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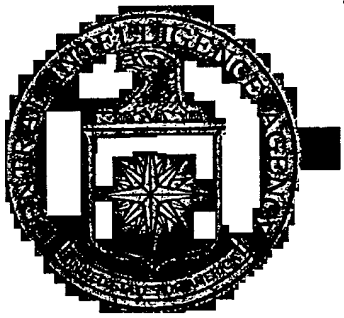
PROVISIONAL INTELLIGENCE REPORT

INPUTS FOR THE PEACETIME PRODUCTION OF SMALL ARMS MORTARS AND ARTILLERY PIECES IN THE USSR



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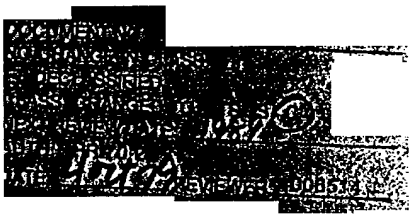

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PROVISIONAL INTELLIGENCE REPORT

INPUTS FOR THE PEACETIME PRODUCTION OF SMALL ARMS, MORTARS, AND ARTILLERY PIECES IN THE USSR

CIA/RR PR-47

(ORR Project 108-51)

NOTICE

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FOREWORD

The primary purpose of this report is to determine the quanti of productive services, or inputs, consumed annually in the peace production of small arms, mortars, and artillery pieces in the US The report also attempts to describe the past development of the Soviet weapons industry, its organization, and its annual output.

No reliable Soviet information is available which can serve a basis for a study of weapons input or of weapons production. Inp estimates have therefore been derived from US analogy and from an interpretation of Soviet weapons requirements based on Army, Navy Air Force production estimates in addition to data obtained from intelligence sources.

This methodology, even when employed with caution, is obvious not exact. It is, however, the only practicable technique to emp in this study and produces results which can be considered reason if not firm, estimates.

Industry-wide estimates of inputs are ordinarily derived on t basis of a summation of individual input requirements for each en item produced by the industry. For an industry producing as many different items as does the weapons industry, the determination o puts for each item in the usual manner would involve an almost pr hibitive number of computations and would vastly increase the tot margin of possible error.

To avoid these limitations, a unit of output representative o weapons produced in the weapons industry of the USSR was construc The unit of product to which the inputs are related is termed a "bundle" of weapons. Once the number of these bundles produced i established, the inputs consumed by the industry are easily compu as a simple multiple of the inputs per representative unit of outp

The bundle of weapons consists of all types of small arms, mo and artillery pieces in direct proportion to their requirements a dicated by the equipment tables of the Soviet armed forces and the estimated annual production of aircraft and naval vessels in the U Adjustments in these peacetime requirements are made to account f different rates of attrition and for the introduction of new model

The further development of the concept of the bundle of weapc to include all items of munitions would provide a working tool fo analysts dealing with the production of munitions comparable to t division slice used by military planners. It promises to be usef in appraisals of the wartime resource requirements of an economy and of the capabilities of that economy to produce munitions. In short, the bundle of weapons is a first attempt to measure the ba in a munitions mix.

CIA/RR PR-47
(ORR Project 108-51)

~~S E C R E T~~

INPUTS FOR THE PEACETIME PRODUCTION OF SMALL ARMS, MORTARS, AND ARTILLERY PIECES IN THE USSR*

Summary

The production of small arms, mortars, and artillery pieces by Soviet weapons industry during 1953 was concentrated in 22 plants. majority of these plants are dispersed throughout the USSR, but th largest groups of plants are located in the industrial area surrou Moscow and in the newly developed industrial areas east of the Ura

The peacetime production of the 22 plants in the Soviet weapon dustry represents about 78,000 short tons of equipment. According Army G-2 estimates, Soviet production for 1952 was 317,500 small a 6,000 mortars, and 22,500 artillery pieces and tank guns. It is a that the 22 plants also produce the weapons required to meet the a needs of the Soviet air and naval forces. The requirements for th forces are 27,000 aircraft cannons, 230 naval artillery units, and 400 naval and antiaircraft artillery units.

The inputs required to produce the indicated quantities of wea are as follows:

Labor	43,000 Man-years
Steel	202,000 Short tons
Aluminum	620 Short tons
Copper	2,000 Short tons
Coal	472,000 Short tons
Petroleum	4.6 Million gallons
Lumber	3.9 Million board feet
Rubber Tires	35,000 Units
Antifriction Bearings	227,000 Units
Electric Power	218 Million kilowatt-hou
Natural or Producer Gas	1.- Billion cubic feet
Machine Tools	376 Units
Capital Equipment and Construction	17,600 Short tons
Transportation	546 Million short-ton-kilometers

* This report contains information available as of 1 December 1953.

The value of all input services for the Soviet weapons indust in 1952 prices is about 1.9 billion rubles, which is almost 3 per of the estimated allocations to munitions procurement in the Sovi defense budget. The value of inputs would represent approximatel the same proportion of such allocations in the 1953 defense targe

The annual productive capacity of the 22 plants in the Soviet weapons industry is about 395,000 short tons of finished weapons, about 5 times the current peacetime output. It is probable that t wartime capacity of the weapons industry is in excess of this amou because new plants may be built and other plants converted to wea production. Limits to the production of weapons would depend on t amounts and relative priorities of other goods produced.

In the event that the Soviet weapons industry were placed on a wartime production schedule, the ratios of inputs to peacetime out implicit in the estimated figures in this report would probably re stable enough to permit their use in making labor and resource cos estimates for the production of a given volume of Soviet weapons d wartime.

I. Introduction.

The Soviet weapons industry, for the purposes of this report, cludes those plants primarily concerned with the production of sma arms, mortars, and artillery pieces, as well as weapons produced f use in armored fighting vehicles and in aircraft.

The term "weapons" includes all forms of small arms, mortars, artillery. All weapons with bore measurements less than 20 mm in diameter are treated as small arms, whereas weapons of a larger bo diameter are considered artillery pieces, or guns. Mortars are no generally placed in either of the two classes but are treated separately. The term "gun" as used in this report applies only to artillery pieces.

Soviet weapons can be characterized in general as simple, rugg and effective, although not particularly impressive when compared

their US counterparts. All models now standard are well suited both to mass production and to ease of handling and maintenance. Their simplicity of design and relatively wide tolerances enable them to function well even under extremely adverse conditions. 1/*

A. Products.

1. Small Arms.

The small arms currently in use in the USSR are essentially those developed and used during World War II. A few changes have occurred, such as the replacement of the Maxim heavy machine gun by the light machine gun M1946. 2/

The small arms in military use in the USSR 3/ during 1953 were as follows:

Tula-Tokarev M1933 Pistol	Standard side arm
PPsh-1941 and PPS-1943	Submachine guns
M1944 Carbine	Standard shoulder arm
7.62-mm Degtyarev Series	Light machine gun and tank machine gun
7.62-mm Guvyunov	Heavy machine gun
7.62-mm M1946	Light machine gun, replacing the 7.62-mm Guvyunov
12.7-mm Degtyarev-Shpagin M1938	Heavy machine gun and anti-aircraft (AA) machine gun

2. Artillery.

Soviet artillery weapons are generally equal in effectiveness to those of the Western powers, although some refinements and characteristics making for maneuverability are lacking in the large sizes. Deficiencies of modern fire control have been overcome by detailed tactical preparation and the use of additional pieces. Emphasis is placed on dual-purpose, high-velocity, direct-fire pieces.

The guns in military use in the USSR during 1953 4/ were as follows:

* Footnote references in arabic numerals are to sources listed in Appendix E.

76-mm Divisional Gun M1942	Dual-purpose, antitank (AT) and field gun
85-mm Gun M1945	Dual-purpose, AT and field gun, replacing the 76-mm gun
100-mm Field Gun M1944	Dual-purpose, AT and field gun
122-mm Howitzer M1938	Divisional field artillery
122-mm Gun M1931/37	Corps artillery
152-mm Howitzer M1943	Standard in the artillery division
152-mm Gun Howitzer	Used for counterbattery and long-range interdiction fire
152-mm Gun M1935	Heavy artillery
203-mm Howitzer M1931	Standard heavy howitzer
210-mm Gun M1939	Super-heavy Skoda-designed weapon
280-mm Howitzer M1937	Short-range heavy howitzer
306-mm Howitzer M1940	Used in army group support
57-mm AT Gun M1943	Divisional AT gun
37-mm AA Gun M1939	Standard divisional AA gun
57-mm AA Gun	Replacing the 37-mm AA gun
85-mm AA Gun M1939 and M1944	Standard heavy AA gun
100-mm AA Gun	Replacing the 85-mm AA gun
85-mm Gun	Mounted on the medium tank, T-34 (85)*
100-mm Gun	Mounted on the medium tank, T-54*
122-mm Gun	Mounted on the heavy tanks, JS-2, JS-3*
100-mm Gun	Mounted on SU-100*
152-mm Gun	Mounted on JSU-152*
132-mm Rocket Launcher M13	Found in tank and mechanized divisions
82-mm Recoilless Rifle	Probably standard in the division
23-mm Aircraft Cannon	Used by MIG-15, IL-28, Type 35, TU-4
37-mm Aircraft Cannon	Used by MIG-15

3. Mortars.

There are 3 models of mortars currently in use in the USSR, the 82-mm, the 120-mm, and the 160-mm. 5/

4. Naval Guns.

The naval guns in military use in the USSR during 1953 were as follows:

37-mm AA Single Gun	O and modified O destroyers
37-mm AA Twin Gun	Sverdlov cruisers

* Only the guns, as distinguished from the self-propelled unit, are considered in this report.

45-mm AA Single Gun	Submarines and merchant vessels
3-inch 55 Single Gun	Subchasers
3-inch 55 DP Twin Gun	O and modified O destroyers
3.9-inch 51 Wet, Single Gun	K class ocean-going submarine
3.9-inch 56 DP Single Gun	Main battery of coastal destroyer
3.9-inch 56 DP Twin Gun	Secondary battery, Sverdlov cruiser
4.8-inch 46 Twin Gun	O and modified O destroyer
6-inch 50 Three-Gun Turret	Chapayev and Sverdlov cruisers

B. History and Organization of the Soviet Weapons Industry.

In 1940 there were 12 gun factories and 30 small arms factories in the USSR. 6/ The most important plants were in Tula, Izhevsk, Nizhniy Tagil, Kovrov, Zlatoust, Podlipki, Leningrad, Stalingrad, Molotov, and Sverdlovsk. The German invasion of 1941 and the consequent evacuation of factories from the western part of the USSR resulted in a net decrease in the total number of weapons plants as well as in a general shift of the industry. In 1942 the number of gun factories had been reduced to six. By 1944, however, 2 new gun factories had been added, bringing the total to 8.

In spite of the evacuation, the production of artillery in December 1942 was 1.8 times greater than in December 1941. 7/ By 1944 the production of guns had reached the high level of about 120,000 pieces as compared with an output of 25,000 guns in 1940. Similarly, the production of rifles and machine guns expanded rapidly. The average yearly production of rifles during the last 3 years of World War II was approximately 3 million 8/ as compared with an estimated peacetime production rate of 600,000 in 1940. 9/ The production of machine guns increased from about 72,000 in 1940 10/ to an average annual output of about 450,000 during the last 3 years of the war. 11/*

Following World War II, Soviet weapons plants were converted to peacetime production. Many gun and small arms plants, particularly the larger ones, however, continued to produce weapons but at a rate much lower than wartime levels. The plants which converted to complete peacetime production were, in the main, small arms plants.

