

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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COMPUTERS AND DATA PROCESSORS, NORTH AMERICA

SPEC - COMPUTER CONTROL COMPANY, INC. - WELLESLEY, MASSACHUSETTS

A stored program educational computer has been designed and is being marketed by Computer Control Company of Wellesley, Massachusetts and Los Angeles, California. It is intended for use by educational institutions to aid in the instruction of digital techniques. The SPEC is a stored program machine utilizing a 12 bit word length with a capacity of 128 words of internal high speed storage. It has eight operations codes and performs at a speed of about 2500 operations per second. The unit is constructed entirely of standard one megacycle dynamic logic plug-in packages. The memory consists of four plug-in magnetostrictive delay units, each storing 384 bits (32 words) with an average access time of about 200 microseconds. The first SPEC has been completed and is operational. The building blocks, which are wired to form the computer configuration are capable of being readily rewired to form many other desired logical configuration that falls within the size restriction of the three 3C-BLOC's of logical packages.

A mark II version is being designed in which the logical wiring of the building blocks will be implemented by means of a program patchboard. This will make possible a rapid transition from a general purpose computer to a digital differential analyzer, or to a "universal" logical building block for student laboratory experiments and projects. The initial design of the D.D.A. logic indicates that this configuration will consist of about 20 integrators, with an integrator bit capacity of about 20 bits. The processing rate will be about 2500 integrators per second. This will be a device that will not only be useful as an educational tool, but will also be practical for complex problem solutions.

MINICARD SYSTEM - EASTMAN KODAK CO. - ROCHESTER, N.Y.

The Minicard System is an electronic-microfilm medium for the unit record storage and single search retrieval of documentary information. The heart of the system is the Minicard film record, the "permanent" photographic memory. A tiny piece of film, measuring 16 by 32 millimeters, it combines the mobility of the tabulating card and the space-saving compactness of microfilming.

Where a tabulating card uses punched holes for indexing and searching purposes, the Minicard film record uses black and white dots, directly exposed in the film emulsion. The film record, thirty times smaller than a standard tabulating card, has a code capacity that is five times greater.

The film record has both the indexing code and the graphic information as a unit, producing a real, complete unified record. This is the single-search feature of the system. The full information can be viewed on a film reader the minute it is located. Minicard film records can be "searched" at a speed of 1000 a minute. Equally important is the refiling job. These film records are simply deposited back into their respective magazines in a file block. No need to sort them in proper alphabetical or numerical sequence.

Almost any kind of indexing system in use today - alphabetical or numerical - may be converted into the Minicard system.

The space savings feature is even greater than in present-microfilming systems, because a ratio of reduction of 60 to 1 is used in the Minicard system. This is about fifty percent more than now available in commercial microfilming.

The first complete Minicard system, now in use by the U. S. Air Force in the Pentagon was produced under a contract placed with Kodak by Rome Air Development Center, Rome, N. Y. The Minicard system is a continuing development of Eastman Kodak Company and will not be generally available until other government commitments are fulfilled. It will be marketed through Recordak Corporation, the Kodak microfilming subsidiary.

Various specialized photographic, electronic, mechanical, and optical pieces of equipment are required to record, code, store, arrange, find and correlate information in the system. The Magnavox Company cooperated with Kodak in the development and construction of some components in the system. Some of the major units and pieces of equipment and their specific functions are:

First is the film record, the tiny piece of film which is the heart of the system. Up to twelve pages of legal-size documents can be exposed on a single film record—such as charts, printed pages, maps, drawings, and even photographs. When the film record contains twelve pages, there is still space remaining for 49 characters of alpha-numeric indexing code. The fewer the number of document images on the film record, the more space there is for indexing code. Sometimes the full area may be used for indexing, with the document images to follow on other film records in sequence.

The breakdown of classifications for file information is unlimited. As many duplicates as needed can be produced and deposited in the same number of classifications in the file. The black bar area at the left end of the film record is used for secondary classification of documentary information by adding the required code pattern on the first generation duplicate film record.

All the classifications given for filing information are first transferred to punched tape on a Flexowriter. The same machine is used to read this code information into the Minicard Camera. It is also used to read additional code into the duplicating machine for making the working file film records. In combination with a plugboard, it is also used to read input inquiries into the selector when searching the files for rapid retrieval.

At the camera, the punched tape is converted electronically into the code pattern on the film record. A small area of the pattern is masked out at this stage to allow space for adding additional classifying code on the first generation duplicates. Next, the documents are microfilmed, one at a time, recording up to 12 pages on a single film record. If a document contains more than twelve pages, extra film records are microfilmed in sequence. The 16mm film comes in 200-foot rolls.

After a full roll of film is exposed it is developed and dried in the continuous Processor. It operates at a speed of 50 frames a minute. One 200-foot roll of film is processed in 40 minutes. Next it is inspected for image quality.

