APPLICATIONS

Manufacturer
Inventory control, machine loading and scheduling, employee time control, reservations. In general, the Datakeeper Computer can be utilized effectively in applications which require the rapid processing of large amounts of random data (Electronic sorting and accumulating).

NUMERICAL SYSTEM

Internal number system Binary coded decimal
Decimal digits per word 10
Arithmetic system Fixed point
Instruction type One address
Number range 0 to 10^-1

ARITHMETIC UNIT

Add time (excl. stor. access) 330 microsec
Add time (includ. stor. access) 33,000
Construction Magnetic cores and germanium diodes
Arithmetic mode Serial by decimal digits and parallel by bits
Timing Synchronous
Operation Concurrent

STORAGE

Media Words Microsec Access
Magnetic Drum 1,000 10,000 35,000

INPUT

Media
Remote Transmitters
Keyboard
Tape Reader
Card Reader

Up to 50 remotely located transmitters can be utilized with each computer.

OUTPUT

Media Speed
Punch Tape 1 dec digit/66 millisec
Visual Display 1 dec digit/150 millisec
Page Printer 1 dec digit/198 millisec

Any "word" on the drum can be displayed at any time by means of the visual display.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes 160
Crystal diodes 664
Magnetic cores 105

CHECKING FEATURES

Power, computer 1.5 kW
Weight, computer 620 lbs.

RELIABILITY AND OPERATING EXPERIENCE

Manufacturer
Average error-free running period 100 hours

INSTALLATIONS

Ford Instrument Company
Division of Sperry-Rand Corporation
Long Island City 1, New York

ADDITIONAL FEATURES AND REMARKS

Remote transmission of input
Fixed program
Up to 10 drums can be utilized for increased storage capacity.
APPLICATIONS

Commercial (business) and scientific application.

NUMERICAL SYSTEM

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal number system</td>
<td>Bin coded dec and coded alphanumeric</td>
</tr>
<tr>
<td>Decimal digits per word</td>
<td>12</td>
</tr>
<tr>
<td>Alphanumeric digits per word</td>
<td>8</td>
</tr>
<tr>
<td>Decimal digits per instruction</td>
<td>12</td>
</tr>
<tr>
<td>Instructions per word</td>
<td>1</td>
</tr>
<tr>
<td>Instructions decoded</td>
<td>1</td>
</tr>
<tr>
<td>Arithmetic system</td>
<td>Fixed point</td>
</tr>
<tr>
<td>Instruction type</td>
<td>Three address (normal)</td>
</tr>
<tr>
<td></td>
<td>Four address (subsequence operation)</td>
</tr>
<tr>
<td>Number range</td>
<td>0-9, 0-16 and 0-64</td>
</tr>
<tr>
<td>Floating point operation may be programmed.</td>
<td></td>
</tr>
</tbody>
</table>
Parallel reading and writing of 31 channels on magnetic tape with serial handling of bits comprising each character and word. Access to high speed storage is parallel. Arithmetic operations are serial. Decimal digits are in binary coded decimal, alphanumeric characters are in a six-bit code.

**STORAGE**

<table>
<thead>
<tr>
<th>Media</th>
<th>Words</th>
<th>Decimals</th>
<th>Microsec</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Cores</td>
<td>2,000</td>
<td>24,000</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Magnetic Cores</td>
<td>248</td>
<td>2,976</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>57,200,000/reel</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description of magnetic tape unit - plastic, 5 inches in width; reel length, 2,700 feet. Magnetizable material is sandwiched between layers of plastic to protect recorded information and increase tape life. Information on tape is recorded across 31 channels. Effective or net information rate is 60,000 decimal digits a second or 40,000 alphanumeric characters a second.

Tape speed is 100 inches a second both forward and reverse. The maximum number of tape units possible is 100.

**INPUT**

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch Card</td>
<td>900 cards/min (Input Converter)</td>
</tr>
<tr>
<td>Paper Tape</td>
<td>10 char/sec (via Console)</td>
</tr>
<tr>
<td>Keyboard</td>
<td>Manual (via Console)</td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>60,000 dec dig/sec (On line tape units)</td>
</tr>
</tbody>
</table>

**OUTPUT**

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch Card</td>
<td>100/min (Output Converter)</td>
</tr>
<tr>
<td>Printing</td>
<td>900 lines/min (Output Converter)</td>
</tr>
<tr>
<td>Paper Tape</td>
<td>10 char/sec (via Console)</td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>60,000 dec dig/sec (On line tape units)</td>
</tr>
<tr>
<td>Character-at-a-Time</td>
<td>10 char/sec (Console Typewriter)</td>
</tr>
<tr>
<td>Paper Tape</td>
<td>Input Converter (available May '59)</td>
</tr>
<tr>
<td>Paper Tape</td>
<td>Output Converter (available May '59)</td>
</tr>
</tbody>
</table>

**CIRCUIT ELEMENTS ENTIRE SYSTEM**

- **Tubes**: 3,600
- **Tube Types**: Type 6345 and other computer quality types
- **Crystal diodes**: 60,000
- **Magnetic cores**: 127,000
- **Transistors**: 500

The above figures are for the Central Machine.

Separate Cabinets: 10 Types (building block units)

Size of installation is dependent on application. Up to 100 magnetic tape units may be used in on-line operation.

**CHECKING FEATURES**

- Every word contains checking digits. Transfer weight count check. Arithmetic weight count check.
- Special circuit checking. Selection and order verification checking.
- Optional: Blank column and multiple punch column detection is under control of the operator of the Input Converter.

**POWER, SPACE AND WEIGHT**

- **Power, computer**: 110 KVA 0.86 FF
- **Power, air cond.**: 60 KVA 0.82 FF
- **Space, computer**: 550 sq. ft.
- **Space, air cond.**: Built-in
- **Weight, computer**: 35 Tons

The above weight and power figures include 10 magnetic tape installations. Space figure excludes aisles and work areas. The total is 4,500 sq. ft. The clear space to ceiling is 8ft. 3 in.

Recommended floor space 40 by 100 feet (for minimum installation).

Voltage requirements - 208 volts, 3 phase, 60 cycle. Cooling - air cooling with a total of 175 gpm of cooling water required.

Air conditioning - no requirements of user; proper conditioning requirements integral with machine. Floor loading - less than 125 pounds per square foot.

**PRODUCTION RECORD**

- **In production**: 2
- **On order**: 4
- **Delivery time**: 12-18 Months

Four systems are scheduled for production in 1957. Eight systems are scheduled for 1958.

**COST, PRICE AND RENTAL RATE**

- Approximate cost of basic system $95,000
- Approximate cost of additional equipment $600,000
- Rental rates of basic system $21,500/Month
- Rental rates of additional equipment $12,000/Month

**PERSONNEL REQUIREMENTS**

<table>
<thead>
<tr>
<th>Daily Operation</th>
<th>Engineers</th>
<th>Technicians</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8 Hour shift</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2-8 Hour shifts</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3-8 Hour shifts</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Operators are excluded in the above figures.

**FUTURE PLANS**

Soon to be announced are:
- Paper tape to magnetic tape conversion.
- Magnetic to paper tape conversion.
- Communication links.
- Magnetic ink to magnetic tape conversion.

**INSTALLATIONS**

The following have ordered systems:
- Michigan Hospital Service, Detroit, Michigan
- First National Bank of Boston
- Minneapolis-Honeywell Regulator Company

**ADDITIONAL FEATURES AND REMARKS**

Certain features are available or included for satisfying the needs of business:
- **Sorting Speed**: 60,000 dec dig/sec
- **File Scanning Speed**: 600,000 dec dig/sec
- **100 Tape Capacity**: 5.72 x 10^9 dec dig
- **Input-Output Speed**: 60,000 dec dig/sec
- **Simultaneous reading, writing, and computing**

A typical DATAmatic 1000 system contains the follow-
Input Converter
Magnetic File(s)
File Reference Device
Output Converter
Central Processor
Central Console

Each of these elements is described below.

Input Converter
A transcription device known as the Input Converter (Type 1200) is used to source data in the form of punched cards into recorded data on magnetic tape. The Input Converter feeds, translates, edits and arranges format for nine hundred fully punched cards per minute.

In the operation of the converter, the punched cards are loaded into the feeding mechanism in quantities up to 3,000 cards at a time, and are then automatically fed sequentially through three stations. The first two stations are used to read and check data from cards and the information is immediately recorded on magnetic tape. At the third station, a serial number is printed on each card. This number is known as the "continuous sequence number" and is used as an index for filing the cards thus eliminating the time consuming job of arranging source data for future reference.

This automatic number assignment and the comparison reading check are the first two of a series of reliability and accuracy features which are inherent in the DATAmatic system. The input converter operates independently of all other system elements, which means that input, output and central processing can take place simultaneously on separate procedures.

Magnetic Tape
The DATAmatic 1000 uses a three-inch wide magnetic tape of heavy duty construction. There are thirty-one recording channels on the tape which may be used simultaneously. An extraordinary amount of data can be stored on each tape reel of 2,700 feet. Actually, one reel of tape can store 37,300,000 decimal digits of information, which is the equivalent of data that would require 435,000 punched cards. Data on the tape can be erased selectively or totally by controlled programs and the tape can be reused many times for new or changed data.

