111293 Price \$2.00

A SURVEY OF

AUTOMATIC DIGITAL COMPUTERS

1953



OFFICE OF NAVAL RESEARCH DEPARTMENT OF THE NAVY WASHINGTON, D. C.

PREFACE

A "Survey of Large-Scale Computers and Computer Projects," by Mr. A. E. Smith of the Office of Naval Research, was originally published in 1947 and 1948 and was brought up to date and republished in 1950. Since that time the computer art has developed rapidly, and a large number of machines that were then only in the design stage are now in successful operation. Early in 1953, Dr. N. M. Blachman of this Office undertook to gather all available information and publish a new "Survey." In this laborious undertaking he received much valuable assistance from Messrs. J. B. Kruskal, Jr., and J. J. Wolf of the Logistics Research Project at George Washington University, and from LTJG D. L. Hogan, USNR, during a two weeks' tour of training duty at ONR, as well as from LT R. R. Weber, USNR, of the London Branch Office of ONR. The cooperation of the Computation Research Team, Flight Research Laboratory. Wright-Patterson Air Force Base, in making available information that had been gathered for the preparation of a similar survey is gratefully acknowledged.

c. 13. Hart

C. B. Hart, CAPT, USN Assistant Chief for Research

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GPO 16-68275-1

INTRODUCTION

On the following pages are presented data on nearly one hundred automatic digital computers intended for more or less general-purpose computation. This information was obtained, for the most part, during the month of February 1953, by means of questionnaires. This compendium was made possible by the very nearly 100 percent response to those questionnaires. While this Survey is as accurate and complete as it could be made under the circumstances, it should be recognized that the data presented are subject to change in as rapidly expanding a field as that of digital computers. Unfortunately, a few machines are omitted for want of information on them.

Most of the entries on the following pages are self-explanatory, but a few words are in order concerning others. The date when "first ready for use" must be interpreted in the light of the February 1953, date of collection of the information. In the case of commercially available computers, this date often refers to use at the customer's location; in other cases it refers to the first useful operation of the computer by the builder. The "floor area" refers in some cases to the entire room housing the computer, and in other cases to the base area of the arithmetic, storage, and control circuitry. The unit "ton" for cooling refers to the amount of cooling provided by the melting of one ton of ice per day at 32° F.

Storage is designated "internal" only when an instruction address refers to a single stored word, and in some cases arithmetic registers have been included under internal storage. Tapes which cannot be both written on and read from under the control of the computer are listed under "input/output" media. In other cases the nomenclature has not been standardized; "match," "normalize," and "justify," for example, all refer to the operation of shifting a number left until its most significant digit is non-zero, and counting the number of places shifted. "Logical multiplication" and "logical 'and'" likewise are synonymous.

At the end of the tabulation are three indexes: (1) listing the computers by name, (2) listing the builders, and (3) giving the geographic location of both the builders and the computers. All left-hand pages have been left blank in order to permit the reader to insert additional data which he may acquire.

ABC (Automatic Binary Computer)

BUILT BY: Air Force Cambridge Research Center, Cambridge, Massachusetts

INSTALLATIONS: Air Force Cambridge Research Center

(Financial contributions made by Air Research Development

Command and the U. S. Air Force.)

COPIES AVAILABLE: NO

PROGRAMMING SERVICE: Not available.

COMPUTING TIME: Not available.

POWER CONSUMPTION: 7 km.

FLOOR APEA:

250 sq. ft.

1100 cu.ft. min. FIRST READY FOR USE: May 1953.

COOLING:

Complex operations on relatively few numbers.

BEST SUITED FOR: OPERATING SCHEDULE:		ERING	1	ROBLEM SOLVIN			
	Sched. Maint.		Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk							
Percent	•						-

PERSONNEL:

NUMBER BASE: 2 (8 or 10 externally).

WORD LENGTH: 56 binary digits.

NUMBER RANGE:

INSTRUCTION TYPE: Four-address. SEQUENCE CONTROL: General store.

NEGATIVE NO. REP.: Ones' complement.

OPERATIONS: Add, subtract, multiply, divide, convert, conditional transfer,

"and", "or", count ones, order of magnitude.

				414	41	h. i + i =	lication	Division	Othe	r			
	SPEED:	Trans		Addi	tion	MUITIP	1 ICal Ion	01110101	-		—		
	Min.	1.5	ms								├		
cl. Access	Max.	50	ms							<u> </u>		7-2-	
Excl. of A	ccess	1.5	ms	20	MB	1	.2 ms	1.2 ms	1.	Z ms	OF	less	
STORAGE:			Funct			ncity No. of CRT Magnetic Tracks, or Acoustic		Time		Mode		Drum Diam. Length or CRT Type	of
							Channels	1	Min.			, , , , , , , , , , , , , , , , , , , ,	1000=
lagnetic	Тотта	ī	nter	nal	40	96	128	50 ms	.5 ms	Ser	lal	20"014	1200r
regine the												K 20-10	78
			 				1						
	T COUTOUT.			-	Туре		4,	Function	1			Speed	
INPUT/OUTPUT: Flexowrite				rite		· · · · · · · · · · · · · · · · · · ·		In-Out					
						<u> </u>	 						
													
									1				

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Arithmetic unit 100 kc; drum 40 kc.

COMPUTING ELEMENT: Flip-flop.

COMPONENTS: 1200 tubes, 500 crystals, 50 relays.

REMARKS: Overflow and order sensing checks are built in. The binary

point location is variable.

ACE Pilot Model (Automatic Computing Engine)

BUILT BY: Electronics Section, National Physical Laboratory INSTALLATIONS: National Physical Laboratory, Teddington, England

COPIES AVAILABLE:

PROGRAMMING SERVICE: Available. COMPUTING TIME: Available.

FLOOR AREA: 152 sq. ft.

COOLING:

POWER CONSUMPTION:

FIRST READY FOR USE:

BEST SUITED FOR:

OPERATIN	G SCHEDULE:	ENG I NE	ERING	F	ROBLEM SOLVI	IG	1	
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk							
	Percent					·		

PERSONNEL:

NUMBER BASE: 2

word LENGTH: 32 binary digits

NUMBER RANGE:

INSTRUCTION TYPE: Two-address

NEGATIVE NO. REP .:

SEQUENCE CONTROL: General storage

OPERATIONS:

*	SPEED:	Tran	sfer	Add i	tion	Multip	lication		Division		Saye of			
	Min.						2 ms							
ncl. Access	Max.					2 ms								
Excl. of A	ccess					1								
STORAGE:			· •		acity in ords	No. of CR Magnetic Tracks, o Acoustic	netic ks, or		ss ne	Mode	Drum Diam., Length or CRT Type	Speed of Motion		
							Channels		Max.	Min.				
Mercury	delay	line	Int	erna	36	50	18	10	اعتبا2(32:49	Seris	1 Most 1	ines 32	
								\Box	,	- /		Words	long,	
							<u> </u>	\perp				a ome	ines 1	
												word	ong.	
												<u> </u>		
I NPU	T/OUTPUT:				Туре			1	Function	1		Speed		
		(Hol	leri	th) r	ninel	ed c	ards	ŀ	Input	4.	vorde/s	ec ·		
			leri		nuncl	ed c	ards		Output Output					
Typewriter (Hollerith)					ang	prir	ter		Juspus		3 80-character lines/sec			

TAPE SEARCH:

ARITHMETIC MODE: Serial

CLOCK FREQ .: 1 megacycle

COMPUT!NG ELEMENT:

COMPONENTS: About 800 tubes.

REMARKS:

AIWAC

(Axel Wenner-Gren Automatic Computer)

BUILT BY: Logistics Research, Inc., Redondo Beach, California

INSTALLATIONS: ALWEG Corp., Cologne, Germany

David Taylor Model Basin, Carderock, Maryland

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 28" x 116"

POWER CONSUMPTION: 4 km.

cooling: Internal fans.

FIRST READY FOR USE: December 1953.

BEST SUITED FOR: General purpose; monorail calculations, wind-tunnel data reduction.

OPERATING	SCHEDULE:	ENGINE	ERING		PROBLEM SOLVIN		T	
-		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk		1.5			7		
E	Percent							

PERSONNEL: Routine maintenance is provided by the manufacturer for one year.

NUMBER BASE: 2

WORD LENGTH: 32 binary digits, sign, and 2 check digits.

NUMBER RANGE:

INSTRUCTION TYPE: "No address." 4 orders/word.

NEGATIVE NO. REP .: Sign & abs. value. SEQUENCE CONTROL: Working storage.

OPERATIONS: Add, subtract, multiply, divide, transfer, absolute value,

extract, negate, compare, overflow, shift, count down, input.

output. complement.

	SPEED:	Transfe			Multip	lication	Division	1			
ncl. Access	Min. Max.		1 8	ms ms							
Excl. of A	ccess		1	ms	34	ms	34 m	1			
STORAGE: Type]		acity No. of CRT in Magnetic rds Tracks, or Acoustic Channels		Ti		Mode	Drum Diam., Length or CRT Type	of
Magnetic drum		In	ternal	nal 2048		64	50	ms	Serial	1000	
		Wo	Working		64		8 ms	1 ms			
		(Ar	ith.	4			1	ns	Serial		
			· .							_	ļ
							<u> </u>				
INPUT	OUTPUT:			Туре	:		Function	<u> </u>		Speed	·
	ed pape	er ta	ре		In&Out	: 10	lecimal	digits/	second		
			10 typewriters							digits/	
	t							 			

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 67 kc.

COMPUTING ELEMENT:

REMARKS: Of the 4 "syllables" in an instruction word, each may represent a command or an address for the preceding command if required. This address will refer to a syllable or word in either of 2 "working storage" channels or to an entire main storage channel. Part of the computer is a test box, which can statically or dynamically test any of the plug-in units.

(All-Purpose Electronic (Rayon) Computer)

BUILT BY: Birkbeck College, University of London

INSTALLATIONS: British Rayon Research Association, Manchester

British Tabulating Machine Co. - HEC-1 and HEC-2 (Hollerith

Electronic Computer)

(The Rockefeller Foundation, Imperial Chemical Industries, the British Rayon Research Association, and the British Tabulating Machine Co. contributed support to the development of

copies available: For sale.

PROGRAMMING SERVICE: Available. COMPUTING TIME: Available.

FLOOR AREA: 20 sq.ft.

POWER CONSUMPTION: 2 km.

cooling: None,

FIRST READY FOR USE: June 1952.

BEST SUITED FOR: General purpose; statistics.

			7 -	,						_
PERATIN	G SCHEDULE:	EN	SINEER	ING	F	ROBLEM SOLVIN		1	\neg	
		Sched. Mai	nt. E	ing. Dev.	Error-Free	Erroneous	Repair	Idle	Total	
	Hrs/Wk	,			37.2		2.8		40	
1	Percent				93		7		100%	\neg

PERSONNEL: 1 mathematician, 1 clerical, 1 operator-maintenance man.

NUMBER BASE: 2 (8 or 10 externally).

WORD LENGTH: 32 binary digits.

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: Two-address.

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication.

	SPEED:	Tran	sfer	Addi	ition		lication	Division				
Incl. Access	Min.	1.2	ms	1.	2 ms		2 ms	Progre	unned			
or. Access	Max.	20	ms	20	ms	38,	4 ms					
Excl. of A	ccess	1.2	ms	1.	2 ms							
STORAGE:			Function		` i	Capacity No. of in Magnet Words Tracks Acoust		Tin		Mode	Drum Diam., Length or CRT Type	Speed of Motion
							Channels	Max.	Min.			
Magnetic	agnetic drum		Inte	ternal 512		?	32	20 ms	1.2 m	s Seria	5"dia.	3000rp
											l"long	
								-				
	· · · · · · · · · · · · · · · · · · ·						 	-				
INDIO	F/OUT PUT •	r ^L			Туре		<u> </u>	Function			Speed	
Teletypewrite				er	······································		In&Out	7 di		r second		
Punc			hed-	card	tabu	late	or	In&Out	32×1	50 digi	ts/mimut	е
								 	+			
		¥						L				······

TAPE SEARCH: None.

ARITHMETIC MODE: Serial

CLOCK FREQ .: 30 kc.

COMPUTING ELEMENT: Double triode.

COMPONENTS: 420 tubes. 30 relays.

REMARKS:

(All-Purpose Electronic (X-Ray) Computer)

BUILT BY: Birkbeck College, University of London

INSTALLATIONS: Birkbeck College Electric Computation Laboratory

(The Rockefeller Foundation, Imperial Chemical Industries, and the British Tabulating Machine Co. contributed support

to the development of this computer.)

COPIES AVAILABLE: PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 20 sq. ft.

POWER CONSUMPTION:

2 kw.

cooling: None.

FIRST READY FOR USE:

End of 1953.

BEST SUITED FOR: General purpose.

ENG INEER ING PROBLEM SOLVING OPERATING SCHEDULE: Total Idle Error-Free Erroneous Repair Sched. Maint. Eng. Dev. Hrs/Wk Percent

PERSONNEL:

NUMBER BASE:

2 (8 or 10 externally).

WORD LENGTH:

32 binary digits.

NUMBER RANGE:

-1 to 1.

INSTRUCTION TYPE: Two-address.

NEGATIVE NO. REP .:

Complement.

SEQUENCE CONTROL: General store.

Addition, subtraction, multiplication. OPERATIONS:

		_		evri -car		mlat	or	In&Out 7 In&Out 32		igita 50 di	per zits	ber m	inute	
INPUT/OUTPUT:					Туре			Function Speed						
				371						<u> </u>				
<u> </u>								1		1	9,41			
Magnetic	arum		Internal 103		102	27 1		ZU IIS	V.O.I	B Ser.	11	long		
	agnetic drum		Toba	ernal 1024		i h		1	06-	I Son	O TEN	Aio	3000 r	
Туре			Function Wo		ords Tracks, o Acoustic Channels		Max.	Min.	Mode	or CRT Type		Motion		
STORAGE:					acity No. of CRT		Ti			L	mDiam., ength	Speed of		
Excl. of	lccess	0.6	MA	0.0	5 ms						8 1 1 1 1 1 1			
Incl. Access	Max.	20	ms 20		ms	19.2 ms							<u></u>	
	Min.	0.6	mg	0.4	5 ms	0.	6 ms	Progre	mmed		4.			
	SPEED:	Tran	sfer	Add	tion	Multip	lication	Division						

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 60 kc.

COMPUTING ELEMENT: Double triode.

COMPONENTS: 310 tubes, 3 relays.

REMARKS:

ARRA (Automatische Relais Rekenmachine Amsterdam)

BUILT BY: Mathematisch Centrum, Amsterdam, the Netherlands

INSTALLATIONS: Mathematisch Centrum.

COPIES AVAILABLE: No.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 80" x16" plus desk. POWER CONSUMPTION: 3 km.

COOLING: None.

FIRST READY FOR USE: 1954.

BEST SUITED FOR: General purpose.

OPERATIN	IG SCHEDULE:	ENGIN	EERING		PROBLEM SOLVII	NG		ľ	1
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldie	Total	١
	Hrs/Wk								l
	Percent								ł
								f ·	ı

PERSONNEL:

NUMBER BASE: 2 (10 externally).

word LENGTH: 30 binary digits (instructions 15 binary digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Ones complement. SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, division, print, etc.

\$			er ta					Input	30 d	charac ecimal	ters/sec. digits/se	c
INPUT	T/OUTPUT:	-			Туре			Function			Speed	
				·		·			<u></u>			
					30-ъ	11	ds			-	30 cm. lone	
Magnetic	drum		Inter	nal	102	4	64	223 ms	21 mg	Seria	llcmdia	3000r
							Acoustic Channels		Min.			
т,	уре		Funct	ion		n rds	Magnetic Tracks, o		•	Mode	Length or CRT Type	of Motion
	STORAGE:					city	No. of CRT	Acces	ss		Drum Diam.	Speed
Excl. of	Access	2	5 ms	2	.5 ms		2.5 ms	82.5 m			10.0 ms	
no. Access	Max.	27			.5 ms			107.5 m		.5 ms		
ncl. Access	Min.	7	.5 ms		ition .5 ms		7.5 ms	Division 87.5 m			Mult. by 27.5 ms	LO

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ.:

COMPUTING ELEMENT: Selenium rectifiers.

COMPONENTS: 500 tubes, 2000 selenium rectifiers, and 15 relays.

REMARKS: This computer, though electronic, has been named after its

relay predecessor.

AVIDAC (Argonne's Version of the LAS Digital Automatic Computer)

BUILT BY: Argonne National Laboratory, Lemont, Illinois

INSTALLATIONS: Argonne National Laboratory

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: No policy fixed. COMPUTING TIME: No policy fixed.

FLOOR AREA: 500 sq. ft.

POWER CONSUMPTION: 20 km.

cooling: 3500 cu.ft. min. First Ready for use: In operation now.

BEST SHITED FOR: General scientific.

G SCHEDULE:		ENGINE	ERING	l I	ROBLEM SOLVIN	G		
	Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
Hrs/Wk						· · · · · · · · · · · · · · · · · · ·		
Percent				1		· .		

PERSONNEL:

NUMBER BASE: 2 (16 externally).

WORD LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1-2-39.

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP.: Twos' complement SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, several transfers of control.

partial substitution into the memory.

	·				-					·			
		Tel	etype					In-Ou	t	12	charact	ers/sec	•
INPU	r/OUTPUT:				Туре		<u> </u>	Functi	on			Speed	
lagnetic!	rape		Exter	nal	50,00	00	40	20 s	+	20 mg	Parallel	80'lon	50*/sec
								 	4			10017	
(W111	iems t	ibe)							\perp				
Blectrost	atic		Inter	nal	102	ł	40	20 p	s	0 Jus	Parallel	5CPLA	
							Channels		T	Min.			
Ту	pe		Funct	ion	ii Wor		Magnetic Tracks, or Acoustic	-	ıme		Mode	or CRT Type	Motion
	STORAGE:			l	Capa	-	No. of CRT		ces: ime			Drum Diam., Length	Speed of
Excl. of A	ccess			20	/us	50	0 /as	800	t <u>is</u>				
Incl. Access	Max.				A28		0 ms	820					
	Min.			20	Ms	50	0 ms	800	118				
	SPEED:	Trar	sfer	Addi	tion	Multip	lication	Divisio	n	1 .	i		

TAPE SEARCH: Possible in both directions.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .:

COMPUTING ELEMENT:

COMPONENTS: 2800 tubes, no crystals, no relays.

REMARKS: The machine is currently in operation for porblem solving, using only 256 words in internal memory and no external memory, but is still being debugged (March 1953). A single external magnetic tape unit of preliminary design will probably be installed within 6 or 8 months, and the internal memory will probably be increased to capacity in that time. Later it is planned to install 4 tape units of greater capacity and perhaps higher speed. The logical design of this computer is modelled on the IAS computer.

BARK (Binar Automatisk Relä-Kalkylator)

BUILT BY: Matematikmaskinnämndens Arbetsgrup

INSTALLATIONS: Matematikmaskinnämndens Arbetsgrup, Kunglig Tekniska

Högskola, Stockholm, Sweden

(This group is supported by the Swedish Board for Computing

Machinery and the Royal Telegraph Administration.)

COPIES AVAILABLE: No.

PROGRAMMING SERVICE: Available.

COMPUTING TIME: Available.

POWER CONSUMPTION: 5 km.

FLOOR AREA: 710 sq. ft. cooling: None.

FIRST READY FOR USE: February 1950. tabulation.

REST SHITED FOR: General purpose:integration of o.d.e. matrix inversion.

OPERAT IN	G SCHEDULE:	ENGINE	ERING	F	ROBLEM SOLVING	· · · · · · · · · · · · · · · · · · ·	Plugging	
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	Programs	Total
	Hrs/Wk	4		74			14	93
	Percent	9		80			15	100

PERSONNEL: 4 operators, 3 mathematicians, 1 maintenance man, 1 clerical.

NUMBER BASE: 2(input is decimal, output is octal or decimal). & sign. 25 bits for numerical part & sign plus 7 bits for exponent/

10⁻¹⁹ to 10¹⁹ INSTRUCTION TYPE: 3-address. NUMBER RANGE:

NEGATIVE NO. REP .: Absolute value&sign Sequence control: Non-removable plugboard.

OPERATIONS: Several transfer and addition operations, multiplication,

logical addition, shift, input, transfer exponent to numerical part of number, transfer 6 digits of numerical part to exponent,

and output.

				- 2									
	SPEED	Tra	nsfer	Addi	tion	Multip	lication	Division	Trai	ısfer	Re	ciproca	1
	Min.												
ncl. Access	Max.	AVE	RAGE	200	ms	300	ms		100	ms	2	or 3 se	c
Excl. of A	ccess					<u> </u>					<u> </u>		
	STORAGE:					acity	No. of CRT					Drum Diam.	
ту	/pe		Func	tion		n rds	Magnetic Tracks, or Acoustic	r		Mode	•	Length or CRT Type	of Motion
				1			Channels		Min.	1			
Relay re	gister	3	Inte	rnal	1	00				Para]	lle	1	
										 			-
· · · · · · · · · · · · · · · · · · ·							 	 		 			
	······································								 	 			
INPU	T/OUTPUT:				Туре			Function		` .		Speed	
		2 ъ	inary	, pun	ched	tap	8	In&Out	One	word	pe	r secon	đ
		5 d	ecime	l pu	nche	d ta	рев	In&Out	8 4	lgits	pe	r secon	d
		3 t	ypewi	iter	8		- ·	Output	8 d	igita	pe	r secon	<u>d</u>
								<u> </u>	<u> </u>				
_		30	_										

TAPE SEARCH: None.

ARITHMETIC MODE: Parallel.

CLOCK FREQ.:

COMPUTING ELEMENT: Relays.

components: About 7,500 relays.

REMARKS: See G. Kjellberg and G. Neovius, "The BARK, A Swedish General Purpose Relay Computer, Mathematical Tables and other Aids

to Computation. V, No. 33, pp. 29-34 (Jan. 1951).

BUILT BY: Bell Telephone Laboratories, Murray Hill, New Jersey.

INSTALLATIONS: National Advisory Committee for Aeronautics, Langley Field, Va.

Ballistic Research Laboratories, Aberdeen Proving Ground, Md.

(Where two figures are given below, the first applies to the NACA machine and the second to the BRL machine.)

COPIES AVAILABLE:

PROGRAMMING SERVICE: Available at BRL to groups engaged in national defense work.

COMPUTING TIME: Available at BRL to groups engaged in national defense work.

FLOOR AREA: 1150/1600 sq. ft. POWER CONSUMPTION: 23/5 kW.

cooling: 72-ton a.cond/NoneFirst READY FOR USE: 1946/1947.

BEST SUITED FOR: General-purpose, repetitive computing with little input.

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING Idle Total Sched. Maint. Eng. Dev. Error-Free Erroneous Repair Idle Total Hrs/Wk 1.0/1.5 0.6/0 100/81.7 0.1/1.0 3.3/8.0 6.9/1.8 112/94.0 Percent 0.9/1.6 0.5/0 89.4/86.90.1/1.1 2.9/8.5 6.2/1.9 100%

PERSONNEL: NACA: 1 operator, 3 maintenance men, 4 mathematicians, 1 cleri-

cal, 1 in training for maintenance.

BRL: 1 maintenance man, 2 mathematicians. each decimal digit.

NUMBER BASE: 10 (biquinary code). One of 2 & 1 of 5 relays must close for/word LENGTH: Sign and 7 significant decimal digits and exponent of -19 to 19.

NUMBER RANGE: $\pm 10^{-20}$ to $\pm 10^{19}$. INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP .: Magnitude and sign. SEQUENCE CONTROL: Punched paper tape.

OPERATIONS: Addition, subtraction, multiplication, division. There are

tables permanently built into the machine for the sine, cosine, inverse tangent, common logarithm, and antilogarithm.

					r . —				1			
	SPEED:	Transfer	Addi	tion	Multi	lication	Divisio	n				
ncl. Access	Min.	0.07 s	0.3	Sec	0.1	3 sec	0.3 se	00	<u> </u>			
nor. Access	Max.	0.07 s	0.3	Sec	1.0		2.2 se		l			
Excl. of A	ccess											
	STORAGE:			Capa	city	No. of CR	Γ Acc	ess			Drum Diam.	Speed
ту	/pe	Func	tion .	i	n rds	Magnetic Tracks, o Acoustic Channels	r	ime	Min.	Mode	Length or CRT Type	of
Relays		Inte	rnal	1	5					Paralle	,	
Punched	l tape	Exte	rnal	Unl	td.	Usuall	y up t	<u> </u>	l į mi	α.		2ª/sec
,			1. 1				 	╁				<u> </u>
I NPUT	COUTPUT:			Туре			Functio	on			Speed	
		Pape	r ta	ре			In & C)u	20	frames	per sec	ond
•	[Туре	writ	er			Outpu	1t	6 c	haracte	ers per s	second
	L			:								
	1						I .	1				

TAPE SEARCH: Possible in either direction.

ARITHMETIC MODE: Parallel.

CLOCK FREQ.:

COMPUTING ELEMENT: Relays.

COMPONENTS: 5000 relays in each of the two computers comprising each in-

REMARKS: stallation. The operating schedules refer to the average for the two. At NACA they are attended only 80 hrs/wk, at BRL 40. The erroneous time is due entirely to human errors; the idle time is due to stopping during unattended operation. See F. L. Alt, Mathematical Tables and Other Aids to Computation, no. 21, pp. 1-13 (January 1948), and no. 22, pp. 69-84 (April 1948).

BUILT BY: Bell Telephone Laboratories, Murray Hill, New Jersey. INSTALLATIONS: Bell Telephone Laboratories.

COPIES AVAILABLE: PROGRAMMING SERVICE: COMPUTING TIME:

FLOOR AREA: 12 bays

POWER CONSUMPTION:

COOLING:

FIRST READY FOR USE: 1949

BEST SUITED FOR: General purpose; network analysis and matrix calculations OPERA

				•				OTOHO.
ATIN	G SCHEDULE:	ENGINE	ERING		PROBLEM SOLVI	NG	<u> </u>	
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk					1.		
	Percent							

PERSONNEL:

NUMBER BASE: 10 (biquinary code).

word Length: Sign & 3-, 6-, or 10-dec.-digit factor and exponent -19 to 19. Number range: $\pm 10^{-19}$ to $\pm 10^{20}$. Instruction type: Three-address.

NEGATIVE NO. REP .: Magnitude and sign. SEQUENCE CONTROL: Paper tape.

OPERATIONS: There is provision for wiring in 200 subroutines of up to 20 steps by passing 2000 insulated wires through the appropriate

coils. Trigonometric, logarithmic, complex, impedance, and ad-

		mittand	e ro	utine	s ar	e thus	immedi	ately	availa	ble at a	1 times
	SPEED:	Transfer	Adid	ition	Multi	plication	Division				
ncl. Access	Min.										
- Access	Max.										
Excl. of A	ccess			-							
Ту	STORAGE:		ction	t i	acity in rds	No. of CRI Magnetic Tracks, o Acoustic	Tir		Mode	Drum Diam., Length or CRT Type	Speed of Motion
						Channels	Max.	Min.	ļ		
						 	-		ļ		
				 		 			ļ	1	
· · · · · · · · · · · · · · · · · · ·						 			 		
				· · · · · · · · · · · · · · · · · · ·					 		
INPUT	/OUTPUT:			Туре		<u> </u>	Function	T	<u> </u>	Speed	
	. [Pu	nched	l tap	e		Input	The	ere is	provision	for 3
				ewri			Output			ntrol sta	
	t							 			

TAPE SEARCH:

ARITHMETIC MODE:

CLOCK FREQ.:

COMPUTING ELEMENT: Relays.

COMPONENTS: 4300 relays and 86 cold-cathode tubes.

REMARKS: When the checking circuits fail to indicate satisfactory operation, the computer automatically goes back and tries

again. Since failures are often due to transient relay-contact failure, the second attempt is generally successful.

BUILT BY: Bendix Computer Division, Bendix Aviation Corp. INSTALLATIONS: Bendix Computer Division, Los Angeles, Calif.

COPIES AVAILABLE: NO. PROGRAMMING SERVICE: Yes. COMPUTING TIME: NO.

FLOOR AREA: 20 sq. ft.

POWER CONSUMPTION: 4 kw.

COOLING:

FIRST READY FOR USE: January 1954.

BEST SHITED FOR: Solution of differential equations.

OPERATING	SCHEDULE:	ENG INE	ERING	,	ROBLEM SOLVIN	G		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Γ	Hrs/Wk	3	1	30	1	3	2	40
ľ	Percent	7.5	2.5	75.0	2.5	7.5	5.0	100

PERSONNEL: 1 operator, 1 maintenance man, 3 mathematicians.

NUMBER BASE: 10 (excess-3). WORD LENGTH: 6 decimal digits.

NUMBER RANGE: Variable.

INSTRUCTION TYPE:

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: Special drum store.

operations: Add dy_m to y_m and multiply by dx_n . The computer has 60 integrators.

	SPEED:	Tra	nsfer	Add	ition	Multi	ofication	Division	Itera	ation		
	Min.) ms		
Incl. Access	Max.					<u> </u>		<u> </u>	10) ms		
Excl. of A	ccess											
	STORAGE:		Funct	ion	,	acity in rds	No. of CRT Magnetic Tracks, or Acoustic	Time		Mode	Drum Diam Length or CRT Typ	of
							Channels	Max.	Min.			
Magnetic	Drum		Inter	nal			15				13*dia	
											2*lon	g
			<u> </u>				<u> </u>					_
INPIN	r/output:		<u> </u>		Туре			Function	T	<u></u>	Speed	
141.01	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		e Rea	der	.,,,,	k,		Input	1			
		Taj	e Pur	ch				Output	1			
		Ty	rewrit	er				Output	10) chara	cters/s	eC.
									į			

TAPE SEARCH: Possible in reverse direction.

ARITHMETIC MODE: Serio-parallel.

CLOCK FREQ .: 204 kg.

COMPUTING ELEMENT:

COMPONENTS: Number of tubes not yet determined, 2400 crystals.

REMARKS: Can compute new initial conditions during each solution and

recompute the solution with the new initial conditions.

(Binar Elektronisk Sekvens-Kalkylator)

BUILT BY: Matematikmaskinnämndens Arbetsgrup, Kunglig Tekniska Högskola Stock-

INSTALLATIONS: Kunglig Tekniska Högskola

holm, Sweden

(This group is supported by the Swedish Board for Computing

Machinery.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: About 70 sq. ft. POWER CONSUMPTION: 14 kw.

cooling: 2000 cfm. First READY FOR USE: 1954.

BEST SUITED FOR: General purpose; government, scientific, & industrial computing.

DEU.	901125 1 9111		* * *		•			
OPERAT IN	G SCHEDULE:	ENG IN	EERING		PROBLEM SOLVIN	IG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk			1				
	Percent							

PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Twos' complement. SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, logical multiplication,

shift.

		re	ader writ				Carrier of the Control of the Control	Outpu		10 eł	aracte	rs/sec.	
		Die	Lectr:	LC DE	per-	tape	er kan a - 21 september sentem sementen byst	Input	PRAINT AT AN	200 1	rames	sec.	
INPU	T/OUTPUT:				Type	No. 100 E. Organization on	grigging grown and the second	Functio	9P			Speed	
				- 1,	n wasan na ilikuwa	THE STATE OF	and the second s		İ	Processing and Processing and Processing		a Magaza Malagara A Tiran Baril I	
lagnetic	arum	 	Exte	ाष 🕇	OTA	<u>k</u>	(4.10)	LEV III	7	• Cinto	301.10.1	x 13" 10	Action to the same of the same
f +	a		F-+ a	Fore	819	2	256	20 -	4	Kma	Serial	4-3/4"a	3000rp
PTGCLOSE	SFTG/#	mrg.	THER	.11G-T	62	<u>U</u>	(m. 2)	127/2	4	55 Irs	* *** ******	2 drums	4.7. (1.1.
	-+1-/W		Theor	· Fore	25	<u> </u>	40	95	3	21	Paralle	n supi	
							Acoustic Channels	Max,	T	Win.			
T	/pe		Func	tion		n rds	Magnetis Tracks, or		i me		Mode	Length or CRT Type	Motion
	STORAGE:					acity	No. of CRT			\$		Drum Diam.,	Speed of
Excl. of A	ccess		1	6	us	250	u.s	STRONG STANDS STANDS STANDS	10070040		angendering State of Parish and the state of	Control Name of the Control	
incl. Access	Max.	50	us	50	1 _{US}	p. p.p. // as and // restee.	7						
	Min.	50	us	50	us	300	us						
	SPEED:	Tra	nsfer	Add	tion	Multip	lication	Divisio	n	1			

TAPE SEARCH: None.