Minicard roll film containing basic code classification and images of graphic material, are cut into the individual frames on the Cutter at a speed of 600 a minute. These are the 1st generation or original negatives. By means of slots in the end of each film record, they are stacked onto steel sticks for handling convenience.

One of these handling sticks holds a total of 2000 film records, the capacity of a magazine in the file blocks where the master file of duplicate film records is stored for future reference. If each film record contains 12 pages of documentary information, then one stick of 2000 film records is the equivalent of 24,000 legal-size pages of information. A smaller handling stick, with the capacity of about 800 film records, is used to handle expendable duplicate film records when providing the information to answer specific questions. These may be destroyed or retained by the person inquiring after they have served their purpose.

From the film cutter the film records are inserted in the electronic duplicator to produce 2nd generation positive duplicates. At this stage, the cross indexing code is added to each film record by means of punched tape input, passed through a reader typewriter. This is the unprecedented feature of the system which permits expanding the files to whatever extent a piece of information lends itself.

The positive film records are now ready for sorting into the working file, the storage of information used for searching purposes. The original negative film records become the master file for security protection, never to be used except in a case of emergency to replace lost positive film records in the working file. Using a plugboard for programming, the film records are sorted into their various classifications in the working file.

The working file of film records consists of aluminum file blocks of fifty magazines each. The capacity of each magazine is 2000 film records, same as the contents of a large handling stick. One file block then has the capacity of 100,000 film records or the equivalent of 1,200,000 document pages. A Minicard file cabinet of nine of these file blocks, therefore, has the capacity of 900,000 film records or a total of 10,800,000 document pages. Over 500 standard, letter-size file cabinets, occupying 2500 square feet of floor space, would be required to store the same amount of information on paper.

The searching, or output operation of the system, starts first with an inquiry. This is coded by all the terms of subjects, locations, and other qualifying phrases and punched into tape to form the inquiry. A control panel plugboard is wired to establish logic conditions for an output selection and is used in conjunction with the tape. From the working file a magazine of film records, covering one of the terms of the inquiry, is removed with a handling stick and inserted in the selector. At a speed of 1000 film records a minute, the selector electronically scans the film records and separates out those containing the necessary information. These are then duplicated to provide the expendable third generation negatives for delivery to the individual seeking information.

The expendable film records may now be viewed in the Analysis Viewer for review purposes. If hard paper copies of any of the documents are required for closer study or for the purpose of dissemination, notches are punched along the edges of the film record to indicate the desired images. A small, table top viewer is also available for reading film images in an individual's own office. After the film records have served their purpose, they may be retained on sticks for future reference or destroyed.

The Enlarger-Processor is used to produce the hard copies of any or all images on the individual film records. The same stick of expendable third generation negatives is simply inserted in the front of the enlarger. The machine automatically reproduces and processes hard paper copies, back to original size. They come out dry at a speed of about 300 prints an hour.

NEW UNIVAC COMPUTER - REMINGTON RAND - NEW YORK, N.Y.

Remington Rand has announced a new magnetic amplifier, solid-state commercial data-processing system. This computer is the first in a new line of low-cost systems utilizing the latest developments in solid-state devices.

The equipment will rent at \$6,950 a month with a purchase price of \$347,500. Deliveries in the United States will begin in June 1959.

The initial installation of the new solid-state computer is at the Dresdner Bank, Hamburg, Germany where it is handling a large range of bank functions. Among the first applications are general commercial accounting, daily statements (checking account statements are issued daily in Europe), and savings accounts.

The new computer will also soon be used to speed billing in the offices of the central purchasing agency for a group of German cooperatives. A German manufacturer in heavy industry will use it for general office functions, beginning with payroll, and another will put it to use on a complicated inventory control and production scheduling application, using operations research techniques. Orders for the system have also been placed by an Austrian insurance firm, which will begin with premium billing, and by a public utility in Italy.

As an operational feature, card reading on both the card reader and the read-punch unit proceeds simultaneously, as well as simultaneously with punching on the read-punch unit and processing within the central processor. This adds significant speed to the entire data-processing function. There is also an on-line high speed printer which operates at a rate of 600 lines a minute.

The principles of the new Univac have been proved by the Athena, designed by Remington Rand as the ground-based guidance system for the Titan Intercontinental Ballistic Missile.

COMPUTING CENTERS

AFCRC MAGNETIC COMPUTER - AIR FORCE CAMBRIDGE RESEARCH CENTER - L.G. HANSCOM FIELD, BEDFORD, MASSACHUSETTS

The AFCRC Magnetic Computer, developed by the Remington Rand Univac Division of the Sperry Rand Corporation, has been in use for approximately 2-1/2 years. The uptime for the first 44 weeks of 1958 was 90% for a nine hour shift scheduled five days a week. The computer is left running unattended overnight and during weekends, and an uptime of 75% was obtained for this time over the same period, giving a total of 3626 hours of production. Scheduled maintenance is 8 hours a week.

