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THE ELECTRONICS INDUSTRY IN THE USSR

CIA HISTORICAL REVIEW PROGRAM
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1999

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CENTRAL INTELLIGENCE AGENCY

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THE ELECTRONICS INDUSTRY IN THE USSR*

Summary

The electronics and telecommunications equipment industry in the USSR has expanded more rapidly than that of any other nation during the past 8 years. The total output of the industry, estimated at 2 billion rubles in 1947, increased to 9 billion rubles in 1954 and will rise to a total of 12 billion rubles by 1956.

The Soviet electronics industry in 1954 consisted of 196 plants and institutes employing about 310,000 persons. Almost 80 percent of the industry is concentrated in 3 geographic regions, and over 60 percent of the industry is located in 4 metropolitan areas -- Moscow, Leningrad, Novosibirsk, and Gor'kiy.

Administrative control of the industry is maintained principally through four ministries. The rather clearly defined functional boundaries indicated among the various administrative units provide assistance in the analysis of product categories and end use.

The major effort of the Soviet electronics industry has been devoted to the production of military equipment. Almost 70 percent of the total output in 1954, which included a heavy schedule for advanced types of radar and other complex devices, was for the

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 May 1955.

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military program. The indicated trend of the industry is one of continued expansion in production, with the emphasis on meeting present and future military requirements. Production of goods for the civilian section has increased, especially after 1953, but the civilian share of the industry's output will continue to be far less than that for the armed services.

I. Scope.

A. Present Status.

During the past 8 years the electronics industry in the USSR has grown more rapidly than that of any nation. By 1954 the ratio of its net output to the gross national product approached 1 percent -- second only to that of the US, the leading producer of electronic equipment in the world.

B. Definition.

The electronics industry is broadly defined as that sector of the electrical engineering industries which produces apparatus employing electron tubes as functional component parts together with other circuit elements. In view of the administrative organization of ministries in the USSR, this definition of the electronics industry also includes those Soviet facilities which produce wire communications equipment.

C. Major Product Categories.

The products of the Soviet electronics industry include consumer goods (such as radio and television receivers); commercial and industrial products (such as communications stations, test equipment, and industrial apparatus); telephone and telegraph equipment; military radio communications; military radar; and special military devices.

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(such as missile guidance and controls and infrared devices). The major effort of the industry continues to be devoted to supplying military requirements.

II. Organization.

A. Ministerial Organization.

The administrative control of the Soviet electronics industry as indicated in Figures 1 and 2, * is exerted principally through four ministries under the Council of Ministers. The largest sector of the industry is subordinate to the Ministry of the Radio-Technical Industry (MRT), whose plants account for slightly more than half of all finished electronic goods. In addition, plants of this Ministry produce all of the electron tubes and nearly all of the electronic components produced in the USSR.

Detailed plant studies indicate rather clearly defined functional boundaries among the various administrative units. Typical examples are as follows:

1. Plants under the Fifth Chief Directorate (CD), MRT, produce all the tubes in the USSR.
2. Civilian radio and television receivers are produced only in plants of the republic and local industries and of the Second CD, MRT, with a few in plants of the Ninth CD, MRT.
3. Telephone and telegraph apparatus is made in plants of the Third CD, MRT, together with some in facilities of the Ministry of Communications.
4. Radar is produced in plants of the First CD, MRT, and in plants producing electronic equipment but controlled by the Ministries of Shipbuilding, the Aviation Industry, and the Defense Industry.

* Following p. 4.

Despite the high degree of security surrounding military electronics activities in the USSR, the analysis of organizational relationships appears to offer an additional and useful technique to intelligence production in such fields as radar, missile guidance, and consumption patterns.

B. Plants, Employment, and Geographical Distribution.

The entire Soviet electronics industry in 1954 is estimated to consist of about 196 plants employing about 310,000 persons.*

The geographical distribution of the electronics industry within the USSR is illustrated in Figure 3.** Almost 80 percent of the industry is concentrated in 3 principal regions -- 39 percent in the Central Region, 21 percent in the Northwest, and 19 percent in the Urals and West Siberia. Sixty percent of the industry is concentrated in four oblasts: Moscow, Leningrad, Novosibirsk, and Gor'kiy.

III. Production.

A. Methodology.***

Three independent techniques were available and have been used in producing the estimates of total output for the Soviet electronics industry. Security surrounding the Soviet electronics program has precluded the use of direct reports of plant schedules or of economic plans in preparing aggregated estimates.

The first technique is based upon the definition of the industry. This definition implies that the total economic effort devoted to the industry manufacturing electronic equipment is related to the effort devoted to electron tubes. In practice, in those countries producing both electronic equipment and tubes, the ratio of the total output value for the electronics industry to the output of electron tubes usually lies