ARITHMETIC MODE: Parallel

CLOCK FREQ .: 160 kg.

COMPUTING ELEMENT: Triodes and diodes.

COMPONENTS: 2250 tubes, 200 crystal rectifiers.

REMARKS: It is hoped to double the spot density on the cathode-ray

tubes and obtain a 512-word memory.

(Binary Automatic Computer)

BUILT BY:

Eckert-Mauchly Division (Remington Rand Inc.). Philadelphia.

INSTALLATIONS:

Northrop Aircraft Corporation,

Penn.

Hawthorne, California

COPIES AVAILABLE:

PROGRAMMING SERVICE:

COMPUTING TIME: FLOOR AREA:

20 sq. ft.

POWER CONSUMPTION:

COOLING:

FIRST READY FOR USE: August. 1949.

BEST SUITED FOR:

General purpose.

	• • • • • • • • • • • • • • • • • • • •					₹				
OPERAT IN	G SCHEDULE:		ENG IN	EERING		F	PROBLEM SOLVI	NG		
		Sched.	Maint.	Eng.	Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk									
	Parcent							l		

PERSONNEL:

NUMBER BASE:

2 (8 externally).

WORD LENGTH:

30 binary digits & sign (instructions 15 binary digits).

NUMBER RANGE:

-1 to 1

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .:

Twos' complement, sequence control: General store.

OPERATIONS: Add, subtract, multiply, divide, transfer; transfer control, input, output, stop.

	SPEED:	Tran	sfer	Add	ition	Multip	lication	Division				
Incl. Access	Min.										·	
inci. Access	Max.			800) us	120	OUS	1200 Jus				
Excl. of A	ccess			284	5 11.8	100	0/48	<i>ل</i> ه 2000 لله				
	STORAGE:		Funct	ion	1	acity in irds	No. of CRT Magnetic Tracks, or Acoustic Channels	Tir		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Mercury	delay	line	s Int	ern	1 5	512	16	336µs	بر که 10	Serial	32 word	3
INPUT	r/OUTPUT:				Туре			Function	\ \		Speed	
			Keybo	ard				Input				
	1		Magne		tape	}		In-out	Writ	ten on	only by	computer
											_	

TAPE SEARCH: None. The tape is controlled manually.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 4 TLC.

COMPUTING ELEMENT: Tubes.

components: 700 tubes.

REMARKS: See A. A. Auerbach, J. P. Eckert, Jr., R. F. Shaw, J. R.

Weiner, L. D. Wilson, "The Binac", Proc. I.R.E., Vol. 40, .pp. 12-29, (Jan. 1952). The storage and arithmetic units are completely duplicated; a difference during computation

stops the computer.

BUILT BY: Burroughs Adding Machine Co., Philadelphia, Pennsylvania
INSTALLATIONS: Wayne University Computation Laboratory, Detroit, Michigan.

COPIES AVAILABLE: Not available.

PROGRAMMING SERVICE: Available.

COMPUTING TIME: Available.

FLOOR AREA: 1200 sq. ft.

POWER CONSUMPTION: 35 kw.

cooling: First ready for use: February 1951.

BEST SUITED FOR: General purpose

DE31 301	I LU I OK		F F						
OPERATING S	CHEDULE:	ENG I NE	ERING	F	ROBLEM SOLVIN	IG		<u> </u>	l
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total	
	Hrs/Wk	4	4	29		3		40	
	Percent	10	10	72.5		7.5		100	j

PERSONNEL: 1 operator, 2 maintenance, 4 mathematicians.

NUMBER BASE: 10 (excess-three code)

word LENGTH: 9 decimal digits wd.

NUMBER RANGE: Dec. pt.anywhere in/INSTRUCTION TYPE: One or two-address (Programmable

NEGATIVE NO. REP.: Complement SEQUENCE CONTROL: General store

change).

OPERATIONS: Add, subtract, multiply, divide, compare, extract, shift,

input-output.

INPU	r/OUTPUT:	Telet	ype electri	Туре	20.0 20.0	ondon	In-Out Input	6	char/sec		
Magnetic	Drum '	In	ternal	8	00	16	32 ms		Serial	8* dia.	1800 rp
Ty	STORAGE:		Function	i :	acity in irds	No. of CRT Magnetic Tracks, or Acoustic Channels	Acces Tim		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Excl. of A	ccess										
nci. Access	Min. Max.	 	0.6	ms ms		O ms					
	SPEED:	Transf		ition	·	lication	Division				

TAPE SEARCH:

ARITHMETIC MODE: Serist.

CLOCK FREQ.: 125 kc

COMPUTING ELEMENT:

COMPONENTS: 3271 tubes, 6773 crystal rectifiers.

REMARKS: This computer was assembled from Burroughs Pulse Control Units. These units are available separately. The computer has an automatic word-check digit which is a weighted count of bits modulo 3. It also has an arithmetic overflow check and tape synchronism check.

CADAC 102 (Cambridge Digital Automatic Computer)

BUILT BY: Computer Research Corporation, Hawthorne, California.

INSTALLATIONS: Project Lincoln, Massachusetts Institute of Technology.

(Owned by the Air Force Cambridge Research Center.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not available.

COMPUTING TIME: Not available.

FLOOR AREA: 3 ft x 2 ft.

POWER CONSUMPTION: 5 kw.

COOLING: Built in.

FIRST READY FOR USE: January 1952.

BEST SUITED FOR: General-purpose computation not requiring large storage.

8531	SULLED FOR-	401401						
	G SCHEDULE:		ERING	F	PROBLEM SOLVI	IG .	ldle	Total
O' ENAT TH	-	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	1016	10001
	Hrs/Wk							
	Percent		·		<u> </u>		L	L

PERSONNEL:

NUMBER BASE: 2 (8 externally).

WORD LENGTH: 36 binary digits (instructions 42 binary digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP.: Magnitude and sign. SEQUENCE CONTROL: General store.

OPERATIONS: Reasonable set of three-address commands, primarily lacking in

input-output commands.

	SPEED:	Transfer	Addi	tion	Multip	lication	Division				
A	VERAGE	55 ms		ms	•	ms	95 ms		4		
Incl. Access	Max.										
Excl. of A	ccess	,	ــــــــــــــــــــــــــــــــــــــ								
т	STORAGE:		ir		acity in inds	No. of CRT Magnetic Tracks, or Acoustic	Tim		Mode	Drum Diam. Length or CRT Type	of
						Channels		Min.			
Magnetic	Magnetic drum		ernal	rnal l		16	25 ms	0	Seria	12"dia.	2400rpm
		_									
		-1							<u> </u>		<u> </u>
INPU	T/OUTPUT:			Туре			Function			Speed	·
	-	Keyboard Input									
			pewri				Output	10	digit	s per sec	ond.
	1								· · · · · · · · · · · · · · · · · · ·		
*							1				

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 100 kg.

COMPUTING ELEMENT: Crystal diodes and flip flops.

COMPONENTS: 195 tubes, 2500 crystal rectifiers, and 10 relays.

REMARKS: During the first four months of operation, covering 170 hours of operating time, three faults occurred, requiring 12 hours for their repair.

BUILT BY Computer Research Corporation, Hawthorne, California.

installations#1 Special order.

#8 USN P-G School, Monterey, Calif.

16

#2 & #4 Army Ord., White Sands Proving Ground, Las Cruces, N.M.

#3 Rand Corp., Santa Monica, Calif. #9 Gulf Res. & Dev. Co., Pittsburgh,

#5 Naval Ord. Test Station, Invokern, Calif.

#6 Army Chem. Center, Edgewood, Md. #10 Prudential Ins.Co., Newark, N.J.

#7 CRC Computing Center.

copies available For sale or rent.

PROGRAMMING SERVICE: Available.

COMPUTING TIME: Available. FLOOR AREA: 8 sq. ft.

POWER CONSUMPTION: 6 kw.

COOLING: Internal fan.

FIRST READY FOR USE: May 1953.

BEST SUITED FOR: Genefal purpose.

			-				and the second s	
OPERATIN	G SCHEDULE:	ENG IN	ERING		ROBLEM SOLVING			
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
	Hrs/Wk	8	0	132	24	, ·	0	168
	Percent	4	0	82	14:		0	100%

PERSONNEL: The foregoing operating schedule is guaranteed in the lease. Estimated personnel requirements are: 1 operator, ½ maintenance man.

and mathematician(s).

NUMBER BASE: 2 (8 or 10 externally-8,4,2,1 code).

WORD LENGTH: 36 binary digits (instructions 42 binary digits).

NUMBER RANGE: -1 to 1. INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP.: Magnitude and sign. SEQUENCE CONTROL: General store.

OPERATIONS: Full set of arithmetic, logical, and input-output orders.

	_					Maria de la composição de						•
	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division	1		I	
A Incl. Access	ERAGE	12	l ≥ ms	$12^{\frac{1}{2}}$	ms	2	5 ms	25 ms				
THEI. Access	Max.											
Excl. of	Access											
	STORAGE:				Capa	city	No. of CRT	Acce	ss		Drum Diam.,	Speed
т,	ype		Funct	ion		n rds	Magnetic Tracks, or Acoustic	r	ne .	Mode	Length or CRT Type	of Motion
	agnetic drum Interna						Channels	Max.	Min.	1		
Magnet	ic dru					24	16	25 ms	0	Serial	12"dia.	2400rpm
Drum b	uffer					8	1	3.lms	. 0	Serial		
Magne t	ic tape					.000	5	2 min		Ser-par	1200 f	: 7 <u>ਵ</u> ੈਾ/se
									- 			
INPU	T/OUTPUT:[Туре						Function	T		Speed	
	1	Keyboard						Input	T			
	1	Magnetic tape						In& Ou	t 60	words r	er secor	ıd
		Punched cards						In& Ou	t 1 ca			ols)/se
	· [Punched paper tape						In& Ou	t 1 w		6-bit ch	
TAPI	E SEARCH:	Pos	sible	in	eithe	er d	irectio	n on se	evera		during o	

on on several tapes during computing

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 100 kg.

COMPUTING ELEMENT: Crystal diodes and flip-flops.

COMPONENTS: 300 tubes and about 4000 crystal rectifiers.

REMARKS: The computer will halt automatically on unprogrammed cverflow

and on number pick-up instead of command.

CALDIC

(California Digital Computer)

BUILT BY: Electrical Engineering Division, Univ. of Calif., Berkeley

INSTALLATIONS: University of California

(The Office of Naval Research contributed financial support

to the development of the computer.)

COPIES AVAILABLE: No (but plans and drawings will be available).

PROGRAMMING SERVICE: Will be generally available. COMPUTING TIME: Will be generally available.

FLOOR AREA: 100 sq. ft.

POWER CONSUMPTION: 10 kw.

cooling: None.

FIRST READY FOR USE: Summer 1953.

BEST SUITED FOR: General purpose (large memory, small output, moderate speed).

	t			501110			ROBLEM SOLVIN	ic		
OPERATING SC	CHEDULE		ENGINE	ERING			KUBLEM SULVIN	10	ldle	Total
	-	Sched.	Maint.	Eng. De	ev.	Error-Free	Erroneous	Repair	1016	iotai
H	rs/Wk									
Po	ercent									

PERSONNEL:

NUMBER BASE: 10 (8-4-2-1).

WORD LENGTH: 10 decimal digits and sign (instructions 6 decimal digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP .: Absolute value & sign . SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, square root, plus subprogram and conditional subprogram operations. (Multiply and divide

operations provide for either rounded or full length results.)

		Photo					eador	Input Outpu				al digita 1 digita	
INPU	T/OUTPUT:				Туре			Functi				Speed	
									I,				
													
								 	+	-		26*lone	+
Magnetic	Drun		Inte	rnal	10,0	000	200	17 m	s 1	60jua	Ser-Pa	r. 8"dia.	
							Acoustic Channels	Max.	I	Min.			
T	STORAGE:		Funct	tion'		acity n rds	Magnetic Tracks, or	T	ime		Mode	Length or CRT Type	of
Excl. of		84	p.s.	330	us	5	Mo. of CRT	10 K	ess	1		Drum Diam.	Speed
inci. Access	Max.	17	ms	17		34	ms	<u>34 m</u>		-			
Incl. Access	Min.	600	/us	600) Jus	5	ms	10 n					
	SPEED:	Trans	sfer	Add i	tion	Multip	lication	Divisio	n				

TAPE SEARCH: None.

Serio-parallel. ARITHMETIC MODE:

CLOCK FREQ .: 144 kc.

COMPUTING ELEMENT:

Diode adder (decimal),

1100 tubes, 1300 crystal rectifiers (12 relays in power supply). COMPONENTS:

Financial support of research and development personnel from REMARKS: ONR. Equipment furnished by University of California. See

P. M. Morton. "The California Digital Computer," Mathematical Tables and other Aids to Computation. V. No. 34, pp 57-61.

(April 1951).

BUILT BY: Hogan Laboratories, Inc., New York, New York.

INSTALLATIONS: Westinghouse Electric Corp. (WAPD) (owned by AEC), Pittsburgh, Pa.

Johns Hopkins University (ORO) (owned by U.S. Army), Chevy Chase,

New York University, New York City, N.Y.

Nuclear Development Associates, White Plains, N.Y.

COPIES AVAILABLE: For sale - for rent at a later date.

PROGRAMMING SERVICE: AVailable.

COMPUTING TIME:

FLOOR AREA: 15 sc. ft.

POWER CONSUMPTION:

3.5 kw.

cooling: 1000 cfm built-in. FIRST READY FOR USE: March 1953

BEST SUITED FOR: General-purpose, scientific computing.

OPERATING SCHE	DULE:	ENGIN	EERING "		PROBLEM SOLVII	NG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Hrs/	Wk	·						·
Perc	ent							

PERSONNEL:

NUMBER BASE: 2 (externally 10 and 16).

WORD LENGTH: 41 binary digits (instructions 20 digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: General-store.

OPERATIONS: Addition, subtraction, multiplication (with and without round-off) division, transfers, decimal-binary conversion, shift, 3 transfer

of control, input-output.

Min.	8 ms	1	100 ·		lication		on	Gon	Parsi	199	I	
	25 ms 34		~ 1		4 ms	34 z	18		34 ms			
		3	4 ms			/_	28		68 ms			
cess	8 ms	1	7 ms	3	4 ms	34 II	ıs		34 ms		\neg	*
STORAGE: Type Lagnotic Drum		nction	j 'i	'n	Tracks, o Acoustic	r			Mode	Leng	gth [°]	Speed of Motion
agnetic Drum		ernal			32 to	17 m	s ½	ms	Seria	1 8*x8'	P	59 rps
оитрит:[Туре			Functi	on			Speed		
- [Flexow	riter	Equi	omen.	t	In-Ou	t	10 0				
			•									
	Drum OUTPUT:	Drum Int OUTPUT: Flexow	Drum Internal OUTPUT: Flexowriter	Drum Internal 1000 400 OUTPUT: Type Flexowriter Equi	Prum Internal 1000 to 4000 OUTPUT: Type Flexowriter Equipmen	Function in Words Tracks, o Acoustic Channels Drum Internal 1000 to 32 to 4000 128 OUTPUT: Type Flexowriter Equipment	Function in Words Tracks, or Acoustic Channels Max. Drum Internal 1000 to 32 to 17 m 4000 128 OUTPUT: Type Functi Flexowriter Equipment In-Ou	Function words Tracks, or Acoustic Channels Max. Drum Internal 1000 to 32 to 17 ms 2 OUTPUT: Type Function Flex: Writer Equipment In-Out	Function in Words Tracks, or Acoustic Channels Max. Min. Drum Internal 1000 to 32 to 17 ms ms 4000 128 OUTPUT: Type Function Flexowriter Equipment In-Out 10 c	Function In Magnetic Time Mode Mode Max. Min. Drum Internal 1000 to 32 to 17 ms ms Serie Max. Min. OUTPUT: Type Function Flexowriter Equipment In-Out 10 charac inclu decim	Function Magnetic Tracks, or Acoustic Channels Max. Min. Drum Internal 1000 to 32 to 17 ms ms Serial 3 x 8 OUTPUT: Type Function Speed Flexowriter Equipment In-Out 10 characters/serial including by decimal const	Function words Magnetic Tracks, or Acoustic Channels Max. Min. Drum Internal 1000 to 32 to 17 ms 2 ms Serial 3 x8

Serial. ARITHMETIC MODE:

CLOCK FREQ .: 80 kg.

Flip-flop. COMPUTING ELEMENT:

> 700 tubes. COMPONENTS:

The Circle Computer was developed under the suspices of REMARKS:

Hogan Laboratories, New York University, and Muclear

Development Associates.

BUILT BY: Consolidated Engineering Corporation, Pasadena, California

INSTALLATIONS: Consolidated Engineering Corporation

copies AVAILABLE: For sale, possibly for rent.

PROGRAMMING SERVICE:

Possibly available.

computing time: Possibly available.

POWER CONSUMPTION: 7 kva. FLOOR AREA: 150 sq. ft. cooling: 2000 cfm built in First READY FOR USE: May 1953

REST SUITED FOR: General-purpose mathematical and scientific computation.

DESI .	3011ED 10K1			Factor.		Commence of		OUM PROGUE	* Y 44 .	
OPERATIN	S SCHEDULE:		ENG I NE	ERING		PROBLEM SOLVIN	G		-	ĺ
		Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total	l
	Hrs/Wk									l
	Percent									j

PERSONNEL:

NUMBER BASE: 10 (8-4-2-1 representation)

WORD LENGTH: 10 dec. digits

NUMBER RANGE: -1 to 1

INSTRUCTION TYPE: 1 address

NEGATIVE NO. REP .: Sign & abs. value SEQUENCE CONTROL: General store

OPERATIONS: Addition, subtraction, multiplication, division, floating-point operations, logical multiplication, comparison, transfer control, inputoutput.

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division				
ncl. Access	Min.		ms ms		ms 2 ms	9.0 8.5	1	12.4 12.5		verage	from log	p s)
Excl. of	ccess	0.09	ms	0.3	ms	8.8	RS	12.2	ma			
F	STORAGE:		Funct	ion	i	icity n rds	No. of CRT Magnetic Tracks, or Acoustic Channels	Tie		Mode	DrumDiam., Length or CRT Type	of
Magnetic	agnetic drum		Inter	nal		80	+ recir	- 1.7m	8	Ser-	parl2"dia	350020
<u> </u>							culatin				14" 10	
		7					loops o	f				
		7					4 track	s each				
			Inter	nal	4	000		17ms		Ser-	par	
INPU	T/OUTPUT:				Type			Function	1		Speed	
	toele			-		Input						
Typewriter							Output 8 dec. digits/sec.					

TAPE SEARCH: None

ARITHMETIC MODE: Serio-parallel

CLOCK FREQ .: 140 kc

COMPUTING ELEMENT: Flip-flop

COMPONENTS: 1200 tubes, 3000 crystal rectifiers

REMARKS: The "loops" on the drum recirculate information between magnetic heads spaced 1/10 of the drum periphery apart. Automatic checks are built in for add-substract overflow, forbidden 4-bit codes, and improper divisions (dividend larger than division). A special 4-digit register facilitates alteration of addresses, floating-point programming, and tallying of repetitive cycles.

CRC 105 Decimal Digital Differential Analyzer

BUILT BY: Computer Research Corporation, Hawthorne, California.

INSTALLATIONS: Army Ord., Ballistic Research Labs., Aberdeen Proving Ground, Md.

Navy Bureau of Ordnance, Washington, D.C. Lockheed Aircraft, Burbank, California.

Naval Ordnance Test Station, Pasadena, California.

Holloman Air Force Base, Alamogordo, New Mexico.

(Army Ord. contributed support to the development of the computer.

COPIES AVAILABLE: For sale or rent.

PROGRAMMING SERVICE: Not available.

computing Time: Not available.

FLOOR AREA: 8 sq. ft.

POWER CONSUMPTION: 7 kw.

COOLING: Internal fan.

FIRST READY FOR USE: February 1953.

BEST SUITED FOR: Solution of ordinary and some partial differential equations.

OPERATIN	G SCHEDULE:	ENG I N	ERING	1	PROBLEM SOLVII	NG	1	
		Sched. Maint. Eng. Dev.		Error-Free	Erroneous	Repair	Idle	Total
	Hrs/Wk							
	Percent	ŀ						

PERSONNEL:

NUMBER BASE: 10 (2*,4,2,1 code).

WORD LENGTH: 6 decimal digits for numbers.

NUMBER RANGE: 1 to 106 or 10-6 to linstruction type: Special.

NEGATIVE NO. REP.: Tens' complement. sequence control: Special drum store.

operations: Step-by-step integration of ordinary differential equations. Limiting, servo, decision, and other uses of integrators.

	SPEED:	Tra	nsfer	Add	ition	Multi	plication	Division			<u> </u>	
ncl. Access	Min. Max.	Six	ty in	egr	ation	s ar	e peri	ormed p	er dr	um revo	olution ons per	
Excl. of A	ccess		71 A TI16	8.1		11.00	Medius /			peration	ons per	ntegrate
ту	STORAGE:		Funct	ion	· ·	acity in irds	No. of CRT Magnetic Tracks, or Acoustic Channels	Tim		Mode	Drum Dlam. Length or CRT Type	of
Magnet	Magnetic drum		Internal		60 inte- grators		8			Seria	1)9°dia.	3600 rp
INPUT	/OUTPUT:				Туре			Function		##1/11 W1	Speed	
	Keyboa				yboard							and compression and analysis
			raph raph							nts per		
			lexov					Output	10		ters per	

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 100 kg.

COMPUTING ELEMENT: Crystal diodes and flip-flops.

COMPONENTS: About 200 tubes and 3000 crystal rectifiers.

REMARKS: This computer is of the MADDIDA type.

CRC 107 General-Purpose Computer

BUILT BY: Computer Research Corporation, Hawthorne, California.

INSTALLATIONS: Army Ordnance, White Sands Proving Ground, Las Cruces, N.M. (Whitesac)

Navy Bureau of Aeronautics, Washington, D.C.

copies available For sale.

PROGRAMMING SERVICE Not available.

COMPUTING TIME Not available.

FLOOR AREA:500 sq. ft.

POWER CONSUMPTION: 18 kw.

cooling waste-water cooled. FIRST READY FOR USE: April 1953.

BEST SUITED FOR General purpose; problems requiring large storage.

OPERATING	G SCHEDULE:	ENG I N	ERING	F	ROBLEM SOLVI	iG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk				,			
	Percent							

PERSONNEL:

NUMBER BASE:10 (excess-three code).

WORD LENGTH 9 decimal digits and sign (instructions 11 decimal digits).

NUMBER RANGE:-1 to 1.

INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP. Magnitude and sign. SEQUENCE CONTROL: General store.

operations Addition, subtraction, multiplication, division, shift, logical and magnitude extraction, overflow test, algebraic comparison, equivalence, input, output.

·	SPEED:	Tra	nsfer	Add i	tion	Multip	lication	Division	Sh	ift	Extract	Compare
Incl. Access	VERAG	e j	2 ms	15	ms	4(ms	40 ms	16	ms	15 ms	12 ms
IICI. ACCESS	Max.											
Excl. of A	ccess											
Ty	STORAGE:		Funct	ion	i	Capacity N in M Words Ti		Tin	ie	Mode	Drum Diam. Length or CRT Type	of
	· ·						Channels	Max.	Min.	<u> </u>		
Magne	tic dr	um	Inte	rnal	100	00	10	4 ms	0	Seria	1 20 "dia	.1500rpm
Magne	tic dr	um	Exte	rnal	10.0	000	100	40 ms	0	Seria	1 20 "dia	1500rps
Magne	tic ta	ре	External 1.000.		000	5	80 sec	0_	Seria	1 200 ft	731/sec	
* * * * * * * * * * * * * * * * * * * *	<u> </u>		ļ					1	· 	1		
INPU	T/OUTPUT:		<u> </u>	لحد	Туре			Function	т	<u> </u>	Speed	<u></u>
		Keyboard						Input				
		Pun	ched	tape	Ty	pewr:	iter	In& Ou	t l word per second			
		Mag	netic	tap	e, H	-S pr	inter	In& On	t 100 words per second			
*		Pun	ched	card	s (80) co]	lumns)	In&Ou	th cards (16 words) per sec			

TAPE SEARCH: Possible in either direction on several tapes while computing.

ARITHMETIC MODE Serial. CLOCK FREQ.: 100 kg.

COMPUTING ELEMENT Crystal diodes and flip-flops.

COMPONENTS 850 tubes, 8000 crystal rectifiers, 50 relays.

REMARKS The internal-storage access time is decimated by the use of 10 heads per channel. Checks are incorporated for forbidden digits, unprogrammed overflow, and number pick-up instead of command.

BUILT BY: Div. of Radiophysics, Commonwealth Scientific & Industrial Research INSTALLATIONS: Div. of Radiophysics, C.S.I.R.O. Organization (Australia)

COPIES AVAILABLE:

Not available.

PROGRAMMING SERVICE:

Not available.

COMPUTING TIME:

Available to local research centers.

FLOOR AREA: COOLING:

400 sq. ft.

POWER CONSUMPTION: 15 kva. FIRST READY FOR USE: October 1951.

BEST SUITED FOR:

Matrix operations, differential equations, function tables, d OPERATING SCHEDULE: PROBLEM SOLVING Idle Tota ! Sched. Maint. Eng. Dev. Error-Free Erroneous Repair Hrs/Wk Percent

1 operator, 2 maintenance, 2 mathematicians, 1 clerical. PERSONNEL:

NUMBER BASE:

2 (2 or 10 externally).

WORD LENGTH:

20 bits.

NUMBER RANGE:

-1 to 1

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Division must be programmed.

	SPEED	"Tra	nsfer	Add	ition	Multip	lication	Division	Trai	nsfer	Lov-Speed	Store
Incl. Access	Min.	2	ms	2	ms	4	5 ms				2 ms	
IIICI. ACCESS	Max.	4	ng ng	4	mg		S ms				20 ms	
Excl. of A	ccess	360	/LS	360	Als		+ ms					
Ту	STORAGE:	24	Func	tion	·	eacity in ords	No. of CRT Magnetic Tracks, or Acoustic	Tin		Mode	Drum Diam. Length or CRT Type	of
							Channels	Max.	Min.	1		
Acoustic	Dalay	Line	Inter	nal	1	024	64	960ALS	60 ALS	Seria	1 5'long	
Magnetic	Drun		Inter	nal	4	096	40	20 ms		Reelle		3000 rp
·						· · · · · · · · · · · · · · · · · · ·				<u> </u>		
								ļ				
				لحج						<u> </u>		
INPUT	/OUTPUT:				Туре			Function			Speed	
		Pap		pe				Input	15-	<u>-20 ro</u>	ws of 10	digits/se
		Pap	er Ta	pe.				Output	3 r	ONE O	10 digi	ts/sec.
,	. [rures est	
			,									
TAPE	SEARCH:	N OI	10		7,000							Section 1

ARITHMETIC MODE: Serial.

CLOCK FREO .: 333 km.

COMPUTING ELEMENT:

COMPONENTS: 1800 tubes, 1500 crystal rectifiers, 30 relays.

REMARKS: See T. Pearcey, "An Automatic Computer in Australia, " Mathematical Fables and other Aids to Computation, VI. No. 39, pp 167-172,

(July 1952).

(Calculateur Universel Binaire de l'Armement)

BUILT BY: Société d'Électronique et d'Automatisme, Paris, France

INSTALLATIONS: Laboratoire Central de l'Armement, Paris, France

COPIES AVAILABLE: PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 1000 sq. ft.

.

POWER CONSUMPTION: 25 kw

FIRST

BEST SUITED FOR:

FIRST READY FOR USE: January 1954

	SCHEDULE:		EERING		ROBLEM SOLVIN	G		<u> </u>
O. LINI		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
	Hrs/Wk							
F	Percent	·		<u> </u>				

PERSONNEL:

COOLING:

NUMBER BASE: 2 (10 externally)

WORD LENGTH: 25 or 50 binary digits (instructions 25 binary digits)

NUMBER RANGE:

INSTRUCTION TYPE: Two-address

NEGATIVE NO. REP.: Complement except in SEQUENCE CONTROL: General store

OPERATIONS: multiplier

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division				
	Min.	2	ms	2	ms	2	ms					<u> </u>
Inci. Access	Max.	35	ms	35	ms	35	ms					
Excl. of A	ccess									,		
	STORAGE:					acity	No. of CRT			1	Drum Diam.	Speed
ту	pe		Func	tion		in ords	Magnetic Tracks, or Acoustic	Time		Mode	or CRT Type	
			1				Channels	Max.	Min.			
Magnetic	drum		Inter	nal	32.	768	256	34ms		Serial	10"	1800rp
Electron		3										
	lines	× .	Inte	nal		16	16_	1		Serial		
Magnetic	trigg	ers	Inter	nal		256		1		 		
(futu			<u> </u>		<u> </u>		<u>L</u>	ا	, 		6.004	
INPU	T/OUTPUT:	* ***			Type			Function	4		Speed	
		Pho	toele	ctr	Lc te	me r	eader	Input	200	charac	ters/sec	
		40	oe mu					Output	18	charac	ters/sec	
			epri			≢ । বাজী		Output	5	charac	ters/sec	

TAPE SEARCH:

ARITHMETIC MODE: Serial

CLOCK FREQ .: 100 kc

COMPUTING ELEMENT: Germanium diodes

COMPONENTS: REMARKS:

DYSEAC (Second SEAC)

Electronic Computer Laboratory, National Bureau of Standards. Washington; D. C. BUILT BY: INSTALLATIONS:

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Availability not yet determined.

COMPUTING TIME: Availability not yet determined.

FLOOR AREA: 200 sq. ft.

POWER CONSUMPTION: 20 km.

cooling: 4000 cu.ft./min. FIRST READY FOR USE: July, 1953, at the earliest. General-purpose, simulation, some classes of real-time control. BEST SUITED FOR:

OPERATING SCHEDULE: ENG INEER ING PROBLEM SOLVING Idle Total Maint. Eng. Dev. Error-Free Erroneous Repair Hrs/Wk Percent

PERSONNEL:

NUMBER BASE: 2 internally; 2, 16, externally; alphameric input/output.

word LENGTH; 45 binary digits, sign digit, and check digit.

NUMBER RANGE: 4 to 4.

INSTRUCTION TYPE Three-address.

NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General storage.

OPERATIONS: Arithmetic, choice, program control, input-output. Operations

include summation, accumulation, justification, shift, and storage and reset of contents of program counters ("file").

	SPEED:			4	tion	Multip	lication	Div	isior	,	F11	•				
Incl. Access	Min.	mill:	isec.	0.2	2	2,	4	2	.4		0.	1				
	Max.			1.	5	3,	6	-3	.6		0.					
Excl. of A	ccess			0.0	15	2,	1	2.	.1		G.					
STORAGE Type		Function		ion	Capacity in Words		No. of CRT Magnetic Tracks, or Acoustic		Acce			Mode	L	nDiam., ength RTType		Speed of otion
							Channels	Ma	×.	М	in.					
Hg Delay			tern			12	64	384	+/us	48	ALS	Seria	18	vords		
Magnetic	Tapes	or Ex	tern	al		00ea					Sec.				51/	sec
Huth Wir	e Bott	lesEx	tern	al	200	00ea	. 7			Q1	Sec.	Seria			81/	sec
Wagnetic	Drum	<u> </u>	ctern	al	85	00	240	17			98C.)0 r
INPUT	/OUTPUT:				уре		<u> </u>	Fund	ction	Т			Spee	<u> </u>		
							Printez	In-	-Ou	t	<u> </u>	charac	ters	seco	nd.	
	· · · · · · · · · · · · · · · · · · ·		Punched Paper Tape						-Oa	5		charac				
	Magne	tic	Wire	(Pe	irce)	In-	-Ou	t) digi					
*	SEARCH:	Done	122				ections			بلن						

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 1 megacycle.