The computer is used primarily for general scientific computation, but has several rather specialized uses involving real-time data sources. Most of the computational problems require floating point arithmetic which does not exist as a basic computer instruction. In fact, a large portion of the problems computed have required multiple precision arithmetic. Consequently single, double, and quadruple precision floating point arithmetic has been programmed. These routines have been incorporated into three interpretive routines utilizing essentially the same pseudo instruction code.

One of the special problems encountered involves the use of the computer with a radar simulator to create and develop improved radar simulation techniques for use in the design and evaluation of radar data processing systems operating in the presence of various types of system interference. An essential characteristics of this type of data is that it is statistical in nature. Statistically accurate samples require that 500 to 10,000 sweeps of a radar across a simulated target be recorded with all parameters. The information is converted from analog to digital form and sent in real-time to the Target register, a 10 bit input register in the computer. The information is converted from binary to decimal, packed, and punched out on paper tape for future reference and analysis, while computing the pulse-pair covariance and correlation matrices characterizing the simulated target.

The computer was recently modified to include alphabetic input-output. The computer has paper tape and typewriter input-output, and originally was capable of handling 10 numbers and 6 punctuation characters in four-bit biquinary code. The original input-output register was a magnetic shift register ten bits long and four bits wide. The modification consisted of paralleling this with another register ten bits long and two bits wide, which existed in the computer, to give a register capable of handling one word 6 bits wide on certain input-output instructions. The tape-handling equipment was capable of expansion without modification; however, it was necessary to order a new typewriter with alphabetics included. It is expected that the addition of alphabetics will enhance communication between the operator and the computer. The development of a compiler utilizing the alphanumeric input is now under consideration.

COMPUTATION LABORATORY - NATIONAL BUREAU OF STANDARDS - WASHINGTON, D. C.

The memory capacity of the IBM 704 at the National Bureau of Standards has been increased to 8192 words by the addition of another section of core memory; an 8192-word drum has also been added. Six tape units are still in use. The increased memory capacity enables the Computation Laboratory to make considerable use of FORTRAN.

Computing time is available to Government agencies and their contractors at \$200 per hour.

355 RAMAC APPLICATION - OGDEN AIR MATERIEL AREA - HILL AIR FORCE BASE, UTAH

Since the addition in July 1958 of the IBM 355 RAMAC disk storage to the 650 tape system, the Statistical Services and Systems Development Division at Ogden Air Materiel Area

Headquarters has been in a better position to support the Maintenance Engineering Management System in forecasting workload and material requirements data for the repair of aircraft and other items of equipment. The new storage has been used as an additional memory device for random access data as well as a limited amount of program storage. In utilizing this versatile piece of equipment in this manner, it has been possible to reduce the amount of main frame computer time and provide better products to the customer on a more timely basis. The new equipment has been the primary factor in reducing the number of machine passes from 6 to 1 in a specific application. It has been the means of eliminating tape sorting by the resequencing of number changes within the 355 itself and subsequently writing the changes in the proper sequence. The reduction of main frame processing time and repetitive handling of data has had a very beneficial effect toward the elimination of processing errors and the maintenance of high productive operating efficiency.

DATA PROCESSING CENTER - OKLAHOMA CITY AIR MATERIAL AREA
HEADQUARTERS - TINKER AIR FORCE BASE, OKLAHOMA

The OCAMA Data Processing Center was established in 1955. It is equipped with two IBM 705's, two Tape 650's and one 650 Basic, and has on order for mid 1959 delivery 2 IBM Disk Control Units, sixteen 355 Disk Files and a 305, all for use with a 705. The center's function is to apply automatic data processing techniques to Air Force logistic problems. At present the primary applications are as follows:

1. Air Force world-wide inventory of aircraft engines. A tape record for each engine by serial number with daily reporting of changes of engine status on an "as happens" basis. Management reports are produced showing inventory position, pipeline status, financial data, engine failure analysis, etc.
2. Inventory accounting and distribution of spare parts for B-52, KC-135 aircraft, as well as for various commodity classes.
3. Status of engineering changes on several types of aircraft.
4. Computation of requirements for spare parts for various aircraft and commodity classes.

PENNSTAC - THE PENNSYLVANIA STATE UNIVERSITY - UNIVERSITY PARK, PENNA.

The PENNSTAC power supplies were replaced in September 1958 and have decreased the down-time considerably. The supplies that were replaced used thyratrons and the Thevinin impedance was high enough to affect the high frequency regulation. The new units are magnetic and have far fewer tubes to fail. An additional factor contributing to the reliability is that the new supplies permit marginal checking of many parts of the computer that could not be checked previously. The computer is now scheduled for preventive maintenance from 8:00 to 12:00 Monday morning and from 8:00 to 9:00 Tuesday through Friday. After the maintenance period the computer is operated until approximately 10:00 each evening. The problems originate on the campus and from outside the university.

