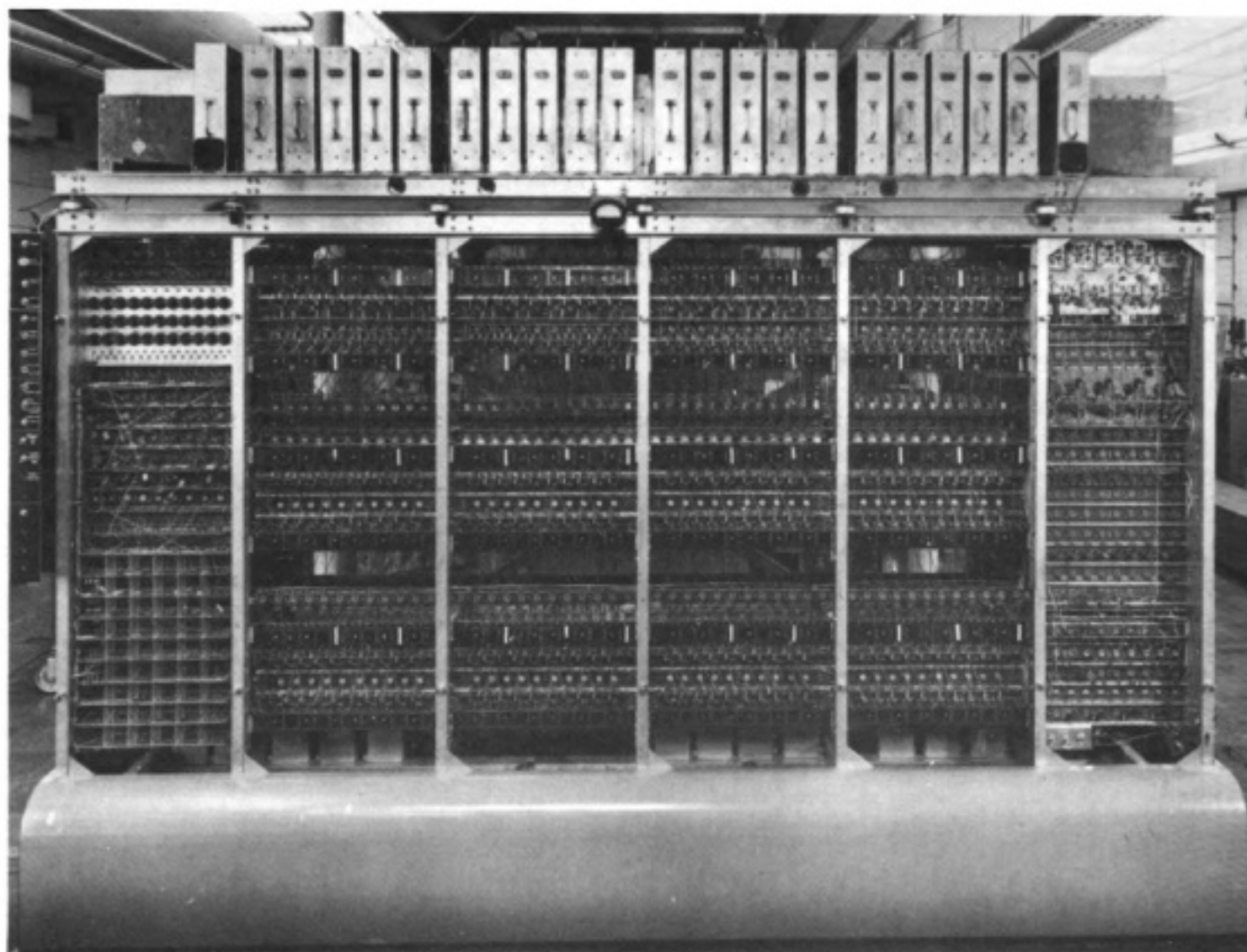


MANIAC I

Mathematical Analyzer Numerical Integrator and Computer

MANUFACTURER

University of California
Los Alamos Scientific Laboratory



Picture by University of California, Los Alamos Scientific Laboratory

APPLICATIONS

Physical, mathematical, chemical, astronomical and biological research.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	40
Binary digits per instruction	8
Instructions per word	2
Instructions decoded	36
Binary digits per instruction not decoded	2
Instructions used	35
Arithmetic system	Fixed point
Instruction type	One address
Number range	$-1 \leq n < 1$