COMPUTING ELEMENT: Germanium diode switches, tube amplifiers, and delay lines.

components: 500 tubes in computer plus 350 in each memory cabinet; 20,500 crystal rectifiers.

REMARKS: Input and output can proceed concurrently with arithmetic.

Provision is made for octupling the acoustic memory and for up to 16 magnetic tapes. An odd-even memory check is built in.

For further information, see NBS Report 1951. "System specifications for the DYSEAC, " by Alan L. Leiner, Sept., 1952.

EDPM Type 701

(Electronic Data Processing Machines)

BUILT BY: International Business Machines Corporation

INSTALLATIONS: 18 government agencies and commercial organizations

will have installations by March 1954.

copies available: For rent

PROGRAMMING SERVICE: Available. Instruction in programming given each month.

COMPUTING TIME: Available.

FLOOR AREA:

POWER CONSUMPTION: 88 kva (80 kw) FIRST READY FOR USE: April 1953

COOLING:

BEST SUITED FOR: General purpose

										
OPERATING S	OPERATING SCHEDULE:			NEERING		. 1	PROBLEM SOLVII	NG	1	
<u> </u>		Sched. Maint. Eng. Dev.		Dev.	Error-Free	Erroneous	Repair	idle	Total	
	Hrs/Wk	Var	ies	accor	ding	to instal	lation.			
F	Percent							1	I	

PERSONNEL: Varies according to installation; complete maintenance furnished by IBM.

NUMBER BASE: 2 (usually 10 externally)

WORD LENGTH: 36 binary digits (instructions 18 binary digits)
NUMBER RANGE: Variable binary pt. INSTRUCTION TYPE: One-address
NEGATIVE NO. REP.: Sign & abs. value SEQUENCE CONTROL: General store

OPERATIONS: Addition, subtraction, multiplication, division, round,

shift, transfer, test for zero or negative

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division						
Incl. Access	Min.	36	Nis	36	118	500	118	500 Als						
inci. Access	Max.	60	Als	60	ns	500	/us	500 Jus						
Excl. of A	ccess		/				7							
STORAGE: Type			Func			pacity No. of CRT Magnetic Tracks, or Acoustic Channels		Tim		Mode	DrumDiam. Length or CRT Type	Speed of Motion		
Electros	tatic		Inter	nal	20	48	72	12	<i>t</i> ts	Paralle				
Magnetic			Inter				144			Paralle	1			
Magnetic										Ser-Par				
			 		-			1		-				
INPUT	r/output:	<u> </u>			Type		<u> </u>	Function	T	1	Speed			
Magnetic t				tar	08			In-Out	125	0 words	per sec.			
Card reader								Input	Up	Up to 150 72-column cards/m				
Card punch								Output	Up	to 100 7	2-column	cards/n		
		Pr	inter							to 150 7	2-column	cards/n		

TAPE SEARCH: Reading possible in both directions

ARITHMETIC MODE: Parallel

CLOCK FREQ .: 1 mc

COMPUTING ELEMENT: Flip-flop

COMPONENTS: 4000 tubes; 15,000 crystal rectifiers

REMARKS: A redundancy-bit check is used on the magnetic tapes. Counter overflow, division, and printing checks are incorporated. A card may contain either 72 decimal or alphameric characters or 24 36-bit words. The 701 is the Electronic Analytical Control Unit, the 706 is the Electrostatic Storage Unit, the 711 is the Punched Card Reader, the 716 is the Alphabetic Printer, the 721 is the Punched Card Recorder, the 726 is the Magnetic Tape Reader and Recorder (2 tapes), and the 731 is the Magnetic Drum Storage

EDSAC I (Electronic Delay Storage Automatic Computer)

BUILT BY: University Mathematical Laboratory, Cambridge, England

INSTALLATIONS: University Mathematical Laboratory

(Cambridge University contributed to the development of the computer. INO, installed at J. Lyons Co., London, is an

engineered version of EDSAC I.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME: Not available.

FLOOR AREA: 12 x 12.

POWER CONSUMPTION: 15 kw.

cooling: Window fan.

FIRST READY FOR USE: June 1949.

BEST SUITED FOR: General-mirnoge

DESI SUITED FOR.	aener or	-bert hose					
OPERATING SCHEDULE:	ENGIN	EERING	1	PROBLEM SOLVII	1G	1	ł
	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk							

Percent PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 34 or 17 binary digits and sign (instructions 17 binary digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, shift, "and".

•	SPEED	Trai	nsfer	Addi	tion	Multip	lication	Division				
	Min.											
inci. Access	7 1.	1.	5 ms	1,	5 ms	6.	0 ms					
Excl. of A	ccess	<u>L</u>						,				
т	STORAGE ype	•	Funct	ion	i	city n rds	No. of CRT Magnetic Tracks, or Acoustic Channels	Tir		/Mode	Drum Diam., Length or CRT Type	Speed of Motion
Mercury 1	Delay	Lines	Inte	mal	1024	ŀ	32	about	600 Na	Serial		
					(17-c	ligit			,	<u> </u>		ļ
					MOI	.gs)	<u> </u>					<u> </u>
Magnetic	Tape		Exter	nal			2	ļ	<u> </u>	· · · · ·		
. INPU	T/OUTPUT	:	<u> </u>		Туре			Function	l	<u> </u>	Speed	
		Par	er Ta	pe ((5-ho	le)		Input	40-	50 rows	second	
			oer Te		5-hc			Output	. 1	3 rows	second	
		ı							1			

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 500 kc.

COMPUTING ELEMENT: Tubes.

COMPONENTS: 4500 tubes.

REMARKS: EDSAC I has refined marginal-checking facilities. See

M. V. Wilkes, David J. Wheeler, and Stanley Gill, The Preparation of Programs for an Electronic Digital Computer, Addison-Wesley Press Inc., Cambridge, Massachusetts (1951).

EDVAC

(Electronic Discrete Variable Automatic Computer)

BUILT BY: Moore School, University of Pennsylvania

INSTALLATIONS: Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland

(Owned by Army Ordnance Corps.)

COPIES AVAILABLE: No.

PROGRAMMING SERVICE: Available to groups engaged in National Defense work.

COMPUTING TIME:

FLOOR AREA: 1200 sq. ft.

POWER CONSUMPTION: 50 kw.

cooling: 12-ton air conditioner FIRST READY FOR USE: April 1952.

BEST SUITED FOR:

	• •							
OPERATING SCHEDULE	: ENGINE	ERING		PROBLEM SOLVII	NG	1		- 1
•	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total	
Hrs/Wk	9.4	25	40	5	70.4	2.4	152.2	_
Percent	6.2	16.4	26.3	3.3	46.2	1.6	100	

PERSONNEL: 10 maintenance men, 12 mathematicians.

NUMBER BASE: 2

NUMBER BASE: 4
WORD LENGTH: 44 binary digits.
2-43_1 to 1-2-43. NUMBER RANGE: 2-43-1 to 1-2-

NEGATIVE NO. REP .: Sign bit.

INSTRUCTION TYPE: Four-address. SEQUENCE CONTROL: General store.

OPERATIONS:

	SPEED:	Tra	nsfer	Addi	tion	Multip	lication	Division	Com	pare		
	Min.			192	ALS	2	.2 ms	2.2 m	i	92 AIS		
ncl. Access	Max.			1.5	ms		.5 ms	3.6 m	3 1	.2 ms		
Excl. of	ccess			4) Jus	2	.0 ms					
т	STORAGE:		Funct	tion	· i	acity in rds	No. of CRT Magnetic Tracks, or Acoustic Channels	Time		Mode	Drum Diam., Length or CRT Type	Speed of Motion
ercury D	elay I	ine	Inter	mal	102	4		384 Azs		Serial		l mega
												cycle
									·	1		
1.2			<u> </u>									
INPU	T/OUTPUT:			9	Туре			Function	<u> </u>		Speed	
		Tel	letype	Tar)e				<u> </u>			
					4.							
	•		7.									
			75						1		1.1	

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 996.75 kg.

COMPUTING ELEMENT:

COMPONENTS:

3600 tubes, 10,000 crystals.

REMARKS: Duplicate algebraic units provide checking.

BUILT BY: Electronic Computer Division, Underwood Corporation, New York, N.Y. INSTALLATIONS: Development and Proof Services, Fire Control Branch, Aberdeen Proving Ground, Maryland. (Owned by Ordnance Corps, U.S. Army.) Project Cyclone, Reeves Instrument Co., New York, N. Y.

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE:

OPERA

COMPUTING TIME:

FLOOR AREA: 25 sq. ft.

POWER CONSUMPTION: 3 kva.

cooling: None required.

FIRST READY FOR USE: November 1952.

BEST SUITED FOR: General numerical computation.

ATING	SCHEDULE	ENG I	NEERING		PROBLEM SOLVIN	G	T	
-		Sched. Maint	. Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
L	Hrs/Wk					- жератт		· · ·
- F	Percent		1					
_					L1			

PERSONNEL: I mathematician, I maintenance man at APG.

NUMBER BASE: 2 (8 and 10 externally).

word Length: 30 binary digits.

NUMBER RANGE: (2-27-4) to 4-2-27). INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP .: Complement. SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication (rounded and double-precision),

logical multiplication, transfer, input-output, no divide.

	ļ		e Rea	ader : Tar)e			Input In-Out		-5_	charact	per 64	nd
	ł		ewrit		·			In-Out		.5	charact	ers/seco	nd
INPUT	/OUTPUT:				Туре			Function	ī			Speed	
													
									1	44.63	201 102	x 2ºlons	
agnetic	Drum		Inte	rnal	51	2	8	17 ms	0.6	me	Serial	10*dia	3600
' y	pe		Fund	ction	Wo	rds	Tracks, o Acoustic Channels		Mi	n.	Mode	or CRT Type	Motion
	STORAGE:		_		1	acity n	No. of CR Magnetic	Ti	ess me			Drum Diam., Length	Speed of
Excl. of A	ccess	0.3	ms	0.3		10							
ici. Access	Max.	34		68	ms		ms						
ncl. Access	Min.	2	ms	3	ms		nication ms	Divisio					

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 115 kc.

COMPUTING ELEMENT: Diode Gating.

COMPONENTS: 240 tubes, 2000 crystal rectifiers, 12 relays.

REMARKS:

Underwood Corporation, N.Y., N.Y. Electronic Computer Division, BUILT BY:

INSTALLATIONS:

COPIES AVAILABLE: For sale. PROGRAMMING SERVICE: Available.

COMPUTING TIME:

FLOOR AREA: 13 8q. ft.

POWER CONSUMPTION: 5 kva.

cooling: None required.

FIRST READY FOR USE:

BEST SHITED FOR: General purpose applications.

BES! SULLED FOR.		A					
OPERATING SCHEDULE:	ENGINE	ERING	l	ROBLEM SOLVIN	1G	ldle	Total
	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	1016	
Hrs/Wk	oched: Marives						
Passant			l		<u> </u>		

PERSONNEL:

NUMBER BASE: 10 (excess-3 representation). WORD LENGTH: 8 decimal digits and sign.

NUMBER RANGE: 10-8-1 to 1-10-8. INSTRUCTION TYPE: Two address NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General store.

OPERATIONS: All basic arithmetic operations, shift-extract, normalize,

tally, store, transfer, input-output, tape search.

	SPEED:	Tran	sfer	Add	tion	Multip	lication	Division	-				
	Min.	1.	5 ms	17					18				1
nci. Access	Max.	3	4 ms	51	ms_		me	68_1					
Excl. of A	ccess	0.	3 ms	0.3	ms	12 m	3.3Y	2 ma	Y.				
	STORAGE:			_	Car	pacity	No. of CRT		ess			Drum Diam., Length	Speed of
Туре		Function		tion	Words Tra		Magnetic Tracks, o Acoustic	r			Mode	or CRT Type	Motion
										Min.			
Magnetic Drum			Internal		1000		20	17 m	b.	6 ma	Serial	10"dia.	3600 m
MOETIC OTO	2/2 (dat								T			x 5"long	
Magnetic	Tape		Exte	rnal	125	.000	5	800 se	cl.	65em	SerPar	1200 ft	274/98
					-				╁				
INDI	T/OUTPUT:				Type			Function	on			Speed	
		Tyr				In-Ou	t	10 char/sec					
			ched		6			In-Ou	t	10 char/sec			
		2 420204 10-50						In-Ou	t	1.6 sec. per 50 words			

TAPE SEARCH: Possible in either direction.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 105 kc.

COMPUTING ELEMENT: Diode gating.

COMPONENTS: 350 tubes, 4000 crystal rectifiers, 35 relays.

REMARKS: The computer utilizes automatic odd-even check and number-of-characters-per-block check on tape read.

Check of 0000 and 1111.

BUILT BY: Electronic Computer Division, Underwood Corporation, New York, N.Y. INSTALLATIONS: Office of Chief of Ordnance, U. S. Army., Washington, D.C.

COPIES AVAILABLE:

PROGRAMMING SERVICE: Not available.

COMPUTING TIME: Not available. FLOOR AREA: 85 ag. ft.

POWER CONSUMPTION: 7.5 kva.

COOLING:

FIRST READY FOR USE: June 1953.

BEST SUITED FOR: General numerical computation-Gordnance supply control studies.

ENG I NE	ERING	ſ	ROBLEM SOLVIN	·			
Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	fidle	Total	
ı				Cabad Wall of Cabad Wall	Sahad Malan E. D. E. T.	Sobod Matrix Comp. 5	

PÉRSONNEL:

NUMBER BASE: 10 (excess-3).

WORD LENGTH: 8 decimal digits plus sign (Instructions consists of two words each.)

NUMBER RANGE: 10 1-10 ... INSTRUCTION TYPE: Three-address.

INSTRUCTION TYPE: Three-address. NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General store.

OPERATIONS: Arithmetic operations including special vector operation, square root, input-output, shift and extract, conditional transfer.

SPEED Addition Transfer Multiplication Division 34 ms 34 mg Min. 2 mg 34 ms incl. Access 68 ms 136 ms 170 ms May. 170 ms 0-3 ms Excl. of Access 0-3 ms 12 ms.Av.12 ms. Av STORAGE: No. of CRT Capacity Access Drum Diam. Speed in Magnetic Time Length of Type **Function** Words Trackš, or Mode or CRT.Type Motion Acoustic Channe is Min. Magnetic Drum Internal 10,000 100 34 ms06 ms Serial 18"dia 1800 rpm 12"1 one INPUT/OUTPUT: Type Function Card Reader Input 100 cards/min. Card Punch Output 100 cards/min.

TAPE SEARCH:

ARITHMETIC MODE: Serial

CLOCK FREQ .: 108 kc.

COMPUTING ELEMENT: Diede gating.

COMPONENTS: 500 tubes, 4500 crystal rectifiers, 120 relays.

REMARKS: Decimal digits are automatically tested for forbidden codes.

The drum-channel-selecting relays are checked.

BUILT BY:

Elliott Brothers Ltd., London, England

INSTALLATIONS:

(The computer was developed under the auspices of the

National Research Development Corp.)

COPIES AVAILABLE:

PROGRAMMING SERVICE:

Available. COMPUTING TIME:

FLOOR AREA:

13ft. x 2 ft. POWER CONSUMPTION: 5 kw.

Self-contained. FIRST READY FOR USE: July 1953. COOLING:

General purpose. BEST SUITED FOR: ENGINEER ING PROBLEM SOLVING OPERATING SCHEDULE: Idle Total Erroneous Repair Error-Free Sched. Maint. Eng. Dev. Hrs/Wk Percent

PERSONNEL:

NUMBER BASE:

32 binary digits. WORD LENGTH:

-1 to 1. NUMBER RANGE:

INSTRUCTION TYPE: TWO-address.

Twos complement. SEQUENCE CONTROL: General store. NEGATIVE NO. REP.:

OPERATIONS: Add, subtract, multiply, multiple transfer, shift, input,

output, collate, round off, add and shift.

	SPEED:	Tea	nsfer	Add	ition	Multi	lication	Division				
	Min.		ms	_			O ms					
nci. Access	Max.		ms		2 mg		1 3					
Excl. of A	ccess	0.1	ms	٠	mg	<u> </u>		<u>,</u>			100	
	STORAGE:		Fund	tion	t i	acity in ords	No. of CRT Magnetic Tracks, o Acoustic	Ti		Mode	Drum Diam., Length or CRT Type	Speed of Motion
				1			Channels		Min.	1		
Magnetic	disk		Inte	rnal	10	24	8	13ms		Serial	9* dia	4500r
Mache CTC	ULSA	Ext	enda			96		14 1	S AV	with	relay se	ection
									<u> </u>			
Magnetos	tricti	ve	Inte	rnal		<u> </u>		0	0	Seria	<u> </u>	
delay							<u> </u>					
INPU	T/OUTPUT	:			Type	11.11.4		Functio			Speed	
	•	Pho	otoel	ectr	ic to	ape I	reader	Input	40	lines/	second	
		_			<u> </u>			 	_			
		(I) (I)	pewri	+				Output	10	charac	ters/seco	nđ

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 333 kc.

COMPUTING ELEMENT:

Crystal-diode gates.

COMPONENTS: 500 tubes, 2500 crystals.

REMARKS: The magnetostrictive delay lines are used for the

arithmetic and instruction registers. The computer is made up of 168 packaged units, of which three types

account for 102.

(Electronic Numerical Integrator and Automatic Computer)

BUILT BY: Moore School, University of Pennsylvania

INSTALLATIONS: Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland

(Owned by Ordnance Corps, U. S. Army.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

OPER

COMPUTING TIME: Available to groups engaged in National Defense work.

FLOOR AREA: 1800 sq. ft.

POWER CONSUMPTION: 200 km.

cooling: Large blowers.

FIRST READY FOR USE: Summer 1947.

BEST SUITED FOR: Ballistic calculations; computing firing tables; general purpose.

RATING	SCHEDULE:	ENGINE	ERING		ROBLEM SOLVI	NG			ı
		Sched, Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total	
Γ	Hrs/Wk	8	4.5	81.5	6	35.6	3.7	139.3	
	Percent	5.8	3.2	58.5	4.3	25.6	2.6	100	

PERSONNEL: 11 maintenance men, 13 mathematicians.

NUMBER BASE: 10 (true decimal).

word Length: 10 decimal digits.

NUMBER RANGE: 10-10-1 to 1-10-10. INSTRUCTION TYPE:

NEGATIVE NO. REP.: Tens' complements. SEQUENCE CONTROL: Plugboard and/or IBM cards.

OPERATIONS: Add, subtract, multiply, divide, and others.

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division				
	Min.	200	Ms	200	ALB.	2.	8 ms					
nci. Access	Max.	200		200	A)B	2.	8 ms					
Excl. of	ccess	200	A.S	200	D.S	2.	8 ms					
T	STORAGE:		Func	tion	· · ·	acity in ords	No. of CRT Magnetic Tracks, or Acoustic	Ti		Mode	Drum Diam., Length or CRT Type	Speed of Motion
							Channels	Max.	Min.	1	1.	
lectroni	c Regis	ten	Inte	rnal	20)						
									,			
INPU	T/OUTPUT:				Туре			Function	n		Speed	
•		Mar	17 10	-Pos	Svi	tche	я	Invut				• .
			d Car					Input	and o	utput		
								- -				

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: 100 kc.

COMPUTING ELEMENT:

COMPONENTS: About 18,000 tubes.

REMARKS: ENIAC is conceptually similar to counter-wheel calculators.

It has 20 electronic registers; all can add, and subtract. Decimal digits are transferred in parallel, each as a train of from 0 to 9 pulses. Operating schedule figures are based

on 1952 experience.

BUILT BY: Engineering Research Associates, Division of Remington Rand, Inc., St. Faul, Minn., and Arlington, Va.

INSTALLATIONS: U. S. Government (2).

Engineering Research Associates Computation Center, Arlington, Va.

COPIES AVAILABLE: For sale. PROGRAMMING SERVICE: Available. COMPUTING TIME: Available.

FLOOR AREA: 110 sq. ft.

POWER CONSUMPTION: 13.5 km.

Integrally included FIRST READY FOR USE: December 1950 (Commerical model - 3rd quarter 1953).

BEST SUITED FOR:	General	Targe=80	STA COMDO	TEL TON .			
OPERATING SCHEDULE:	ENG I NI	EERING	l	ROBLEM SOLVIN	lG .		_
	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk	13	0	117		3	0	133
Percent	10	0	88	-	2	0	100

PERSONNEL:

2 (8 externally). NUMBER BASE: WORD LENGTH:

24 binary digits. 1-2²³ to 2²³-1. INSTRUCTION TYPE: One-address. NUMBER RANGE: NEGATIVE NO. REP .: Ones! complement. SEQUENCE CONTROL: General store.

OPERATIONS: General erithmetic and logical operations including multiplication.

division, multiple shift, input, output,

	SPEEDS	Tran	sfer	Add	ition	Muitip	lication	Divis					
nol. Access	Min.	32	AL	96	71.0	352	me	416	18				
nci. Access	Max.	Se	Res	arkı									
Excl. of A	ccess	2.5	ns.		118	260	ne	324	118_	<u> </u>			
	STORAGE:		7			acity	No. of CRT Magnetic		ccess Time	P ************************************		Drum Diam., Length	of
Ту	ipe.		Func	t i on	Wo	rds	Tracks, or		,		Mode	or CRT Type	Motion
							Channels	Max.		Min.			
Magnetic	Drum		Inter	mal	16.3	84	192	17 m	s 3	2 /118	Brellel	Bardia.	3450 m
										7		x 14*1ee	
												<u> </u>	
	*.												
I NPU	T/OUTPUT:				Type			Funct	ion	_		Speed	
		Phot	oele	stri	c Tap	e Re	ader	Inpu	t	35 1	cords/s	ec.	
		Dec	tric	Typ	ewrit	er		Outp	at		char/se		
		Pana	Pun	sh.				Outp	nt	60	chan/se	G.	

TAPE SEARCH: Not available.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: 400 kg.

COMPUTING ELEMENT: Flip-flop.

COMPONENTS: 2695 tubes, 2385 crystal rectifiers, 135 relays.

REMARKS: Although drum period is 17 ms., minimum-access programming techniques normally used result in the execution of a number of instructions per drum revolution. Marginal checking plus diagnostic programs are used for maintenance.

INSTALLATIONS:

BUILT BY: Engineering Research Associates, Division of Remington Rand, Inc., St. Paul. Hinn., and Arlington, Va., ALLATIONS: Arnold Engineering Development Center, Tullahoma, Tenn. (3 1102's).

(Owned by Air Materiel Command, Wright Patterson Air Force

Base, Ohio.)

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE: Available at ERA.

COMPUTING TIME:

FLOOR AREA: 110 sq. ft.

. POWER CONSUMPTION. 20 km.

cooling: Integrally included FIRST READY FOR USE: 4th quarter 1953.

BEST SUITED FOR: General-purpose computation -- on-line data reduction. OPERAT

AT I NO	SCHEDULE:	ENG I NE	ERING	ı	ROBLEM SOLVIN	IG ,			
_		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total	ľ
	Hrs/Wk						:		
I	Percent		·	·					

PERSONNEL:

NUMBER BASE:

24 binary digits. WORD LENGTH:

1-225 to 225-1. INSTRUCTION TYPE: One-address. NUMBER RANGE: Ones complement. SEQUENCE CONTROL: General store. NEGATIVE NO. REP.:

General arithmetic and logical operations including multiplication, OPERATIONS:

division, scale factor, multiple shift, operations related to

input-output.

							Division			T	
· 1	SPEED:	Transfe 18 /1		ition [18		/us	334 ALS	+			
inci. Access	Max.		lenark		7.5	/45) J-Y MA				
Excl. of A	ccess	14/12			76-2	94 ALS	318 As				
	STORAGE:	F	unction	<u>'</u> 1	ncity n rds	No. of CRI Magnetic Tracks, o Acoustic	Tim		Mode	Drum Diam., Length or CRT Type	Speed of Motion
				1.00		Channels		Min.		261222	(000
lagnetic]	Drum	In	ternal.	409	6	96	8.5 ms	2/48	Paralle	144 dia.	
			,				1			x 8 Jone	
										·	
										ļ	
INPUT	/OUTPUT:			Туре			Function			Speed	
	Ī	hotoe	lectri		e Re	ader	Input	50	words/s	second.	
			ic Typ				Output			ters/seco	ad
		Pape P					Output	-		ters/seco	
	_			tters			Output				

TAPE SEARCH:

ARITHMETIC MODE: Parallel:

CLOCK FREQ .: 500 kg.

COMPUTING ELEMENT: Flip-flop.

COMPONENTS: 2200 tubes, 3000 crystal rectifiers, 90 relays.

REMARKS: Although the drum revolution period is 8.5 ms., minimum-access programming techniques normally used result in the execution of a number of instructions per drum revolution. Marginal checking plus diagnostic programs are used for maintenance. Multiplication and division overflow alarms are incorporated.

BUILT BY: Engineering Research Associates, Division of Remington Rand, Inc., St. Paul, Minn., and Arlington, Va. INSTALLATIONS: U. S. Government.

COPIES AVAILABLE: For sale or rent. PROGRAMMING SERVICE: Available at ERA.

COMPUTING TIME:

FLOOR AREA: 300 sq. ft.

POWER CONSUMPTION: 45 KW.

COOLING: Built-in.

FIRST READY FOR USE: September 1953 (Commercial model -

BEST SUITED FOR: General large-scale computation; real-time control & simulation.

ING	SCHEDOLE		ENGINE	ENTING		KOULEM BOLVII			
		Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
-[Hrs/Wk			·					
	Percent								

PERSONNEL:

NUMBER BASE: 2

WORD LENGTH: 36 binary digits.

NUMBER RANGE: 1-235 to 235-1.

INSTRUCTION TYPE: TWO-BOATESS . SEQUENCE CONTROL: General store.

NEGATIVE NO. REP.: Ones! complement

OPERATIONS: General arithmetic and logical operations including multiplication,

division, scale factor, multiple shift, repetition, memory search

(both threshold and equality), and operations relating to input-output.

			Pun	ch.			t Optio	Ou	tput			char/s		
					c Ta		eader	_	put	+	<u>24</u>			
INPUT	/OUTPUT:				Туре			Fu	nction	T			Speed	
Magnetic	Tape		Exte	mal	200	000	4 uni	4	-	-	-	Ser, -Per	a tape	15"/sec.
Electrost			Inte			24	36		VIB	6	<u>us</u>			179/222
	7										•		x 10, Jose	
Magnetic !	Drum		inte	cnal	16.3	384	144	34	ms	4	μs	Parallal	17*dia.	1725 rp
. 19	pe		runc	L TON	***	,,,,,	Acousti Channel	ا ہ	ax.		īņ.			
	STORAGE:	\dashv	Func	lon	· •	acity in irds	No. of CR Magneti Tracks.	١ :	Acce			Mode	Drum Diam., Length or CRT Type	Speed of Motion
Excl. of A	ccess	18)18	24	/us	102	402/us	464	482	28			1	
Incl. Access	Max.	Sec		ark					•	\perp				·
	Min.	42	/118	48	/us	126	/18	480	A18					
	SPEED	Trans	fer	Add	tion	Multi	plication	ווט	ision					

TAPE SEARCH: Possible in both directions. Tape postuloned control. CLOCK FREQ .: 500 EC.

ARITHMETIC MODE: Parallel. COMPUTING ELEMENT: Flip-flop.

COMPONENTS: 4500 tubes, 6000 crystal rectifiers, 150 relays.

REMARKS: Although the drum revolution period is 34 ms., minimum-access

programming techniques normally used result in the execution of a number of instructions per drum revolution. Marginal checking plus diagnostic programs are used for maintenance. Multiplication and division overflow alarms are incorporated.

36

FIAC (Florida Automatic Computer)

BUILT BY: Air Force Missile Test Center, Patrick Air Force Base, Cocoa, Fla. INSTALLATIONS: Air Force Missile Test Center.

COPIES AVAILABLE: Copies will be available for sale.

PROGRAMMING SERVICE: Limited time and programming service are available to Air

computing time: [Force contractors.

FLOOR AREA: 400 sq. ft.

POWER CONSUMPTION: 8 km.

cooling: Integral.

FIRST READY FOR USE: April 1953.

BEST SUITED FOR: General-purpose scientific computation.

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING Sched. Maint. Eng. Dev. Idle Total Error-Free Erroneous Repair Hrs/Wk 16 128 168 Percent

PERSONNEL: 4 operator-maintenance men, 4 mathematicians.

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 44 binary digits and sign.

NUMBER RANGE:

INSTRUCTION TYPE:

Three-address

NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply (rounded and unrounded, high and low order). divide (remainder available), shift, power extract, logical transfer,

comparisons, complete decimal-binary and binary-decimal conversion, file.

												200ª/s
Mercury De Magnetic			Inter Exter		51: 500.0		64 6	384 ps	48 pas	Serial SerPa		60 and
Ту	STORAGE pe		Funct	ion	i i	acity n rds	No. of CRT Magnetic Tracks, or Acoustic Channels	Tin		Mode	DrumDiam., Length or CRT Type	Speed of Motion
Excl. of A					/us	3.0 2.2	o ms	3.0 m			2.2 ms	
Incl. Access	. Min.	ļ		1.6	ms	2.		2.5 m	s 3.	0 ms	0.8 ms	
	SPEED	1 1 1 7 8	ınsfer	Add	ition	Multip	lication	Division	Dec	Bin	BinDec.	

TAPE SEARCH: Possible in both directions.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 1 mc.

COMPUTING ELEMENT: Dynamic flip-flop with diode current gating.

components: 800 tubes, 15,000 crystals, 30 relays.

REMARKS: Addresses may either be absolute, relative to control counter, or relative to special register. Odd-even checking is used on the external memories. The acoustic storage can be ectupled in size. This computer is similar to SEAC, DYSEAC, and MIDAC.

BUILT BY: Arbeitsgruppe Numerische Rechenmaschinen, in cooperation with the Abteilung für Astrophysik, Max-Planck-Institut für Physik. INSTALLATIONS:

> Max-Planck-Institut furPhysik, Gottingen, Germany, (The development of the computer was supported by the Max-Planck-Gesellschaft, Göttingen, and by ERP grants.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 125 sq. ft.

POWER CONSUMPTION: 2.4 kw.

COOLING: None.

FIRST READY FOR USE: June 1952.

BEST SUITED FOR: Numerical integration and other repetitive calculations.

			•			4		<u> </u>
PERATING	SCHEDULE:	ENG I NE	ERING	F	ROBLEM SOLVI	NG		
_		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
I	Hrs/Wk	5		70 - 75		10 - 15		90
ſ	Percent							

PERSONNEL: 2 operators, 2 mathematicians, 1 part-time maintenance man.

NUMBER BASE: 2 (10 externally). WORD LENGTH: 32 binary digits.

NUMBER RANGE: -8 to 8.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Abs. val. &sign in stars QUENCE CONTROL: Punched paper tape.

OPERATIONS: Addition, subtraction, multiplication, division, square root.

	SPEED:	Transfer	Add	ition	Multip	lication	Divisio	_	Sa.	Root		
	Min.		280	D S	450	ms .	450 ms		60	0 ms		
nci. Access	Max.		420	ms	590	ms	590 ms		60	0 mg		
Excl. of A	ccess		5	ms	320	ms	320 ms		40	O ms		
Ту	STORAGE:	Func	tion	1	city n rds	No. of CRT Magnetic Tracks, or Acoustic Channels	r T1	ess me	in.	Mod e	Drum Diam., Length or CRT Type	Speed of Motion
Magnetic	drum	Inte	rnal	3	6	9	20 m	20	ms	Serial	3hdia.	
INPUT	r/OUTPUT:			Туре			Functio	n			Speed	
		4 punch	ed-te	ape r	eade	rs	Input		7 d	gits p	er secon	d
		Tape pu	nch				Outpu	X			er secon	<u>a</u>
		Typewri	tar				In&ou	e 1	8 d:	igits p	er secon	đ

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 7.2 kc.

COMPUTING ELEMENT: Gates and flip-flops. COMPONENTS: 476 tubes, 101 relays.

