**APPLICATIONS**

Ballistics, scientific calculations.

**NUMERICAL SYSTEM**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal number system</td>
<td>Bin coded dec</td>
</tr>
<tr>
<td>Decimal digits per word</td>
<td>16 + sign</td>
</tr>
<tr>
<td>Decimal digits per instruction</td>
<td>16</td>
</tr>
<tr>
<td>Instructions per word</td>
<td>1</td>
</tr>
<tr>
<td>Instructions decoded</td>
<td>13</td>
</tr>
<tr>
<td>Arithmetic system</td>
<td>Fixed point</td>
</tr>
<tr>
<td>Instruction type</td>
<td>Three address</td>
</tr>
<tr>
<td>Number range</td>
<td>0 to $10^{16}$</td>
</tr>
</tbody>
</table>

**ARITHMETIC UNIT**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Microsec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add (Incl. stor. access)</td>
<td>4,400</td>
</tr>
<tr>
<td>Milt (Incl. stor. access)</td>
<td>13,200</td>
</tr>
<tr>
<td>Construction</td>
<td>Vacuum tubes</td>
</tr>
</tbody>
</table>

**Basic pulse repetition rate**

30 Kc/sec

**Arithmetic mode**

Serial

**Timing**

Synchronous

**Operation**

Sequential

System operates on a 30 Kc/sec clock. Storing of result overlapped with reading of next operands.

**STORAGE**

<table>
<thead>
<tr>
<th>Media</th>
<th>Words</th>
<th>Digits per word</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Drum</td>
<td>150</td>
<td>16</td>
<td>4,400</td>
</tr>
<tr>
<td>Magnetic Drum</td>
<td>200</td>
<td>16</td>
<td>4,400</td>
</tr>
<tr>
<td>Magnetic Drum</td>
<td>4,000</td>
<td>16</td>
<td>80,000</td>
</tr>
<tr>
<td>Magnetic Drum</td>
<td>4,000</td>
<td>16</td>
<td>4,400</td>
</tr>
</tbody>
</table>

The drums are used for the storage of constants, the storage of variables, for ten/twenty words per access, and the storage of instructions, respectively.
INPUT

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Tape</td>
<td>5 words/sec</td>
</tr>
</tbody>
</table>

Eight units used.

OUTPUT

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Tape</td>
<td>5 words/sec</td>
</tr>
</tbody>
</table>

Eight units used. Off-line printing from tape is available.

CIRCUIT ELEMENTS ENTIRE SYSTEM

<table>
<thead>
<tr>
<th>Tubes</th>
<th>5,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube types</td>
<td>6</td>
</tr>
<tr>
<td>Crystal diodes</td>
<td>1,500</td>
</tr>
<tr>
<td>Separate cabinets</td>
<td>2</td>
</tr>
</tbody>
</table>

CHECKING FEATURES

<table>
<thead>
<tr>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicate information on tape</td>
</tr>
<tr>
<td>Illegitimate character check</td>
</tr>
<tr>
<td>Parity check on instruction words</td>
</tr>
<tr>
<td>Optional Identity check on operand registers</td>
</tr>
</tbody>
</table>

POWER, SPACE AND WEIGHT

| Power, computer      | 40 kW        |
| Space, computer      | 2,400 sq. ft.|

Space, air cond. 30 cu. ft. 400 sq. ft.
The 2,400 sq. ft. includes the maintenance area.
Capacity, air cond. 30 Tons

PRODUCTION RECORD

| Produced | 1 |
| Operating| 1 |

COST, PRICE AND RENTAL RATE

Approximate cost of basic system $600,000.
Approximate cost of additional equipment $50,000.

PERSONNEL REQUIREMENTS

<table>
<thead>
<tr>
<th>Daily Operation</th>
<th>Engineers</th>
<th>Tech and Operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8 Hour shift</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>3-8 Hour shifts</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

RELIABILITY AND OPERATING EXPERIENCE

Operating ratio (Good/Attempted to run) 0.80
Figures based on period January 1955 to December 1955.
System in operation since January 1951.