ARITHMETIC UNIT

Add time (exclud. stor. access)	80	Microsec
Mult time (exclud. stor. access)	1,000	
Div time (exclud. stor. access)	1,000	
Construction	Vacuum tubes	
Arithmetic mode	Parallel	
Timing	Asynchronous	
Operation	Concurrent	

STORAGE

Media	Words	Microsec Access
Electrostatic (CRT)	1,024	8 - 16
Magnetic Drum	10,000	50 words in 83,000

INPUT

Media	Speed
Paper Tape	1,024 words in 48 seconds
Magnetic Tape	1,024 words in 45 seconds

OUTPUT

Media	Speed
Printer (Teletype)	36 words/min
Printer (Anelex)	3,600 words/min
Paper Tape	81 words/min
Magnetic Tape	1,024 words in 45 seconds

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	2,400
Tube types	7
Crystal diodes	500
Different plug-in units	1 Electrostatic 6 Magnetic drum
Separate cabinets	4

Type 2BP1 cathode ray tubes (Williams) are used in the storage unit.

CHECKING FEATURES

Fixed
Check sum on filling storage by paper tape and magnetic tape.
Check sum on filling magnetic drum.

POWER, SPACE AND WEIGHT

Power, computer	35 KW
Space, computer	128 cu ft 20 sq ft
Capacity, air cond.	10 Tons

PRODUCTION RECORD

Produced	1
Operating	1

COST, PRICE AND RENTAL RATE

Approximate cost of basic system \$250,000.
Approximate cost of high speed printer and magnetic drum \$48,000.
Prices include development, construction and overhead.

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech and Operators
Two 8-Hour shifts	4	12

All the operators are programmers.

RELIABILITY AND OPERATING EXPERIENCE

Average error-free running period	5 hours
Good time	11,493 hours
Attempted to run time	12,399 hours
Operating ratio (Good/Attempted to run)	0.93

Acceptance test March 1952.

INSTALLATIONS

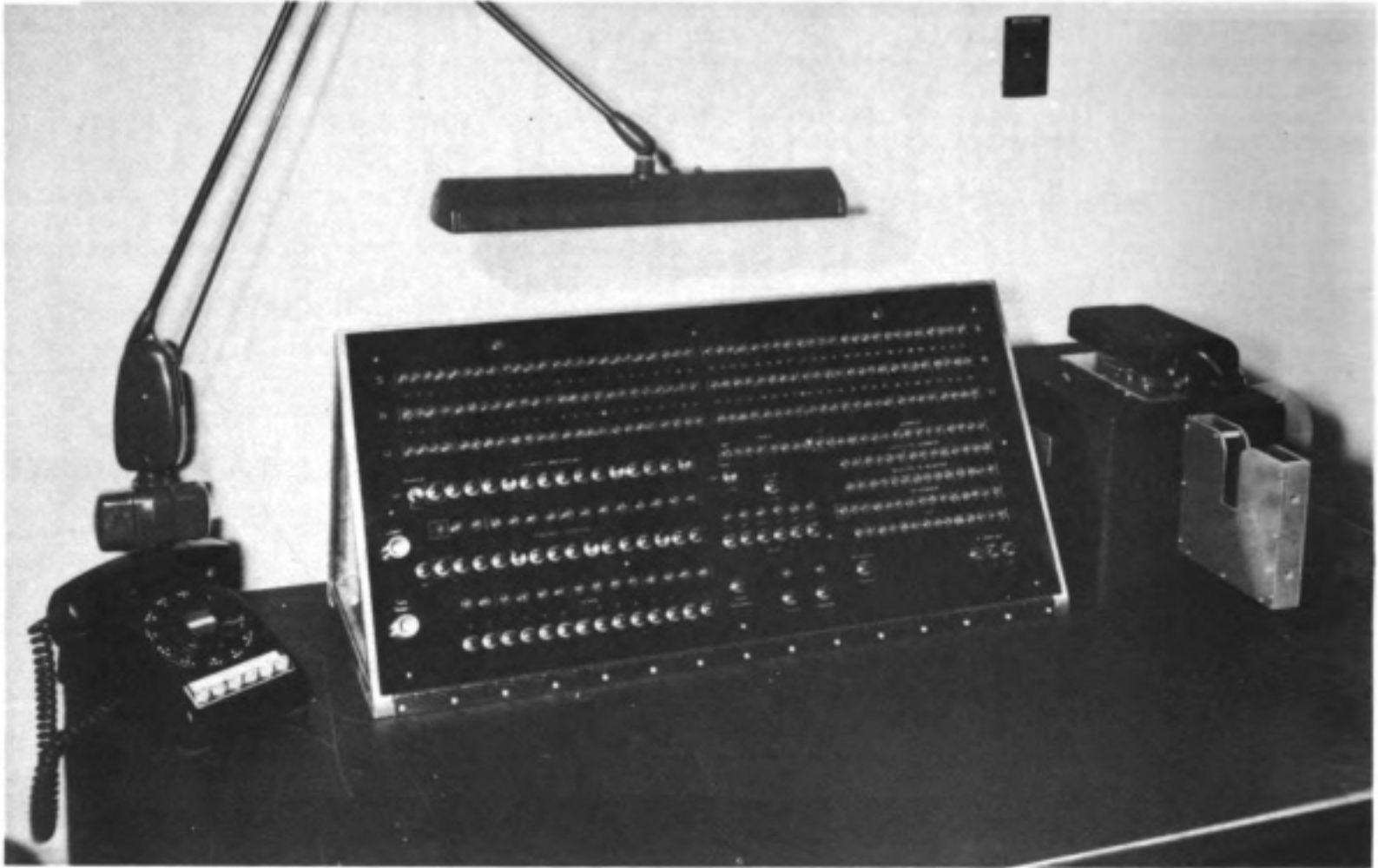
University of California
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