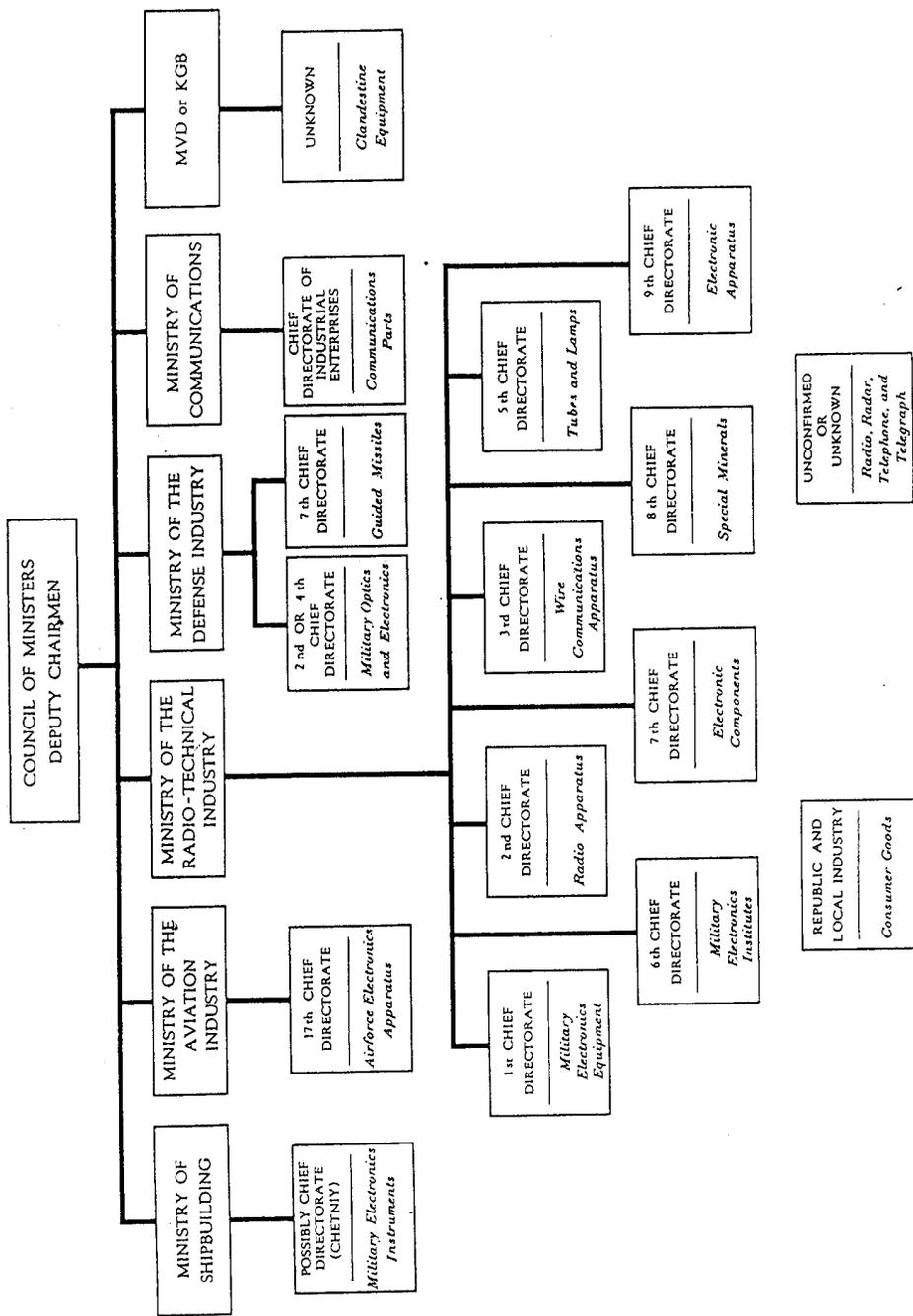
* See Appendix A.

** Following p. 4.

*** See Appendix C.

Figure 1

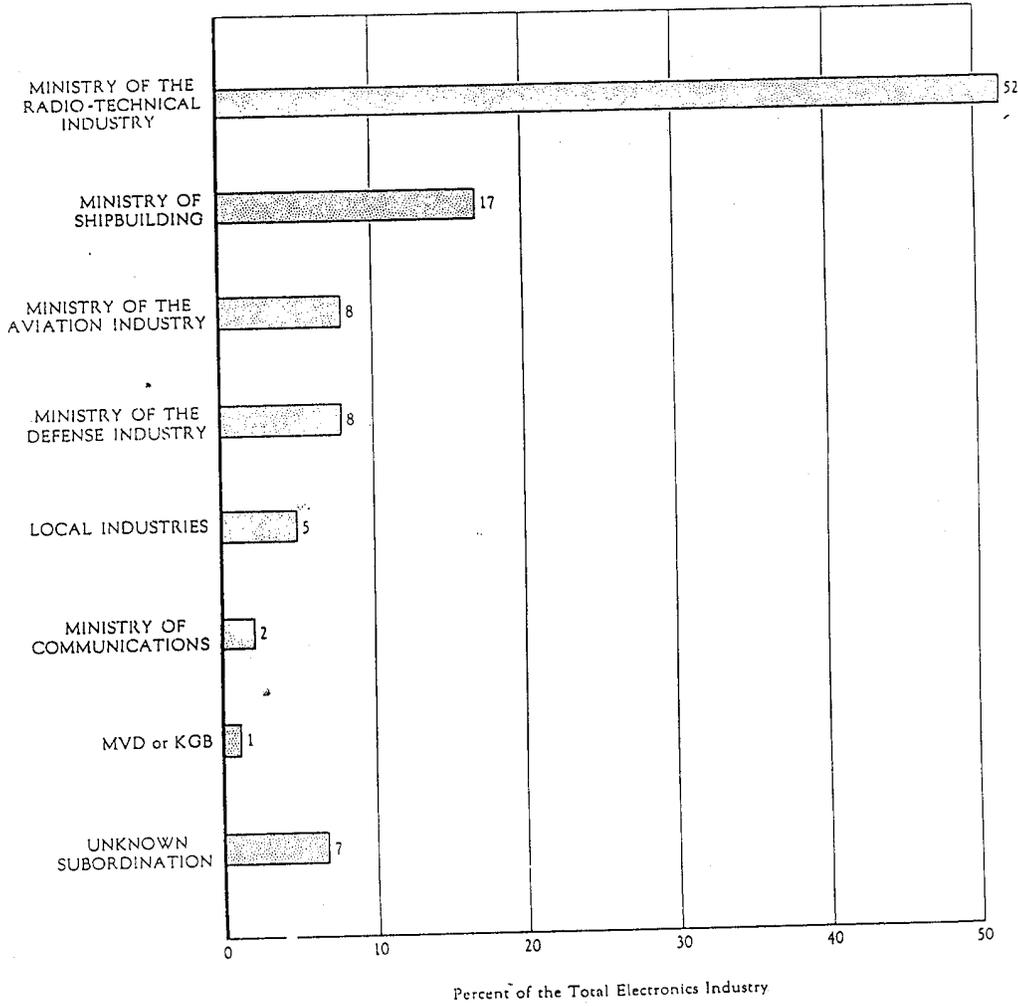
ORGANIZATION OF THE ELECTRONICS INDUSTRY OF THE USSR