> REMARKS: Negative numbers are represented by complements in the arithmetic unit. For short descriptions of the Gl, see L. Biermann, H. Bil-

ling, A. Schläter, Hopmann, ZAMM 33, 48-60 (1953) and L. Biermann

and H. Billing, Naturwiss. Heft 1, 7-13 (1953).

BUILT BY: Arbeitsgruppe Numerische Rechenmaschinen, in cooperation with the INSTALLATIONS: Abteilung für Astrophysik, Max-Planck-Institut für Physik.

> Max-Planck-Institut für Physik, Göttingen, Germany. (The development of the computer was supported by the Max-Planck-Gesellschaft, Göttingen, and by ERP grants.)

COPIES AVAILABLE: No.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 200 sq. ft.

POWER CONSUMPTION: 5 km.

cooling: None.

FIRST READY FOR USE: Spring 1954

BEST SUITED FOR: General purpose; numerical analysis and algebra.

OPERATIN	G SCHEDULE:		ENG INE	ERING		f	ROBLEM SOLVII	√G		
		Sched.	Maint.	Eng.	Dev.	Error-Free	Erroneous	Repair	. Idle	Total
	Hrs/Wk									
	Percent									

PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 50 binary digits (instructions 18 binary digits, two per word).

NUMBER RANGE: -8 to 8.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Abs.val.&sign in store QUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, division.

	SPEED:	Transfer	Add	ition	Multi	plication	Division				
nci. Access	Min.		20	ms	80	ms	80 ms				
nove necess	Max.		20	ms	80	ms	80 ms				
Excl. of A	ccess		0.6	ms	60	ms	60 ms				
	STORAGE:		tion	i i	acity n rds	No. of CRI Magnetic Tracks, or	Ti		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Mamatia	daman	Inter		204	0	Acoustic Channels	Max.	Min.			
- Toghoulo	agnetic drum		no T	204	<u> </u>	04	20 ms	20 ms	Serial	12"dia. 12"long	
INPUT	/OUTPUT:			Туре			Function			Speed	
		Teleprin	ter å	tap	e pu	nch :	n & Ou	t 7	ligits	per seco	nd.

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREO .: 92 kc.

COMPUTING ELEMENT: Gates and flip-flops.

COMPONENTS: About 1100 tubes.

REMARKS: While one order is being executed, the next order is being

read from the drum.

BUILT BY: Compagnie des Machines BULL, Paris, France.
INSTALLATIONS:

copies available: For sale and for rent.

PROGRAMMING SERVICE: Available.

COMPUTING TIME: Available.

FLOOR AREA: 2 ft x 43 ft.

POWER CONSUMPTION: 3 km.

cooling: None.

FIRST READY FOR USE: October 1952.

BEST SUITED FOR: Accounting & math. problems requiring limited fast storage cap. ENGINEERING PROBLEM SOLVING OPERATING SCHEDULE: Idle Total Repair Sched. Maint. Eng. Dev. Error-Free Erroneous 40 Hrs/Wk 38.8 1004 97

PERSONNEL: 1 operator, & maintenance man.

NUMBER BASE: 10 (8,4,2,1 representation).

WORD LENGTH: 12 decimal digits, splittable (instructions 16 binary digits).

NUMBER RANGE: Variable decimal pt. INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Magnitude and sign. SEQUENCE CONTROL: Plugboard &/or punched cards.

OPERATIONS: Addition, subtraction, multiplication, division, comparison, transfer-reset.

	SPEED	Tra	nsfer	Add	ition	Multi	plication	Division	Com	mariaen		
	Min.	0.8	ms	0.8	5 ms	י נו	a av.	11 mg	VO	85 mg		
Incl. Access	Max.	2.9	ms	2.9	ma	21 :	18	21 ma	2.	9 ma		
Excl. of A	CC#88	0.17	ms.	0.1	7. ms	11/2	21 ma	11/21		17 ms		
	STORAGE:		Func	tion	r	pacity in lords	No. of CRT Magnetic Tracks, or Acoustic	r Ti		Mode	DrumDiam., Length or CRT Type	Speed of Motion
							Channels		Min.			
Blectroma	gnetic	3										
	y line		Inte	rnal	4 t	0 31		.17 m	.17ms	Sarial		
lectrome	chanic	al					<u> </u>	4				
	count	ers	Exte	rnal		0	-	NOO m	1. Ums	Parall	ф	
I NPU	r/output:	7			Туре			Functio	<u> </u>		Speed	
											per minu	
		Line	pri	nter	(92	cha	ractors	Outpu	150	lines	per minu	te

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 280 kg.

COMPUTING ELEMENT: Gates.

COMPONENTS: 400 tubes, 7000 crystal rectifiers, and 200 relays.

REMARKS: Provision for marginal checking is incorporated. GAMMA 3 is intended to be connected to standard 80-column punched-card machines.

Harvard Mark I (Automatic Sequence Controlled Calculator)

BUILT BY: IBM and Harvard University

INSTALLATIONS: Harvard University, Cambridge, Mass.

(Financial support to development contributed by

IBM and the U. S. Navy.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available through U. S. Air Force (Wright Field).

COMPUTING TIME: Available through U. S. Air Force (Wright Field).

floor area: 240 sq. ft.

Fan; room air FIRST READY FOR USE: 1944

cooling: Fan; room air FIRST READY FOR USE: 1944.

BEST SUITED FOR: Routine computation of tables: bles: general purpose
PROBLEM SOLVING OPERATING SCHEDULE: ENGINEER ING Idle Total Sched. Maint. Eng. Dev. Error-Free Erroneous Repair 8 Hrs/Wk 110 0 128 Percent 0 <u>86</u> 0 100

PERSONNEL: 3 operators, 1 maintenance man, 2 mathematicians, 2 clerk.

NUMBER BASE: 10 (true decimal).

WORD LENGTH: 24 decimal digits (instructions 24 binary digits).

NUMBER RANGE: Variable.

NEGATIVE NO. REP.: Nines complement.

SEQUENCE CONTROL: Paper tape.

OPERATIONS: Add, multiply, divide, shift, choice.

	SPEED:	Trai	nsfer	Add	ition	Multi	plication	Divi	sion	Pun	ch	Print		
ncl. Access	Min.								,		·			
ner. Access	Max.													
Excl. of A	ccess	0.3	sec.	0.3	sec.	7	sec.	60 s	ec.	3 1	sec.	3 sec	3.	
	STORAGE:				Capa	city	No. of CR	т	Access			Drum	iam.	Speed
Ту	pe		Funct	ion		n rds	Magnetic Tracks, o Acoustic Channels	r L	Time	Min.	Mode		igth	of Motion
Counters			Inter	nal	7	2	1	0.3	sedO	-3986	Parall	-1		
Punched (Cards		Exter	nal			1				Paralle			
Punched !	l'ape		Exter	nal	500	0					Paralle			
									_	7		+		
INPUT	/OUTPUT:				Туре			Fund	tion			Speed		
	1	Pun	ched	Card	L S			Inp	at	200	words	/minut		
	Punched Cards				s			Out				minut		
	Typewriter							Out				minut		
	Punched Tape)			Inp						

TAPE SEARCH: Possible in both directions.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .:

computing element: Ten-position, wheels.

components: No tubes, no crystals, many relays.

REMARKS: The 72 storage counters are all additive. Addition and

transfer can occur during multiplication, as the multiplier is an independent unit. The decimal point may be placed anywhere

in word.

Harvard Mark II (Aiken Relay Calculator)

BUILT BY:

Computation Laboratory, Harvard University

INSTALLATIONS:

Naval Proving Ground, Dahlgren, Virginia (Owned by Bureau of Ordnance, U.S. Navy.)

COPIES AVAILABLE: Not available.

PROGRAMMING SERVICE:

To government agencies or contractors if approved. To government agencies or contractors if approved. COMPUTING TIME:

FLOOR AREA:

501 x 601.

POWER CONSUMPTION: 2.5 km.

COOLING:

Rm.air-conditioned FIRST READY FOR USE: September 1948

Ballistic trajectory calculations. BEST SUITED FOR:

PROBLEM SOLVING ENGINEERING OPERATING SCHEDULE: Idle Total Repair Maint. Eng. Dev. Error-Free Erroneous Sched. 102 18 120 Hrs/Wk 100 85 15 Percent

PERSONNEL: 11 operators and maintenance, 5 mathematicians.

NUMBER BASE: 10 (8-4-2-1).

WORD LENGTH: 10 decimal digit, sign bit, and 5 exponent bits (instr.6 octal digits).

NUMBER RANGE: Variable.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Sign plus abs. value sequence control: Paper tape.

OPERATIONS: Arithmetic operations plus searching and punched tape input-

output orders. Division must be programmed.

	NPUT/OUTPUT:			Týpe			Function			Speed	
rehet 1	Lape	HA UG	. mor								
Relay Paper 1	lone	Inte		130	00		33 ms		Parallel Serial		
	Туре	Func	tion	*	lord s	Tracks, or Acoustic Channels	Max.	M[n.	Mode	or CRT Type	Motion
	STORAGE:				pacity	No. of CRT Magnetic	Acce			Drum Diam., Length	Speed of
Excl. o	Max. f Access		500		750		1 1 1 1				
ncl. Acces	ss Min.	67 ms	500		750 750		5 mac.				
	SPEED:	Transfer	Add	ition	Multip	lication	Division				

TAPE SEARCH: Possible in both directions.

ARITHMETIC MODE: Parallel.

CLOCK FREO .:

COMPUTING ELEMENT: Relays.

COMPONENTS: 13.000 relays

REMARKS: Number range from 1.0 to 9.999 999 999 with a multiplier

of 10k, where k ranges from -15 to 15. Adders and

multipliers are separate, and may operate simultaneously. Complete automatic checking is accomplished by duplicate

equipment.

BUILT BY: Computation Laboratory, Harvard University

INSTALLATIONS: Naval Proving Ground, Dahlgren, Virginia

(Owned by Bureau of Ordnance, U. S. Navy.)

COPIES AVAILABLE: Not available.

PROGRAMMING SERVICE: Available to government agencies and contractors.

COMPUTING TIME: Available to government agencies and contractors.

FLOOR AREA: 401 x 401. POWER CONSUMPTION: 40 km.

FIRST READY FOR USE: 1 January 1951.

COOLING: Portable fans. FIRST READY FOR USE: 1 January room air conditioned. Problems requiring large internal storage. OPERAT

TINO	SCHEDULE	ENGINE	ERING	j i	ROBLEM SOLVING	G		1	7
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total	
	Hrs/Wk	8	8	94	18	8		136	1
	Percent	6	6	69	13	6		100	7

PERSONNEL: 17 operators and maintenance men, 6 mathematicians, 5 clerical.

10 (2*, 4, 2, 1 representation). NUMBER BASE:

16 decimal digits and sign (instructions are 16 hexadecimal digits). WORD LENGTH:

Variable dec. point. INSTRUCTION TYPE: Three-address. NUMBER RANGE:

NEGATIVE NO. REP.: Sign & abs. value. SEQUENCE CONTROL: Special store, but some alteration of

Arithmetic operations, sequenc-OPERATIONS: instructions is possible.

ing. input-output. Division is

accomplished by computing a reciprocal.

	Magn		,ue 010	, taj	<i></i>			III-OUE	3	words/s	Speed ds/sec.		
INPUT	INPUT/OUTPUT:		Type lagnetic Tape				Function In-Out		words/s				
Magnetic			Inte		400		1600	5 ms				7000	r
Magnetic	Draim		Inte	rnol	20	10	80	4.5 ms		Care Down	8"dia.	7000	
T	/pe		Funct	ion		n rds	Magnetic Tracks, or Acoustic Channels	Tim.		Mode	Length or CRT Type	of Moti	F
	STORAGE:	/ 0	113	0.0		10	MS No. of CRT	Acce	ss		Drum Diam.	Spe	ed
Excl. of A	Max.		ns ns	0.8	ms	13	ms	100 ms	3				
Incl. Access	Min.		ns	5	ms	13	ms	100 m					
	SPEED:	Trai	nsfer	Add i	tion	Multip	lication	Division					

ARITHMETIC MODE:

Serio-Parallel

CLOCK FREO .: 28 kc.

COMPUTING ELEMENT:

Flip-flop

COMPONENTS:

5000 tubes, 1300 crystal diodes, 1500 relays.

REMARKS:

Information is recorded in duplicate on the tape.

Harvard Mark IV

(Harvard Magnetic Drum Calculator)

BUILT BY: Computation Laboratory, Harvard University

Mass.

INSTALLATIONS: Harvard University (development supported by USAF), Cambridge,/

Technische Hochschule, Darmstadt, Germany (The Darmstadt machine is being built by the Technische Hochschule.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available through USAF (Wright Field)
COMPUTING TIME: Available through USAF (Wright Field)

FLOOR AREA: 30ft x 10ft

POWER CONSUMPTION: Approx. 25 kw

cooling: Fan; room air-cond.first READY FOR USE: 1952

BEST SUITED FOR: General purpose

PERATIN	G SCHEDULE:	ENGIN	EERING	2 - EVA -	PROBLEM SOLVIN	G	87 4.5 4.1	
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk							
	Percent			80	2	0 '		100

PERSONNEL: Approx. 3 operators, 5 maintenance men, 5 mathematicians, 2 clerical.

NUMBER BASE: 10 (modified 7,4,2,1 representation)

WORD LENGTH: 16 decimal digits and sign (instructions 8 decimal digits)

NUMBER RANGE: Decimal pt. variable instruction type: One-address

NEGATIVE NO. REP.: Abs. value and sign SEQUENCE CONTROL: Special drum store OPERATIONS: Add, multiply, divide, shift, choice, input, output.

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division	, <u> </u>			
Incl. Access	Min.	2	ns	3	ns	10	ms	22 ms				
Inci. Access	Max.	2 :	ms	3	ms	10	me	22 ms				
Excl. of A	ccess			1	ms	8	ms	20 ms				
Ту	STORAGE:		Funct	tion	Capa ii Wor	•	No. of CRT Magnetic Tracks, or Acoustic	TI	ess me	- Mode	Drum Diam., Length or CRT Type	of
							Channe I s	Max.	Min.			<u> </u>
Magnetic	tape		Exte	rnal	12 t	apes	4		20ms	ser-par	5/8"wi	100in/s
Magnetic	drum		Inte	rnal	4000	no	140	27ms	2ms	ser-par	30*	1800rpm
					10000	ins	tr.				1	
Magnetic-	-core		Inte	rnal	230	no	230x4	lms	lms	ser-par		
shiftir	g regi	ste	rs									<u> </u>
INPUT	/OUTPUT:				Туре			Function	n.		Speed	No. of
the state of the state of	44.1	Magnetic tape						In/Out	57	words pe	r second	<u> </u>
		(Ea	ch ta	pe c	an be	use	d at a	ny tim			put. out	
ing the second second		or	prin	ting						led manu		

TAPE SEARCH: Possible in forward direction only.

ARITHMETIC MODE: Serio-parallel

CLOCK FREQ .: 16 kc

COMPUTING ELEMENT: Selenium rectifier networks

COMPONENTS: 4000 tubes, many crystal rectifiers.

REMARKS: The computer can alter addresses and jump instructions only. The adder, multiplier, and divider are separate and operate simultaneously. There is a check against forbidden digits, and there is elaborate checking in printing.

Information is recorded twice on the tapes to assure

accuracy.

INSTALLATIONS:

Atomic Energy Research Establishment, Harwell, England Atomic Energy Research Establishment, Harwell, England

COPIES AVAILABLE:

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA:

COOLING:

POWER CONSUMPTION:

FIRST READY FOR USE: May 1952.

BEST SUITED FOR: OPER

ERATING	SCHEDULE:	ENG IN	ERING	f	ROBLEM SOLVIN	lG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldie	Total
•	Hrs/Wk			92 1		4		
F	Percent							

PERSONNEL:

NUMBER BASE:

WORD LENGTH:

8 decimal digits (instructions 5 decimal digits).

NUMBER RANGE:

-10 to 10.

INSTRUCTION TYPE: Two-address.

NEGATIVE NO. REP .:

SEQUENCE CONTROL: Punched tapes. OPERATIONS:

	SPEED:	Trai	nsfer	Add	ition	Multip	lication	Division				
ncl. Access	Min.			2 8	3eC	10	sec	10 se	C			
nci. Access	Max.			2 5			sec	15 se				
Excl. of A	ccess			l .	SOC							
	STORAGE:					acity	No. of CRT				Drum Diam.,	Speed
ту	pe		Funct	tion		n rds	Magnetic Tracks, or Acoustic		ne	Mode	Length or CRT Type	of Motion
							Channels	Max.	Min.	1		
Dekatron)ekatron		Inter	nal	nal 40							
<u></u>												
,												
			<u> </u>			<u> </u>		ļ		1		-
INPUT	/OUTPUT:	ليسي			Туре			Function		<u> </u>	Speed	
	Į.	7	punch	ed t	ape	read	ers	Input	1 1	nstruci	tion per s	econd

TAPE SEARCH:

ARITHMETIC MODE:

CLOCK FREQ.:

COMPUTING ELEMENT: Relays, double-length Dekatron accumulator.

COMPONENTS:

There is provision for an additional 50 words of Dekatron REMARKS:

storage. The computer is designed for unattended operation; on encountering an error it recommences the computation, goes back a few steps, or starts the next problem.

BUILT BY: Research and Development Laboratories, Hughes Aircraft Co.,

INSTALLATIONS: U. S. Air Force Culver City, Calif.

(Financial support contributed to development by Wright

Air Development Center.)

COPIES AVAILABLE: Not available PROGRAMMING SERVICE: Not available COMPUTING TIME: Not available

FLOOR AREA: Vol. 5 cu.ft.

POWER CONSUMPTION: 1.2 kw

cooling: 6 1b/min First READY FOR USE

FIRST READY FOR USE: February 1952

BEST SUITED FOR: Calculation of real-time control problems.

PERATIN	SCHEDULE:		ENGINEERING PROBLEM SOLVII			IG				
		Sched.	Maint.	Eng.	Dev.	Error-Free	Erroneous	Repair	idle	Total
	Hrs/Wk									
	Percent			,		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				

PERSONNEL: Operation and maintenance handled by same man.

NUMBER BASE: 2

0P

WORD LENGTH: 16 bits (instructions 17 bits)

NUMBER RANGE: -1 to 1

INSTRUCTION TYPE: One address & rel. add. of next order.

NEGATIVE NO. REP.: Abs. value & sign | SEQUENCE CONTROL: General store

OPERATIONS: All arithmetic operations and transfers among memory positions, as well as a few logical choice operations.

			ogue ogue			2003		Input Output	\pm			
· · · · · · · · · · · · · · · · · · ·			oard					Input				
INPU	T/OUTPUT:				Type			Functio	n		Speed	
							 					
							-	 		-	<u> </u>	
lagnetic	Drum		Inte	mal	25	00	39	7 ms	6 p	Seria:	1 44 410.	8000 m
							Channels	Max.	Min.			
. Т	уре		Funct	lon		n rds	Magnetic Tracks, or Acoustic			Mode	or CRT Type	
	STORAGE:		7			city	No. of CRT	Acc Ti		a to the	Drum Diam., Length	Speed
Excl. of	Access	120	Als	120	ALS	1.	9 mg	1.9				
nci. Access	Max.		ma		ms		3 mg	4.3 9				
	Min.	240	21.8	600	Als	2.	5 ms	2.5				
	SPEED:	Trans					lication	Division				·

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 160 kg.

COMPUTING ELEMENT: Binary adder.

COMPONENTS: 350 tubes. 2500 crystal rectifiers.

REMARKS:

BUILT BY: International Business Machines Corporation

INSTALLATIONS: Several thousand in use.

COPIES AVAILABLE: For rent.

PROGRAMMING SERVICE: Available at IBM service bureaus. COMPUTING TIME: Available at IBM service bureaus.

POWER CONSUMPTION: 700 watts.

FLOOR AREA:

56* x 28*.

None required.

BEST SUITED FOR:

e required. First READY FOR USE: 1948.
etitive calculations each of which is a short sequence, with ited variations of that sequence.
ENGINEERING PROBLEM SOLVING

OPERATING SCHEDULE: Hrs/Wk

ldle Total Sched. Maint. Eng. Dev. Error-Free Erroneous Repair Varies according to installation. Percent

PERSONNEL: Varies according to installation; complete maintenance furnished

by IBM.

NUMBER BASE: 10 (true decimal).

word LENGTH: Variable-generally 6 to 12 decimal digits.

NUMBER RANGE: Variable decimal pt. Instruction type: Composed of sub-instructions.

NEGATIVE NO. REP.: Tens' complement. SEQUENCE CONTROL: Prewired on plugboard.

OPERATIONS: Addition, subtraction, multiplication, division, comparison,

negative test.

	SPEED:		nsfer rcle		ition 701e		olication o 2 per	Division		aad wan	ies from	1.
	XIOXX	- 0			, 020	mu.l	tiplier	OF I to	7 cy	cles per	r card at	t 50
Excl. of A	ccess				-	dig	16 (100 lent	ca	rds/min.	<u>downway</u>	rd)
T	STORAGE:		Funct	tion	i	city n rds	No. of CRT Magnetic Tracks, or Acoustic	Tim	ss	Mode	Drum Diam., Length or CRT Type	Speed of Motion
			ļ				Channels	Max.	Min.			
lectrome	chanic	al	Inter	nal	102-	134						
					deci	mal						
					digi	ts						
												
I NPU	T/OUTPUT:				Туре		<u> </u>	Function		<u> </u>	Speed	
		Car		der				Input	Var	iable		
		Car	d Pur	<u>ich</u>				Output	Var	iable		
									 		· · · · · · · · · · · · · · · · · · ·	
	F 654064.	L						L			<u> </u>	

TAPE, SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ.:

COMPUTING ELEMENT: Counter wheels or gear clutches controlled by relays.

COMPONENTS: Several hundred relays.

REMARKS: The storage units are basically 12 decimal digits for read-in. They may be split for 6-digit read-cut. The multiplier-divisor register is 8 decimal digits long. The IBM 602A can perform parallel transfers, parallel additions and subtractions, and parallel multiplications with a common multiplier.

BUILT BY: International Business Machines Corporation

installations: Over 1500 in use

COPIES AVAILABLE: For rent

PROGRAMMING SERVICE: Available at IBM service bureaus computing time: Available at IBM service bureaus

FLOOR AREA: 604:53x33",521:40x26" POWER CONSUMPTION: 6.9 kva

cooling: 19000 btu/hr FIRST READY FOR USE: 1948

variations [limited]

BEST SUITED FOR: Repetitive calculations, each of which is a short sequence with

OPERATIN	G SCHEDULE:	ENGINE	ERING	•	ROBLEM SOLVIN	IG	44.5	
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	·: 'Idle .	Total
	Hrs/Wk	Varies	according	to insta	llation			
	Percent	·						

PERSONNEL: Varies according to installation; complete maintenance furnished by IBM

NUMBER BASE: 10 (binary coded internally)

WORD LENGTH: Variable

NUMBER RANGE: Variable

INSTRUCTION TYPE: Composed of sub-instructions

NEGATIVE NO. REP.: Tens' complement/signsequence control: Prewired on plugboard

OPERATIONS: Addition, subtraction, multiplication, division, zero test,

positive or negative test, repetition, shift.

				_				,			· ·	
	SPEED:	Tran	sfer	Add	tion	Multip	lication	Division	·		Table 1	
	Min.	480	<i>1</i> 1.9	480) 116	2.	4 mg	4.8 mg	4	3	in the fact of the second	
incl. Access	Max.	480			/118	24	ma	6.4 mg		, Pa		.
Excl. of A	ccess		I		7				7 7 7 7	and a state of	Andrews and and an artist and artist	
т	STORAGE:		Func	t I on	1	acity in ords	No. of CRT Magnetic Tracks, or Acoustic	Tim		Mode	Drum Dlam., Length or CRT Type	Speed of Motion
							Channels	Max.	Min.			
acuum-tu	be reg	ist	Inte	rna	50	deci						
	e					digi					. De Part Car	
					11.5			17.7		A	e ja karana	
		-		*						4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	40.0		ar ing i			4 4 5 5		ver all				
INPU	r/OUTPUT:				Type			Function			Speed	
		Car	d rea	ader				Input	100	carda/	mimite	
		Car	d pu	ach				Outon	t 100	cards/	minute	<u> </u>
	-											
								.	, h			

TAPE SEARCH:

ARITHMETIC MODE: Parallel

CLOCK FREO .: 50 kc

COMPUTING ELEMENT: Flip-flop

components: 1400 tubes, 125 relays

REMARKS: The 50-digit total register capacity may be broken up in various ways to accommodate different number lengths. The decimal point is variable in position. Instructions are effectively of the two-address type. A product-overflow test, a balance test, and a double-punch blank-column

test are incorporated in the computer.

BUILT BY:

International Business Machines Corporation

INSTALLATIONS:

COPIES AVAILABLE:

For rent.

PROGRAMMING SERVICE:

Available at IBM service bureaus. Available at IBM service bureaus.

COMPUTING TIME: FLOOR AREA:

COOLING:

942 are 53x33 hower consumption: 18 40x25 FIRST READY FOR USE: April 1953.

BEST	SUITED FOR:	Prob	Lems	requir	ing moder	ate store	age and	computation	•
OPERATIN	G SCHEDULE:	ENG	INEERI	NG		PROBLEM SOLVI	NG		
, *		Sched. Mai	it. Er	ıg. Dev.	Error-Free	Erroneous	Repair	idle	Total
	Hrs/Wk	Va	cies	accord	ing to in	stallation	n.		
1	Percent		T	• 3	7.79				

PERSONNEL:

Varies according to installation; complete maintenance

furnished by IBM.

NUMBER BASE:

10 (binary coded internally).

WORD LENGTH:

Variable.

NUMBER RANGE:

Variable. INSTRUCTION TYPE: Composed of sub-instructions.

NEGATIVE NO. REP .: OPERATIONS:

Ten's complement sequence control: Prewired on plugboard. Addition; subtraction, multiplication, division, zero test,

balance test, suppression, skip, repeat.

			Division	T @	00-4	
SPEED:		ition Multiplication		Suppress		
ncl. Access Min.	520 µs 52	0 μs 2.4 ms	4.7 ms	80 µs	80 µs	
Max.	520 Us 52	0 us 23. ms	25.4 ms	80 /us	80 us	
Excl. of Access		/				
STORAGE:		Capacity No. of CR	T Acces		Drum Diam.	Speed
		in Magnetic		1	Length	of
Туре	Function	Words Tracks, o		Mode	or CRT Type	Motion
		Channels		Min.		
Vacuum-tube	Internal	162				
registers	wat di je	decimal				
		digits				1
		v i		· l		
INPUT/OUTPUT:	14.53.7	Туре	Function		Speed	
. [0	ard reader		Input	100 car	ds/min	
	ard punch		Output		ds/min	
						• •

TAPE SEARCH:

ARITHMETIC MODE:

Parallel.

CLOCK FREQ.: 50 kg.

COMPUTING ELEMENT:

Flip-flop.

COMPONENTS:

2000 tubes, 150 relays.

REMARKS:

The word length and decimal-point position are arbitrary within the limits imposed by the register capacity. Effectively instructions are of the two-address type. A double-punch blank-column check, a balance test, and a product-overflow check are incorporated in the computer.

BUILT BY: International Business Machines Corp. Installations: International Business Machines Corp.

COPIES AVAILABLE: Will be available for rent with 1000- or 2000-word memory.

PROGRAMMING SERVICE: Will be available. COMPUTING TIME: Will be available.

POWER CONSUMPTION: 16 kva. FLOOR AREA: See Remarks.

cooling: Internal fans. FIRST READY FOR USE: July 1954.

BEST SHITTED FOR: Scientific & commercial computing, utility, billing; genral-purpose.

OPERATING SCHEDULE		EERING	1	PROBLEM SOLVII	NG .		_
OPERATING SCHEDOLL	Sched. Maint.	T	Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk			<u></u>				
Percent			<u> </u>				

PERSONNEL: Maintenance by manufacturer.

NUMBER BASE: 10 (biquinary representation; 0 or 5 plus 0,1,2,3, or 4).

WORD LENGTH: 10 decimal digits and sign.

NUMBER RANGE: Dec.pt. arbitrary. INSTRUCTION TYPE: Two-address. NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, input, cutput, branching,

table look-up, shift right or left, alter instruction address,

normalize.

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division				
	Min.											
nci. Access	KKX	Aver	age:	5.2	ma	11.	6 ms	14.5 m	Ц			
Excl. of	Access											
2.11	STORAGE:					city	No. of CRT	Acce			Drum Diam.	Speed
*	ype		Func	tion		in ords	Magnetic Tracks, or Acoustic	Tim	•	Mode	or CRT Type	
					1		Channels	Max.	Min.	· .	<u> </u>	
Magnetic	Dense		Inter	ກອໃ	1000	07	20 or	4.8 ms		Serio-Re	at 50 word	12500m
MORTION	, Drum		222 002	*****	20		40					
	<u> </u>		†									
			T						* 1			
IND	UT/OUTPUT				Туре			Function			Speed	
			rd Re	ade				Input	20	0 cards		
A SAN TO SAN			rd P					Output	10	0 cards	per min	ute
					rd ca	n ca	rry 10	words.				
		-										

TAPE SEARCH:

ARITHMETIC MODE: Serioparallel.

CLOCK FREQ.: 125 kg.

COMPUTING ELEMENT:

COMPONENTS:

REMARKS: On the drum, the 2-out-of-5 (0,1,2,3,6) representation is used. The left and right halves of the double-length accumulator have (separate) addresses. The calculator consists of three units, the 650, the 652, and the 533. Their floor areas are, respectively, 313 x 78 3/4". 293 x 44". and 25" x 53".

IBM CPC (Card-Programmed Electronic Calculator)

BUILT BY: International Business Machines Corporation installations: Over 150 in use.

COPIES AVAILABLE: For rent.

PROGRAMMING SERVICE: Available at IBM service bureaus. COMPUTING TIME: Available at IBM service bureaus.

FLOOR AREA: 45 8Q. ft.

POWER CONSUMPTION: 10.2 kva.

cooling: 25000 btu/hr.

FIRST READY FOR USE: 1949.

BEST SHITED FOR: Lengthy segmential operations.

OLU I	501125 1011	- Tome am	BOGROMFI	T OPOTOU.				
OPERAT IN	G SCHEDULE:	ENGINE	ERING	ſ	ROBLEM SOLVIN	IG .		_
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk	Varies a	ccording	to instal	lation			
	Percent		,				<u> </u>	<u> </u>

PERSONNEL: Varies according to installation; complete maintenance furnished

by IBM.

NUMBER BASE: 10 (binary coded internally).

WORD LENGTH: 10 decimal digits and sign.

NUMBER RANGE: Variable dec. pt. INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP .: Ten's complement /signequence control: Program cards and plugboard. OPERATIONS: Addition, subtraction, multiplication, division, repetition,

zero test, suppression, shift, wired subroutines for power-

series expansions of basic transcendental functions.

									,			
	SPEED:	Transfer	Add	ition	Multip	lication	Divisio	n				
	Min.	480 us	480	us	2.	4 mg	4.8	ms				
Incl. Access	Max.	480 /18	480		24	ms	26.4	ms				
Excl. of A	ccess	/	<u> </u>	/								
	STORAGE:	Fun	ction	<u> </u>	oacity in ords	No. of CRI Magnetic Tracks, o	T	ess ime		Mode	Drum Diam. Length or CRT Type	of
	/pe		JETON			Acoustic Channels		М	in.			
Vacuum-tu	.be	Inte	rnal	290	deci	_	<u> </u>					
register	ß			mal	digi	ts		4		<u> </u>		
Relays		Inte	rnal	16	words	in ea	ch of	110	to	three	941's.	
INPU"	T/OUTPUT:			Type			Functi	on .		<u> </u>	Speed	
		Card	eade	r			Input		Ūρ	to 150	cards/m	innte
		Print	er		1 11		Outp	t l	150	lines	/min_mw	meric
		Print	er				Outp	<u> </u>	100	lines	/min_al	phameric
							<u> </u>			<u> </u>		

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: 50 kc.

