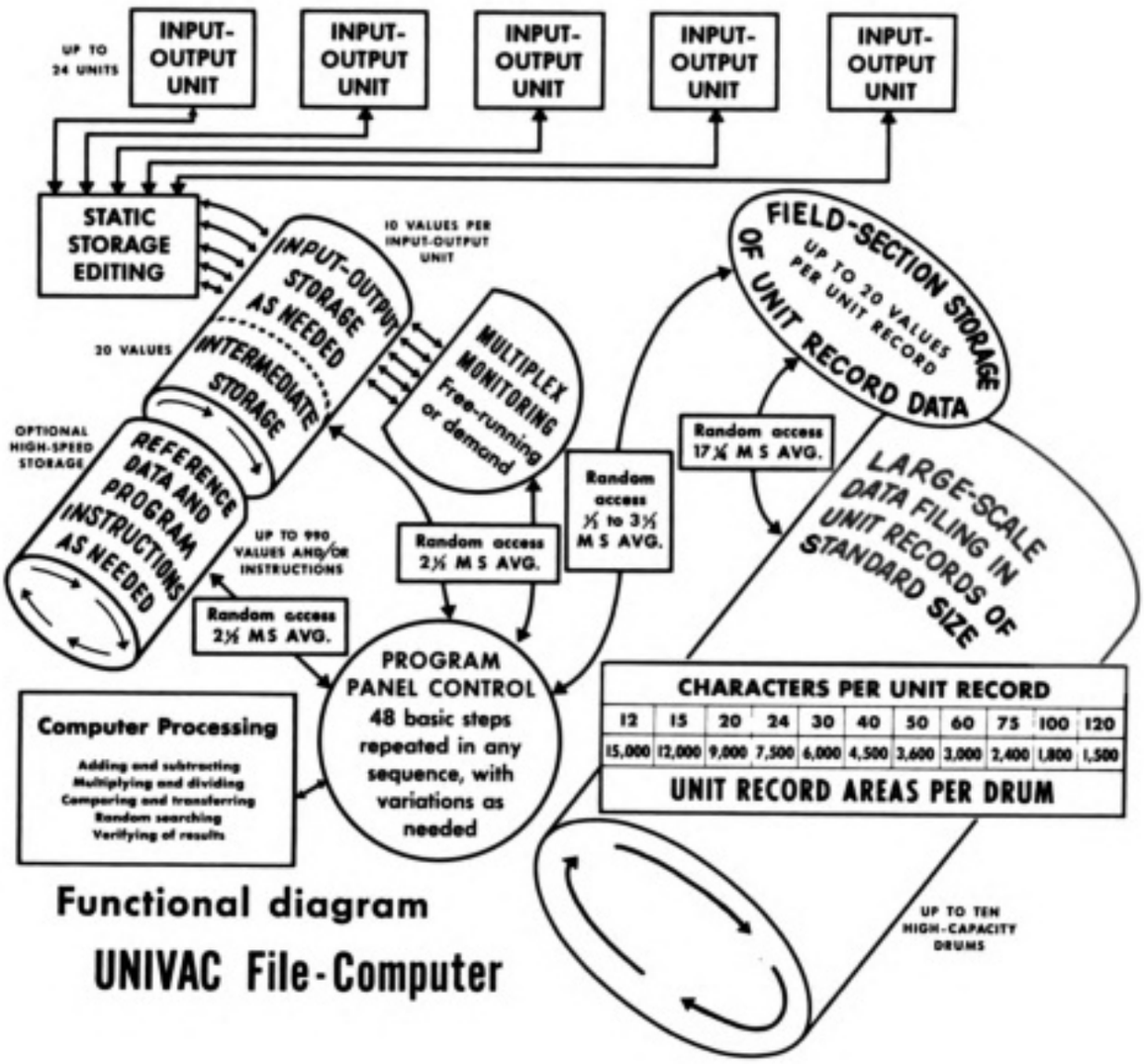
UNIVAC FILE

Universal Automatic Computer - File System

MANUFACTURER

Sperry-Rand Corporation
Remington Rand Univac Division



Functional diagram

UNIVAC File-Computer

Picture by Sperry Rand Corporation, Remington Rand Univac Division

APPLICATIONS

Manufacturer

The Univac File-Computer System is an electronic computer system which provides for magnetic filing combined with electronic computing for random access processing of unsorted data. It has common language versatility and many types of input-output may be used simultaneously. Input-Output units, and storage units can be put together as building-block units to produce a system satisfying individual requirements. Such a system is expandable at any time.

The five components of any computer system are input, storage, arithmetic, control and output. The Univac File-Computer System has these components but the type number and capacity of some of these units in any grouping of equipment is determined by the individual application requirements.

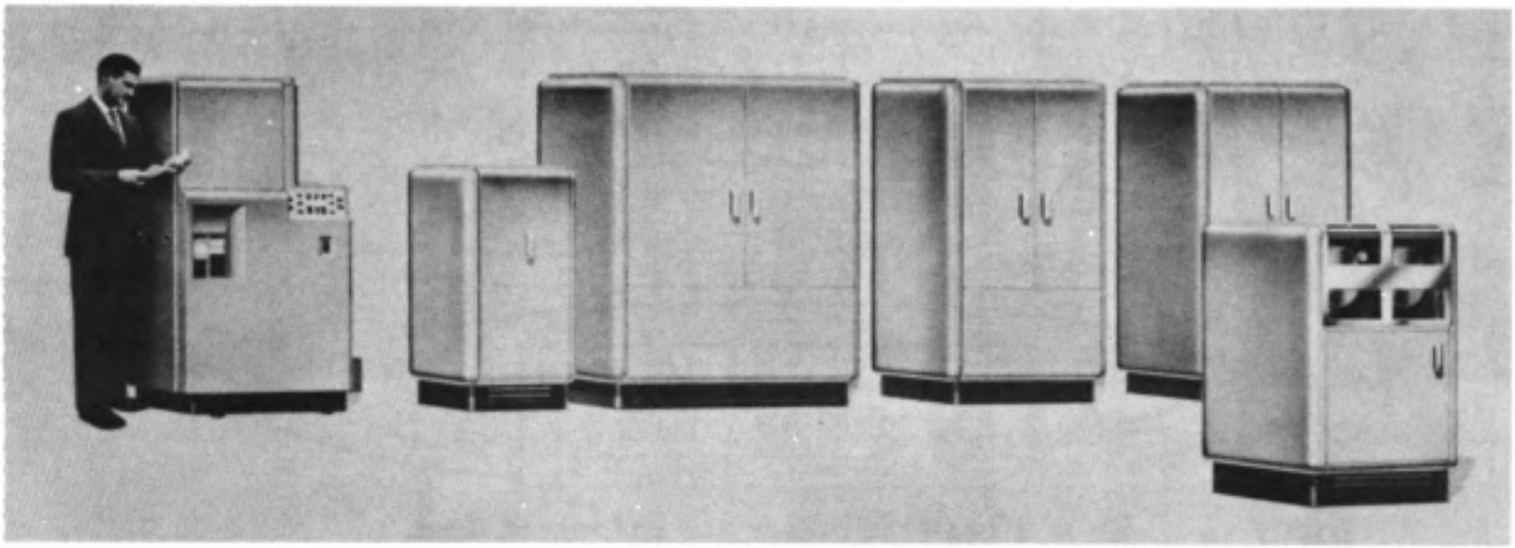
Government Sample

U. S. Department of Agriculture, Commodity Stabilization Service

The first application planned for the system is grain loan and purchase agreement operations at the Kansas City Commodity Office. Following this application, all activities presently on conventional equipment will be surveyed with the view of converting them to E.D.P. operations, making possible the release of all conventional equipment except key punches and verifiers. These activities embrace inventory management, transit tonnage records, financial accounting records, and statements and reports. Also studies of present manual operations will be made to determine applicability to data processing.

