorded on standard 35 mm film. Each line of the record contains 100 characters and spacings; the characters may be letters (including capitals), figures and various signs and symbols. Minimum speed: 2,000 characters per second.

Several units are manufactured for attachment to CAB computers of the 2.000 to 3.000 types.

ENAC Plotting Recorder -

This automatic graph plotting recorder accepts information in form of a series of coded digital values from either: a hand-controlled keyboard, a digital computer, a punch card computer. Digital-to-Analog conversion is achieved by means of a special storing register included in the recorder proper.

The recorder can interpret data given in floating binary point number codes.

Several units have been manufactured for attachment to CAB computers and punched-card computers.

MISCELLANEOUS

UNIVERSITY OF PENNSYLVANIA, MOORE SCHOOL OF ELECTRICAL ENGINEERING

A new graduate course, EE 634, "Applications of Large-Scale Digital Computers to Business and Industrial Systems" has been introduced into the curriculum at the Moore School. The course is open to graduate students of engineering and business administration.

During the first term business problems such as payroll procedures and inventory control in manufacturing industries were discussed. Department store accounting and stock control was surveyed and appraised. In the second term the management phase of "Decision-making" via programming and electronic computer and the problem of coding were discussed. For business systems, banking and insurance were surveyed. Professors A. Matz of the Wharton School and G. W. Patterson of the Moore School are in charge of the course alternating between the business and engineering phase as subject and discussion require.

U. S. NAVY AVIATION SUPPLY OFFICE - INVENTORY CONTROL WITH AN IBM "702"

Using an IBM type "702" EDPM, the U. S. Navy Aviation Supply Office, Philadelphia, Pa., electronically calculates procurement and distribution requirements for 120,000 aviation spare parts. Ultimately, this type of information may be electronically formulated for 300 - 400,000 aviations items.

Employing conventional machine and manual methods, these calculations required ninety-three days; with the IBM "702," this ninety-three day figure has been reduced to fifty-eight days - a saving of thirty-five days! In addition, information regarding the amount of spares necessary to sustain an aircraft throughout its useful life is also produced during this same fifty-eight day period. This latter type of information, known as "life-of-Type Requirements," was never before calculable because of the prohibitive time elements involved using conventional machines.

Further, the Program Usage Replenishment System has been programmed on the ASO's EDPM equipment. PURS is a mechanized stock control system designed to determine spare part distribution and procurement requirements predicated upon future CNO aircraft deployment plans, and BUAER overhaul schedules.

Based upon PURS, the ultimate product of ASO's "702" is a Consolidated Stock Status Report (CSSR). This report lists which items must be redistributed, which activities are short of stock, and which items must be purchased in order to maintain minimum stock levels. In addition to the CSSR, electronic calculations will be made also for the annual Fiscal Year budget, stock retention, and disposal information. The quarterly production of the CSSR alone requires the development of 3,000 to 3,500 reels of magnetic tape which must be saved for ninety days.

Supporting the ASO's EDPM installation (which operates three shifts a day, six days a week) is a staff of twenty-two military operators; six officers, several clerical personnel and fifteen programmers.

The production of ninety-three programs - some 120,000 instructions - in a little over thirteen months is a staunch testimony to the skill and ingenuity of a civilian programming force recruited from and trained within ASO.

Thus, through the use of electronic equipment, the Bureau of Supplies and Accounts and the Aviation Supply Office have taken vast strides toward the creation and maintenance of a nearly "automatic" inventory control system.

NATIONAL BUREAU OF STANDARDS

A new section, Applications Engineering, has been established in the Data Processing Systems Division of the National Bureau of Standards. This section is concerned with the systematic analysis of functions which involve extensive data processing in such areas as accounting, inventory control, logistics, data or document retrieval and management and economic analysis. Other responsibilities include research in new areas of applicability of data processing systems, new techniques for analysis of data processing problems, methods for more efficient handling of information, and the evaluation of available systems and equipment in terms of particular problem requirements. S. N. Alexander, Chief of the Data Processing Systems Division, is serving as Chief of the new section, with Mary E. Stevens as Assistant Chief.

WAYNE UNIVERSITY, COMPUTATION LABORATORY - SUMMER COURSES

The Computation Laboratory of Wayne University has announced three one week summer courses, on Automatic Computers, Electronic Data Processing in Business and Government, and Applications of Computers to Engineering, Science and Industry. The courses are planned to run from 23 July to 11 August for three consecutive weeks.

Further information and the final program may be obtained from A. W. Jacobson, Director, Computation Laboratory, Detroit 1, Michigan.

CONTRIBUTIONS FOR DIGITAL COMPUTER NEWSLETTER

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