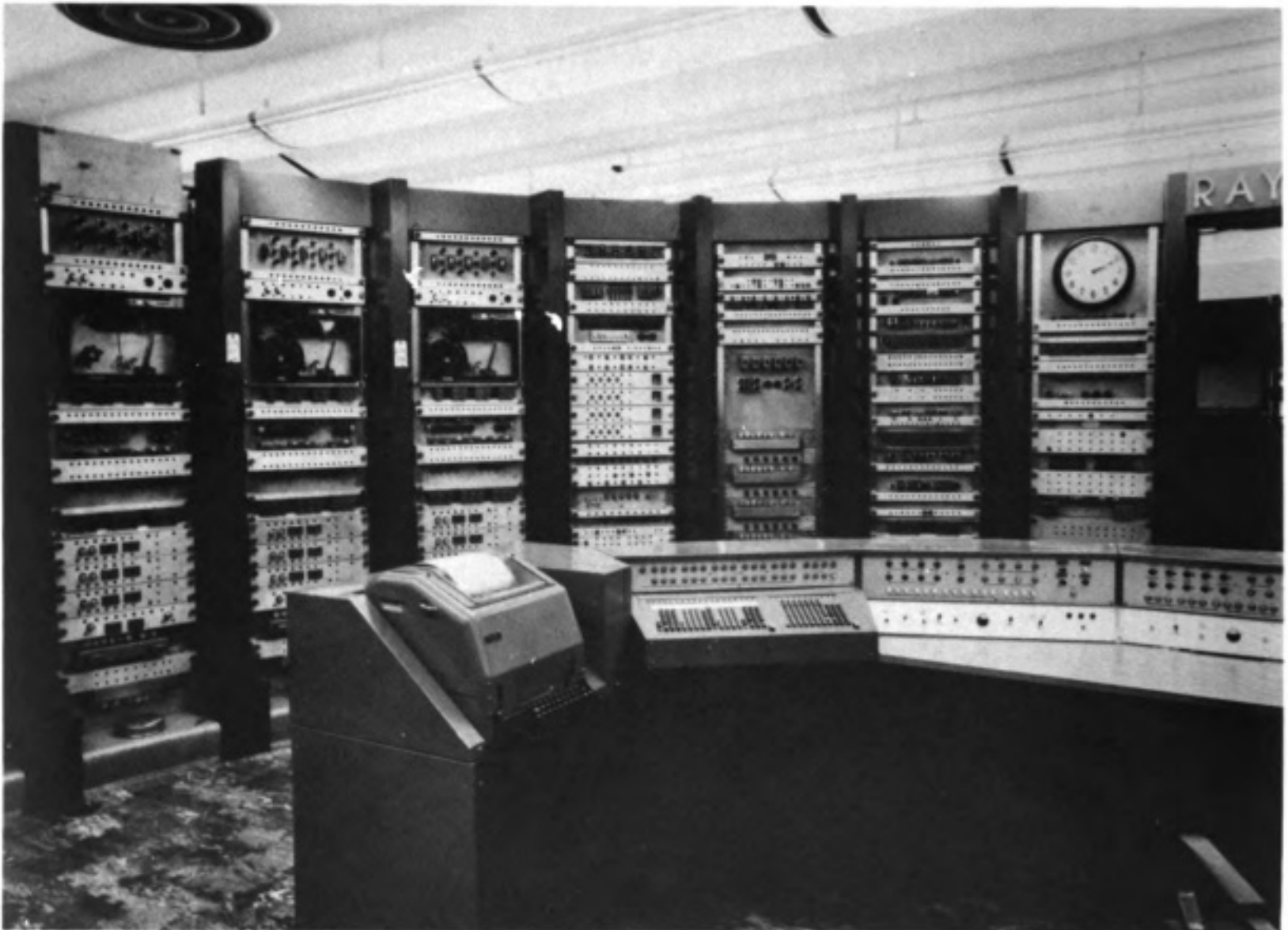


# RAYDAC

Raytheon Digital Automatic Computer

## MANUFACTURER

Raytheon Manufacturing Company



Picture by U. S. Naval Air Missile Test Center

## APPLICATIONS

General purpose scientific computations and data reduction.

### NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	30 + 1 sign bit + 4-bit check tag + 1 blank
Binary digits per instruction	54 + 2 sign bits + two 4-bit check tags + 8 blanks
Instructions per word	One-half
Arithmetic system	Fixed and floating point mode
Instruction type	Four address
Number range	-1 to +1

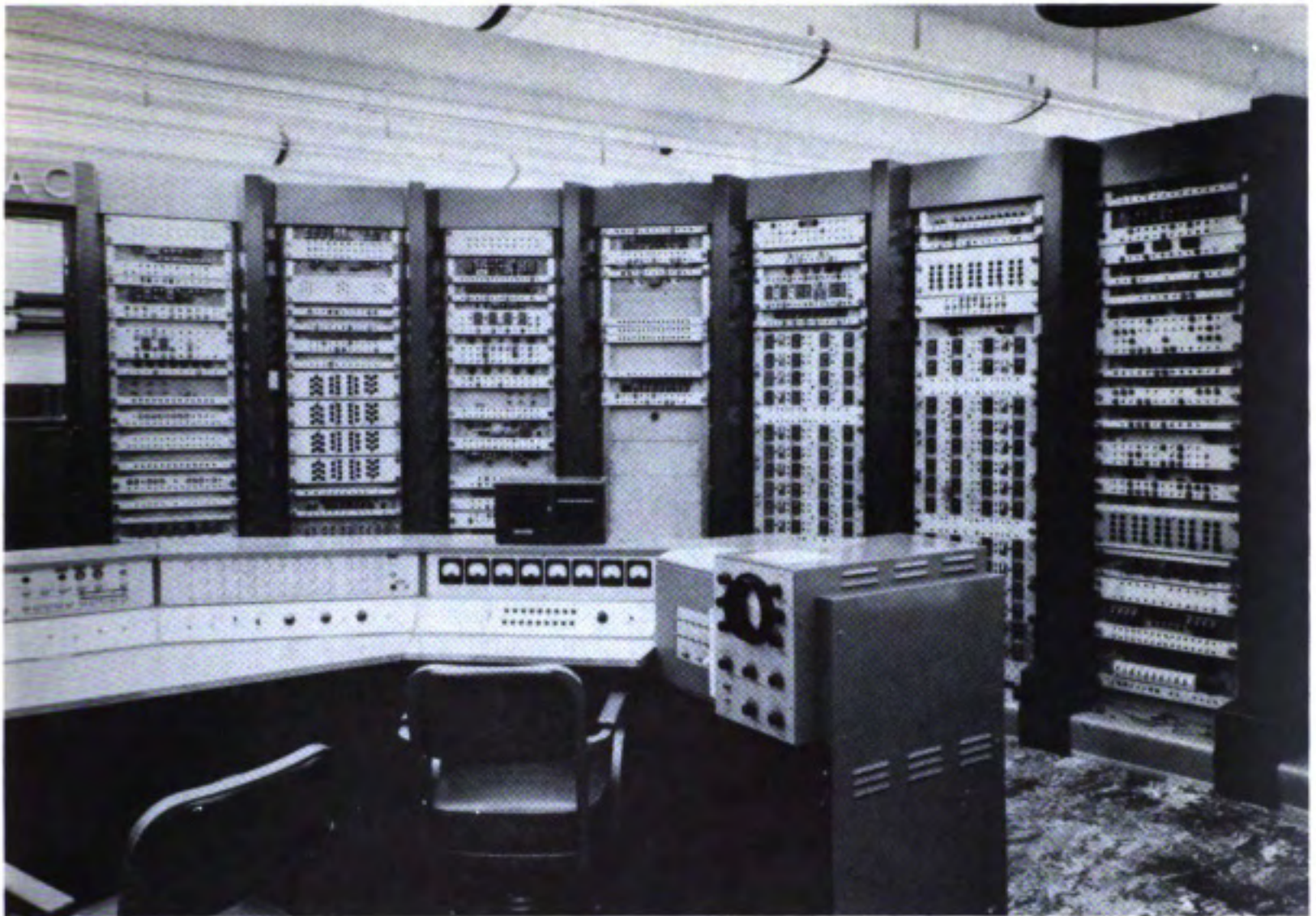
The arithmetic unit has built-in floating point operations. The standard mode of operation is

fixed point. The arithmetic unit also has built-in double precision addition and subtraction.