The system at the Kansas City Commodity Office (field area office) is to consist of:

1 Univac File Computer, Model 1A
2 Magnetic Drums, 180,000 alphanumeric char each
1 Double Feed Sensing Punch Card Unit, 120 cards/min



Picture by Sperry Rand Corporation, Remington Rand Univac Division

4 Magnetic Tape Units
1 Off-line High Speed Printer, 300 lines/min
1 Input-Output Typewriter.

Industrial Sample

American Telephone and Telegraph Company, Western Electric, Point Breeze
Programs in preparation for the File Computer include:
Production control
Stock Recordkeeping
Merchandise Routines
Bulletin Revision.

The First National City Bank of New York
Programs are in preparation for utilization of a Univac File Computer in a banking activity project.

ARITHMETIC UNIT

In the File-Computer System, this unit handles all data entering or leaving the system or going from one unit to another. It performs the process of addition, subtraction, multiplication and division. In performing this process it takes two values, V_1 and V_2, together with their signs and arrives at a result, R, with its sign. The necessary decimal alignment is made for each step in calculations. The arithmetic unit also is used in comparison of alphanumeric data, transferring data to different locations, and it provides a method for searching for data on the Large Capacity General Storage Unit.

The control section guides the Computer through the routine of steps necessary to arrive at the desired result. This direction on the Univac File-Computer is accomplished by two major means: connection-panel wiring which is external programming; and stored instructions which is internal programming. The external or internal programming is developed to handle the individual requirements.

The File-Computer System can operate with many input/output units working simultaneously. Control is accomplished by the Multiplexing Unit.

STORAGE

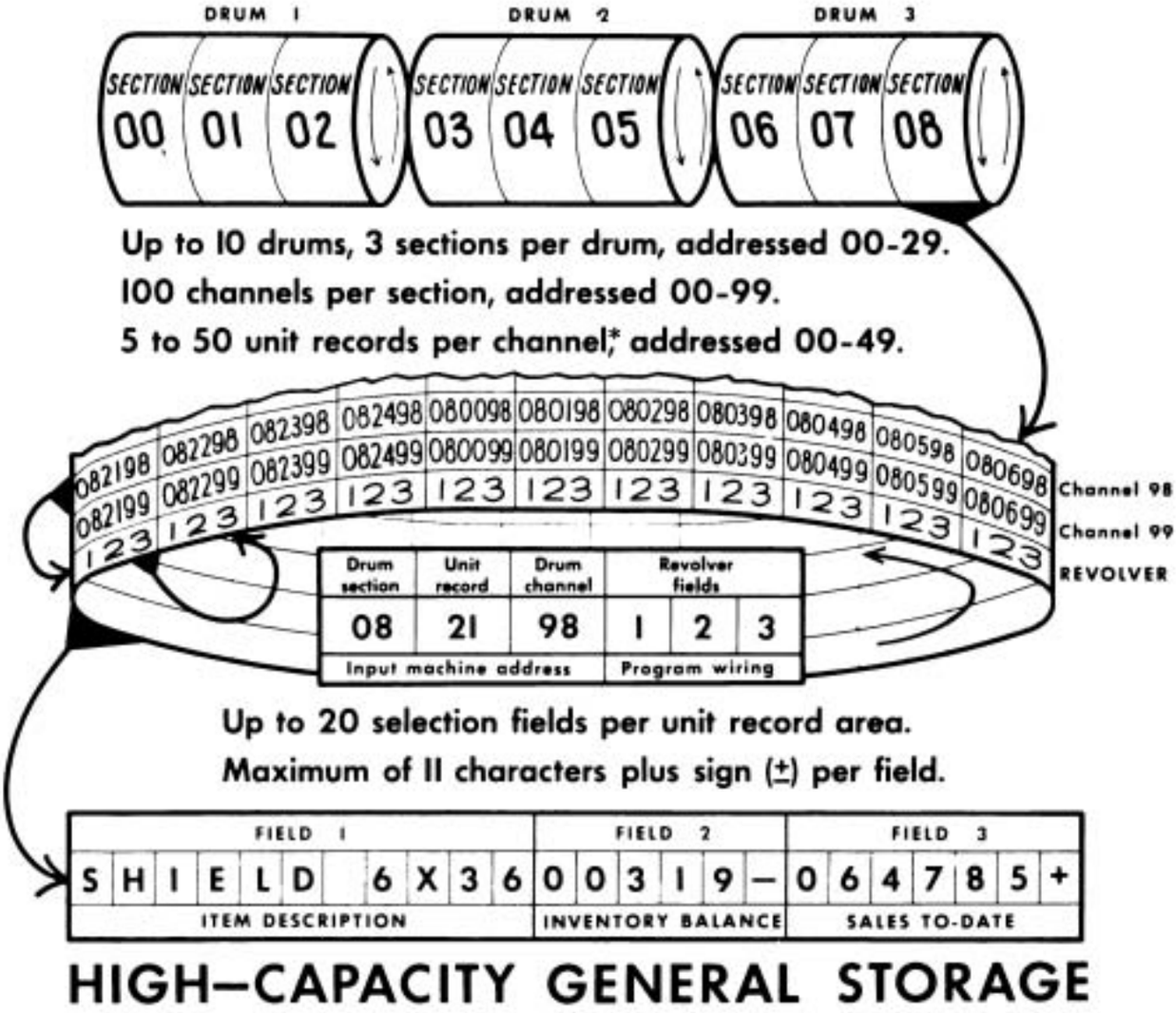
The File-Computer System has several different types of internal storage:
Input-Output
Intermediate Storage Section
High Speed General Storage Unit
Large-Capacity General Storage Unit

Input-Output Storage

The purpose of this unit is to accept data from and deliver data to the input-output device or devices, to store the input data until it is called into the system, to store output data until it is accepted by the related output devices.

Intermediate Storage

The Intermediate Storage unit provides a method of



HIGH–CAPACITY GENERAL STORAGE

Picture by Sperry Rand Corporation, Remington Rand Univac Division

storing either constant information or developed information. Intermediate Storage has a capacity of 20, 11 digit data fields plus signs.

High-Speed General Storage Unit

A High-Speed General Storage Unit of the random access type may be included as a building block in a system. Such a storage may be used either for stored instructions directing the program, for regular data storage, or a combination of both. High-Speed General Storage Units can be either one of two capacities: 190, 11-character fields; 990, 11-character fields. In each field there is an additional character for sign value.

Large Capacity General Storage Unit

A Large Capacity General Storage Unit of the random access type can be included in any system. This storage can be increased by adding from 1 to 9 Large-Capacity General Storage Expansion Units as required. Each storage unit has a capacity of 180,000 alphanumeric characters for a possible total Large-Capacity storage of 1,800,000. According to the individual applicational requirements, these characters can be grouped in units within certain limitations. These groupings are called Unit Record Areas and such a grouping is analogous to a punched card as a unit record. These established Unit Record Areas can be divided into fields at the will of the programmer similar to the division of a punched card into fields.