Work in progress includes coded diagnostic routines for locating malfunctions that are not "solid" and a new means of output. The latter will include the incorporation of a high-speed punch as an alternative output device to the electric typewriter used at present. The format will be controlled by the program instead of by the external format tape as presently used.

The PENNSTAC (completed in 1956) is approximately equivalent to an IBM 650 without peripheral equipment and has a 2500 eleven decimal digit IBM 650 magnetic drum for storage. During the past year the computer has been used by twenty different departments of the university for the solution of research problems. Recently programming effort has been concentrated on the development of programs in statistics and factor analysis. About 70% of the available computing time is used for educational and unsponsored research projects at no cost to the user. The remaining 30% is devoted to sponsored research.

FLAC AND 709 - RCA SERVICE COMPANY - PATRICK AIR FORCE BASE, FLORIDA

Two Florida Automatic Computer (FLAC) systems are now in use for the processing of range data. These computers are operated on a 24 hour day, five days per week schedule.

Operating statistics for the period July through September 1958:

	FLAC I	FLAC II
Data Processing Time	640.40 Hours	973.90 Hours
Code Check Time	186.46 "	224.30 "
Reruns a. Computer Error	17.40 "	35.78 "
b. Problem Error	56.32 "	85.62 "
Preventative Maintenance	119.72 "	236.73 "
Corrective Maintenance	60.97 "	66.92 "
	<u>1,081.27 "</u>	<u>1,623.25 "</u>

Installation of an IBM 709 system is scheduled for 1 July 1959. This system will replace one of the FLAC systems at that time. As soon as the 709 can assume the total data processing workload, the second FLAC system will be shut down. It is estimated that the 709 will assume the total workload by 1 January 1960. This new system will be composed of the following units:

<u>Quantity</u>	<u>Model No.</u>	<u>Name</u>
1	709	Main Frame
2	737	Magnetic Core Storage
1	711-2	Card Reader (On-line)
1	716	Printer (On-line)
1	721	Card Punch (On-line)
1	714-759	Card Reader and Control Unit (Off-line)
1	717-757	Printer and Control Unit (Off-line)
9	729	Magnetic Tape Units
2	755	Tape Control Units
1	766	Data Synchronizer Unit
1	776	Tape Switching Unit
1	9200	Paper Tape-to-Magnetic Tape Converter
1	727 (modified)	FLAC Format Magnetic Tape Unit
1	736	Power Supply Unit
1	741	Power Supply Unit
1	746	Power Distribution Unit

In addition to the above there will be various verifiers, interpreters, sorters, etc.

AUTOMATIC DATA PROCESSING DIVISION - U.S. ARMY ELECTRONIC
PROVING GROUND - FORT HUACHUCA, ARIZONA

Heading one of the major efforts in the Army's project to develop a tactical Automatic Data Processing System (ADPS) for the Army in the Field is a new organization at the U. S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Arizona. This project is under the control of the Automatic Data Processing Division which was activated in December 1957.

The tactical ADPS visualized for the Army in the Field will be designed to handle, largely on a common-user or service center basis, much of the information processed by manual methods at the present time. The system will consist mostly of general purpose type digital computers interconnected by a communications network. A wide variety of input-output devices will be required to provide access to the system by its user. Machine programs for all functions to be handled by ADPS are also required.

A high-priority program has been under way for over a year now under the guidance of USCONARC and a joint DA-USCONARC ADPS Committee. The Signal Corps has been designated as the prime cognizant agency for the Department of the Army in the fields of research and development and logistical support of Automatic Data Processing. The U. S. Army Electronic Proving Ground in turn has been delegated the important role of assembling the tactical ADPS hardware to provide the interconnected computer system, testing this system's performance and preparing recommendations for improvement of hardware, translation of functional area studies into machine programs, refining and combining individual functional programs, and formulating proposed TOE organizations and proposed doctrine for the system's operation. The fully militarized prototype ADP System is scheduled to be operational by 1963.

To accomplish the staggering task the ADP Division has been organized into three major units—Systems, Operations & Programming, and Field Test—each being self-explanatory as to the type of work done. Contractual assistance has been secured to launch all phases of the effort. The contract will cover a five-year period and has as one of its primary objectives, the training of USAEPG military and civil service personnel to the point where all operations can be handled internally.

The general approach taken involves a maximum use of simulation methods. Interpretive techniques will be employed to simulate the militarized data processors so that working programs can be prepared and checked out prior to the delivery of the actual machines. Simulation of the statistical or Monte Carlo type will be utilized to predict the performance of the overall systems operation. Finally, simulation will be used throughout the field test phases to automatize the data collection and reduction as much as possible.