* See footnote on p. 31.

These factories could be readily reconverted to wartime production in case of a new national emergency.

Until the latter part of 1936, all gun production was directed by the People's Commissariat for Heavy Industry. From the end of 1936 until early 1939 the responsibility for gun production fell to the People's Commissariat for Munitions. From 11 January 1939 until the reorganization of March 1946, which involved not only a change in structure but also a change in titles from People's Commissariats to Ministries, the People's Commissariat of Armaments was responsible for the production of all guns 37 mm and upward. Since then the Ministry has been responsible for small arms as well. 12/ On 15 March 1953 the Supreme Soviet created a new Ministry of Defense Industry, which assumed the functions of the former Ministry of Armaments.

II. Coefficients of Production.

The major purpose of this report is to determine the peacetime inputs of the Soviet weapons industry. This section is devoted to an examination of the proper unit for measuring the output of the weapons industry and to the computation of the various production coefficients. A production coefficient is defined as the quantity of an input necessary to produce one unit of output, given the appropriate amounts of cooperating inputs or services. The discussion is limited to the following inputs: steel, aluminum, copper, coal, petroleum, lumber, rubber tires, antifriction bearings, electric power, man-hours, gas, machine tools, capital equipment, and capital construction.

A. Unit of Output.

The value of production coefficients, relating inputs to outputs, is affected by the size and nature of the units in which both input and output are expressed. The units adopted for measuring inputs are widely used units such as tons and gallons. There are 33 types of weapons currently being produced or used in the USSR, and, consequently, there are 33 units for measuring output. Treatment of each weapon separately would involve considerable detail and would at times become unwieldy. It is desirable, therefore, to construct a representative unit of output in order to facilitate computations and simplify presentation.

The proportions in which the various weapons are produced are known only to a very limited degree. Thus representativeness must

be based on the next best alternative to the known composition of supply -- the composition of demand. This report is concerned wit establishing a level for peacetime demand as contrasted with two c demands -- mobilization demand and wartime demand. Obviously, pea time demand stems from conditions and requirements different from time or mobilization demand. The principal difference is a change the attrition rates for each type of weapon in use.

In this report, Soviet production schedules for weapons wi be established in accordance with peacetime demand for weapons in given year. Peacetime demand for weapons will reflect (1) mainten of existing weapons inventory and (2) replacement of obsolete mode with new models. This statement assumes that there will be no increase in the size of the weapons inventory. The inventory has be built up over a period of years and does not necessarily contain a complete stock of new models. New models are being produced continually to replace old models, but replacement is spread out o a number of years. Not all weapons in existence are in the hands troops; approximately 60 percent are in storage. 13/ Because the attrition rate on stored weapons is relatively small, it is ignore It is also assumed that exports consist entirely of obsolete model not subject to replacement. The exceptions to this assumption are discussed in the footnotes for Table 1.*

In addition to ground weapons, it is necessary to include craft and naval guns in a unit which represents peacetime demand. Peacetime demand for naval guns, however, stems from a different u pattern from that for ground and aircraft weapons. Therefore, two representing peacetime demand are established. One unit provides measure for naval guns, and the other combines ground and aircraft weapons in a single unit. Aircraft weapons are produced by the sa establishments as other weapons, which justifies their inclusion f input purposes. Table 1 illustrates the two representative units, bundles of weapons. In the case of Bundle 1, ground force and air craft weapons, total peacetime weapons demand per year is divided 100, and for Bundle 2, naval weapons, total peacetime demand per year is equal to 1 bundle. The footnotes for Table 1 explain the detailed method for establishing the peacetime demand for each wea

* Table 1 follows on p. 8.

Table 1

Representative Unit, or Bundle,
for Measuring Weapons Output in the USSR
1953

Bundle 1, Ground and Aircraft Weapons a/*

Type of Weapon	Number of Weap
Rifles and Carbines	970.0 b/
Pistols	230.0 b/
Submachine Guns	291.0 b/
7.62-mm Machine Gun	32.4 b/
12.7-mm Machine Gun	14.8 b/
57-mm AA Gun	23.5 b/
100-mm AA Gun	44.1 b/
57-mm AT Gun	11.7 b/
132-mm Rocket Launcher	2.5 b/
82-mm Recoilless Rifle	8.2 b/
82-mm Mortar	3.4 b/
120-mm Mortar	6.7 b/
160-mm Mortar	3.2 b/
85-mm Gun	3.7 b/
122-mm Gun and Howitzer	7.7 e/
152-mm Howitzer, Gun, Gun Howitzer	5.0 e/
203-mm Howitzer	0.3 b/
100-mm Tank Gun (T-54)	63.0 c/
122-mm Tank Gun (JS)	14.6 c/
100-mm SP Gun (SU-100)	11.0 c/
152-mm SP Gun (JSU-152)	21.9 c/
23-mm Aircraft Cannon	212.9 d/
37-mm Aircraft Cannon	58.3 d/
Total	2,039.9

* Footnotes for Table 1 follow on p. 9.

Table 1

Representative Unit, or Bundle,
for Measuring Weapons Output in the USSR
1953
(Continued)

Bundle 2, Naval Weapons f/

Type of Weapon	Number of Weapons
37-mm AA Single Gun	266.0
37-mm AA Twin Gun	78.6
45-mm AA Single Gun	60.0
3-inch/55 Single Gun	50.0
3-inch/55 DP Twin Gun	18.0
3.9-inch/51 Wet, Single Gun	40.0
3.9-inch/56 DP Single Gun	40.0
3.9-inch/56 DP Twin Gun	26.1
4.8-inch/46 Twin Gun	36.0
6-inch/50 Three-Gun Turret	17.4
Total	632.1

a. The weapons included in Table 1 are those believed to be in current production in the USSR. The 100-mm Gun and various types of heavy artillery pieces are probably manufactured in very small quantities, but the total input for these weapons is negligible. These weapons, therefore, are not listed in the bundle of weapons.
b. Peacetime demand per year for all weapons in this category is calculated on the following basis -- the number of weapons needed to maintain existing inventory plus the number of weapons needed to replace obsolete weapons.

The maintenance factor is equal to the weapons in use by troops on active duty multiplied by the peacetime attrition rate. The total weapons being used by troops is equal to 40 percent of the total mobilization requirements as estimated by the Department of the

Table 1

Representative Unit, or Bundle,
for Measuring Weapons Output in the USSR
1953
(Continued)

Army in NIS 26, dated March 1951. The total mobilization requirem is equal to 420 field divisions plus 100 divisions in the process training. The 40-percent factor includes the estimated 175 active divisions (33 percent) plus 7 percent for various supporting troop active duty. Department of the Army training attrition factors ar as the peacetime attrition rates.

The replacement factor allows for the introduction of new mode the Soviet weapons system. Replacement per year is equal to the t number of weapons needed for full mobilization requirements multip by a factor of 20 percent. The 20-percent factor is based on know Soviet practice in the tank industry which introduces the new mode T-54 medium tank over a period of approximately 5 years. This tan placement rate is assumed correct for other categories of weapons.

For the 100-mm AA Gun the replacement rate is based on a total weapons inventory estimated by the Department of the Army. A new heavier AA gun has been seen, and it is assumed to be the 100-mm AA Gun which will supersede the older 85-mm AA Gun when the replac ment program is completed. The replacement rate is equal to zero all cases where a new model is not being introduced during the per covered by this report.

c. The peacetime demand for tank cannon is equal to the number of cannon necessary to provide current tank production. The current CIA estimates are used in this report.

d. The peacetime demand for aircraft cannon is equal to the numbe weapons necessary to provide cannon for current aircraft productio The current USAF estimate is used in this report.

e. The peacetime demand for the 122-mm Howitzer and 152-mm Howitze is assumed to be equal to the minimum production for the period 19 as enumerated by CIA analyses. demand is higher than a demand factor calculated according to the described in footnote b, above.

Table 1

Representative Unit, or Bundle,
for Measuring Weapons Output in the USSR
1953
(Continued)

Therefore, the peacetime demand reflects the demand factor due to export of the above guns. The only other gun known to have been exported in appreciable quantities is the 76-mm Divisional Gun in 1942. However, it is assumed that export of this weapon is not reflected in the peacetime demand, because the weapon has been replaced by the 85-mm Gun and is being retired from service.

f. The peacetime demand for naval weapons is equal to the average number of guns needed per year to complete the armaments requirements for ship construction. The ONI shipbuilding estimates for the period 1950-55 are averaged to obtain the number of ships completed each year. Coast defense guns are not considered in the report, because no information is available.

Given the distribution of peacetime weapons demand, it is necessary to assume that this distribution is the same as the distribution in production. It is obvious that, for short periods of time, correspondence of the distribution pattern of peacetime demand and of the distribution pattern in production will not always occur. If, for instance, over a period of 6 months, great emphasis is placed on the production of AA artillery, a considerable disparity between the 2 patterns may occur. But over a period 2 or 3 times as long -- for instance, 18 months -- the disparity will most probably disappear as the production pattern is reflected in the demand pattern.

The demand pattern, that pattern revealed by the bundle of weapons, remains unchanged only for periods short enough to exclude changes in military tactics and techniques of warfare. Major changes in war techniques or tactics will be reflected in the representative bundle through changes in the Order of Battle and attrition rates, yielding a representative bundle with a series of ratios differing in varying degrees from the ratios of the earlier bundle.

B. Computed Coefficients.

1. Steel, Aluminum, and Copper.

The coefficients for steel, aluminum, and copper are taken without adjustment from the World War II production data for equivalent US weapons. There is not enough information with respect to these coefficients in the USSR either for their direct computation or for providing adjustment factors. In order to avoid errors resulting from differences in the weight of end items performing similar functions in the US and the USSR, the coefficients settled on are those giving the ratio of the weight of material input to the weight of the finished output. The less satisfactory alternative is to relate units of input to full units of output.

The first column of Table 2* repeats the list of 33 weapons composing Bundle 1 and Bundle 2. Column 2 in Table 2 gives the weight of the individual Soviet weapons which, multiplied by Column 3 (the number of weapons per bundle), yields the weight (Column 4) of each type of weapon per bundle. The coefficients of Column 5 are the ratios of the input of finished steel products, aluminum, and copper to pound of finished weapon, based on US production data. 14/ The input of steel includes all the steel required for the production of each weapon and the spare parts ordinarily produced with the weapon; machining wastage and losses from rejects are therefore included. In the absence of definite information, it is assumed that the same holds true for nonferrous metal inputs. Column 6, the product of Columns 4 and 5, indicates the input per bundle by weapon.

The steel, copper, and aluminum requirements for Bundle 1 are 1,861, 13, and 6 short tons, respectively, and for Bundle 2, 17,737, 729, and 23 short tons, respectively.

Table 14** lists, with their Soviet equivalents, the types of US weapons used to compute these input coefficients.