Since the recording surface of conventional magnetic tape is normally subject to some deterioration from manual handling as well as from contact with the recording head, special techniques have been employed to prevent tape damage. A unique sandwich type construction shields the recording surface between two layers of plastic thus preserving it in handling as well as reducing the amount of friction encountered between the tape and the recording head. This sandwich construction has proved to be so satisfactory that life tests in which the tape has been manually handled freely and passed beneath the recording head over ten million times have failed to show any appreciable signs of corrosion or wear on either the recording head or the tape. Furthermore, no loss of information signals has been encountered.

Magnetic File
The Magnetic File (Type 1100) handles magnetic tape for five principal functions:
Record data on magnetic tape from the input converter
Read data from magnetic tape to the output converter
Read data from magnetic tape to the File Reference Device
Transfer data to the Central Processor
Record data from the Central Processor

Volume of transactions and complexity of operations govern the number of Magnetic Files used in a DATAMatic system. The "building block" plan is followed.

For moderate sized installations only a few units are needed - but for very large, multiple application installations, as many as 100 Magnetic Files with a capacity of billions of digits can be actively in a single system. A single Magnetic File is capable of reading or recording as many as 60,000 decimal digits or 40,000 alphanumeric characters per second. This is not a peak reading rate but a rate of continuous information flow which can actually be realized. Magnetic tape moves under the reading-recording head at 40 inches per second and can be scanned while the tape is moving in either direction.

File Reference Device
Any Magnetic File can be referred to or interrogated without disturbing the rest of the system by means of an auxiliary unit known as the File Reference Device (Type 1150). This unit is used to control a particular Magnetic File from which it is desired to extract specific information such as, account number, work order or item cost. The record or any desired portion of it is printed out by means of the File Reference Device's self-contained printer.

Output Converter
The Output Converter (Type 1300) has two principal functions, both of which are associated with the transfer of data from the Magnetic Files. These are:
Conversion of magnetic recordings to printed records and reports
Conversion of magnetic recordings to standard punched cards
In both functions the output is edited and format is governed automatically by the converter, this feature eliminates many conventional central processor operations usually needed to condition data for output.

Punched card output will be achieved at the rate of 6,000 cards per hour. Two speeds of electro-mechanical printed output will be available, which are: 150 lines of 120 characters maximum per minute 600 to 900 lines of 120 characters maximum per minute

Central Processor
The Central Processor performs two principal functions, which are:
Automatic Sequential Control of Processing Operations
Data Manipulation, (Sorting, Merging, Automatic Operations)

Physically, it contains the electronic elements and circuitry for carrying out, at high speeds, the stored programs. The fast and reliable internal memory system is composed of magnetic cores with a capacity of 24,000 decimal digits. Four 62-word buffers are provided for efficient input and output. Access to memory is in parallel and time for reading a word is approximately 10 microseconds.

Searching for items on tape may be accomplished automatically under Central Processor control with the scan being performed on as many as ten magnetic tapes simultaneously. This scanning is performed under the control of standard machine instructions and at the rate of as much as 600,000 decimal digits per second. The availability of buffer storage makes possible the performance of searching while other central machine operations are in progress.

The Processor is especially designed for high-speed sorting, merging and file maintenance. Some examples of sorting speeds are:
Sort - 60,000 decimal digits per second (equivalent of 750 fully punched cards per second)
Merge - 60,000 decimal digits per second
File Search - 600,000 decimal digits per second

Central Console
The supervision and master control of the System is exercised through the Central Console (Type 1090).
This unit also enables the operator to communicate directly with any element of the system under control of the Processor when required for diagnostic purposes, and receive printed answers to any interrogation of the machine. Under normal operation the Central Console permits monitoring of the machine. It monitors the condition of key components in the system and permits the location of potential trouble before it actually occurs.

Building Blocks
Each unit in the DATAmatic 1000 System is an individual "building block". Enough building blocks are integrated into a system to handle the requirements of the records being processed. However, if the work load increases or new applications are developed, additional units can be added. Conversely, if the work load should diminish, units may be removed from the system. This building block principle is followed within system units which are constructed of small individual packages which contain a limited number of components. These packages may be plugged into the system or removed as required. Consequently, when there is an indication on the Central Console of some component weakening, the package containing the declining component can simply be removed and replaced with a spare package.

Services
The DATAmatic Corporation provides the following services to prospective customers and users at no charge:
- Assistance in feasibility surveys and application analysis.
- Training schools for programmers and coders.
- Instruction manuals including routines for automatic programming.
- Field service on leased equipment.
- If the user elects to purchase equipment outright, his maintenance personnel will be trained at the DATAmatic factory, or service contracts will be arranged. Fully tested magnetic tape is stocked at the factory and sold to users as needed.
APPLICATIONS

Manufacturer
Designed specifically to cope with the full range of electronic computing problems in the fields of business, industry, science and government.

Government Sample
Naval Air Test Center
Scientific and scientific data processing.
Naval Ordnance Laboratory, Corona, California
Missile evaluation-data processing.
Ordnance Tank - Automotive Command Engineering.
U. S. Army Hydrographic Office
Scientific computations in oceanography, navigation, etc., and business applications in inventory control, cost accounting, etc.
Wright-Patterson Air Force Base
Scientific.

Industrial Sample
American Bosch-Arma Corporation
Systems analysis, systems design and data reduction.
California Research Corporation
Problems arising from petroleum research and development.
JPL - California Institute of Technology
80% scientific calculations and 20% data processing.
Magnolia Petroleum Company
Application of applied mathematics to petroleum exploration and production research.
Nuclear Development Corporation of America
General purpose scientific computation.
Princeton Computation Center - Electronic Associates, Incorporated
Service computation.
Socony Mobil Oil Company, Incorporated
Technical, scientific, operations research.
Southern California Co-operative Wind Tunnel
Wind tunnel data reduction and related problems. Prime application is to provide on-line data reduction on a real time basis. The computer input can be taken directly from the wind tunnel output equipment.
without resorting to any form of manual intervention
or temporary storage media.
Great Lakes Pipe Line Company
50% business, 50% scientific.

NUMERICAL SYSTEM

Manufacturer
Internal number system Binary coded decimal
Decimal digits per word 10 plus sign
Decimal digits per instruction 2 to 10
Instructions per word One
Instructions decoded 83
Arithmetic system Floating and fixed point arithmetic units. The floating point control is a
separate unit which can be purchased with Datatron depending on application. Fixed point arithmetic
incorporated in central computer.
Instruction type One address

Number range
Computer \(+10^{-10}\) to \(-10^{-10}\)
Floating point unit \(10^{-31} \leq N < 10^{49}\)

Government Sample
Naval Air Test Center
Floating point control on order.
Naval Ordnance Laboratory, Corona, California
Floating point control on order.
U. S. Navy Hydrographic Office
2 instruction digits, 4 address digits, 1 breakpoint
digit, 3 extra digits. No floating point. Conven-
ient scaling command makes floating point program-
ing quite easy.

Wright-Patterson Air Force Base
Floating point subroutine.
Industrial Sample
American Bosch-Arma Corporation
Has floating point.
JPL - California Institute of Technology
Fixed point.
Magnolia Petroleum Company
Floating point on order.
Nuclear Development Corporation
Fixed point.

ARITHMETIC UNIT

Manufacturer
Microsec
(1) Add (exclud. stor. access) 169 or 338
(2) Add (includ. stor. access) 1,019 or 1,188
(3) Mlt (exclud. stor. access) 8,450 (mean)
(4) Mlt (includ. stor. access) 9,300 (mean)
(5) Div (exclud. stor. access) 11,830 (mean)
(6) Div (includ. stor. access) 12,680 (mean)

Construction Vacuum tubes and condenser-diodes
Rapid access word registers 6
Basic pulse repetition rate 142 Kc
Arithmetic mode Series parallel
Timing Synchronous
Operation Sequential
Additions per digit in division equal the value of
quotient digit plus 2. Additions per digit in multiplication equal value of accumulator digit (multiplier).

Government Sample

Naval Air Test Center

Operation time including storage access time is considered the average time required using high speed loops for access of command, operand and actual operation time. Operation times are, given in order as above (1) 170, (2) 2,500, (3) 1,576-16,856, (4) 10,800, (5) 1,850-20,020, and (6) 14,000.

Ordnance Tank - Automotive Command

The average operation times, on the basis of 4 word and 40 word-times are, respectively (1) 190, (2) 1,040, (3) 6,980, (4) 2,840, (5) 10,000, (6) 11,040. Binary information is handled in parallel and decimal information is handled serially. Arithmetic unit construction requires 1,127 tubes and 3,800 crystal diodes.

U. S. Navy Hydrographic Office

When including order access and operand access, operation times, respectively, are (1) 500, (2) 2,200, (3) 9,000 aver., (4) 10,700, (5) 13,000 aver., (6) 14,700. The adder is serial. Words are transferred in parallel.