As intimated above, this activity at the Proving Ground is organizing two separate but very related test facilities, a Fixed Plant and a Field Test Facility. First, the Fixed Plant Test Facility will provide the controlled environment to test hardware components and concepts. The Computer Center will be within the Fixed Plant Test Facility and will furnish high-speed digital computer services to the entire project. The following is the initial equipment complement:

IBM 709 with 32,000 Word Core Storage	1 Real-Time Package
1 Data Synchronizer Unit	1 High-Speed Paper Tape Reader & Punch
2 Tape Control Units	1 On-line Card Reader & Punch
16 Magnetic Tape Units	1 On-line Printer
1 C R T and Recorder	1 Off-line Card-to-tape
1 Off-line Tape-to-printer	

The target date for the Computer Center to become operational is the first of January 1959.

The Field Test Facility will be used to operationally test and evaluate, under field conditions, the military tactical equipment and systems developed. It is planned that the field facility will be ready for use in 1960.

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

Construction of the Universal Data Transcriber (UDT) is proceeding on a schedule leading to completion early in 1959. Simulation on NORC of the logic for all standard instructions has been completed and the wires connecting the logic modules are being installed. The 8192 character core memory and other remaining major components were due for delivery in November 1958.

The NORC continues operating on a three-shift schedule often including weekends. For the year 1958 through October, statistics are as follows:

Availability - 95% of scheduled operating time (78% of total working hours)
Production - 253.9 hours per month

Problem checkout - 133.0 hours per month
Scheduled Maintenance - 79.4 hours per month

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

On 9 October 1958, an IBM 704 high speed digital computer with a 32,000 word memory capacity was placed in operation at the Applied Mathematics Laboratory, David Taylor Model Basin. In addition to the magnetic core storage, the system has the following components: one 8,000 word magnetic drum, ten magnetic tape units, a card reader, a card punch, and a printer. Auxiliary equipments include an off-line printer and a transceiver.

A recent change in the organization of the Applied Mathematics Laboratory, David Taylor Model Basin, reflects the addition of a new division. This division, the Operations Research Division, will conduct a research program dealing with the application of high speed digital computer techniques to the solution of problems relating to strategic and tactical operations of the Navy.

A Univac II computer was turned over for operation to the Philadelphia Naval Shipyard on 15 October 1958. Initial applications are in the area of payroll and supply management.

COMPUTERS AND CENTERS, OVERSEAS

ELLIOTT 802 - ELLIOTT BROTHERS LTD. - LONDON, ENGLAND

The Elliott 802 is a small desk size general purpose stored program computer designed for both mathematical and research calculations, and also for process control systems.

The computer contains a 1024-word 33 digit magnetic core store. Magnetic cores together with junction transistors are also used for the logical system. By using these solid state devices, and eliminating all moving parts, a high degree of reliability required for on-line applications has been achieved. Provision has been made for the inclusion of a large range of special purpose input and output devices.

Each 33 digit order can represent two 16-digit instructions, the extra digit being used as a B line. If this digit is present the second order of the pair is B-modified by the store address of the first order—in this way any of the 1024 words can be used as a B-line. The 64 functions in the order code include all commonly required fixed point arithmetic and logical orders, and there is an overflow register which automatically registers if any result exceeds capacity. The order code is easily learned and since there are no exceptions, it is easy to program directly in machine code, although simplified programming methods are being developed. The basic operating speed is 612 microseconds for all orders except multiplication, division and shift. Multiplication and division each require 21 milliseconds.

COMPUTING CENTER - MATHEMATISCHER BERATUNGS-UND PROGRAMMIERUNGSDIENST, G.M.B.H. - DORTMUND, GERMANY

This Mathematical Consulting and Programming Service Company is going to open a computing center the middle of 1959. Initially, this center will be equipped with the Dutch electronic computer X 1. This is a computer which has a magnetic core memory with a storage capacity of 4,096 words. Also, the computer has an additional storage of 1,536 words to store frequently used subroutines (floating point, solution of linear equations, double precision arithmetic, etc.).

The input-output is handled by means of punched tape or a typewriter directly connected with the machine. Punched-card input-output is being planned.

The center will work problems coming from the various technical fields. They have special experience in the fields of statics, steel and reinforced concrete buildings, as well as problems arising in the chemical and electrical industry, and in machine factories. In the future they expect to add additional computer types and auxiliaries. Their services are available to any firm.

The company was founded almost 2 years ago to handle all problems of office automation. Their services include:

1. Objective and independent advice for prospective users of an electronic computer.
2. Organization and programming in the commercial field with regard to the use of electronic computers and punched card machines.
3. Programming and solution of technical-scientific problems.
4. Programming courses.

COMPONENTS

METALLIC TAPE CLEANER - DIGITRONICS CORP. - ALBERTSON, N. Y.

A Digitronics Metallic Tape Cleaning Machine (see Digital Computer Newsletter, October 1958) was installed at Franklin Life Insurance Co., Springfield, Illinois during October. The insurance company reports that the equipment has proven to be very effective. A large number of tapes had accumulated in the "for tape-test" category. These tapes had been tested and were unusable for some reason or another.