MANIAC II

Mathematical Analyzer Numerical Integrator and Computer

MANUFACTURER

University of California
Los Alamos Scientific Laboratory



Picture by University of California, Los Alamos Scientific Laboratory

APPLICATIONS

Physical research

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	48 plus 1 parity check
Binary digits per instruction	24
Instructions per word	2
Instructions decoded	81
Arithmetic system	Floating and fixed
Instruction type	One address, computer Two address, mag tape
Number range	
Floating point	$2^{-155} \leq n < 2^{112}$; base is 2^{16}
Fixed point	$-1 \leq n < 1$
Floating point	
Base	2^{16}
Exponent	Sign plus 3 bits
Fraction	Sign plus 43 bits
Fixed point	Sign plus 43 bits

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	16	6
Mult time	160	150
Div time	400	390
Construction	Vacuum tubes	
Rapid access word registers	3	
Basic pulse repetition rate	1 Mc/sec	

Arithmetic mode	Parallel
Timing	Asynchronous
Operation	Sequential
Add 5 microseconds to above operation times for access to instructions.	

STORAGE

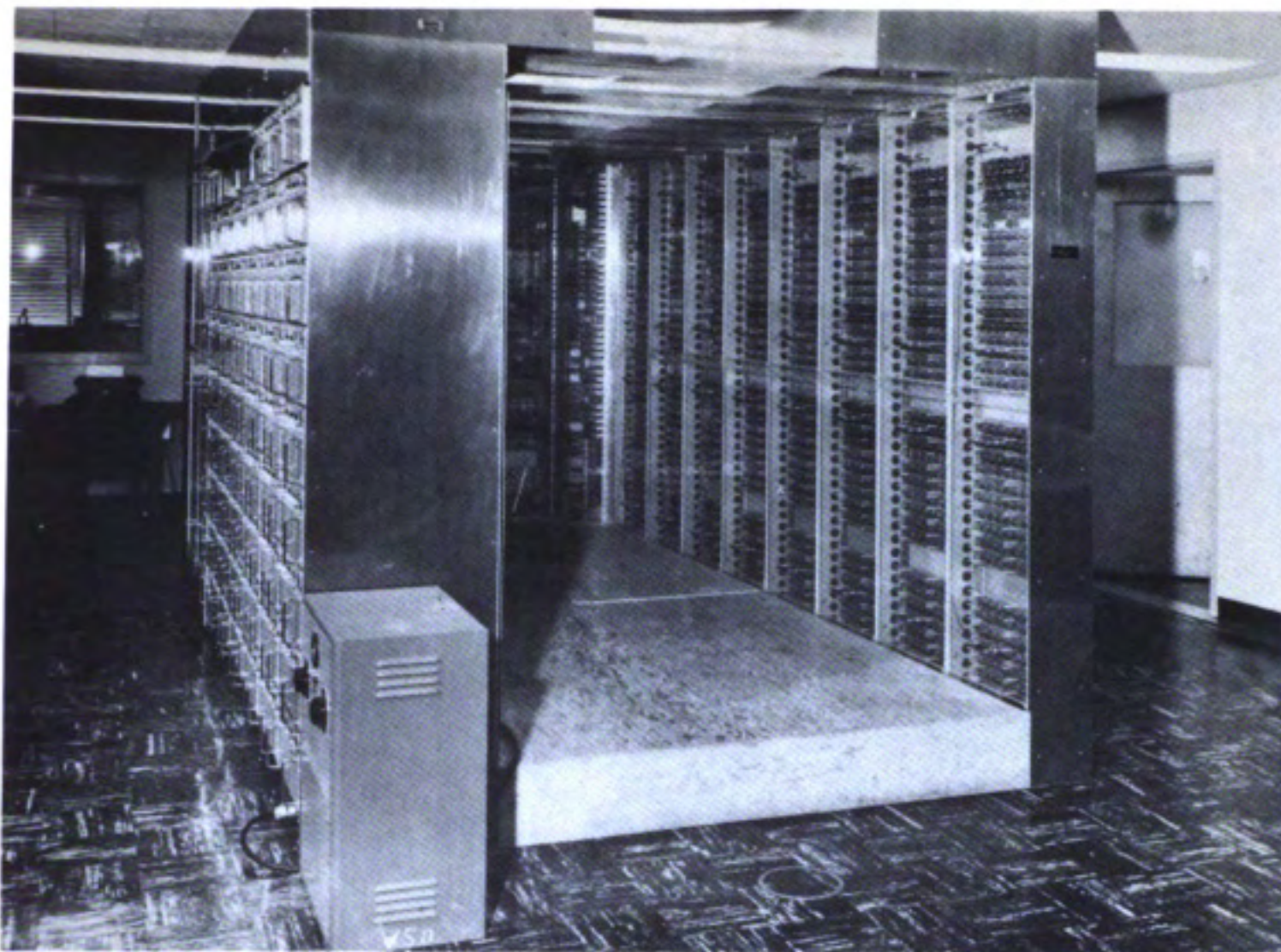
Media	Words	Microsec access
Electrostatic (CRT)	12,888	10 (avg)
Magnetic Tape (2)	640,000	15,000 (starting) 1,000/word
Total electrostatic storage is 631,512 binary digits. Barrier grid type cathode ray tubes are used. Magnetic tape will search while machine is computing.		

INPUT

Media	Speed
Paper Tape (Photoelectric)	18 words/sec
Magnetic Tape	1,000 words/sec
Keyboard (Flexowriter)	Manual

OUTPUT

Media	Speed
Typewriter (Flexowriter)	8.55 words/sec
High Speed Paper Tape (Teletype)	4.28 words/sec
Synchroprinter	720 char/sec 48 char/line 15 lines/sec 100 space lines/sec



Picture by University of California, Los Alamos Scientific Laboratory

