RELEASE AS SANITIZED
1999

45 60

CIA HISTORICAL R... ...GRAM
RELEASE AS S... ...D

~~SECRET~~

APPENDIX B

CHARACTERISTICS OF SELECTED SOVIET GENERAL PURPOSE DIGITAL COMPUTERS

Models	Dates Prototype/ Production	Number Produced (Estimated)	Price in Thousand New Rubles	Operating Speeds Add/Multiply/ Divide Microseconds	Internal Storage Type/Capacity/Cycle Time	Auxillary Storage Type/Capacity/Transfer Rate
BESM-2	1956-58/	105	350	70/230/230 8,000 - 10,000 ops	Ferrite cores/up to 4,096 words/6 µs	2 Magnetic drums/8,000 words each/12,000 wps 4 Magnetic tapes/30,000 words each/400 wps
BESM-3	1959-60/ 1964-65	5	250	20,000 ops	Ferrite core/4,000 words, 10 µs	4 Magnetic drums/16,000 words each
BESM-6	1962-63/1965	5	3,000	1.1/1.9/.4.9	Ferrite core/32,000 words 2 µs	16 Magnetic tapes/10^6 words each 8,000 wps 8 Magnetic drum/16,000 words each/25,000 wps
ERA	NA	85	200	39/104/429	Ferrite core/4,096 words, 13 µs	6 Magnetic tapes/240,000 words 2,000 nps
EV-80-3		185	36	400/30,000/30,000	Electronic/8 words/94 ms	Punched cards/360 cpm
M-3	1956/ 1958-59	170	18	Average 30-40 ops with magnetic drum storage; or 1,500 ops with ferrite core store	Magnetic drum/2,048 words/ 10 ms and/or ferrite core/ 2,048 words	
M-20	Prototype 1955-57/ Production 1959	100	500	28/70/137 20,000 ops	Ferrite core/4,090 words/ 6 µs	3 Magnetic drums/4,096 words each/12,000 wps 4 Magnetic tapes/

Abbreviations

ops	operations per second	wps/m	words per second/minute	nps	numbers per second
µs	microseconds	cps/m	cards per second/minute	Lps	Lines per minute
	milliseconds	chs	characters per second		

0954

Input Type/Rate	Output Type/Rate	Components	Remarks
Punched tape	Punched tape Printer/700 Lpm	Vacuum tubes semiconductors diodes	Academy of Sciences counterpart to M-20. About like an IBM-704.
		Transistors, semiconductor diodes	Transistorized version of the M-20. Its magnetic drum is superior to that on the M-220.
Punched cards/700 cpm Punched tape/800 chs	Punched card/100 cpm Punched tape/20 chs Line printer/400 Lpm	Transistors semiconductor diodes	Has look-ahead and interrupt features. About equal to IBM 7090 or IBM 7094. This is the fastest computer known to be commercially available in the USSR. Series production just beginning.
Punched cards/ 360 cpm	Punched cards/ 300 digits per second	Vacuum tubes	
	Punched card/ 360 cpm	Vacuum tubes	This is a punched card calculator comparable to IBM-605.
Punched paper tape/ 30 wpm or punched type/1,200 words wpm	Punched paper tape/ 30 words per minute Teletypewriter	Vacuum tubes semiconductor diodes	With some components from USSR, single units have also been constructed in Hungary and Communist China. M-3 is similar to the ELECOM 120 without magnetic tapes.
Punched card/20 cps	Punched cards	Vacuum tubes semiconductor diodes	The M-20 is currently the "workhorse" of large scale computers in the USSR. Although its arithmeter is faster, the M-20 has overall capabilities similar to those of the IBM-704. Speed of arithmeter is more like that of AN/FS6-7.