INPUT

The File-Computer System is universal insofar as input is concerned. Up to 24 units of input, input-output and output could be put in a system and these units could be working simultaneously. Such devices include:

Card Sensing and Punching Unit - Input/Output
10 Key Keyboard with Input Printers
10 Key Inquiry Keyboard with Input-Output Printer
Key Actuated Tabulating Card Punch Input-Output
Electric Typewriter Input-Output
Perforated Paper Tape Input-Output (5, 6, or 7 Channel Tape)
Magnetic Tape Input-Output

OUTPUT

There are many types of output devices on the File-Computer System. Some of these output devices are in turn used as input devices. The following output devices are used:

Card Sensing and Punching Unit
Ten Key Inquiry Keyboard with Input-Output Printer
Key Actuated Tabulating Card Punch
Electric Typewriter
Perforated Paper Tape (5, 6, or 7 channel tape)
Magnetic Tape

CHECKING FEATURES

Checking features such as bit counts and odd-even checks are included throughout the system.

COST, PRICE AND RENTAL RATE

The File Computer is priced at $300,000 to $500,000. The monthly rental rate is $4,500 to $8,000. The actual figure would be based on the units required for a given application.

Government Sample
U. S. Department of Agriculture, Commodity Stabilization Service
Acquisition is to be on a rental basis.

FUTURE PLANS

Government Sample
U. S. Department of Agriculture, Commodity Stabilization Service
System is scheduled for installation 1 September 1957.

ADDITIONAL FEATURES AND REMARKS

Manufacturer

Random access feature provides large file of information readily accessible to many types of input-output devices.

Eliminates necessity of batching items. Information can be fed into the system at any time with ready access to balances.

Random access feature eliminates many interim steps associated with other methods such as sorting and collating. Postings can be made from source documents which are kept in their original sequence.

Same record filed magnetically is available to all input-output devices simultaneously. Then all operators can post to the same record even making entries to the same items at the same time.

Keyboard entries can be made directly into the system.

Eliminates searching for a record card.

Gives freedom in handling late items.

Gives freedom in handling rush items.

Cumulative total of all entries is constantly available.

Through on-line and off-line operation, the system, can handle several applications simultaneously and use common information according to different activities.

UNIVAC SCIENTIFIC 1101

Universal Automatic Computer
Scientific Model 1101

Sperry-Rand Corporation
Remington Rand Univac Division

Picture by Georgia Institute of Technology, Rich Electronic Computing Center

APPLICATIONS

Commercial and scientific data processing.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	24
Binary digits per instruction	24
Instructions per word	1
Instructions decoded	48
Instructions used	43
Arithmetic system	Fixed point
Instruction type	One address
Number range	$1-2^{23}$ to $2^{23}-1$

Negative numbers used are in the ones complement arithmetic. +5 = 00000005 and -5 = 77777772 octal.

ARITHMETIC UNIT

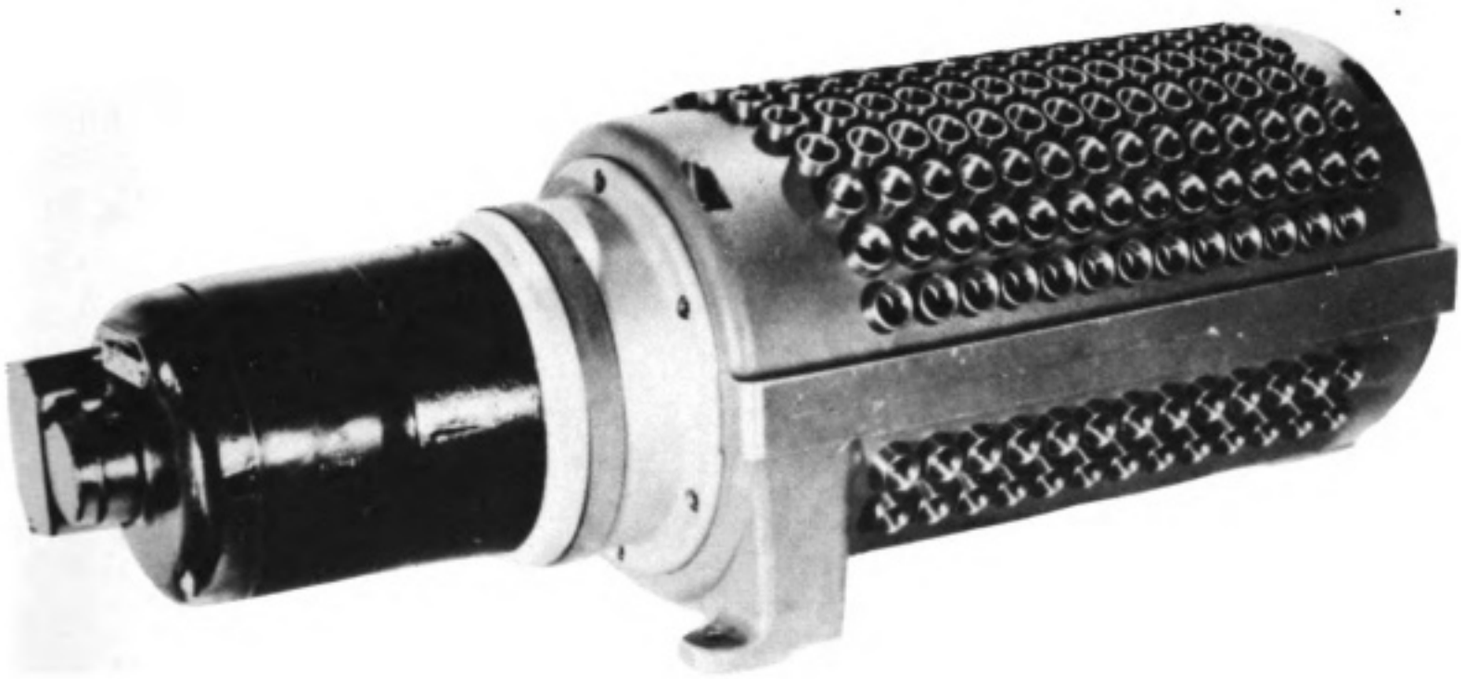
	Microsec
Add time (exclud. stor. access)	5
Mult time (exclud. stor. access)	260
Div time (exclud. stor. access)	324
Construction	Vacuum tubes
Basic pulse repetition rate	400 Kc/sec
Arithmetic mode	Parallel
Timing	Asynchronous
Operation	Sequential

STORAGE

Medium	Words	Microsec Access
Magnetic Drum	16,384	32 - 17,000

INPUT

Medium	Speed
Paper Tape (Photoelectric)	35 words/sec



Picture by Sperry-Rand Corporation

	140 frames/sec
	70 ft/min

OUTPUT

Medium	Speed
Paper Tape (Teletype)	60 char/sec
Typewriter (Flexowriter)	10 char/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	2,695
Tube types	18
Crystal diodes	2,385
Different plug-in units	52
Separate cabinets	5

CHECKING FEATURES

Improper command stops the machine.