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	4,500
Tube types	6
Crystal diodes	2,000
Different plug-in units	1
Separate cabinets	3

95% of the tubes are type 5965.

5% are primarily high power drivers.

The plug-in units are storage units.

CHECKING FEATURES

Parity check on electrostatic storage and magnetic tape.

Load sums for identification

(+) Exponent spill

Overflow

(-) Exponent spill

POWER, SPACE AND WEIGHT

Power, computer	25 KW
Space, computer	580 cu ft 98 sq ft
Space, induction regulator	20 sq ft
Space, power supply	24 sq ft
Capacity, air cond.	20 Tons

PRODUCTION RECORD

Produced 1 (Under construction)

COST, PRICE AND RENTAL RATE

Approximate cost of basic system \$225,000.

Cost includes fast printer and 2 magnetic tape units.

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech and Operators
Two 8-Hour shifts	4	20

Some operation is on a three 8-hour shift basis.

INSTALLATIONS

University of California
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

ADDITIONAL FEATURES AND REMARKS

3 indexing registers (B registers) for automatic, address modification and cycle counting (independent of arithmetic elements).

Semi-automatic exit from sub-routines.

Large base for floating point operation to increase speed of floating point additions.

"Madcap", Mathematical and Descriptions Coding Assembly Program, will translate a series of logical and algebraic statements into a computer ready code, this will use a seven hole tape, standard coding uses five holds. Tape reader can handle either.

The first picture shows the electrostatic storage unit on the left, the arithmetic unit on the right and the control and input-output in the back.