CHARACTERISTICS OF SELECTED SOVIET GENERAL PURPOSE DIGITAL COMPUTERS (continued)

Models	Dates Prototype Production	Number Produced (Estimated)	Price in Thousand New Rubles	Operating Speeds Add/Multiply/Divide Microseconds	Internal Storage Type/Capacity/Cycle Time	Auxillary Storage Type/Capacity/Transfer Rate
M-220	1959-60/ 1964-65	40	600	NA	Ferrite core/16,000 words/ 6 µs	Magnetic drum/32,000 words Read only/16,000 words
MINSK-1		300	55-100	2,000-3,000 ops 250/1,400/1,500	Ferrite core/1,024 words/ 25 µs	Magnetic tape/65,500 words, 500 wps
MINSK-2	1962	285	200	72 µs/200 µs/624 µs	Ferrite core/4,096-8,492 words/24 µs	4 Magnetic tapes
MINSK-22	1963/1965	85	250	5,000-6,000 ops 90 us/NA/NA	Ferrite core/8,192 words/ 24 µs	Up to 16 magnetic tapes/NA 30,000 chs
NAIRI	1965/1965	90	70	2,000-4,000 ops	Ferrite core/1,000 words/ 20 µs	16,000 words read only
PROMIN	/1965	15	500	1,000/10,000/NA	100 words	NA
RAZDAN-2	/1962-63	75	45	Average 5,000 ops	Ferrite core/2,048 words/ 24 µs	Magnetic tape/120,000 wor 2,000 wps
RAZDAN-3	NA	25	150	Average 20,000-25,000 ops	Ferrite core/ 16,000 to 18,000/8-10 µs	16 Magnetic tapes up to 30 magnetic drums/16,000 words each
URAL-1	1954-55/1956	475	55	10,000/10,000/20,000	Magnetic drum/1,024 words/ 10 ms	Magnetic tape/40,000 word 75 wps

Input Type/Rate	Output Type/Rate	Components	Remarks
NA	Printer/400 Lps	Transistors/	A transistorized version of the M-20 uses military grade transistors; program compatible with M-20.
Punched film/ 700-800 chs	Printer/20 chs	Vacuum tubes	
Photoelectric reader 800 chs	Printer/20 Lps	Transistors/	
Punched card	Printer/300-400 Lpm	Transistors/	
Teletype and Electric typewriter		Transistor	Similar to IBM 1620
Punched card reader Plug board keyboard	Electric typewriter	Transistor	
Punched tape/35 nps	Punched tape/25 nps Printer/20 nps	Transistor	
NA	NA	Transistor	
Punched film/75 wpm	Punched film/75 wps Printer/100 Lpm	Vacuum tube	Now being replaced. Several are used in high schools for training. About like early IBM 650's, or NCR-102d.

CHARACTERISTICS OF SELECTED SOVIET GENREAL PURPOSE DIGITAL COMPUTERS (continued)

Models	Dates Prototype Production	Number Produced (Estimated)	Price in Thousand New Rubles	Operating Speeds Add/Multiply/Divide Microseoonds	Internal Storage Type/Capacity/Cycle Time	Auxillary Storage Type/Capacity/Transfer Rate
URAL-2	1959/1959-60	340	120	Average 5,000 ops	Ferrite core/2,048 words/ 12 µs	Up to 8 magnetic drums/8,192 words each/5,000 wps Up to 10 magnetic tapes/ 700,000 words each/1,000 wps
URAL-4	/1961-64	160	350	5,000-6,000 ops	Ferrite core/2,048 words	Up to 8 magnetic drum/16,000 words/1,000 wps 4 Magnetic tapes/262,144 words each/15,000 chs
URAL-11	1964/1965	25	100	Average 3,000 ops	Ferrite core/4,000-8,000/ 9 µs	
URAL-14	1964/1965	5	145	Average 8,000-18,000 ops	Ferrite core/4,000-32,000 words/9 µs	8,000 - 32,000 words read only
URAL-16	1964/1966-67	2	600	70,000-80,000 ops	Ferrite core/8,000-64,000/ 9 µs	4 Magnetic tapes Magnetic drum/130,000 words/
SETUN	1958/		50	180/320/370	Ferrite core 31-162 words/ 20 µs	Magnetic drum/972 words/

