

The Soviet Defense Industry Complex in World War II*

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* Published in *World War II and the Transformation of Business Systems*, pp. 237-62. Edited by Jun Sakudo and Takao Shiba. Tokyo: University of Tokyo Press, 1994.

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This version: March 22, 1993.

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I. Historical background

1. Formation and structure

Defense factories already played an important role in prerevolutionary Russian industry. They contributed significantly (although on an insufficient scale) to Allied military strength in World War I. Unable to avoid the general economic catastrophe of the Russian civil war, they were further run down during the military demobilization of the early 1920s, and defense production remained at a low level for the best part of the decade.¹

The economic status of the defense sector changed again with Stalin's turn to forced industrialization and the first Five Year Plan (1928-32). The goals of national security and industrialization became tightly interlinked.² Military power was identified as the chief element in national security, and the development of modern industry and transport was identified as the key not only to economic development but also to military power in the long run. The country's defense capacity was promoted not only in the long run but also through immediate orders for defense products. Externally the aggressive plans of the Axis powers reinforced the new economic priority of the Soviet defense sector.

The terms required for detailed definition of the soviet defense sector can be a problem. Julian Cooper has suggested that we reserve the term "defense industry" for the branches of industry specialized in the supply of military goods, regardless of their ministerial subordination. "The defense industry complex", or defense complex for short, refers to the ministerial agencies with specialized responsibility for administering defense production.³ There is also need for an overarching concept embracing the full range of defense-related activity in the economy – everything involved in providing military goods and services – the armed forces themselves, the defense industry specialized in supply of military equipment, and the nonspecialized civilian enterprises supplying food, fuel, and other goods and services for military construction and operations. This I call "the defense sector as a whole".

At the core of the prewar defense industry lay the big assembly plants permanently specialized in producing finished tanks, guns, aircraft, and ammunition. But hundreds of smaller factories were also part-time or occasional producers of

¹ P. Gatrell and R. W. Davies, "The Industrial Economy", in R. W. Davies, *From Tsarism to the New Economic Policy: Continuity and Change in the Economy of the USSR* (Basingstoke, 1990), pp. 134-7.

² See J. Barber and M. Harrison, *The Soviet Home Front, 1941-1945: a Social and Economic History of the USSR in World War II* (London, 1991), pp. 3-5.

³ J. M. Cooper, *The Soviet Defence Industry: Conversion and Reform* (London, 1991), p. 6.

final defense products they were being drawn from civilian industry into the defense industry by the pace of prewar rearmament, which far exceeded the capacity of the big permanent defense producers. Surrounding the assembly plants lay the subcontracting system. Again this comprised both Permanent and part-time suppliers of specialized, weapons-related materials and components (e.g. armor steel or radiotechnical instruments). Beyond the periphery, no longer part of the defense industry as such lay the nonspecialized civilian plants supplying defense producers, defense subcontractors, and the armed forces with general purpose goods and services – food and fuel, power, transport services, and machinery.

Defense production was administered by a powerful grouping of supply and user ministries (called “people’s commissariats”) – the defense industry complex. The core supply ministries were four people’s commissariats formed in 1938 on the breakup of the former unified commissariat for the defense industry; they comprised the commissariats for (1) the aircraft industry, (2) shipbuilding, (3) armament, and (4) ammunition. To this list might also be added two other commissariats, for (5) the tank industry, and (6) mortar armament, both formed shortly after the outbreak of war from engineering enterprises previously subordinated to nominally civilian commissariats.⁴ Also within the defense complex, but not, strictly speaking, of the defense industry, should be listed (7) Glavvoenstroï, the chief administration for defense industry construction, formed around the outbreak of war.

Lastly, the defense complex should include the procurement agencies of the user departments, the commissariats of (8) defense (i.e. of the Army and Air Force) and (9) the Navy.