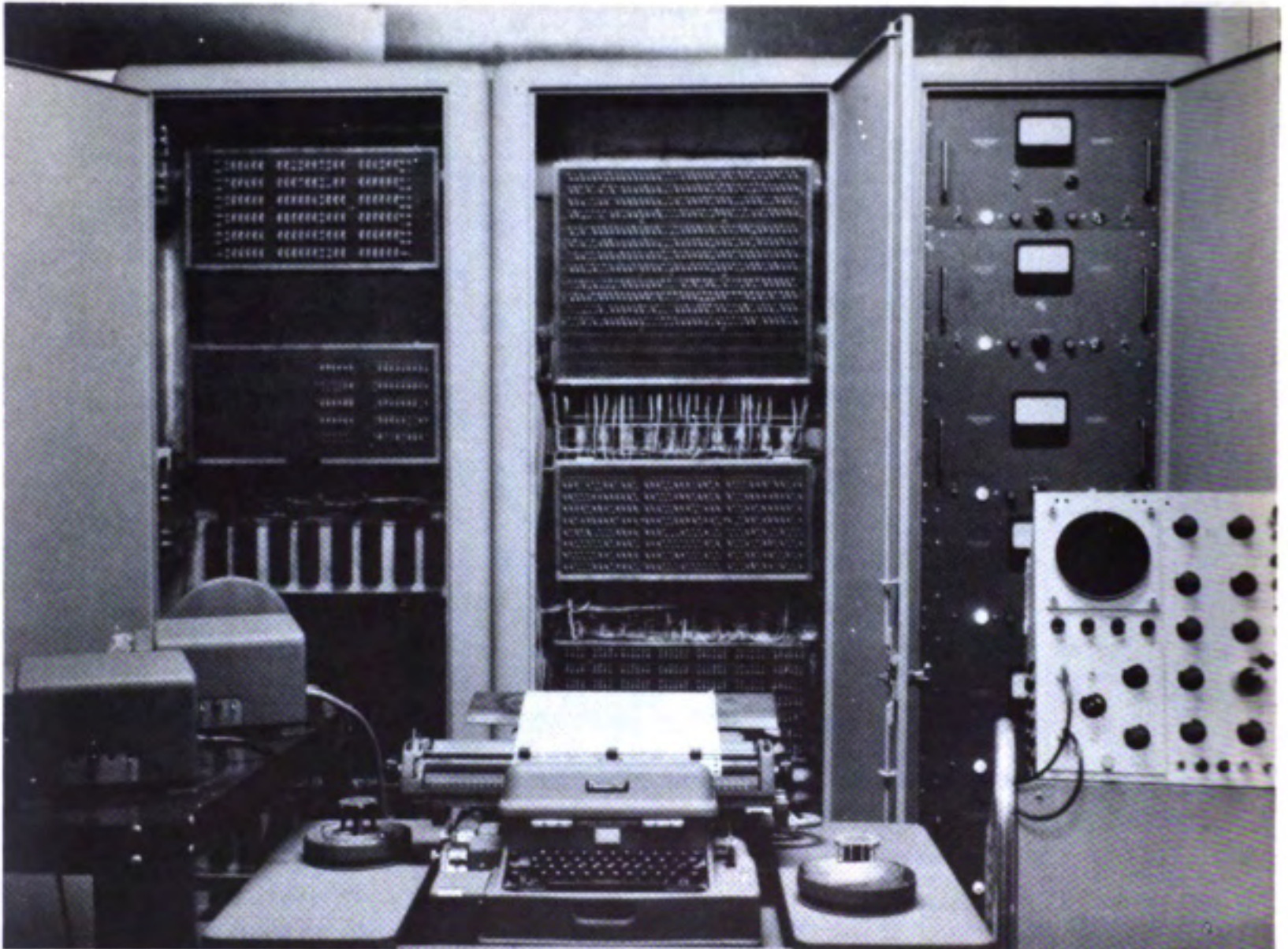
The second picture shows the control panel. The photoelectric tape reader is on the right.