COMPUTING ELEMENT: Flip-flops.

COMPONENTS: 1400 tubes, 10 crystal rectifiers, 2000 relays.

REMARKS: Some simultaneous execution of different operations is possible by appropriate wiring. Bouble-punch blankcolumn check and product-overflow check are built into

this computer.

ILLIAC

(Illinois Automatic Computer)

BUILT BY: University of Illinois INSTALLATIONS: University of Illinois

(Financial support to development of ILLIAC contributed directly or indirectly by U. S. Army Ordnance Corps, Office of Naval

Research, Atomic Energy Commission, U. S. Air Force.)

COPIES AVAILABLE: NO. PROGRAMMING SERVICE: NO.

COMPUTING TIME: Available within the University of Illinois.

POWER CONSUMPTION: 35 km.

FLOOR AREA: 25 sq. ft. POWER CONSUMPTION: 35 kw. COOLING: 3000 cu.ft. min. FIRST READY FOR USE: 1 September 1952.

BEST SUITED FOR: Computation not involving large input or output.

OPERATING	SCHEDULE:	ENGIN	EERING	4,4	ROBLEM SOLVIN	G		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Γ	Hrs/Wk	122	10	· 5 0		72		80
Ε	Percent	151	122	62 ½		95		100

PERSONNEL: 1 operator, 1 maintenance man on call, 3 mathematicians.

2 (16 externally). NUMBER BASE:

word LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1-2-39.

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP.: Twos complement. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, absolute value, logical

multiply, shift, sign-conditional transfer.

			e Pun					<u>Output</u> Output	6.3	charac			
			toele		.c Ta	pe R		Input	240	charac			
I NPU	T/OUTPUT:				Туре			Function			Speed		
	• .	******							Re	ad-arc	und r	atio	25
(WILLI	ams tu	be)						pr.					7
Electros	tatic		Inter	nal	102	4	40	36 ALS	18 AL	Parelle	13KP1		
* ; * * * * * * * * * * * * * * * * * *							Channels	Max.	Min.	1			
Ty	ype		Funct	ion	Wor	rds	Tracks, or Acoustic			Mode	or CRT	Туре	Motion
	STORAGE:		ŀ			city n	No. of CRT Magnetic	Acce Tim			Drum C Len	lam., igth	Speed of
Excl. of A	ccess			50	/118	71	4 MS ER	754 p	8	16 /118			
	Max.				2 /us		2 ms					-	
ncl. Access	Min.				2 Ms		2 µs	772 p	8				
	SPEED:	Tra	nsfer	Add	tion		lication	Division		Ct			

TAPE SEARCH:

ARITHMETIC MODE: Parallel. CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT: Mccles-Jordan flip-flop and or not.

COMPONENTS: 2774 tubes, no crystals, I relay.

REMARKS: The logical design of this computer is modeled after the IAS computer. ORDVAC is a very similar computer also

built by University of Illinois.

BUILT BY: Institute for Advanced Study, Princeton, New Jersey

INSTALLATIONS:

Institute for Advanced Study. For other similar computers, see AVIDAC, ILLIAC, JOHNNIAC, MANIAC, ORACLE, ORDVAC, and TC-1.

(Financial support to development contributed by Office of

Naval Research, Atomic Energy Commission, U. S. Air Force, and the

U. S. Army Ordnance Corps.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 100 sq.ft.

POWER CONSUMPTION: 15 km.

cooling: 2000 cu.ft. min. FIRST READY FOR USE: 1 January 1952.

BEST SHITED FOR: General purpose.

DEG.	001120 . 0.51		F F						1
OPERATIN	G SCHEDULE:	ENG IN	ERING		PROBLEM SOLVI	NG	1		Į
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total	
	Hrs/Wk	10.0	19.8	32.2	2.8	15.2	0	80.0	1
	Percent	12.5	24.7	40.3	3.5	19.0	0	100.0	J

PERSONNEL: 3 operators, 2 maintenance men.

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1-2-39. NEGATIVE NO. REP.: Twos complement

INSTRUCTION TYPE: One-address. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, shift right or left by

arbitrary number n, unconditional and conditional transfers of

control.

SPEED:		nsfer	Addi	tion	Multip	lication	Divis	ion	Shif	t		
Min.		μs	62	Ms	435	Ms	1100	μs	42	n.s		
Max.					990	us	1100	us	410	as		·
cess		,	25	us	400-	955 NS	1065	us	410	/us		
TORAGE:	·	Funct	tion	·	in	Magnetic Tracks, o	-			Mode	Drum Diam., Length or CRT Type	Speed of Motion
									Min.	l		
atic.		Inte	rnal	102	4	40	25 A	18	25 µs	Perellel	5CP1A	
s tube	77											
drum (bei	ag du	ilt)				1					
										<u> </u>		
						<u> </u>	<u> </u>				1	
OUTPUT:				Туре			Funct	ion			Speed	
	Pune	ched	Card	Rea	der		Inp	ıt	1024	words	in 48 sec	2.
	Car	d Pun	ch				Out	out				
				 			 		 			
	cess TORAGE: e atic	cess ctorage: ce ctic cs tube) courput: Punc	cess TORAGE: e Func. atic Intestube) Drum (being bu	cess 25 TORAGE: Function Atic Internal Stube) Drum (being built)	cess 25 Jus TORAGE: Cap Function Wo Atic Internal 102 Stube) Crum (being built) COUTPUT: Type Punched Card Rea	Cess 25 Als 400- Capacity in Words Atic Internal 1024 Stube) Orum (being built) COUTPUT: Type Punched Card Reader	TORAGE: TORAGE: TORAGE: Tele Function Function Capacity in Magnetic Tracks, o Acoustic Channels Actic Internal 1024 Course (being built) Course Type Punched Card Reader	Cess 25 us 400-955 us 1065 Capacity in Magnetic Tracks, or Acoustic Channels Attic Internal 1024 40 25 ps Drum (being built) Type Function Cess 25 / us 400-955 / us 1065 / us	Cess 25 /us 400-955 /us 1065 /us 410 Capacity in Magnetic Tracks, or Acoustic Channels Max. Min. Atic Internal 1024 40 25 /us	Capacity in Magnetic Tracks, or Accustic Channels Max. Min. Atic Internal 1024 40 25 µs 25 µs Perellel Orum (being built) Type Function Cess 25 / us 400-955 / us 1065 / us 410 / us TORAGE: Function Function Words Tracks, or Acoustic Channels Max. Min. Atic Internal 1024 40 25 / us 25 / us Parallel 5CP1A Torum (being built) Type Function Speed Punched Card Reader Input 1024 words in 48 see		

TAPE SEARCH: No tape.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT: 6J6 Toggle.

COMPONENTS: 2300 tubes, no crystals, no relays.

BUILT BY: Bell Telephone Mfg. Co., Antwerp, Belgium.

INSTALLATIONS: The Institut pour l'encouragement de la Recherche

Scientifique dans l'Industrie et l'Agriculture and the

Fonds Nationale de la Recherche Scientifique have

supported the development of this computer.

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

COOLING: Air-conditioned/ FIRST READY FOR USF: 106h FLOOR AREA: 25' x 25'

REST SHITED FOR: General Durbose.

DEST SOTTED TONE							
OPERATING SCHEDULE:	ENG	NEERING		PROBLEM SOLVI	NG		
	Sched. Main	t. Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
Hrs/Wk							
Percent	[*	

PERSONNEL:

NUMBER BASE:

10 (four-binary-digit code).

WORD LENGTH:

17 decimal digits and sign (instructions 9 decimal digits). ±10-50 to ±10-50. INSTRUCTION TYPE: One-address.

NUMBER RANGE:

NEGATIVE NO. REP.: Absolute value & simequence control: Hagnetic drum.

OPERATIONS:

	SPEED:	Transfer	Add	ition	Multip	lication	Division				
	Min.		3	ms	3	ms	Program	med:			
nci. Access	Max.		3	me	14	ms	140 mg				
Excl. of A	ccess										
Ŧ	STORAGE:	Funct	: i on		acity in irds	No. of CRI Magnetic Tracks, o Acoustic	The		Mode	Drum Diam., Length or CRT Type	Speed of Motion
						Channe Is	Max.	Min.			
Magnetic	drum	Interr	al	2000	nos.	200	14 ms	0	Serial	12"dia.	4000r1
			1	4000	inst	-				20" long	
6 Magnet	ic tap	es Extern	al	ļ	The	se tap	era se	circu	ar.	150 ft.	Forma
			, .	+					\$ 1 1 11		
INPU	T/OUTPUT:		-	Туре			Function		na a manigar kali mili S	Speed	
		Magnetic	: ta	pe			In&Out	1.0	ster pe	r second	. 10 kg
. 41				1 4							
						· · · · · ·	ļ				

Possible in the forward direction. TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 100 kg.

COMPUTING ELEMENT: Rectifier matrices.

diodes.

COMPONENTS: About 2000 tubes, 1000 selenium rectifiers, and 1500 germanium/ REMARKS: Input and output are on two tape tracks, which are checked against each other and against the drum on each transfer. The drum is asynchronous, and relay track selection is used. The decimal point can be either fixed (variable) or floating. In the former case, numbers are 17 decimal digits long; in the latter case 2 digits are given over to the exponent.

JAINCOMP-A (Jacobs Instrument Co. Computer)

The Jacobs Instrument Co. Bethesda, Md.

INSTALLATIONS:

The Jacobs Instrument Co.

(Bureau of Ordnance, U. S. Navy, has supported the

development of this computer.)

COPIES AVAILABLE: Not available.

PROGRAMMING SERVICE: Not available.

computing time: Not available.

FLOOR AREA: 1.2 sq. ft.

POWER CONSUMPTION:

450 w.

cooling: 130 cfm.

FIRST READY FOR USE:

Spring 1950.

BEST SUITED FOR: Built to test principles.

OPERAT IN	G SCHEDULE:	ENG I NE	ERING	F	ROBLEM SOLVII	NG .		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk							
	Percent							

PERSONNEL:

NUMBER BASE:

word LENGTH: 5 binary digits.

NUMBER RANGE: -15 to

15.

INSTRUCTION TYPE: Two-address.

NEGATIVE NO. REP .: Sign & abs. value. Sequence control: Several sequences built in.

OPERATIONS: Addition, subtraction, multiplication, sine.

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division	9	in		
ncl. Access	Min.	1	LS	6	u. 8	50	11.5			50 /Ls		
	Max.	1/2	Ls	15/	us.	50	us l		7	50/LE		
Excl. of A	ccess	. /		3-12	La	47	us	,	2	50 Us		
	STORAGE:		Funct	tion	<u> </u>	acity n rds	No. of CRT Magnetic Tracks, or Acoustic	Tir	ss	Mode	Drum Diam., Length or CRT Type	Speed of Motion
							Channe Is	Max.	Min.			
Vacuum tr	1be		Inter	nal		3	İ	1 45	1 48	Paralle	ai I	
regi	lst ers								/			
· · · · · · · · · · · · · · · · · · ·												
INPUT	T/OUTPUT:				Туре			Function			Speed	
	1	Tog	gle s	witc	hes			Input	Ac	cess tim	el s	
Α.		Pun	ched	card				Input		cess tim		
		Ana	log i	nstr	umen	ts		Input				
	1	MAA	n ind	400+	^**			Output				-

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ.: Asynchronous.

computing element: Flip-flop.

COMPONENTS: 103 tubes, 350 crystal rectifiers.

REMARKS: This computer was built to test the feasibility of a

compact, real-time computer operating in the parallel

mode. Several programs are built in.

JAINCOMP-B1 (Jacobs Instrument Co. Computer)

BUILT BY: The Jacobs Instrument Co., Bethesda, Maryland.

INSTALLATIONS: The Jacobs Instrument Co.

(The U.S. Navy Bureau of Ordnance supported the development

of the computer.)

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE: Not available. COMPUTING TIME: Not available.

FLOOR AREA: 4.75 sq. ft.

POWER CONSUMPTION: 2.75 kva.

cooling: 780 cfm.

FIRST READY FOR USE: Spring 1951. · BEST SUITED FOR: Real-time computation with fixed program and little input.

OPERATING SCHEDULE: ENG INEER ING PROBLEM SOLVING Sched. Maint. Eng. Dev. Idle Total Error-Free Erroneous Repair Hrs/Wk Percent

PERSONNEL:

NUMBER BASE: 2.

WORD LENGTH: 24 binary digits (instructions 16 binary digits).

NUMBER RANGE: -32 to 32.

INSTRUCTION TYPE: Two- or three-address.

MEGATIVE NO. REP.: Magnitude and sign. SEQUENCE CONTROL: One electronically scanned OPERATIONS: Addition, subtraction, multiplipunched card.

cation, division, sine, inverse sine,

squaring, cubing, reverse division, reverse subtraction.

	SPEED:	Trai	nsfer	Add	ition	Multi	plication	Divisio	on		Sin	Arcsin	
ncl. Access	Min.		u.s	ىد	8 4	75	10 La	1.6 =	18.	1	ma	80 mg	
	Max.	13	jue !	2	4 110	75	io La	24			me	80 mg	****
Excl. of A	ccess	Max	·'		B WE	73	10 Us	2.38			De .	80 mg	
71	STORAGE:		Funct	l on		city n rds	No. of CRT Magnetic Tracks, or Acoustic Channels	Acc	cess Time	(In.	Mode	DrumDiam., 'Length or CRT Type	Speed of Motion
Static m	ameti	e l					1		┿				
	Gore		Inte	rna	3		†	14 14	1	. 11.6	Paral	10	
Program	Memor	y	Inte	ma	3			1 4		_	Paral		
	-							/				•	
INPUT	/OUTPUT:				Туре			Functio	on			Speed	
•	•						witches h card					me l micro	
	ı		n ind			JUA G		Inmi Outou	_	ASCE	as ti	me l micro	second

TAPE SEARCH;

ARITHMETIC MODE: Parallel.

CLOCK FREQ.: Asynchronous.

COMPUTING ELEMENT: Flip-flops.

components: 409 tubes, 4032 crystal rectifiers.

REMARKS:

JAINCOMP-C (Jacobs Instrument Co. Computer)

BUILT BY: The Jacobs Instrument Co.. Bethesda, Maryland.

installations: The Jacobs Instrument Co.

(The U.S.Navy Bureau of Ordnance supported the development

of this computer.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not available. COMPUTING TIME: Not available.

FLOOR AREA: 4.2 sq. ft.

POWER CONSUMPTION: 4 kw.

COOLING: 1200 cfm.

FIRST READY FOR USE: Summer 1953.

BEST SUITED FOR: Real-time or general-purpose computing.

OPERATING SCHEDULE: ENGINEER ING PROBLEM SOLVING Idle Total Sched. Maint. Error-Free Eng. Dev. Erroneous Repair Hrs/Wk Percent

PERSONNEL:

NUMBER BASE: 2 (2 and 8 externally).

WORD LENGTH: 24 binary digits.

NUMBER RANGE: -16 to 16.

INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP .: Magnitude and sign. SEQUENCE CONTROL: Electronically scanned punched OPERATIONS: Addition, subtraction, multiplication, division, sine,

cos arcsin, squaring, reverse subtraction.

		5				•									
	SPEED:	Tran	sfer	Add	ition	Multi	lication	D	ivisio	n		Sin	Cc	s sini	
Incl. Access	Min.	17	Иs	18	/LB	0.2	5 ms	0	.90	ms	3	ms		2.5 ms	
	Max.	13 §	'u s	24	LB	0.6	5 ms		-	ms	5	ms	-	1.2 ms	
Excl. of A	ccess		Max:	8	UB	0.6	3 ms	1	.61	ms	5	ms	L	1.2 ms	
Table of Season Annual	STORAGE:				Cap	acity	No. of CR	T	Acc	ess				Drum Diam.,	Speed
Ту	/pe		Funct	ion		in ords	Magnetic Tracks, o Acoustic Channels		Max.	ime	lin.	Mode		Length or CRT Type	of Motion
Static ma	gnetic												•		
TV	CO	res	Inter	nal	2	24		4	48	4	/LS	Para]	10	1	
Input sto	rage		Inter	nal		9		4			us	Paral	110	1	
Program m	emory		Inter	nal		4		1	ILS		us	Para]	Lle	1	
								T	7	T	7				
INPUT	/OUTPUT:				Туре			F	unctio	on				Speed	
		Var	ious	ins	trume	nts	_	I	n& 0	ut]	npu	t cyc]	Le	0.1 s.,	out. 15 8
	Toggle swi			wite	ches			-	nput					l micro	
				car	1 (66	nun	bers)		nput		cce	ss tin	ne	1 micro	second.
	Punched car Punched car			car	1 (12	28 in	strs.)		nput		cce	es tin	18	l micro	second.

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT: Flip-flop.

COMPONENTS: 801 tubes and a large number of crystal rectifiers.

REMARKS:

JOHNN IAC (After John von Neumann)

BUILT BY: RAND Corp., Santa Monica, California

INSTALLATIONS: RAND

(Owned by U. S. Air Force.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not at present (February 1953).

computing time: Not at present (February 1953).

FLOOR AREA: 600 sq. ft.

POWER CONSUMPTION:

30 kw.

COOLING: 10,000 cu.ft. min. FIRST READY FOR USE: January 1954.

,	SUITED FOR: G SCHEDULE:	ENGINE	 	ROBLEM SOLVIN			<u>-</u>
O' ENAT IN		Sched. Maint.	Error-Free	Erroneous	Repair	1dle	Total
	Hrs/Wk		3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
	Percent					<u> </u>	<u> </u>

PERSONNEL: 1 operator, 1 maintenance man, 5 mathematicians, 1 clerk.

NUMBER BASE: 2

WORD LENGTH: 40 binary digits (instructions 19 binary digits).

NUMBER RANGE: -1 to 1-2-39.

INSTRUCTION TYPE: One-sidress.

NEGATIVE NO. REP.: Twos' complement

SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, absolute magnitude, selective

substitution, logical product, transfer control, hoot, display

on console.

	SPEED:	Tran	sfer	Addi	tion	Multip	lication	Divis	ion						
	Min.	25	/LE	55	/LS	42	Mas .	835							
ncl. Access	Max.		/118	55	/48		5 ms	835			1 ""				
Excl. of A	ccess		,	30	/ILB	400	810/24	810	p	8			1		
	STORAGE:		Func	t i on		acity in ords	No. of CRT Magnetic Tracks, or Acoustic		Asce Tin	ne -		Mode	1 1	m Diam., Length CRT Type	Speed of Motion
		j					Channe is	Max			in.				
Electros	tatic		Inter	nal	25	6	40	25	/L8	25	128	Parall			
(Select	ron tul	(B)				K + 42									
									25						
Magnetic	Drum		Exter	mal	204	8	40	25	ms	5	ms	Parell	1 1	7 -	1200rp
INDI	T/OUTPUT:		Copy of the Copy		Туре	y y		Func	t l or	<u>L</u>		L	Spe	ed	
	-	IB	M 077	7 Col	lato	r		In	out		96	words	/sec	•	
		B		Pur				Ou			20	words	BOC		
	and the second								, , , , ,	士	1.				

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT: 6J6 flip-flop.

COMPONENTS: About 3000 tubes, no crystals, about 200 relays.

REMARKS: This machine is a modified IAS type computer with selectron

and magnetic-drum memory.

(Lyons Electronic Office)

BUILT BY: J. Lyons & Co., Ltd., London INSTALLATIONS: J. Lyons & Co.

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available. COMPUTING TIME: Available.

FLOOR AREA: 800 sq.ft.

POWER CONSUMPTION: 35 km. FIRST READY FOR USE: 1951.

cooling: 3500 cfm.

BEST SUITED FOR: General purpose; routine commercial clerical work,

							F 44.07 TF 8	
OPERATIN	G SCHEDULE:	ENG I NE	ERING	ļ ļ	ROBLEM SOLVIN	IG		
	jar-1981	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk	7	30	15	1.5	8	0	67.5
	Percent	11.4	48.8	24.4	2.4	13.0	0	100%
		_						14000

PERSONNEL: 2 operators, 4 maintenance men, 5 programmers, 5 clerical.

NUMBER BASE: 2 (externally decimal, sterling, etc.)

WORD LENGTH: 34 or 17 binary digits and sign (instructions 17 binary digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, shift, "and."

	9	Add	lition Multi	plication	Division				
Min.		<u> </u>							
Max.	1.5 ms	1	5 ma 6	0 me					
cess									
TORAGE:			Capacity	No. of CRI	Acce			Drumplan	Speed
e	Fu	nction	in Words	Magnetic Tracks, o Acoustic	Tin		Mode	Length or CRT Type	of Motion
	Int	ernal	2048	64	1.2 ms		Seriel		
							NOT ALL		
			words)				<u> </u>	1	
OUTPUT:			Туре		Function			Speed	
					In&Out In&Out				
E	Photoe Telepr	lectr	ic tape r		Input	25 &	200 ro	s/second	
	TORAGE: e	TORAGE: e Full Int DUTPUT: Punched Punched Photoe	TORAGE: e Function Internal DUTPUT: Punched car Punched pap Photoelectr Teleprinter	TORAGE: Function Function Capacity in Words Internal 2048 17-digit words) OUTPUT: Type Punched cards Punched cards Punched paper tape Photoelectric tape r Teleprinter, Tabulat	TORAGE: Function Functio	TORAGE: Function Capacity in Magnetic Tracks, or Accoustic Channels Internal 2048 64 1.2 ms 17-digit words) Funched cards Punched cards Punched paper tape Photoelectric tape readers Toracks, or Accoustic Channels Max. Function Function Incout Incout Theory Teleprinter, Tabulator Output	TORAGE: Function Capacity in Magnetic Tracks, or Accustic Channels Internal 2048 64 1.2 ms 17-digit words) Function Type Function Punched cards Punched paper tape Photoelectric tape readers Time Access Time Max. Min. Function Function Incout Read Incout 7 che Photoelectric tape readers Teleprinter, Tabulator Output 7 che	TORAGE: Function Funched cards Funched paper tape Photoelectric tape readers Time Max. Min. Function Function Function Function In&Out Reads 200 cm In&Out 7 characters Flotoelectric tape readers Function Output 7 characters Flotoelectric tape readers Flotoelectric tape readers Function Function Function Output 7 characters Function TORAGE: Function Capacity in Magnetic Tracks, or Access Trime Function Function Function Capacity in Magnetic Tracks, or Acoustic Channels Max. Min. Internal 2048 64 1.2 ms Serial (17-digit Words) Function Function Speed Punched cards Punched paper tape Fhotoelectric tape readers Teleprinter, Tabulator Output 7 characters per second	

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 500 kc.

COMPUTING ELEMENT:

COMPONENTS: 6000 tubes, 1500 crystal rectifiers, 120 relays.

REMARKS: LEO is patterned after EDSAC I. Marginal checking, using

50-cycle a.c. injected at numerous points, is incorporated

into the computer.

BUILT BY: Engineering Research Associates, Div. of the Remington Rand Corp. INSTALLATIONS: Logistics Research Project of George Washington University, D.G.

(Owned by Office of Naval Research.)

COPIES AVAILABLE: For sale.

OP

PROGRAMMING SERVICE: Sometimes available.

COMPUTING TIME: Available.

FLOOR AREA: 190 sq. ft.

POWER CONSUMPTION: 43 kw.

cooling: 11 tons cooling air FIRST READY FOR USE: 1 March 1953.

BEST SHITED FOR: Data handling: short simple routines repeated many times.

DE31 3	011120 104.		~~~~~		0 20000000			
PERAT ING	SCHEDULE:	ENGINE	ERING	F	ROBLEM SOLVIN	IG		1
		Sched, Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
ľ	Hrs/Wk	11_6	6-8	16-18	6-8	2-4	0-2	42호
ŀ	Percent	10-15	15-20	40-45	15-20	5-10	0-5	100

PERSONNEL: 1 operator, 2 maintenance men, 3 mathematicians, 1 clerk, 1 in training as mathematician.

NUMBER BASE: 10 (excess-3).

word Length: From 4 to 12 decimal digits. Number range: Up to \pm (10 12 -1). Instruction type: Composed of sub-instructions. NEGATIVE NO. REP.: Nines' complement. SEQUENCE CONTROL: Wired in removable plug board.

OPERATIONS: Transfer, add, subtract, multiply, count, shift, unconditional

and conditional jumps, no division.

	SPEED:	Trans	fer Add	ition Multip	lication	Division	Con	ınt	Steremon	Read iro
	Min.			us-ins 1		.			10 ms	4 ms
Incl. Access	Max.			-20ms 14.2.			96	48	36 ms	30 ms
Excl. of	Access	· •								
Т	STORAGE:		Function	Capacity in Words	No. of CRT Magnetic Tracks, or Acoustic	Acce Tim		Mode	Drum Diam. Length or CRT Type	of
*		1			Channels	Max.	Min.	·		
lagnetic	Drum	I	nternal	175000	200	25ms	4ms	Sera	Par 8 3x14	3600rp
				dec.dig.						
Elec. r	egiste	rs I	nternal	41 dec.		130 us	70µ8	Ser-	er.	
				dig.		1	<u> /</u>	ļ		
1 1 1 1	JT/OUTPUT:			Туре		Function	T .	<u> </u>	Speed	
inru	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		r Tape	Photores	a)	Input	300	digi	s/sec.	
			etic Ta			Input	300	digi	s/sec.	
			r Tape	(Punch)		Output	11	digi	s/sec.	
			etic Ta			Output	300	digi	s/sec.	

TAPE SEARCH: None.

ARITHMETIC MODE: Serio-parallel.

CLOCK FREQ : 220 kc.

COMPUTING ELEMENT: Flip-flop.

COMPONENTS: 3500 tubes, 2000 crystals, 200 relays.

REMARKS: Number length on drum variable between 4 to 12 digits, set by switch. Input and computation are concurrent. Under "Speed," the shorter times include access to the electronic registers, the longer times include access to the drum. Decimal point is variable.

MADD IDA (Magnetic Drum Digital Differential Analyzer)

BUILT BY: Northrop Aircraft Corp., Hawthorne, California.

INSTALLATIONS: Northrop, North American, Utah University,

Applied Physics Laboratory (3), Arnold Engineering, etc.

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not available. COMPUTING TIME: Not available.

FLOOR AREA: 10 sq. ft.

3 kw. POWER CONSUMPTION:

cooling: Internal fan.

FIRST READY FOR USE: July 1951.

provided FOR Solution of differential equations.

DEST	SULLED LOK.	207401011	Or Crart	TOTTO TOTTO	decent outs				
OPERAT IN	G SCHEDULE:	ENGINE	ERING	1	PROBLEM SOLVII	NG .		Total	ļ.
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	Idle	iotai	l
	Hrs/Wk	0	0	20	12	8	0	40	
	Percent	i o	0	50	30	20	0	100	ļ

PERSONNEL: 2 operator, 2 maintenance man, 1 other person.

NUMBER BASE: 2 (8 externally).

WORD LENGTH: 32 binary digits (instructions 64 binary digits).

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE:

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: Special drum store.

OPERATIONS: Add, dym to ym and multiply by dxn.

	SPEED:		sfer	Add i			olication	Division				
ncl. Access	Min.	For	ty -f o	or ir	teg	atio	ons are	proces	sed	in one	drum rev	olution.
nci. Access	Max.					<u> </u>		 				
Excl. of A	Access											<u> </u>
	STORAGE:		5		į,	acity in ords	No. of CRT Magnetic Tracks, or	Tim		Mode	Drum Diam. Length or CRT Typ	of
T	ype		Func	tion	•••		Acoustic	Max.	Min.	-		
Magnetic	Drum		Inte	rnal	20	64	6	16ms		Seria	1 8*	3600rpm
												
							<u></u>		_		Speed	
INPU	T/OUTPUT:			- 75	Type		4 91	Function		3	Speed	
		Ke	yboar	d (2	Key	s, U		Input		low		
		Oc	illos	cope				Dutput		low		
								ł	1			

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 100 kc.

COMPUTING ELEMENT:

COMPONENTS: 150 tubes, 1200 crystals.

REMARKS: Overflow can be used for decision if desired.

BUILT BY: Ferranti Ltd., Moston, Manchester, England

INSTALLATIONS: Manchester University, England (owned by D.S.I.R.)

University of Toronto, Canada (owned by N.R.C., called FERUT)

Ferranti Ltd., London, England Shell, Amsterdam, The Netherlands

British Ministry of Supply (2), for Armament Research Hatab-

lishment, Fort Halstead

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE: Available in England and Toronto.

COMPUTING TIME: Available in England and Toronto.

FLOOR AREA: 2 bays 16x18 & despower consumption: 26 km.

COOLING: 3000 cfm/3-ton a./First Ready For use: July 1951

BEST SUITED FOR: General purpose.

DE01 001120 10111						·	
OPERATING SCHEDULE:	ENG IN	EERING		PROBLEM SOLVIN	G		
M=Manchester		Eng. Dev.	Error-Free	Erroneous	Repair	Idle	Total
	T15 M		M81 T40	M11 T10	T40	T50	M110 T168
		7 T7	M73 T24	M10 T6	T24	T30	100%

PERSONNEL: Manchester: 12 operator-mathematicians, 5 maintenance men, 3 administrative, 3 clerical, 3 in training on maintenance. Toronto: 3 maintenance men, 10 mathematicians, 2 clerical.

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 20 or 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: Fixed binary point. INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Complement. SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, logical operations;

no division. A "B" tube stores eight 20-binary-digit lines

to which relative addresses can be referred.

												
	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Division				
	Min.	1.2	2 mg	1.2	2 ms	3.	36 ms	About				
nci. Access	Max.					i		0.1 50				
Exci. of A	CC#88					2.	16 ms	Progra	nned.			<u></u>
	STORAGE:				Cap	acity	No. of CRT				Drum Diam	
			Func	t ion		in rds	Magnetic Tracks, or	Tim	•	Mode	Length or CRT Typ	of Motion
, 'Y	pe						Acoustic Channels	L	Min.	-		
Electros	****	ADG	Inte	rna 1	2	56	8	240 us		Serial	GEC	
Magnetic		UAT.	Exte	rnal			256	30 ms		Serial	10" d1	2000-
BEG HALLE	_urum_				(40-						x12"	
			1			da)						
						٧.						
INPU	C/OUTPUT:				Type			Function			Speed	
		Pho	otoel	ectr	ic te	De I	eader	Input			per sec	
			pe pu					Output	18	frames	per sec	
a de la companya de l		Te.	lepri	nter			***	Output		charact		
			ralle			•		Output	150	lines/m	in, of	64 chars
	200		433				4 4 4					

TAPE SEARCH: Possible in the forward direction.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 100 kg.

COMPUTING ELEMENT: Tubes.

COMPONENTS: 1800 pentodes, 2000 vacuum diodes.

REMARKS: The cathode-ray store holds all the digits of a word on one line of a single tube.

MAN IAC

(Mathematical Analyzer, Numerical Integrator, and Computer)

BUILT BY: Los Alamos Scientific Laboratory INSTALLATIONS: Los Alamos Scientific Laboratory

COPIES AVAILABLE:

No.

PROGRAMMING SERVICE:

Available in limited quantity to other AEC laboratories and for

COMPUTING TIME:

certain problems of academic interest to staff.

POWER CONSUMPTION: 30 km.

FLOOR AREA: COOLING:

20 sq.ft.

24 kw air-conditioner RST READY FOR USE: 1 March 1952

BEST SUITED FOR:

General purpose.

				<u> </u>				· · · · · · · · · · · · · · · · · · ·
OPERATING	SCHEDULE:	ENGIN	EERING	F	PROBLEM SOLVI	NG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
1	Hrs/Wk				·			2 shifts
Ī	Percent	35 total	engin.	65 total	problem	solving		100

Fin. JONNEL: 10 operators, 1 maintenance man, 4 mathematicians, 1 clerk.

NUMBER BASE: 2 (10 or 16 externally)

WORD LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1-2-39.

INSTRUCTION TYPE: One-address.

NEGATIVE NO: REP.: Twos' complement

SEQUENCE CONTROL: General store. OPERATIONS: Add, subtract, multiply, divide, logical operations,

shift right and left, input, output.