ADDITIONAL FEATURES AND REMARKS

Instructions and numbers are stored in separate storage units. Instruction tape preparation machine automatically inserts certain subroutines.
APPLICATIONS

Manufacturer
General purpose computer for scientific-engineering-research and business-industrial-financial applications.
Data reduction, aircraft structural data
Engineering design calculation
Fractionation-parameter variation for increased profit
Design calculations
Ray tracing problems
Mass spectrometer computation, thermodynamic studies, gas network distribution analysis, power load distribution problems

Pressure, flow, stress, heat-transfer problems

Government Sample
David Taylor Model Basin ALWAC-III
Wind tunnel data reduction and allied research problems. (This machine model is no longer in production in favor of an improved model.)

Industrial Sample
Southwestern Computing Service
Manufacturing production scheduling and inventory control, engineering and business data reduction problems. Scientific computing.

Frequently theoretical problems dealing with various phases of wind tunnel testing are run on the machine. The computer is able to keep pace with the problems and data.
**NUMERICAL SYSTEM**

- **Manufacturer**
- **Internal number system**: Binary
- **Binary digits per word**: 32 plus sign
- **Binary digits per instruction**: 16
- **Instructions per word**: 2, 3, or 4
- **Instructions decoded**: 75
- **Arithmetic system**: Fixed point
- **Instruction type**: One address
- **Number range**: \((2^{35} - 1)\)

The number range is equivalent to ± 4, 294, 967, 295. Both alphabetical and numeric characters are permissible. Of the 16-bits devoted to an instruction, 8 are for address and 8 are for command. In addition to the 75 instructions (commands) decoded, there are several variations depending upon auxiliary equipment. Floating point may be programmed, the fixed point arithmetic system may be either integral or fractional. A "float command" provides simplified binary scaling. Either two or four operations per word is possible. The program is stored on a magnetic drum.

**Government Sample**
David Taylor Model Basin ALWAC-III

Some orders do not require an address, but the computer is basically a one address system. An instruction consists of an order and an address (16 binary digits) or an order (8 binary digits). Since the computer follows orders from the first syllable (4 per word) of each of 8 words before following orders from the second syllable, each word could have 4 addresses, 1 order and 3 addresses, 2 and 2, 3 and 1 or 4 orders. The number of instructions per word may be 0, 1, 2, 3, 4, depending on order and address combination.

**ARITHMETIC UNIT**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Microsec</td>
<td>Microsec</td>
</tr>
<tr>
<td>Add time</td>
<td>1,000 or 9,000</td>
<td>500</td>
</tr>
<tr>
<td>Mult time</td>
<td>17,000 or 25,000</td>
<td>16,500</td>
</tr>
<tr>
<td>Div time</td>
<td>17,000 or 25,000</td>
<td>16,500</td>
</tr>
<tr>
<td>Construction</td>
<td>Vacuum tubes and germanium diodes</td>
<td></td>
</tr>
<tr>
<td>Arithmetic mode</td>
<td>Serial</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Timing</td>
<td>Synchronous</td>
<td>Sequential</td>
</tr>
</tbody>
</table>

Computer may be singly or doubly optimum programmed. Addressing is performed by holding second command in a 500 microsecond recirculating line, permitting an average of 60% optimization. By optimization is meant the use of the faster access times.

**Government Sample**
David Taylor Model Basin ALWAC-III

Operation time excluding storage access time for
this model is 1,000, 32,000 and 32,000 for add, multiply, and divide, respectively.