-C

Input Type/Rate	Output Type/Rate	Components	Remarks
Punched film/ 150 wpm; Punched card/300 cpm Direct communication lines	Punched film/100 cpm Printer/1,200 Lpm Direct communication lines	Vacuum tubes	
Punched tape/400 chs	Punched tape/8-10 cps Page printer/3,001	Vacuum tube	Handles alphanumeric information; especially intended for data processing for economics planning and accounting. About like an IBM 705 III with limited drum and tape.
NA	NA	Transistor	
NA	NA	Transistor	Designed for data processing. URAL-11 and URAL-14 will reach a production rate 100/year.
NA	NA	Transistor	
Punched tape/400 chs	Typewriter/7 nps/ 60 wpm	Tubes and transistors	There is no Western counterpart for this computer which uses tertiary base logic.

~~SECRET~~

APPENDIX C

CHARACTERISTICS OF SOVIET GENERAL-PURPOSE ANALOG C

NAME OR DESIGNATION	TYPE (Electro-mechanical . EM; Linear electronic . . . LE; Nonlinear electronic . NLE)	YEAR COMPLETED	DEVELOPING INSTITUTE/ PERSONALITIES [b]	OPERATIONAL AMPLIFIERS			FUNCTIONAL ALLOCATION OF OPERATIONAL AMPLIFIERS						ELEMENTS FOR COEFFICIENT SETTING			MULTIPLIERS
							INTEGRATING		SUMMING		SCALING AND INVERTING		FIXED (Voltage-Dividers)		VARIABLE	
				NUMBER	AMPLIFICATION FACTOR	METHOD OF ZERO STABILIZATION	Quantity	Duration of Integration (in seconds)	Quantity	Number of Inputs	Quantity	Maximum Gain	Quantity	Precision (in percent of full scale)	Quantity and Type of Stepping	Quantity and Type
EDA	NLE	Early 1950's	Power Engineering Institute, Academy of Sciences, USSR/ I. S. Bruk	33		Centralized manual	Any or all of the 38		Any or all of the 38		Any or all of the 38		22			4 time-pulse
EMU-1	LE	Before 1954	IAT/B. Ya. Kogan	20				150					40		Some servomechanism	
EMU-2	LE	Before 1954		20				150					40		20 manually set 1 servomechanism	
EMU-3	LE	Before 1954		12		Individually manual		150					30		Some servomechanism	
EMU-4	NLE	Before 1954		14		Individually automatic		200					30		1 servomechanism	
EMU-5	NLE	1954	IAT/B. Ya. Kogan. Series produced by industry, 1956	12		Individually automatic		200					30	.1		2
EMU-6	NLE	1955	IAT/B. Ya. Kogan	12				2,000								2
EMU-7	NLE	Series production 1957	IAT/B. Ya. Kogan, V. V. Gurov, V. A. Trapeznikov. Series produced by industry, 1960													
EMU-8 and EMU-8A	NLE	1956–1957	IAT/B. Ya. Kogan, V. V. Gurov, V. A. Trapeznikov. Series produced by industry, 1960													
INTEGRAL I	EM	1957	Kiev State University/ A. A. Bednyakov Design Bureau, MPSA													
IPT-4	LE	1950	MPSS/V. B. Ushakov, G. M. Petrov	33	4×10^4	Individually manual	6	150	6	Up to 9	21	50	25	.1	25	
IPT-5	LE	1950	MPSS/V. B. Ushakov	18	4×10^4	Individually manual	Any or all of the 18	150	Any or all of the 18	Up to 9	Any or all of the 18	50	18	.1	18	

MPUTERS[a]