### ARITHMETIC UNIT

	Includ. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	134-1,280	48
Mult time	296-1,440	210
Div time	470-1,620	380
Construction		Vacuum tubes
Rapid access word registers		12
Basic pulse repetition rate		3.77 Mc/sec
Arithmetic mode		Parallel
Timing		Synchronous
Operation		Sequential

The cycle time is dependent upon storage access and operation times. Bistable devices used in RAYDAC are not balanced circuits, such as bistable multivibrators, but are regenerative pulse stretching circuits which are not dependent on balance, nor sensitive to component value or supply voltage



Picture by U. S. Naval Air Missile Test Center

variations.

### STORAGE

Media	Words	Digits	Microsec Access
Acoustic Delay Line	2,176	78,336	19-305
Magnetic Tape	400,000	14,400,000	19-4 min

Acoustic medium is Mercury. Thirty-two words are stored in each of sixty-four 305-microsecond delay paths.

Information is stored on tape in blocks of 32 words. Blocks are addressable at random through the use of optical address markings on the tape.

### INPUT

Media	Speed
Keyboard	14 words/min
Magnetic Tape	400 words/sec

High speed input equipment under development will permit direct entry from paper tape at 200 frames/sec, IBM cards at 240 cards/min and from magnetic tapes prepared in the field.

### OUTPUT

Media	Speed
Typewriter	5 dig/sec
Magnetic Tape	400 words/sec

Output equipment under development will permit printing at 150 lines/minute, punching 100 IBM cards/min, and plotting 20 points/sec.

### CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	5,200
Crystal diodes	17,300 (Germanium)
Relays	630
Tube types	Principle type is the 6AN5. Large numbers of the type 5670, 6AK5, 6AS6, and 5687 are also used.
Separate cabinets	16 eight-foot relay racks plus two high speed storage frames, operator's console, and input-output equipment.

### CHECKING FEATURES

**Fixed**  
Fully automatic built-in self-checking on arithmetic operations, transfer, selection and control. Each word carries a 4-bit check number calculated from the



Picture by U. S. Naval Air Missile Test Center

word, which is recalculated and checked after transfers. For arithmetic check, a 5-bit check number is calculated for each operand and result and appropriate checks are calculated using the 5-bit check numbers.

### POWER, SPACE AND WEIGHT

Power, computer	30 KW
Power, air cond.	21.6 KW
Space, computer	17,600 cu. ft. 1,760 sq. ft.
Space, air cond.	325 sq. ft.
Capacity, air cond.	25 Tons

The computer area is 44 ft by 40 ft by 10 ft. The air conditioner requires two spaces, 15 ft by 8 ft and 15 ft by 15 ft. Freon 114 is circulated through the 16 racks to carry off the heat. The air conditioning equipment and the equipment required to cool and circulate the freon 114 are located on two different floors because of space limitations.

### PRODUCTION RECORD

Produced	1
Operating	1

### COST, PRICE AND RENTAL RATE

Approximate cost of basic system \$3,000,000.

Approximate cost of additional equipment	
Input-Output equipment is under development	\$300,000
Main storage No. 2 (1,024 words)	\$ 25,000

### PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech and Operators
1-8 Hour shift	4	8

### RELIABILITY AND OPERATING EXPERIENCE

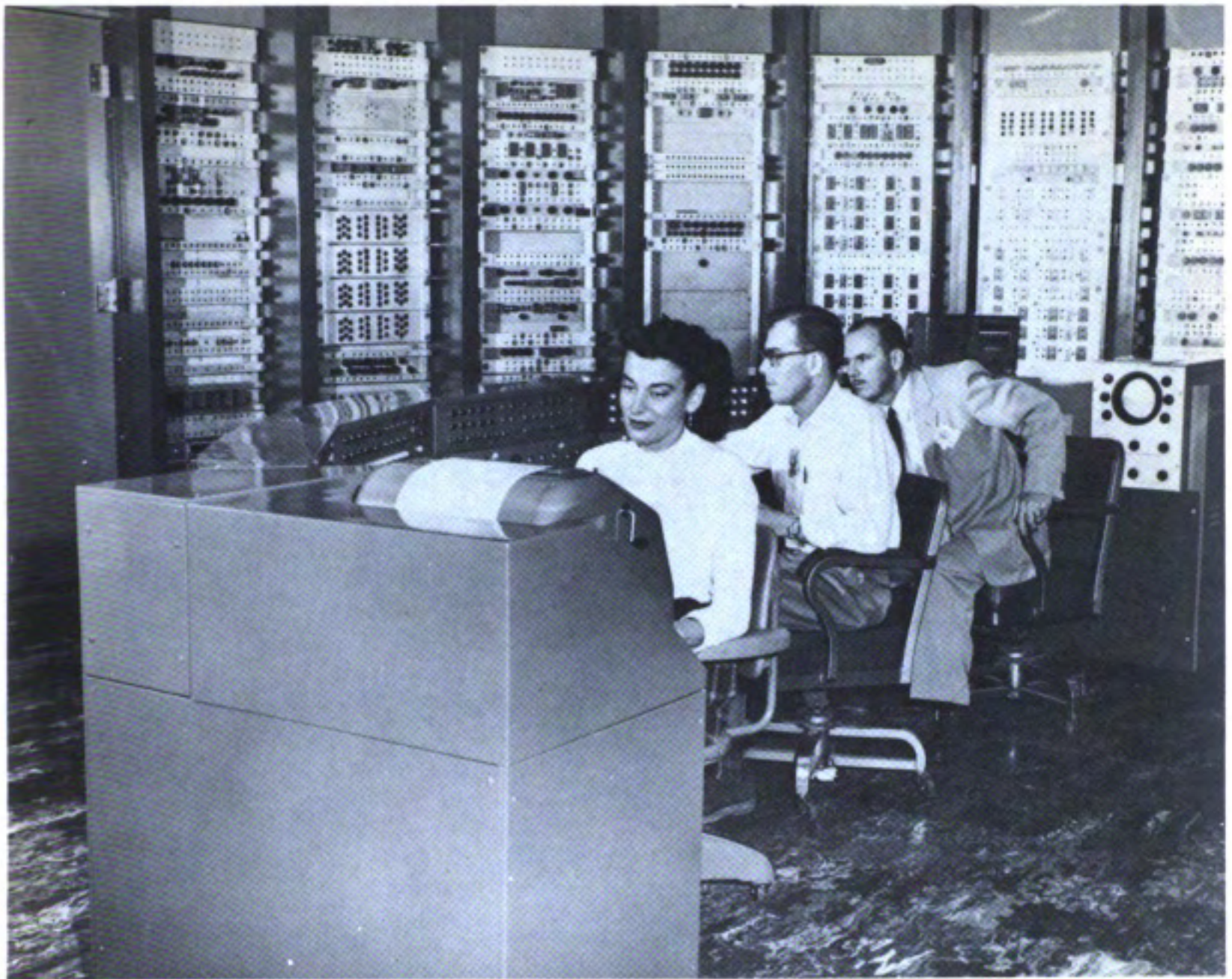
Average error-free running period	0.33 hours
Good time	411 hours
Attempted to run time	666 hours
Operating ratio (Good/Attempted to run)	0.62

Figures based on period 9 April 1956 to 23 September 1956.  
Acceptance test July 1953.

The complete checking features of RAYDAC cause it to stop whenever a transient error is detected. In most cases it is possible to restart by pushing the start button. The average error-free running time given above is, therefore, low because of this feature.