Industrial Sample

American Bosch-Arma Corporation

Random average operation time is 1,600 microseconds.

Nuclear Development Corporation

Operation time excluding storage access time is, respectively, (1) 170, (3) 1,576-16,856, (5) 1,850-20,020. Times are given for multiplication (and division) by zero to multiplication (and division) by 9,999,999,999.

Princeton Computation Center - Electronic Associates, Incorporated

Operation times are given as, respectively, (1) 170, (2) 2,000, (3) 1,576-16,856, (4) 8,500, (5) 1,850-20,000, (6) 10,100.

STORAGE

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Words</th>
<th>Digits</th>
<th>Microsec Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Drum</td>
<td>4,060</td>
<td>40,800</td>
<td>850</td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>400,000</td>
<td>4,000,000</td>
<td>240,000,000</td>
</tr>
<tr>
<td>Data File</td>
<td>2,000,000</td>
<td>20,000,000</td>
<td>24,000,000</td>
</tr>
</tbody>
</table>

4 High-speed 20-word drum loops
4,000-word intermediate-speed main drum memory

Government Sample

Naval Air Test Center

Up to 10 magnetic tape units can be used. Each unit stores 400,000 10-digit words in addressable blocks of 20 words. Independent block search at 60 in/sec on 1,500 ft. tape is used.

Ordnance Tank - Automotive Command

Magnetic drum main memory access time is 8,500 microseconds average.
Industrial Sample
Magnolia Petroleum Company
Two magnetic tape transports used.
Nuclear Development Corporation
Installation has 2 tape units.

**INPUT**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Tape</td>
<td>540 dig/sec</td>
<td></td>
</tr>
<tr>
<td>Keyboard</td>
<td>Manual</td>
<td></td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>6,000 dig/sec</td>
<td></td>
</tr>
<tr>
<td>Cards</td>
<td>21,120 dig/min, ea. reader</td>
<td></td>
</tr>
</tbody>
</table>

Up to 7 card readers can be used with DATATRON. Magnetic tape speed is 46 millisec per block, 20 words/block.

Additional Input Systems in Use:
Government Sample
Naval Ordnance Laboratory, Corona, California
2 Cardatron input units on order.
Ordnance Tank - Automotive Command
Photo and mechanical reader, 240 and 10 char/sec respectively, 6 channel tape.
U. S. Navy Hydrographic Office
IBM 528 200 cpm card reader on order.

**OUTPUT**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Typewriter</td>
<td>10 char/sec</td>
<td></td>
</tr>
<tr>
<td>Paper Tape</td>
<td>60 dig/sec</td>
<td></td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>6,000 dig/sec</td>
<td></td>
</tr>
<tr>
<td>Cards</td>
<td>1,800 char/min</td>
<td></td>
</tr>
</tbody>
</table>

Up to 7 printers may be used with system.
Up to 7 punch card machines may be used at one time.

Additional Output Systems in Use:
Government Sample
Naval Ordnance Laboratory, Corona, California
2 Cardatron output units on order, Tallyplotter at 20 points per second manufactured by Tally Register Company, Seattle, Washington.
U. S. Navy Hydrographic Office
Line printer 150 lines/min. max., Flexowriter 5 or 10 char/sec (half-speed for alphabetic).
Wright-Patterson Air Force Base
407 IBM Tabulator 150 lines/min.

**DATATRON**
Line Printer 150 lines/min IBM 407.
Magnolia Petroleum Company
IBM 416 Tabulator 150 lines/min.
Socony Mobil Oil Company
IBM 402 Tabulator 100 lines/min.
Southern California Co-operative Wind Tunnel
IBM 526 Reproducer 100 c/min, normal use is 80
digits of output, IBM 416 Numerical Account Machine
150 lines/min, normal use is 80 digits per line.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Manufacturer Central Computer

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubes</td>
<td>Approx. 1,202</td>
</tr>
<tr>
<td>Tube types</td>
<td>Approx. 3,176</td>
</tr>
<tr>
<td>Resistors</td>
<td>Approx. 10,000</td>
</tr>
<tr>
<td>Tube types</td>
<td>Primarily 5965, 12B17, 5965 2DE1, 2881</td>
</tr>
</tbody>
</table>

Separate cabinets Maximum 24

Government Sample
Naval Ordnance Laboratory, Corona, California
Complement consists of computer, console, typewriter
control, punch card converter, power supply, tape
control unit, 2 tape storage units, and Tally Plott-
er. On order are floating point, additional power
supply, 5 Cardatron cabinets (1 Control, 2 Inputs,
2 Outputs), and a Datafile Bin.

Naval Air Test Center

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubes</td>
<td>1,500</td>
</tr>
<tr>
<td>Tube types</td>
<td>1/4</td>
</tr>
</tbody>
</table>

Crystal diodes 3,500

CHECKING FEATURES

Manufacturer
Fixed

DATATRON automatically stops upon the appearance of
an unanticipated overflow. An alarm light is turned
on and computation is stopped by a forbidden combi-
nation (binary-coded decimal digits 10 through 19) in
the A, B, D and R registers, the address register,
control counter, and shift counter. Inspection of
the registers on the control panel indicates the failure
location. An alarm stops the computer if
the storage cell counted does not contain all zeros
at the start of each drum revolution. This prevents
information from being recorded on or read from in-
correct locations on the drum.

An audible alarm indicates excessive rise in exhaust
air temperature in the computer cabinet. After a
preset interval, up to 15 minutes, DC voltage will
be shut off if the temperature stays at or above a
predetermined level.

Optional

The marginal voltage test panel facilitates select-
ive lowering of voltages in registers and control
section which, in conjunction with test routines,
can detect marginal components before they give
trouble in actual operation. Supervisory test panel
on front of computer has extensive controls and
check features, including access to any flip-flop for manual setting, substitution of manual or low frequency pulse operation for the drum clock, and a switch panel which allows maintenance personnel to force abnormal register behavior and to inhibit certain normal checking functions for diagnostic purposes.

Contents of all registers are displayed simultaneously at all times.

Checking features in use:

Government Sample

Naval Air Test Center

Forbidden combination, word storage position check, selective voltage marginal checking panels, tape parity, tape search, read-write check, defective tape check.

Naval Ordnance Laboratory, Corona, California

Standard Datatron checks.

Ordnance Tank - Automotive Command

Marginal check panel providing means to vary filament and bias voltages, with switching arrangements to isolate to selected circuit groups; test oscillator for frequency variation allows asynchronous operation; switches for checking of selected operations; diagnostic routines.

U. S. Navy Hydrographic Office

Stop on forbidden combination (binary coded decimal digit greater than 9) anywhere in arithmetic unit.

Wright-Patterson Air Force Base

Forbidden combination, sector alarm, parity check on tapes, overflow, tape summing devices, break-point.

Industrial Sample

JPL - California Institute of Technology

Automatic stop on unallowed binary coded digits greater than 9.

Nuclear Development Corporation of America

Forbidden combination, word storage position check, selective voltage marginal checking panels, tape parity, tape search, read-write check, defective tape check.

POWER, SPACE AND WEIGHT

Manufacturer

Power, computer 16.5KVA
Space, computer 181 ft.3 28 ft.2
Weight, computer 3,175 lbs.

Amount of air conditioning depends upon size of computer system installed. For every 12,000 BTU/hr. generated by the system one ton of refrigeration is recommended. Environmental conditions should also be taken into consideration.

Government Sample

Naval Air Test Center

The computer requires 29.1 KVA (including M-G set, console, and tape control), 182 cu. ft., 28 sq. ft.; measures 144 by 28 by 78 inches, and weighs 3,440 lbs. The air conditioner requires 9.7 KW; 148.4 cu. ft.; 17.7 sq. ft.; measures 62-1/4 by 31 by 96-9/16 inches; weighs 2,400 lbs. and has a 10-Ton capacity. The weight of the system, including output devices,
tape control and tape unit, power control and voltage regulator, but not the motor-generator or air conditioner is about 6,100 lbs. The same equipment uses about 70 sq. ft. of floor area and is housed in a room of 437 sq. ft.

U. S. Navy Hydrographic Office
Installed in room 26 by 40 ft.

Wright-Patterson Air Force Base
Computer power factor 0.9, 16.04 KVA, requires total space of 10,500 cu. ft., 750 sq. ft., and weighs 7,358 lbs. Air conditioner requires 12.435 KVA, p.f. 0.9, requires total 2,100 cu. ft., 150 sq. ft., weighs 6,000 lbs. and has a capacity of 15-Tons.

Industrial Sample
California Research Corporation
Capacity of air-conditioner is 7-Tons.

Princeton Computation Center
Computer power 37 KVA, air conditioner 32 KVA, capacity of air conditioner 27-Tons.

Socony Mobil Oil Company
Standard 10-Ton Carrier "Weathermaker" air conditioning unit takes care of computer and building heat load.