MELLON INSTITUTE

The Mellon Institute Digital Computer

MANUFACTURER

The Mellon Institute of Industrial Research
The University of Pittsburgh



Picture by The Mellon Institute of Industrial Research

APPLICATIONS

Research and development problems.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	64
Binary digits per instruction	16
Instructions per word	4
Instructions decoded	44
Instructions used	37
Arithmetic system	Fixed point
Instruction type	One address
Number range	$\pm (1 - 10^{-18})$

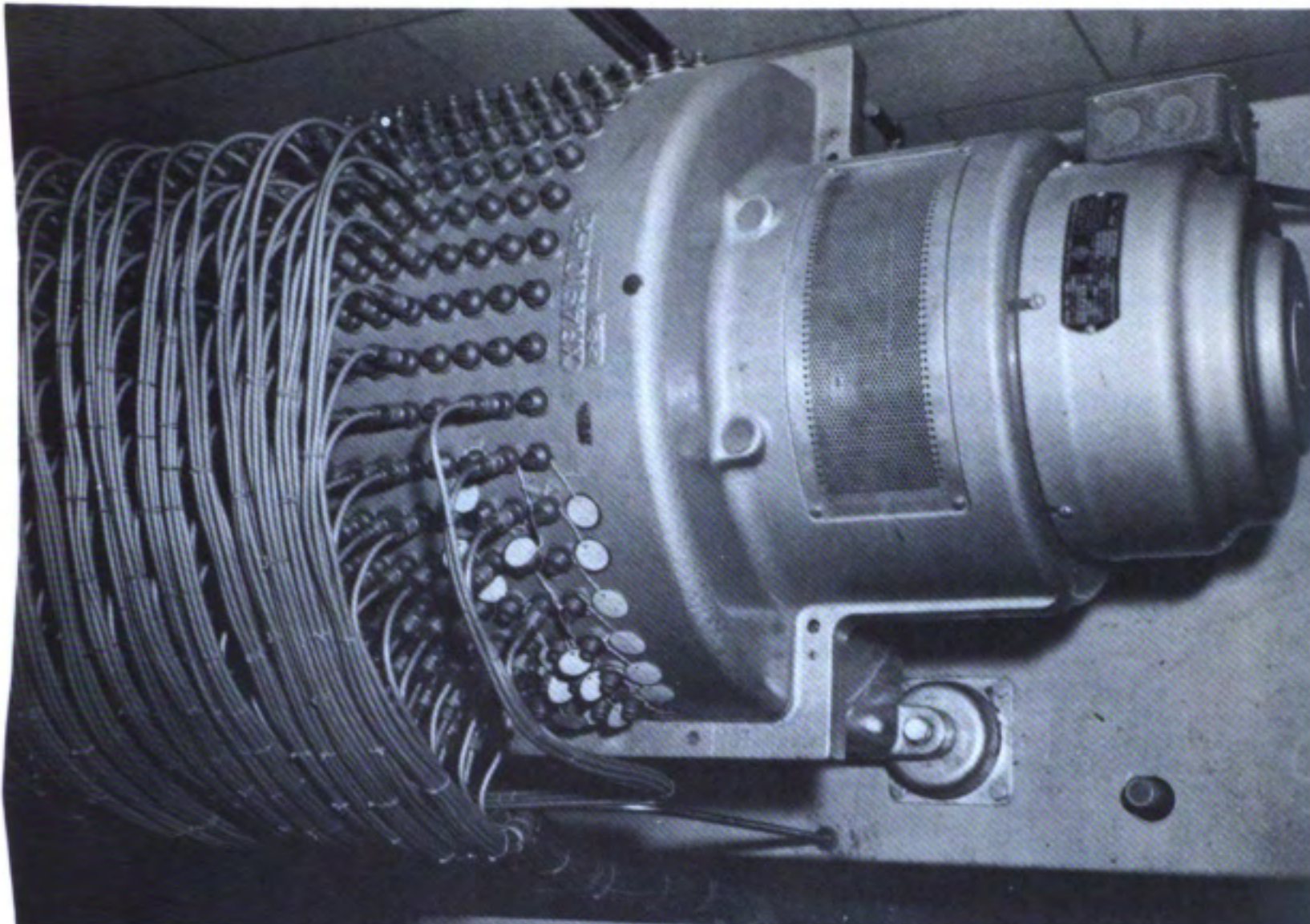
A justify instruction is used to simplify the programming of floating-point operation.

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	50,000	650
Mult time	50,000	
Div time	150,000	
Construction.	Vacuum tubes are used as amplifiers and cathode followers. Diodes are used for logic. Magnetic cores are used as registers.	
Rapid access word registers	3	
Basic pulse repetition rate	100 Kc/sec	
Arithmetic mode	Serial	
Timing	Synchronous	
Operation	Sequential	

PERSONNEL REQUIREMENTS

Daily Operation	Tech and Operators
1-8 Hour shift	2



Picture by The Mellon Institute of Industrial Research

STORAGE

Media	Words	Digits	Microsec Access
Magnetic Drum	16,384	64/word	50,000

The total drum storage is 1,048,576 binary digits.

