UDEC I

Unitized Digital Electronic Calculator

MANUFACTURER

The Burroughs Corporation
Electronic Instrument Division

APPLICATIONS

Scientific computing

NUMERICAL SYSTEM

Internal number system	Binary coded decimal
Decimal digits per word	10
Decimal digits per instruction	5
Instructions per word	2
Instructions decoded	34
Instructions used	34
Arithmetic system	Fixed point
Instruction type	One or two address
Number range	$10^{-9} \leqslant n \leqslant 10^{9}$

Program selection permits one- or two-address modes of operation. The decimal point may be manually set at any desired location. Two address operation is optional for optimum programming.

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	176-264	88-176
Mult time	4,000	3,912 (avg)
Div time	6,000	5,912 (avg)
Construction		
Vacuum tubes	3,000	
Magnetic cores	320	

Rapid access word registers	2
Basic pulse repetition rate	125 Kc/sec
Arithmetic mode	Serial-parallel
Timing	Synchronous

STORAGE

Media	Words	Digits	Microsec Access
Magnetic Drum	5,300	53,000	8,000(avg)
Magnetic Cores	100	1,000	88

INPUT

Media	Speed
Paper Tape (Ferranti Photoelectric)	400 char/sec
Keyboard	Manual

OUTPUT

Media	Speed
Printer	6 char/sec
Paper Tape	60 char/sec

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	3,000
Tube types	8
Crystal diodes	6,000
Magnetic cores	4,700
Separate cabinets	28 standard, 19 in by 7 ft, each.

Tube types include 6CL6, 5687, 7AK7, 6197, 12AU7, 12AT7, 6BC5, 12BH7.

System is constructed of standard Burroughs pulse control equipment and interconnected with R662U coaxial cable.

CHECKING FEATURES

Modulo 3 arithmetic check

Modulo 3 check on each word transferred to and from storage.

Forbidden combination multiply and divide check.

POWER, SPACE AND WEIGHT

Power, computer	30 KW, 32 KVA
Space, computer	400 sq ft area, floor space part of machine
Capacity, air cond.	Blower-exhaust type

System arranged in form of an almost closed rectangle.

PRODUCTION RECORD

Produced	1
Operating	1

COST, PRICE AND RENTAL RATE

Approximate cost of basic system $500,000.
Approximate cost of modifications and additions $200,000.

PERSONNEL REQUIREMENTS

Personnel varies with changes in activity of university laboratory.

RELIABILITY AND OPERATING EXPERIENCE

Average error-free running period	7 hours/8 hour shift
Good time	8.5 hours
Attempted to run time	10 hours

Operating ratio (Good/Attempted to run) 0.85
Figures based on period May 1953 to November 1956.
Acceptance test December 1953.

Decimal-binary automatic conversion is utilized.

INSTALLATIONS

Wayne University
Computational Laboratory
Detroit 1, Michigan

UDEC II III

Unitized Digital Electronic Computer
Model II (Modified to Model III)

MANUFACTURER

Burroughs Corporation
Electronic Instruments Division

Picture by Burroughs Corporation

APPLICATIONS

Scientific and commercial

NUMERICAL SYSTEM

Internal number system	Excess-three bin coded dec
Decimal digits per word	9 plus sign digit
Decimal digits per instruction	5
Instructions per word	2
Instructions decoded	40
Instructions used	32
Arithmetic system	Fixed point
Instruction type	One address
Number range	Movable decimal point

Two address word possible if second instruction in each word is unconditional transfer. Each instruction is one half word, i.e. 5 digits. Of these, 3 digits specify address and 2 digits the command.

ARITHMETIC UNIT

Add time (exclud. stor. access)	680 microsec
Mult time (exclud. stor. access)	30,000 microsec
Div time (exclud. stor. access)	30,000 microsec
Construction	Vacuum tubes
Basic pulse repetition rate	125 Kc/sec
Arithmetic mode	Serio parallel
Timing	Synchronous
Operation	Sequential

STORAGE

Media	Words	Microsec Access
Magnetic Core	1,000	20/5 digits
Magnetic Drum	10,000	8,500 (Avg)

53,000 decimal digits total drum storage. Drum information contained in blocks of 200 words for transfer to and from core storage.

INPUT

Media	Speed
Paper Tape (Ferranti Photoelectric)	120 char/sec

Paper Tape (Potter magnetic tape handler modified for photoelectric input) Magnetic Tape (Potter)

OUTPUT

Media	Speed
Paper Tape (Teletype) (2)	60 char/sec (5-level)
Paper Tape (Teletype)	60 char/sec (7-level)

Magnetic Tape (Potter)

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes 3,000

Machine consists of Burroughs Pulse Control Equipment, approximately 600 units in all.

CHECKING FEATURES

Fixed
Transfer check modulo 3
Overflow, halt, and multiplication-division alarms.

POWER, SPACE AND WEIGHT

Power, computer	33 KW
Space, computer	31 racks
Capacity, air cond.	15 Tons

PRODUCTION RECORD

Number produced	2 (Incl UDEC I)
Number in current operation	2
Delivery time	6 Months

UDEC I located at Wayne University, Detroit, Michigan
UDEC II III located at Burroughs Corporation, Philadelphia, Pennsylvania

COST, PRICE AND RENTAL RATE

Approximate price of basic system	$200,000 (UDEC II)
Additional equipment	$100,000

PERSONNEL REQUIREMENTS

Daily Operation	Engineers	Tech or Operators
One 8-hour shift	1	3
Two 8-hour shifts	2	4

RELIABILITY AND OPERATING EXPERIENCE

Average error free running period	6 hours
Operating ratio	0.85

Acceptance test October 1953

INSTALLATIONS

Wayne University (UDEC I)
Computational Laboratory
Detroit 1, Michigan

Burroughs Corporation
Electronic Instruments Division
1209 Vine Street
Philadelphia, Pennsylvania

ADDITIONAL FEATURES AND REMARKS

Special instructions:
Four B-boxes
Overflow transfer instruction
Complete format control
Transfer on special character
Logical sum and product
Single and double register shift instructions
Buffered input-output for photoreaders and teletype punches.

Provision for additional equipment and modification of logic.

Burroughs UDEC III is a general modification of UDEC II. UDEC III will consist of Burroughs pulse control equipment which has been used in UDEC II. The basic flexibility of this equipment provides for a maximum of modification with respect to special instructions and special input-output equipment which must be added as required. In addition to this, the flexibility also provides for a modernization of the machine with the advancement of the art.

When all plans for the modification of UDEC II are complete, the system will be designated UDEC III. The changeover is scheduled to take place in the Spring of 1957. Accordingly, UDEC II will then cease to exist. At the present time, UDEC II is in operation.

UDOFT

Universal Digital Operational Flight Trainer

MANUFACTURER

Electronic Systems Division
Sylvania Electric Products, Inc.