**Delivery time** 6 to 12 Months, depending on system ordered.

**COST, PRICE AND RENTAL RATE**

**Manufacturer**
The information listed is for general guidance in selecting DATATRON electronic data processing machines. A variety of systems may be assembled, incorporating punched card or perforated tape input, punched card, perforated tape, typewriter or tabulating machine output, and auxiliary high-capacity storage in the form of magnetic tapes. All prices are subject to change without notice. Under the ElectroData lease plan the DATATRON computer may be combined with various accessory equipment to provide alternate means of input-output, and various capacities of auxiliary storage. All rentals are subject to change without notice and all equipment is leased only as part of data processing system.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Price</th>
<th>Dollars/Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATATRON Digital</td>
<td>$135,000</td>
<td>$3,900</td>
</tr>
<tr>
<td>Computer Model 205</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Includes cabinet, plug-ins, and 12-inch magnetic drum with read-write heads for 4,080-word memory. Also includes Magnetic-Electronic Power Supply and Power Control Units.

**Control Consoles**
All consoles, of standard office-desk size, contain
the decimal keyboard, displays of the computer registers, and computer and system controls. In all consoles, the right desk-drawer position will accommodate a Photoelectric Reader.

Photoelectric Reader: Reads a 6-hole code from Flexowriter tape at the rate of about 540 decimal digits per second.

High Speed Tape Punch: Perforates paper tape under control of the computer at the rate of 60 decimal digits per second. It is mounted in a separate cabinet and connected to the console by a single cable.

Control Console Model 405 $7,050 $230

The 405 console is the basic unit, neither the Photoelectric Reader nor the High Speed Punch are included.

Control Console Model 406 $14,210 $490

The 406 console includes both the Photoelectric Reader and the High Speed Punch.

Control Console Model 409 $11,250 $362

The 409 console includes a Photoelectric Reader.

Console Model 407 $1,980 $70

Table-top unit, contains decimal keyboard, essential controls and indicators of full console, but does not include neon-lamp displays of the registers.

Typewriter Control Model 446 $4,560 $137

Usable with all consoles, the 446 includes the stand which supports the Flexowriter and contains external format control equipment and a relay translator.

Modified Flexowriter

Model 458 $3,115 $95

Incorporates the correct code for alphanumerical print-out under computer control; both a Tape Punch and a Tape Reader are attached to the Flexowriter. The Tape Reader may be used for slow input to the computer.

Tape Perforator and

Verifier Model 454 $3,790 $133

Includes a decimal keyboard, tape perforator, and tape reader. Used to prepare, verify, or automatically duplicate numeric perforated tape.

Numeric Code Converter

Model 460 $3,680 $110

Provides conversion, digit by digit, from punched paper tape code to another. Includes a motorized tape reader, motorized tape punch, and two matrix cards (ElectroData to Teletype and Teletype to ElectroData code). Matrix card prices for other codes will be quoted separately on request.

External Switching and Output

Selector Model 420 $4,375 $155

Permits the 500 Punched Card Converter to operate with either an IBM tabulator or summary punch as selected by computer programming.

External Switching

Model 421 $2,890 $105

Provides selective switching to eight external sources as directed by the computer program. Includes computer conversion kit and external relay closures, but does not include the Output Selector Unit for use with the 500 Punched Card Converter.

Punched Card Converter

Model 500 $18,625 $567

Permits use, under computer control, of an IBM summary punch as input and an IBM tabulator or gang punch as output.

Cardatron Model 506

Buffer Control Unit and Auxiliary Power

Supply $5,000 $770

Input Station $22,500 $860

Output Station (80 character) $26,500 $660

Output Station (120 character) $27,550 $690

(maximum number of stations: seven)

Permits simultaneous high-speed communication between standard punched card machines and the 205 Computer. Alphanumeric, special, and numeric characters may be intermixed in any manner.

Magnetic Tape Control

Model 543 $25,000 $750

Master control system which provides electronic control for up to 10 Datareader units.

Datareader Model 544 $12,000 $375

Magnetic tape storage unit includes a read-write head and tape drive mechanism and operates under control of 543 Tape Control Unit. Reel type storage accommodates up to 2,500 feet of tape. Capacity: maximum 400,000 ten-digit (decimal) words, addressed in 20-word blocks.

Datafile Model 560 $25,000 $825

Multiple magnetic tapes for data storage under control of the 543 Magnetic Tape Control Unit. Includes drive mechanism for fifty lengths of tape (one hundred logical tapes), partitioned bin, and read-write heads. Tapes are brought out over guide rods and the two recording heads are servo positioned under the selected tape. Up to 12,500 feet of tape in a single Datafile gives a capacity of two million ten-digit words, addressed in 20-word blocks.

Floating Point Control

Model 560 $21,200 $725

Provides automatic floating point arithmetic for the operations of addition, subtraction, multiplication, and division.

Outline of Sale Policy

Guarantee and Installation Policy

Except for expendable items, such as tubes, diodes, fuses, lamps, and neon indicators, all equipment is guaranteed for one year against defective material or workmanship. The purchase of DATATRON data processing machines includes the following:

Necessary sets of coding, operational, and maintenance manuals, the services of trained personnel to supervise installation in the purchaser’s plant and to conduct operation demonstration, and prescribed training of the purchaser’s employees by qualified ElectroData instructors in programming, operation and maintenance procedures and techniques. NOTE: The purchaser may contract for the additional services of a staff of qualified programmers, mathematical analysts and engineers, and for time on the DATATRON system at the ElectroData Computing Center to further improve his specific utilization of the equipment.

Maintenance Service: Maintenance service on a continuing, periodic, or on-call basis is available by contract through a staff of qualified service engineers stationed in major cities across the country.

Terms of Sale: Net 10 days from date of invoice. Prices for machines requiring an operational demonstration are payable 30% upon delivery to a common carrier, 20% upon completion of installation.

Prices are F.O.B. factory, Pasadena, California. Handling, shipping, and insurance charges will be borne by the purchaser. Sales, use, or other taxes imposed directly or indirectly on the sale of ElectroData machines by Federal, State, or Local governments will be borne by the purchaser. A standard ElectroData Corporation sales agreement covering all purchase terms is executed at the time of sale.

Outline of Lease Policy

A standard ElectroData Corporation lease agreement covering all leased equipment and terms and incorporating substantially the following provisions, will be executed at the time of leasing: The rental agreement is effective for one year from the date installation of the equipment is complete, and
remains in effect thereafter until terminated by either party upon three months' written notice. ElectroData provides maintenance service as required to keep the machines in good operating condition. The lease price includes personal property tax and insurance coverage on the machines; all additional taxes are paid by the lessee. Transportation costs on machines from and to ElectroData's plant in Pasadena will be paid by lessee. Machines under lease may be placed at any time at the prices in effect at the time such option is exercised, less a credit of 40% of all rentals paid, up to a maximum of 60% of the purchase price. ElectroData furnishes prescribed training of customer employees in programming, and operating procedures and techniques.

NOTES: Additional services of a staff of qualified programmers, mathematical analysts and engineers and time on the DATATRON system at the ElectroData Computing Center to further improve specific utilization of the equipment may be contracted for.

Government Sample

Ordnance Tank - Automotive Command
Basic system $135,000; tape control $25,000; data reader $12,000; tape file $25,000.

U. S. Navy Hydrographic Office
Basic system $135,000; control console $7,050-14,210; Flexwriter and control $7,695; card converter $12,625; magnetic tape control $25,000; magnetic tape transport $12,000; Cardatron $35,000-up.

Rental Rate = (Purchase Price + 10%) / 36.

Wright-Patterson Air Force Base
Basic system $135,352; additional equipment $76,670 (Magnetic tape and card converter); IBM 407 and 522 $802; additional IBM 519, 552, 024, 582, 082 $475.

Industrial Sample

American-Bosch-Adams Corporation
Basic system $140,000; all additional equipment in Adams facility $350,000.

Nuclear Development Corporation
Basic system $200,000.

Southern California Co-operative Wind Tunnel
$5,000/month, single shift for computer and input-output equipment; approximately $250/month, single shift, for auxiliary equipment and tunnel output equipment.

Princeton Computation Center
Basic system cost $200,000, $8,000 per month rental rate basic system and $600 per month additional equipment. System is rented.

PERSONNEL REQUIREMENTS

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>ElectroData</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Operation</td>
<td>Engineers</td>
</tr>
<tr>
<td>1-8 Hour shift</td>
<td>1</td>
</tr>
<tr>
<td>2-8 Hour shifts</td>
<td>2</td>
</tr>
<tr>
<td>3-8 Hour shifts</td>
<td>3</td>
</tr>
</tbody>
</table>

Engineers are for maintenance only. Tech/Operators are for an average size system.

Government Sample

Naval Air Test Center
One engineer required. A one shift day is sufficient for usual needs. Overtime is scheduled as it is needed. The computer installation is maintained by a full time company maintenance engineer who is on call for emergency service if more than one shift is needed. Because of the recruiting problem, the mathematicians and mathematically inclined people do data reduction groups write and debug programs and operate the computer for their own work.

Naval Ordnance Laboratory, Corona, California
For three 8-hour shifts, 2 engineers and 6 technicians or operators are used, which includes operation of associated input-output devices. In addition, approximately 10 people are engaged in programming, etc.