POWER, SPACE AND WEIGHT

Power, computer	12 KW	
Space, computer	2,880 cu ft	360 sq ft
Space, air cond.	1,024 cu ft	128 sq ft
Weight, computer	16,000 lbs	
Capacity, air cond.	5 Tons	
Type air cond.	Gas	

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech and Operators
One 8-Hour shift	2	2

INSTALLATIONS

Georgia Institute of Technology
Engineering Experimental Station
Rich Electronic Computing Center
Atlanta, Georgia

ADDITIONAL FEATURES AND REMARKS

An extensive library of subroutines are available, including among others, the following input-output subroutines:

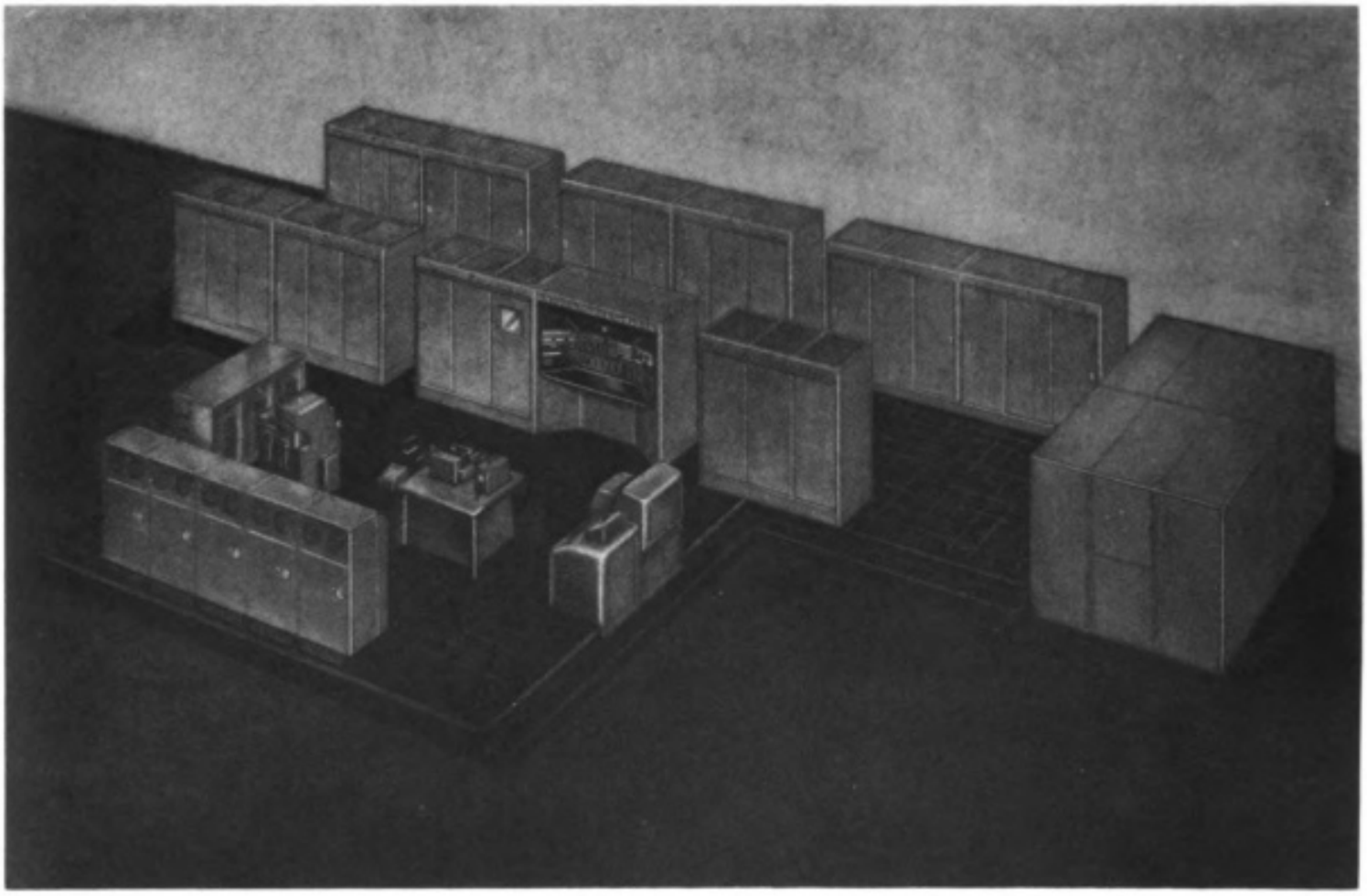
Fixed point decimal input
Fixed point decimal output
Floating point input
Floating point output
Function evaluation, including

$u = \log_2 y$	$u = \arcsin y$
$u = \log_e y$	$u = \arctan y$
$u = \log_{10} y$	$u = \sqrt{y}$
$u = 2^y$	Utility routines include floating point, storage dump, check point, translating, clear storage and print-code to bi-octal conversion.
$u = \sin(\pi y/2)$	

UNIVAC SCIENTIFIC 1102

Universal Automatic Computer
Scientific Model 1102

Sperry Rand Corporation
Remington Rand Univac Division



Picture by Arnold Engineering Development Center, ARDC, Tullahoma, Tennessee

APPLICATIONS

Arnold Engineering Development Center
Data reduction in Wind Tunnel and Engine Test Facilities. The three computers are used on-line during wind-tunnel and aerodynamic testing.

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	24
Binary digits per instruction	24
Instructions per word	1
Instructions decoded	Depends upon program
Octal digits per instruction not decoded	8
Arithmetic system	Left circular shift
Instruction type	One address
Number range	Accumulator holds 48 binary digits

ARITHMETIC UNIT

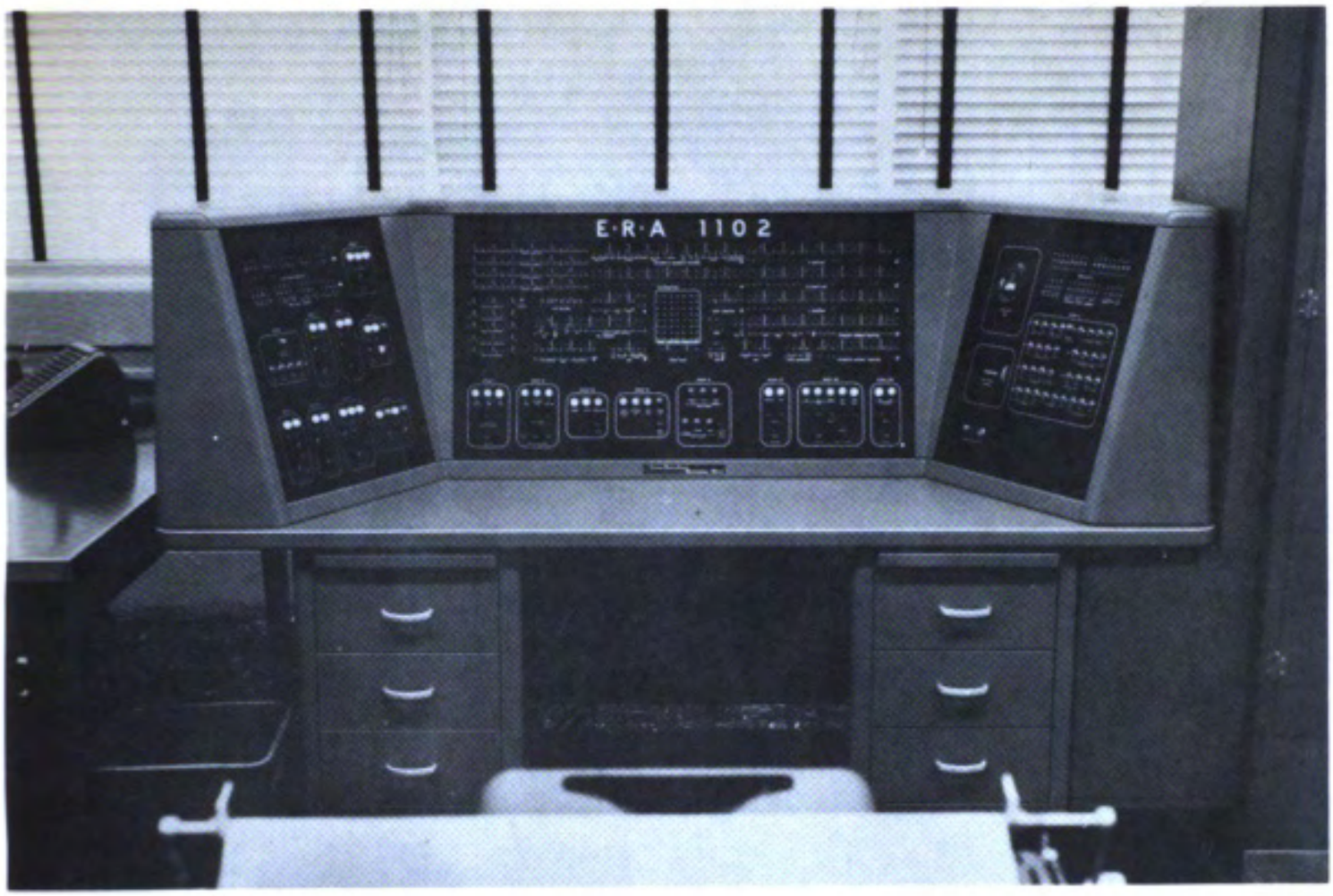
Add time (exclud. stor. access)	17 microsec max
Mult time (exclud. stor. access)	264 microsec max
Div time (exclud. stor. access)	340 microsec max
Construction	Vacuum tubes
Rapid access word registers	1
Basic pulse repetition rate	500 Kc/sec
Arithmetic mode	Parallel