The defense industry and the defense complex were, therefore, not coterminous. The defense complex included agencies which monitored the work of (or, in the case of Glavvoenstroï, supplied services to the defense industry without being part of it, It also included firms with significant commitments to supply of civilian vehicles, aircraft, ships, and electrical goods. However, with the accelerated pace of rearmament before the war, the civilian production of the defense complex was probably less important than the growing military production of a widening circle of nominally civilian enterprises outside the defense complex which were in fact being drawn into the defense industry.⁵

The regulatory structure of the defense complex was multi-dimensional. By the spring of 1940, after several years’ experimentation, the following arrangements existed. Under the government, or council of people’s commissars (Sovnarkom or

⁴ See M. Harrison, *Soviet Planning in Peace and War, 1938-1945* (Cambridge, 1985), appendix 4. On continuity with the postwar organization of the defence complex, see further J. Crowfoot and M. Harrison, “The USSR Council of Ministers under Late Stalinism, 1945-1954: Its Production Branch Composition and the Requirements of National Economy and Policy,” *Soviet Studies*, 42:1, appendices A, E.

⁵ See S. M. Tupper, “The Red Army and Soviet Defence Industry, 1934-1941”, (unpub. PhD thesis, University of Birmingham, 1984).

SNK), there operated two supraministerial committees for strategic oversight, one for defense (the Komitet Oborony), and one for the economy (the Ekonomsovet). The Ekonomsovet ran several production-branch subcommittees, including one for the defense industry headed by first deputy prime minister N.A. Voznesenskii. And, for most of our period, Voznesenskii was also chief of the state planning commission (Gosplan), of which the department for defense industry was responsible for detailed monitoring, coordination, and troubleshooting,

The Sovnarkom defense committee, in its turn, supervised the work of the defense and navy commissariats; its military-industrial commission (voenno-promyshlennaia komissii, or VPK) had charge of the mobilization readiness both of specialized defense industry, and of industry generally.

Lastly, since 1939, the defense commissariat had the right to appoint its military representatives (voennye predstaviteli, or voenpredy for short) to work in all the important defense factories, where they were responsible for ensuring war readiness, chasing the progress of defense orders, and accepting or rejecting finished output.

2. Behavior

Before the revolution the Russian defense industry had operated in a market environment. Of course there were limits on the scope of market forces. Some were peculiar to a low-income, agrarian economy which had emerged only recently from its medieval phase, and which retained a centralized, bureaucratic mode of government. Other limits on the market for defense products were those which we find even in highly industrialized market economies – monopsony and monopoly, a significant element of public-sector ownership, barriers against the entry of new private-sector capital, cost-plus pricing, and accompanying tendencies to inflated costs and underutilized capacity.⁶

The shortage economy which emerged under Stalin's Five Year Plans wrote most of these tendencies in large on Soviet economic institutions generally. Nonmarket resource allocation now characterized the whole economy, not just the defense industry. Industrial enterprises generally ceased to respond to price signals in their input choices and cost decisions. They were regulated instead by nonprice controls imposed from above. Subject to stringent quantity regulation, they sought to protect their autonomy by accumulating excess stocks, bargaining for increased input allocations, inflating costs, and insuring against external supply failure by unauthorized investment in vertically integrated processes.

In a number of ways, the defense industry was protected against the worst features of the shortage economy. On the supply side, defense needs were given

⁶ One revisionist Soviet historian even described the prerevolutionary management of Russian public-sector defense industry, based on physical output quotas and cost-plus pricing, as a "semi-feudal" system, favoured by the nobility in opposition to the bourgeoisie, later perfected by Stalin in the Soviet command-administrative system and extended to the whole economy. See K. Shatsillo, "Kogda rodilas' Stalinskaia ekonomika? [When was the Stalinist Economic System Born?]", *Moskovskie novosti* (1989), no. 40, p. 12.

high priority. Thus defense producers were less likely to suffer from interrupted or deficient supply. Probably, therefore, their transactions costs were lower than those faced by civilian firms; avoiding these costs was the main incentive for firms to develop excessive vertical integration. As a result, defense factories were better able to tolerate dependence on external suppliers and reap the benefits of specialization,

While privileged on the supply side, however, the defense industry faced demand conditions more challenging than those facing civilian producers. This is because the users of the defense industry's final output were in a much stronger position than the users of civilian goods. Unlike civilian households, the military was technically knowledgeable and politically influential; unlike civilian industrial users, the military was also in a position to refuse defective output, through its military inspectors present in all major defense assembly plants. The military's ability to force industry to share its objectives helped to limit the discretionary behavior of defense industry management.