APPLICATIONS

Government Sample
U. S. Naval Training Device Center
Real time simulation of flight for pilot training. This system is based on studies conducted by the Moore School of Electrical Engineering and sponsored by the USNTDC. The computing system described is a preliminary design. A contract for development was awarded to Sylvania Electric Products, Inc., Electronic Systems Division, Waltham, Mass. for development and fabrication. The purpose of the computer is to actuate Navy and Air Force type operational flight trainers, which at present utilize analog computers. It's intended to be a research tool upon which extensive mathematical investigations relative to flight simulation and pilot training will be conducted.

Industrial Sample
University of Pennsylvania, Moore School of Electrical Engineering
Operational flight trainers and real-time control problems.

NUMERICAL SYSTEM

Moore School of Electrical Engineering

Internal number system	Binary
Binary digits per word	20 plus sign plus parity check bit
Binary digits per instruction	19 plus parity check
Instructions per word	1
Instructions decoded	28
Arithmetic system	Fixed point
Instruction type	One address

Number range $(1 - 2^{-20})$ to $-(1 - 2^{-20})$

ARITHMETIC UNIT

	Exclud. Stor. Access Microsec
Add time	5
Mult time	10
Div time	105

Construction-Vacuum tubes and crystal diodes
Arithmetic mode Sequential - parallel
Timing Synchronous
Operation Sequential

The system utilizes sequential-parallel operation using serial synchronous circuits. Construction of the arithmetic unit is similar to the SEAC System. Employs W.E. type 404A tube. Some transistors are used. A 5 phase clock source is used.

STORAGE

Media	Words	Microsec Access
Magnetic Core	8189	5

The storage system consists of two separate units: 4,094 number words and 4,095 instruction words. Both units require an access time of 5 microseconds while the arithmetic unit is operating on the previous instruction.

INPUT

Manufacturer

Media	Speed
Punched Cards	750 words/min
Gray Code Shaft Converters	10 microseconds
Switches	Manual

U. S. Naval Training Device Center
Punched cards are used only at start of simulation. The switches are sensed in 5 microseconds. 64 switches are used as discrete inputs. Analog and discrete inputs are initiated by pilots' controls and certain flight instructor inputs.

OUTPUT

Manufacturer

Media	Speed
Binary Printer	2,000 lines/sec

U. S. Naval Training Devices Center

Printer - Teledeltos paper 2,000 words/sec
64 Analog
24 Discrete

Analog and discrete outputs provide voltages to actuate pilots instruments and indicators.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	1,800
Tube types	3
Crystal diodes	20,000
Magnetic cores	180,224
Transistors	500

Above figures are approximate. A tube type utilized is the 404A.

Separate cabinets 6 (not including A-D conversion equipment)

CHECKING FEATURES

U. S. Naval Training Devices Center
Fixed
Parity, marginal, overflow, unused order type

Optional
Slow computation switch and one cycle operation for program check and calibration.

POWER, SPACE AND WEIGHT

Power, Computer	10 KW
Capacity, air cond.	10 Ton

Above power requirement is estimated.

PRODUCTION RECORD

Produced	0
In production	1
Delivery time	30 Months

U. S. Naval Training Devices Center
Prototype version due January 1959.

PERSONNEL REQUIREMENTS

U. S. Naval Training Devices Center
One pilot trainee, one flight instructor, one computer operator (engineer), 3 - 4 technicians (maintenance, calibration) etc.

FUTURE PLANS

U. S. Naval Training Devices Center
Future models to be transistorized and possibly mobilized. Has possibility of simulating more than one cockpit simultaneously.

INSTALLATIONS

University of Pennsylvania, Moore School of Engineering, 200 South 33rd Street, Philadelphia 4, Pennsylvania

ADDITIONAL FEATURES AND REMARKS

Manufacturer
Ultra high speed is achieved through a novel logical structure. System includes an interval timer of great flexibility for real-time simulation.

U. S. Naval Training Devices Center
Real time simulation of many different types of flight trainers. Solves complete aerodynamic and engine equations in flight and on ground. Eighty-eight inputs and outputs (analog and discrete). Relative address register. Will actuate two different aircraft cockpits.

UNIVAC I

Universal Automatic Computer Model I

MANUFACTURER

Sperry Rand Corporation
Remington Rand UNIVAC Division

Picture by Pacific Mutual Life Insurance Company

APPLICATIONS

Manufacturer
General purpose large scale digital

Government Sample
Army Map Service
Geodetic, cartographic and photogrammetric computations.

Bureau of the Census
Two computers are utilized for statistical data processing.

New York Naval Shipyard
The shipyard utilizes the Bureau of Ships' computer at the David Taylor Model Basin for the following applications:

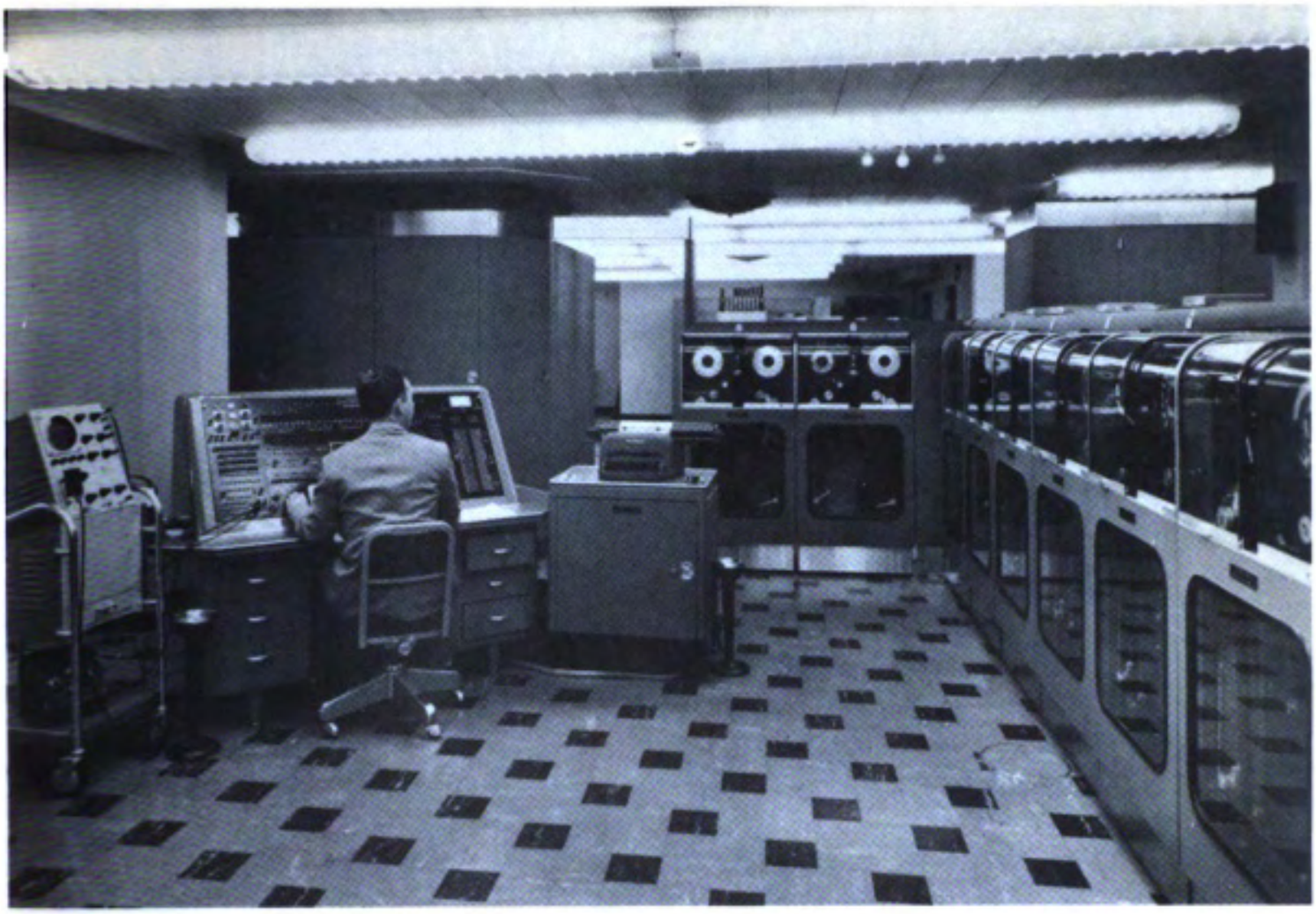
Random numbers were generated to facilitate statistical experimental design associated with an investigation of the holding strength of various screw fasteners in several types of wood suitable for decking under several experimental conditions. Univac saved several hundred man-hours which would have been required for manual solution of the problem. Univac aided in insuring independence among lists of random numbers which would have been difficult in manual solution.