During the cleaning process any obvious defects in the tapes were corrected by the technician operating the machine. While the project is far from being completed, enough tapes have been processed to determine that 9 out of every 10 such tapes can be placed in operation without any difficulty.

HIGH SPEED PRINTER - ELECTRODATA DIV., BURROUGHS CORP. - PASADENA, CALIF.

Burroughs Corporation's solution to high speed printing is a new solid-state system which will select, edit and print out data from either a computer or magnetic tape at rates up to 1500 lines per minute. The System consists of two units: a printing unit and a control box, housing both a magnetic-core buffer, plugboard editing controls, and power supplies. All logical and control circuitry is transistorized.

Within the printing unit is a high speed drum which features random access to the print cycle. The drum comprises 120 print positions with a total of 51 solid-face characters per position. Fifteen of these characters are special symbols such as CR, OD, +, and DB.

System flow is in three stages: loading, scanning and printing.

Loading of the buffer involves the transfer of a predetermined number of words--up to 100--from either magnetic tape or the central processor. Plugboard wiring determines the destination with the buffer of each output word.

All editing and marshalling of information is accomplished during the scanning operation. Digits from the 1100 bit memory may be deleted, augmented, rearranged and variously edited under complete plugboard control. The result is then sent to a special 120-position print register in preparation for printing.

The last operation is the transfer of print register information to the printed page. This occurs at one of four speeds, and for the most part, simultaneously with buffer loading.

Effective output speeds are determined by drum speeds and format requirements. By manual switch, the operator chooses one of four drum speeds. Normal alphanumeric rates of output corresponding to the four drum speeds are: 624, 720, 1068, and 1225 lines per minute. If only numeric or special-character information is printed, output rates corresponding to drum rates are: 750, 900, and 1500 lines per minute. Difficult format requirements dictate slower output rates.

This system, when linked with the Burroughs 220 Data Processing System, becomes a powerful processing-and-printing combination. It can be fed off-line by a single magnetic tape storage unit, or, in a more complex printing application, two magnetic tape units may be used alternately. This allows the masking of tape handling time, and merging of various records with ease.

Information handling in the system is held to an absolute minimum. The buffer, for example, is able to transfer fixed information repeatedly without re-loading. Also, as each digit is transferred from the buffer to the print register, its decimal value is made available at the control panel.

In addition to character recognition, the operator may very simply initiate file inquiry with rotary switch settings. Independent of the computer, 10 interrogation switches may be set as an identification key in off-line category select. Re-wiring of the plugboard is not necessary to print out information selected under the new category.

Another feature—a form of index accumulator—allows plugboard control of side-by-side and multiple line printing operations. This facilitates the printing of different information on the same format, the same information on a different format, and simplifies control panel wiring. It also allows variable addressing and the "floating in" of information into the buffer.

The entire system of data transfer and control functions is machine checked. Detection of non-permissible characters is checked during translation; and a parity bit is carried and monitored on transfer operations. Control functions are checked as information moves from the bit register to the printer. Unless every character to be printed "clocks in" at a designated time, a synchronization mechanism sounds an alarm. All alarm conditions allow the operator to choose between exception printing and machine halt.

The printer turns out solid-face copy on multiple forms used in billing, management reporting, customer statement, transfer, inventory and other high volume printing applications.

HIGH SPEED TAPE READERS - FERRANTI-PACKARD ELECTRIC LTD - TORONTO, ONTARIO

A new series of bi-directional, high speed tape readers and spoolers has been announced by Ferranti-Packard to complement the Ferranti Ltd high speed readers types TR2 and TR3 which have been widely adopted on the North American continent.

The new series is available for 5, 7, and 8 hole tape in desk top, and rack mounted models. Some models are transistorized and employ silicon solar battery photosensitive elements. All models can recognize and stop on a selected character at a nominal speed of 200 characters per second.

Type 206 Bi-Directional, Desk Model. Designed to meet MIL-T-945 specification and 2000 hour minimum life. Employs 10-1/2" feed and take-up spools for bi-directional operation and silicon transistor amplifiers for -23°C to +70°C operation.

Type 196 Bi-Directional Reader, Rack Mounting. Standard rack or cabinet mounted, bi-directional transistorized reader with 10-1/2" feed and rewind spools. Nominal speed 200 characters per second starting and stopping on each character; 270 ±5% characters per second when free running. Dual silicon solar cell sensing elements provide 100% standby operation with a self-checking feature optional. Plug-in transistor amplifiers and power supplies built-in.

Type 197 Transistorized Tape Reader, Desk Model. A desk top version of Type 196 but without spooling.

Type 198 Internal/External Feed Tape Spooler, Rack Mounting. A versatile spooler designed to feed tape, as required, from the centre or outside of a 1000 foot reel and to rewind onto a second spool at rates up to 27 inches per second. Equipped with standard 10-1/2" and optional "centre unwind" type feed reels.