UNCONFIRMED OR UNKNOWN
Radio, Radar, Telephone, and Telegraph

REPUBLIC AND LOCAL INDUSTRY
Consumer Goods

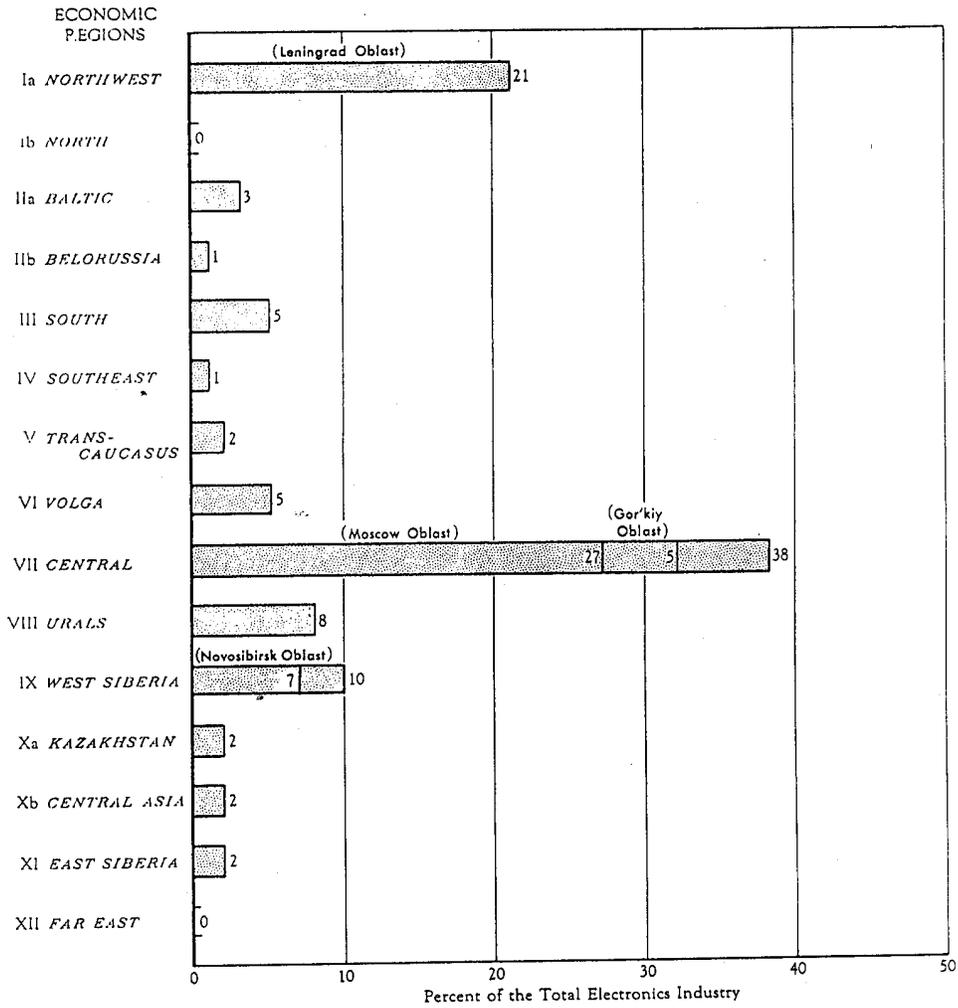
ORGANIZATIONAL CONTROL OF THE ELECTRONICS INDUSTRY OF THE USSR



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Figure 3

GEOGRAPHICAL DISTRIBUTION OF THE ELECTRONICS INDUSTRY OF THE USSR



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within a predictable range. For the USSR this ratio has been selected as 9 to 1. Concentration of Soviet tube production in six major plants,

estimates of total tube production of greater accuracy than is possible for other sectors of the industry.

The second technique is based upon the fact that labor is the major economic input to the electronics industry. Detailed studies of plants and organizational structures have provided a 1954 estimate, necessarily approximate, of 196 plants and about 310,000 employees. analyses of production methods obtained from technical studies of Soviet materiel, have provided the means for estimating the output per employee-year at 28,000 rubles.

The third technique is based upon combining order-of-battle information for military products and plan or press information for consumer goods to provide an estimate for all equipment categories produced during 1950-54. Since the order-of-battle coverage is limited, estimates of totals must be made from wide extrapolations, and plan and press information has been vague even at its best. This technique is therefore considered to be the least exact, serving only as an approximate confirmation of the other methods.

B. Production Estimates.

Figures derived by using the three techniques resulted in the following comparable estimates for 1954: from industry employment estimates, 8.7 billion rubles; from tube production estimates, 9 billion rubles; and from estimates of equipment categories produced, 9.4 billion rubles.

Estimates of output from 1946 through 1956 are shown in Figure 4.* Similar US data are provided for comparison. Soviet output increased from 2 billion rubles in 1947 to 9 billion rubles

* Following p. 6.

in 1954, while the production of the US electronics industry expanded from 1.2 billion dollars in 1947 to 4.7 billion dollars in 1953 and dropped to 4.5 billion dollars in 1954. Although these estimates are purposely provided in units of domestic currencies as being more significant, an approximate comparison is valid for the electronics industry if 1 dollar is equated to 10 rubles as a unit of measure.*

IV. Consumption Pattern.

A. End-Use Sectors.

Three independent techniques have also been used to study the Soviet consumption pattern for electronic equipment.*

The first technique is based upon an analysis of the organizational structure, including the reported product categories and employment figures for the various administrative units. This process is somewhat simplified by the functional lines of demarcation. (See II, A, above.)

The second technique involves a detailed study of Soviet production of selected categories of electron tubes:

The third method follows directly and obviously from that technique described earlier in preparing production estimates from analysis of equipment categories produced during 1950-54.

The probable 1954 consumption pattern for the Soviet electronics industry is shown in Figure 5.*** It is estimated that 16 percent of the output was devoted to civilian radio and television, 14 percent to essential nonmilitary domestic services, and 70 percent to military devices.