The solution of simultaneous equations represents approximately ten per cent of the work in a pipe stress problem. Six by six matrixes are solved by desk calculators and those of a higher order are solved by an analog computer.

Computations of standard deviation, arithmetic averages, were requested. Comparisons of computing methods showed manual methods would take 80 hours and Univac 1 hour.

X-ray spectroscopy computations were requested. This included the computation of wave lengths by continuously substituting values from an extremely large range of variables.

Requests for a continuous sequential regression analysis representing life testing were made. Also due to the many environmental variables factorial analysis was requested to control experimental



Picture by Franklin Life Insurance Company

conditions.
David Taylor Model Basin
Mathematical and data processing.

Industrial Sample

Consolidated Edison Company
Customer billing and accounting.
E. I. du Pont de Nemours and Company
General engineering, scientific and commercial.
The Franklin Institute
Computing center activity.
Franklin Life Insurance Company
Insurance data processing.
General Electric Company Appliance and TV Receiver Division
Business data processing.
New York University, AEC Computing Facility
Scientific and data handling problems.
Pacific Mutual Life Insurance Company
Business: Data processing of ordinary life insurance work on a daily cycle basis.
University of California Radiation Laboratory
Research and services in mathematical sciences and weapons development.

NUMERICAL SYSTEM

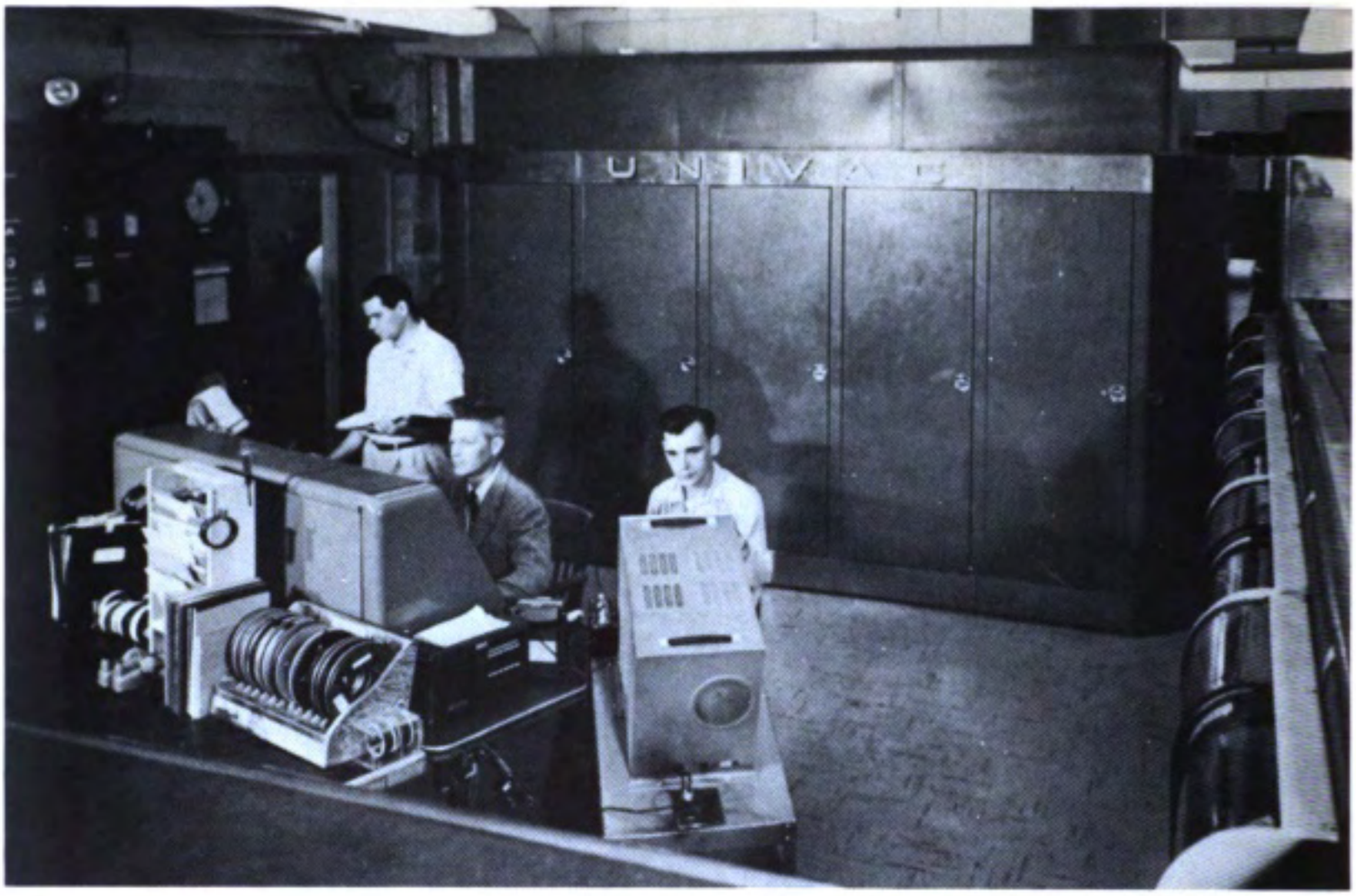
Internal number system	Binary coded decimal
Decimal digits per word	12 (11 plus sign)
Decimal digits per instruction	6
Instructions per word	2
Instructions decoded	63
Instructions used	45
Arithmetic system	Fixed point
Instruction type	One address
Number range	Between -1 and +1

Floating point is performed by sub-routines supplied with the computer. The decimal point occurs at the right of the sign digit.