Ordnance Tank - Automotive Command
For one 8-hour shift, 1 engineer and 1 technician used for maintenance.

U. S. Navy Hydrographic Office
One 8-hour shift, 1 engineer, 2 technicians.
Two 8-hour shifts, 2 engineers, 3-4 technicians.
Three 8-hour shifts, 3 engineers, 4-5 technicians.

Wright-Patterson Air Force Base
One 8-hour shift, 2 engineers, 1 operator, 9 mathematicians, 3 technicians, 1 secretary. Second shift worked 1½ years, above personnel split up to cover this shift. NDCP (Data Processing Section, Facility and Data Branch, Test Engineer Division, Directorate of Flight and All-Weather Testing), works a 2nd shift only when work load is too great for one shift.

Industrial Sample

American Bosch-Adams Corporation
One 8-hour shift, 10 engineers, 3 technicians.
Two 8-hour shifts, 15 engineers, 6 technicians.
Three 8-hour shifts, 17 engineers, 8 technicians.
Personnel engaged in other activities.

California Research Corporation
One 8-hour shift, 6 engineers, 2 technicians.

JPL - California Institute of Technology
Two 8-hour shifts. During day shift, the machine is operated by members of the management staff. Two operators are employed at night. Maintenance is carried out by staff primarily concerned with other engineering development. Time required is about 10% of an engineer's time and 20% of a technicians time. There is no night maintenance.

Great Lakes Pipe Line Company
One 8-hour shift, 1 engineer, 2 technicians or operators. Programmers operate equipment at present, however, a computer operator will be used shortly.

Magnolia Petroleum Company
One 8-hour shift, 7 technologists, 3 technicians or operators. 8-hour shift plus overtime.

Nuclear Development Corporation
One 8-hour shift, 1 engineer, 3 technicians.
Two 8-hour shifts, 2 engineers, 4 technicians.
Three 8-hour shifts, 5 engineers, 5 technicians.

Socony Mobil Oil Company
Two 8-hour shifts, 1 engineer for maintenance, 1 technician per shift, 7 analysts and programmers, 3 non-degree operators, card punchers.

Southern California Co-operative Wind Tunnel
One 8-hour shift, 4 engineers, 1 operator, shift starts between 6:30 AM and 8:00 AM. Second 8-hour shift starts at 4 PM with one engineer and one operator or technician. Totals are 226 hours per week of salaried labor (supervisor and programmer), 96 hours per week of hourly labor (machine operators). Computing service is provided from 6:30 AM until Midnight, 6 days per week.

RELIABILITY AND OPERATING EXPERIENCE

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>ElectroData Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average error-free running period</td>
<td>greater than 95%</td>
</tr>
<tr>
<td>based on customer reports to ElectroData</td>
<td></td>
</tr>
</tbody>
</table>

Government Sample

Naval Air Test Center
Good time 1,550 hours, attempted to run time 1,400
hours, operating ratio (Good/Attempted to Run) 95%, preceding figures based on period from 1 February 1956 to 30 September 1956. System passed customer acceptance test 23 January 1956. Scheduled preventive maintenance is 1 hour per day. Down time used to compute operating ratio includes time not available for use as result of failure in any of the equipment including input and output devices.

Naval Ordnance Laboratory, Corona, California Respectively as above, 53.4 hours, 90 hours, 59.3% from 1 January 1956 to 15 September 1956.

Ordnance Tank - Automotive Command Respectively 655.5 hours, 680 hours, 96%, 23 July 1956 to 16 November 1956, 23 July 1956. U. S. Navy Hydrographic Office Operating ratio 94.5%, based on period from 1 July 1956 to 1 October 1956, acceptance test passed 29 June 1956.

Wright-Patterson Air Force Base Respectively 1,463.75 hours, 1,964.66 hours, 74.50%, 1 December 1955 to 30 September 1956, acceptance January 1955. Summary of figures: 1,964.66 hours attempted to run, 1,463.75 good problem time, 462.56 hours scheduled preventive maintenance, 38.55 hours unscheduled maintenance, 95.43% hours modification and auxiliary installation time not included in attempted to run time.

Industrial Sample
American Bosch-Arma Corporation Respectively 109 hours/week, 110 hours/week, 99%, February 1955 to December 1955, acceptance passed February 1955.
California Research Corporation Respectively 480 hours, 505 hours, 95%, July 1956 to October 1956, 18 July 1956.
JPL - California Institute of Technology Respectively 2,506 hours, 2,602 hours, 96%, January 1956 to October 1956, August 1955.
Magnolia Petroleum Company Acceptance passed March 1956. On the average unscheduled maintenance time has been less than 5% of a total of 6,000 hours of DC time.

Nuclear Development Corporation Operating ratio is 72%, period from May 1956 to October 1956, acceptance in May 1956, average error-free running time is 10 hours.
Socony Mobil Oil Company Operating ratio is 90%, period from July 1956 to September 1956, acceptance passed on 20 December 1954, average error-free running period is 6 hours (obtained with difficulty).
Southern California Co-operative Wind Tunnel Respectively 2,850 hours, 3,800 hours including unscheduled maintenance, 84.5%, 1 December 1955 to 31 October 1956, acceptance 4 October 1955. 84.5% of the time demand was placed upon the equipment, production was obtained, or the equipment was capable of producing good output. Records are maintained so as to show preventive maintenance, unscheduled maintenance, including lost time due to equipment failures and assumed good time.

ADDITIONAL FEATURES AND REMARKS

Manufacturer
The automatic address-modification features of the B-register, along with its automatic tally. Automatic editing provided by the format bands on Cardatron buffer drums, as well as freeing of the computer as soon as information is transferred. This allows input, output, and processing to proceed simultaneously while machine operate at a maximum rate. Independent search for permanently addressed blocks on magnetic tape, which allows processing of results of previous search while current search is going on. Ability to read from magnetic tape, updating information, and write back on the same tape in the same position. Provision of high-speed through quick-access loops, which allows straightforward sequential coding and does not require complicated placement of instructions or data for minimal access.

Government Sample
Naval Air Test Center
The built-in B-register permits easy use of relative addresses for sub-routines and is very convenient for address modification and tallying. The four high speed loops into which blocks of twenty words can be transferred from the main memory, permit nearly all operations to be carried out at high speed. The visual display of the accumulator, operand and command registers is very convenient in code checking. Magnetic tape search is initiated by computer control but is carried out independent of the computer. A command word is made up of a digit order, a four digit address, a one digit breakpoint or skip digit, three space digits which are used for a tally and the sign position which is used to control paper tape and B-register modification.

Ordnance Tank - Automotive Command
Automatic editing can be programmed by means of SAC and DOTI routines. Datatron contains a B-register and photo-electric reader used as input device.
U. S. Navy Hydrographic Office
Scaling order, one B-box, paper tape input very fast, accurate, and convenient, addressable magnetic tape blocks are a superb advantage.

Wright-Patterson Air Force Base System has A, B, C, and R registers and Flexwriter output, theodolite magnetic tape auxiliary input, auxiliary slow speed airborne magnetic tape playback input (Digital).

Industrial Sample
American Bosch-Arma Corporation
Installation has standard 4 high-speed loops, 1 B-box and optional magnetic tapes, floating point and high speed card converting equipment.

JPL - California Institute of Technology
Auxiliary Equipment: (1) Tape preparation unit for preparing, verifying, and duplicating tapes. This unit will also compare two supposedly identical tapes. (2) Punched tape operated word-at-a-time printer operating at a speed of 1.4 words/second with a format controlled both by the computer and by the carriage position of the printer. The computer has been modified to permit punching of tape for service listing on a Flexewriter without using the Electrodata typewriter control unit.

Nuclear Development Corporation
One 4-digit B-box used for address modification and counting, four 20-word high speed drum loops increases standard drum access time by a factor of 10, floating point obtained by an automatic coding routine, which also supplies mathematical functions.

Princeton Computation Center
Following features are extremely helpful: B-box, quick access loop, mobility of input to memory, addressability of tape storage.
Socony Mobil Oil Company
In addition to standard Datatron features, a Socony innovation consists of a monitoring system responsive to a "flag" digit in the instruction words if the "flag" switch is "ON".

Southern California Co-operative Wind Tunnel
Input-output system is straight numeric. The manufacturer altered their stock computer to allow input
or output of 50 decimal digits plus 50 signs (x - overpunches). The normal is 80 plus 5 signs.
Input is selected manually from either an IBM 514 punch or from the punch magnets of the wind tunnel data recording IBM 517 punch, through a direct tie-
line. Other features are standard.

FUTURE PLANS

Governmelt Sample
Naval Air Test Center
A floating point unit is on order. Additional
magnetic tape storage in the form of an additional
Datareader, Model 940, or Datafile, Model 560, is
being considered for use as an input medium for
telemetered or airborne digitized test data.
Naval Ordnance Laboratory, Corona, California
Scheduled for delivery in summer of 1957 are a
Cardatron with 2 input and 2 output units, Floating
Point Unit, Datafile Bin, and additional power
supply.