**STORAGE**

<table>
<thead>
<tr>
<th>Medium</th>
<th>No. of Access</th>
<th>Access Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Drum</td>
<td>32,000 to 16,000</td>
<td>500 or 8,500</td>
</tr>
<tr>
<td>b main</td>
<td>4,096 or 8,192</td>
<td>85,000</td>
</tr>
<tr>
<td>c working</td>
<td>3 1/2</td>
<td>500</td>
</tr>
<tr>
<td>d arith. reg.</td>
<td>3 1/2</td>
<td>500</td>
</tr>
</tbody>
</table>

Remarks: The 8,192 word magnetic drum is optional. The double length A - B accumulator contains 64 bits each half with sign. "A" register also includes one overflow bit. "E" or count-down register for automatic address modification and tallying is 16 bits long. Working storage is composed of four channels of eight 16-word recirculating loops. Each word contains 32 bits plus a sign bit. For a, b, and c above the following remarks apply: a) for block write and one word read, b) for block of 12 words, c) for optimum and double optimum address scheme.

**STANDARD DRUMS**

<table>
<thead>
<tr>
<th>Material, Diameter and Length</th>
<th>Weight</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoa 61 ST 9 5/8&quot; D, 16 13/16&quot; L</td>
<td>35 lb</td>
<td>GE 1/3 hp, 3450 rpm</td>
</tr>
<tr>
<td>Alcoa 61 ST 9 3/4&quot; D, 27 3/4&quot; L</td>
<td>44 lb</td>
<td>Fairbanks Morse 1 hp, 3480 rpm</td>
</tr>
</tbody>
</table>

Overall Length and Weight:
- 32" 125 lb
- 15/16" 27 lb

Head Boreings in Barrel:
- 195

Channels:
- 170 (25 recirc) 314 (28 recirc)

Bit Capacity at 100:
- 390,000
- 740,000

Word Capacity in ALWAC:
- 4,096

Price:
- $5,000
- $ 8,000

In two years of operating experience these drums have proved reliable and have shown no mechanical wear or deterioration of the 0.0015" red oxide magnetic coating.

**SPECIAL DRUMS**

Logistics Research has developed and built for special applications magnetic drums ranging in diameter from 1 inch to 4 feet and in length from 1/2 inch to 40 inches. Quotations and bids for design and production of special drums will be given on request.

Prices f.o.b. Redondo Beach, subject to change.

Logistics read-record heads are designed for use with magnetic drums of digital computing systems.
Center-tapped coil is wound on two ferrite core sections and positioned accurately in the half-inch-diameter barrel by two aluminum washers. The entire assembly is sealed with epon resin.

When the head is used to record close to read heads, a metal washer is inserted in the core end of the barrel, to reduce the cross-talk to a low level. Heads are available for recording and reading both eight and sixteen channels per inch.

**TYPICAL OPERATING CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Recording System: NRE</th>
<th>Dimensions: 1-1/2&quot; by 1/2&quot; diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum Surface Speed: 1400&quot; per second</td>
<td>Track Width: .050&quot; and .100&quot;</td>
</tr>
<tr>
<td>Writing Current: 70 ma.</td>
<td>Gap Width: .003&quot;</td>
</tr>
<tr>
<td>Pulse Density: 50 pulses per inch</td>
<td>Gap Material: Brass</td>
</tr>
<tr>
<td>Head to Drum Spacing: 0.001&quot;</td>
<td>Winding: 500 turns center-tapped, wound to customer specification.</td>
</tr>
</tbody>
</table>


These heads have proved trouble-free in ALMAC computing equipment during intermittent and continuous service.

**OUTPUT**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper tape</td>
<td>60 bin coded dec or hex char/sec</td>
</tr>
<tr>
<td>Magnetic tape</td>
<td>10,000 hexadecimal char/sec</td>
</tr>
</tbody>
</table>

**INPUT**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Graph Plotter-Follower</td>
<td>Commercially Available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plotter $2250.00; Plotter with coupling unit for DDA (Bendix D-12, CRC 105 or Maddida 44A) in relay rack mounting, $2700.00; in console type cabinet, $3200.00. Plotter-Follower with coupling unit for DDA (Bendix D-12, CRC 105, or Maddida 44A) $5700.00; Plotter-Follower three dimensional $6500.00.</td>
</tr>
</tbody>
</table>

**Electrical Impulses on 4 Terminals for x and y from Bendix D-12, CRC 105, Maddida 44A or other compatible Digital Differential Analyzers or pulse generating equipment.**

**Presentation:**

- 12" x 18" ink plot and up to 20 steps per second in 4 directions. Increment .01" standard, 1 64" available. Ball point pen trace for carbons or stencils.