ARITHMETIC UNIT

	Incl. Stor. Access Microsec	Exclud. Stor. Access Microsec
Add time	525	282.6
Mult time	2,150	1,907.6
Div time	3,950	3,707.6
Construction	5,000 vacuum tubes	
Rapid access word registers	4	
Basic pulse repetition rate	2.25 Mc/sec	
Arithmetic mode	Serial	
Timing	Synchronous	
Operation	Sequential	

The minimum storage access time is 40.4 microseconds.
The maximum storage access time 404 microseconds.



Picture by University of California Radiation Laboratory

STORAGE

Media	Words	Digits	Microsec Access
Acoustic Delay Line	1,000	12,000	40.4 to 404

The acoustic medium is mercury. If average access time is 5 word times, the average access time would be 202 microseconds.

Industrial Sample
The Franklin Life Insurance Company

The read-out from storage is serial. Therefore, access time is 1 word time plus latency time, which can be as high as 9 word times, so if the average latency time is assumed to be 5 word times (202 microseconds) plus 1 word read-out time (40.4 microseconds), average access is 242.4 microseconds.

Author's note: Perhaps a realistic random access time, taken over a large number of storage cycles, would be a statistical average of 1 word time plus 4-1/2 word times or 222.2 microseconds, or the arithmetic mean obtained from the minimum and maximum access times. However, the 222.2 microseconds would not represent any real access time for a given word in storage.

INPUT

Media	Speed	
Magnetic Tape (UNISERVO I)	12,800 char/sec	
Keyboard	Manual	
Unityper II	Keypunching	50 char/in density
Verifier	Keypunching	Verifies Unityper II recording
80 Column Card-to-Tape Converter	240 char/min.	120 char/in. density
90 Column Card-to-Tape Converter	240 char/min.	120 char/in. density
Paper Tape to Magnetic Tape Converter	200 char/sec.	5, 6 or 7 channel code
Magnetic Tape to Magnetic Tape Transrecorder	90 char/sec.	Speed dependent upon communication facilities

Government Sample
Army Map Service

The packing density may be 20, 50 or 128 pulses/in on 7 channels. The keyboard may be used to "type" information directly into storage. Auxiliary (off-line) equipment includes 2 Unitypers-Model I, 3 Unitypers-Model II and 6 IBM keypunches. A card to tape converter is available by co-operative arrangement with a nearby government agency.

Picture by University of California Radiation Laboratory

Industrial Sample

The Franklin Life Insurance Company

A read-in requires the use of the main computer for 3,500 microseconds. At the end of this time, the main computer is released and the read-in continues into the I-tank, a 720-digit auxiliary storage exclusive of the main storage. Transfer from the I-tank to main storage is performed during this time of 3,500 microseconds, during which the previous block of information is read into the I-tank.

University of California Radiation Laboratory

Unityper I records at 20 char/in. and is "loop controlled". Unityper II records at 50 char/in. and printed copy is produced simultaneously.

OUTPUT

Media	Speed	
UNISERVO I	12,800 char/sec	
Printing Unit	10 in/sec	
Uniprinter	10 char/sec	20 char/in density
High Speed Printer	600 lines/min	130 char/line (maximum)
Tape-to-Card Converter	120 cards/min	80 column cards
Magnetic Tape to Paper Tape Converter	50 char/sec	5, 6 or 7 channel code
Magnetic Tape to Magnetic Tape Transrecorder	90 char/sec	Speed dependent upon communication facilities

Government Sample

Army Map Service

Magnetic tape, 100 in/sec, 20 or 128 pulses/in. Printer (typewriter) 12 char/sec, direct printing from storage. Auxiliary (off-line) equipment includes 4 Uniprinters, 1 high speed printer and 1 Electro-plotter on order from the Benson-Lehner Corporation.

Industrial Sample

The Franklin Life Insurance Company

A write requires the use of the main computer for 3,500 microseconds, at which time the main computer is released for further computation, as the write continues from an auxiliary 720 digit storage exclusive of the main storage, called the O-tank.

University of California Radiation Laboratory

Output equipment using magnetic tape input: Uniprinter 10-11 char/sec converts recording on magnetic tape to desired printed format. High Speed Printer 600 lines/min, adjustable to 200 and 400 if desired; 120 char/line; 130 char/line is maximum when there is repetition of characters.

CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	5,200
Tube types	15
Crystal diodes	18,000

Picture by the E. I. du Pont de Nemours and Company

Separate cabinets 15

The separate cabinets are included in the Central Computer, the Supervisory Control, the Power Supply and eleven Uniservos. The above figures are approximate and do not include input-output devices.

Government Sample
Army Map Service

The tube types used throughout the entire system include the 25L6, 6AN5, 7AK7, 6AU6, 6BE6, 6SN7, 6X5, 6AK7, 28D7, 807, 829B, 2050, 5545, 5651, 5687, 6AL5, 6AK5, 6AH6, 5V4, 5R4, 4D32, 3C23, 8008. The system includes the Computer, Power Supply, Supervisory Control, Printer and 8 Uniservos.

Industrial Sample
The Franklin Life Insurance Company

Approximately 50% of the tube complement are 25L6's. Each of ten Uniservos (tape handlers) are separate and interchangeable.

CHECKING FEATURES

Fixed

Duplicate circuitry for checking results of computation and comparison
Odd-even pulse
Read-in and read-out pulse check on the 720-digit auxiliary storage.
Three minute interval pulse check.
Automatic re-read provides for reading a block from the tape again when the first reading indicates an error. Marginal checking causes weak tubes to fail during scheduled maintenance instead of during production time.