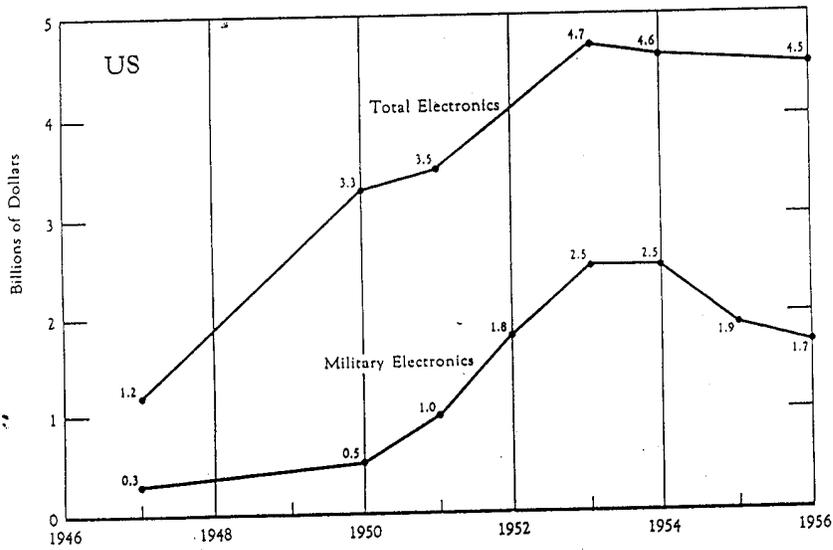
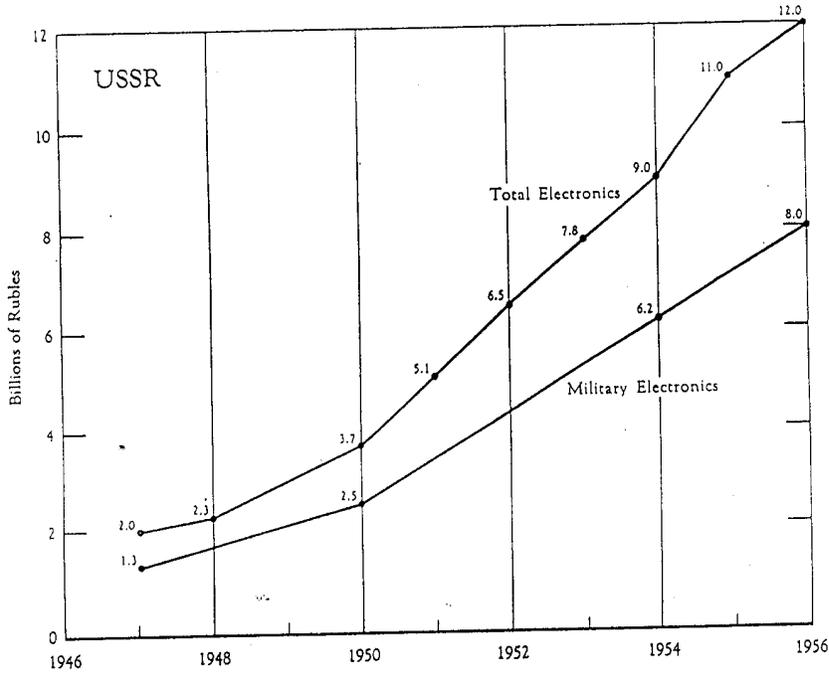
* See Appendix C

*** Following p. 6.

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Figure 4

COMPARISON BETWEEN THE NET F.O.B. OUTPUTS OF THE ELECTRONICS INDUSTRIES OF THE USSR AND THE US

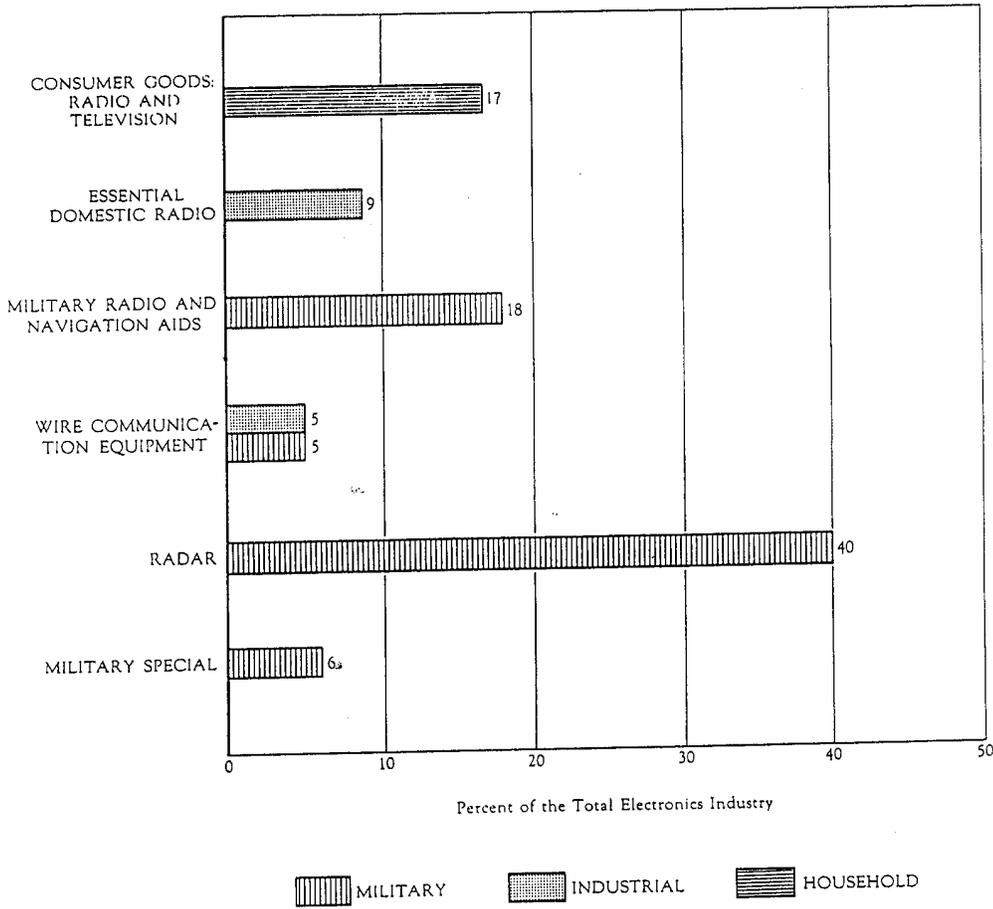


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Figure 5

OUTPUT OF THE ELECTRONICS INDUSTRY OF THE USSR, BY END USE



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B. Consumer Goods.

Although these estimates indicate that the Soviet electronics industry was engaged predominantly in military work in 1954, the proportion of effort devoted to the civilian sector increased more rapidly since 1950 than did the total industry. In 1950, 900,000 radios and 9,000 television receivers were produced. After 1953, production was greatly accelerated. For 1954 it is estimated that 2.3 million radios and nearly 300,000 television receivers were made available for civilian consumption. The 1956 Plan calls for 4.4 million radios and 1 million television receivers.

C. Soviet Military Capabilities.

The basic policy underlying the Soviet expansion in electronics has been the support of the military services. During World War II, Soviet army and air force operations suffered frequently from inadequate communications and a general lack of aircraft detection and fire-control capabilities. Subsequently, several high-level statements stressed the intention to establish a domestic source of supply for electronic weapons and communications facilities which could put the Soviet military services on an equal footing with those of the US and the UK.