Ordnance Tank - Automatic Command
Tape Control Unit, 2 Magnetic Tape Data Readers,
Floating Point Unit and High-Speed Paper Tape Output
Punch are to be added. A feasibility study will be
made to determine if the Datatron can be integrated
with an analog computer.

U. S. Navy Hydrographic Office
Cardatron to be delivered February 1957 and two
additional tape (magnetic) units by end of 1957.

Wright-Patterson Air Force Base
A development contract is being sponsored to record
digital airborne data in high speed test instrumentation measurements
on magnetic tape at a high speed (2,000
samples per second maximum rate or a 100 sample per
second per transducer) and play the recorded magne-
tic tape directly back into the computer. Interest
lies in point-to-point and line plotters using card
input. Intensive efforts have not been expended in
this field to date by Wright-Patterson Air Force Base.

Industrial Sample
Socony Mobil Oil Company
Delivery of Floating Point unit expected in November
1956.

Southern California Co-operative Wind Tunnel
On or about 1 January 1956, an Electrodax Catatron
Input-Output System is to be attached. This will
include one input-output station and two output
stations. A proposed speed-up of the data output of
the wind tunnel will make the system adequate for
real time calculations on a per point cycle. Since
the wind tunnel is not a continuous output device,
it is intended to provide on-line (without manual
intervention) services in primary areas of interest.
It is anticipated that real time calculations on a
run cycle basis (a run of 20 points) can be pro-
vided. The programming system will be one which has
data artificially entered by subroutine action
whenever the tunnel has data ready and which will
automatically link two asynchronous devices (wind
tunnel digitizing equipment and the computer).
This is possible due to the fact that the higher speed
device (the tunnel) periodically stops.

INSTALLATIONS

Southern California Cooperative Wind Tunnel,
Pasadena, California.
Allstate Insurance Company, Skokie, Illinois
Jet Propulsion Laboratory, Pasadena, California
American Bosch Arms Corporation, Arma Division
(2), Eglin Air Force Base, Florida
U. S. Naval Ordnance Laboratory, Corona, Cali-
ifornia
Magnolia Petroleum Company, Dallas, Texas
Socony-Mobil Oil Company, Incorporated (2),
Paulsboro, New Jersey
Cornell Aeronautical Laboratory (2), Buffalo,
New York
Purdue University, Lafayette, Indiana
Edwards Air Base, Edwards, California
Wright Air Development Center, Dayton, Ohio
Dow Chemical Company, Midland, Michigan
National Advisory Committee for Aeronautics (2)
Moffett Field, California
Shell Development Company (2), Emeryville, Cali-
ifornia
General Insurance Company of America, Seattle,
Washington
Babcock and Wilcox Company, New York City
Aerojet-General Corporation, Sacramento, Califor-
nia
Arthur D. Little, Incorporated (2), Cambridge,
Massachusetts
U. S. Naval Air Station, Patuxent River, Maryland
United Gas Corporation, Shreveport, Louisiana
California Research Corporation, Richmond, Cali-
ifornia
Convair, Pomona, California
Phillips Petroleum Company, Bartlesville, Okla-
 homa
University of Dayton, Dayton, Ohio
Canadair Division, General Dynamics Corporation,
Montreal, Quebec
McDonnell Aircraft Corporation, St. Louis, Miss-
ouri
University of Chicago, Chicago, Illinois
Westinghouse Electric Corporation, Research
Laboratory, Pittsburgh, Pennsylvania
Nuclear Development Corporation of America,
White Plains, New York
The M. W. Kellogg Company, New York, New York
Detroit Arsenal, Center Line, Michigan
Hydrographic Office, Suitland, Maryland
Sears Roebuck & Company, Chicago, Illinois
Great Lakes Pipe Lines Company, Kansas City,
Missouri
The Ohio Oil Company, Denver, Colorado
American Machine & Foundry, Greenwich,
Connecticut
California Institute of Technology, Pasadena,
California
Babcock and Wilcox Company, Lynchburg, Virginia
Atomic Energy of Canada, Limited, Chalk River,
Ontario, Canada
Certified Grocers of California, Limited, Los
Angeles, California
General Petroleum Corporation, Los Angeles,
California
Melpar, Incorporated, Boston, Massachusetts

The following information was received too late to be
included in the above outline:

Edwards Air Force Base, Air Force Flight Test
Center
The system is utilized for processing flight test
data.

Reliability and operating experience:
Average error-free running period 110 hours
Good time 110 hours
Attempted to run time 120 hours
Operating ratio (Good/Attempted to run) 0.92
Figures based on period 10 September 1956 to
December 1956.
Acceptance test May 1956.
National Advisory Committee for Aeronautics, Ames Aeronautical Laboratory, Moffett Field, California.

Datatron System No. 107
Price of basic system was $120,000
Price of additional equipment $21,000
One engineer and three technician-operators are required. Programmers do most of the operating.

Reliability and operating experience:
Average error-free running period 12 hours
Good time 131.8 hours
Attempted to run time 588.2 hours
Operating ratio (Good/Attempted to run) .40
Figures based on period 29 November 1956 to 3 January 1957.
Acceptance test April 1955.
The above figures are not representative for the total period of operation of this system, but are quite representative for the last six months. About 6% of the “attempted to run” time is scheduled maintenance.

Datatron System No. 128
Reliability and operating experience:
Average error-free running period 24 hours
Good time 269 hours
Attempted to run time 588.2 hours
Operating ratio (Good/Attempted to run) 0.81
Figures based on period 29 November 1956 to 3 January 1957.
Acceptance test April 1955.
About 12% of the “attempted to run” time is scheduled maintenance. This time is not included under “good time”.

System is used for scientific computing and data processing. "CARDATRON" will be used. The CARDATRON system will increase the speed of the punched cards to 240 cards/min. The present DATATRON system will be modified by the addition of a buffered alphanumeric card handling system, the CARDATRON. Should the need arise, for floating point arithmetic, this could be readily provided. The only other addition which might be required in the foreseeable future is the DATAPLEX, a quasi-random access magnetic tape file.

Allstate Insurance Company
The system is utilized for the consolidation of statistics and accounting records. A second DATATRON will be used for storing policy holder information for renewal, billing, etc.
One, two and three engineers and two, four and six technician-operators are required for one, two and three 8-hour shifts, respectively.
The operating ratio is 0.97, which allows 3% for scheduled and unscheduled maintenance.
The system was accepted on 15 February 1955.

General Insurance Company of America
Personnel requirements for two 8-hour shifts are two engineers, one technician, and two operators. These requirements are based on current operating status.

Reliability and operating experience:
Average error-free running period 16 hours
Good time 3,568 hours
Attempted to run time 4,123 hours
Operating ratio (Good/Attempted to run) 0.86
Figures based on period 1 February 1956 to 31 December 1956.
It is planned to replace the present punched card converter with an Electrodata CARDATRON in April 1957.

Shell Development Company
Application is in support of chemical and physical research and engineering.
Checking features utilized on system include:
Forbidden B, C, D, combination check
Drum sector count alarm
Overflow stop
Input-output interlocks
Marginal voltage check panel
Variable frequency test facility
State of logical control toggles are displayed.
Reliability and operating experience:
Average error-free running period 20 hours
Good time 3,981 hours
Attempted to run time 3,690 hours
Operating ratio (Good/Attempted to run) 0.92
Figures based on period July 1955 to July 1956.
Acceptance test 8 June 1955.
The system has been subjected to three major installa-
tions.

United Gas Corporation, Research Department
Application is in the public utility, gas and oil industry.
The normal operating day is 13 hours, consisting of an 8 and a 5 hour shift. Two engineers and three operators are required. The engineers are on call for trouble during both shifts. They are usually occupied with modifications, and improvements. The operators run routine problems and the mathematicians de-bug programs.
Reliability and operating experience:
Average error-free running period 30-40 hours
Good time 2,650 hours
Attempted to run time 3,868 hours
Operating ratio (Good/Attempted to run) 0.75-0.96
Based on weekly data
Figures based on period January 1956 to December 1956.
Acceptance test December 1955.
It is proposed to install an automatic monitor device for printing the register contents as the program is executed. This will be useful in debugging. This will provide a higher speed monitor without the necessity of a stored monitor program.
It is also proposed to install an automatic operation control, which will control operations by means of a paper tape master program. This will eliminate the necessity of an operator attending the computer.
**APPLICATIONS**

General purpose business applications.