Government Sample
Army Map Service

Fixed

Trouble shooting and indicating checks on this system include:
DC fault test and locator
Primary alarm circuits
Audio check
Mercury tank heater monitor
Storage checker
Checking circuits
Marginal check
Function table checker and neon bank
Duplicate arithmetic circuits

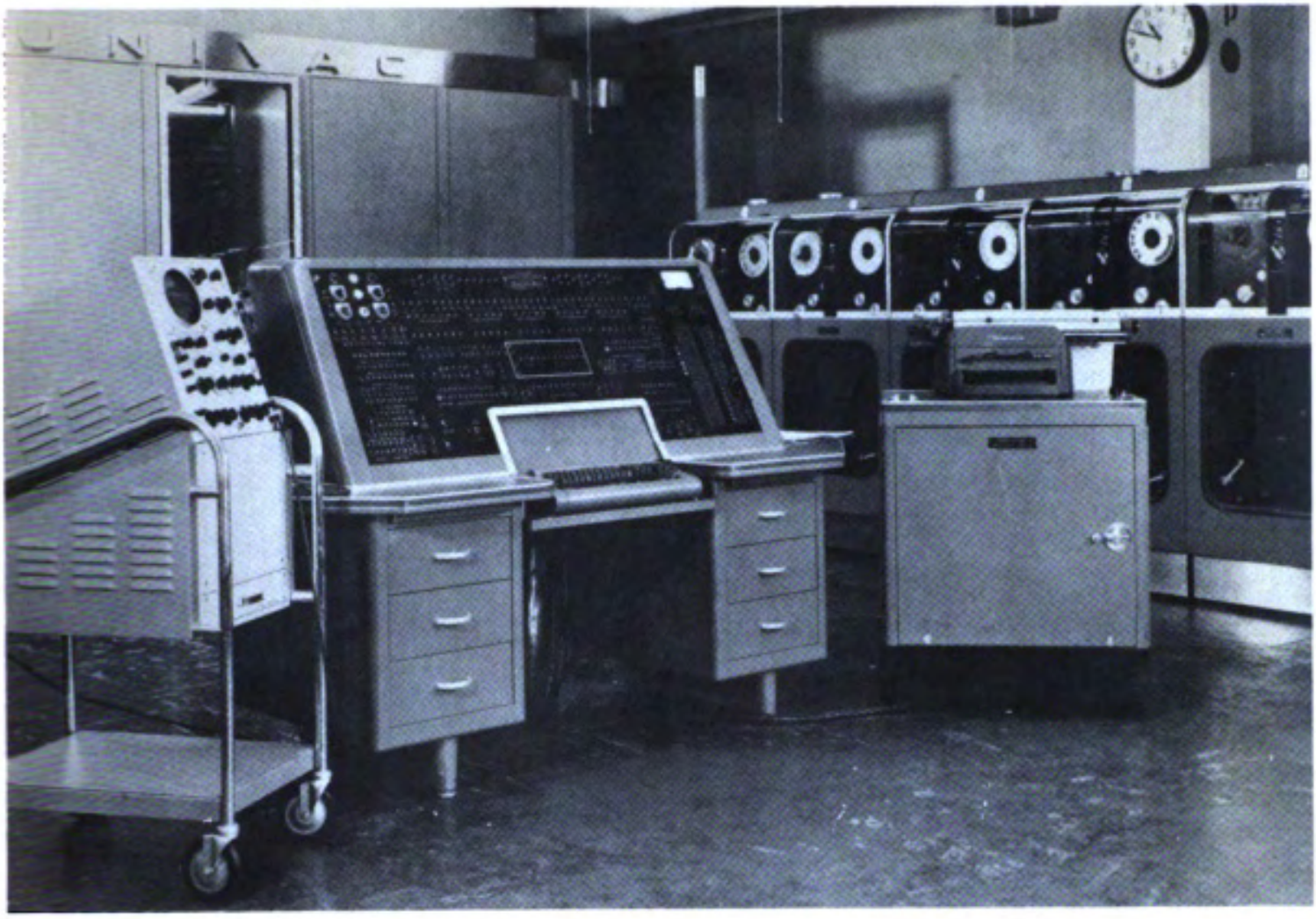
Optional

Test bench and various test equipments
2 modifications for checking purposes
ACC voltage monitor either by meter or scope

Every character has an odd number of pulses. Odd-even checkers on input and output buffers and in other circuits within the machine. Other automatic internal checking features also included.

David Taylor Model Basin

Checking summarized as parity, comparison and counting.



Picture by Wright-Patterson Air Force Base

Industrial Sample

The Franklin Institute and University of California Radiation Laboratory

Parity check throughout system, character count on each block of input and output, and parallel computing.

The Franklin Life Insurance Company

No programmed checks are used in normal operation, except during maintenance time, because of the comprehensive hardware checking circuits mentioned above.

Odd-even check of each decimal digit transferred within main computer and of digits coming from or going to magnetic tape.

Duplicated circuits of all arithmetic operations and most control functions.

POWER, SPACE AND WEIGHT

Power, computer	81 KW, 90 KVA, 0.98 PF, 124.5 KVA with 10 Uniservos and power supply
Space, computer	943 cu. ft., 16 ft. by 22 ft.
Space, air cond.	Height: 8 ft, 6-9/16 in. Width: 14 ft, 3-3/8 in. Depth: 7 ft, 10 in.
Weight, computer	16,686 lbs.
Capacity, air cond.	35 Tons

The choice of air conditioner is optional with customer. A closed chilled-air system cools the Central Computer Group and heavy auxiliaries. Chilled water must be supplied at a temperature from 45° to 50° with controls to the Power Supply and the Central Computer. The Central Computer and Power Supply Unit require 35 Tons of refrigeration.

Government Sample

Army Map Service

Total requirement is 125 KVA, 3 input stabilizers are used.

Computer requires 1,400 sq. ft., high speed printer 400 sq. ft.

Weights are:	Computer	10,000 lbs.
	Power Supply	4,500 lbs.
	Supervisory Control	445 lbs.
	Printer and typer	444 lbs.
	Uniservos, each	450 lbs.

Computer generates 314,000 BTU/hour.

Power Supply generates 98,000 BTU/hour.