The heavy planned expansion for civilian radio and television equipment provides additional economic support to this predominantly military industry and is a potential source of facilities and trained personnel which could be diverted to military electronics in the event of a general war.

V. Military Electronics.

A. Radar.

Since 1948 the radar defenses of the Soviet Bloc have been greatly expanded in number and equipped generally with modernized systems. Table 1* provides a summary of the coverage in depth for

* Table 1 follows on p. 10.

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those areas which have been observed, as well as an extrapolated estimate for the balance of the periphery, and indicates that the USSR relies upon a radar deployment involving large numbers of units.*

About 40 percent of the total output of the electronics industry of the USSR since 1950 is estimated to be radar equipment. This production has included a variety of functionally different units of ground, naval, and airborne radar. Some of the types of radar equipment have certainly been produced in larger quantities than similar units in the US.

B. Military Radios.

In general, production of military radios has been sufficient to provide 100-percent utilization for all tactical units, tanks, and aircraft. The most notable recent advances in the USSR have been the quantity production of decimeter radio-relay systems and the rapid shift of aircraft command sets from high-frequency equipment to a new 4-channel very-high-frequency radio set. It is estimated that the production of military radios has absorbed about 18 percent of industry output since 1950.

C. Scope of the Military Electronics Program.

As of late 1954, at least 56 operational types of major Soviet military electronic equipment have been identified, as follows**

1. Sixteen ground radars, including early-warning, ground-control intercept (GCI), identification-friend or foe (IFF), fire-control, acquisition, and airport and harbor control systems.
2. Fifteen naval radars, including early-warning, surface-search, fire-control, and IFF.
3. Seven airborne radars, including IFF, navigational, bombing, tail-warning or gun-laying, and air-intercept (AI).

* See Appendix C.

** See Appendix B.

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4. More than 17 types of ground communications equipment.

5. More than nine types of airborne radios and navigational aids.

VI. Conclusions.

Since World War II the Soviet electronics industry has progressed from the position of a secondary sector of the electrical machinery industry, poorly equipped and of extremely limited capacity, to the status of the second largest electronics industry in the world, with generally modern plant equipment. The almost simultaneous appearance of a wide variety of different complex types of apparatus, many of which are of native design, and the apparent reliability and effectiveness of some systems indicate a technological capability far beyond the ability of the industry before 1950.

* To some extent, the industry is relatively vulnerable on two counts: the continued, although decreasing, dependence on imports for a few specialized production materials and the geographical concentration of its most important facilities.

The apparent over-all policy of the Soviet electronics industry is to emphasize all means for meeting present and future military requirements. The indicated trend for this industry is one of continued expansion in output, although probably at a lower annual percentage change than prevailed from 1950 through 1954. Present plans call for an increased share of output for consumer goods but a share which will continue to be far less than the military share.

Table 1

Estimated Radar Defense of the Soviet Bloc a/* 2/
31 December 1954

Area	Early-Warning		Early-Warning/Intercept		Fire-Control		Identification-Friend or Foe		Units
	Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated	
Ground radar									
mileage of Soviet Bloc periphery, 7,140 miles	238	476	153	306			46	210	
Northeastern Siberia periphery: projection	N.A.	140	N.A.	78 ^e			N.A.	30	
Northern and Southern Soviet periphery: projection	N.A.	554	N.A.	119			N.A.	50	
USSR: internal	9	90	7	100			9	160	
European Satellites: internal		34		50				50	
Soviet Bloc fire-control					104	923			
Total	<u>247</u>	<u>1,294</u>	<u>160</u>	<u>653</u>	<u>104</u>	<u>923</u>	<u>55</u>	<u>500</u>	

* Footnotes for Table 1 follow on p. 11.

Table 1

Estimated Radar Defense of the Soviet Bloc a/ 2/
 31 December 1954
 (Continued)

Area	Early-Warning		Early-Warning/Intercept		Fire-Control		Identification-Friend or Foe		Units
	Observed	Estimated	Observed	Estimated	Observed	Estimated	Observed	Estimated	
Naval radar									
No area breakdown			570			770			540
No intercept breakdown									
Airborne radar									
Transponders								N.A.	20,000
Air-intercept radar including radar intercept and target lock-on				200					
Bombing radar									3,000
Gun-laying radar									3,300

a. Blank spaces in the table indicate "not applicable."

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APPENDIX A

ORGANIZATION AND FACILITIES
OF THE SOVIET ELECTRONICS INDUSTRY 3/

1. Council of Ministers.

Deputy Chairmen.

a. Ministry of Shipbuilding.

Products: Radar, sonar, fire-control equipment, and instrumentation.

Employees: 40,000.

Facilities: 16

8-22

** Nauchno-Issledovatel'skiy Institut (Scientific Research Institute).

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T/A MILYA, Leningrad
Plant No. 869, Saratov
T/A BAKS, Moscow

b. Ministry of the Aviation Industry.

Seventeenth Chief Directorate.

Products: Airforce electronic equipment and instruments, early-warning (EW) and airborne radar, IFF equipment, and altimeters.

Employees: 20,000.

Facilities: 9.

c. Ministry of the Defense Industry.

Second and/or Fourth Chief Directorate.

Products: Military, optical, and electronic equipment; fire-control equipment; radar; computers; and infrared devices.

Employees: 20,000.

Facilities: 7.

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Seventh Chief Directorate.

Products: Military electronics and missile guidance.

Facilities: 2.

d. Ministry of Communications.

Chief Directorate of Industrial Enterprises.

Products: Audio, telephone and telegraph parts, supplies,
and repairs.

Employees: 5,000.

Facilities: 14

* Konstruktorskoye Byuro (Design Bureau).

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e. MVD* or KGB.**

(Number unknown) Chief Directorate.

Products: Clandestine electronic equipment, radio relays, coding equipment, direction-finding equipment, and radar.

Employees: 3,000.

Facilities: 6.

f. Ministry of the Radio-Technical Industry.

First Chief Directorate.

Products: Military electronic apparatus: navigation aids, radar, transmitters and receivers.

* Ministerstvo Vnutrennykh Del (Ministry of Internal Affairs).

** Komitet Gosudarstvennoy Bezopasnosti (Committee on State Security).

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Employees: 35,000.

Facilities: 15.

Second Chief Directorate.

Products. Radio communication apparatus and home receivers.

Employees: 57,000.

Facilities: 24.

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Third Chief Directorate.

Products: Wire communication apparatus and audio equipment.