STORAGE

Media	Words	Microsec Access
Magnetic Drum	8,192	8,500 max

INPUT

Media	Speed
Tape Reader	200 lines/sec
Raw Data Scanner	Scans 252 channels in 12.5 sec or 20/sec.



Picture by Arnold Engineering Development Center, ARDC, Tullahoma, Tennessee

The raw data scanner is connected to transducers measuring test data.

OUTPUT

Media	Speed
Automatic typewriter	10 char/sec
Automatic plotter	

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	2,700
Crystal diodes	3,000
Magnetic elements	700 relays
Number of separate cabinets	3
Number of different kinds of plug-in units	47

CHECKING FEATURES

Accumulator overflow indicator
"Oversize quotient" check
Improper operation code check
Address check on tape loading

POWER, SPACE AND WEIGHT

Power, computer	22 KW	
Space, computer	772 cu. ft.	122 sq. ft.
Weight, computer	14,000 lbs.	
Power, air cond.	9 KW	
Space, air cond.	80 cu. ft.	12 sq. ft.
Weight, air cond.	3,000 lbs.	
Capacity, air cond.	25 Tons	

PRODUCTION RECORD

Number produced	3
Number in current operation	3
Delivery time	31 Months

COST, PRICE AND RENTAL RATE

Three computing systems were developed and manufactured under contract. Total cost was approximately $1,400,000.

PERSONNEL REQUIREMENTS

Daily Operation	No. of Eng.	No. of Tech.
One 8 Hour shift	5	2

Above totals are for one computer.

RELIABILITY AND OPERATING EXPERIENCE

Arnold Engineering Development Center

The following performance figures are given for the three computers for the period January through September 1956. The last of the three computers was accepted on 1 March 1956. Each column is for a separate engineering facility at the Arnold Engineer-

Picture by Arnold Engineering Development Center, ARDC, Tullahoma, Tennessee

ing Development Center.

	ETF	PWT	GDF
Manned Time	57.0%	25.6%	30.1%
Utilization	51.4%	20.3%	24.8%
Computer Efficiency	87.5%	89.3%	84.4%
Reliability	96.8%	99.3%	97.9%
Scheduled Maintenance	9.5%	10.0%	13.9%
Unscheduled Maintenance	3.0%	0.7%	1.7%
Maintenance Factor	0.331	0.301	0.388

TERMS AND DEFINITIONS OF COMPUTER PERFORMANCE

O - Operational Time - Productive computer hours used in data reduction, engineering problems, program checking, or other productive computations. It does not include hours used in running of check problems for maintenance purposes.
I - Idle Time - Computer hours during which the computer is manned and in condition for productive operation but not in use for such purposes.
U - Unused and Unmanned Time - Hours during which personnel are not scheduled for computer operation.
C - Marginal Checking - Daily routine testing prior to operation to determine that the computer is in operable condition.
P - Preventive Maintenance - Computer hours used for testing of the computer to improve its performance and which does not detract from scheduled operational time.
R - Unscheduled Maintenance - Hours consumed in restoring the computer to operating condition when failure occurs.
C.M. - Concurrent Maintenance - Hours spent in repair and testing of computer components which does not consume computer time.
E.M. - Engineering Modifications - Computer hours used in accomplishing engineering modifications to the computer and its circuitry.
T - Total Time = O + I + U + C + P + R + E.M.
On a daily basis Total Time is twenty-four hours.

Manned Time
100 (T-U)/T

Utilization
100 (O+E.M.)/(O+I+U+E.M.)

Computer Efficiency
100 (O+I+E.M.)/(T-U)

Reliability
100 (O+I+E.M.)/(O+I+R+E.M.)

Scheduled Maintenance
100 (C+P)/(T-U)

Unscheduled Maintenance
100 R/(T-U)

Maintenance Factor
(C+P+C.M.+R)/(T-U+C.M.)

UNIVAC SCIENTIFIC 1103 1103A

Universal Automatic Computer - Scientific
Model 1103 - 1103A

Sperry Rand Corporation
Remington Rand Univac Division

Picture by White Sands Proving Ground

APPLICATIONS

Manufacturer
Scientific computation.

Government Sample
Holloman Air Development Center
Real-time system analysis, trajectory calculations, heat transfer problems, solution of various kinds of linear simultaneous equations, and algebraic equations.
Wright Air Development Center
Scientific computation and systems analysis.