**Plotter Output:**

- Photoelectric light gun follows any continuous line up to infinite slope of .02" minimum width. Will accept x value and determine corresponding y value. Couples to any digital differential analyzer.
- Stepping Rate: 20 steps per second.
- Accuracy: .01" step increments without cumulative error.
- Size: 18" x 28" x 37" including console.

Government Sample

David Taylor Model Basin ALMAC-III system uses keyboard and paper tape input at 10 dec dig/sec.
Type: General purpose Table-Type Plotter-Follower
Commercially Available:
Presently in final development; 6 months delivery.
Input:
Will accept inputs from punched paper tape, edge punched cards, IBM cards or manual keyboard.
Output:
As follower will punch IBM cards, edge-punched cards, or paper tape. Can be tied into Digital Differential Analyzer. Analog output is also available.

Plotter Presentation:
Plotter converts x and y coordinates of each point presented as parallel binary coded decimal digits, into their analog equivalent in 01" steps on a 24" x 36" table chart. Method can be a straight point to point line drawing, or a set of printed symbols for parameter studies. 24" wide roll chart of any length can be substituted as accessory, if x coordinate increment is uniform for each chart. Increment can be varied between charts.

Follower Presentation:
Tracks any continuous curve, on a line of .02" thickness or greater, on a coordinate chart and including infinite slopes.

Speed:
Plotter: Directions: Maximum travel speed between points 10 inches/second. Points per second limited by travel time and data input time.
Size:
Mounted in console 42" x 62" x 42".

Government Sample
David Taylor Model Basin ALWAC-III
Input to this system includes electric typewriters and punched paper tape at a rate of 10 dec dig/sec.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Manufacturer

Tubes
Computer 280
Card Converter 120
Tape Transport 20
Tape Buffer 50

Diodes
Computer 5,000
Card Converter 2,000
Tape Transport 500
Tape Buffer 1,000
Tube Types 4

Separate Cabinets
Computer 3 - 22
Converter 1
Tape Buffer 1
Each Tape Transport 1

Government Sample
David Taylor Model Basin ALWAC-III
This system utilizes 250 tubes, 3,500 diodes, 3 cabinets and 13 different types of plug-in units. Excluding the power supply, the tube types include the 5963, 5067 and the 12AT7.

CHECKING FEATURES

Manufacturer
Fixed

Main storage block transfer. An alarm is set if transfer check fails.
Overflow alarm. An overflow flip-flop is set.

Dividend - divisor check causes overflow flip-flop to set.
Optional
Program checks

Other checks
Magnetic tape has a horizontal parity check. Tape has pretested zones with a block marker pre-recorded at time of tape test. Possibility of tape defect in record area is minimized.

Government Sample
David Taylor Model Basin ALWAC-III
Checking systems utilized include storage verification, overflow, impossible order code, automatic sequencing, and programmed checks.

POWER, SPACE AND WEIGHT

Manufacturer
Power, computer 6.5 - 8 KW
Space, computer 158 cu. ft. 28 sq. ft.
Weight, computer 2200 lbs (3 cabinets)

Power required by auxiliary equipment is additional and is approximately proportional to the number of vacuum tubes. The ambient temperature is 400 - 800F. Each cabinet contains a fan at the base. Air passes through a filter.

Three cabinets require a space of 2.41 by 11.40 by 5.50 ft.

Government Sample
David Taylor Model Basin ALWAC-III
This model requires 5 KW occupies 120 cu. ft., 22.3 sq. ft., consisting of 2 cabinets 28" by 34" by 64" and 1 cabinet 28" x 48" x 64". System weighs 1400 lbs.