Employees: 25,000.

Facilities: 18.

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Fifth Chief Directorate.

Products: Tubes, lamps, semiconductors, and fabricated
production materials.

Employees: 50,000.

Facilities: 29.

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Sixth Chief Directorate.

Products: Military research and development; controls and guidance.

Employees: 5,000.

Facilities: 3.

Seventh Chief Directorate.

Products: Electronic components.

Employees: 12,000.

Facilities: 16.

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Eighth Chief Directorate.

Products: Special minerals, quartz, and the like.

Facilities: 20 (field stations).

Ninth Chief Directorate.

Products: Military and civilian electronic apparatus.

Employees: 9,000.

Facilities: 4.

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2. Republic and Local Industries.

Products: Radio and television receivers, loudspeakers, and record players.

Employees: 12,000.

Facilities: 18.

a. RSFSR

b. Ukrainian SSR

c. Latvian SSR

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d. Azerbaydzhan SSR

e. Estonian SSR

f. Belorussian SSR

3. Unknown or Unconfirmed

Products: Various electronic equipment, such as radios, radar,
* telephone and telegraph equipment.

Employees: 17,000.

Facilities: 15.

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APPENDIX B

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IDENTIFIED SOVIET MILITARY ELECTRONIC EQUIPMENT 4/

1. Ground Radar.

<u>Soviet Type</u>	<u>US/UK Name or Type</u>	<u>US Counterpart</u>	<u>Function</u>	<u>Date and/or Country of Manufacture</u>
RUS-2		Canadian AA No. 4 Mk I	Early-warning	World War II
P2M		Canadian AA No. 4 Mk I	Early-warning	World War II
SON-2		UK AA No. 1 Mk II	Fire-control	1946
P3	DUMBO	UK AA No. 4 Mk III	Early-warning	1948/49
	WHIFF	SCR-584	Fire-control	1949/50
	KNIFEREST	SCR-602A	Early-warning/ ground-control intercept	1951
	TOKEN	AN/CPS-6B	Early-warning/ ground-control intercept	1952 (?)
	GAGE	AN/CPS-5 (Approximate)	Early-warning	1952
	PATTYCAKE	AN/CPS-4 (Approximate)	High-frequency	1952 (?)
	FISHNET	Mk III IFF; AN/TPX-1	Identification- friend or foe	1951 (?)
	WOODGAGE	AN/CPS-5 (?)	Acquisition	1953
	TRESPASS	AN/CPS-4 (?)	High-frequency	1953
	FIREDISH	SCR-584 (?)	Fire-control	1952 (?), Hungary
RM (?)		SCR-602	Early-warning/ ground-control intercept	1953 (?), Hungary
RA (?)				
HGUF-2	TWIN EYES		Harbor control Airport control (?)	1952, Hungary 1953

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3. Airborne Equipment.

(Continued)

<u>Soviet Type</u>	<u>US/UK Name or Type</u>	<u>US Counterpart</u>	<u>Function</u>	<u>Data and/or Country of Manufacture</u>
	Tail-warning		Airborne tail-warning or gun-laying	1952
TAIFUN	LITTLE PET SISTER		Air-intercept Long-range navigation (transporter)	1953 1951
RA SCH-3M			Air-intercept Identification-friend or foe, (transporter)	1953 (?), Hungary 1945
RPK-10M		Bendix MN26	Direction-finding receiver	1947
ARK-5		AN/ARN-6	Automatic direction-finding receiver	1950
	Airborne very-high-frequency direction finder		Automatic direction-finding receiver	1953
	SHORAN		Short-range navigation, bombing	1953
RV-2		AN/APN-1	Altimeter	1948
	Pulse altimeter	SCR-718	Altimeter	1952
RSI-6		SCR-274	High-frequency command radio	1947
		BC-348 ART-13	High-frequency liaison radio	World War II
	Very-high-frequency radio	SCR-522	Very-high-frequency command radio	1951

Military Ground Communications.

<u>Soviet Type</u>	<u>US/UK Name or Type</u>	<u>US Counterpart</u>	<u>Function</u>	<u>Date and/or Country of Manufacture</u>
RBM-1			Command pack set	
RBM-5			Command radio	
13-R			Infantry transceivers	World War II
A-7A, A-7B			Artillery frequency modulation set	
12 RBM			Vehicle set	
9 RS			Tank set	
RSB-F			Mobile 50-watt transmitter	
5AK-1M			Mobile 20-watt transmitter	
11-AK		SCR 299/399	Mobile long-range transmitter	
RVG-902		Stuttgart (German)	Super high-frequency relay	1948, East Germany
RVG-903			Super high-frequency relay	1950, East Germany
TAL-43		EE-8	frequency relay	
ST 35		US 14	Field telephone	World War II
PK-10			Teletypewriter	World War II
PK-30			10-line board	
ME-8			30-line board	
			Carrier equipment	
REYD-1			Shipment	
			Shipboard	
			transceiver	

APPENDIX C

METHODOLOGY

I. Output of the Soviet Electronics Industry.

A. Ratio of Industry Output to Tube Output.

Production of the electronics industry in the USSR was estimated by applying to estimates of Soviet tube production an estimated ratio of the value of the total output of the electronics industry to the value of electron tube production. Similar industrial experience in the US and East Germany indicates that this ratio is approximately 9 to 1, as shown in Table 2. 5/* Estimates of Soviet production for 1954 support applicability of this ratio to Soviet tube data. The estimates of Soviet tube production in 1954 are supplemented by two additional methods: one based on employment data and the other on categories of equipment produced.

B. Industry Output as Related to Total Employment.

Analysis of the data summarized in Appendix A provides an estimate of about 196 facilities with a total employment of about 310,000. Usable estimates of employment are available for 72 of the identified plants; of the others, less reliable information indicated that 91 are small plants and 33 are large plants. Total employment for the 72 "estimated" plants is approximately 196,000; for this report, total employment in the 33 large plants was assumed at 76,000 and in the 91 small plants, 38,000.

The derivation of these industry estimates is illustrated in Table 3.**

* Table 2 follows on p. 30.