Open Chassis and Enclosed Construction Spoolers. 5 and 10-1/2" reel spoolers are available in both open chassis and enclosed construction for 4 and 7 inch per second winding speeds, respectively.

Tape Chopper. Capacity 100 feet of tape.

Ferranti Electric Inc. advises that Ferranti Ltd, Model TR7, 1000 characters per second (2000 characters per second rewind) solid state bi-directional reader will be available in the very near future. The unit embodies signal amplifiers, brake controls and power supplies. Tape widths are 5, 7, and 8 hole on 1000 foot reels.

All units are available in the U.S.A. through Ferranti Electric, Inc., Hemstead L.I., N.Y.

**305 RAMAC EQUIPMENT - INTERNATIONAL BUSINESS MACHINES CORPORATION -
NEW YORK, NEW YORK**

Additional features for the 305 RAMAC data processing system have been introduced by IBM's Data Processing Division. The new devices are available as auxiliary units for adding to the regular punched card input-output, printer output, and console typewriter facilities of the 305.

381 Remote Printing Station. Up to four 381 stations may be attached to 305 to provide remote typing output for information developed during processing and from records stored in the disk memory file. The 381 may be located as far as 40 feet from the 380 operator's console, or, through the use of additional cable installed by the customer, may be operated at distances up to 2500 feet from the console.

By program control, output data may be typed on one or any combination of the remote printing stations, as well as on the typewriter at the 380 console. An inquiry keyboard may be added to each Remote Printing Station for quick access to stored information. Inquiries are entered direct from the keyboard and the replies are transmitted back and typed out on the station typewriter. In general, a 381 station with both typewriter and keyboard duplicates, at a remote distance, the typing and inquiry operations regularly associated with the console typewriter.

382 Paper Tape Reader. This new input unit can read punched paper tape directly into the 305 system. Tape input from the 382 can be used either separately or in conjunction with punched card input to the 305. As with card input, it is not necessary for the tape record to contain all of the necessary information required for processing.

Designed to read 5-channel telegraphic tape and 8-channel binary coded decimal tape, the unit also incorporates an "all-channel" decoding principle which provides for reading virtually all types of 5 through 7 channel tapes. The reading mechanism handles tapes up to one inch wide.

The reader operates at the rate of 20 characters per second. When tape is processed, input data is checked as it enters the system, and also as it is transferred during processing. Information from the tape is recorded on a tape input track in the disk memory file in the same order in which it is read, but this sequence can be rearranged if desired by the use of a special skip control feature. With special tape codes for the 382, writing on the input track can be turned on and off automatically so that only significant data is selected for recording on the tape input track.

407 Accounting Machine. The 407 Accounting Machine can now be operated with the RAMAC. The 407 may be used either "on-line" as a printer-accounting machine or "off-line" as a normal 407. Attachment of the 407 does not preclude the use of the regular 370 Printer for the 305 system if desired.

Second Disk Storage Unit. For applications requiring more than the 5 million characters of storage capacity provided by the 350 Disk Storage Unit a second disk memory file may be connected to the system for a total storage capacity of 10 million alpha-numeric characters.

Dual Access Arm. Each Disk Storage Unit can be provided with two access arms on the disk file to increase the productive capacity of the system. The dual arm makes it possible for one access unit to be in position for reading or writing while the other arm is moving to the next record. Since both arms may be in motion simultaneously, processing time is reduced.

Dual System Control. Forming a new and more powerful system, a 305 with Dual System Control is essentially two complete systems except that both share the same disk file. Each system is independently controlled and, except for the shared disk memory, is equipped with the required complement of input, processing, and output units.

In a system with Dual System Control, the same program can operate in each of the two processing units, with input data and processing divided between the two systems to reduce record-keeping time. This form of Dual System Control will be advantageous to anyone having a high volume of input data to be processed rapidly. With Dual System Control, a different program can also be set up in each of the processing units so that two completely different jobs can be processed simultaneously using the same disk storage.

COMPUTER READOUT DISPLAY - STROMBERG-CARLSON - SAN DIEGO, CALIFORNIA

Stromberg-Carlson - San Diego has announced four series of computer readout and display systems complementing their S-C 5000 High-Speed Electronic Printer.

These various systems are presently being used in commercial data processing installations, with scientific computers, and with special purpose computers such as those required for air traffic control and military area surveillance systems.

S-C 1000 Series—Direct View Displays. The S-C 1000 series, including the S-C 1010 Computer Display Intervention and Recording System (now being used with the Remington Rand Univac 1103 Scientific Computer for flight data reduction at Eglin Air Force Base), permits monitoring of computer programs during the course of the computations and provides for operator instructions to the computer during the course of the program. This series also includes the S-C 1020 Situation Display Console, a quantity of which are presently being installed in a classified military area surveillance system. The Direct-View Display, known as the S-C 1000, is a computer monitoring device providing the display of programmed data on the face of a 19" CHARACTERON Shaped Beam Tube. The S-C 1000 can also be adapted to provide a manual intervention console to assist in experimental computer programming. The entire series requires a parallel input register of 26 bits.