### FUTURE PLANS

The new Input equipment will include:  
Ferranti Mark II Paper Tape Reader  
IBM 077 Card Reader



Picture by U. S. Naval Air Missile Test Center

Ampex 207 Magnetic Tape Unit  
Raytheon 21-channel Magnetic Tape Unit  
The new Output equipment will include:  
IBM 407 Line Printer  
IBM 523 Summary Punch  
Tally Register High Speed Plotter

### INSTALLATIONS

U. S. Naval Air Missile Test Center  
Point Mugu, California

### ADDITIONAL FEATURES AND REMARKS

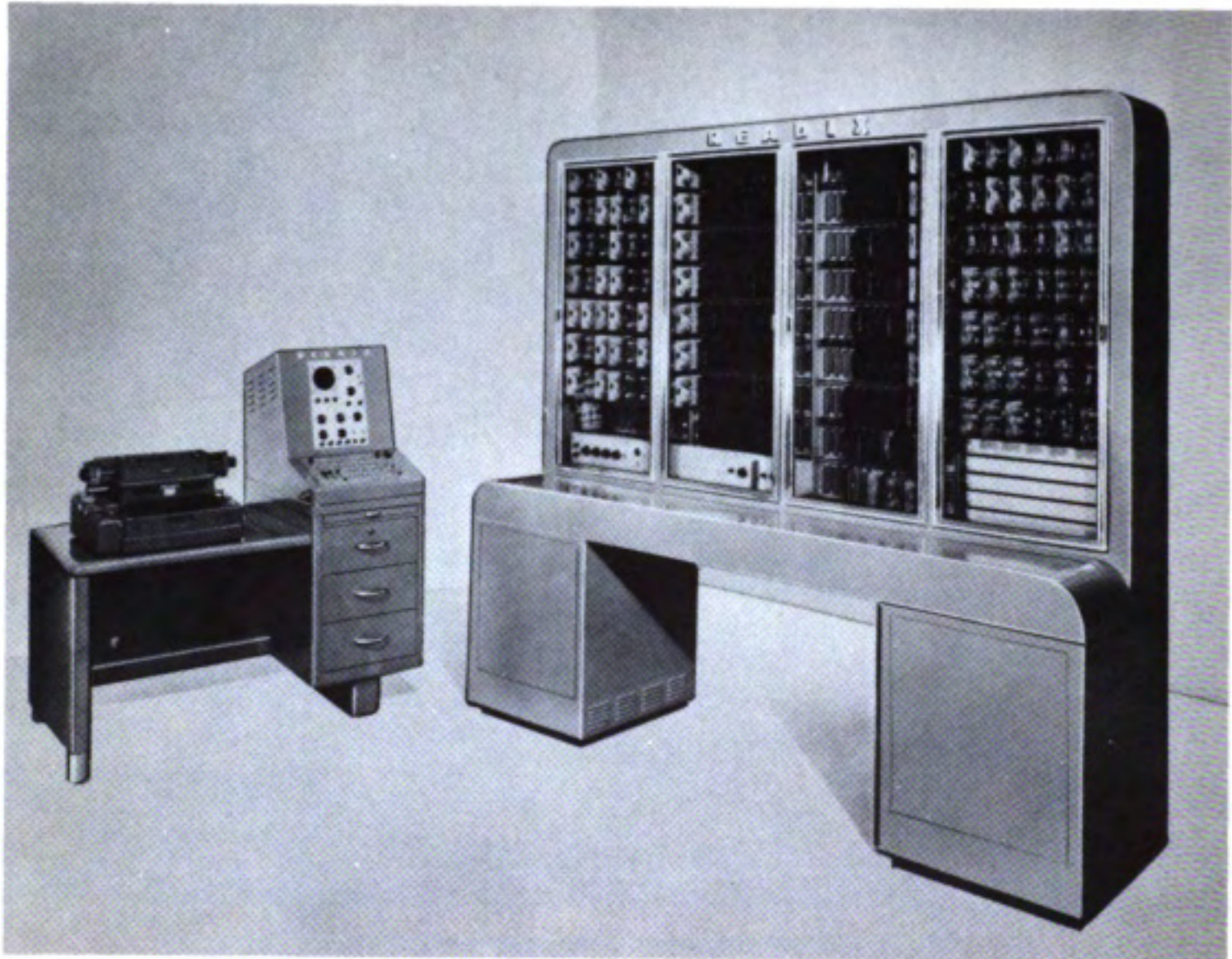
26 built-in operations are available.  
A special address containing a checked zero word is built-in.  
Several optional stops, based on either addresses or operation codes are available for code-checking purposes.