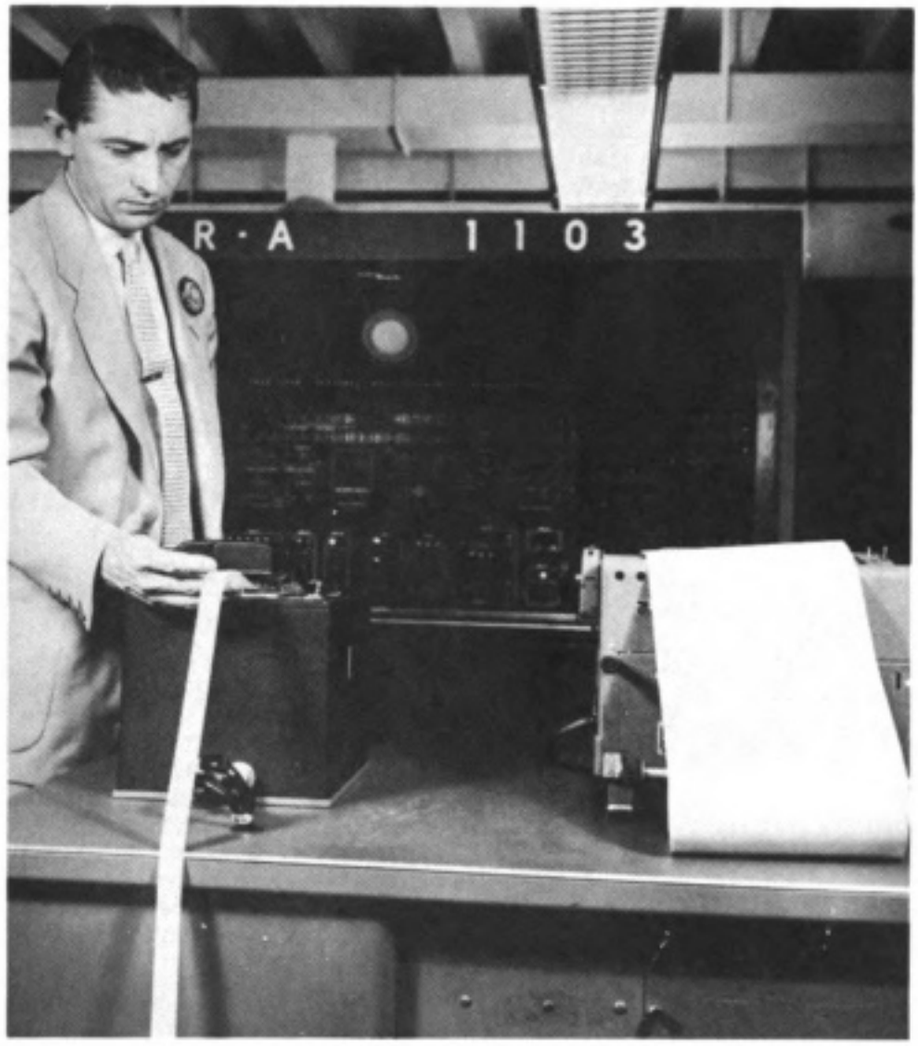
Industrial Sample
Lockheed Aircraft Corporation, Missile Systems Division
Scientific and business.

NUMERICAL SYSTEM

Internal number system Binary

Binary digits per word		36
Binary digits per instruction		36
Instructions per word		1
Instructions decoded	Model 1103	41
	Model 1103A	50
Arithmetic system		Fixed and floating point
Instruction type		Two address
Number range	Fixed point	$(1-2^{35}) \leqslant n \leqslant (2^{35}-1)$
	Floating point	$-2^{127} \leqslant n \leqslant 2^{127}$

The instruction consists of a 2-character operating code (command), a 5-character First Address and a 5-character Second Address.
The floating point system utilizes nine instructions. Fixed point operation utilizes 41 instructions. There are two 15 bit addresses per word. This facilitates writing of programs, since less instructions are required, less storage is consumed in storing program, and a smaller repertoire of instructions has to be learned by the programmer.



Picture by White Sands Proving Ground

Government Sample
Wright Air Development Center

A two-address mode of operation with a Program Control Register, which stores the next instruction address, is used. The instruction word structure consists of a U and V address of 15 binary digits each and the operation code consists of 6 binary digits. The word notation is octal.
Forty six of 64 possible codes are decoded and used.
Floating point is programmed with all decimal numbers converted to octal notation. In fixed point operation, all numbers must be integer numbers in octal notation.

Industrial Sample
Lockheed Aircraft Corporation, Missile Systems Division

The number range may be considered as 0 to $\pm 2^{35}-1$, as in storage, or 0 to $\pm(2^{71}-1)$ as in the accumulator. Fixed point system is used at present.

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	44	28
Mult time	239	223
Div time	486	470
Construction	Vacuum tubes	
Basic pulse repetition rate	500 Kc/sec	
Arithmetic mode	Parallel	
Timing	Synchronous	
Operation	Sequential	

Operation times given above are average values.
Add time includes transmitting result to V address.
Multiply time is for product to form in accumulator with multiplier in "0" register.
Divide time includes quotient in "0" register and positive remainder in the accumulator.
The arithmetic unit is constructed of Eccles-Jordan flip-flop type circuits triggered by pulses from pentode "gate" circuits which are "enabled" by either other flip-flops or signals from "AND" or "OR" circuits. The flip-flops may be manually controlled from the console.
Although the arithmetic mode is parallel, all operations pass through the exchange register "X".
The "X", "0", and "A" registers separately and in combination are used to form eleven distinct logical and arithmetic sequences.

Government Sample
Wright Air Development Center

The add, multiply and divide times are 42, 78-376, and 436-450 microseconds, respectively, excluding storage access.
A total of 1,230 vacuum tubes are utilized in the arithmetic unit.
The arithmetic mode is a parallel, one's compliment, subtractive binary system.

White Sands Proving Ground

Operation times for add, multiply and divide are 66, 120 to 224, 484 to 492 microseconds, respectively, including high speed storage access time and 24, 102 to 196, and 470 to 478 microseconds, respectively, excluding storage access.

Industrial Sample

Lockheed Aircraft Corporation, Missile Systems Division

The add, multiply, and divide times for this system are 20, 104 to 402, and 462 to 476 microseconds, respectively, including storage access and 4, 80 to 378, and 438 to 452 microseconds, respectively, excluding storage access.

STORAGE

	Words	Digits	Microsec Access
Magnetic Core	4,096	147,456	8
Magnetic Core	4,096	147,456	8
Magnetic Core	4,096	147,456	8
Magnetic Drum	16,384	589,824	17,500

The magnetic core matrix is 64 x 64 bits. The matricies are stacked in groups of 36. Up to three stacks may be used as high speed storage.
The magnetic drum is a medium speed storage system.
The magnetic tape Uniservos store 326,000 words of low speed storage. Up to 10 Uniservos can be accommodated.

Government Sample

Wright Air Development Center

The storage system utilizes 1,024 words of magnetic core, 16,384 words of magnetic drum, and 262,144 (total) words of magnetic tape. The magnetic tape consists of 4 units, each with 65,536 words in blocks of 32 words each. The mean access time for magnetic tape is 2 minutes.

White Sands Proving Ground

The storage system has 1,024 words of electrostatic storage, 16,384 words of magnetic drum and 524,288 words of magnetic tape.

Lockheed Aircraft Corporation, Missile Systems Division

The storage system consists of 4,096 words of magnetic core, 16,384 words of magnetic drum, 1,500,000 words of magnetic tape and 3 words of arithmetic register.

INPUT

Media	Speed
Magnetic Tape	2,130 words/sec
Tape Reader	200 frames/sec
Card Reproducer	120 cards/min

The magnetic tape speed is given for the continuous input mode.
The tape reader senses 2 octal digits/frame.
The card reproducer uses 80-column cards, placing 24 words on a card.
Special equipment, such as analog-to-digital converters can be used as optional equipment. By means of input-output buffer registers, a variety of input or output equipment can be accommodated by the computers.

Government Sample

Wright Air Development Center

Input media on this system include punched paper tape at 2,000 words/min, 80-column punched cards at 120 cards/min, and magnetic tape at 60 inches/sec, 100 lines/in and 7 binary digits/line. Information intended for magnetic tape must be from previous intermediate results. Tapes are used as temporary storage only.

White Sands Proving Ground

Input media include a Ferranti Reader, operating at 200 lines/minute (max) and a card reader, operating at 120 cards/minute (max).

Industrial Sample

Lockheed Aircraft Corporation, Missile Systems Division

Input media include paper tape at 400 octal digits/sec, magnetic tape at 25,600 octal digits/sec, and 80-column cards at 120 cards/min.