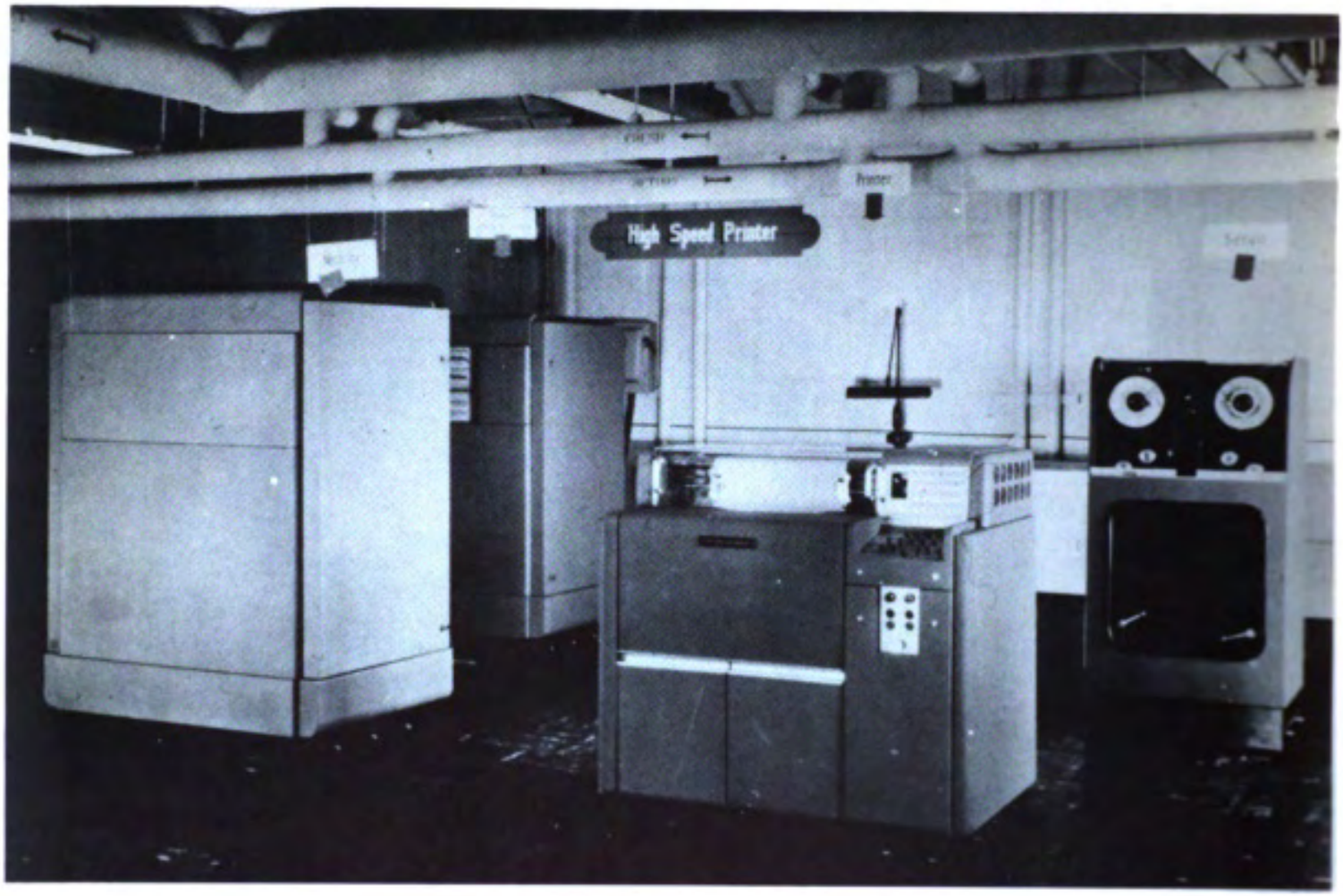
David Taylor Model Basin

Installation requires 124.5 KVA, utilizes 1,000 sq. ft., and weighs 29,853 lbs., and is air conditioned at 50 Tons.

Industrial Sample

The Franklin Institute

The air conditioner has a 100-Ton capacity. The computer occupies 4,000 sq. ft. and the air conditioner 150 sq. ft.



Picture by Wright-Patterson Air Force Base

The Franklin Life Insurance Company
Installation requires 120 KW, 130 KVA, 0.924 PF, 9,600 cu. ft., 1,200 sq. ft., weighs 125,505 lbs. All of the 60 Ton air conditioner is not required for the central computer.

University of California Radiation Laboratory
A 35-Ton air conditioner of the evaporative type is used.

PRODUCTION RECORD

Delivery time 6 Months

COST, PRICE AND RENTAL RATE

Description	Base Monthly Rental 1 Shift-5 day week	Outright Sale Price F. O. B. Factory
UNIVAC I Central Computer with Power Supply & Supervisory Control Desk	$13,390.00	$750,000.00
UNISERVO I	320.00	18,000.00
UNIPRINTER	390.00	22,000.00
UNITYPER II	90.00	4,500.00
VERIFIER	NOT CURRENTLY AVAILABLE	
HIGH SPEED PRINTER	3,300.00	185,000.00
CARD-TO-TAPE UNIT (47 Character Code)	2,520.00	142,100.00
CARD-TO-TAPE UNIT (38 Character Code)	2,500.00	--------
TAPE-TO-CARD UNIT	2,300.00	130,000.00
PERFORATED TAPE-TO-MAGNETIC TAPE (PTM) Converter	1,800.00	108,000.00
MAGNETIC TAPE-TO-PERFORATED TAPE (MTP) Converter	1,500.00	90,000.00

Prices quoted above subject to change without notice. Rental charges include maintenance service, spare parts and test equipment. Separate maintenance contract and maintenance advisory service contract available to purchasers of UNIVAC Systems.