** Table 3 follows on p. 31.

Table 2

Ratio of the Net Value of the Output of the Electronics Industry
to the Value of Electron Tube Production
in the US, 1944, 1947, and 1953
and in East Germany, 1951

	US			East Germany 1951
	1944	1947	1953	
Net industry output (million US dollars)	3,000	1,200	4,700	35
Tube production (million US dollars)	345	125	560	3.73
Ratio	8.7	9.6	8.4	9.4

In estimating the output per employee for the Soviet electronics industry, several sources were employed:

A recent CIA estimate listed the output per nonagricultural worker as 14,600 rubles per year in 1953. ^{6/} For the electronics sector of manufacturing, output per employee should be nearly twice that for all nonagricultural employees, indicating a 1954 value of 29,000 rubles per year.

employee of 36,000 rubles per year indicates an output per
rubles per year in 1950 and of 29,500
in 1951. ^{7/} By excluding double-counting
the average output per employee for the industry will be less than
output per employee in individual plants.*

* Continued on p. 34..

The Soviet Electronics Industry
1954

Administrative Organization	Total Number of Plants	Plants for Which Employment Estimates Are Available				Total Number of Employees	Number of Large Plants	Number of Small Plants	Number of Other Plants	Estimated Employees	Total Number of Employees
		Number of Plants	Number of Employees	Number of Small Plants	Number of Large Plants						
Ministry of the Radio-Technical Industry											
First Chief Directorate	15	6	28,000	7	2	7,000				35,000	
Second Chief Directorate	24	13	49,000	8	3	8,000				57,000	
Third Chief Directorate	18	5	12,000	8	5	13,000				25,000	
Fifth Chief Directorate	29	14	44,000	14	1	6,000				50,000	
Sixth Chief Directorate	3	3	5,000	0	0	0				5,000	
Seventh Chief Directorate	16	2	2,500	12	2	9,500				12,000	
Ninth Chief Directorate	4	3	8,500	1	0	500				9,000	
Ministry of Ship-building											
Unknown Chief Directorate	16	4	15,000	5	7	25,000				40,000	

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Table 3
The Soviet Electronics Industry
1954
(Continued)

Administrative Organization	Total Number of Plants	Plants for Which Employment Estimates Are Available			Other Plants		Total Number of Employees
		Number of Plants	Number of Employees	Number of Small Plants	Number of Large Plants	Estimated Employees	
Ministry of Defense Industry							
Second and/or Fourth and Seventh Chief Directorates	9	4	10,000	2	3	10,000	20,000
Ministry Aviation Industry							
Seventeenth Chief Directorate	9	4	8,000	2	3	12,000	20,000
Ministry of Communications							
Chief Directorate of Industrial Enterprises	14	0	0	12	2	5,000	5,000

Table 3

The Soviet Electronics Industry
1954
(Continued)

Administrative Organization	Total Number of Plants	Plants for Which Employment Estimates Are Available			Other Plants		Total Number of Employees
		Number of Plants	Number of Employees	Number of Small Plants	Number of Large Plants	Estimated Employees	
MVD or KGB	6	2	2,000	4	0	1,000	3,000
Republic and local industries	18	8	8,000	8	2	4,000	12,000
Unknown subordination	15	4	4,000	8	3	13,000	17,000
Total	<u>196</u>	<u>72</u>	<u>196,000</u>	<u>91</u>	<u>33</u>	<u>114,000</u>	<u>310,000</u>

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From another CIA report, 8/ the average output per employee of the Soviet tube industry is estimated at 21,500 rubles per year. Experience indicates that the average for an integrated electronics industry is about 1.3 times the output per employee in the tube industry. 9/

On the basis of these sources, it is believed that the 1954 output for the Soviet electronics industry is close to 28,000 rubles per employee. With 310,000 employees, a total industry output of 8.7 billion rubles is indicated.

C. Industry Output as Derived from Equipment Category Estimates.

Analysis of reports and of order-of-battle information offers a means for establishing an approximate estimate of the total inventories of military electronic items. Industry studies of other sectors, including civilian radio and television and domestic communications, provide the additional data necessary for an integrated estimate.

Using the data in Table 1* and applying estimated unit prices, ** the total value of production for radar is summarized in Table 4. 10/*** Nearly all of the radar equipment has been produced in the USSR since 1949.

For the same 5-year period, estimates of production for other categories are as follows: military radio and navigational aids, at 25 percent of radar, 3.5 billion rubles; special military devices, at 10 percent of military electronics, 2.5 billion rubles; military maintenance, at 20 percent of total military electronics, 4 billion rubles; civilian radio and television receiver production and maintenance, 5.5 billion rubles 11/; wire communications equipment and maintenance at 10 percent of total industry, **** 3 billion rubles; and

* P. 10, above.

** Based on US analogy.

*** Table 4 follows on p. 35.

**** Based on the distribution of employment figures as shown in Appendix A.

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essential domestic radio services, at 5 percent of total industry, 1.5 billion rubles.

Table 4

Estimated Value of the Production of Radar in the USSR
1950-54

Million Rubles	
Class of Radar	Production
Early-warning metric	480
Early-warning/ground-control intercept centimetric	4,900
Fire-control	1,300
Identification	15
Naval early-warning	1,140
Naval fire-control	1,080
Naval identification	15
Airborne intercept	120
Airborne bombing, navigation	4,000
Airborne tail-warning	400
All radar	<u>13,500 a/</u>

a. Rounded.

These figures indicate a total military equipment value of 23.5 billion rubles and a nonmilitary total of 10 billion rubles. On the reasonable assumption that the annual increment in output for the Soviet electronics industry is directly proportional to the increment in tube output, the output of the electronics industry in 1954 is estimated at 28 percent of the total output for the 5-year period, 1950-54.

D. Estimates of Production.

The application of the ratio of 9 to 1 to the most current estimates of electron tube production in the USSR to obtain the total value of the Soviet electronics industry is shown in Table 5.

Table 5

Production of Electron Tubes and Total Production
of the Electronics Industry in the USSR
1947-56

..Million Rubles

<u>Year</u>	<u>Electron Tubes ^{a/}</u>	<u>Total Electronics Industry ^{b/}</u>
1947	220	2,000
1948	260	2,300
1949	290	2,600
1950	410	3,700
1951	570	5,100
1952	720	6,500
1953	870	7,800
1954	1,000	9,000
1955	1,200	11,000
1956	1,300	12,000

a. Estimates of tube production are from the following sources: 1946-48, 12/ (figure misprinted, should be 30 million instead of 3 million); 1949-50, 13/; 1951-53, 1955-56, 14/; and 1954, interpolated on the basis of estimates for 1953 and 1955.

b. Estimated by applying a ratio of 9 to 1 to tube production estimates. Margins of error, based on margins attached to tube estimates and on the range implied by the 9 to 1 ratio, are as follows: 1947, plus or minus 50 percent; 1948, plus or minus 35 percent; 1949, 1954-56, plus or minus 30 percent; 1950, 1953, plus or minus 20 percent; 1951-52, plus or minus 15 percent.