PRODUCTION RECORD

Manufacturer
Produced 17
In production Assembly line approximately 3 per month
Operating 17
On order 12
Delivery time 6 Months

Government Sample
David Taylor Model Basin ALWAC-III
Two systems of this model have been built. Models of current production have changed.

COST, PRICE AND RENTAL RATE

Manufacturer
ALWAC III-E Computer
with 4,096 word memory $48,000
8,192 word memory $55,000

Above prices and rates include:
Memory Unit
Arithmetic and Control Unit
Power Supply Unit
Control Panel
Flexewriter Input-Output Unit
(including Tape Punch and Reader)
Interconnecting Cables

ALWAC III-E Computer

Sale
Price
Lease Rate

$48,000
$1,775

$55,000
$2,050
The following equipment (except mobile tester) is required for successful operation and maintenance of an installation:

Spare Parts Kit $3,000 Incl. in above rate

Includes 10% spare plug-in assemblies. (Sale price of this unit for 8,192 word storage is $4,000.)

Recommended Oscilloscope $625 Incl. in above rate

(2M Textronix Type 310) For maintenance, program trouble-shooting and monitoring.

Diode Tester $600 Incl. in above rate

For testing diode plug-in assemblies.

Active Tester $1,000 Incl. in above rate

For testing all plug-in assemblies other than diode.

Mobile Tester $3,000 Not Incl. in above rate

For testing all plug-in assemblies including diodes. This tester combines the ALWAC diode and active testers into one convenient unit with work space, drawer storage, and oscilloscope mounting facilities.


Programming Sheets $20/M "

Daily Performance Reports $12/Doz "

One month supply per book.

Unit: Sale Price: Lease Rate

Auxiliary
Card Converter $19,000 $600

Capable of reading or punching 80 columns of mixed alphabetic and numeric information at 100 cards per minute.

Magnetic Tape Buffer $15,000 $400

Coupling for 16 magnetic tape searching units to ALWAC III-E computer.

Magnetic Tape Searching $10,000 $300

Units

Reads or writes from magnetic tape buffer at 10,000 characters per second. Searches at 100 inches per second. 10-1/2 reel holds 320,000 words on 2,400 feet (of 1/2 inch tape).

High Speed Paper Tape $5,500 $180

Reader and Console

Coupled to ALWAC, permits reading input data from punched paper tape at 200 characters per second.

High Speed Paper Tape $3,700 $125

Punch with Console

Coupled to ALWAC permits punching of output data on paper tape at 60 characters per second.

High Speed Paper Tape $5,700 $290

Reader and Punch combined with Console

Spare Flexowriter Input-

Output Including Tape $4,950 $150

Scanner Unit $500/Flex $15

Connects as many as ten Flexowriters to ALWAC III-E computer.

Remote Control Station $500/Station $15

Used in conjunction with Flexowriter for remote control of ALWAC III-E computer.

Sale Policy

Sale prices above are for the ALWAC III-E computer with the 4,096 word memory, except where noted. Shipping charges are borne by the purchaser. All prices are subject to change without notice. Terms, 20% on shipment, 80% on completion of installation. All Federal, State, and Local taxes are extra.

Lease Policy

These rates apply to a one-shift per day operation. Rates for more than one shift per day will be quoted on inquiry.

Shipping charges and installation charge of $2000 are borne by lessor. Installation charge includes services of a full-time Field Service Engineer for the initial one month period. During this period a 40-hour maintenance course will be presented.

Equipment is leased for one year or more.

Terms, monthly in advance beginning at installation. Fifty per cent of paid rental may at any time be applied to purchase of installed equipment or standard terms.

All Federal, State, and local taxes, if applicable, are extra.

Services

ALWAC III-E

Computer Installation $2,000

Provides for full-time Field Service Engineer for a one-month period. During this period a 40-hour maintenance course will be presented.