In this sense, the army and the defense industry faced each other in the "market place" for munitions as antagonists. The army's interest in low-cost, combat-effective munitions did not complement the interest of the defense industry in ease of plan fulfilment, the inflation of claims on current resources, and the aggrandisement of capacity reserves.⁷ At the same time, both the military and the defense complex shared common interests in the high priority accorded to defense needs, the prestige associated with defense work, and the identification of national security with military power.

Although military themes became more prominent in the 1930s, civilian leaders (in the first place, Stalin) retained complete authority over the course of rearmament and military-economic policy. Military representation in the highest circles of party and government remained very limited. The supremacy of civilian leadership was reinforced by the extensive purges of 1937-8, which destroyed preemptively any leanings towards independent political ambition on the part of the Red Army officer corps, and severely weakened its professional autonomy. At a lower level, however, there was a pervasive military presence in defense industry, and military influence over its management.

Thus the position of the Soviet military-industrial elite was and remained paradoxical – privileged in prestige, and in access to resources, yet without political autonomy. Military power lay at one focus of the Soviet industrialization drive, yet this did not contribute to the independent power of the armed forces or the defense complex in economics or politics.

Although the term "military-industrial complex" is sometimes applied to a Soviet context, it cannot be used in the sense of an active collusion of autonomous military and industrial interests against the interests of society in our period. Peter Almquist has suggested that:

⁷ This type of conflict is much emphasised by P. Almquist, *Red Forge: Soviet Military Industry Since 1965* (New York, 1990), pp. 126-7.

For a military-industrial complex to exist in a meaningful way, the military and its supporting industries must have, first, complementary interests. By this it is meant that one of the ‘partners’ generally benefits from the self-interested actions of the other. [...]

Second, and equally important, both the military and the industry must have a means of influencing the political decision makers. In a military-industrial complex, a “silent partner” is an irrelevant partner.

Finally, the military must be seen as an important part of defending the sovereignty of a country.⁸

Although the last of these conditions was clearly met, the capacity for concerted action by military and defense industry interest groups was constrained to a high degree. The interests of Soviet society were already strongly identified with military and defense-industry interests, and at the same time these latter interests had little or no freedom of independent action. David Holloway has pointed out one way of understanding this paradox – the argument that:

the Soviet Union does not have a military-industrial complex, but is such a complex. This is too sweeping a statement, but it does make the point that the history of the soviet Union is so bound up with military power that it seems wrong to speak of a separate military-industrial complex acting within the state.⁹

3. The Approach of War

In the late 1930s, the resources allocated to the defense industry grew out of all proportion. Between 1937 and 1940, nominal budget spending on defense more than trebled, rising at the same time from 17% to 33% of total budget spending (which was also growing in terms of its share in total output).¹⁰ There was a corresponding, remarkable jump in the defense share of Soviet GNP (measured at constant factor costs of 1937), from 8% in 1937 to 17% in 1940.¹¹ Rapid growth in

⁸ Almquist, *Red Forge*, pp. 12-13.

⁹ D. Holloway, “War, Militarism and the Soviet State”, in E. P. Thompson and D. Smith (eds), *Protest and Survive* (Harmondsworth, 1980), p. 158.

¹⁰ K. N. Plotnikov, *Ocherki istoriia biudzheta sovetskogo gosudarstva* [Essays in the History of the Soviet State’s Budget] (Moscow, 1955), pp. 206, 261. At this time there was no deliberate concealment of Soviet defense spending, except that military R&D was and always has been) classed under science expenditure rather than defense.

¹¹ A. Bergson, *The Real National Income of Soviet Russia Since 1928* (Cambridge, MA, 1961), p. 128. The author’s own evaluation suggests 28%; for the basic methodology see M. Harrison, “New Estimates of Soviet Production and Employment in World War 11: a Progress Report”, *Soviet Industrialisation Project* no. 32 (Centre for Russian and East European Studies, University of Birmingham,

the budget allocation to defense, which reflected the heightening of international tensions in both Europe and the Far East, was the driving force behind Soviet rearmament.