S-C 2000 Series—Bright Displays. The S-C 2000 series of Bright Displays provide for console or large screen projection of combined radar and digital intelligence. This series of computer readout systems has its major application in air traffic control and military area surveillance systems. Multi-colored target information, displayed on theater screens or small consoles, provides position, direction, speed, altitude, and other pertinent data on map overlays, or provides similar data in tabular form. This system employs the CHARACTERON Shaped Beam Tube and a Haloid xerographic system. They provide flicker-free displays with high light output (100 foot lamberts on a 21" diameter screen) and high resolution (up to 80 lines/millimeter). These displays are fail-safe, the last frame is permanently retained—even in the event of complete power failure. Separate channels are provided for radar and symbolic data.

S-C 3000 Series—High-Speed Communication Printers. The S-C 3000 series are very fast communications printers, printing over the range of 10 to 10,000 words per minute. Primary components are the field-proven CHARACTRON Shaped Beam Tube and a XeroX Printer. Reliability is obtained by using solid state circuitry with modular construction and simplified plug-in boards. Economy of operation results from the use of untreated paper. This non-impact printer also prints on standard off-set and vellum masters. It is designed to print digital and facsimile data from high-speed communications links. It can be used in the manner similar to the S-C 5000 (see below) for high-speed readout from medium size digital computers such as the IBM 7070. Acceptable inputs include teletype, Collins Kineplex, punched tape, magnetic tape, computer output, or any source which provides a serial character output.

S-C 4000 Series—High-Speed Microfilm Printers. The S-C 4000 series of printers provide on-line and off-line computer output in the form of tabular data, graph plotting and design drawings. These printers print up to 20,000 characters or 10,000 graph plotting points per second. The first printer in the series, installed at a major missile facility, has been in operation for over three years. Other printers in this series have been delivered for use at Convair, University of California Radiation Laboratory, Naval Ordnance Proving Ground, Johns Hopkins University ORO, and Eglin Air Force Base. When used for graph plotting these printers provide for grid projections and drawing of axes and vectors. An automatic processing camera provides for console screen viewing of computer output within 8 seconds after exposure of each film frame. On-line input to the S-C 4000 series is a 36-bit parallel word. Off-line input is a 6-bit parallel word, which is used as is for tabular recording and assembled into 36-bit words for random recording. This series of printers provides automatic forms projection thus eliminating the need for preprinted forms. Microfilm permanent storage and inexpensive shipping costs for computer output data are also provided users of these printers.

S-C 5000 Series—High-Speed Electronic Printers. This non-impact printer prints 5,000 (120-character) lines per minute on untreated paper. When used with the auxiliary M-10 Registration Buffer, the S-C 5000 provides accurate registration of tabular data on preprinted forms. The unit utilizes the CHARACTRON Shaped Beam Tube and the XeroX Printer. Any binary coded decimal tape code may be used as input. These printers are now being manufactured in production quantities.

MISCELLANEOUS

THE CHESAPEAKE AND OHIO RAILWAY COMPANY - CLEVELAND, OHIO

It is reported that Chesapeake and Ohio Railway Company, which installed a Univac I in its Cleveland offices in November 1955, has been seeking proposals from interested manufacturers for the delivery of a large-scale, high-speed, data-processing system in late 1961. Several computer manufacturers have already discussed their future plans with Dr. H. N. Laden, Chief, New Systems Development, The Chesapeake and Ohio Railway Company, Terminal Tower, Cleveland 13, Ohio. Since the C&O seems to be seeking insurance against early technological obsolescence for a considerable period beyond 1961, interest appears to be in the next generation of computers rather than those being delivered today. It is reported that the C&O, whose Univac I is presently on a three-shift basis, will probably triple or quadruple its computing requirements in the next four or five years.

MSTS DATA PROCESSING - NAVY MANAGEMENT OFFICE - WASHINGTON, D.C.

The Commander, Military Sea Transportation Service has approved the MSTS Controller's report on "The Feasibility of Automatic Data Processing at Headquarters, MSTS." The report recommended that detailed systems studies be undertaken to develop an integrated management information system which would involve, among other things, agreement on compatible codes for all services which would facilitate interchange of data on the loads being carried aboard ships and improvements in data transmission among MSTS elements as well as with MSTS customers. The Service plans for the time being to obtain electronic data processing time from other government agencies rather than install equipment of their own.

A survey is now under way at the MSTS Atlantic Area Command to determine the best data processing methods for Civilian Marine Personnel Records. Integration of personnel and payroll records is one of the aims of this study. It is anticipated that changes to payroll records can be made automatically as a by-product of changes to personnel records.

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.

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