# READIX

Readix General Purpose Computer

## MANUFACTURER

J. B. Rea Company, Incorporated



Picture by Wright-Patterson Air Force Base

## APPLICATIONS

### Manufacturer

Engineering, business and accounting

### Government Sample

Air Technical Intelligence Center, Wright-Patterson Air Force Base  
Applied engineering problems.

### Industrial Sample

E. I. Dupont de Nemours and Company  
General scientific research.

Instructions decoded

103

Arithmetic system

Available fixed or fixed and floating point

Instruction type

One Address

Number range

Fixed point  $\pm 10^{10} - 1$

Floating point  $\pm 10^{49}$  to  $10^{-50}$ ,  
with 8 significant digits.

### Government Sample

Air Technical Intelligence Center, Wright-Patterson Air Force Base

Readix Model I is fixed point model.

## NUMERICAL SYSTEM

### Manufacturer

Internal number system

Binary coded decimal

Decimal digits per word

10 plus sign

Decimal digits per instruction

5

Instructions per word

2



Picture by J. B. Rea Company, Inc.

### ARITHMETIC UNIT

**Manufacturer**

	Incl Stor Access Microsec	Exclud Stor Access Microsec
Add time	850 - 9,350	850 -
Mult time	9,350 - 27,000	5,000 - 27,000
Div time	9,350 - 44,000	5,000 - 44,000
Construction	260 vacuum tubes, 3,040 diodes	
Rapid access word registers	4	
Basic pulse repetition rate	100 Kc/sec	
Arithmetic mode	Serial	
Timing	Synchronous	
Operation	Sequential	

**Government Sample**

Air Force Technical Intelligence Center

On Readix Model I

	Incl Stor Access Microsec	Exclud Stor Access Microsec
Add time	17,100	100
Mult time	34,500	5,000
Div time	34,500	5,000

Basic pulse repetition rate 50 kilocycles.

### STORAGE

**Manufacturer**

Media	Words	Digits	Microsec Access
Magnetic Drum	4,000	40,000	425 - 9,350
Magnetic Tape	50,000	1,200 ft x 5/8 in	tape