II. Ruble to Dollar Ratio.

In view of the extremely broad range of products of the electronics industry, it is essential to utilize an appropriate unit of measure for any aggregate treatment of the subject. Except for specific instances of detailed analysis, the use of physical units is unsatisfactory. The high degree of convertibility of facilities and manpower between different product categories and the general dependence upon common component parts facilitates the application of product value as an acceptable unit of measure. Industry experience indicates that the best measure of aggregate output or of industry capacity is expressed in terms of net f. o. b. value in current domestic currency prices.

For analysis of the Soviet electronics industry or broad sectors thereof, the net f. o. b. product sales price in rubles has been chosen as the best available unit of measure.

Earlier economic intelligence studies have included initial attempts to correlate the ruble and the dollar as a unit of measure for the electronics industry. ^{15/} Information on specific f. o. b. unit prices and on specific product comparisons has been limited. Subject to confirmation or modification resulting from newer information, available data indicate that the average unit price for Soviet electronics products in rubles is 10 times the US dollar unit price. For the electronics industry, therefore, the ruble/dollar conversion ratio has been taken as 10 to 1.

III. Consumption Pattern.

Analysis of the indicated product mix and of the estimated output of specific tube families provides the means of determining the consumption pattern for the Soviet tube industry against selected categories of end use. ^{16/} A review of Appendix A and of Table 3 provides an estimate for employment in various ministerial directorates and their subordinate equipment manufacturing plants. In view of the apparent functional assignments and the reported product lines, it is possible to construct a probable industry consumption pattern on the permissible assumption that output is proportional to employment in facilities producing electronic equipment. An end-use

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consumption pattern for the 5-year period from 1950 through 1954 has been cited above (I, C).

Table 6* is a summary of results, comparing indicated consumption patterns as derived from these three independent techniques. The last column of Table 6 has been used for this report as the most probable 1954 consumption pattern for the electronics industry of the USSR.

IV. Radar Order of Battle.

1. Ground Radar.

The inventory of Soviet early-warning (EW) and ground-control intercept (GCI) radar as of 31 December 1954 was obtained in the following manner.

the northeastern Siberian seacoast and the northern and southern Soviet borders (a total of 10,000 miles). Radar for these areas is projected on the basis of 1 set per 30 miles for EW and 1 set per 70 miles for GCI. The EW number is doubled for coverage in depth. The GCI number is doubled for depth in the case of the Siberian border but is allowed no support in depth along the northern and southern borders.

The method of estimating internal radar coverage accounts for the wide discrepancy in Table 1** between Observed Sites and Total Estimate.

* Table 6 follows on p. 39.

** P. 10, above.

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Table 6

Estimated Consumption Pattern of the Soviet Electronics Industry
1954

End. Use	Consumption	Employment	(Million Rubles)	(Percent)	Estimated	(Percent)	Probable
	Pattern of the Soviet Tube Industry 1953	Distribution of the Soviet Electronic Equipment Industry a/ 1954					
	(Percent)	Employees (Thousand)					(Percent)
Consumer goods	17	34	5,500	16	16	17	
Essential domestic radio	10	20	1,500	10	5	9	
Wire communications equipment		33	3,000	10	9	10	
Nonmilitary Military						5	5
Radar	47	84	16,300	35	48	40	
Military radio	22	42	4,200	17	13	18	
Military, special devices Maintenance	4	33	3,000	12	9	6	
Civilian Domestic services Military		17 10 37					
Total	100	310	33,500 b/	100	100	100	

a. Data include maintenance and replacement electronics supplies.

b. Based on the value of equipment estimate as shown on p. 35.

The projection is a ratio of radar sets to urban population rather than to area or total population. The assumption underlying this methodology is that urban population is the best indication of primary targets.

Fire-control radar is estimated on a ratio of 1 radar set to 8 anti-aircraft guns. It is known that fire-control radar is used only with 85- and 100-mm guns by the Soviet military forces. The inventory of these guns operationally employed on 31 December 1954 is estimated to be 7,390. 17/

The estimate of the number of ground components of identification-friend or foe (IFF) is based on the method used to estimate the EW and GCI. To the total thus obtained has been added an additional 300 sets on the assumption that

the production pattern of GCI radar with which IFF is used indicates that a larger number of IFF sets probably have been produced.

2. Naval Radar.

The estimate for Table 1 is based on the order-of-battle information on the Soviet Navy and on the visual observations of Soviet naval units. 18/ Accordingly, all Soviet surface ships and submarines are assumed to have an air-search radar.

Naval fire control is allocated as follows: heavy and light cruisers, 10 to 12 radar sets per ship; destroyers, 3 radar sets per ship; ocean and escort destroyers, 1 to 3 radar sets per ship.

All Soviet naval ships of consequence have IFF. Cruisers are estimated to have 2 sets, and destroyers, 1 to 2 sets. This report estimates IFF on long- and medium-range submarines. This capability is not given to 130 short-range submarines. The current effective Soviet naval strength is estimated as follows 19/:

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Battleships and Monitors	4
Cruisers	26
Destroyers	136
Ocean escorts	27
Coastal destroyers	17
Submarines	360
Total	<u>570</u>

3. Airborne Radar.

The USSR is estimated to have 200 air-intercept (AI) radar.

This report estimates that the Soviet airborne IFF is operational in all military planes. The authorized strength of the Soviet Air Forces is about 20,000 units. 20/

Bombing and navigational radar has been installed in the majority of the Soviet operational light and medium bombers. 21/ Tail-warning or gun-laying radar has been installed in a high proportion of light and medium bombers. For this report a total of 2,450 light and 1,240 medium bombers has been assumed as operational. 22/

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APPENDIX D

GAPS IN INTELLIGENCE

In general, information on all aspects of the Soviet electronics industry has been limited since 1945. Plan announcement data cover only a small percent of total output; press releases on specific plants are brief and seldom provide details on products;

As a result, present gaps in intelligence exist in two basic areas of activity: there is an urgent need for current firm information on industrial operations and on electronics order of battle, as well as information on those fields comprising the more advanced categories of military electronics.

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APPENDIX E

SOURCE REFERENCES

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