Programming Course $600

Provides for 80 hours of Programming instruction at customer's location. No charge is made for this service when course is held at Redondo Beach.

One-Year Maintenance Contract $6,000/Yr.

Provides for scheduled visits and emergency "on-call" service as required, by a Field Service Engineer. The charge for parts and materials will be billed separately.

Resident Engineer $14,000/Yr.

Logistics Research, Inc. will supply a full-time resident engineer capable of machine operation, routine maintenance, special maintenance, and coding. Cost of parts and materials will be billed separately.

Emergency On-Call Service $80/Day

Logistics Research, Inc. will provide special service as required. The charge for transportation will be billed separately. Maximum charge for transportation is 500 miles.

Government Sample

David Taylor Model Basin ALWAC-III

Prices paid for this model, consisting of basic system, punched card input-output, magnetic tape input-output, and high speed paper tape input, output are approximately equal to the prices quoted above.

PERSONNEL REQUIREMENTS

Manufacturer

Tech and Operators

Daily Operation

1-8 Hour shift 1
2-8 Hour shifts 2
3-8 Hour shifts 3

Operator runs periodic maintenance check

Government Sample

David Taylor Model Basin ALWAC-III

One operator is used on a full time basis. He operates and does some programming. Remainder of programming is done by his supervisor. The main-
RELIABILITY AND OPERATING EXPERIENCE

Manufacturer
Average error-free running period 80 hours
Good time 570 hours
Attempted to run time 600 hours
Operating ratio (Good/Attempted to run) 0.95
Figures based on period Feb. 1954 to Oct. 1956
Acceptance test June 1954

Government Sample
David Taylor Model Basin AIVAC-III
Average error-free running period 43 hours
Good time 3,250 hours
Assisted to run time 4,065 hours
Operating ratio (Good/Attempted to run) 0.80
Figures based on period 7 June 1954 to 16 Oct. 1956
Acceptance test 7 June 1954

FUTURE PLANS

Manufacturer
An AIVAC 800 Data Processing System has been announced. (See AIVAC 800 System)

Industrial Sample
Oregon State College
Purchase of an AIVAC III-E magnetic drum computer is planned. The system will have an 8,192 word storage unit.

INSTALLATIONS

U.S. Navy David Taylor Model Basin, Aerodynamics Laboratory, Washington, D.C.
Institute of Gas Technology, 17 West 34th Street, Chicago, Illinois
The U.S. Weather Bureau, Weather Records Center, Asheville, North Carolina

Reliance Electric & Engineering Company, 1068-1086 Ithaca Road, Cleveland 10, Ohio
U.S. Navy Aeronautical Structures Laboratory, U.S. Naval Shipyard, Philadelphia, Pennsylvania
Defence Research Board, Canadian Armament, Research & Development Establishment, Valcartier, P.Q., Canada
North American Aviation, Inc., Los Angeles Branch, International Airport, Los Angeles 45, California
National Security Agency, Washington, D.C.
Southwestern Computing Service, 910 South Boston Street, Tulsa, Oklahoma
Adalco Limited, 810 Castle Building, 1410 Stanley Street, Montreal, Canada
Champlin Refining Company, Enid, Oklahoma
Autronic, A.B., Skeppargatan 26, Stockholm, Sweden
Litton Industries, 356 North Foothill Road, Beverly Hills, California

ADDITIONAL FEATURES AND REMARKS

Manufacturer
Automatic dec/binary conversion of integers when input or output thru flexowriter or punch tape equipment.
Scope display of any word in computer.
End-register (B-Box) auto address modification and tallying.
Two extracting commands (A if A+B; A if B+W)
Programmed format control on card output.
Library of 40 utility and function routines, programming and debugging aids. Includes floating point abstraction. Fully annotated. Coding manual and programming text.
Nationwide service organization; 1 field service engineer for each two to three machines.
Instruction courses in programming and maintenance given regularly.
APPLIED PROGRAMS

Data processing for scientific, commercial, and engineering applications.