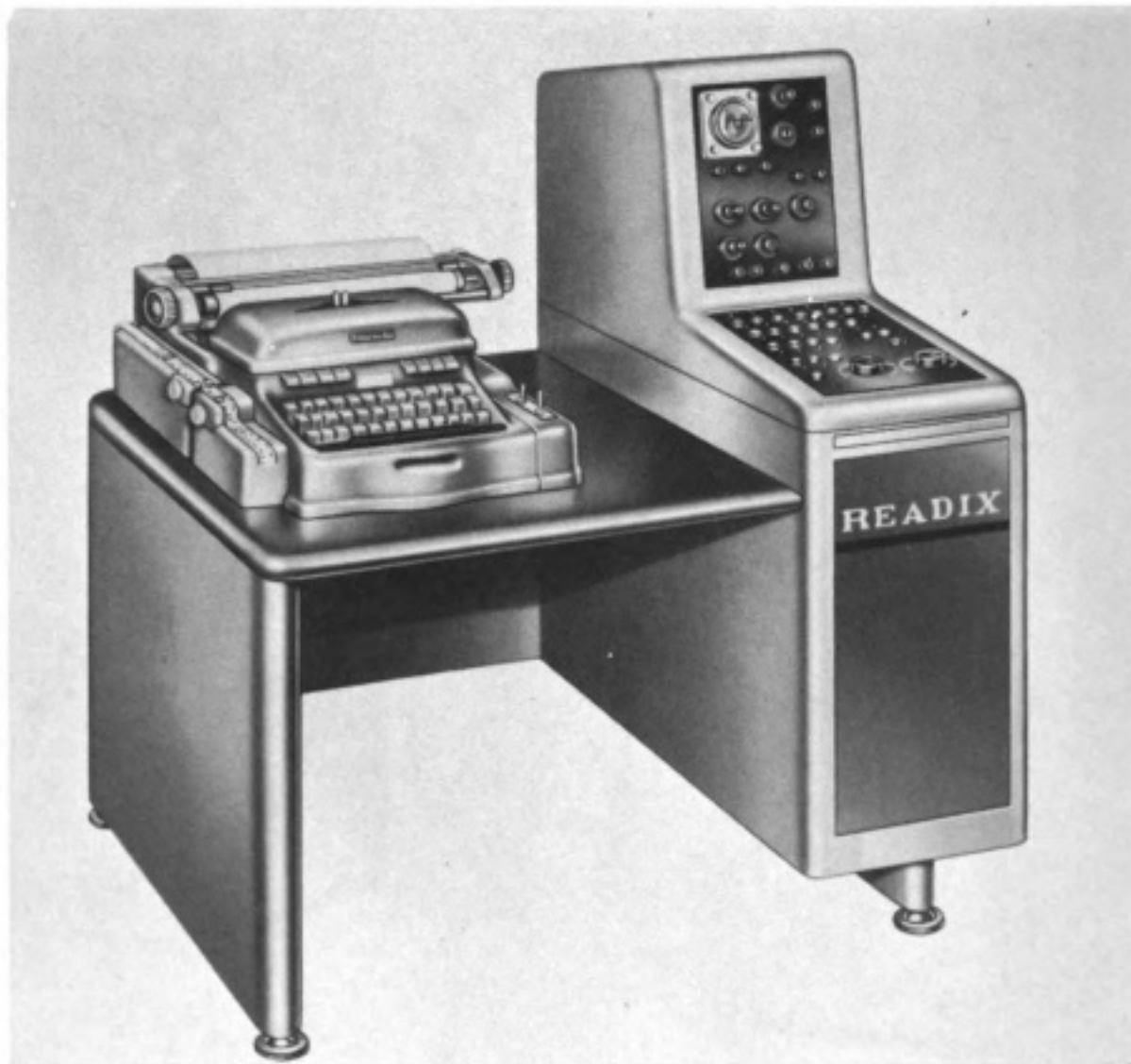
Air Technical Intelligence Center, W-P AFB  
Readix Model I has 4,000 words of main storage plus 160 words of working storage. Magnetic drum access time is 34,000 microseconds.

### INPUT

**Manufacturer**

Media	Speed
Flexowriter	10 char/sec
IBM Punched Cards	100 cards/min
Magnetic Tape	700 dec dig/sec

Air Technical Intelligence Center  
Readix Model I magnetic tape unit operates at 40 words/34 millisecc.



Picture by J. B. Rea Company, Inc.

### OUTPUT

Media	Speed
Flexowriter	10 char/sec
IBM Punched Cards	100 cards/min
Magnetic Tape	700 dec dig/sec

### CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	260
Tube types	7
Crystal diodes	3,040
Flip flops	128
Drivers, Amplifiers	132
Separate cabinets	3

Air Technical Intelligence Center  
 Tube types used in Model I are 5963 and 5687. Three cabinets are 1 power supply, 1 logic rack, and 1 control desk.

### CHECKING FEATURES

Fixed  
 Overflow alarm  
 Impossible command (non-existent command)

### POWER, SPACE AND WEIGHT

Power Requirements  
 Computer - 5 KW, 110 volts, 60-cycle, single phase.  
 Flexowriter and Console Oscilloscope - 0.68 KW, 110 volt, 60-cycle, single phase, from same line. Isolation transformer built into console.  
 Point Plotter - 0.15 KW, 110 volts, 60-cycle, single phase.  
 Magnetic Tape Unit - 0.4 KVA, 110 volts, 60-cycle, single phase. (For motor operation only. Other voltages supplied by computer)  
 IBM Interim Register - All voltages supplied by computer.

Space and Weight	Height Inches	Width Inches	Depth Inches	Approx. Weight Lbs.
Computer	78	86.5	23	500
Console, Including Flexowriter	48	45	32	200
Power Supply	85	22	18	700
Point Plotter and Register	60	22	18	100
Magnetic Tape Unit	67	22	18	150
IBM Interim Register	40	22	18	100

Dimensions shown above do not include connectors.