**NUMERICAL SYSTEM**

<table>
<thead>
<tr>
<th>Internal number system</th>
<th>Binary coded decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal digits per word</td>
<td>Variable word and block length</td>
</tr>
<tr>
<td>Decimal digits per instruction</td>
<td>10</td>
</tr>
<tr>
<td>Instructions per word</td>
<td>1</td>
</tr>
<tr>
<td>Instructions decoded</td>
<td>19</td>
</tr>
<tr>
<td>Instructions used</td>
<td>19</td>
</tr>
<tr>
<td>Arithmetic system</td>
<td>Fixed point</td>
</tr>
<tr>
<td>Instruction type</td>
<td>Two address: Source and destination</td>
</tr>
</tbody>
</table>

Number range: Alphanumeric: 0 to 99 char/word
Numerical for computation: Up to 12 places

**ARITHMETIC UNIT**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Add time Microsec</td>
<td>560</td>
</tr>
<tr>
<td>Mult time Microsec</td>
<td>3,137</td>
</tr>
<tr>
<td>Div time Microsec</td>
<td>4,830</td>
</tr>
<tr>
<td>Construction</td>
<td>Magnetic cores</td>
</tr>
<tr>
<td>Basic pulse repetition rate</td>
<td>150 Kc/sec</td>
</tr>
<tr>
<td>Arithmetic mode</td>
<td>Parallel</td>
</tr>
<tr>
<td>Timing</td>
<td>Synchronous for all components except file drums</td>
</tr>
<tr>
<td>Operation</td>
<td>Sequential and concurrent</td>
</tr>
</tbody>
</table>

The operation times given above for addition and multiplication are for the number 999,999 as operands. The divide time is for a 5 digit quotient. Computer operations are mainly sequential. Input-output operations are concurrent with computation. The arithmetic unit may also work concurrently with non-arithmetic operations. Non-arithmetic operations...
may be performed concurrently during the last 115 microseconds of the addition time, during the last 2,265 microseconds of multiplication, and during the last 3,966 microseconds of division.

The arithmetic unit consists of the product, multiplier, and multiplicand registers. These registers are 12 digits in length, with character position 0 holding the sign and character position 12 holding the most significant character.

Since the system is capable of handling British sterling notation, the adder, which is part of the arithmetic unit, operates in a scale of 12 unless digit d of the addition, subtraction, multiplication, and round instructions is a zero. In this case, scale of 10 operation is specified. Multiplication is accomplished by halving the multiplier and doubling the multiplicand, with the contents of the multiplicand register being added to the contents of the product register each time the number in the multiplier is odd. On the whole, this method of multiplication is faster than one involving successive additions. Division is accomplished by repeated subtraction of the divisor from the dividend, with the dividend initially in the multiplicand register and the divisor in the multiplier register. The quotient appears in the multiplicand register and the remainder in the product register.

**STORAGE**

<table>
<thead>
<tr>
<th>Media</th>
<th>Words</th>
<th>Characters</th>
<th>Access (Avg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Core</td>
<td>Variable</td>
<td>200-10,000</td>
<td>34</td>
</tr>
<tr>
<td>Hi-Speed Drum</td>
<td>Variable</td>
<td>58,500</td>
<td>11,000</td>
</tr>
<tr>
<td>File Drums</td>
<td>Variable</td>
<td>(1,875-625)x10^6</td>
<td>197,000</td>
</tr>
</tbody>
</table>
| Magnetic Tape    | Must be transferred to drum | Access times given above include drum switching. The high speed drum rotates at a speed of 100 revolutions per second, recording is performed in parallel and includes 6,000 characters of input-output buffers.

The file drum rotates at 3 revolutions per second, recording is serial. Each file drum has a capacity of 15 x 10^6 bits. Characters may be alphanumeric or numeric only. The magnetic file drum is the bulk storage medium. It is 15 inches in diameter by 15 inches long, having a capacity of 1,975,000 alphanumeric characters or 2,500,000 numeric characters. Any number of these file drums (up to a maximum of 330) can be used in a given installation, and regardless of how many are used, the average random access time to any part of the entire file remains one-sixth of a second. For intermediate and buffer storage a single high-speed drum is used, having a capacity of 58,500 alphanumeric characters and an average random access time of 10 milliseconds.

Internal working storage (GAST) consists of from
200 to 10,000 characters of magnetic core storage with an average access time of 34 microseconds. In addition, there are twelve transfer registers, each with magnetic core storage for 10 alphanumeric characters.

Since the storage capacity of the magnetic file drums and of OAST is scalable, a user need acquire only the capacity required by his application. This factor, together with a choice of the type and quantity of input and output devices, provides a flexible system that can be tailored to the individual requirements of any given application.

File drums are grouped into units of from one to 53 drums per unit (actually, from 300 to 10,000 tracks per unit), which, at 300 tracks per drum, would be a maximum of 33-1/3 drums per file drum unit). The maximum number of file drum units in a given installation is 10. Both the number of file drums per unit and the number of units are determined by the requirements of the application for which the system is intended.

Each file drum unit contains its own reading and writing mechanism and track selection devices, as well as a track or character selector. In locating a record in a file drum unit, the computer must first select the proper track by placing the track number in the track address register. The track number may be wholly contained in the record number (tag), or it may be found on an index track which relates record numbers to the appropriate track numbers.

Transfers from a file drum unit can be in the form of a block transfer to OAST, or a word or character transfer to the arithmetic unit or one of the transfer registers. Multiple-block transfers to OAST are also possible, provided OAST is large enough.

Information can be transferred from one file drum unit to another, a track at a time. If the installation includes a magnetic tape unit, information can also be transferred from a file drum unit to tape, a track at a time.

Information can be written on the file drum in only three ways: by a block transfer from OAST, by a track transfer from another file drum unit, or by a track transfer from magnetic tape. During track transfers in either direction, the computer may perform other operations which do not require the use of the drums. The time required for a track transfer is 0.6 second. One drum, therefore, can be loaded or unloaded in three minutes.

On the file drums, information is stored in serial by bit fashion. On the magnetic tape it is stored in parallel by bit, serial by character fashion. The high speed drum serves as an intermediate storage for the computer and in addition contains the input-output buffers. This drum sets the system pulse repetition frequency of 150 kc by means of an engraved clock track. A second clock track is used in locating sectors on the drum. This sector clock track has 20 equal divisions which are used to locate the 20 sectors of any given band.

The use of bands (adjacent tracks in groups of 7) permits parallel by bit handling of characters and a 150 kc character frequency. The capacity of this drum can be specified for each system arrangement.

MAGNETIC CORE STORAGE (OAST, TRANSFER REGISTERS)

OAST has a maximum size of 10,000 characters arranged into 100 sectors of 10 decades per sector, 10 characters per decade. Its minimum size is two sectors or 200 characters. Information is located by sector, decade, and character position, or by sector and word number. Data is handled in parallel by bit, serial by character fashion at a character frequency of 150 kc. The maximum access time to any character is 9 bit times or 60.3 microseconds (the time required to move from the first to the last character in a decade).

Information recorded in OAST is retained in storage by recirculation of the characters. In a single-block transfer to OAST, the most significant character of the block transferred is placed in the zero position of the decade addressed. In a multiple-block transfer to OAST, the most significant character of the first block transferred is placed in the zero position of the decade addressed; following blocks are written densely. The number of blocks to be transferred is specified in the instruction.

<table>
<thead>
<tr>
<th>INPUT</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td></td>
</tr>
<tr>
<td>Paper Tape</td>
<td>60-300 dig/sec</td>
</tr>
<tr>
<td>Punched Cards</td>
<td>100-500 cards/min</td>
</tr>
<tr>
<td>Typewriter</td>
<td>Manual</td>
</tr>
</tbody>
</table>

Special

Many different types of input-output equipment may be used simultaneously, each working concurrently with the others and with the computer.

Information to be processed or stored can be entered into the system in a number of different ways: via punched paper tape, punched cards, direct keyboard or in certain cases, via magnetic tape. Output can be via punched paper tape, punched cards, line printer, direct typewriter cathode ray tube viewer, or in certain cases, magnetic tape. The magnetic tape input and output units are more in the nature of drum loading and unloading devices; they are used chiefly to store information to which random access is not currently required, or to provide duplicate storage for security purposes.

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td></td>
</tr>
<tr>
<td>Paper Tape</td>
<td>60 dig/sec</td>
</tr>
<tr>
<td>Line Printer</td>
<td>150 lines/min</td>
</tr>
<tr>
<td>Punched Cards</td>
<td>100 cards/min</td>
</tr>
</tbody>
</table>

Special devices include any type of on-line input-output equipment such as keyboards, window machines, etc.

CIRCUIT ELEMENTS ENTIRE SYSTEM

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubes</td>
<td>1,500</td>
</tr>
<tr>
<td>Tube types</td>
<td>8</td>
</tr>
<tr>
<td>Crystal diodes</td>
<td>62,000</td>
</tr>
<tr>
<td>Magnetic cores</td>
<td>15,000</td>
</tr>
<tr>
<td>Separate cabinets</td>
<td>1</td>
</tr>
</tbody>
</table>

Above information is based on the Chase-Manhattan Bank, New York computer. These figures will vary, depending upon the size of the system.

CHECKING FEATURES

Fixed

Single bit errors are detected in all information and control paths except in the arithmetic unit. This includes input-output paths, and all data on the addressed file drum track.

Optional

Dual (parallel) arithmetic unit. If the dual arithmetic unit is not included, arithmetic operations can be checked by program.
POWER, SPACE AND WEIGHT

Power, computer  55 KW, 52 KVA, 0.92 PF, 208 V, 60 cycle, 3 phase, 4 wire
Power, air cond.  230V, 60 cycle, 1 phase, 3 wire
Space, computer  800-1,500 sq. ft., max. width 29 in., max. height 75 in.
Weight, computer  18,000 lbs., 200 lbs/sq. ft.
Capacity, air cond.  20 Tons

PRODUCTION RECORD

In production  2
On order  2
Delivery time  18 Months

First installation will be in the Chase-Manhattan Bank, New York during the latter part of 1957.