NUMERICAL SYSTEM

- Internal number system: Bin coded decimal
- Dec digits per word: 12 plus sign
- Dec digits per instruction: 6
- Instructions per word: 2
- Instructions decoded: 50
- Arithmetic system: Fixed point
- Instruction type: One address
- Number range: $(10^{-10} - 1) \times 10^{49}$ to $(10^{-10} - 1) \times 10^{50}$

Floating point is an optional feature. The computer will handle alpha-numeric information.

ARITHMETIC UNIT

- Add time (Incl. stor. access): 96 microsec
- Mult time (Incl. stor. access): 120 - 300
- Div time (Incl. stor. access): 200 - 500

Storage access time is 80 microseconds. Times given above includes picking up the next command.

- Construction: Vacuum tubes, transistors and magnetic cores
- Arithmetic mode: Parallel
- Timing: Synchronous and asynchronous
- Operation: Sequential and concurrent

The system is synchronous in that most components are synchronized to a standard clock. The system is asynchronous in that arithmetic operations do not require a fixed time, but are a function of their complexity up to a maximum time as given above.
Arithmetic operation is concurrent. Storage transfer is made by four concurrent transfers of sequential bits. All functions (calculations plus input-output) can be performed simultaneously.

**STORAGE**

<table>
<thead>
<tr>
<th>Media</th>
<th>Words</th>
<th>Digits</th>
<th>Microsec Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Core</td>
<td>500/unit</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Magnetic Drums</td>
<td>$120 \times 10^6$</td>
<td>16,000</td>
<td></td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>$240 \times 10^7$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Magnetic core storage choices are 0, 100, 200, or 500 words. (Can be supplemented by buffer core storage up to 5,000 words). Magnetic drums of 10,000 or 20,000 word capacity are available. (Can be supplemented with up to 500 drums). The magnetic tape operates at a speed of 20,000 char/sec and 150 inches/sec.

**INPUT**

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard (Flexowriter)</td>
<td>Manual</td>
</tr>
<tr>
<td>Paper Tape (Flexowriter)</td>
<td>10 char/sec</td>
</tr>
<tr>
<td>Paper Tape (Hi-Speed)</td>
<td>200 char/sec</td>
</tr>
<tr>
<td>Punched Cards</td>
<td>100 cards/min</td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>20,000 char/sec</td>
</tr>
</tbody>
</table>

The computer will accept information at the rate of 90,000 char/sec on paper and magnetic tape. It will accept card information at the rate of 3,600 cards/min.

**OUTPUT**

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typewriter (Flexowriter)</td>
<td>10 char/sec</td>
</tr>
<tr>
<td>Hi-Speed Paper Tape</td>
<td>60 char/sec</td>
</tr>
<tr>
<td>Punched Cards</td>
<td>100 cards/min</td>
</tr>
<tr>
<td>Magnetic Tape</td>
<td>20,000 char/sec</td>
</tr>
<tr>
<td>Hi-Speed Printer</td>
<td>2,400 lines/min</td>
</tr>
</tbody>
</table>

Computer can discharge information at the rate of 90,000 char/sec on paper tape and magnetic tape. It will discharge card information at the rate of 2,400 cards/min.

It is possible to use a second ALMAC 800 as an input-output unit.

**CIRCUIT ELEMENTS ENTIRE SYSTEM**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubes</td>
<td>40</td>
</tr>
<tr>
<td>Crystal diodes</td>
<td>11,000</td>
</tr>
<tr>
<td>Magnetic cores</td>
<td>1,500</td>
</tr>
<tr>
<td>Transistors</td>
<td>500</td>
</tr>
<tr>
<td>Separate cabinets</td>
<td>Unit housed in one main cabinet.</td>
</tr>
</tbody>
</table>

**CHECKING FEATURES**

Magnetic tape and magnetic drum input and output is checked.