ONLINEAR ELEMENTS		PHYSICAL DIMENSIONS		POWER REQUIREMENTS	ELECTRONIC CIRCUIT ELEMENTS	MAXIMUM ORDER OR EQUATION SOLVED	REMARKS
UNIVERSAL FUNCTION GENERATORS Quantity and Type	SPECIAL DEVICES	SIZE (in meters)	WEIGHT (in kilograms)	LEVELS IN VOLTS[d]/ TOTAL IN KILOVOLT-AMPERS	*Semiconductor diodes* . SD *Transistors* . . . . . TR *Vacuum tubes* . . . . . VT	*Linear algebraic* . . . . . LA *Linear differential* . . . . . LD *Ordinary differential* . . OD	
4 functions [illegible] able							Problems set up with patch cord.
		1.2 x .6 x 2.5		26 dc/.1 220 ac/1.5	VT	10th order LD	
		1.2 x .41 x 1.1		26 dc/.1 220 ac/1.5	VT	10th order LD	
	1 blocks of condensers for the storage of voltage levels and for generating delays	1.2 x .41 x .7		26 dc/.06 220 ac/.85	VT	6th order LD	Problems set up by cords between blocks.
	1 functional transformer and 1 block of condensers for storage and for delays	1.2 x .41 x 1		26 dc/.07 220 ac/.9	VT	7th order OD	
Cathode-ray [illegible] function generator available [illegible] iary equipment	1 diode-function generators	.68 x .5 x 1		26 dc/.07 220 ac/.76	VT	6th order OD	
	1 diode-function generators	.68 x 5 x .54		26 dc/.07 220 ac/.35	VT	6th order OD	Has a patchboard for problem setup.
		consists of 6 modules each .45 x .46 x .32		220 ac/.9 No separate power supply needed	VT	10th order OD	Each of the five computing modules may be used as a separate computer.
		250 square meters floor space	25,000	/100	c		Servomechanism can be set from punched-tape program. Solves up to four problems simultaneously.
		2.17 x 1.01 x 1.89 without power supply	1,000	26 dc/1.3 220 ac/4	236 VT	6th order LD	Problems set up on nondetachable patch-cord panel.
		2 x .4 floor space	500	26 dc/.5 220 ac/2	125 VT	9th order LD	Problems set up with long patch cords between modules. May be connected directly to physical system.

MN-2	LE	1955		26	4 x 10[4]	Individually manual	12	100	12	13	12	15	144	.1-1		
MN-1	NLE	1953	Design Bureau, MPSA	171	10 x 10[5]	Individually automatic	12	200	24	8	24	100	36	.1	6 servomechanism with arbitrary or constant step width	20 electronic time-pulse
MN-2	NLE	1954–1955	Design Bureau, MPSA	72	4 x 10[4]	Automatic group stabilization	6	200	12	6	12	50	6	.1	2 servomechanism with constant step width	4 diode-network
MN-7	NLE	1955	Design Bureau, MPSA	18	4 x 10[4]	Individually manual	6	200	10	9	10	50	2	.1		4 diode-network
MN-8	NLE		MPSA	304	10 x 10[4]	Individually automatic	32	Up to 10,000	48	12	48	500	48	.1	36 servomechanism with provision for partial steps	12 electronic and electro-mechanical
MN-10	NLE (transistorized)	1957	NII-Schetmash/ G. V. Rigoreyev, G. M. Petrov	24	5 x 10[4]		6		6		6		36		2	Up to 6 multipliers or nonlinear functions of 1 variable
MN-11	NLE	1959	NII-Schetmash/ I. M. Vitenberg	9			9		38						Automatically varies coefficients in search for optimum solutions	
MN-14	NLE (high precision)	1961	NII-Schetmash/ V. B. Ushakov	360	10 x 10[4]											
MN-M	NLE		NII-Schetmash/ V. B. Ushakov, G. M. Petrov	16			6	200					6	.1		4 diode-network
MPT-9	LE	1952	MMP	48	10 x 10[6]	Individually automatic	16	200	32	12	34	100	48	.1	48 servomechanism with arbitrary or constant step width	
MPT-11	NLE	1953 (modernized 1956)	MMP	62	10 x 10[6]	Individually automatic	6	400	6	6 in old 12 in modern version	6	100	24	.1	12 servomechanism with added time-pulse interpolation	6 diode-network
OPERATOR	NLE	Before 1956	MMP	36		Individually automatic							110	.1	12 by punched-tape program 10 photoservo controlled	
POLET	NLE	Before 1956	MMP	370		Centralized automatic			46						20 by punched-tape program	40 diode-network