2. Coal, Petroleum, Gas, Lumber, and Electric Power.

The data for this group of inputs are not so extensive as the data for steel, copper, and aluminum, which covered the US

* Table 2 follows on p. 13.
** P. 48, below.

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Table 2

Inputs of Steel, Aluminum, and Copper per Bundle of Weapons
1953

(1)	(2)	(3)	(4)	(5)				(6)			
				Coefficients 15/ a/*				Inputs per Bundle (Pounds)			
				Steel				Steel			
Weapons in Bundle 1	Weight per Weapon (Pounds) 16/	Number of Weapons per Bundle	Weight per Bundle (Pounds)	Carbon	Alloy	Aluminum	Copper	Carbon	Alloy	Aluminum	Copper
Rifles and Carbines	8.8	970.0	8,536	1.33	1.24	0	0	11,353	10,585	0	0
Pistols	2.0	230.0	460	5.80	0.67	0	0.003	2,668	308	0	1.4
Submachine Guns	6.6	291.0	1,921	3.60	0.09	0	0.003	6,916	173	0	5.8
7.62-mm Machine Gun	28.7	32.4	930	2.60	1.00	0.008	0.004	2,418	930	7.4	3.7
12.7-mm Machine Gun	89.1	14.8	1,319	0.33	1.73	0	0	435	2,282	0	0
57-mm AA Gun	4,630.0 b/	23.5	108,805	1.22	0.64	0	0	132,742	69,635	0	0
100-mm AA Gun	15,000.0 b/	44.1	661,500	1.33	1.37	0.010	0.028	879,795	906,255	6,610.0	18,522.0
57-mm AT Gun	2,535.0	11.7	29,660	0.53	2.26	0	0.020	15,720	67,032	0	593.0
132-mm Rocket Launcher	2,300.0 c/	2.5	5,750	0.82	1.35	0.007	0.050	4,715	7,763	40.2	288.0
82-mm Recoilless Rifle	166.0 d/	8.2	1,361	0.82	1.35	0.007	0.050	1,116	1,837	9.5	68.0
82-mm Mortar	128.0	3.4	435	0.82	1.35	0.007	0.050	357	587	3.0	21.8
120-mm Mortar	606.0	6.7	4,060	0.82	1.35	0.007	0.050	3,329	5,481	28.4	203.0
160-mm Mortar	2,381.0	3.2	7,619	0.57	3.15	0.007	0.050	4,343	24,000	53.3	381.0
85-mm Gun	3,748.0	3.7	13,868	0.67	1.50	0	0.025	9,292	20,802	0	346.7
122-mm Gun and Howitzer	7,643.0 c/	7.7	58,851	0.50	2.22	0	0.024	29,426	130,649	0	1,412.4
152-mm Howitzer, Gun, Gun Howitzer	15,714.0 c/	5.0	78,570	0.43	1.84	0	0	33,785	144,569	0	0
203-mm Howitzer	39,021.0	0.3	11,706	0.33	2.22	0	0.016	3,863	25,986	0	187.3
100-mm Tank Gun (T-54)	2,382.0 d/	63.0	150,066	0.03	2.85	0	0	4,500	427,688	0	0
122-mm Tank Gun (JS)	4,454.0	14.6	65,028	0.03	2.85	0	0	1,951	185,330	0	0
100-mm SP Gun (SU-100)	2,382.0 d/	11.0	26,202	0.03	2.85	0	0	786	74,676	0	0
152-mm SP Gun (JSU-152)	4,500.0 b/	21.9	98,550	0.03	2.85	0	0.005	2,957	280,868	0	492.8
23-mm Aircraft Cannon	150.0	212.9	31,935	0.21	3.08	0.17	0.090	6,706	98,360	5,430.0	2,874.2
37-mm Aircraft Cannon	405.0 d/	58.3	23,612	0.21	3.08	0	0.021	4,959	72,725	0	495.9
Total (Pounds)			1,390,744					1,164,132	2,558,521	12,181.8	25,897.0
Total (Short Tons)			695.9					582.1	1,279.3	6.1	12.9

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Table 2

Inputs of Steel, Aluminum, and Copper per Bundle of Weapons
1953
(Continued)

(1)	(2)	(3)	(4)	(5)				(6)			
				Coefficients 15/ a/				Inputs per Bundle (Pounds)			
				Steel				Steel			
Weapons in Bundle 2	Weight per Weapon (Pounds) 16/	Number of Weapons per Bundle	Weight per Bundle (Pounds)	Carbon	Alloy	Aluminum	Copper	Carbon	Alloy	Aluminum	Copper
37-mm AA Single Gun	4,430.0 b/	266.0	1,178,380	1.17	1.35	0	0.131	1,378,704	1,590,813	0	154,368
37-mm AA Twin Gun	7,970.0 b/	78.6	626,442	1.17	1.35	0	0.131	732,937	845,697	00	82,064
45-mm AA Single Gun	1,124.0 b/	60.0	67,440	0.69	1.91	0	0	46,534	128,810	0	0
3-inch/55 Single Gun	10,913.0 b/	50.0	545,650	0.94	1.19	0.003	0.107	512,911	649,323	1,637	58,385
3-inch/55 DP Twin Gun	19,600.0 b/	18.0	352,800	0.94	1.19	0.003	0.107	331,632	419,832	1,058	37,750
3.9-inch/51 Wet, Single Gun	12,400.0 b/	40.0	496,000	1.15	2.77	0	0.141	570,400	1,373,920	0	69,936
3.9-inch/56 DP Single Gun	22,266.0 b/	40.0	890,640	0.94	1.19	0.003	0.107	837,202	1,059,862	2,672	95,298
3.9-inch/56 DP Dual Gun	90,000.0 b/	26.1	2,349,000	0.94	1.19	0.003	0.107	2,208,060	2,795,310	7,047	251,343
4.8-inch/46 Twin Gun	88,500.0 b/	36.0	3,186,000	0.94	1.19	0.003	0.107	2,994,840	3,791,340	9,558	340,902
6-inch/50 Three-Gun Turret	460,000.0 b/	17.4	8,004,000	0.17	1.48	0.003	0.046	1,360,680	11,845,920	24,012	368,184
Total (Pounds)			17,696,352					10,973,900	24,500,827	45,984	1,458,230
Total (Short Tons)			8,848.2					5,486.9	12,250.4	22.99	729.1

a. Pounds of raw material per weight of finished weapon in pounds.
b. Estimated weight based on specifications of US and Soviet weapons.
c. Weighted average for all weapons in the category.
d. Weight of US prototype.

equivalents for all 33 Soviet weapons. The data for these inputs are for only 11 US ground and aircraft weapons and include partial data for 3 US naval weapons. To apply the coefficients for the 11 US ground and aircraft weapons to all 23 Soviet ground and aircraft weapons, it is necessary to treat 1 or more of the 11 US weapons as representative of a class of Soviet weapons. Seven of the ground force weapons (see Table 3)* are assigned to separate classes; the type of weapons and coefficients differ sufficiently to warrant separate treatment. The other four are assigned to one class because of the homogeneity of their input coefficients. The puts of coal, petroleum, and natural gas are not available for the first three weapons of Table 3. The weapon most nearly like the f three weapons in Table 3 is the one in Class F. The inputs of coa petroleum, and natural gas for Class F are therefore used for the three weapons of Table 3. Bundle 2, naval weapons, is broken down to three classes. Because of the similarity of the input coeffici ground force weapons coefficients are used in all cases where data not available for the specific naval weapon.

The weapons listed in Table 3 are divided into 11 clas The inputs per 1,000 pounds of weapons of each class are assumed t be representative of the inputs per 1,000 pounds of output for all of the weapons assigned to that class. Class A, including the US Rifle, M1, is assumed to be representative of all the Soviet weapo of that class -- namely, the carbine, the rifle, the pistol, and the submachine gun. Class B, including the US Browning Automatic Rifle, is assumed to be representative of the Soviet light machine Other classes are assumed to be similarly representative.**

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* Table 3 follows on p. 17.

** The Soviet weapons included in each class are as follows:

Bundle 1:

Class A includes the carbine, rifle, pistol, and submachine g
Class B includes the 7.62-mm Machine Gun.
Class C includes the 12.7-mm Machine Gun, the 23-mm Aircraft Cannon, and the 37-mm Aircraft Cannon.
Class D includes the 82-mm Mortar and the 82-mm Recoilless Rifle.
Class E includes the 120-mm Mortar, the 160-mm Mortar, and th 132-mm Rocket Launcher.
Class F includes the 57-mm AA Gun.

(footnote continued on p. 16)

Table 4* gives the results of the application of the puts per 1,000 pounds of output from Table 3 to the 11 classes cc sisting of 33 different Soviet weapons. The portion of the total weight of the representative bundles accounted for by each class weapons (in units of 1,000 pounds) is given immediately below eac class designation. The inputs per 1,000 pounds of output make up first row following each input. The second row is the quantity c that input required per bundle, or the product of the input per 1,000 pounds and the weight of the weapons (in units of 1,000 pou in each class. The total inputs per bundle appear in the last cc

3. Rubber Tires and Antifriction Bearings.

The number of antifriction bearings and rubber tires Bundle 1 as determined from the descriptive data of Soviet and US weapons is 2,209 units and 356 units, respectively. 17/ The numb antifriction bearings for Bundle 2 is 8,256.

4. Labor.

Labor is an important input in the production of weap making up a considerable proportion of their cost. It is also an

(footnote continued from p. 15)

Class G includes the 85-mm Gun; the 122-mm Gun and Howitzer 152-mm Gun, Howitzer, and Gun Howitzer; the 57-mm AT Gun; the 100-mm AA Gun.
Class H includes the 100-mm Tank Gun, the 122-mm Tank Gun, 100-mm SP Gun, the JSU 152-mm SP Gun, and the 203-mm Howit

Bundle 2:

Class J includes both 37-mm AA Guns and the 45-mm AA Gun.
Class K includes the 3-inch/55 DP Twin Gun.
Class L includes the 3-inch/55 Single Gun, the 3.9-inch/51 Gun, both 3.9-inch/56 Guns, the 4.8-inch/46 Twin Gun, and the 6-inch/50 Three-Gun Turret.

* Table 4 follows on p. 20.

Table 3

Input per Weapon and Input per 1,000 Pounds of Output
for Eleven US Weapons 18/
1953

Item	Weight of Weapon (Pounds)	Coal (Short Tons)	Petroleum (Gallons)	Natural or Producer Gas (Thousand Cubic Feet)	Lumber (Board Feet)	El P (Ki H
Class A						
Rifle, M1	10.3	N.A.	N.A.	N.A.	29	
Input per 1,000 Pounds		1.10 a/	11 a/	2.8 a/	2,815	
Class B						
Browning Automatic Rifle, Caliber .30, M1, 1918, H3	19.4	N.A.	N.A.	N.A.	25	
Input per 1,000 Pounds		1.10 a/	11 a/	2.8 a/	1,289	
Class C						
Machine Gun, Caliber .50 AC	113	N.A.	N.A.	N.A.	15	
Input per 1,000 Pounds		1.10 a/	11 a/	2.8 a/	133	
Class D						
81-mm Mortar, M29, with Mount M23A1	136	0.47	4.4	1.2	0	

a. The same as the values in Class F.