INPUT

Media	Speed
Paper Tape (Flexowriter)	10 dec dig/sec
Keyboard (Flexowriter)	Manual
Motorized Paper Tape	25 dec dig/sec

OUTPUT

Media	Speed
Paper Tape (Flexowriter)	10 dec dig/sec
Printed Page (Flexowriter)	10 dec dig/sec
Motorized Tape	25 dec dig/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	395
Tube types	10
Crystal diodes	2,300
Magnetic cores	198
Seperate cabinets	4

110 additional tubes are used in the power supply. Approximately 80% of the tubes are of one type.

CHECKING FEATURES

Fixed
Odd-even check on drum transfers.

Optional
Sign check in addition and subtraction operations.
Number size check in divide operation.

POWER, SPACE AND WEIGHT

Power, computer	9.5 KW
Power, air cond.	2.5 KW
Space, computer	120 cu. ft. 18.7 sq. ft.
Space, air cond.	325 cu. ft. 5 sq. ft.
Capacity, air cond.	3 Tons

Computer is 7-1/2 by 2-1/2 by 6-1/2 ft.
Air conditioner is 2 by 2-1/2 by 6-1/2 ft.

PRODUCTION RECORD

Produced 1 Operating 1

ADDITIONAL FEATURES AND REMARKS

The system used in writing numbers on the drum allows the drum to be used for holding the multiplier in the multiply instruction. Therefore, only 2 arithmetic registers are needed in the computer.

MICHIGAN STATE UNIVERSITY

Michigan State University
Digital Computer

Michigan State University of Agriculture and
Applied Science
College of Engineering
Computer Laboratory

APPLICATIONS

Scientific computation

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	2,800
Tube types	18
Separate cabinets	2

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	40
Binary digits per instruction	20
Instructions per word	2
Arithmetic system	Fixed point
Instruction type	One address
Number range	$-1 < n < +1$

POWER, SPACE AND WEIGHT

Power, computer	35 KVA
Power, air cond.	10 KVA

ARITHMETIC UNIT

	Time	Microsec
Add (includ. stor. access)		90
Mult (includ. stor. access)		700
Div (includ. stor. access)		900
Construction	Vacuum tubes	
Arithmetic mode	Parallel	
Timing	Asynchronous	
Operation	Concurrent	

PRODUCTION RECORD

In production	1
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INSTALLATIONS

Computer Laboratory
Michigan State University
East Lansing, Michigan

STORAGE

Media	Words	Digits	Microsec Access
Electrostatic (CRT)	1024	40	18

INPUT

Media	Speed
Paper Tape	300 char/sec

5 hole tape and a sexadecimal system will be used.

OUTPUT

Media	Speed
Tape Punch	60 char/sec
Teletype Printer	100 words/min

ADDITIONAL FEATURES AND REMARKS

This computer is presently under construction. It will utilize the logical system developed by the Institute for Advanced Study. Consequently, it will be similar to the machines in the IAS family of computers. (See IAS Computer.)



Picture by University of Michigan

APPLICATIONS

Scientific calculation; simulation; mathematical research by numerical solution of equations involving simultaneity, complex roots, high order differentials, eigenvalues, eigenvectors, partials, boundary values, calculus of variations.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	44 plus sign
Binary digits per instruction	45
Instructions per word	1
Instructions decoded	19
Instructions used	17
Arithmetic system	Fixed point
Instruction type	Three address
Number range	$0, \pm (2^{-44} \leq n \leq 1-2^{-44})$

A standard machine word contains a sign and 11

decimal or sexadecimal characters.

ARITHMETIC UNIT

	Microsec
Add time (exclud. stor. access)	48
Mult time (exclud. stor. access)	2,208
Div time (exclud. stor. access)	2,208
Construction	Diodes and vacuum tubes
Basic pulse repetition rate	1 Mc/sec
Arithmetic mode	Serial
Timing	Synchronous
Operation	Sequential

STORAGE

Media	Words	Microsec Access
Mercury Delay Line (Technitrol)	512	192(Avg)
Magnetic Drum (ERA)	6,144	536

The drum is used as an auxiliary storage. Average access to the first word on a track is 3,400 micro-