COST, PRICE AND RENTAL RATE

Approximate cost of basic system $450,000.
Approximate cost of additional equipment $15,000 to $1,000,000.
Rental rates of basic system $11,250/month, including 3 shift operation and 1 shift maintenance.

Rental rates of additional equipment $375-$25,000/month.

The basic system includes computer with 1 File Drums (7,500,000 characters), 1,000 characters of core storage, 500 digit/sec paper tape reader, and 150 lines/min printer. Additional 15,000,000 bit file drums cost $15,000 each.

ADDITIONAL FEATURES AND REMARKS

Large random access storage with ability to handle several remote input-output stations concurrently, makes DIANA ideal for on-line or multiple access applications. Inputs do not need to be batched or presorted, and may be posted in some cases at a 20,000 per hour rate. DIANA's ability to both select certain records and sort them by any classification at a rate of speed compatible to the output printer rate makes DIANA ideal for exception reporting.
APPLICATIONS
Special purpose system for the automatic statistical analysis of data taken during radio propagation studies.

NUMERICAL SYSTEM
Internal number system  Binary
Binary digits per word   18
Instructions per word  Wired program
Arithmetic system  Fixed point
Number range  Input 0 to 128 (Binary notation)
              Output 0 to 8,191 (Decimal notation)
No instructions are necessary since the program is completely wired-in.

ARITHMETIC UNIT
Add time (excl. stor. access)  5 microsec/dig
Construction  Filamentary subminiature tubes are used extensively when high speed is not required.

Arithmetic mode  Serial
Timing  Synchronous
Operation  Sequential

STORAGE
Media  Magnetic Drum
Words  125
A small, high speed (2,400 RPM) magnetic drum is used both for storage and to provide the sequential access to the words necessary for forming the correlation products.

INPUT
Media  Seven Bit Signals
Speed  150 words/sec, Maximum
The input number represents power level in decibels. The input digits are parallel.
OUTPUT

Media: Clary Parallel Printer
Speed: One 4-digit correlation product per second

CIRCUIT ELEMENTS ENTIRE SYSTEM

- Tubes: 1,200
- Tube types: 13
- Crystal diodes: 1,400
- Separate cabinets: 3

CHECKING FEATURES

- Fixed
- Built-in check program periodically checks machine operation.

POWER, SPACE AND WEIGHT

- Power, computer: 4 kW
- Space, computer: 96 cu. ft. 16 sq. ft. (total)
  - 2 cabinets 2 by 2 by 6 ft.
  - 1 cabinet 2 by 4 by 6 ft.

PRODUCTION RECORD

- Produced: 1
- Operating: 1
- Delivery time: 12 Months, for similar units

COST, PRICE AND RENTAL RATE

Approximate cost of system $67,000.

PERSONNEL REQUIREMENTS

The computer may be operated by a single untrained operator. An engineer or trained technician would be required (part time) for maintenance.

INSTALLATIONS

U. S. Naval Research Laboratories
Washington 25, D. C.

ADDITIONAL FEATURES AND REMARKS

This computer is a special purpose machine designed to compute auto-or cross-correlations of the input data. Correlation sums for shifts of zero through twenty sample intervals are computed simultaneously.
APPLICATIONS

General purpose, simulation, real-time control.

NUMERICAL SYSTEM

Internal number system    Binary
Binary digits per word     45 plus check digit
Binary digits per instruction     45 plus check digit
Instructions per word     1
Instructions decoded     16
Instructions used     16
Arithmetic system     Fixed point
Instruction type     Three address
Number range     $-\left(4 - 2^{-42}\right) \leq n \leq \left(4 - 2^{-42}\right)$

ARITHMETIC UNIT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Microsec</td>
<td>Microsec</td>
</tr>
<tr>
<td>Add</td>
<td>192 - 1,536</td>
<td>48</td>
</tr>
<tr>
<td>Mul</td>
<td>2,204 - 3,648</td>
<td>2,112</td>
</tr>
<tr>
<td>Div</td>
<td>2,304 - 3,648</td>
<td>2,112</td>
</tr>
<tr>
<td>Construction</td>
<td>Diode gates, tube amplifiers, and electrical delay lines</td>
<td></td>
</tr>
<tr>
<td>Rapid access word registers</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Basic pulse repetition rate</td>
<td>One megacycle/sec. A four phase clock is used.</td>
<td></td>
</tr>
<tr>
<td>Arithmetic mode</td>
<td>Serial</td>
<td></td>
</tr>
<tr>
<td>Timing</td>
<td>Synchronous</td>
<td></td>
</tr>
</tbody>
</table>

Operation Storage and arithmetic processing are serial. Input-output external control are concurrent with arithmetic operations. In addition to the normal complement of operations, the
operations of summation, accumulation, overflow-check, justification, shift, and file are also included.

**STORAGE**

<table>
<thead>
<tr>
<th>Media</th>
<th>Words</th>
<th>Digits</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury Delay Line</td>
<td>512</td>
<td>24,576</td>
<td>46-384</td>
</tr>
</tbody>
</table>

There is provision for up to 4,096 words of high speed storage. In addition, the computer has provision for the attachment of many multi-channel magnetic tape or wire units, and a magnetic drum. These would operate concurrently with computation operations.

**INPUT**

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard</td>
<td>Manual</td>
</tr>
<tr>
<td>Paper Tape Reader</td>
<td>10 char/sec</td>
</tr>
<tr>
<td>Magnetic Wire</td>
<td>3,500 dig/sec</td>
</tr>
</tbody>
</table>

Keyboard and punched paper tape reader is a Flexowriter. Alpha-numerical operation is utilized. There is provision for the attachment of a wide variety of input devices that would operate concurrently with computation. There is also a one-word addressable switch memory via a serializer unit.

**OUTPUT**

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typewriter (Flexowriter)</td>
<td>10 alphanumeric char/sec</td>
</tr>
<tr>
<td>CRT Display Unit</td>
<td>2,000 wordsa/sec</td>
</tr>
<tr>
<td>Magnetic Wire</td>
<td>3,500 dig/sec</td>
</tr>
</tbody>
</table>

There is provision for the attachment of a wide variety of output devices that would operate concurrently with computation.

**CIRCUIT ELEMENTS Entire System**

| Tubes                  | 900       |
| Tube types             | 90% are 1 type |
| Crystal diodes         | 24,500    |
| Separate cabinets      | 2         |

There are 524 tubes in the central computer and 350 in the storage unit. The central computer utilizes 21,500 crystal diodes. The central computer has two basic types of package. One type contains tube amplifiers and diode gates. The other type contains delay lines and diode gates. There are 524 tube packages and 251 delay-line packages.

**CHECKING FEATURES**

Fixed
Odd - even parity check on storage.

Optional
Automatic program jump or print-outs are optional upon detection of a memory error. Also available for program checking are a wide variety of automatic monitoring operations for loading and printing out of internal storage locations and substituting new instructional addresses. Each word is checked as it is read from the memory. A real-time clock periodically initiates a storage scan which checks the entire storage.

**POWER, SPACE AND WEIGHT**

| Power, computer       | 12 KW, 20 KVA |
| Power, air cond.      | 35 KVA        |
| Space, computer and storage | 270 cu. ft. |
| Space, air cond.      | 750 cu. ft.   |
| Capacity, air cond.   | 18 Tons       |

There are two trailer vans. Van No. 1 contains the control console, input-output, computer, storage, and 12 Tons of refrigeration capacity. Its internal dimensions are approximately 39 x 7 x 9 feet and weighs about 12 tons. Van No. 2 contains DC power supplies, 6 Tons of refrigeration capacity, and 1700 cubic feet of spare space. This van also has internal dimensions of 39 x 7 x 9 feet. It weighs 8 tons.

**PRODUCTION RECORD**

Produced 1
Operating 1

The DYSEAC was designed and constructed by the Electronic Computer Laboratory of the National Bureau of Standards as part of a development program under the sponsorship of the Department of Defense. It was delivered to the Signal Corps in May, 1954.

**RELIABILITY AND OPERATING EXPERIENCE**

Acceptance test passed in April 1954.

**ADDITIONAL FEATURES AND REMARKS**

For further information on this system see
Transactions of the IRE-PEC, Vol. EC-3, No. 2, June 1954

Two counter-registers are provided for program sequencing. Each counter holds a twelve-binary-digit address. The coder may select the address in either counter as the address of the next instruction to be performed. Also, either counter-register can furnish the base number for relative addresses.

Major design emphasis was placed on versatility of control facilities and on latitude for expansion of the installation. The versatility is achieved by (1) the concurrent input-output property, (2) a self-regulation property which allows the external environment to automatically control the pace of the internal work program, (3) an interruption property which enables the machine to handle unscheduled job assignments which originate externally without advance notice and must be executed as soon as possible, and (4) the preceding three properties acting in concert enable the machine to be employed as a control element in a generalized feedback loop.