Table 3

Input per Weapon and Input per 1,000 Pounds of Output
for Eleven US Weapons 18/
1953
(Continued)

Item	Weight of Weapon (Pounds)	Coal (Short Tons)	Petroleum (Gallons)	Natural or Producer Gas (Thousand Cubic Feet)	Lumber (Board Feet)	Ele Po (Kil Ho
Class D (Continued)						
Input per 1,000 Pounds		3.46	32.0	8.8	0	1,
Class E						
4.2-inch Mortar, M30, with Mount M24	340	1.47	14.1	3.7	0	
Input per 1,000 Pounds		4.32	41.0	10.9	0	1,
Class F						
40-mm Gun, Twin, Automatic, T141	2,000	2.20	21	5.5	0	
Input per 1,000 Pounds		1.10	11	2.8	0	
Class G						
105-mm Howitzer	6,565	7.33	70	20.7	0	2,
Input per 1,000 Pounds		1.11	11	3.2	0	

Table 3

Input per Weapon and Input per 1,000 Pounds of Output for Eleven US Weapons 18/
1953
(Continued)

Item	Weight of Weapon (Pounds)	Coal (Short Tons)	Petroleum (Gallons)	Natural or Producer Gas (Thousand Cubic Feet)	Lumber (Board Feet)	El P (Ki H
Class H						
155-mm Gun SP, T97	7,350	57.66	533	162.0	0	17
Input per 1,000 Pounds		7.84	75	22.0	0	2
8-inch Howitzer SP, T108	6,392	45.66	440	133.0	0	13
Input per 1,000 Pounds		7.14	69	20.8	0	2
105-mm Howitzer SP, T98	942	6.50	62	19.0	0	1
Input per 1,000 Pounds		6.90	66	20.2	0	2
155-mm Howitzer SP, T99	3,490	20.72	196	72.0	0	6
Input per 1,000 Pounds		5.94	56	20.6	0	1
Underweighted Average of Inputs in Class H per 1,000 Pounds		6.96	67	20.6	0	2

Table 4

Inputs of Coal, Petroleum, Natural or Producer Gas, Electric Power, and Lumber per Bundle of Soviet Weapons
1953

	Bundle 1									Bundle 2			
Input	Class A (1,000 Pounds) 10.9 x a/	Class B (1,000 Pounds) 0.9 x a/	Class C (1,000 Pounds) 56.8 x a/	Class D (1,000 Pounds) 1.8 x a/	Class E (1,000 Pounds) 17.4 x a/	Class F (1,000 Pounds) 108.8 x a/	Class G (1,000 Pounds) 842.5 x a/	Class H (1,000 Pounds) 351.5 x a/	All Classes Total per Bundle	Class J (1,000 Pounds) 1,872.3 x a/	Class K (1,000 Pounds) 352.0 x a/	Class L (1,000 Pounds) 15,471.3 x a/	All Classes Total per Bundle
Coal (Short Tons)													
Input per 1,000 Pounds b/	1.1	1.1	1.1	3.46	4.32	1.1	1.1	6.96		1.1	6.96	6.96	
Input per Bundle	12.0	1.0	62.5	6.2	75.2	120.0	927.0	2,446.4	3,635.9	2,059.5	2,449.9	107,680.0	112,189.4
Petroleum (Gallons)													
Input per 1,000 Pounds b/	11.0	11.0	11.0	32.0	41.0	11.0	11.0	67.0		11.0	67.0	67.0	
Input per Bundle	120.0	10.0	625.0	57.6	713.4	1,196.8	9,270.0	23,550.5	35,546.6	20,595.0	23,584.0	1,036,577.0	1,080,756.0
Natural or Producer Gas (1,000 Cubic Feet)													
Input per 1,000 Pounds b/	2.8	2.8	2.8	8.8	10.9	2.8	3.2	20.9		2.8	20.9	20.9	
Input per Bundle	30.5	2.5	159.0	15.8	189.6	304.6	2,696.0	7,346.0	10,743.8	5,242.4	7,356.8	323,350.0	335,949.0
Lumber (Board Feet)													
Input per 1,000 Pounds b/	2,815.0	1,289.0	133.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Input per Bundle	30,683.5	1,160.0	7,554.4	0.0	0.0	0.0	0.0	0.0	39,397.9	0.0	0.0	0.0	0.0
Electric Power (Kilowatt-Hours)													
Input per 1,000 Pounds b/	6,700.0	16,000.0	9,150.0	1,044.0	1,324.0	388.0	340.0	2,115.0		388.0	4,780.0 c/	3,000.0	
Input per Bundle	73,030.0	14,400.0	519,720.0	1,879.2	23,037.6	42,214.4	286,450.0	743,423.0	1,704,154.0	726,452.0	1,682,560.0	46,413,900.0	48,822,912.0

a. See Table 2, p. 13, above.
b. See Table 3, p. 17, above.
c. CIA estimate.

input which varies with production rates and time and between countries for a given amount of product. At the present time there is not enough information to calculate the productivity of labor in the production of weapons from Soviet data, nor is there enough information to allow a reliable comparison of the productivity of US and Soviet labor in the production of weapons.* It is therefore necessary, in spite of any error involved, to use unadjusted US data for the labor input.

* Following is an interesting comparison of productivity, which cannot be taken as final, however, since it is not known whether the man-hours reported by Voznesenskiy refer to the production of the complete weapon or to a subassembly only. The productivity of Soviet labor for the war period was given for five weapons by a Soviet economist. 19/ The man-hour requirements in 1944 for the five weapons are as follows:

Estimated Direct Labor Inputs for Weapons Production in the USSR
1944

Weapon	Weight of Weapon (Pounds)	Man-Hours per Weapon	Man-Hours per 1,000 Pounds of Product
76-mm Regimental Cannon	1,323	800	605
76-mm Division Cannon	2,460	600	244
152-mm Howitzer	7,937	2,400	302
Average			384
Large-Caliber Machine Gun	89.1	329	3,692
Rifle	10.3	9	874
Average			2,283

The man-hour requirements for similar weapons in the US are as follows: (footnote continued on p. 22)

Table 5* shows the man-hour requirements for the same 11 US ground force weapons used to determine inputs in the previous section. Column 1 of Table 5 gives the weight of the weapons; Column 2, the direct man-hours required to produce the weapons; and Column 3, the number of direct man-hours required to produce 1,000 pounds of the weapons, calculated by dividing Column 2 by Column 1 and multiplying by 1,000.

(footnote continued from p. 21)

Direct Labor Inputs for Weapons Production in the US 1944 and 1952 20/

Weapon	Weight of Weapon (Pounds)	Man-Hours per Weapon	Man-Hours per 1,000 Pounds of Product
75-mm Howitzer, Pack	2,000	1,649 a/	820
75-mm Howitzer	2,700	2,045 a/	757
105-mm Howitzer	6,565	4,200 b/	640
Average			739
Machine Gun, Caliber .50	126	45.0	357
Rifle, M1, Caliber .30	10.3	7.35	724
Average			541

a. 1944 data.

b. 1952 figure. The ratio of 1 to 4.2 for US to Soviet labor in small arms production is in line with general belief. 21/ The ratio of 1 to 0.52 in artillery production is, however, quite to the contrary. It may be that the Soviet figure is mainly an assembly time figure or a subtotal for only part of a finished weapon. The US figure includes direct labor only.

* Table 5 follows on p. 23.

Table 5

Direct Man-Hour Requirements for Eleven US Weapons 22/
1953

Class	Weapon	Weight of Weapon (Pounds)	Direct Man-Hours per Weapon	Direct Man-Hours per 1,000 Pounds of Output
A	Rifle, M1	10.3	7.35	714
B	Browning Automatic Rifle, Caliber .30	19.4	36.5	1,881
C	Machine Gun, Caliber .50	126	45.0	357
D	81-mm Mortar	136	135	993
E	4.2-inch Mortar	340	285	838
F	40-mm Gun, Twin, Automatic	2,000	3,730	1,865
G	105-mm Howitzer	6,565	4,200	640
H	155-mm Gun, SP	7,350	2,475	337
	8-inch Howitzer, SP	6,392	2,690	421
	105-mm Howitzer, SP	942	830	881
	155-mm Howitzer, SP	3,490	2,240	642
	Unweighted Average of Class H			570

The labor input per 1,000 pounds of weapons output varies from 357 man-hours for a machine gun, caliber .50, to 1,865 man-hours for a 40-mm AA gun and finally to 1,881 man-hours for an automatic rifle.

In Table 6* the coefficients of Table 5 are applied to all 23 Soviet ground and air force weapons of the 8 classes. In addition, coefficients for each naval weapon, obtained from ORR, are listed in Table 6 and are applied in the same manner as the coefficients for each of the ground force classes. The first column gives the weight of the class in thousands of pounds. The second column gives the direct man-hours per 1,000 pounds of output (derived from Table 5).

* Table 6 follows on p. 24.

Table 6

Direct Man-Hour Requirements per Bundle of Soviet Weapons a/
1953

Class of Weapons	Weight of Class b/ (1,000 Pounds)	Man-Hours per 1,000 Pounds Output	Man-Hours per Bundle
Bundle 1			
A	10.9	714	7,783
B	0.9	1,881	1,693
C	56.8	357	20,278
D	1.8	993	1,787
E	17.4	838	14,581
F	108.8	1,865	202,912
G	842.5	640	539,200
H	351.5	570	200,355
Total			988,589
Bundle 2			
37-mm AA Single Gun	1,178.4	1,400 c/	1,649,760
37-mm AA Twin Gun	626.4	1,400	876,960
45-mm AA Single Gun	67.4	500	33,700
3-inch/55 Single Gun	545.7	990	540,243
3-inch/55 DP Twin Gun	352.8	868	306,230
3.9-inch/51 Wet, Single Gun	496.0	612	303,552
3.9-inch/56 DP Single Gun	890.6	612	545,047
3.9-inch/56 DP Twin Gun	2,349.0	400	939,600
4.8-inch/46 Twin Gun	3,186.0	400	1,274,400
6-inch/50 Three-Gun Turret	8,004.0	289	2,313,156
Total			8,782,648

a. See Table 5, p. 23, above.
b. See Table 2, p. 13, above.
c. ORR estimate.

and the last column, the product of the first two, shows the direct man-hour requirements of each class and all classes per bundle of weapons. The total number of direct man-hours required for Bundle 1 is 988,589 and for Bundle 2, 8,782,648. Allowing 2,500 man-hours per man-year, 23/ the total labor requirements per Bundle 1 are 395.4 man-years, and for Bundle 2, 3,513.1 man-years.