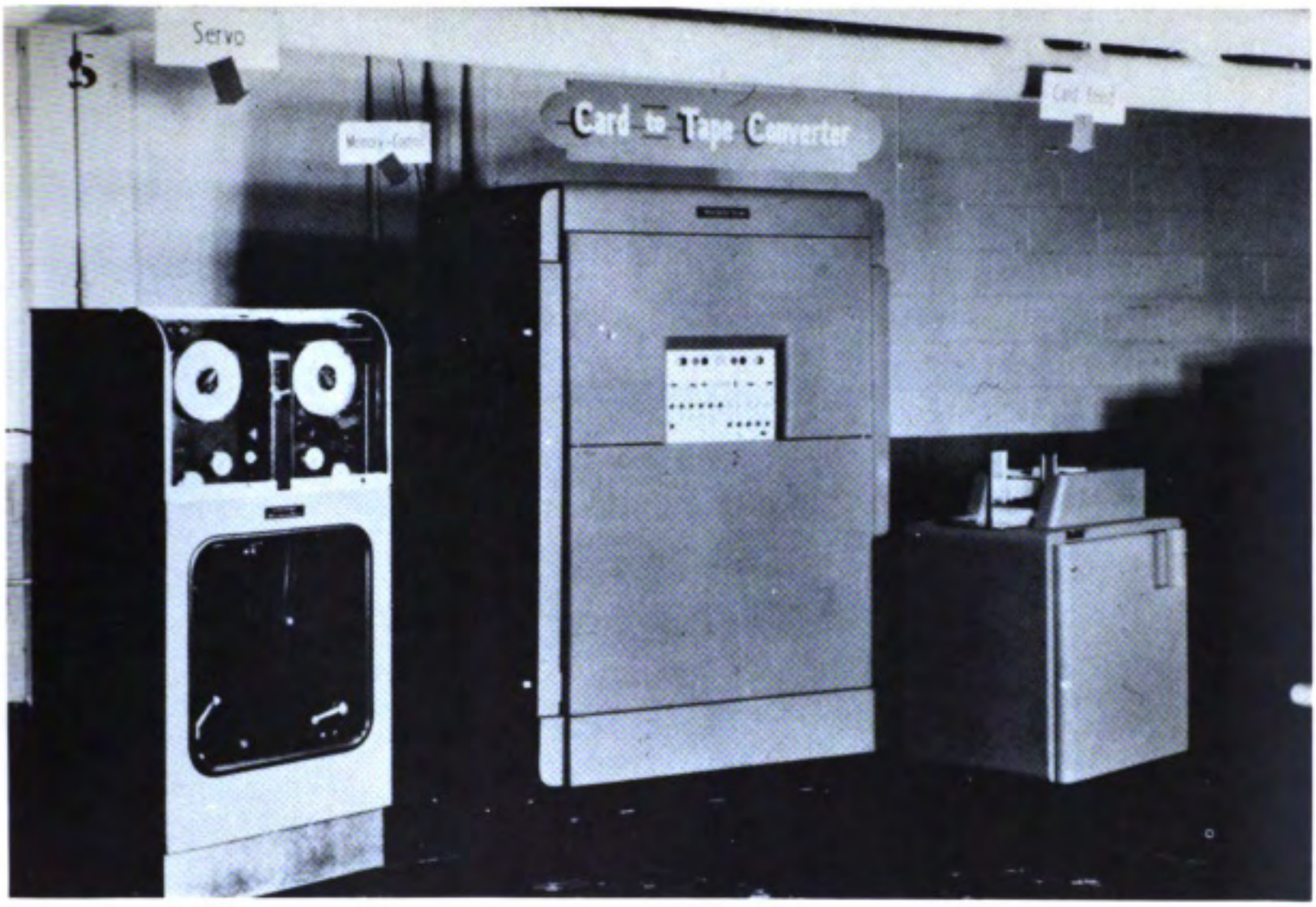
Government Sample

Army Map Service
Approximate price of basic system was $600,000. This price does not reflect present purchase price of similar equipment, as this equipment was purchased by contract negotiated before first machine was built.

Bureau of the Census
$2,300/month for card to tape converter.
$3,300/month for High Speed Printer (Internal Revenue Service)

David Taylor Model Basin

Item	Price Paid
Basic system	$935,000
Plotter	21,000
Hi-Speed Printer	185,000
Card-to-Tape Converter	125,000
2 Unitypers I	36,000



Picture by Wright-Patterson Air Force Base

2 Uniprinters	36,000
1 Unityper II	4,000

Industrial Sample

The Franklin Institute

Approximate price of basic system was $930,000. Approximate price of additional equipment $365,000. Installation cost of $150,000 includes the construction of a Computation Exhibit as well as the Computing Center.

The Franklin Life Insurance Company

Approximate cost of basic system was $900,000. Approximate cost of high speed printer $100,000.

University of California Radiation Laboratory

Approximate cost of basic system was	$860,000
Approximate cost of high speed printer	130,000
Approximate cost of Unityper II	5,500

PERSONNEL REQUIREMENTS

Manufacturer

The number of engineers, technicians, and operators required depends upon the equipment complement of the UNIVAC System and the shift operation.

Government Sample

Army Map Service

Three 8-hour shifts require 2 engineers, 5 technicians and 6 operators. The total staff is 60 persons, including programmers, computer and auxiliary equipment operators and maintenance crews.

Bureau of the Census

Two computers are operated on a 168-hour/week basis. Present staff consists of 5 engineers, 15 electronic technicians, and 15 operators.

David Taylor Model Basin

For three 8-hour shifts, 3 engineers and 11 technician-operators are required to operate two Univacs and maintain one.

Industrial Sample

The Franklin Institute

One 8-hour shift requires 1 engineer, 4 technicians and 1 operator.

The Franklin Life Insurance Company

For three 8-hour shifts, 5 days a week, 3 engineers, 4 technician-operators, and 2 non-technical operators are required.

New York University, AEC Facility

For three 8-hour shifts, 3 to 4 engineers, 13 technicians and operators, and several other categories of personnel are required, such as typewriter mechanic, stock supervisor, clerical, etc.

Pacific Mutual Life Insurance Company

Daily Operation	Engineers	Technicians	Operators
1-8 Hour shift	1	2	2
2-8 Hour shifts	1	4	3
3-8 Hour shifts	1	6	4

Figures are minimum requirements, based on having one high speed printer and 15 Unitypers II, in addition to the 10 Uniservos.

Picture by Wright-Patterson Air Force Base

University of California Radiation Laboratory
For four shift operation, 2 engineers and 14 technician-operators are required.

RELIABILITY AND OPERATING EXPERIENCE

Manufacturer
Reliability and operating experience are based on several years records. Using the formula "Available Operating Time" minus "Lost Time" divided by "Scheduled Operating Time", cumulative performance of the UNIVAC I Central Computers averages 93.0% for the past year.

Government Sample
Army Map Service
Good time 11,952 hrs (=115 hrs/week,avg)
Attempted to run time 13,403 hrs (=129 hrs/week,avg)
Operating ratio (Good/Attempted to run) 0.892
Figures based on period 1 January 1955 to 31 December 1956.
Acceptance test April 1952.

Approximately 22 hrs/week scheduled preventive maintenance is not included. Best 3 month period, July-September 1955, operating ratio was 0.944
Last 6 month period, (July-December 1956), operating ratio was 0.921.

Bureau of the Census
Average error-free running period Approximately 19 min. average for both computers during 1956.
Good time 11,161 hours
Attempted to run time 14,440 hours
Operating ratio (Good/Attempted to run) 0.77
Figures based on period 1 January 1956 to 31 December 1956.
Acceptance test 2nd computer accepted 4 February 1955.

In addition to the attempted to run time given above, 1,539 hours were scheduled and used for maintenance and engineering changes.

David Taylor Model Basin
Average error-free running period 8 hours
Figures based on period January 1954 to October 1956
Acceptance test August 1953.
Average efficiency 87%
Scheduled production 112 hours/week

E. I. du Pont de Nemours and Company
Average error-free running period 168.6 minutes
Good time 3,707 hours
(Scheduled minus Down Time minus All Lost Time)
Attempted to run time 3,895 hours
Operating ratio (Good/Attempted to run) 0.95
Figures based on period 23 December 1955 to 20 December 1956.
Acceptance test 10 April 1955.

The Franklin Institute
Acceptance test 1 January 1957.

The Franklin Life Insurance Company
Operating ratio (Good/Attempted to run) 0.92
Figures based on period March 1955 to October 1956.
Acceptance test March 1955.

In the 17 months of operation, an average efficiency of approximately 92% was obtained, where efficiency is defined as good time divided by scheduled time, (and converting to percentage). Scheduled Time is defined as On Time minus Scheduled Engineering. Scheduled Engineering averages about 20 hours/week.