OUTPUT

Media	Speed
Magnetic Tape (Uniservo)	2,130 words/sec (continuous write)
High Speed Printer	600 lines/min (130 char/line)
High Speed Punch	60 frames/sec (2 char/frame)
Card Reproducer (80 Col)	120 cards/min (24 words/card)
Flexowriter	Supplied as monitor

Government Sample

Wright Air Development Center

A standard 7-level Teletype Paper Tape Punch is used, operating at a speed of 60 words/min.
An 80-column card punch operating at a speed of 120 cards/min is used. A maximum of 8 words/card or 240 holes/card are punched simultaneously.
A 150 line/min medium speed printer is used. A maximum of 92 print columns/line are possible. Alphanumeric characters are on all wheels, totaling 36 different characters.

White Sands Proving Ground

Output Media	Speed
Card Punch	120 cards/min
Line Printer	150 lines/min
Flexowriter	120 words/min
High Speed Punch	3,600 lines/min

All speeds given above are maximum speeds.

Industrial Sample

Lockheed Aircraft Corporation, Missile Systems Division

Output Media	Speed
Paper Tape	120 octal dig/sec
Punched Cards	120 cards/min, 80 col/card
Magnetic Tape	25,600 octal dig/sec
Electric Typewriter	10 char/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	3,907
Tube types	12
Crystal diodes	8,956
Magnetic cores	147,456
Uniservo Magnetic Tape Units	77 tubes, each add'l
Card Reproducer Unit	211 tubes, add'l

Industrial Sample

Lockheed Aircraft Corporation, Missile Systems Division

Tubes	4,700
Crystal diodes	6,000
Magnetic Cores	147,456
Relays	150
Wire	150 miles
Tube types	12
Separate cabinets	14

CHECKING FEATURES

Manufacturer

Fixed

Operate at reduced heater voltages.
Operate at high and low bias voltages (marginal voltages).
Modular construction - pluggable chassis allow faults to be isolated to one section quickly from the console and this section replaced by a spare chassis. The faulty chassis can be serviced without interferring with computer operation.

Optional

Command Test
Magnetic Core Test
Magnetic Drum Test
Card Unit Test

Many special routines for testing operations have been developed by users.

Government Sample

Wright Air Development Center

Computer has multiply, overflow, divide, and missing information fault indication. A number of power, temperature and no water fault indications. Computer has extensive library of maintenance routines and tests for checking to allow a comprehensive preventive maintenance routine to be conducted.

White Sands Proving Ground

Multiply and add overflow
Divide fault
Illegal command
Storage class control fault

Industrial Sample

Lockheed Aircraft Corporation, Missile Systems Division

Odd-even check on magnetic tapes
Overflow in the accumulator
Overflow in the Q-register on a divide command
Unused addresses
Unused instruction codes
Unused typewriter characters

POWER, SPACE AND WEIGHT

Manufacturer

Power, computer	82 KVA, 0.9 PF, 220 Volt, 3 Phase, 100 KVA min, including cooling blower.
Space, computer	946.3 sq ft Minimum room size 58 ft 6-1/4 in by 30 ft 6 in
Weight, computer	38,543 lbs Floor loading 40.7 lbs/sq ft
Capacity, air cond.	Required equivalent capacity is 20 Tons

Two voltage regulators, 3Ø, 45 KVA, required.
Customer furnished cooling water 50° F 65 gal/min, required.
Separate maintenance area approximately 14 by 24 ft, required.

Government Sample

Wright Air Development Center, Wright-Patterson Air Force Base

Computer requires 43 KW, 0.9 PF, occupies 7,200 cu ft and 755.5 sq ft, measures 56 by 26, weighs 34,747 lbs, with a floor loading of 46.1 lbs/sq ft. The air conditioner capacity is 15 Tons. The internal unit, heat exchanger is cooled by chilled water in a closed loop system. The computer heat exchanger makes use of room air which is at approximately 72° F. This is cooled to 60° F and then directed to the bottom of each equipment rack. The normal exhaust temperature is approximately 80° F at the top of each rack.

White Sands Proving Ground

Power requirement 50 KW, 0.9 PF, 1,560 sq ft, 26 x 60 ft includes working space, 33,747 lbs for basic computer, 15 Tons air conditioning.

Industrial Sample

Lockheed Aircraft Corporation

Power, computer	45 KW, 45 KVA, 1 PF
Power, air cond.	4.5 KW, 5.05 KVA, 0.89 PF
Space, computer	9,000 cu ft, 1,500 sq ft 60 by 25 by 6 ft
Weight, computer	34,000 lbs
Capacity, air cond.	15 Tons

Weight includes plenum, air conditioner, Bull reproducer, Flexowriter, Ferranti reader, and paper tape punch.

PRODUCTION RECORD

Manufacturer

Delivery time	12 Months, average

Government Sample

White Sands Proving Ground

Approximately 14 systems produced, with the same number in operation. The ERA 1103 is obsolete and the ERA 1103-A is in current production.

COST, PRICE AND RENTAL RATE

BASIC SYSTEM	Monthly Rental/ Shift, 5 day wk.	Outright Sale
1103A Computer with 4,096 words of core storage and 16,384 words of drum storage. Includes: 1 Flexowriter, 1 Photoelectric Paper Tape Reader, 1 High Speed Paper Tape Punch	$20,960.00	$895,000.00
Optional system: Same as above except less 16,384 words of drum storage.	$17,980.00	$760,000.00
ADDITIONAL EQUIPMENT		
Punched Card Input-Output Unit - 80 columns	890.00	44,500.00
Uniservo Magnetic Tape Unit (Up to 10 units may be used with the 1103A)	320.00	18,000.00
*High Speed Printer operating off-line (600 lines/minute)	3,300.00	185,000.00
On-line operation feature for the High Speed Printer	515.00	20,660.00
Plotting feature for High Speed Printer	590.00	35,400.00
Variable block length feature for Magnetic Tape recording	290.00	17,000.00
Output Printer (150 lines/minute)	1,100.00	51,800.00
Unityper II	90.00	4,500.00
Uniprinter	390.00	22,000.00
Punched Paper Tape Preparation Unit Model II. Consisting of one each bi-octal printer unit, perforator unit and octal keyboard unit.	225.00	8,045.00
Each additional bank of 4,096 word core storage for 1103A. See remarks	4,500.00	195,000.00
*Punched card to magnetic tape converter with 47 character code (80 columns)	2,520.00	142,100.00
Magnetic Tape to Punch Card Converter (80 columns)	2,300.00	130,000.00
Punch Paper Tape Comparator Unit	75.00	2,350.00

*This unit requires a customer furnished voltage regulator of the following type or equivalent:

Superior Electric Company
Stabiline Voltage Regulator
Type EM 4228 Single Phase
27.5 KVA, nominal output voltage 230 volts
Frequency 50-60 cycles
Output voltage range 220-240 volts
Input range for nominal output voltage 195-225 volts

Prices subject to change without notice

This computer will handle up to ten Uniservos. The 1103A may have up to two additional core storage banks, giving a total of 12,288 words of core storage.

PERSONNEL REQUIREMENTS

Manufacturer

Personnel requirements will vary with the amount and use of optional auxiliary equipment.

Government Sample

Wright Air Development Center

Daily Operation	Engineers	Technicians	Operators
One 8-hour shift	1	2	1
Two 8-hour shifts	1	3	2
Three 8-hour shifts	?	4	3

Normal maintenance period of ? hours during a 24-hour operation period. Maintenance performed prior to first shift operation.