5. Capital Construction.

The weapons plants of the USSR have been described in intelligence sources, but the detail required for estimating capital construction and capital equipment inputs has been lacking. Therefore, it is necessary to estimate such inputs from plans for a "normal" plant with floor space measurements equal to the average floor space of the 22 plants listed in Appendix A and a labor force equal to the average labor force of the same plants. (See Appendix B.) In effect, the plans used are plans, drawn up according to known building practices in the USSR, for an average-size weapons plant capable of producing all kinds of weapons. The construction materials required for the plant are as follows:

Type of Construction	Weight
Steel	17,564 short tons
Masonry	
Mortar	1,450 cubic yards (9,724 short tons)
Bricks	2,860,000 units)
Concrete	44,465 cubic yards (88,930 short tons)
Other	
Creosoted Woodblock Flooring	5,000 short tons
Barrels of Pitch	800 short tons
Corrugated Asbestos Sheeting	1,545 short tons
Fasteners (Galvanized Metal)	22 short tons
Window Glass	125,000 square feet (1,370 short tons)

Using a depreciation rate of 2 percent appropriate for buildings of this kind, 24/ yearly depreciation expenditures in real units were determined. The normal plant employs 9,000 workers in 2 full shifts. It requires at most 558 man-years to produce Bundle 1 and 4,953 man-years to produce Bundle 2, or, in terms of time, it

requires 558/9,000 and 4,953/9,000, or 6 percent and 50 percent, respectively, of a year: that is, 6 percent and 50 percent, respectively, of annual depreciation are attributed to the production of each bundle of weapons. The material requirements per bundle representing depreciation are as follows:

	Weight	
Type of Construction	Bundle 1	Bundle 2
Steel	21.1 short tons	175.5 short tons
Masonry		
Mortar)	11.7 short tons	97.5 short tons
Bricks)		
Concrete	106.7 short tons	889.3 short tons
Other		
Creosoted Woodblock Flooring	6.0 short tons	50.0 short tons
Barrels of Pitch	1.0 short tons	8.0 short tons
Corrugated Asbestos Sheeting)	1.8 short tons	15.5 short tons
Fasteners (Galvanized Metal)		
Window Glass	1.6 short tons	13.7 short tons
Total	150.0 short tons	1,250.0 short tons

6. Capital Equipment.

The normal or average plant provides the basis for the capital-equipment input just as it does in the case of capital construction. The wear and tear on the machine tools charged to the production of one unit of output at the normal weapons plant is the basis of the capital-equipment input. The number of machine tools installed in the normal plant is 1,160 units. A yearly depreciation rate of 5 percent (ORR estimate) applied to machine tools gives an annual requirement of 58 units. The normal plant employs 9,000 workers in

2 full shifts. Requirements per bundle of weapons are at most 558 man-years for Bundle 1 and 4,953 man-years for Bundle 2. Used as a measure of the extent to which the facilities are used in the production of 1 unit of output, the part of a year required for a bundle of weapons amounts to 6 percent and 50 percent, respectively. Multiplied by the annual machine-tool expenditure of 58 units, the percent gives an input coefficient of 3.5 units for Bundle 1, weighing 11.6 short tons, and 29 units for Bundle 2, weighing 95.7 short tons.

Other capital equipment included in the normal plant is as follows:

Overhead Traveling Crane	55 units (2,526 short tons)
Jib Crane	260 units (195 short tons)
Storage Battery Truck	32 units
Charging Equipment	8 units
Rails	626 short tons
Woodworking Tools	32 units
Capital Equipment, n.e.c.	1,188 short tons

The inputs per bundle are figured with the same conversion factors which were used for machine tools. Rails are the exception, depreciating at 4 percent a year rather than at 5 percent. 25/ The inputs per bundle are therefore as follows:

	Input	
Type of Capital Equipment	Bundle 1	Bundle 2
Overhead Traveling Crane) Jib Crane)	8.2 units	68.0 units
Storage Battery Truck	Negligible	Negligible
Charging Equipment	Negligible	Negligible
Rails	1.9 short tons	15.7 short tons
Woodworking Tools	Negligible	Negligible
Capital Equipment, n.e.c.	3.6 short tons	29.7 short tons

The capital-equipment inputs, excluding those for which input weights are negligible, weigh 13.7 short tons for Bundle 1 and 113.4 short tons for Bundle 2.

7. Transportation.

The transportation input coefficients are expressed in short-ton-kilometers and are the products of the various inputs expressed in short tons and the average length of haul for the different materials (see Table 7).* The transportation required per unit of weapons output is about 4.5 million short-ton-kilometers for Bundle 1 and 96.5 million short-ton-kilometers for Bundle 2.

III. Output and Input.

In this section, output is considered in terms of bundles of weapons. A level of output is established for the production estimates in order that estimates of total input may be made.

A. Output.

The trends in gun production for more than two decades are shown in Table 8.** The figures in Table 8 relating to the early 1930's are not so large as those quoted in the historical discussion of Section I, because all plants are not covered in the first series of estimates, nor are all guns included, particularly tank guns and heavy guns. The production indexes in the last column of Table 8, crude as they are, serve to indicate major changes in gun production. The base years for the two indexes are 1937 and 1941. The year 1937 was the middle year of three fairly stable years for gun production, and 1941 was the first year for which there are reliable data.

Production increased sharply from 1931 to 1933, corresponding to the final years of the First Five Year Plan (1928-32) and the beginning of the Second Five Year Plan (1933-37) and also increased steadily from 1933 to 1940, with the exception of the slight setback in 1934. The years from 1941 to 1944 were the

* Table 7 follows on p. 29.
** Table 8 follows on p. 30.

Table 7

Transportation Input per Unit of Weapons in the USSR a/

Material	Short Tons per Bundle of Weapons	Average Length of Haul b/ 26/ (Short-Ton-Kilometers)	Short-Ton-Kilometers per Bundle of Weapons (Thousand Short-Ton-Kilometers)
Bundle 1			
Coal	3,636	640 to 660	2,327.0 to 2,399.8
Petroleum	131 c/	950 to 1,000	124.5 to 131.0
Steel	1,861	900 to 1,000	1,674.9 to 1,861.0
Aluminum	6	900 to 1,000	5.4 to 6.0
Copper	13	900 to 1,000	11.7 to 13.0
Lumber, Nonconstruction	69 d/	1,000 to 1,100	69.0 to 75.9
Construction Material	150	240 to 250	36.0 to 37.5
Capital Equipment	25	690 e/	17.3 to 17.3
Total for Bundle 1			4,265.8 to 4,541.5
Bundle 2			
Coal	112,189	640 to 660	71,801.0 to 74,044.7
Petroleum	3,980 c/	950 to 1,000	3,781.0 to 3,980.0
Steel	17,737	900 to 1,000	15,963.3 to 17,737.0
Aluminum	23	900 to 1,000	20.7 to 23.0
Copper	279	900 to 1,000	251.1 to 279.0
Lumber, Nonconstruction	0	0	0
Construction Material	1,250	240 to 250	300.0 to 312.5
Capital Equipment	209	690 e/	144.2 to 144.2
Total for Bundle 2			92,261.3 to 96,520.4

a. Not including transportation of rubber tires and antifriction bearings.
b. These are average haul figures for 1950.
c. Converted to weight from gallons.
d. Converted to weight from board feet.
e. Average haul for all freight.

Table 8

Production of Guns in the USSR
1929-52

	Units			Indexes		
	45-mm to 152-mm	37-mm and Up		Base Year 1937	Base Year 1941	
Year	Estimates 27/ a/	Estimates 29/	G-2 Estimates 30/	Estimates	Estimates	G-2 Estimates
1929	200+			Negligible		
1930	300+			Negligible		
1931	300+			Negligible		
1932	1,300+			32		
1933	2,700+			66		
1934	2,400+			59		
1935	3,330+			81		
1936	3,900+			95		
1937	4,100+	7,000		100	25	
1938	4,400+	N.A.		107	N.A.	
1939	1,160+	N.A.		150	N.A.	
1940	9,800+	17,200		239	62	
1941	16,610+	27,800	36,000 b/		100	100
1942	64,500+	81,700	96,500		294	268
1943	66,700	N.A.	110,700		N.A.	307
1944	71,500	108,300	121,700		390	338
1945		65,000	64,800		234	180
1946		36,600	28,100		132	78
1947		23,700	23,300		85	65
1948		17,750	22,100		64	61
1949		16,150	22,500		58	66
1950		N.A.	22,500		N.A.	61
1951		N.A.			N.A.	57
1952		N.A.			N.A.	61

a. Source 28/ gives production rates for guns of 45 mm to 152 mm as follows: 1929, 200; 1930, 550; 1931, 550; 1932, 1,480; 1933, 3,300; 1934, 2,800; 1935, 3,950; 1936, 5,139; 1937, 4,760; 1938, 11,140; 1939, 16,700; 1940, 13,580; 1941, 48,500; 1942, 118,750; 1943, 127,300.

b. Including spare parts.

years of expanding war production, which occurred in spite of the structural changes in the armaments industry resulting from the German invasion and the evacuation of plants eastward into the Urals. The year 1944 was the high point in armaments output for the USSR. Stalin stated in a speech at Moscow in 1946 31/ that the average yearly production of weapons in the USSR during the last 3 years of the war was 120,000 guns, 450,000 machine guns, 3 million rifles, 2 million submachine guns, and 100,000 mortars.*

Gun production declined considerably from 1944 to 1945, from 40 to 47 percent. By 1948, after further declines, gun production leveled off to between one-sixth and one-fifth of the highest level in 1944, coinciding with a general trend in all armaments production. 33/

Table 8 gives the estimated figure for 1952 gun production as 22,500 units, including spare parts. This figure is less reliable than the figures up to and including 1949. From 1949 to the present, data with respect to gun plants have been less reliable and less extensive than data before that time. Recent estimates of gun production have been influenced by the stable trend of output from 1947 through 1949.

has estimated that Soviet gun production in 1952 was 22,500 units. For small arms, the estimate is 317,500, and for mortars the estimate is 6,000, making a total for all units of 346,000. 34/ Table 9** shows the weight of the 346,000 weapons as 131,629,730 pounds, or 65,815 short tons. These weapons do not include the 23-mm and 37-mm aircraft cannons, rocket launchers, or naval guns. Excluding these weapons from the representative bundle, the weight of 1 bundle is 1,328,086 pounds, or 664 short tons. If 664 short tons of weapons are equal to 1 bundle of weapons, then 65,815 short tons of weapons are equal to 99 bundles. This number of bundles is accepted as the estimate of weapons production.

* There is disagreement about the proper translation of this passage. One source translated the figures as maximum figures rather than average. 32/ Support for the latter interpretation is given by an ORR translation of an article by M.I. Medelin in the 22 November 1953 issue of Pravda.