	SPEED:	Tra	nsfer		ition		lication	Divis		1			
Incl. Access	Min.	30	/us	60	ALS.	950	/us	950	A1S				
inci. Access	Max.	30	/us	60	MB	950	us	950	NS.	<u> </u>			
Excl. of A	ccess			45	/D.S	935	Als	935	ns				
ту	STORAGE: ype		Func	tion	· 'i	acity in rds	No. of CRT Magnetic Tracks, or Acoustic		cces Time		Mode	Drum Diam., Length or CRT Type	Speed of Motion
							Channels	Max.		Min.	l		
Electron	ic		Inte	rnal	102	24	40	16 p	s	8 pas	Paralle		
Magnetic	Drum		Exte	rnal	10,0	000	200		\top		Serial	8 dia.	3600rpm
										٠.		15"long	
							<u> </u>		-		<u> </u>		
INPU	T/OUTPUT:				Туре			Funct	ion		<u>1</u>	Speed	
		Phot	toele	ctri	c Tay	e Re	ader	Inpu	it	25	words	sec.	
		Prin	ter-	anal	ex		8.55	Outr	nıt	25	words	sec.	
		Pape	r Ta	pe P	ınch	1		Outr	nut	15	charac	cters/sec.	
		Sin	cle C	hanne	el Ta	me		In-C	nt	25	words	sec.	

TAPE SEÁRCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT:

COMPONENTS: 2500 tubes, 800 crystals, no relays.

REMARKS: The logical design of this computer is modeled on the IAS computer.

Testing of the electrostatic storage system is built in: automatic

checking of overflow is to be installed soon.

Mark 22 Computer (Bell Computer, Model IV)

BUILT BY: Bell Telephone Laboratories

INSTALLATIONS: Naval Research Laboratory (Radio Division III, Operational Research Branch), Washington, D.C. (Development supported

by Bureau of Ordnance, U.S. Navy.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not available. COMPUTING TIME: Not available.

FLOOR AREA: 42 sq. ft.

cooling: Air-conditioned/ FIRST READY FOR USE: March 1945.

POWER CONSUMPTION: 3 km.

BEST SUITED FOR: Ordnance problems.

OPERATIN	G SCHEDULE:	ENGINE	ERING		PROBLEM SOLVIN	IG		*
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	Idle	Total
	Hrs/Wk	•				L_,		168
	Percent	0	0	87	Negligib!	.e 3	10	100

PERSONNEL: 1 Operator, 1 maintenance man, 2 mathematicians.

NUMBER BASE: 10 (biquinary).

WORD LENGTH: 5 or 6 decimal digits (instructions 2 digits).

NUMBER RANGE: -99999 to 99999. INSTRUCTION TYPE: Two-address.

SEQUENCE CONTROL: Paper tape.

NEGATIVE NO. REP .: Complement. OPERATIONS: Add, subtract, multiply, divide.

INP	JT/OUTPUT:	 letyp		Туре			Function In-Ont		igita/s	Speed AC.	s'
·				:							
Relay		 Inter	TEC	10			Ua4B	V. 48	Feren		
		 T 4		30		Channels	0.4		Parall		
1	STORAGE:	Funct	tion	` 1	city n rds	No. of CRT Magnetic Tracks, or Acoustic Channels] Tin		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Excl. of											
ncl. Access		Sec Sec		890		6 sec	4.0 s				
	SPEED:	 nsfer				lication	Division				

TAPE SEARCH: Possible in both directions.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous operation.

COMPUTING ELEMENT: Telephone relay.

COMPONENTS: No tubes, no crystals, 1200 relays.

REMARKS: Cannot alter its instructions. Logical checks are incorporated

in all circuits. Machine operates attended for 50 hours and

unattended 118 hours of each week. The decimal point is

variable.

MIDAC (<u>Michigan Digital Automatic Computer</u>)

BUILT BY: Willow Run Research Center, Ypsilanti, Michigan.

INSTALLATIONS: Willow Run Research Center.

(Constructed under the emspices of Wright Air Development

Center. U. S. Air Force.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available. Write to Director, Willow Run Research Center

COMPUTING TIME: (for further information.

FLOOR AREA: 845 sq. ft.

POWER CONSUMPTION: 83 km.

cooling: 10-ton air condit. FIRST READY FOR USE: 1 May 1953.

BEST SUITED FOR: General-Turbose.

OPERATING SCHEDULE	ENGII	NEERING		PROBLEM SOLVI	VG.	<u> </u>	1
	Sched. Maint	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk							
Percent							

PERSONNEL: Planned for 40 hr./wk. operations: 12 operators, 4 maintenance

men. 12 mathematicians, 4 clerical.

NUMBER BASE: 2 (10 or 16 externally).

WORD LENGTH: 45 binary digits.

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, 3 types of multiplication, divide, shift,

power extract, logical transfer, comparison, decimal-binary

and binary-decimal conversion, file,

	SPEED	Tra	nsfer	Add	ition	Multip	lication	Divis	on	Shi	ft (on	rersion	(d-b or
incl. Access	Min.			192	Ma	2.3	MS	2.3	ms	240	/us	0	.8 ms	
inci. Access	Max,			1.5	ms	3.6	ms	3.6	ms	3.6	ms	1	.8 ms	
Excl. of A	ccess			48	/us	2,1	ms	2,1	ms		112/18	5	76 µs	
100	STORAGE:				Capa	acity	No. of CRT	A	cces	5	,		Drum Diam	Speed
_					1	n Č	Magnetic		Time			١.	Length	of
Ту	pe		Funct	ion	₩o	rds	Tracks, or Acoustic				Mode	ď	or CRT Type	Motion
				•			Channels	Max.	1	Min.				
dercury D	elay]	ine	Inter	mal	512	?	64	384,4	8		Seria	1	24"lone	
lagnetic :	Drum		Inter	mal	6144	,	192			5 ms	Serie			3450 rpm
*								1					14"lone	
												\top		
						•			T					
INPUT	/OUTPUT:				Туре			Funct	on			S	peed	
		Flex	cowrit	er	Paper	Tap	e	In-0	ut	10	charac	te	rs/sec.	
	· · · · · · · · · · · · · · · · · · ·		ranti					Inpu					ers/sec	
			Cape I											
	• •													
TAPE	SEARCH:	Pos	sible	in	the	forw	ard di	recti	on .					

ARITHMETIC MODE: Serial.

CLOCK FREO .: 1 mc.

COMPUTING ELEMENT:

COMPONENTS: About 1100 tubes, 20,000 crystals, and 120 relays.

REMARKS: Substantial increases in the memory, input, and output are planned. MAGIC I (Michigan Automatic General Integrated

Computation) is a system which automatically converts an easilycoded form of floating-address, unscaled, decimal program into machine-acceptable form. MIDAC is similar to FLAC, DYSEAC, and

SEAC.

MINAC

(Minimal Automatic Computer)

BUILT BY: Digital Computing Group, California Institute of Technology

INSTALLATIONS: Digital Computing Group

(Continental Oil Co. has contributed financial support

to the development of the computer.)

COPIES AVAILABLE:

Not available.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 1

1 sq. ft.

POWER CONSUMPTION: 500 W.

COOLING:

FIRST READY FOR USE: Summer 1953.

BEST SUITED FOR: General-purpose scientific and engineering computation

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING

School Maint For Day Fron-Free Erroneous Repair

Sched. Maint. Eng. Dev. Error-Free Erroneous Repair

Hrs/Wk
Percent

PERSONNEL:

NUMBER BASE: 2 (externally hexadecimal).

WORD LENGTH: 32 bits (instructions 17 bits).

NUMBER RANGE: -1 to 1

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, division, extract,

logical control orders.

y	SPEED:	Tra	nsfer	Add	tion	Multip	lication	Divisio						
	Min.	2	ms	2 1	18	19		19 ns						
inci. Access	Max.	19	ms	19 1	16	<u> 36</u>		36 ms						
Excl. of	ccess	Ž	ms	7 1	16	17	20	17 ms						
STORAGE:			Function		Capacity in Words		No. of CRT Magnetic Tracks, or Acoustic Channels	Time.			Mode	Drum Dlam., Length or CRT Type	Speed of Motion	
Туре		Max.						1 1	lin.					
¥			Tork	rnal	819	2	128	17 =	Le l	1	Serial	6" dia.	3500rp	
Magnetic	Drun		24.00	11444	027					3.17		8" long		
			+							,				
								200						
			+	. ,										
ı wöi	T/OUTPUT:				Type		J 4	Functi	on	, politica		Speed		
		Flexovriter						In-Ou	tt					
and the second s			The state of the s											

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 120 kg.

COMPUTING ELEMENT: Tabes and crystal diodes.

COMPONENTS: 90 tubes, 900 crystal rectifiers.

REMARKS:

BUILT BY: Marchant Research Inc. (formerly Physical Research Lab.), Oakland, Installations: Atlantic Refining Co. (2 machines). California.

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE: Not available.

COMPUTING TIME: Not available.

FLOOR AREA: 16 sq. ft.

POWER CONSUMPTION: 22 km.

cooling: Built-in.

FIRST READY FOR USE: April 1953.

BEST SUITED FOR: General purpose.

OPERATING	SCHEDULE:	ENGINE	ERING		ROBLEM SOLVIN			
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
L	Hrs/Wk							
	Percent							

PERSONNEL:

NUMBER BASE: 8 and 10 (8-4-2-1 code).

WORD LENGTH: 10 decimal digit.

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE:

NEGATIVE NO. REP.: Sign & abs. value. SEQUENCE CONTROL:

OPERATIONS:

SPEED:		nsfer	Add	ition	Multi	plication	Division		·		•	
Min.	125 µs 37		375	5 Ms 6		.2 ms	6.2 ms					
Max.	10	'Mg					16 ms				· · · · · · · · · · · · · · · · · · ·	
cess	125	/us	375	jas	6							
STORAGE:		Function		Capacity in Words		No. of CRT Magnetic Tracks, or	Tin		Mode	Drum Diam., Length or CRT Type	Speed of Motion	
						Channels	Max.	Min.				
Magnetic Drum		Internal 409		409	6		10 ms			63 dia	6000 ro	
										x 10 Ton		
					· 	<u> </u>	1		_			
					•				+	1		
OUTPUT:	Туре						Function	T	Speed			
			Tape Reader						digits/second		*******	
								put 10 digits/secon			<u> </u>	
Typewrit			ter							igits/second		
	Min. Max. ccess STORAGE:	Min. 125 Max. 10 ccess 125 STORAGE: pe Drum /OUTPUT: Tap	Min. 125 µs Max. 10 ms ccess 125 µs Func Drum Inter /OUTPUT: Tape Rec	Min. 125 ps 375 Max. 10 ms 10 ccess 125 ps 375 STORAGE: pe Function Drum Internal /OUTPUT: Tape Reader Tape Punch	Min. 125 µs 375 µs Max. 10 ms 10 ms ccess 125 µs 375 µs STORAGE: pe Function Wo Drum Internal 409 /OUTPUT: Type Tape Reader Tape Punch	Min. 125 As 375 As 6 Max. 10 ms 10 ms ccess 125 As 375 As 6 STORAGE: pe Function Words Tape Reader Tape Punch	Min. 125 µs 375 µs 6,2 ms Max. 10 ms 10 ms 16 ms cess 125 µs 375 µs 6,2 ms STORAGE: Function Capacity No. of CRT Magnetic Tracks, of Acoustic Channels Drum Internal 4096 /OUTPUT: Type Tape Reader Tape Punch	Min. 125 MS 375 MS 6.2 MS 16 MS MS MS MS MS MS MS M	Min. 125 Mis 375 Mis 6,2 ms 6,2 ms	Min. 125 as 375 as 6.2 ms 6.2 ms	Min. 125 Mis 375 Mis 6.2 Mis 16 Mis	

TAPE SEARCH:

ARITHMETIC MODE:

CLOCK FREQ .:

COMPUTING ELEMENT:

COMPONENTS:

REMARKS:

MONROBOT Corp., Morris Plains, New Jersey

INSTALLATIONS:

Air Force Cambridge Research Center (MONROBOT III)

Monroe Calculating Machine Co. (MONROBOT IV)

Army Engineer Corps (MONROBOT V)

COPIES AVAILABLE: For sale.

PROGRAMMING SERVICE:

COMPUTING TIME: Available in summer 1953.

FLOOR AREA: 16 sq. ft.

POWER CONSUMPTION: 3 km.

COOLING:

FIRST READY FOR USE: 1 March 1953

BEST SUITED	FOR:	General	purpose ((IV), ante	nna desig	n (III).	manning ((V)
OPERATING SCHE					PROBLEM SOLVIN	G	idie	Total
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	1010	
Hrs								
Par	cent						ث	

PERSONNEL:

NUMBER BASE:

10 (8-4-2-1).

WORD LENGTH:

20 decimal digits (instructions 10 decimal digits). -1010 to 1010 INSTRUCTION TYPE: Four-address.

NUMBER RANGE:

NEGATIVE NO. REP.: Absolute value & sign, sequence control: Special drum store.

OPERATIONS: Add, subtract, multiply & divide, print, stop, increase an

instruction address by unity, read tape, punch tape, conditional

transfer, operations on absolute values.

	·										· · · · · · · · · · · · · · · · · · ·
SPE	D: Tre	nsfer	Add	t ion			Division	_			
Min.	13	5 ms	135	28.0	0.6		6 80				
Incl. Access Max.	13	5 20	135	20.5	0.6	990. O	6 11				
Excl. of Access	6	4 me	.64	20.5	0.59	800. C	.59 11	0			
STORAG Type	E:	Func	tion	'	pacity in brds	No. of CRT Magnetic Tracks, or Acoustic	Į Tie	OS :	Node	DrumDlam., Length or CRT Type	Speed of Motion
						Channels	Max.	Min.			
Magnetic dru	n	Inte	rnal	100	Not	100	16 ms		Serial	10°dia,	3600rp
		1			List						
		1					4.1				
		1									
									1 1 1 1 1 1		
INPUT/OUTP	UT :			Type			Functio	n		Speed	
IMPOLICUL		y boar	·4				Input	1			
		exov:			1 1		In & C) dicit	5/800.	
		per					In & C	at 1	digit	5/80G.	
	1										

TAPE SEARCH: Possible in the forward direction. CLOCK FREQ .: 10 kg.

ARITHMETIC MODE: Serial. COMPUTING ELEMENT: TUDOS.

COMPONENTS: 650 tubes, 200 crystals, 15 relays.

REMARKS: MONROBOT V is ruggedised for truck mounting, high and low

temperatures (elimination of germanium diodes), shock mounted,

etc.

(Moore School Automatic Computer)

BUILT BY: Moore School, University of Pennsylvania INSTALLATIONS: Moore School, Philadelphia, Pennsylvania

(The Signal Corps Engineering Laboratories, Fort Monmouth contributed financially to the development of the computer.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available for governmend and industrial use in late 1954. computing time: Available for government and industrial use in late 1954.

FLOOR AREA: 1400 sq. ft.

POWER CONSUMPTION: 100 km.

COOLING:

FIRST READY FOR USE: Between July & December 1954.

General purpose; small input-output problems.

BEST SUITED FOR:

TING	SCHEDULE	,	ENGINE	ERING	3.740	ROBLEM SOLVII	IG		l i	
_		Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ld le	Total	
	Hrs/Wk									
E	Percent									

PERSONNEL:

NUMBER BASE: 2 (2, 8, or 16 externally).

word Length: 44 binary digits.

NUMBER RANGE: 2-13-1 to 1-2-13.

INSTRUCTION TYPE: Four-address. SEQUENCE CONTROL: General store.

NEGATIVE NO. REP .: Sign bit. OPERATIONS: Add, substract, multiply (with, without roundoff)

divide, compare, input, output.

,	SPEEQ:	Transfer			Multip	lication	Division	Comp	are		
icl. Access	Min.) Jus	2.	2 ms	2.2 ms	192	JUS		
ICI. ACCESS	Max.			ms	3.	5 ms	3.6 ms	1.2	'ms		
Excl. of A	ccess		48	MB	2.) ms					
	STORAGE:	Func	tion	i	icity n rds	No. of CRT Magnetic Tracks, or Acoustic	Time		Mode	DrumDiam., Length or CRT Type	Speed of Motion
						Channels	Max.	Min.			
							1				
reury De	alay Li	nesInter	nal	102	2/4	128	384 A18		Serial	8 words	1 mc
reury De	alay Li	nesInter	nal	102	5/7	.128	38/4 ALS		Serial	8 words	1 mc
rcury De	elay Li	nesInter	nal	102	2 ls	.128	384 ms		Serial	8 words	l mc
reury De	alay Li	nesInter	mal	10:	SP	128	384 /ns	,	Serial	8 words	1 me
reury De	alay Li	nesInter	mal	102	SF .	128	384 prs		Serial	8 words	1 mc
	T/OUTPUT:	nesInter	mal	102	5k	.128	Function		Serial	8 words	1 mc
	T/OUTPUT:	nes Inter		Туре	5/4	.128			Serial		1 mc
	T/OUTPUT:			Туре	≥ t	128			Serial		1 mc
	T/OUTPUT:			Туре	ols.	128			Serial		1 mc

TAPE SEARCH:

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 996-75 kc.

COMPUTING ELEMENT:

COMPONENTS: 3000 tubes, 20,000 crystals, 200 relays.

REMARKS: As MSAC is still under construction, many details

(particularly concerning input-output) have not yet (March 1953) been frozen. Automatic checking is provided by duplicate arithmetic units working simultaneously and checking pulse for pulse.

MOSAIC (Ministry of Supply Arithmetical Integrator & Calculator)

BUILT BY: Post Office Research Section, London, England.
INSTALLATIONS: Radar Research Establishment, Malvern, England.

COPIES AVAILABLE:

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: Room 24 x18 .

POWER CONSUMPTION: 30 kw.

COOLING:

FIRST READY FOR USE: December 1952.

BEST SUITED FOR: Trial analysis. OPERAT I

ING	SCHEDULE:		ENG INE	ERING		ROBLEM SOLVII	IG		 .
		Sched. M	aint.	Eng. Dev.	Error-Free	Erroneous	Repair	Idle	Total
	Hrs/Wk								
	Percent								

PERSONNEL:

NUMBER BASE:

WORD LENGTH:

40 binary digits.

INSTRUCTION TYPE: Four-address.

NUMBER RANGE:

NEGATIVE NO. REP .:

SEQUENCE CONTROL: OPERATIONS: Addition, subtraction, multiplication, shift, logical

operations.

	SPEEDS	Tran	sfer	Add	tion	Multip	lication	Division				
	Min.				: .							
nci. Access	Max.								1			
Excl. of A	ccess			70	ш	6	ms					1
	STORAGE:		Funct	: 1 on	1	ncity n rds	No. of CRT Magnetic Tracks, or Acoustic	Aeces Tim		Mode	Drum Diam. Length or CRT Type	of
		- 1					Channels	Max.	Min.			<u> </u>
Mercury	delay	11 na	Inte	rna	10	40		1024//		Serial		
NOT CULT				2. / /								
									, , , , , , , , , , , , , , , , , , , 			
										<u></u>		
INPUT	r/OUTPUT:				Type			Function			Speed	
		Pun	ched	CAT	is			In&Out				
		-	er ta			ride)		Input				,
		T VI	ewri	ter				Output				

TAPE SEARCH:

ARITHMETIC MODE: Serial

CLOCK FREQ.: 570 kc.

COMPUTING ELEMENT: Tubes

COMPONENTS: About 6000 tubes and about 2000 crystals.

REMARKS:

NAREC (Naval Research Laboratory Electronic Digital Computer)

BUILT BY: Naval Research Laboratory

INSTALLATIONS: Naval Research Laboratory, Washington, D. C. (Radio Division III,

Operational Research Br.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not available. COMPUTING TIME: Not available.

FLOOR AREA: 100 sq. ft.

POWER CONSUMPTION: 40 km COOLING: 15-ton air-conditioner inst READY FOR USE: June 1954

BEST SUITED FOR: General Turnose

DED1,	,011.20 10.01		F		*			
OPERAT INC	SCHEDULE:	ENG IN	EERING		PROBLEM SOLVIN	IG		
_		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Totai
	Hrs/Wk							
· · · · · · · · · · · · · · · · · · ·	Percent							

PERSONNEL:

NUMBER BASE: 2 (10 externally).
WORD LENGTH: 45 binary digits (instructions 21 binary digits)

NUMBER RANGE: -1 to 1.

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP.: Twos! complement SEQUENCE CONTROL: General store

OPERATIONS: Add, subtract, multiply, divide, several transfers of

control, shifts, increase address contained in instruction

in memory by 1.

	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Divis	ion		-				
	Min.	13	/as	22	/LS	530	/18	670	/118						
Incl. Access	Max.	13	/US	22	ps	800		800							
Excl. of A	ccess	3	p.s	3	/us	520	- 790 (560-		A S					
	STORAGE:				Сар	acity	No. of CRT		Acces	s				Drum Diam.,	Speed
]			in	Magnetic		Time	•	ı			Length	of
T)	ype		Func	tion	Wo	ords	Tracks, o				- 1	Mod	e	or CRT Type	Motion
•							Channels		.	Min	\Box				
Electrost	atic		Inte	rnal	102	24	45	10	/118	10	/ls	Baral	lel	3 BP1	
Magnetic	drum		Inte	rnal	201	18	48	16.7		8	A1.8	Parall	lel	12°dia.	3600rp
														18*long	
I Ņ P U	T/OUTPUT:				Туре			Func	tion					Speed	
		Mag	meti	c ta	pe			In.8	Out	30) W	ords	/se	c: 30°/	50C
	1	Pay	er t	ape				Inpo	ıt	20) W	ords	se	e: 20*/	sec
	·]	Paj	er t	ape	punch	1		Out	nt	1	WO	rd/s	9C		
	I	Fle	IWOXE	iter				Out	nt	1 g	WO	rd/s	ec		
T.0	E SEADOH.	Nor	16.												

TAPE SEARCH: NODE.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT: Vacuum tube.

COMPONENTS: 2000 tubes, 20 000 crystals, no relays.

REMARKS: First successfully operated on test problems with the magnetic-

drum memory only November 1952.

NICHOLAS (Nickel-Delay-Line-Storage Computer)

BUILT BY: Elliott Bros. Ltd., London, England

INSTALLATIONS: Elliott Bros. Ltd.

COPIES AVAILABLE:

PROGRAMMING SERVICE: Available.

COMPUTING TIME: Available.

FLOOR AREA:

POWER CONSUMPTION:

FIRST READY FOR USE: January 1953.

COOLING:

BEST SUITE	ED FOR:	Gen	GLOT	Par bonce					
OPERATING SCI			ENGINE	ERING		ROBLEM SOLVIN	G	√ldle÷	Total
UPERATING SCI		Sched.	Ma int.	Eng. Dev.	Error-Free	Erroneous	Repair	- 1016	- Total
		Scheu.	.ma III.C.	Liigt Str			•		
Hr	rs/Wk	L							
Pe	rcent				<u></u>			L	

PERSONNEL:

NUMBER BASE:

WORD LENGTH:

32 binary digits (instructions 16 binary digits, two per word).

NUMBER RANGE:

INSTRUCTION TYPE: One-address. SEQUENCE CONTROL: General store.

NEGATIVE NO. REP .:

OPERATIONS:

INF	0,70011011	Pun	ched pape	er t	ре		In&Out Output		Level to	pe is use	d
INF	UT/OUTPUT:			Туре			Function			Speed	
							11				
						 	+			·	
delay	lines	\	Arith.		_5_	 	+		DOLLAR.	1	
		tive	Internal	10	124	64	125 BS		Serial	1 word	
							12 ms	0	Seriel	16 wds	
	, i i i					Acoustic		Min.	1		
	Гуре	1.	Function		n rds	Tracks, o	r		Mode	or CRT Type	Motion
	STORAGE:		1		city	No. of CRI Magnetic				Length	of
Excl. of	Access			·		, <u>l</u>		1	1	Drum Diam.	Speed
cl. Access	Max.		<u> </u>					Bec	ond, av	erage.	
	Min.									operation	a per
	SPEED:	Trans	fer Addi	tion	Multip	lication	Division	+			- 202

TAPE SEARCH:

ARITHMETIC MODE:

Serial.

CLOCK FREQ .: 50 kc.

COMPUTING ELEMENT:

COMPONENTS:

REMARKS:

BUILT BY: Central Institute, Royal Norwegian Council for Scientific and

Industrial Research INSTALLATIONS:

Norsk Regnesentral (Norwegian Computing Centre), Oslo University,

Blindern, Norway.

(U.M.M. The Board for Mathematical Machines of the Royal Norwegian Council of Scientific and Industrial Research

supported the development of the computer.)

COPIES AVAILABLE: No.

PROGRAMMING SERVICE: Available to Norwegian science and industry. COMPUTING TIME: Available to Norwegian science and industry.

FLOOR AREA: 2m x 3m.

POWER CONSUMPTION: 2 km.

COOLING: None.

FIRST READY FOR USE: Fall. 1953

BEST SUITED FOR: General purpose.

OPERATING	SCHEDULE:		ENGINE	ERING		PROBLEM SOLVII	NG			ı
		Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	Idle	Total	
	Hrs/Wk									1
F	Percent									ı

PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 32 binary digits.

NUMBER RANGE:-1 to 1.

INSTRUCTION TYPE: Two-address. SEQUENCE CONTROL: General store.

NEGATIVE NO. REP .: Complement.

OPERATIONS: Transfer, addition, subtraction, multiplication, sign conditional

transfer of control.

	SPEED:	Tra	nsfer	Addi	ition	Multip	lication	Division				
ncl. Access	Min.		. ms		L ms	<u> </u>	3 ms	Progra	mned			
nor Access	Max a	15	ms	15	ms	50	0 ms					
Excl. of	Access		. ms]	l ms			·				
Т	STORAGE:		Funct	tion		acity in ords	No. of CRT Magnetic Tracks, or Acoustic	Tin		Mode	Drum Diam., Length or CRT Type	Speed of Motion
							Channels		Min.	1	1	
Magnetic	dram		Inter	nal	51	2	32	15 ms	l ms	Serial	2"dia.	4000rp
T-SALVES											5"long	
												<u> </u>
INPU	T/OUTPUT:				Туре			Function			Speed	·
	L	Par	er te	pe 1	reade	r		Input	50	lines p	er sec.	
	[Tar	e pur	<u>ich</u>				Output	7	lines p	er sec.	
	Γ	Tel	eprir	ter				Output	7	charact	ers per	sec.

TAPE SEARCH: Possible in the forward direction.

THMETIC MODE: Serial. CLOCK FREQ.: 40 kc.

ARITHMETIC MODE: Serial.

COMPUTING ELEMENT: Electron tube.

components: About 450 tubes, 200 crystal rectifiers, and 10 relays.

REMARKS: This computer is a modified version of APE(X)C, built by Dr. A. D. Booth. Birkbeck College, University of London.

OARAC

(Office of Air Research Automatic Computer)

BUILT BY: General Electric Company, Syracuse, New York

INSTALLATIONS: Computation Branch, Flight Research Laboratory.

Wright Air Development Center, Wright-Patterson

Air Force Base, Ohio

COPIES AVAILABLE: No.

PROGRAMMING SERVICE: Available to Air Force groups and contractors. COMPUTING TIME: Available to Air Force groups and contractors.

FLOOR AREA: 80 sq. ft.

POWER CONSUMPTION: 25 km.

COOLING: 3000-4000 cu.ft.minfirst READY FOR USE: 1 April 1953.

REST SHITED FOR: General purpose.

DESI SOLLED LOW!							
OPERATING SCHEDULE:	ENG I NE	ERING	1	ROBLEM SOLVIN	G		Total
	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk	oched: Hallitt						
Percent						<u> </u>	

PERSONNEL: 2 operators, 3 maintenance, 15 mathematicians, 2 clerical.

NUMBER BASE:

10 (2*-4-2-1).

WORD LENGTH:

10 decimal digits and sign (instructions 7 decimal digits).

NUMBER RANGE:

Variable.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Tens complement. SEQUENCE CONTROL: General store. OPERATIONS: Add, subtract, multiply, divide, choice, match,

address add, normalize, clear and add, subtract absolute value, input, output,

Division ultiplication Addition SPEED Transfer 13 ms 400 ALS 10 ms max Min. Incl. Access 17 ms 30 ms 26 ms Max. 13 ms 80 pre 1-9 ms Excl. of Access Drum Diam. No. of CRT Speed Access Capacity STORAGE: Length

Туре	Function	Words	Tracks, or Acoustic			Mode	or CRT Type	Motion
· · · · · · · · · · · · · · · · · · ·			Channels	Max.	Min.			
Magnetic drum	Internal	10,000	200	17 ms	240/us	Ser-Per.	22*dia.	3500 rpm
Magnetic diam	-		1		,		30*long	
Magnetic tape	External		5			Sen-Par		50"/sec.
				<u> </u>	<u> </u>	<u> </u>	Speed	

Type INPUT/OUTPUT: 35-45 m/word (see above) In-Out Magnetic tape 7 words/minute Input Keyboard 10 words/minute Output Typewriter

TAPE SEARCH: No tape search possible.

ARITHMETIC MODE: Serio-parallel.

CLOCK FREQ .: 150 kc.

COMPUTING ELEMENT:

COMPONENTS: About 1400 tubes, about 7000 crystals, 240 relays. REMARKS: An automatic redundancy check is performed on the

decimal codes.

BUILT BY: A. and C. S. Division, General Electric Co., Schenectady, N.Y.

INSTALLATIONS: Aeronautical and Ordnance Systems Division,

General Electric Co.

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Not available.

FLOOR AREA:

COMPUTING TIME: Not available.

cooling: 3000 ca.ft.min.

POWER CONSUMPTION: 12 km.

FIRST READY FOR USE:

BEST SUITED FOR: General purpose; ballistic and flight-path studies.

OPERATING SCHEDULE:	ENGINE	ERING		ROBLEM SOLVIN	G		I
	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	- Idle	Total
Hrs/Wk	\$	15	52	10	. 6	5	75
Percent	0.7	2.0	69.3	13.3	8.0	6.7	100

PERSONNEL: 1 operator, 1 maintenance man, 2 mathematicians, 4 in training as maintenance-operators.

NUMBER BASE: 2

word Length: 24 binary digits (instructions 34 binary digits).

NUMBER RANGE: 2-32 to 2+31 INSTRUCTION TYPE:

INSTRUCTION TYPE:

NEGATIVE NO. REP.: Twos! complement.

SEQUENCE CONTROL: Special drum store.

OPERATIONS: Add, subtract, multiply, divide, extract exponent or

integral part of number, transfers of control, synthesize

floating-point form, modify instruction, stops.

·	SPEED:	Tra	nsfer	Add i	tion	Multi	plication	Divis	ion	A	11			
ncl. Access	Min.	•												
iici. Access	Max.									1	2 ms			
Excl. of A	ccess													
· · · · · · · · · · · · · · · · · · ·	STORAGE:				Capa	city	No. of CRT		Acces	s		0	rum Diam	Speed
т	/pe		Funct	ion i		n rds	Magnetic Tracks, or Acoustic		Time		Mode	٥	Length r CRT Type	of Motion
Magnetic	Amo		Tark as		m en		Channels			Min.	<u> </u>	_	75	1.000
			Inter	naı	750		36	12	ms	·	Prelle	1	6"dia.	ं800 r p
. (ins	tructi	ons					 	1	_				14"100	5
Magnetic	drum		Inver	nal	540		26	11	ms		Pare 1	7 6	#dia w	5400 r pi
(n	umbers)						† 		*	1		4 long	
INPUT	r/OUTPUT:				Туре			Funct	ion				peed	
•		Tel	etype				ż	In&0	u.t	63 c	digits	ъe	r aecon	ાહોં .
											-			
	1		·				·						•	
	i									1				

ARITHMETIC MODE:

Parallel.

CLOCK FREQ .: 10 kc.

COMPUTING ELEMENT:

COMPONENTS:

3300 tubes.

REMARKS: Floating binary point is used. Separate drums are used to store instructions and numbers. Computer can alter its instructions. In each instruction time (instruction-drum revolution) computer: (1) stores result of previous operation. (2) performs arithmetic of current operation, (3) obtains

operands for next instruction.