General Electric Company

Good time	82.9 hours/week, average over period shown
Attempted to run time	93.9 hours/week, average over period shown

Operating ratio (Good/Attempted to run) 0.872
Figures based on period 2 September 1956 to 23 December 1956.

The "Good" time/week indicated above does not include re-run time. Good time is defined as the time that the UNIVAC was producing good, usable output that did not have to be redone for any of a number of reasons associated with tape or machine malfunctions.

New York University, AEC Facility

Good time	3,740 hours
Attempted to run time	4,084 hours

Operating ratio (Good/Attempted to run) 0.91
Figures based on period January 1956 to July 1956.
Acceptance test November 1952.

These figures were essentially constant for two and one-half years.

Pacific Mutual Life Insurance Company
Operating ratio (Good/Attempted to run) Exceeds 0.90
Figures based on period October 1955 to December 1956.

University of California Radiation Laboratory

Average error-free running period	5.5 hours
Good time	1,816 hours
Attempted to run time	2,000 hours

Operating ratio (Good/Attempted to run) 0.91
Figures based on period 1 July 1956 to 30 September 1956.
Acceptance test 19 November 1952.

FUTURE PLANS

Government Sample

Bureau of the Census
Currently evaluating presently available equipment with the expectation of purchasing two new computers for installation during 1958. These will replace our two UNIVAC I Systems, which are expected to be sold to any interested parties at a price well under the original purchase cost.

Industrial Sample

Consolidated Edison Company
Expect to start customer billing and accounting operations shortly. Conversion to UNIVAC System will be progressive and additional units from Sperry-Rand; a Central Computer, High Speed Printer, Card-to-Tape and Tape-to-Card Converters will be added as required. High Speed Card Punching Printer on order with Sperry-Rand.

The Franklin Institute
The following modifications will be made to the system in the near future:
Circuitry for an "I" instruction will be added.
A storage breakpoint feature will also be incorporated.
The UNIVAC I will be converted to a UNIVAC II System in the near future.

The Franklin Life Insurance Company
In the near future, consideration will be given to the use of a UNIVAC II or two UNIVAC I Systems.

New York University, AEC Facility
The addition of two new instructions is in progress. They are a "sorting" instruction and a generalized comparison instruction.
A number of modifications have been made to facilitate the engineering trouble shooting and program debugging.
A high speed digital-to-analog converter and graph plotter has been constructed and is in use.

Pacific Mutual Life Insurance Company
System to be replaced by UNIVAC II when available.

INSTALLATIONS

Government Sample

Bureau of Census, Department of Commerce, Washington 25, D. C.
Office of the Air Controller, Headquarters U. S. Air Force, Washington 25, D. C.
Army Map Service, 6500 Brooks Lane, Washington 16, D. C.
Bureau of Ships, Department of the Navy, Washington 25, D. C.
Wright Patterson Air Force Base (AMC), Air Material Command, Dayton, Ohio
Bureau of Census, Federal Office Building No. 3, Suitland, Maryland
Air Material Command, Sacramento, California
Air Material Command, Gentilly

Industrial Sample

New York University (AEC), 45 Fourth Avenue, New York, New York
University of California (AEC), Radiation Laboratory, P. O. Box 808, Livermore, California
Electronic Computing Center, Remington Rand, 315 Fourth Avenue, New York, New York
General Electric Company, 310 West Liberty Street, Louisville, Kentucky
Metropolitan Life Insurance Company, One Madison Avenue, New York 10, New York
United States Steel, National Tube Division, 525 William Penn Place, Pittsburgh, Pennsylvania
E. I. du Pont de Nemours and Company, Louviers Building, Wilmington, Delaware
United States Steel, Gary Steel Works, Chicago, Illinois
Franklin Life Insurance Company, 812 South 6th Street, Springfield, Illinois
E. R. A., 1900 W. Minnehaha Avenue, St. Paul 4, Minnesota
Pacific Mutual Life Insurance Company, Box 6050, Metropolitan Station, Los Angeles 55, California
Westinghouse Electric Company, 3 Gateway, P. O. Box 2278, Pittsburgh 30, Pennsylvania
Electronic Computing Center, Remington Rand, 2601 Wilshire Blvd., Los Angeles, California
Chesapeake and Ohio Railroad, Terminal Tower Building, Cleveland 1, Ohio
John Hancock Mutual Life Insurance Company, 200 Berkeley Street, Boston, Massachusetts
Consolidated Edison Company of New York
Metropolitan Life Insurance Company (2) One Madison Avenue, New York 10, New York
Life and Casualty Insurance Company of Tennessee
Frankfurt Germany, Service Bureau
Sylvania Electric Products, Incorporated, Camillus,

New York
Great Northern Railroad, St. Paul, Minnesota
The Franklin Institute, 20th and Parkway, Philadelphia 3, Pennsylvania
Boston, Massachusetts, Service Bureau
Consolidated Edison, 4 Irving Place, New York 3, New York
The Carborundum Company, Buffalo, New York
Sperry Gyroscope
Harvard University, Cambridge, Massachusetts

The installations are listed in approximate order of delivery.

ADDITIONAL FEATURES AND REMARKS

Manufacturer

Library and compiler routines for mathematical and commercial use and service routines for maintenance use are available to customers.

In addition to the checking circuits in the Central Computer, the CARD-TO-TAPE CONVERTER, the TAPE-TO-CARD CONVERTER and the HIGH SPEED PRINTER contain built-in checking features.

Design features which facilitate maintenance include accessibility of chassis through doors in the casework and accessibility of interwiring between chassis from inside.

Simultaneous reading, writing and computation are possible due to built-in buffer units.

UNIVAC can read from one UNISERVO; write on a second and rewind a third. Unless there is another read, write or rewind instruction immediately following, UNIVAC may continue to compute while the reading, writing and rewinding operations are being performed.

Industrial Sample

The Franklin Institute

Pivoted tape wipers have been installed on each servo. The wipers feature a gauze roll which exerts a relatively constant force on the tape. The gauze may be changed easily when necessary by merely cutting off the soiled portion.

A function table board neon checking system has been installed. By pressing a button it is possible to quickly determine if any neons on this board have failed.

A new tape ring has been designed. Once inserted in the tape reel it never has to be removed. Positioning of the tape reel when mounting it or at any other time will determine whether it can or cannot be written upon. In conjunction with this, a warning neon has been installed under the servo switch on each servo. This neon lights when a tape can't be written upon. It gives positive proof of this because it indicates to the operator that the no-write micro-switch has been engaged.

The Franklin Life Insurance Company

In addition to the main computer, a high speed printer is maintained by personnel mentioned above. (See PERSONNEL REQUIREMENTS, above). Two additional operators are required for 24 hour operation. The printer is a Remington Rand 600 line/minute unit, utilizing 1,500 vacuum tubes.