White Sands Proving Ground

Daily Operation	Engineers	Tech-Operators
One 8-hour shift	?	?
Two 8-hour shifts	?	3
Three 8-hour shifts (5 day week)	?	4
Three 8-hour shifts (7 day week)	?	5

Industrial Sample

General Dynamics Corporation, Convair Division

Three 8-hour shifts require 6 engineers, 30-50 programmers and 6 coders.

Lockheed Aircraft Corporation, Missile Systems Division

Daily Operation	Engineers	Technicians	Operators
One 8-hour shift	2	3	2
Two 8-hour shifts	2	4	4
Three 8-hour shifts	2	5	6

RELIABILITY AND OPERATING EXPERIENCE

Manufacturer

Typical operation performance is 0.985, where performance is defined as (Available Operating Time minus Lost Time) divided by Scheduled Operating Time. The Available Operating Time is based on Scheduled Operating Time minus preventive maintenance time which may have run past the scheduled starting time. Statistics for determining the average error free running period have not been tabulated because of the high degree of reliability of the computers.

Government Sample

Wright Air Development Center

Average error-free running period	30 hours
Good time	4,183.2 hours
Attempted to run time	4,290.3 hours
Operating ratio (Good/Attempted to run)	0.975

Figures based on period 5 January 1956 to 5 January 1957.
Acceptance test 5 January 1956.

Total Performance Figure is (Total Available Time - Lost Time) divided by (Scheduled Time plus Maintenance Time) or (4,183.2 - 22.2)/(4,290.3 + 548.2) = 0.860.
Lost time includes that time lost due to machine malfunction only.

White Sands Proving Ground

Average error-free running period	54.78 hours
Good time	2,822.42 hours
Attempted to run time	2,900.00 hours
Operating ratio (Good/Attempted to run)	0.973

Figures based on period 1 August 1955 to 1 August 1956.
Acceptance test February 1955.

Industrial Sample

General Dynamics Corporation, Convair Division

Average error-free running period	6-8 hrs, estimated
Operating ratio (Good/Attempted to run)	0.95

Figures based on period June 1956 to October 1956.
Acceptance test September 1954.

System has been in steady three shift operation for over nine months.

Lockheed Aircraft Corporation, Missile Systems Division

Average error-free running period	10.7 hours
Good time	103.2 hours
Attempted to run time	107.6 hours
Operating ratio (Good/Attempted to run)	0.95

Figures based on period 12 October 1956 to 1 November 1956.
Acceptance test 12 October 1956.

Ramo-Wooldridge Corporation, Computer Systems Division

Average error-free running period	10.2 hours
Good time	3,581.87 hours
Attempted to run time	3,759.06 hours
Operating ratio (Good/Attempted to run)	0.95

Figures based on period August 1955 to October 1956.
Acceptance test 1 August 1955.

FUTURE PLANS

Government Sample

Holloman Air Development Center

Two 1103-A Computers are under contract for purchase with Sperry-Rand Corporation with additional equipment, including:

1 Card Reproducer
5 Uniservo Tape Units
1 Uniprinter
2 Ferranti Tape Readers
2 High Speed Tape Punches
1 Tape Preparation Unit
Analog to Digital Conversion Equipment

Wright Air Development Center

Negotiations are currently in progress to purchase the 1103 Computer (currently being leased) from the manufacturer. The system is then to be maintained by the Air Force and will result in substantial savings in operating costs. A number of desired modifications are currently under study, which if incorporated into the computer's circuitry, will result in increased operating capacity. These changes deal primarily with input/output equipment control and programmed interlock features between the computer and its external equipment, thus allowing the use of additional computer time made available by the changes.
Consideration is also being given to connecting the 1103 digital circuitry to a large Analog Computing System, soon to be installed. This will allow greater capacity and real-time simulation, allow digital output presentation, in addition to analog output and will allow both systems to operate on the same problem, resulting in a substantial savings of computation time in the solution of certain classes of problems.
A Remington Rand Univac Scientific Digital Computing System (1103 AF) is scheduled for delivery to this organization in October, 1957. The system will consist of a 12,288 address high speed Magnetic Core Memory, built-in Floating Point Arithmetic, 10 Univac Magnetic Tape Servo-Mechanisms, high speed Univac Line Printer and several other associated off-line Univac Data Handling devices. This addition will greatly expand the computational capacity of the Computation Branch and will enable the solution of many classes of scientific problems, which at the present time can not be put on the 1103 due to excessive conversion and computation times involved in the solution, not to mention the large amount of time involved in transcribing the resultant output data into the finished report.

White Sands Proving Ground

It is proposed that the 1103 Computer now in use, be replaced by the 1103A, which has provision for magnetic tape input-output and other highly desirable input-output devices. This modification plan is now under study.

Industrial Sample

Lockheed Aircraft Corporation, Missile Systems Division

It is proposed to install a High Speed Printer on-line with the computer for purposes of a direct output device.
An IBM 727 Magnetic Tape Unit will be modified for use on the Sperry-Rand High Speed Printer.
A field installation of an internal floating point feature is being considered. The decision concerning installation of floating point is dependant upon the length of time required for the field installation.
A variable block length feature will be installed during 1957.

INSTALLATIONS

Government Sample

Eglin Air Force Base, Florida

Holloman Air Development Center
Holloman Air Force Base, New Mexico

White Sands Proving Ground
New Mexico

Wright Air Development Center
Wright-Patterson Air Force Base, Ohio

Industrial Sample

Boeing Aircraft
Seattle, Washington

General Dynamics Corporation
Convair Division
Pomona, California

General Dynamics Corporation
Convair Division
San Diego 12, California

John Hopkins University
Chevy Chase, Maryland

Lockheed Aircraft Corporation
Missile Systems Division
Sunnyvale, California

The Ramo-Wooldridge Corporation
Computer Systems Division
Los Angeles 45, California

Sperry Rand Corporation
Remington Rand Univac Division
315 Fourth Avenue
New York 10, New York

Sperry Rand Corporation
Remington Rand Univac Division
Univac Park
St. Paul 16, Minnesota

ADDITIONAL FEATURES AND REMARKS

Manufacturer

Analog to digital and digital to analog converters are available on special order.
Automatic programming system in process.
Library of approximately 150 subroutines.
USE compiling system now available.

Special features of the computer:
Repeat command
Interrupt command
Interpret command
Variable drum interlace
Two address computer
Index jump command
On-line High Speed Printer operation
Variable block length tape operation
Fixed and Floating Point Arithmetic

Extensive auxiliary equipment, all using common communication medium and code via magnetic tape. Units include:
MTM Magnetic to Magnetic Tape Transrecorder (remote com. via telephone line)
PTM Paper Tape to Magnetic Tape Converter
MTP Magnetic Tape to Paper Tape Converter
80 & 90 column card to tape converters
Tape to Card Converter
High Speed (600 line per min.) Printer
Unityper (Keyboard for preparing magnetic tape)
Verifier (Keyboard and verifier/reader for magnetic tape) and others

Government Sample
White Sands Proving Ground
Outstanding features are:
Multiply add
Repeat command
Index jump command
Return jump

Industrial Sample
Lockheed Aircraft Corporation, Missile Systems Division
System includes a high speed printer which will print 600 lines of 120 characters per minute from magnetic tape. The magnetic tape can either be prepared from the computer as output or from magnetic tape preparation equipment called the Unityper II.