**POWER, SPACE AND WEIGHT**

Power, computer 10 kW

The main console is 45 in. high by 8 ft. long by 30 in. deep.

The auxiliary units, which may be stacked, are 36 in. high by 24 in. wide by 24 in. deep.

System operates at not higher than $100^\circ$ F.

**INSTALLATIONS**

Logistics Research, Inc.
141 S. Pacific Avenue
Redondo Beach, California

**ADDITIONAL FEATURES AND REMARKS**

5 "P" boxes included.

Independent buffering at all input-output devices.
Complete versatility of system design.
Up to 10 input-output combinations
Up to 100 magnetic tape units
Up to 500 magnetic drum units
### APPLICATIONS

General scientific

### NUMERICAL SYSTEM

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal number system</td>
<td>Binary</td>
</tr>
<tr>
<td>Binary digits per word</td>
<td>40</td>
</tr>
<tr>
<td>Binary digits per instruction</td>
<td>20</td>
</tr>
<tr>
<td>Instructions per word</td>
<td>2</td>
</tr>
<tr>
<td>Arithmetic system</td>
<td>Fixed point</td>
</tr>
<tr>
<td>Instruction type</td>
<td>One address</td>
</tr>
<tr>
<td>Number range</td>
<td>$-1 \leq x &lt; +1$ in multiples of $2^{-39}$</td>
</tr>
</tbody>
</table>

### ARITHMETIC UNIT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Add time</td>
<td>50 microsec</td>
<td>18 microsec</td>
</tr>
<tr>
<td>Malt time</td>
<td>1,600 microsec</td>
<td>1,500 microsec</td>
</tr>
<tr>
<td>Div time</td>
<td>1,600 microsec</td>
<td>1,500 microsec</td>
</tr>
<tr>
<td>Construction</td>
<td>Vacuum tubes</td>
<td></td>
</tr>
<tr>
<td>Arithmetic mode</td>
<td>Parallel</td>
<td></td>
</tr>
<tr>
<td>Timing</td>
<td>Asynchronous</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>Sequential</td>
<td></td>
</tr>
</tbody>
</table>

### STORAGE

<table>
<thead>
<tr>
<th>Media</th>
<th>Words</th>
<th>Digits</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic (CRT)</td>
<td>512</td>
<td>40/word</td>
<td>35</td>
</tr>
</tbody>
</table>

### INPUT

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Tape</td>
<td>200 char/sec</td>
</tr>
</tbody>
</table>

This is a Ferranti reader.

### OUTPUT

<table>
<thead>
<tr>
<th>Media</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Tape</td>
<td>30 char/sec</td>
</tr>
</tbody>
</table>

### CIRCUIT ELEMENTS ENTIRE SYSTEM

- Tubes: 2,700
- Tube types include the 6J6, 5844, 5670, 5687, 12AU7, 1NAT7, and 6AL0.

### CHECKING FEATURES

Optional
All codes must contain coded check routines as an operational policy.

### POWER, SPACE AND WEIGHT

- Power, computer: 22 kW
- Air conditioned by building system.

### PRODUCTION RECORD

- Produced: 1
- Operating: 1

See IAS Computer.

### PERSONNEL REQUIREMENTS

<table>
<thead>
<tr>
<th>Daily Operation</th>
<th>Engineers</th>
<th>Tech and Operators</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>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Above figures for two 8-hour shifts are totals.

### RELIABILITY AND OPERATING EXPERIENCE

- Average error-free running period: 2 hours
- Good time: 6 hours/day
- Attempted to run time: 8 hours/day
- Operating ratio (Good/Attempted to run): 0.75
- Figures based on period January 1951 to November 1956.
- Acceptance test: 1950

### INSTALLATIONS

Argonne National Laboratory, Box 299, Lemont, Illinois

### ADDITIONAL FEATURES AND REMARKS

System is a member of the family of machines originated by the Institute for Advanced Study (See IAS Computer).