ONR RELAY COMPUTER (Office of Naval Research)

BUILT BY:

INSTALLATIONS: Logistics Research Project,

George Washington University, Washington, D.C.

(Owned by the Office of Naval Research.)

COPIES AVAILABLE: No. PROGRAMMING SERVICE: NO.

Available.

COMPUTING TIME:

40 sq. ft. FLOOR AREA: Total 3 hp. POWER CONSUMPTION: 5 km.

FIRST READY FOR USE: 1 May 1951 at G.W.U.

COOLING: General purpose (small input and output).

BEST SUITED FOR: PROBLEM SOLVING ENGINEERING OPERATING SCHEDULE: Idle Total Erroneous Repair Error-Free Eng. Dev. Maint. 425 0 Test 6.75 1.0 3B.5 Hrs/Wk 100 0 2.4 79.0 2.8 Percent

PERSONNEL: 2 operator, 2 mathematician, 1 maintenance, 1/10 clerical.

NUMBER BASE: 2

WORD LENGTH: 24 binary digits.

SUMBER RANGE: $-(2^{23}-1)$ to $(2^{23}-1)$ INSTRUCTION TYPE: One-address. NEGATIVE NO. REP.: Ones! complement. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, extract, unconditional

and conditional jumps, selective write.

INP	JT/OUTPUT:		per te	ape	Туре			Inpu		150	words	Speed /minute /minute	
Magnetic	Drum		Inter	nal	409	4	48	136	ms	68 Jus	Barall	el 8½x12*	440 Pp
Т	STORAGE:		Func	tion		acity in ords	No. of CRT Magnetic Tracks, or Acoustic Channels	Max		Min.	Mode	Drum Diam. Length or CRT Type	of Motion
Excl. of			6 ms			2.5	sec	2,5	sec	<u></u>			
ncl. Access	Min. Max.	27	6 ms 2 ms		ms	2.5		2.5					
	SPEED:		nsfer			-	SeC .	Divis 2.5		T			

None. TAPE SEARCH:

Parallel. ARITHMETIC MODE:

CLOCK FREQ.: 15 kc (magnetic-drum clock)

COMPUTING ELEMENT: Relay.

COMPONENTS: 655 tubes, 332 crystals, 734 relays.

REMARKS: See J. J. Wolf, "The Office of Naval Research Relay Computer,"

Mathematical Tables and other Aids to Computation, VI, No. 40,

pp 207-212-(October 1952).

ORACLE (Oak Ridge Automatic Computer and Logical Engine)

BUILT BY: Argonne National Laboratory INSTALLATIONS: Oak Ridge National Laboratory

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Possibly to government and AEC laboratories.

COMPUTING TIME: Possibly to government and AEC laboratories. FLOOR AREA: 1500 sq. ft. POWER CONSUMPTION: 50 kw.

cooling: 5000 cu.ft./min. First READY FOR USE: June 1953.

BEST SUITED FOR: General purpose.

OPERATING SCHEDULE:	ENG IN	ERING		ROBLEM SOLVIN	IG	·	
Hrs/Wk	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
Percent							
***************************************	·····						

PERSONNEL:

NUMBER BASE: 2

WORD LENGTH: 40 binary digits (instructions 20 binary digits). NUMBER RANGE: -1 to 1-2-39. INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Twos complement. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, several transfers of control, partial substitution into the memory, shifts right and left.

	SPEED:		nsfer	Add	ition	Multip	lication	Divi	sion	,]				· · · · · · · · · · · · · · · · · · ·
Incl. Access	Min.		us		8 Jus		/us	660	/11.S	3				
	Max.	40	Ns	4	8 Jus	520	A1S	/A -						
Excl. of A	ccess		•		8 jus	480	/us	(1 -	µ.s	_				
	STORAGE:		Funct		Сар	acity in rds	No. of CR Magnetic Tracks, o Acoustic	r	Acce Tir	ss		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Slectrosta	2+10		T 4		200		Channels	-			in.			
agnetic !			Inter		102		80	40	/us	20	/us	Paralle	l.	
EHRATE .	rape		Exter	nal	unli	mite	a 40					Paralle		75"/sec
								 						
								1	-				 	
INPUT	/OUTPUT:				Туре			Funct	ion	T			Speed	
	[Tel	etype					In-0		_			opeed	
	}													
	t							<u> </u>		+		<u> </u>		
	SEARCH:													

Possible in both directions

ARITHMETIC MODE: Parallel.

CLOCK FREQ.:

COMPUTING ELEMENT:

components: 3500 tubes.

REMARKS: The logical design of this computer is modelled on the IAS

computer.

ORDVAC (Ordnance Discrete Variable Automatic Computer)

University of Illinois BUILT BY:

Aberdeen Proving Ground, Maryland (Owned by U.S. Army Ordnance INSTALLATIONS:

Corps.)

(Financial contributions to development of ORDVAC were made by Office of Naval Research, U.S. Air Force, and

Atomic Energy Commission.)

COPIES AVAILABLE:

COMPUTING TIME:

No.

PROGRAMMING SERVICE:

Available to groups engaged in National Defense work.

800 sq. ft. FLOOR AREA:

POWER CONSUMPTION: 35 kw.

COOLING:

72 ton air-conditioner FIRST READY FOR USE: March 1952 to APG.

Scientific computation. BEST SUITED FOR:

PROBLEM SOLVING ENGINEERING OPERATING SCHEDULE: Total ldle Eng. Dev Maint. Error-Free Erroneous Repair 145.8 27.2 26.3 63.5 5.0 Hrs/Wk 3.4 18 100 10.7 5.4 43.5 Percent

PERSONNEL: 10 maintenance men. 21 mathematicians.

NUMBER BASE: 2 (16 externally).

WORD LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1-2-39.

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP .: Twosi complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, absolute value, logical

multiply, shift, several transfers of control.

	SPEED:	T	nsfer	Add	ition	Multin	lication	Division	Shi	f t	T	
	Min.	rar	15151	 	N.s	642		772 rus				
ncl. Access	Max.			72		822		· · - / -				
Excl. of	Access			50	ns		7		10	o pre	i	
т	STORAGE:		Func	tion	i .	acity in ords	No. of CRT Magnetic Tracks, or Acoustic	Acce Tim		Mode	DrumDiam., Length or CRT Type	Speed of Motion
							Channels	Max.	Min.	1		
lectrost	atic		Inter	rnal	10	24	40	36 Aus	18 ns	Parallel	3 K P1	
(William								,				
							, , , , , , , , , , , , , , , , , , , ,			<u> </u>		
INPL	JT/OUTPUT:				Type			Function	1		Speed	
		Tar	e Rea	ader				Input	2	5 charac	ters/sec	
	1		e Pui					Outpu	t 2	5 charac	ters/sec	
			d Re		(IB)	()		Input			-	
			d Pu		(IBM))		Outpu	1			

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: Asynchronous.

COMPUTING ELEMENT: Eccles-Jordan flip-flop.

COMPONENTS: 2700 tubes.

REMARKS: The logical design of this computer is modeled on the IAS computer. ILLIAC is a very similar computer also

built by the University of Illinois.

(Programmgesteuerte Elektronenrechenmaschine, München)

BUILT BY: Arbeitsgemeinschaft für Elektronische Rechenmaschinen, T. H., Munich.

INSTALLATIONS: Technische Hochschule, Munich, Germany,

(The Deutsche Forschungsgemeinschaft contributed support to the development of the computer.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: Room 800 sq.ft.

POWER CONSUMPTION: 7 km.

COOLING:

FIRST READY FOR USE: 1954.

BEST SUITED FOR: General purpose.

				F					
OPERATING	SCHEDULE:		ENGINE	ERING		PROBLEM SOLVIN	G		<u> </u>
		Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
1	Hrs/Wk								
-	Percent								

PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 49 binary digits (9 for exponent) (instructions 50 binary digits).

NUMBER RANGE: Floating or fixed pt. INSTRUCTION TYPE: One-address. NEGATIVE NO. REP .: Complement. SEQUENCE CONTROL: General store. OPERATIONS: Addition, subtraction, multiplication, division.

		Telety	ре		· · · · · · ·		In&Out	1		·	
INPU	F/OUTPUT:			Туре			Function			Speed	
	<u> </u>						†				
	· · · · · · · · · · · · · · · · · · ·	1				 	 			0 2005	
iagnetic	drum	Inte	rnal	819)2	200	4 mg	0_	Parall	8"long	250 rps
					·	Channe Is	Max.	Min.]	1.00	
т	/pe	Fund	tion		in ords	Magnetic Tracks, or Acoustic		•	Mode	Length or CRT Type	of Motion
	STORAGE:				acity	No. of CRT				Drum Diam.,	Speed
Excl. of A	ccess		4-8	ILB	0.1	-1 ms ().l-1 m				
Inci. Access	Max.		 		 						
	SPEED:	Transfer	700	ition	MUTCIS	lication	Division	+			

TAPE SEARCH: None.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: 250 kc.

COMPUTING ELEMENT: Tubes.

COMPONENTS: 1700 tubes, 2000 crystal rectifiers.

REMARKS:

(Postal Telecommunications Electronic Automatic Calculator)
BUILT BY: Central Laboratory, P&TS, the Hague
INSTALLATIONS: Central Laboratory of the Postal and Telecommunications

Services, the Hague, the Netherlands

COMES AVAILABLE: NO

PROGRAMMING SERVICE: Not available computing time: Not available

floor area: 6 ft. x 12 ft.

POWER CONSUMPTION: 8-9 kw

cooling: FIRST READY FOR USE: January 1953

BEST SUITED FOR: General purpose, filter and antenna design

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING

OPERATING	SCHEDULE:	ENG I NE	ERING		ROBLEM SOLVIN	IG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	Idle	Total
	Hrs/Wk							
	Percent							

PERSONNEL: Estimated: 1 operator, 1 maintenance man, 3 mathematicians, 3 programmers.

NUMBER BASE: 2 (only 10 externally)

WORD LENGTH: 31 binary digits (instructions 18 binary digits)

NUMBER RANGE: -1 to 1
NEGATIVE NO. REP.: Ones' complement

INSTRUCTION TYPE: One-address
SEQUENCE CONTROL: General store

OPERATIONS: Add, subtract, multiply, divide, read, print, stop, conditional

skip.

										to a second control of the control o	
•	SPEED:	Transfer	Add	ition	Multip	olication	Division	Con	ditions	l skip	er Heller
	Min.		50) ms	75	ms	:	. 2	5 ms		
inci. Access	Max.		50		75	ms		2	5 ms		
Excl. of A	ccess			:							
	STORAGE:				acity	No. of CRT Magnetic				Drum Diam., Length	Speed
Ţ	ype	Fu	nction	•	rds	Tracks, o	rl		Mode	or CRT Type	Motion
				1		Channels	Max.	Min.			
Magnetic	drum	Int	rnal	10	24	32	25ms	.25ms	Serial	8"dia.	2400rp
			ture:	20	48	64				10"long	
									1	1	
INPU"	T/OUTPUT:			Туре			Function		:	Speed	
		Punche	i pape	er ta	pe		Input	20	decimal	digits/	sec.
		Typewriter					Output	10	decimal	digits/	sec.
								-			
	1										

TAPE SEARCH: None

ARITHMETIC MODE: Serial; parallel mult. CLOCK FREQ.: 50 kc

COMPUTING ELEMENT: Kirchoff-adder; multiplicands stored on relays.

COMPONENTS: 650 tubes, about 20 crystals, 120 relays

REMARKS: The successive digits of a word are stored in every 32nd location around the drum so as to permit serial operations as the digits appear. The computer makes very economical use of registers, three 31-digit registers sufficing for instruction register, program counter, multiplicand storage, and double-length accumulator.

BUILT BY: Eidgenossische Technische Hochschule, Zurich. INSTALLATIONS: Eidg. Techn. Hochschule, Institut für angewandte Mathematik, Zurich, Switzerland.

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available. COMPUTING TIME: Available.

FLOOR AREA:

POWER CONSUMPTION:

FIRST READY FOR USE: 1955.

COOLING:

est suited for: Partial differential equations.

BES1 3011ED FOR.	Lat. ATC	r griteren	ATOT CAME	, = 0,110 0			
OPERATING SCHEDULES	ENG	INEERING		PROBLEM SOLVIN	lG _.		Total
	Sched. Main	nt. Eng. Dev.	Error-Free	Erroneous	Repair	ldle	iotai
Hrs/Wk						<u> </u>	
Percent						<u> </u>	L

PERSONNEL:

NUMBER BASE: 10 (2*,4,2,1 representation).

WORD LENGTH: 15 decimal digits (instructions 7 decimal digits).

NUMBER RANGE: ±10-99 to ±1099.

INSTRUCTION TYPE:

NEGATIVE NO. REP.: Absolute value & signequence control: General store. OPERATIONS: Addition, subtraction, multiplication, division.

	SPEED:	Tra	nsfer	Add	tion	Multip	lication	Division				
ncl. Access	Min.					-	<u> </u>					
Excl. of A	ccess	1/2	ms	5 I	18	20	ms	40 ms				
	STORAGE:		Func	tion	,	acity in ords	No. of CRI Magnetic Tracks, o Acoustic Channels	Tin		Mode	Drum Diam., Length or CRT Type	Speed of Motion
agnetic (drum		Inte	rnal	10,0	000	200			Ser.par		
								1			Speed	
INPUT	r/OUTPUT:		ached	car	Type ls			Function In&Out	8		er sec.	
		Pr	inter					Output	0.5	words I	er sec.	
•									1			

TAPE SEARCH:

ARITHMETIC MODE: Serio-parallel.

CLOCK FREQ .: 30 kc.

COMPUTING ELEMENT: Crystal rectifiers.

COMPONENTS: 1200 tubes, 500 crystals, 200 relays.

REMARKS: This computer uses a floating decimal point. It incorporates automatic checking of all transfer and arithmetic operations.

RAYDAC (Raytheon Digital Automatic Computer)

BUILT BY: Raytheon Mfg. Co., Waltham, Massachusetts

INSTALLATIONS: Naval Air Missile Test Center

Point Mugu, California

(Contract to build RAYDAC administered by the Special Devices Center of ONR, funded by Bureau of Aeronautics,

U.S.Navy.)

Not available. COPIES AVAILABLE:

Probably available. PROGRAMMING SERVICE:

Probably available. COMPUTING TIME:

FLOOR AREA:

200 sq.ft. POWER CONSUMPTION: 28 kw. Liquid Freon cool-RST READY FOR USE: July 1953. COOLING:

Data reduction and general large-scale computations. BEST SUITED FOR: PROBLEM SOLVING ENGINEERING OPERATING SCHEDULE: Total ldle Repair Error-Free Erroneous Sched. Maint. Eng. Dev. Hrs/Wk Not established. Percent

PERSONNEL: 4 operators, 14 maintenance, 25 mathematicians, 5 clerical,

4 in training as programmers and coders.

NUMBER BASE: 2 (externally 2,8, and 10).

WORD LENGTH: 30 bits (instructions 54 bits). INSTRUCTION TYPE:

Four-address. NUMBER RANGE: -1 to 1. NEGATIVE NO. REP.: Sign & absolute valuesequence CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, division, shifting,

branch orders, automatic normalization, semi-automatic

double-precision orders, floating-point orders, tape orders.

Tran	sfer	Addit	ion	Multip	lication	Divisio	n	+				
115	118	134	u.s	29	6 и в	470 p	s				_	
				144	Ous	<i>بر'</i> 1620	8				\dashv	
	/	48	us	21	.0 /vs	380 W	S	10	jus]	نسريب		
	7		Cap	acity								Speed of
	_	. 1					i me		Mode	1		Motion
	Func	tion	WO	ras							•	er de de transporte de la companya d
- 1					Channels	Max.		Min.			- 2	
Tine	Int	ernal		1152	36	305 M	3 1	9 //8	Seria	$1 305 \mu$	S	
			400	0,000	6	4 mir	1	9/18	Ser-I	ar		30"/se
							丄					
$\neg \uparrow$,								
							L					A THE
			Туре			Functi	on			Speed		
Ver	host	A				Input	;	14	words	/min		
						Outpu	ıt					
)e	· ·		In-O	ıt	400	words	sec		
	115 975 48 Line	Iine Int Ext Keyboar Typewri	115 µs 134 975 µs 1280 48 µs 48 Function Iine Internal External Keyboard Typewriter	115 µs 134 µs 975 µs 1280 µs 148 µs 48 µs Cap Function Wo Iins Internal External 400 Type Keyboard	115 µs 134 µs 29 975 µs 1280 µs 144 148 µs 48 µs 21 Capacity in Words Iins Internal 1152 External 400,000 Type Kayboard Typewriter	115 µs 134 µs 296 µs 975 µs 1280 µs 1440 µs 1440 µs 148 µs 210 µs Function Capacity No. of CR Magnetic Tracks, o Acoustic Channels	115 134 148 296 1490	115 µs 134 µs 296 µs 470 µs 975 µs 1280 µs 1440 µs 1620 µs 48 µs 48 µs 210 µs 380 µs Capacity No. of CRT Magnetic Tracks, or Accustic Channels Max. Iins Internal 1152 36 305 µs 1 External 400,000 6 4 min.1 Type Function Type Function Type Function Type Output	115 μs 134 μs 296 μs 470 μs 172	115 134 148 296 1490	115 μs 134 μs 296 μs 470 μs 172 μs	115 µs 134 µs 296 µs 470 µs 172 µs 975 µs 1280 µs 1440 µs 1620 µs 1035 µs 48 µs 48 µs 210 µs 380 µs 105 µs Capacity in Words Magnetic Tracks, or Access Time Mode OrumDiam., Length or CRT Type

TAPE SEARCH: Possible in both directions.

CLOCK FREQ .: 3.77 mc in memory. ARITHMETIC MODE: Parallel. COMPUTING ELEMENT: Flip-flops, diode gating.

COMPONENTS: 5200 tubes, 17 300-crystal rectifiers, 630 relays.

REMARKS: Fully-automatic built-in self-checking on computation, transfer, selection and control. Each word carried a 4-bit check number (weighted sum of bits) which is recalculated and checked after transfers. For arithmetic check, a 5-bit check number is calculated for each operand and for result, and appropriate checks are calculated for these. See MTAC 24, 286-295 (October 1948).

BUILT BY: Institut für Praktische Mathematik, Technische Hochschule, Darmstadt

INSTALLATIONS: Technische Hochschule, Darmstadt, Germany.

(The development of the computer has been supported by the Deutsche Forschungsgemeinschaft and ERP Authority.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available.
COMPUTING TIME: Available.

FLOOR AREA:

POWER CONSUMPTION:

COOLING:

FIRST READY FOR USE: End 1953.

BEST SUITED FOR: General purpose.

OPERATIO	IG SCHEDULE:	ENGINE	ERING	ſ	PROBLEM SOLVII	NG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk							
	Percent							

PÉRSONNEL:

NUMBER BASE: 10 (excess-three code).

WORD LENGTH: 12 decimal digits (instructions equivalent of 5 decimal digits).

NUMBER RANGE: Variable dec. point. INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP.: Complement.

SEQUENCE CONTROL: Special drum store.

OPERATIONS: Addition, subtraction, multiplication, division, conditional

transfer.

	SPEED:	Tra	nsfer 🗠	Add	ition	Multip	lication	Division				
ncl. Access	Min.	0,	4 ms	0.4	4 ms	40	ms	40 ms				
nci. Access	Max.	20	ms	20	ms	60	ms	60 ms				
Excl. of A	ccess	0,	4 ms	0.4	4 ms	6	ms	20 ms				
	STORAGE:		Funct	ion	i	icity n rds	No. of CRT Magnetic Tracks, or Acoustic	Ti		Mode	Drum Diam., Length or CRT Type	of
·							Channels		Min.	1		
Magnetic	drum		Inter	rnal	50	0	10	20 ms	0	Serial	8#	3000rpm
	<u> </u>	_	Insti	es.	50	0	5	20 ms	0	Serial		
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,												
	· · · · · · · · · · · · · · · · · · ·									ļ	<u> </u>	<u> </u>
INPUT	/OUTPUT:	أحد			Түре			Function		<u>i </u>	Speed	
		Par	ched	tape				Input		charact	ers per	second
	1	Tar	e por	ich				Output			ers per	
	l.		pewrit					Output	10		ers per	
	1	Th	ched		·			In&Out	I _	_	r second	

TAPE SEARCH: None.

ARITHMETIC MODE: Serial.

CLOCK FREQ.: 150 kc.

COMPUTING ELEMENT: Germanium diode networks.

COMPONENTS: About 300 tubes, 1000 crystal rectifiers, and 100 relays.

REMARKS: Marginal checking is incorporated in the computer.

BUILT BY: Remington Rand Inc. INSTALLATIONS: About 40 in use.

copies available: For sale or rent.

PROGRAMMING SERVICE: Available at Remington Rand offices. COMPUTING TIME: Available at Remington Rand offices.

FLOOR AREA: 43.6 sq. ft.

POWER CONSUMPTION: 10 kva.

cooling: 3-ton air cond. FIRST READY FOR USE: December 1951. BEST SUITED FOR: Punch-card accounting and scientific computing.

						1 - C - C - C - C - C - C - C - C - C -	· •	
OPERATING	S SCHEDULE:	ENGINE	ER ING	F	ROBLEM SOLVII	NG	THE STATE	
	·	Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldlê	Total
	Hrs/Wk	None	None	29.1	0.4	0.5	10	40
	Percent			72.75	1.0	1.25	25	100

PERSONNEL: \$ operator, 1 maintenance man, \$ programmer. maintenance is provided by Remington Rand.

NUMBER BASE: 10 (represented by none, one, or two out of five pulses; or true

WORD LENGTH: 10 digits.

decimal).

NUMBER RANGE: 10 digits.

instruction type: Prewired on plugboard.

NEGATIVE NO. REP .: By control.

SEQUENCE CONTROL: Plugboard.

OPERATIONS: Shifting decimal, alignment, transfer and intermediate functions,

addition, subtraction, multiplication, division. The low live and the low

	<u> </u>									
SPEED:	Transfer	Add	ition	Multip	lication	Division		1, 2, 977	. 3	
Min.										
Max.					V. 4					, toget with think there is secure age to
ess	a a la la la								* :	i anazan
	Func	tion	1	n	Magnetic Tracks, o	Time		Mode	DrumDiam. Length or CRT Type	Speed of Motion
·					Channels	Max.	Min.			Se
	Inter	rnal	10 d	igit	5			Paral:	lel	
									en de la companyona de la companyona de la companyona de la companyona de la companyona de la companyona de la	As on a second
									THE GAS	
						20.0			NA 7 34 7 534 1	1004164
		124.4							5 1.24° 848	12.00
OUTPUT:			Туре			Function			Speed	: FURRAY
	Punch ca	ards				In&Out	150	cards	per min.	Section of the sectio
										A Secretary
								1 g g 127		
	Min. Max. cess TORAGE:	Min. Max. cess TORAGE: e Func	Min. Max. cess TORAGE: Internal	Min. Max. cess TORAGE: Capa i Function Wo Internal 10 d	Min. Max. cess TORAGE: Capacity in Words Internal 10 digit OUTPUT: Type	Min. Max. cess TORAGE: Function Capacity in Magnetic Tracks, or Acoustic Channels Internal 10 digits OUTPUT: Type	Min. Max. cess TORAGE: Function Capacity in Magnetic Tracks, or Acoustic Channels Max. Internal 10 digits OUTPUT: Type Function	Min. Max. cess TORAGE: Function Capacity in Magnetic Tracks, or Acoustic Channels Internal 10 digits OUTPUT: Type Function Function Function Function Function Function Function Function Function	Min. Max. cess TORAGE: Function Capacity in Magnetic Tracks, or Accustic Channels Max. Min. Internal 10 digits Paral: OUTPUT: Type Function	Min. Max. Cess TORAGE: Function Capacity in Magnetic Tracks, or Access Time Mode or CRT Type Function Internal 10 digits Parallel OUTPUT: Type Function Type Function Speed Punch cards Internal Internal Type Function Function Speed Function Function Speed Function Speed Function

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .:

COMPUTING ELEMENT: 22 ring counters.

components: 1500 tubes, 200 relays.

REMARKS: Forty algebraic program steps can be performed for each card; any number of repetitions of parts of this sequence can be obtained. Storage is checked by returning "echo" pulses to the accumulator and subtracting to obtain zero.

SEAC

(Standards Eastern Automatic Computer)

BUILT BY: Electronic Computer Laboratory, National Bureau of Standards

INSTALLATIONS: National Bureau of Standards, Washington, D. C.

Machines based on SEAC are located at NBS (DYSEAC); AFMTC.

Cocoa, Florida (FIAC); and at the University of Michigan (MIDAC).

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE: Available through Applied Mathematics Division. NBS.

COMPUTING TIME: Available through Applied Mathematics Division, NBS.

POWER CONSUMPTION: 15 km. FLOOR AREA: 150 sq. ft.

cooling: 2000 CFM at 50 F. FIRST READY FOR USE: May 1950.

BEST SUITED FOR: General computation service and engineering development.

					~ ~ ~~~ ~~ ~~ ~~	Parent and	CO A OT O Dett	CALUE
OPERATING	SCHEDULE:	ENG I NE	ERING	F	PROBLEM SOLVII	NG .		
_		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
. [Hrs/Wk				•			
F	Percent	•						

PERSONNEL:

NUMBER BASE: 2 internally; 16 externally, allowing decimal input and output.

WORD LENGTH: 44 binary digits and sign.

NUMBER RANGE: -4 to 4. INSTRUCTION TYPE: 4- and 3-address. NEGATIVE NO. REP.: Abs. value & sign. SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply (high-order, low-order, rounded), divide,

substitute digits, logical product, conditional jumps, input,

output.

	SPEED	Tra	nsfer	Add	ition	Multip	lication	Division					
Incl. Access	Min.				2.ms		4 ms	2.4	ne	So	eed wi	th e-s m	- V-rome
ING! ACCESS	Max.				5ma	3.	6 ms	3, 6 :	นเร	i	acludi	ne acces	
Excl. of	Access		:	0.	05 as	2.	1 ms	2.1	ne			•	
	STORAGE					city	No. of CRT Magnetic					Drum Diam. Length	, Speed of
. 1	'ype		Func	tion		rd s	Tracks, or Acoustic	•			Mode	or CRT Type	1 -
							Channels	Max.	M	n.		,	
Mercury ?	Delay :	وهذا	Inte	rnal	51	.2	64	384 228	48	AL#	Seria	18 words	1
MMS. MIGC	irosta	110	Inte	rnal	51	2	45	12'M	12	/116	Farelle	1 50P1.31	dri.
Magnetik	Tope Ur	ite	Exte	rnal	2600	Oea.	1		0.4	200	Saria	1200108	Sft/sec
Ay theon	Tape (nit	Exte	rnal	7200	Otra	k 4		0.]	.000	Seria	1 800 ft.	4547/sec
INPL	JT/OUTPUT				Type			Function				Speed	
	•	20.	etyp	e Pr	inter	& K	yboard	In-Out	6	al	aracte	ers/sec.	
		Pur	ched	Tel	etype	Tap	0	In-Out	. 6	G)	naract	ers/sec.	
		Xa	pne ti	c Wi	re (P	eiro	e)	In-Out	3			ry digita	/800.

TAPE SEARCH: Possible in both direction.

CLOCK FREQ .: 1 megacycle. ARITHMETIC MODE: Serial.

COMPUTING ELEMENT: Germanium diode switches, tube amplifiers, and delay lines. COMPONENTS: 1300 tubes; 15,800 crystal diodes; 10 relays.

REMARKS: Development supported by USAF, Dept. of Defense, NBS. Odd-even memory check built in. For further information, see "The NBSMAC," by S. N. Alexender in the proceedings of the joint AIEE-IRE computer conference, Feb., 1952, pp 84-89, and

"Engineering experience with the SEAC," by Ralph J. Slutz.

pp. 90-94.

BUILT BY: Experimental Towing Tank, Stevens Institute of Technology INSTALLATIONS: Experimental Towing Tank, Stevens Institute of Technology, Hoboken, New Jersey

COPIES AVAILABLE: May be available for sale.

PROGRAMMING SERVICE: To be available.

COMPUTING TIME: To be available

FLOOR AREA: 300 sq. ft. POWER CONSUMPTION: 2.5 kw. cooling: No additional req. FIRST READY FOR USE: May 1953

T SHITED FOR. To be used for hydrodynamic research.

 G SCHEDULE:		ENGINE				ROBLEM SOLVIN			
	Sched.	Maint.	Eng.	Dev.	Error-Free	Erroneous	Repair	ldle	Total
Hrs/Wk									
Percent						,			<u> </u>

PERSONNEL:

NUMBER BASE: 2 (externally 10; 8, 4, 2, 1 code).

WORD LENGTH: 24 binary digits.

NUMBER RANGE: -1 to 1 INSTRUCTION TYPE: Special.

NEGATIVE NO. REP.: Absolute value & sign. SEQUENCE CONTROL: Special store and punched cards.

OPERATIONS: Digital integration, input-output, decimal-binary and binary-

decimal conversion. The computer cannot alter its own instructions.

		Typewi	riter				Output	73	dec. d:	ig./sec.	
		Punche	d Car	ls			Input	30	bits/se	ec.	<u> </u>
INPU	T/OUTPUT:			Туре			Function			Speed	
•									1	حصينات	
						1					
Magnetic	Drum	Int	ernal	160	0					10*dia.	1800rm
						Channels	Max.	Min.	1		
Т	уре	Fu	nction		in ords	Magnetic Tracks, or Acoustic	Tin	ne	Mode	Length or CRT Type	of Motion
	STORAGE:			Сар	acity	No. of CRT				Drum Diam.,	
Excl. of	ccess										
ncl. Access	Max.										
	Min.										
	SPEED:	Transfer	Addi	tion	Multi	dication	Division				

TAPE ŞEARCH:

ARITHMETIC MODE: Serial

CLOCK FREQ .: 104 kc.

COMPUTING ELEMENT: Integrators and adders.

COMPONENTS: 450 tubes, 3000 crystal rectifiers, 25 relays.

REMARKS: This computer is very similar to MADDIDA. It contains 100

integrators, each with a constant multiplier.

SWAC (Standards Western Automatic Computer)

BUILT BY: National Bureau of Standards, Los Angeles, California
INSTALLATIONS: Institute for Numerical Analysis, National Bureau of
Standards. (Financial support contributed by the Flight
Research Laboratory, Wright Air Development Center.)

COPIES AVAILABLE: Not available.

PROGRAMMING SERVICE: Available to government agencies and contractors.

COMPUTING TIME: Available to government agencies and contractors.

FLOOR AREA: 75 sq. ft. POWER CONSUMPTION: 30 kw

cooling: 4000 cu. ft./min. First READY FOR USE: 1 January 1952.

BEST SUITED FOR: General-purpose; problems with small am't of input & output.

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING ldle Total Sched. Maint. Eng. Dev. Erroneous Repair Error-Free Hrs/Wk 45 80 10 15 56 19 100

PERSONNEL: 12 operators, 6 maintenance men, 6 mathematicians.

2 clerks.

NUMBER BASE: 2

WORD LENGTH: 36 binary digits.

NUMBER RANGE: -1 to 1. INSTRUCTION TYPE: Four-address

NEGATIVE NO. REP .: Abs. value and sign. SEQUENCE CONTROL: General store

OPERATIONS: Arithmetic and logical operations, no divide.

	SPEED:	Trans	fer	Addi	ition	Multip	lication	Divisio	EZ	tract		
	Min.	64	/us	64	ALS.	381	l Als		6	4 113		
Incl. Access	Max.		716	*1	7 ₁₈	**	7 300		38	4418		
Excl. of A	ccess	17	Ħ	78	特	38	10					
т	STORAGE:		Func	tion		acity in ords	No. of CRT Magnetic Tracks, or Acoustic	Ti	ess	Mode	Drum Diam., Length or CRT Type	Speed of Motion
							Channels	Max.	Min.			·
Electros	tatic		Int	erna	2	56	37			Parall	el SJPlA	
Magnetic	drum				40		128	16ms	16ms	Serial	81 nd.x	3600rp
(under	const.							L	<u> </u>	<u> </u>	30"long	
									1	<u> </u>		
									<u> </u>	<u> </u>		<u> </u>
INPUT	r/OUTPUT:[Туре			Functio	n		Speed	
	1	Туре	wri	ter	<u>.</u>		·	In&Ou	t			
		Pape	er T	ape				In&Ou	t			· · · · · · · · · · · · · · · · · · ·
		Punc	ched	Car	ds			In&Ou	t L			

TAPE SEARCH:

ARITHMETIC MODE: Parallel

CLOCK FREQ .: 125 kc

COMPUTING ELEMENT: Flip-flop

COMPONENTS: 2300 tubes. 3000 crystals.