** Table 9 follows on p. 32.

Table 9

G-2 Estimates of Soviet Production of Weapons and Weight of Weapons 1952

Weapons	Weight of Weapon (Pounds)	Production Estimates (Units)	Total Weight of Weapons (Pounds)
Pistols	2.0	35,000	70,000
Rifles	8.8	125,000	1,100,000
Submachine Guns	6.6	100,000	660,000
7.62-mm Machine Gun	28.7	50,000	1,435,000
12.7-mm Machine Gun	89.1	7,500	668,250
Subtotal		317,500	3,933,250
82-mm Mortar	128	3,000	384,000
120-mm Mortar	606	2,000	1,212,000
160-mm Mortar	2,381	1,000	2,381,000
Subtotal		6,000	3,977,000
76-mm Gun	2,460	4,200	10,332,000
85-mm Gun	3,748	1,000	3,748,000
100-mm Gun	7,628	1,000	7,628,000
122-mm Howitzer	4,960	1,200	5,952,000
122-mm Gun	15,692	600	9,415,200
152-mm Howitzer	7,937	800	6,349,600
152-mm Gun Howitzer	15,714	800	12,571,200
152-mm Gun	40,093	60	2,405,580
203-mm Howitzer	39,021	100	3,902,100
280-mm Howitzer	40,565	20	811,300
57-mm Gun	2,535	500	1,267,500
37-mm AA Gun	4,630	1,000	4,630,000
85-mm AA Gun	9,480	1,000	9,480,000
100-mm AA Gun	23,148	500	11,574,000
Super-Heavy Artillery	97,000 a/	20	1,940,000
76-mm Gun, Tank, SP, and Spares	1,190	500	595,000
85-mm Gun, Tank, SP, and Spares	3,210	6,000	19,260,000
100-mm Gun, Tank, SP, and Spares	2,382	1,200	2,858,000
122-mm Gun, Tank, SP, and Spares	4,500	1,000	4,500,000
152-mm Gun, Tank, SP, and Spares	4,500	1,000	4,500,000
Subtotal		22,500	123,719,480
Total		346,000	131,629,730

a. Average weight of the 210-mm Gun and the 305-mm Howitzer.

B. Input.

1. In Real Units.

The input coefficients per representative unit of output were developed in Section II. Multiplied by the output in representative bundles of weapons, the input coefficients yield the quantity of inputs required for the estimated levels of weapons output. Table 10 lists the quantity of inputs required for the production of 99 representative units of Bundle 1 and 1 representative unit of Bundle 2.

Table 10

Inputs per Bundle of Weapons and Quantities of Input of the Soviet Weapons Industry a/*
1953

		1	2	3	4
Input	Unit of Input	Input for Bundle 1	Bundle 1 Input Required 99 Bundles	Input for Bundle 2	Total Inputs (Column 2 plus Column 3)
Labor	Man-Year	395.4	39,145	3,513	42,658
Steel	Short Tons	1,861	184,239	17,735	201,974
Aluminum	Short Tons	6	594	23	617
Copper	Short Tons	13	1,287	729	2,016
Coal	Short Tons	3,636	359,964	112,189	472,153
Electric Power	1,000 Kilowatt-Hours	1,704	168,696	48,823	217,519
Petroleum	1,000 Gallons	36	3,564	1,081	4,645
Natural or Producer Gas	1,000 Cubic Feet	10,744	1,063,656	335,949	1,399,605
Lumber, Noncon-struction	1,000 Board Feet	39	3,861	0	3,861
Antifriction Bearings	Units	2,209	218,691	8,256	226,947
Rubber Tires	Units	356	35,244	0	35,244

Table 10

Inputs per Bundle of Weapons and Quantities of Input
of the Soviet Weapons Industry
1953
(Continued)

		1	2	3	4
Input	Unit of Input	Input for Bundle 1	Bundle 1 Input Required 99 Bundles	Input for Bundle 2	Total Inputs (Column 2 plus Column 3)
Machine Tools	Units	3.5	347	29	376
Other Productive Equipment	Short Tons	13.7	1,356	114	1,470
Construction Materials	Short Tons	150	14,850	1,250	16,100
Transportation	1,000 Short-Ton-Kilometers	4,542	449,609	96,520	546,129

2. In Rubles.

The ruble value of the inputs received for the production of weapons in the USSR is indicated in Table 11.* With the exception of labor, the prices are those of 1 January 1950. For labor the best available estimate was that of current wages. It was not possible in all cases to find the price of a particular item -- roller bearings, for example. Instead, the price of a similar item was used, such as the price of ball bearings of similar dimensions and specifications.

The specific inputs listed in Table 12** are limited to direct charges against the cost of production of weapons. In order to establish the value of indirect charges, US cost data for weapons were examined. The cost analysis by the Springfield Arsenal for small arms

* Table 11 follows on p. 35.
** Table 12 follows on p. 36.

Table 11

Ruble Value of Inputs at 1950 Prices Required for Soviet Weapons Production in 1953

Input	Unit	Price per Unit 35/ (Rubles)	Total Input a/	Rubles Value of Total Inputs (Million Rubles)
Labor	Man-Years	7,800 to 8,400	42,658	358.3
Petroleum	Metric Tons	405	14,392	5.8
Steel	Metric Tons	1,650 b/	183,231	302.3
Aluminum	Metric Tons	10,360	560	5.8
Copper	Metric Tons	9,000	1,829	16.5
Coal	Metric Tons	89 c/	428,337	38.1
Electric Power	1,000 Kilowatt-Hours	500 d/	217,519	108.8
Lumber, Non-construction	1,000 Board Feet	800	3,861	3.1
Antifriction Bearings	Units	35	226,947	7.9
Miscellaneous Metals (Zinc, Tin, and the Like)	Metric Tons	8,000 e/	2,744	22.0
Transportation	1,000 Metric-Ton-Kilometers	50	495,448	24.8
Rubber Tires	Units	300	35,244	10.6
Natural or Producer Gas	1,000 Cubic Meters	50	42,814	2.1
Subtotal				906.1
Indirect Costs (125 Percent of Direct Costs)				1,132.8
Total				2,038.9

a. The inputs expressed earlier in short tons are changed to metric tons.
b. Steel price is weighted to include both carbon and alloy prices.
c. Price at the mine.
d. Price when usage is at the rate needed by the average plant.
e. Miscellaneous metals is calculated as 1.5 times the weight of copper. This is an estimate of alloying elements, particularly those used in brass or solder.

revealed an approximate 1 to 1 ratio for direct cost to indirect cost. Information for heavier weapons was not so precise but showed a higher value for indirect cost -- in one case as high as 150 percent of the direct cost. It is assumed that indirect costs are 125 percent of the direct costs as calculated in Table 12. The total value of direct and indirect inputs for 1952 is 2,040 million rubles in 1950 prices.

The defense budget including estimated supplementary allocations is divided into munitions and nonmunitions components in Table 12. The munitions portion is expressed both in current and in constant 1940 prices.

Table 12

Procurement in the Soviet Defense Budget
1949-53

Year	Explicit Defense Budget (Billion Rubles)	Supplementary Allocations (Billion Rubles)	Nonmunitions (Billion Rubles)	Munitions (Billion Rubles)	Price Index (1940=100)	Constant 1940 Munitions Price (Billion Rubles)
1949	79.2	15	55	39.2	135	29.0
1950	82.9	15	56	41.9	115	36.4
1951	93.9	16	56	53.9	109	49.4
1952	108.6	16	56	68.2	106	64.3
1953	110.2	16	56	70.2	104	67.3

The price index decreased from 115 in 1950 to 106 in 1952; therefore, the value of inputs in 1952 is 106/115 x 2,040 million rubles, or 1,880 million rubles. This value of inputs into the Soviet weapons industry in 1952 represents 2.75 percent of the munitions portion of the defense budget. US weapons production is 5 percent of the munitions portion of the defense budget, but that includes fire-control instruments and other pieces of equipment which ordinarily accompany the weapon.

There has probably been a great emphasis in the USSR during the postwar years on the production of aircraft, guided missiles, and

electronic equipment in order to alleviate shortages and to enhance the power position of the USSR. The proportionate value of expenditures for weapons as defined in this report might well be lower than similar items in the US.

IV. Capacity.

The fundamental policy guiding the operation of the weapons industry in the USSR is that war industries should not be separated from other industries. In the words of the official Soviet press, "The problem is in the assimilation of war production with commercial processes. The manufacture of a tank and a tractor, of a commercial and military airplane, an automobile and an armored car, of an instrument used for military and civil communication, naval and merchant marine shipbuilding, and a number of other industries have a great many points in common. Even artillery, machine guns, and rifles could be manufactured successfully in the commercial factories. The cooperation of various enterprises in manufacturing separate parts, to be assembled later on in munitions factories, would further strengthen the national defense of Soviet Russia." 36/

Even though this official opinion was stated more than two decades ago, it is essentially valid today. For example, the 1941 Gosplan held the armaments and munitions ministries responsible for the production of such items as steam turbines, machine tools, instruments, steel bands, celluloid, and forging and pressing equipment. Postwar examples include motorcycles, bicycles, machine tools, fans, sewing machines, and many others.

In the USSR there are 22 plants believed to be devoting all or part of their facilities to producing guns, small arms, or both. (See Appendix A.) The average floor space of the 22 producing plants is 1,210,000 square feet. The average labor force is between 8,700 and 10,000, working in 2 full shifts.* The total number of

* It seems in most cases that 3 shifts are worked, but in total employees the number amounts to no more than 2 full shifts.

workers engaged by these armaments plants ranges from a little more than 191,000 to slightly more than 222,000, working in 2 full shifts. 37/

With minor retooling, the plants now devoting only part of their facilities to weapons production probably could turn all of their facilities to that use, in which case all their workers would be producing weapons.* The maximum output resulting would be 555 ground and air force bundles per year (222,000 minus 3,513, the man-year requirement for 1 naval bundle, divided by 395.4 man-years).** The 555 ground and air force bundles and 1 navy bundle would represent the production of approximately 395,128 tons of weapons per year. Production from the existing 22 plants, however, cannot be considered the sole source of weapons for the Soviet armed forces. During World War II, many plants producing various types of industrial products were converted to weapons production, especially small arms and mortars. There is every reason to believe a similar policy would be followed during any future mobilization. The resulting output would be considerably higher than the 395,128 tons of weapons per year.

V. Export and Import.

The movement of weapons between the West and the Soviet Bloc is almost nonexistent, although some clandestine shipments are reported. 38/ There is, of course, movement of weapons between the USSR and the Satellites. The pattern of this exchange is generally of the following nature. Each of the Satellites produces some weapons or parts of weapons. Many of these are exported to the USSR, and in return the Satellites receive weapons which have become obsolescent or which are being replaced in the Soviet Army. On balance, the USSR probably exports more in the way of weapons to the Satellites than it imports. Czechoslovakia and East Germany (on balance probably an im-

* In the case of mobilization the number of workers employed in the plants would be increased. It is assumed that the increase would be sufficient to account for the indirect labor requirements, which are not included in the labor input per bundle.

** It is assumed that naval requirements would remain constant.

porter of weapons) reportedly have exported weapons to the USSR.* Communist China, Poland, Hungary, Rumania, Bulgaria, and Albania are ultimately dependent in varying degrees on the USSR for supplies of weapons.** 40/

There may be a further limiting characteristic of the trade determined by the USSR's general policy of prohibiting the assembly of guns, as distinguished from small arms, in the Satellites: that is, the import of weapons into the USSR is likely to consist of small arms and unassembled gun parts, whereas the exports, consisting of all items, probably favor major-caliber guns. 41/

* Czechoslovakia reportedly delivered 540 100-mm Howitzers to the USSR in 1951 to 1 September. In addition, between 12,000 and 15,000 submachine guns, 24,000 to 25,000 rifles, and 7,000 to 8,000 pistols were delivered. 39/

** A report of a Sino-Soviet agreement stated that Communist China was to be supplied with 1.4 billion rubles worth of weapons, including 500 artillery pieces, 290 medium tanks and armored fighting vehicles, 780 fighter planes, 54 bombers, and AA equipment.