[a] Typical Soviet special-purpose analog computers are described briefly in the appendix.

[b] The following abbreviations are used for the Institutes listed in this column:

IAT ..... Institute of Automatics and Telemechanics, Academy of Sciences, USSR
NII-Schetmash .. Scientific Research Institute of Computing Machine Building
MMP ..... Ministry of Machine and Instruments Building (abolished in the 1957 reorganization of industrial management)
MPSA ..... Ministry of Instrument Building and Means of Automation (abolished in the 1957 reorganization of industrial management)
MPSS ..... Ministry of Communications Equipment Industry (abolished in the 1957 reorganization of industrial management)

[c] Electromechanical, using 3,500 relays and 185 servo motors.

[d] The volts are given as dc for direct current or ac for alternating current.

SECRET

			1.34 x .93 x 1.36	500	220 ac/1.5	114 VT 165 SD	12th order LA	Problems set up on revolving drum switch. May also be used to solve linear differential equations.
1 diode-triode line segment approximators	6 trigonometric functions 3 dead-zone simulators 6 limiters		30 square meters floor space 6 sections	3,000	220 ac/15	1,436 VT	12th order OD	Problems set up with patch cords. May be connected directly to physical systems.
0 diode-line segment approximators			2.15 x 1.2 x 1.95 without power supply	1,500	220 ac/7	500 VT	6th order OD	
4 diode-line segment approximators	6 diode special-function generators; a constant time-lag generator can be added		.5 square meters	1,170	220 ac/.7	111 VT	6th order OD	Problems set up with patch cords. May be connected directly to physical systems.
10 diode-triode line segment approximators	4 constant time-lag generators 6 dead-zone generators		60 square meters floor space 13 cabinets	6,000	220 ac/35	2,410 VT 8,620 SD	32nd order OD	
	4 diode special-function generators		.3 square meters desk space	35	220 ac/130	635 TR and SD	6th order OD	Cathode-ray tube output. Parallel operation of two MN-10 computers is possible.
							9th order OD	Especially designed for use in the study of sets of differential equations that describe control processes.
								Especially designed for use in simulating chemical processes and for use in process control.
4 diode generators functions o[illegible] able	4 diode special-function generators		.3 square meters desk space	45	220 ac/450	TR and SD—Some of both	6th order OD	Has provisions for direct connections to parts or all of physical systems. May be used with additional standard blocks for an increased number of linear functions.
			7 x .8 x 1.23 without power supply	1,800	26 dc/1.3 220 ac/4	245 VT	16th order OD	Problems set up on central panel. Can also be produced (acquired) as a half set that is capable of solving 8th order equations. May be connected directly to physical systems.
6 diode-line s[illegible] approximat[illegible]			3.5 x .4 floor space without power supply	450	220 ac/4.5	562 VT	6th order OD	Problems set up with patch cords on each of the two control desks. Two MPT-11 computers may be combined to solve 12th order equations. Each half set is called an MPT-11-M. May be connected directly to physical systems.
1 block of [illegible] functions								Problems set up on switches and separate switchboard. Has 18 spark gap recorders.
[illegible]			5 cabinets				12th order OD	Has 18 spark gap recorders for output.