REMARKS:

TAC (Tokyo Automatic Computer)

Tokyo Shibaura Electric Manufacturing Company

INSTALLATIONS:

Department of Electrical Engineering, University of Tokyo (The Japanese Ministry of Education contributed financial

support to the development of TAC.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 2300 sq. ft.

POWER CONSUMPTION: 7.5 kw.

FIRST READY FOR USE: April 1954.

COOLING:

BEST SUITED FOR: General purpose.

OPERAT I

ING	SCHEDULE:	ENGINE	ERING	F	ROBLEM SOLVIN	lG	idle	Total
ING		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	Tute	
Γ	Hrs/Wk							
Г	Percent		,			<u> </u>	L	L

PERSONNEL:

NUMBER BASE:

2 (10 externally).

WORD LENGTH: 35 bits (instructions 17 bits)

NUMBER RANGE: Variable.

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Addition, subtraction, multiplication, division, shift,

conditional transfer, input, output.

	SPEED	Tran	nsfer				lication	Division				
	Min.	432	A18	144				9.9 ms	 			
ncl. Access	Max.	576		2 88	้นธ			0.0 ms				
Excl. of	Access	432	/us	144	us	4.	8 ms	9.9 ms				
	STORAGE:		Func	tion	į	acity n rds	No. of CRT Magnetic Tracks, of Acoustic Channels	Tim		Mode	DrumDiam., Length or CRT Type	of
							8	14448		Serial	3**	
electros				rnal		12				Parelle		
Magnetic	Drum		Exte	rnal	15	36	35	30 ms		Lorerre		
			ļ				 	+				
					├		 					
		. 	<u> </u>		Туре			Function			Speed	
INP	UT/OUTPUT	m _a	ne R	ender				Input				
			Tape Reader Typewriter					Output			·	
								<u> </u>	+			
								1				

TAPE SEARCH:

Serial. ARITHMETIC MODE:

CLOCK FREQ .: 250 kc.

COMPUTING ELEMENT:

COMPONENTS: REMARKS: 1200 tubes, 2400 crystal rectifiers, a few relays. Input and output decimal. Number represented between -1 and 1 with a multiplier of 2 k where k ranges

from 0 to 63.

TC-1 (Telemeter Computer Model #1)

BUILT BY: International Telemeter Corp., Los Angeles, California.

INSTALLATIONS:

COPIES AVAILABLE: Can be made available for sale or for rent.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 30 sq. ft.

POWER CONSUMPTION: 50 kw.

cooling: 72 ton refrigeration. FIRST READY FOR USE: Spring 1955.

BEST SUITED FOR: General scientific computation.

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING
Sched. Maint. Eng. Dev. Error-Free Erroneous Repair
Hrs/Wk
Percent

PERSONNEL:

NUMBER BASE: 2 (10 or 16 externally).

WORD LENGTH: 40 binary digits (instructions 20 binary digits).

NUMBER RANGE: -1 to 1-2-39. INSTRUCTION TYPE: One-address

NEGATIVE NO. REP.: Twos' complement SEQUENCE CONTROL: General store.

OPERATIONS: Add, subtract, multiply, divide, transfer, logical decision.

							·							
	SPEED:	Tran	sfer	Addi	tion	Multip	lication	Divi	sion	\perp				
	Min.	20	μs	52	s Ms	71	0 ps	752	μs	\dashv				
Incl. Access	Max.	40	้นร	72	2/128	73	0 /us	772	វាន	4				
Excl. of A	ccess	20	Jus	3:	2 rus	69	O'nas	732	/0.8				- 	
	STORAGE:		7			acity	No. of CR		Acce				Drum Diam. Length	, Speed of
-			Func	tion		in rds	Magnetic Tracks, o		Tir	ne		Mode	or CRT Type	1 .
' '	pe		, 4,,,,				Acoustic Channels		۲.	М	in.		1	
Electrost	atic		Inte	rnal	10	124	40	40	MS	20	vra	Paralle	1 3KP1	
(Willia		e)							7	Ĺ			 	
Magnetic	Drum		Exte	rnal	81	192	160	17	ms	80	ns	Serial	8½ dia	•
							_	-		-			_	
			-		Tuna		<u> </u>	Fun	ctio	+		L	Speed	
INPUT/OUTPUT:			Type IBM Collator							Input 24			min.	
			IBM Summary Punch						pu	_		cards		
			Flexowrtier Tape						rut		10	charac	ters/se	c
			lexowriter Tape					Out		t L	10	charac	ters/se	c

TAPE SEARCH:

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: No clock.

COMPUTING ELEMENT:

COMPONENTS: 3500 tubes, no crystals, no relays.

REMARKS: Design of this computer is based on ORDVAC, hence indirectly its logical design is based on the IAS computer. Actual construction has not started yet

(April 1953) and is pending completion of contract.

Tokyo Mark I

(Pilot Model of Large Scale Automatic Relay Computer)

BUILT BY: Laboratory of Applied Mathematics, Electrotechnical Laboratory,

INSTALLATIONS: Laboratory of Applied Mathematics.

Tokyo, Japan.

COPIES AVAILABLE: Not available PROGRAMMING SERVICE: Not available COMPUTING TIME: Not available

FLOOR AREA: 80 sq. ft.

POWER CONSUMPTION:

cooling: None

FIRST READY FOR USE: March 1953

BEST SUITED FOR: Constructed primarily as pilot model.

OPERATIN	G SCHEDULE:	ENG I NE	ERING	F	ROBLEM SOLVIN	IG		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	idle	Total
	Hrs/Wk							
	Percent							

PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 16 bit

NUMBER RANGE: Variable

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP .: Sign bit & abs. val. sequence control: Plugboard

OPERATIONS: Add, subtract, multiply, divide, decimal-binary and binary-

decimal conversion.

	SPEED:	Transfer	Addit	ion Multi	plication	Division				
ncl. Access	Min. Max.		50 n	ns 20	00 ms	200 ms				
Exci. of A	ccess									
	STORAGE:	Func	tion	Capacity in Words	No. of CRT Magnetic Tracks, or Acoustic Channels	Time		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Relay		Inte	rnal	6				Parall	P.	
INPUT	/OUTPUT:			уре		Function	ļ		Speed	
	Ĺ	Keyboard				Input				
	-	Display	isplay Panel				-			·
	ŀ						 			

TAPE SEARCH:

ARITHMETIC MODE: Parallel

CLOCK FREQ.:

COMPUTING ELEMENT: Relays

COMPONENTS: 1500 relays

REMARKS: Range of numbers 2-9-1 to 1-2-9 times 2 from 0 to 15. Adder and multiplier-divider are separate

units and may operate simultaneously.

BUILT BY: Laboratory of Applied Mathematics, Electrotechnical Laboratory,

INSTALLATIONS: Laboratory of Applied Mathematics

Tokyo, Japan

(The development of the computer is supported by the Agency of Industrial Science and Technology, Ministry of International

Trade and Industry, of the Japanese government.)

COPIES AVAILABLE: Not available.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 50 sq. ft.

POWER CONSUMPTION:

COOLING: None.

FIRST READY FOR USE: March 1954.

BEST SUITED FOR: General purpose.

OPERATIN	G SCHEDULE:		ENGINE	ERING		F	ROBLEM SOLVII	NG .		
1		Sched.	Maint.	Eng.	Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk									
	Percent									

PERSONNEL:

NUMBER BASE:

2 (10 externally). and sign, 7 bits for exponent and sign.

WORD LENGTH: 42 bits (instructions no more than 30 bits). 35 bits for factor

NUMBER RANGE: Variable. INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .: Sign bit & abs. val. SEQUENCE CONTROL: Paper-tape (non-alterable).

OPERATIONS: Add, subtract, multiply, divide, decimal-binary and binary-

decimal conversion.

	INPUT/OUTPUT: Te			. Jhe			Input Output				
INPUT	/OUTPUT:			Туре		L	Function	<u> </u>	1	Speed	
<u> </u>											
-				<u> </u>	-		<u> </u>	<u> </u>	<u> </u>		
Relay		I	nternal	10	00				Paralle	1	
Ту	pe		Function	Wo	rds	Tracks, or Acoustic Channels	L	Min.	Mode	or CRT Type	Motion
	STORAGE:			i	icity n	No. of CRT Magnetic	Ti			DrumDiam., Length	Speed of
Excl. of A	ccess							-			
ncl. Access	Min. Max.	· · · · · ·	70	ms	300	ms	300 m	-		-	
	SPEED:	Trans	Ter Add	ition	Multi	plication	Divisio	1			

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: No clock.

COMPUTING ELEMENT: Relays.

components: 50,000 relays.

REMARKS: Numbers range from 2^{-33} -1 to $1-2^{-33}$ times $2^{\pm k}$ where k varies from 0 to 63. Adder and multiplier-divider are separate and may operate simultaneously. Transfer is always checked by automatic circuits which automatically correct errors within their capacity and otherwise stop computer. Separate 30-hole and 42-hole tape readers are used for instructions and numbers.

Telecommunications Research Establishment (Radar Res. Est.)

INSTALLATIONS:

Telecom. Res. Est., Great Malvern, England (The British

Ministry of Supply supported the development of the computer.)

COPIES AVAILABLE:

No.

PROGRAMMING SERVICE: Not available.

COMPUTING TIME: Not available.

14 ft. x 6 ft. FLOOR AREA:

POWER CONSUMPTION: 10 kw

COOLING:

2050 cu. ft./min.first READY FOR USE: Summer 1953.

BEST SUITED FOR:

General purpose.

OPERATING	G SCHEDULE:		ENGINE	ERING	F	ROBLEM SOLVIN	IG		
		Sched.	Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk						<u> </u>		
-	Percent								

PERSONNEL:

NUMBER BASE:

2 (10 externally).

WORD LENGTH:

24 binary digits.

NUMBER RANGE:

-1 to 1-2

INSTRUCTION TYPE: One-address.

NEGATIVE NO. REP .:

Twos' complement. SEQUENCE CONTROL:

General store.

OPEFATIONS:

Add, subtract, transfer, shift right, jump, conditional jump, input, stop; and the logical operations "and", "or".

"and/or", and "equivalence"; no multiply or divide.

· .	SPEED:	Tra	nsfer	Add	ition	Multip	lication	Divisio	1	Mos	t othe	re		
	Min.	40	us	40	us	<u> </u>				40	μs			
Incl. Access	Max.	40	us	40	us	Abou	t 10ms	(pro-		40	μs			
Excl. of	Access		/		/			gramme	4				i	·
т	STORAGE:		Func	tion	·	acity in ords	No. of CR Magnetic Tracks, c Acoustic Channels	Ti	me	Min.	Mode	- 1	rum Diam. Length or CRT Type	of
Electrost	atic		Inte	rnal	Pres		24		5	μs	Paral	141		
Electrost	atie		Inte	rnal	Fid	16	24	1	5.	μs	Paral	161	VCRX2	66
Magnetic	drum		<u> </u>				<u> </u>		╄			-	· ·	
Mode	I		Exte	rnal	65.	536_	24						limais	
Mode	TT		Exte	rnal	2.0	148	24	40 ms	ررا	عبرد	Paral) 9#7 or	<u> </u>
INPL	T/OUTPUT:				Type			Functio	n	<u>'</u>	<u></u>	S	peed	
		Pun	ched '	tape	(5-)	nole)		In-ou	t	10	rows	sec	cond	
			eprin					<u> </u>	_					
•								1	- [

TAPE SEARCH:

None.

ARITHMETIC .MODE:

Parallel.

CLOCK FREQ .: 100 kc

COMPUTING ELEMENT:

Tubes.

2000 tubes, 1000 crystals, 25 relays.

COMPONENTS: REMARKS:

This computer uses two wires to transfer each binary digit, one for 0, the other for 1. Similarly each register uses two flip-flops per digit, of which only one must be flipped. With the drum in mode I, the heads, mounted on a bridge, each traverse a 32-revolution helix in l_4^1 sec., returning in

another (unusable) $1\frac{1}{2}$ sec. In mode II the heads remain

fixed over a 33rd track.

UNIVAC (Universal Automatic Computer)

BUILT BY: Eckert-Mauchly Division of Remington Rand, Inc., Phila., Pa. INSTALLATIONS: #1 Bureau of the Census, Commerce Dept., Suitland, Maryland. #2 Office of the Air Comptroller, USAF, Washington, D.C. #3 Army Map Service, U.S. Army, Washington, D.C. #4 New York University (for Atomic Energy Commission), N.Y., N.Y. #5 University of California Radiation Laboratory, Livermore, Calif. #6 David Taylor Model Basin, U.S. Navy Bureau of Ships, Carderock, COPIES AVAILABLE: For sale. Md. PROGRAMMING SERVICE: Available on #4 & 5 to AEC contractors et al., on #6 to BuShips COMPUTING TIME: Available on #3 on military priority and as above. FLOOR AREA: About 25'x50'. POWER CONSUMPTION: 120 kva. COOLING: 35 tons/26.000cfm. FIRST READY FOR USE: 3/51, 152, 1/53, 5/53, 4/53, 7/53. BEST SUITED FOR: General-purpose computing with large amounts of input and storage. OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING Instruct'd of #2/#3/#4 Tota! Sched. Maint. Eng. Dev. Erroneous Error-Free Debugging Repair Hrs/Wk 34/16/24 34/10/24 25/-/ 0 75/110/114 0/0/5 68/136/168 45/81/69 0/0/3 20/7/14 15/-/-20/12/14 PERSONNEL: On #2/#4/#5/#6: -/10/8/6 operators, 10 to 12/5/8/7 maintenance men, 15/31/20/15 mathematicians, $-\frac{5}{4}$ clerical, $-\frac{15}{-111}$ in training, 4/-/- /- on auxiliary equipment. NUMBER BASE: 10 (excess-three code), alphameric (6-bit code plus check bit). WORD LENGTH: 12 characters, including sign (instructions 6 characters). NUMBER RANGE: 10-11-1 to 1-10-11. INSTRUCTION TYPE: One-address (two per word). NEGATIVE NO. REP .: Magnitude and sign. SEQUENCE CONTROL: General store. OPERATIONS: Addition, subtraction, multiplication, division, branch orders. input, output, tape orders, logical multiplication, store program-counter contents. Transfer Addition Multiplication Division Comparison

Incl. Access	404	LIB	525	u.s.	2.1	5 ms	3.89 1	as 365	// S		
Max.									/		
Excl. of Access	<u>40</u>	4 118	285	us	<u> </u>						
STORAGE:		Funct	tion	· 1	acity in rds	No. of CRI Magnetic Tracks, o Acoustic Channels	T i		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Mercury delay 1	ines	Inte	erna.	10	00	100			Serial		
10 magnetic ta	pes	Exte	erna.	. 96,	000	8	B min.			r.1500 ft.	100%/se
				per	tape					per tap	
INPUT/OUTPUT:				Туре			Function			Speed	
•	Ma	gneti	ic te			1.e	In& Ou		5 words	per sec	ond.
	Ty	pewri	lter				Output	; 11	charac	ters per	second

TAPE SEARCH: Possible in both directions.

ARITHMETIC MODE: Serial.

CLOCK FREQ .: 2.25 mc.

COMPUTING ELEMENT: Flip-flop.

components: 5600 tubes, 18,000 crystal diodes, and 300 relays.

REMARKS: Checking is provided by duplicate arithmetic circuits with automatic comparison of results, and checking for oddness of the number of ones in the code for each character after a transfer of information.

BUILT BY: Nuclear Energy for Propulsion of Aircraft (NEPA) Project

INSTALLATIONS: Oak Ridge National Laboratory

(The U. S. Air Force contributed financially to the development

of one computer.)

COPIES AVAILABLE: NO.

PROGRAMMING SERVICE:

COMPUTING TIME:

FLOOR AREA: 600 sq. ft.

POWER CONSUMPTION: 15 km.

cooling: 2500 c.f.m.

FIRST READY FOR USE: 1 June 1950.

INSTRUCTION TYPE: One-address.

BEST SUITED FOR: Inversion of matrices; solution of simultaneous linear equations.

OPERATIN	G SCHEDULE:	ENG I N	EERING	1	ROBLEM SOLVIN	5		
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	id!e	Total
	Hrs/Wk	4	4	28	0	4	0	40
	Percent	10	10	70	0	10	0	100

PERSONNEL: 2 operators, 1 maintenance man.

NUMBER BASE: 10 (excess-3).

WORD LENGTH: 4 decimal digits (instructions 4 binary digits).

NUMBER RANGE: -1 to 1

NEGATIVE NO. REP .: Wines' complement SEQUENCE CONTROL: Built-in and magnetic tape.

OPERATIONS: Addition, subtraction, multiplication, Gauss-Seidel iterative

process.

	SPEED:	Tra	nsfer	Add	ition	Mult	iplication	_ 0)ivision						
	Min.	1.5	ms	7	ms	'	7 ms								
Inci. Access	Max.	1.5	ms												
Excl. of A	ccess			20	/us	32	0 /128								بمنصد بسيديد
	STORAGE:				Ca	pacity	No. of C	₹Т	Acc				-	Drum Diam.,	
_				. •		in Kords	Magneti Tracks,		Ti	me		Mode	ı	Length or CRT Type	of Motion
Ту	pe		Funct	: i on	"	iora s	Acousti							or one grape	
		4		٠.	<u> </u>		Channel	s	Max.	N	lin.				
Circulati	ng		inter	nal	34	<u> </u>	6		2 8	6	ma	Sec-B	æ.	40 "lone	20*/800
Magneti	c Tap	9													1
								\perp		_	· 	 	_	7.000 8	000/
Magnetic	Tape		ixter	naı	90,0	000	1 5	+	 	┼		202-10	r,	TSOO IF	20*/sec
I NPII	T/OUTPUT:				Туре			4	Lance Sign	<u></u>		4		Speed	
	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		ding	Mac		 		6	utput	-	1 W	ord/se	C.	 	
								\top		1					
	_							1		T					
•								T		\neg					

TAPE SEARCH: Not possible.

ARITHMETIC MODE: Serio-parallel.

CLOCK FREQ .: 50 kg.

COMPUTING ELEMENT: Vacuum diodes.

components: 2200 tubes, 20 crystals, about 50 relays.

REMARKS: Automatic checking includes check for overflow, misoperation

of read-in circuits and multiplier, tape synchronization.

See J. J. Stone, "The USAF-Fairchild Specialised Digital Computer,"

<u>Mathematical Tables and other Aids to Computation</u>, VII, No. 41,

pp 35-37, (Jan. 1953).

(Model, University of Toronto Electronic Computer)

BUILT BY: Computation Centre, University of Toronto INSTALLATIONS: Computation Centre, University of Toronto

(The Defense Research Board of Canada contributed financially

to the development of the computer.)

COPIES AVAILABLE:

PROGRAMMING SERVICE: NO. COMPUTING TIME: NO.

FLOOR AREA: 375 sq. ft.

POWER CONSUMPTION: 4 KW.

cooling: 6 fans.

FIRST READY FOR USE: 1952

REST SHITED FOR: Mathematical problems, limited storage, input and output.

DESTIS	UTILD I DAY							copo a maria	2 000	Dar Of
OPERATING SCHEDULE:		l	ENGINE	ERING			PROBLEM SOLVI			
		Sched.	Maint.	Eng.	Dev.	Error-Free	Erroneous	Repair	idle	Total
Γ	Hrs/Wk		i i							
Г	Percent									

PERSONNEL:

NUMBER BASE: 2 (10 externally).

WORD LENGTH: 12 binary digits (instructions 12 binary digits).

NUMBER RANGE: U to 224.

INSTRUCTION TYPE:

NEGATIVE NO. REP.: Twos' complement.

SEQUENCE CONTROL: General store.

OPERATIONS: Only 8 orders; add, subtract, clear to transfer, critical transfer, input, output, 2 special orders. No multiplication,

no division.

	SPEED:		nsfer			Cod	olication	Division	_			
ncl. Access	Min.	100	/us	100	/us	Coa	ea	Coueu				
	Max.					 						
Excl. of A	ccess	50	hre									
Т,	STORAGE:	4	Funct	tion	i	acity n rds	No. of CR Magnetic Tracks, o Acoustic Channels	Ti		Mode	Drum Diam., Length or CRT Type	Speed of Motion
Electrostatic Inter		nal	51	2	12	25 µ s		Parallel	3 CRT			
							 	 				
										1		
I NPU	T/OUTPUT:		·		Туре	******	<u> </u>	Function	<u> </u>	1	Speed	
		Pap	er Te	pe F	leade	r		Input				
		Pap	er Ta	pe F	unch			Outpu	t			
			ewrit					Outpu	t			
	F SFARCH.						.			ooth dire	-a+4 ana	•

TAPE SEARCH:

Magnetic tape search is possible in both directions.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: 100 kc.

COMPUTING ELEMENT:

COMPONENTS:

400 tubes. 200 crystals. 25 relays.

REMARKS: Computer is completed, but will not be put into

operation until FERUT is loaded.

BUILT BY: M.I.T. Digital Computer Laboratory INSTALLATIONS: M. I.T. Digital Computer Laboratory

Cambridge, Massachusetts

COPIES AVAILABLE: Not available PROGRAMMING SERVICE: Not available

COMPUTING TIME: Some time available for academic use by MIT staff and others.

POWER CONSUMPTION: 60 KW FLOOR AREA: 3300 sq. ft.

FIRST READY FOR USE: December 1950 cooling: 13000 cu.ft/min.

BEST SUITED FOR: Real-time control problems, also general-purpose computation.

PROBLEM SOLVING ENGINEERING OPERATING SCHEDULE: Total Idle Erroneous Repair Sched. Maint. Error-Free Eng. Dev. 168 16 58 60 Hrs/Wk 100 35.5 34.5

PERSONNEL: 11 operators, 15 maintenance, 45 mathematicians, 13 clerical

NUMBER BASE: 2 (10, 8, or alphameric externally)

WORD LENGTH: 16 bits NUMBER RANGE: -1 to -1

INSTRUCTION TYPE: One-address

NEGATIVE NO. REP.: Ones! complement SEQUENCE CONTROL: General Store

OPERATIONS: All arithmetic operations, scale factoring, logical orders,

versatile input-output orders.

SPEED:	Tran	sfer	Addi	tion	Multip	lice	tion	Divi	ion	1	rans	fer C	ontr	0]		
Min. 70		眉	49	ti.s		61	ns	100	118	\perp	30	NS.	<u> </u>			
ncl. Access Max.	-	MS	49			61	us	100	U.S	\perp	30	'us	1			
Excl. of Access.	12		12	us		24	us	63	us	L	12	us	١.,		_	
STORAGE: Type		Functi	on	,	acity in rds	Ma Tra Ac	of CRT gnetic cks, or oustic annels]	Acces	•	in.	Mod		Drum Diam. Length or CRT Type	of	F
ec. Tube Register	ra	Inter	nal			-	anners	5 1	-+			Perall	.el			
Keyboards	-	Inter		2	7	1	,	5 A	ıs		us	n			<u> </u>	
Electrostatic Stora	99	Inter				1	34	16	usl	.6	ng			TIM		
Magnetic Drum		Exter			6		192		ms		us	*		8°dja.	3600	ron
Magnetic Tape (47	Exter			0 ea	ĮŠ,	Mic.	5 I	ain	3	7ms	Ser.	-120	500	100	/sec
INPUT/OUTPUT:	<u> </u>			Type				Fund	tion	T				Speed		
	PR	Tape F	ead	er				In	out	1:	140	char	/800	3		
		xowrit			omen	t			tout	_		cha	- A			
		netic			- produced as	· -			Ħ			char	7			
		illoso			amer	a			ħ					ts/sec.	150	dig

TAPE SEARCH: Reading, recording, searching all possible under program control.

ARITHMETIC MODE: Parallel

CLOCK FREQ .: 2 mc and 1 mc

COMPUTING ELEMENT: Flip-flops

COMPONENTS: 6800 tubes, 22000 crystal rectifiers, 1800 relays.

REMARKS: 12 of the 28 hours of scheduled maintenance represent time allowed for recovery from installation of new terminal equipment. Extra bit in electrostatic storage provides parity check. There are transfer checks, arithmetic overflow

alarm, and marginal checking facilities.

WISC (Wisconsin Integrally Synchronized Computer)

BUILT BY: Electrical Engineering Department, University of Wiscontin

INSTALLATIONS: University of Wisconsin

(Development of the computer was supported in part by the Wisconsin Alumni Research Foundation, the Engineering Experiment Station, and the University of Wisconsin.)

COPIES AVAILABLE:

PROGRAMMING SERVICE: Available to Univ. of Wisconsin and interested concerns. COMPUTING TIME: Available to Univ. of Wisconsin and interested concerns.

FLOOR AREA: 12 sq. ft. COOLING:

POWER CONSUMPTION: 6.6 kw. FIRST READY FOR USE: 1954.

BEST SUITED FOR: General purpose (small input-output problems).

OPERATING	SCHEDULE:	ENGINE	ERING	F	ROBLEM SOLVIN	,		
_		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
[Hrs/Wk							
ſ	Percent							

PERSONNEL:

NUMBER BASE: 2 (10 externally).

word Length: 50 bits.

10-75 to 1075. NUMBER RANGE:

INSTRUCTION TYPE: Three-address.

NEGATIVE NO. REP.: Absolute value & store.

OPERATIONS: Add, subtract, multiply, divide, compare. - all either alge-

braic or absolute value - transfer, in, out, halt (conditionally or definitely); extract (substitute digits).

	SPEED:	Tra	nsfer	Ad	dition	Multi	plication	Division				
Incl. Access	Min.			<u> </u>		L						
Inci. Access	Max.	17	ms		17 ms		17 ms	17 ms				
Excl. of A	ccess					<u> </u>		·				deal address of minister of the last
	STORAGE:				Cap	acity	No. of CRT	Acce	ss		Drum Diam.,	Speed
Т	/pe		Fun	ction		in ords	Magnetic Tracks, or Acoustic	Tim	e	Mode	Length or CRT Type	of Motion
							Channels	Max.	Min.			
Magnetic	Drum		Inte	rna	1 102	24	32	17ms		Serial	8.5"dia	3525rpm
Magnetic			Inte			4	4	550us		Serial	8.5"dia	3525rp
Magnetic	Drum		Inte	rna	1	3	3	400 µs		Serial	8.5"dia	3525rp
(44-bit	words)				·						
									1 1			
INPU	T/OUTPUT:				Туре			Function			Speed	
	ſ	Fle	XOW:	ite	r			In-Out	10	decimal	digits/	sec.
	. [(6 cl	ann	el par	oer t	ape)	,				
	Ī											
	1											

TAPE SEARCH:

None.

ARITHMETIC MODE: Serial.

CLOCK FREO .: 100 kc.

COMPUTING ELEMENT: Vacuum tube.

components: 700 tubes, 60 crystal rectifiers.

REMARKS: Provision made for operation one cycle at a time. The following four procedures are normally carried out at the same time (integral synchronization): (1) locate

order N, (2) locate the two operands called for by order N-1, (3) perform operation specified by order N-2, (4) deliver

to storage result of order N-3.

BUILT BY: Zuse K.G., Neukirchen (Kreis Hünfeld), Germany

INSTALLATIONS: Eidgenossische Technische Hochschule, Institut für angewandte

Mathematik, Zurich, Switzerland

COPIES AVAILABLE: No.

PROGRAMMING SERVICE: Available. COMPUTING TIME: Available.

FLOOR AREA: 160 sq. ft.

POWER CONSUMPTION: 1 kw.

cooling: None.

FIRST READY FOR USE: 1950.

BEST SUITED FOR: Differential equations

OPERATING	SCHEDULE:	ENGINE	ERING	ſ	ROBLEM SOLVIN			
		Sched. Maint.	Eng. Dev.	Error-Free	Erroneous	Repair	ldle	Total
	Hrs/Wk	2		108	4	6		120
F	Percent	1.7		90	3.3	5		100

PERSONNEL: 2 operators, 2 maintenance men, and 2 mathematicians (all part time).

NUMBER BASE: 2 (10 externally).

word Length: 32 binary digits (instructions 8 binary digits).

**NUMBER RANGE: #2⁻⁶³ to #2⁶³. INSTRUCTION TYPE:

NEGATIVE NO. REP .: Absolute value & signequence control: Paper tape.

OPERATIONS: Addition, subtraction, multiplication, division, square root;

multiplication by 2, 10, $\frac{1}{2}$, 1/3, 1/5, 1/7, π , 1/ π , -1.

		T	1	141		11411	Division	C	- P-		
·	SPEED:	Transfer			·	olication			re Ro	ot	
nci. Access	Min.			5 80		sec	<u>5 sec</u>		sec		
	Max.	0.5 se	<u>c </u>	0 se	<u> 3</u>	sec	5 sec	5_	sec		
Excl. of A	ccess										
	STORAGE:				city	No. of CRT Magnetic				Drum Diam., Length	Speed of
Ty	ype	Fu	nction	Wo	rds	Tracks, or Acoustic	L		Mode	or CRT Type	Motion
						Channels	Max.	Min.	<u> </u>		
Mechanic	al sto	re Int	ernal	6	4		0.58		Paral	lel	<u></u>
· · ·								.:			
I.NPU	T/OUTPUT:			Туре			Function			Speed	
		Paper	tape				In&Out	30 v	vords	per min.	
		Printe					Ontput	20 1	rords	per min.	
2		10.0							·		
								1			

TAPE SEARCH: None.

ARITHMETIC MODE: Parallel.

CLOCK FREQ.: 20 cycles per sec.

COMPUTING ELEMENT: Relay.

components: 2200 relays.

REMARKS: This computer uses a floating binary point. The exponent is represented by 7 binary digits. See Roger C. Lyndon,

"The Zuse Computer," Math. Tables and Other Aids to Computation,

no. 20, p. 355 (Oct. 1947).

BUILT BY: Zuse K.G., Neukirchen (Kreis Hünfeld), Germany. INSTALLATIONS: Leitz GmbH., Wetzlar, Optical Works.

copies available: For sale.

PROGRAMMING SERVICE: Not available.

COMPUTING TIME: Not available.

FLOOR AREA:

POWER CONSUMPTION: 3 km.

FIRST READY FOR USE: June 1953.

cooling: None.

BEST SUITED FOR: General purpose; optical computations.

OPERATING SCHEDULE: ENGINEERING PROBLEM SOLVING
Sched. Maint. Eng. Dev. Error-Free Erroneous Repair Idle Total
Hrs/Wk
Percent

PERSONNEL: 1 cperator.

NUMBER BASE: 2

WORD LENGTH: 36 binary digits.

NUMBER RANGE: $\pm 2^{-63}$ to $\pm 2^{63}$.

INSTRUCTION TYPE:

NEGATIVE NO. REP.: Complement. SEQUENCE CONTROL: Film tape.

OPERATIONS: Addition, subtraction, multiplication, division, square root.

SPEED: Transfer Division Addition Multiplication Square Root 50 ms Min. Incl. Access 100 ms Max. 100 ms 450 ms 750 ms 750 ms Excl. of Access STORAGE: No. of CRT Capacity Access Drum Diam. Speed in Magnetic Time Length of Type Function Words or CRT Type Tracks, or Mode Motion Acoustic Channels Max. Min. Relay (tentative) Internal 12 .00 ms 50 ms Parallel <u>Cascade</u> operation INPUT/OUTPUT: Type **Function** Speed Keyboard Input Tape Input 200 binary digits per sec. Typewriter 8 characters per sec. Output

TAPE SEARCH: Possible in the forward direction.

ARITHMETIC MODE: Parallel.

CLOCK FREQ .: None.

COMPUTING ELEMENT: Relay.

components: 2500 relays.

REMARKS: This computer uses a floating binary point. The exponent

is represented by 7 binary digits.

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