APPENDIX A

SOVIET WEAPONS PLANTS WITH ESTIMATES OF SIZE AND OF LABOR FORCE

1. Identification of Specific Plants.

The identification of the plants producing guns and small arms in the USSR was fundamental to this report in a number of ways. (For the locations, see the accompanying map.*) It was necessary to identify the plants in order to describe them. A description was necessary in order to place broad limits on the estimates of input and output. Furthermore, identification of the plants and their location is a prerequisite to any discussion of the industry's vulnerabilities.

A systematic survey of many intelligence files led to the selection of those Soviet plants most probably producing guns and small arms in 1953. As a point of departure in the survey, the plants listed by G-2 were subjected to scrutiny. The plants listed by G-2 are as follows:

1. Red Barricade Plant No. 221, Stalingrad
2. Bolshevik/Stalin Turbine, Leningrad
3. Molotov No. 172, Molotov
4. Gun Factory No. 9, Sverdlovsk
5. Gun Factory No. 8, Sverdlovsk
6. Stalin No. 92, Gor'kiy
7. Frunze No. 7, Leningrad
8. Armament Plant No. 235, Votkinsk
9. Voroshilov No. 4, Krasnoyarsk
10. Armament Plant, Yurga
11. Plant No. 535, Tula
12. Plant No. 536, Tula
13. Plant No. 71, Izhevsk
14. Plant No. 74, Izhevsk
15. L'vov Armament Plant, L'vov
16. Plant No. 525, Kuybyshev
17. Plant No. 710, Podol'sk
18. Troitsk Armament Plant, Troitsk
19. Alatyr Armament Plant, Alatyr
20. Riga Small Arms Plant, Riga

* Following p. 45.

21. Volodarski No. 3, Ul'yanovsk
22. Vladivostok Armament Plant, Vladivostok
23. Arsenal No. 2, Kiev
24. Plant No. 19, Kazan'
25. Plant No. 66, Zlatoust
26. Kirkish No. 2, Kovrov
27. Plant No. 106, Khabarovsk

The following plants from the G-2 list were eliminated for the reasons given:

2. Bolshevik/Stalin Turbine, Leningrad. There is no reference to this plant at all in the most recent list of installations engaged in the manufacture of armaments. 42/
15. L'vov Armament Plant, L'vov. This plant is primarily a repair shop. It is not now producing. 43/
17. Plant No. 710, Podol'sk. This plant produced weapons and ammunition during World War II. In 1945 or 1946 the factory was converted to the production of sewing machines. 44/
18. Troitsk Armament Plant, Troitsk. This plant is not reported in operation. 45/
19. Alatyr Armament Plant, Alatyr. This plant is not reported in operation. 46/
20. Riga Small Arms Plant, Riga. This plant is primarily a repair and storage area. 47/
21. Volodarski No. 3, Ul'yanovsk. This plant is primarily a producer of tools. 48/ If any of the production consists of military end items, it is most likely ammunition. 49/
22. Vladivostok Armament Plant, Vladivostok. There is not enough information on this plant to assert that it is or is not producing armaments.
23. Arsenal No. 2, Kiev. This "plant /is/ chiefly engaged in the repair of ex-German guns and automatic weapons." 50/
24. Plant No. 19, Kazan'. Information on this plant is not adequate to bear out the supposition that it is producing military end items. 51/

The remaining plant list was amended to include the following for the reasons given:

Plant No. 524, Izhevsk. This plant was a small arms plant during World War II and has continued to produce since then. 52/
Plant No. 232, Leningrad. This plant was an important producer during World War II and has continued to produce since then. 53/

Plant No. 13, Ust'-Katav. This plant became important after the evacuations during World War II. Some production has been noted since the war. 54/

Plant No. 88, Kaliningrad. This plant, too, was an important producer during World War II. Since then some armaments production has been evident. 55/

Plant No. 622, Izhevsk. This plant is closely interconnected with Plants No. 71 and 74, Izhevsk. Production since the war has been repeatedly noted. 56/

The final list, therefore, is as follows:

1. Red Barricade Plant No. 221, Stalingrad
2. Molotov No. 172, Molotov
3. Gun Factory No. 9, Sverdlovsk
4. Gun Factory No. 8, Sverdlovsk
5. Stalin No. 92, Gor'kiy
6. Frunze No. 7, Leningrad
7. Armament Plant No. 235, Votkinsk
8. Voroshilov No. 4, Krasnoyarsk
9. Armament Plant, Yurga
10. Plant No. 535, Tula
11. Plant No. 536, Tula
12. Plant No. 71, Izhevsk
13. Plant No. 74, Izhevsk
14. Plant No. 525, Kuybyshev
15. Plant No. 66, Zlatoust
16. Kirkish No. 2, Kovrov
17. Plant No. 106, Khabarovsk
18. Plant No. 232, Leningrad
19. Plant No. 13, Ust'-Katav
20. Plant No. 88, Kaliningrad
21. Plant No. 622, Izhevsk
22. Plant No. 524, Izhevsk

2. Estimates of Size of Plants and Labor Force.

Table 13* gives the floor space and labor force for most of the plants listed in the above section. Column 1 gives the best available estimate of the floor space. The sources of the values are

* Table 13 follows on p. 45.

footnoted, and the methods used in determining them are discussed in Appendix C. Column 2 was determined by dividing the floor space by a constant labor floor space ratio of 240 square feet per employee.* The figures of Column 3 are those of Column 2 doubled. Had only one shift been working, Column 2 would have been the appropriate one. In most plants it was reported that there were 2 or 3 shifts. Therefore, since 2 full shifts compare roughly with 3 shifts less than fully staffed, the figures of Column 2 were doubled. Column 4 consists of the prisoner-of-war estimates of labor force. These figures are derived by the method explained in Appendix C.

Column 3 of Table 13,** the calculated labor force, yields an average plant labor force of 10,100 employees. Column 4, the prisoner-of-war estimates, yields an average labor plant force of 8,700. The latter is accepted as a lower estimate of average plant labor force, and the former is accepted as the upper limit. Multiplied by 22, the number of weapons plants, the average employee figures place the number of workers in the Soviet weapons industry between 191,000 and 222,000.

It must be noted that the sources for these figures are dated from 1949 and earlier. The changes that have taken place since then are, of course, not accounted for. It is only possible to speculate about those changes. A higher degree of industrialization in an economy combined with a small increase in the size of its labor force would tend to stabilize the size of the labor force of a mature industry over a short period of time. Some increase in the floor space of an industry may occur under these conditions.

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* The following labor floor space ratios were computed from US plant layouts. 57/ The average figure of 240 square feet per employee is within 20 percent of ratios in some US machine tool production areas (CIA estimate).

Item	Square Feet of Floor Space per Laborer
90-mm AA Gun	269
105-mm Howitzer	248
90-mm Tank Gun	221
75-mm Tank Gun	221
Average	240

It may be expected that the ratio of labor force to floor space is fairly stable when levels of employment and technological development are held constant.

** Table 13 follows on p. 45.

Table 13

Estimates of Floor Space and Labor Force for Soviet Weapons Plants

Plant	Plant Floor Space (Square Feet)	One Shift, or Column 1 ÷ 240 58/ (Rounded to Nearest 100)	Calculated Labor Force (Two Shifts) (Column 2 x 2)	Prisoner-of-War Reported Labor Force
Stalin No. 92, Gor'kiy	2,125,900 59/	8,900	17,800	15,000 60/
No. 172, Molotov	3,621,800 61/	15,100	30,200	20,000 62/
No. 8, Sverdlovsk	312,000 63/	1,300	2,600	N.A.
No. 9, Sverdlovsk	N.A.	N.A.	N.A.	N.A.
No. 4, Krasnoyarsk	720,000 64/	3,000	6,000	5,500 65/
Yurga	776,000 66/	3,200	6,400	3,000 67/
No. 235, Votkinsk	N.A.	N.A.	N.A.	5,500 68/
No. 13, Ust'-Katav	N.A.	N.A.	N.A.	N.A.
No. 221, Stalingrad	2,208,200 69/	9,200	18,400	10,000 70/
No. 7, Leningrad	1,194,200 71/	4,600	9,200	
No. 232, Leningrad	681,800 72/	2,800	5,600	6,000 73/
No. 88, Kaliningrad	403,700 74/	1,700	3,400	2,000 75/
No. 106, Khabarovsk	355,000 76/	1,500	3,000	4,600 77/
No. 71 and 74, Izhevsk	1,614,000 78/	6,700	13,400	20,000 79/
No. 524, Izhevsk	N.A.	N.A.	N.A.	
No. 622, Izhevsk	N.A.	N.A.	N.A.	N.A. 80/
No. 66, Zlatoust	1,833,500 81/	7,600	15,200	3,000 82/
No. 2, Kovrov	421,400 83/	3,000	6,000	
No. 525, Kuybyshev	457,000 84/	1,900	3,800	3,000 85/
No. 535, Tula	N.A.	N.A.	N.A.	N.A.
No. 536, Tula	N.A.	N.A.	N.A.	15,000 86/
Sum of Known Values	16,933,500		141,000	112,600 87/
Mean	1,209,500		10,100	8,700

[p. 46 blank]

APPENDIX B

COEFFICIENT SOURCES

1. Soviet Weapons with US Counterparts.

Table 14* gives a list of the various Soviet weapons with US equivalents. Weapons of similar size and make-up were compared in order that input data for the US weapons could be used for the Sov weapons of similar size and caliber. The difference in the weight the two weapons compared in each case was accounted for by using t weight of input per unit weight of output rather than by using inp per each weapon. The comparison was used for determining steel, copper, and aluminum inputs.

2. "Normal" Weapons Plant.**

Capital requirements for the Soviet weapons industry are not available currently in any form. In order to arrive at an estimat of what those requirements may be, it has been necessary to draw u plans and specifications for a weapons plant representative of Sov weapons plants in terms of floor space, labor force, product mix, a type of equipment and structure.

Table 13*** sets the average labor force between 8,700 and 10,3 employees. This labor force, it was stated, consists of two full a equal shifts. For purposes of drawing up the plans, a compromise round figure of 9,000 employees is used. The single shift figure then 4,500. The average floor space of the plants of Table 13 is 1,209,500 square feet. Rounded, the floor space is 1 million squa feet. This figure was used for the plant floor area dimensions. T product mix was assumed to include all the weapons of the represent ative bundle and in the same proportions. The type of structure a the kind of equipment used in the plant were determined, by and la from plant studies. US engineering practices and US plant layouts ultimately provided the framework for the many and scattered bits of information obtained from plant studies.

* Table 14 follows on p. 48.
** The plans were drawn up by CIA.
*** P. 45, above.