No air conditioner required on new models.  
 Air Technical Intelligence Center  
 Model I requires 5 Tons of air conditioning, 5.5 KW  
 computer power requirement, occupies 84 cu. ft.,  
 25 sq. ft., logic rack is 2 x 6 x 6 ft. and control  
 desk is 3 x 4 x 4 ft.

### PRODUCTION RECORD

Produced	3
In production	4
Operating	3
Delivery time	6 Months

Air Technical Intelligence Center  
 Readix Model I required 13 months for delivery from  
 time of receipt of order.

### COST, PRICE AND RENTAL RATE

	Price	Rental Per Month
READIX for floating point and fixed point operation. Com- plete with power supply, con- sole, input-output Flexowriter with paper tape punch and reader, oscilloscope, and plug- in test set. . . . .	\$98,000	\$ 2,725
Spare parts kit for the READIX Computer . . . . .	\$ 4,500	
Magnetic Tape Input, Output and Storage Unit . . . . .	\$16,000	\$ 445
Multiple units may be used		
Provision for IBM Input and Output Unit . . . . .	\$16,000	\$ 445
IBM Machines not supplied		
Digital Point Plotter Output Unit . . . . .	\$ 9,000	\$ 250

Annual on call maintenance and regularly scheduled  
 preventative maintenance supplied by R. C. A.  
 Service Company or J. B. Rea factory personnel.  
 Annual service charge will depend upon computer  
 location.

Prices on special modifications will be furnished  
 on request.

Delivery - Maximum of 180 days after receipt of  
 firm order.

Prices are F.O.B., J. B. Rea Company, Inc.  
 Plant - Santa Monica, California

The READIX equipment is available on lease with  
 option to purchase if desired.

Delivery prices and rental rates are subject to  
 change without notice.

Air Technical Intelligence Center W-P AFB  
 Readix Model I (Fixed point) approximate cost of  
 basic system was \$55,000. For magnetic tape,  
 plotter, and punch card, \$45,000.

### PERSONNEL REQUIREMENTS

Manufacturer	Tech and Operators
Daily Operation	
1-8 Hour shift	1
2-8 Hour shifts	2
3-8 Hour shifts	3

For programming: Approximately 5 programmers for  
 1 shift operation.

Air Technical Intelligence Center W -P AFB  
 A total of one engineer and 2 technician - operators  
 are utilized for 2 shift operation.

### RELIABILITY AND OPERATING EXPERIENCE

Manufacturer  
 Service bureau is used for final check-out prior to  
 delivery to customer.

Air Technical Intelligence Center W-P AFB  
 Average error-free running period 36 hours  
 Operating ratio (Good/Attempted to run) 0.90  
 Figures based on period May 1956 to October 1956  
 Acceptance test February 1956

### FUTURE PLANS

Manufacturer  
 Production rate for READIX Computers planned to be  
 one per month starting February 1957 and two to  
 four per month starting February 1958.

### INSTALLATIONS

Air Technical Intelligence Center, Wright-  
 Patterson AFB, Ohio  
 E.I. Dupont de Nemours and Company, Wilmington,  
 Delaware  
 Ballistic Test Facility, Edwards Air Force Base,  
 Pasadena, California

### ADDITIONAL FEATURES AND REMARKS

Manufacturer  
 Decimal Operation  
 Automatic Floating Point  
 Automatic Address Modification  
 Automatic Return from Subroutines  
 Automatic Square Root  
 Large Versatile Command Structure  
 Simultaneous Computation during Print Out  
 Input-Output: Cards, Tape Paper, Tape Mag. etc.  
 One B-Box  
 Special Tie-Ins  
 Control Panel easy to operate and read  
 Mag. Drum 4000 or 8000 words  
 Ease of Programming - sample available  
 Ease of Maintenance  
 Compact Modern Design  
 Low Power Requirement (5 KW.)  
 Convenience in Use  
 Leased or purchased

Air Technical Intelligence Center W-P AFB  
 Low cost, medium speed.