Table 14

Soviet Weapons with the US Equivalent Used for Estimating Metal Inputs 88/

Soviet Weapon	US Equivalent
Bundle 1	
Rifles and Carbines	Springfield Rifle, MA1903A1, Caliber
Pistols	Colt Pistol, M3, Caliber .45.
Submachine Guns	Thompson Submachine Gun, M3, Caliber
7.62-mm Machine Gun	Browning Automatic Rifle 1918A2, Cali
12.7-mm Machine Gun	Browning Machine Gun, M2, Caliber .50
57-mm AA Gun	40-mm M1, Mount (M-5)
100-mm AA Gun	90-mm M1 and M1H1, AA Mount M1A1
57-mm AT Gun	57-mm AT Gun
132-mm Rocket Launcher	Multiple Rocket Launcher, 6 x 6 Mount
82-mm Recoilless Rifle	75-mm Recoilless Rifle
82-mm Mortar	81-mm Mortar
120-mm Mortar	
160-mm Mortar	4.2-inch Mortar
85-mm Gun	75-mm Field Gun, M1A1
122-mm Gun and Howitzer	105-mm Howitzer, M2A1
152-mm Howitzer, Gun, Gun Howitzer	155-mm Howitzer
203-mm Howitzer	155-mm Gun, M2 and Carriage, M1
100-mm Tank Gun (T-54)	90-mm Gun, M3A1
122-mm Tank Gun (JS)	90-mm Gun, M3A1
100-mm SP Gun (SU-100)	90-mm Gun, M3A1
152-mm SP Gun (JSU-152)	90-mm Gun, M3A1
23-mm Aircraft Cannon	37-mm Automatic Gun, M9
37-mm Aircraft Cannon	37-mm Automatic Gun, M9
Bundle 2	
37-mm AA Single Gun	40-mm Single Gun, M3
37-mm AA Twin Gun	40-mm Twin Gun, Mark 1
45-mm AA Single Gun	
3-inch/55 Single Gun	3-inch/50 DP Single Gun
3-inch/55 DP Twin Gun	3-inch/50 DP Single Gun
3.9-inch/51 Wet, Single Gun	5-inch/25 Wet, Single Gun
3.9-inch/56 DP Single Gun	5-inch/38 DP Single Gun, Mark 30
3.9-inch/56 DP Twin Gun	5-inch/38 DP Single Gun, Mark 32, Mod
4.8-inch/46 Twin Gun	5-inch/38 Twin Gun, Mark 38, Model 1
6-inch/50 Three-Gun Turret	6-inch/47 Three-Gun Turret, CL 155 Cl

APPENDIX C

METHODOLOGY

In the introduction, it was noted that the primary purpose of report was the determination of the kinds and amounts of inputs r quired for the current level of weapons output in the USSR. Othe purposes of the report were mentioned, although they were, in the main, supplementary to the chief purpose. This section will be c cerned with the methods used in attaining the primary goal rather with any other methods relative to the report.

Ideally, the proper way to determine inputs for weapons manuf ture is to inspect at first hand the accounting records of the producing plants or of the central statistical authority. Short this, first-hand observation or intelligence reports of plant, la force, material shipments, and the like are acceptable. For this report, intelligence reports dealing with plant area and total la force are available and have been used. For other inputs, howeve it has been necessary to use approximations based on an analogy o production requirements for similar end items. The details of th method using the analogy have been discussed at some length in th text.

Use has been made of prisoner-of-war information with respect floor space and labor force in the manner described below. Fortu- nately, estimates of floor space were available from air-photogra interpretations for most of the large weapons plants.

1. Prisoner-of-War Estimates of Floor Space.

In the cases where estimates of floor space were not available from air photographs, it was necessary to use alternative data. T were estimates made by prisoners of war who, for limited periods during the years 1946-49, were employed in the plants under consid ation. Certainly, there are many reasons for expecting that an estimate of floor space made by an individual who has worked in th plant is not very valuable. Yet, when a series of estimates are treated as statistical data and measures of central tendency are applied, reasonably valid results are obtained.*

* See Appendix B and references to Table 13, Appendix A.

2. Prisoner-of-War Estimates of Labor Force.

Column 4 of Table 13,* Appendix A, consists of a number of pri of-war estimates of the size of the labor force working in each pl with the exception of three plants for which no data are available These values are determined in 1 of 2 ways. Either they are the mean value of a few estimates with a relatively small range in val or they are the median of a large number of estimates having, in general, a large range.

* P. 45, above.

APPENDIX D

GAPS IN INTELLIGENCE

Information concerning the weapons industry of the USSR is, o course, tightly controlled. The Soviet weapons which came into t possession of the US during World War II and those captured in Ko have provided an important and relatively adequate source of inte ligence concerning weapons description, although recent models of various weapons are absent. Intelligence sources concerning weap output and weapons production methods are grossly inadequate. Co parative studies of US and Soviet production methods and producti relationships would help in closing this gap and would be of utmo importance to the quantitative expression of input and output re- lations. Furthermore, there is no doubt that studies utilizing known price data and state budgets would be of value in setting b checks on estimates of both input and output. More complete expl tation of Soviet publications would be important for the study of military program of the USSR and the Soviet Bloc.

Additional information relative to any of the 22 weapons plan and any other plants that may be producing weapons is required. plants about which the least is known include Plant No. 13, Ust'- Plant No. 106, Khabarovsk; Plant No. 88, Kaliningrad; Plant No. 2 Votkinsk; Plants No. 524 and 622, Izhevsk; and Frunze No. 7, Leningrad.

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APPENDIX E

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

The sources of this report are distributed among five general classes: prisoner-of-war interrogation reports; captured German military documents; reports of US intelligence agencies; [redacted]; and unclassified published materials. Each class deserves separate comment.

The prisoner-of-war interrogation reports have provided information concerning the size and geographical distribution of the Soviet weapons industry. They have also provided information relative to type of plant structure and to the kinds of equipment used by the industry.

Granted the limitations of the potential information held by released prisoners of war, there is information which is never brought to the surface by the interrogators. In part, these gaps are the result of inadequate coordination between the supplier and the user of information. In part, also, they are the result of the lack of sufficient technical knowledge at the time and place of interrogation. The kinds of technical knowledge which would seem appropriate are of a twofold nature. First, there is the need for considerable knowledge of various kinds of productive equipment and of productive processes. Information of this sort at the place of interrogation would prevent many errors in product and equipment identity. Second, there is the need for knowledge pertinent to the individual as a source of information. Superficial evaluations of the source by the interrogator as "intelligent," "not very intelligent," and the like, reveal, perhaps, more about the interrogator than the informant. The need for an evaluation of the source's ability to make certain kinds of estimates is obvious.

German military documents have been useful for plant descriptions. In many cases, plant description was supplemented by air photographs. The output estimates of the German documents, however, were not used.

They were far out of line when compared with other reliable sources. The time study analyses, though impressive, were also discarded because of the obvious arbitrary nature of the methods used.

Reports of the US intelligence agencies have been widely used and in general have been considered reliable.

ts.

All sources cited in this report are classified SECRET or lower. In addition, many unclassified published materials have been used throughout the report. They have been quite productive and in the main are considered reliable.

2. Sources.

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63. Oberkommando des Heeres, Abteilung Fremde Heere, Ost, Geschuetz Fertigung in der SU, 1943.
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66. Figured from a series of 28 estimates in CIA IR No. 7041]
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71.
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77. Median value of a series of 28 estimates from CIA IR No. 9003577.
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79. Arithmetic mean of 6 estimates given in CIA IR No. 701001
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83.
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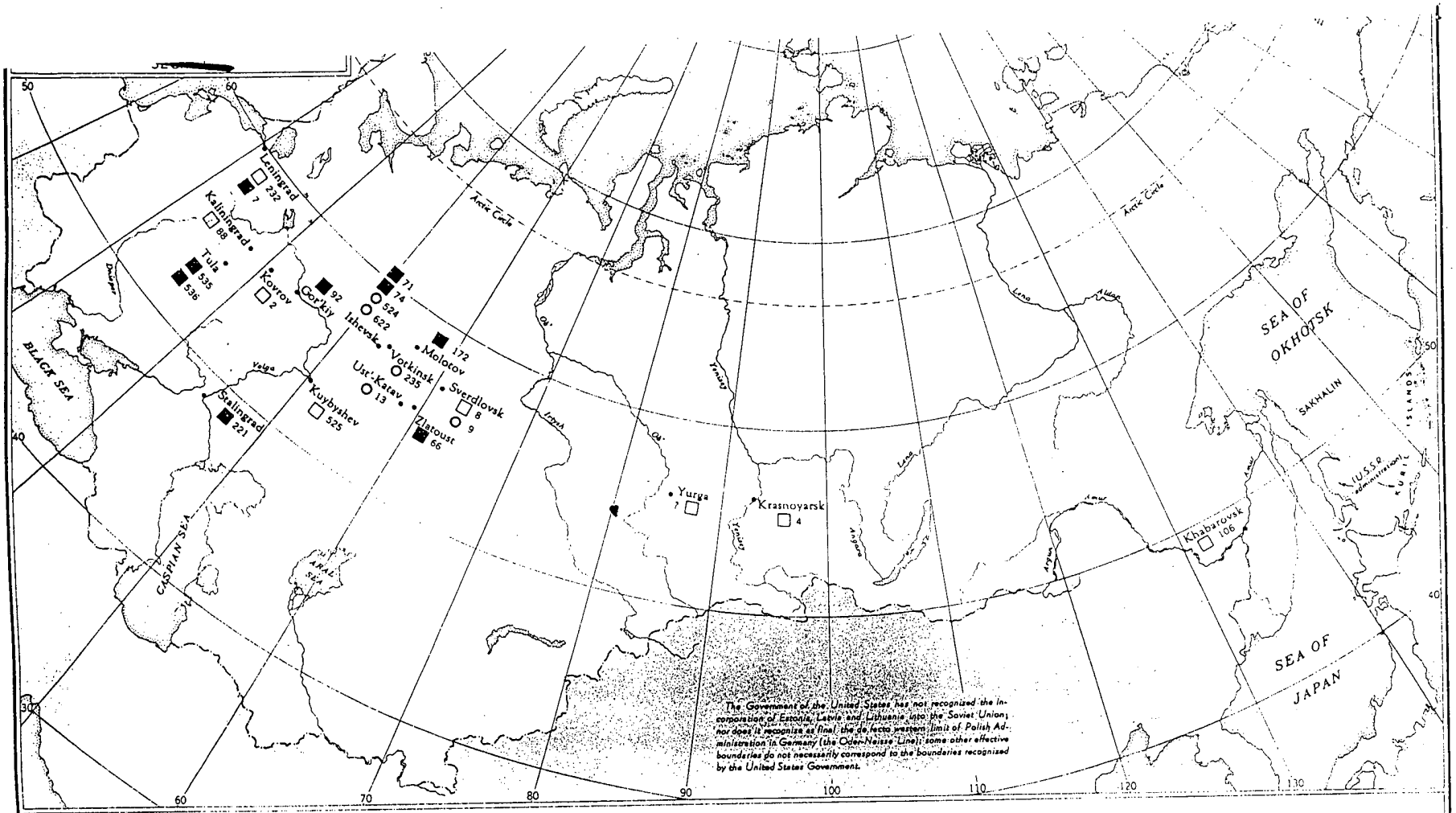
85. Median value of a series of 12 estimates from CIA IR No. 7008178.
86. Median and mode of a series of 27 estimates in CIA IR No. 8002425.

87. Median value of 15 estimates from CIA IR Nos. 9023854 and 8002708.

88.



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