On the author's estimate, shown in table 1, by 1940 the specialized defense industry employed some 1.6 million workers, out of a total industrial workforce of nearly 14 millions (unlike the official figures, these include an allowance for unregistered employment of forced labor within establishments of the NKVD, the interior ministry responsible for corrective labor camps, colonies, and settlements). Total numbers employed in the supply of munitions, however, including the supply of nonspecialized materials, power, and components, were probably double the employment in specialized munitions assembly. Not to be forgotten, moreover, were additional millions in industry, agriculture and transport, engaged in the direct supply of the armed forces with the means of subsistence, operations, construction, and other objects. On the basis of material balances compiled within Gosplan, which were certainly incomplete, a grand total of nine million defense workers can be identified for 1940 in industry, agriculture, transport, construction, and trade – roughly 16% of the entire working population.¹²

Prewar employment under the defense complex is also hard to uncover. The data shown in table 2 (A) may be incomplete, at least as far as concerns industry as a whole, and certainly exclude significant elements of the workforce by definition. They suggest that employment under the four main prewar supply departments reached at least 1.2 millions in 1940 (14% of the total for industry shown in the table).

In industrial terms the rearmament drive of the late 1930s was heightened by realization that the Soviet armed forces were losing their military-technical advantage over Germany (such was the conclusion of Soviet observers of the conflict in Spain, where Russians and Germans tested their new weapons and tactical doctrines). This trend was a result of the acceleration of German rearmament in the mid-1930s, at a time when the Soviet economy was becoming increasingly strained, and defense production was being held level.

Translated into rising targets for the supply of munitions and other military goods, defense spending propelled the expansion of the defense industry in terms of both its own capacity and its control of the products of the civilian economy. Munitions procurement, which ran at about one-third of expenditures on the Army, rose rapidly, although by 1940 it was being squeezed by the maintenance costs of the rapidly growing number of conscripts.¹³ New weapons were developed, and new

1991), and for more recent findings in the light of new archival and other data M. Harrison, "Soviet Production and Employment in World War II: a 1993 Update", Soviet Industrialisation Project no. 35 (Centre for Russian and East European Studies, University of Birmingham, 1993).

¹² Harrison, "Soviet Production", table 5,

¹³ According to M. V. Terpilovskii (ed.) *Finansovaia sluzhba Vooruzhennykh Sil SSSR v period voiny* [Financial Service of the USSR Armed Forces in the Period of the

defense factories were laid down. Of the new specialized defense capacities, too high a proportion was still being maintained in the vulnerable western and southern regions where defense industry was already concentrated. This made it easier to commission new factories quickly and increase output, because the supply infrastructure was already there, but a high price would be paid for these short term gains when war broke out and the Wehrmacht swallowed the Donbass and the Leningrad region in a few gulps.

As it was, prewar strains on the economy were already immense, and the supply of investment goods was too limited for new specialized defense capacity to suffice for production of the new military goods required. At this time large swathes of civilian industry were also conscripted into the rearmament effort, laying down the main features of a new subcontracting system. Well before war broke out, hundreds of civilian producers were supplying ammunition, tank parts, and special steels for munitions; in the aircraft industry, a policy of vertical integration under a single ministerial authority was pursued, bringing many civilian subcontractors under the direct control of the people's commissariat for the aircraft industry in 1940.¹⁴

There were also military-industrial mobilization plans. In workplaces, towns, and ministries, contingency plans were drawn up to enable a smooth transition to war production in the event of war. But the substance of these plans was still negatively affected by the prewar atmosphere of repression, mainly because, given the assumption that war would quickly result in a victorious offensive, it was impossible to arrive at a realistic assessment of likely combat needs.¹⁵

II. Wartime structure and performance

1. Performance

When war broke out, defense production was accorded unlimited priority. A number of factors made possible immediate gains in defense output; these included capacity reserves, an immediate increase in working hours, and the mobilization capacity of civilian producers previously involved as occasional defense subcontractors. Table 3 shows that in the third quarter of 1941, the production of all kinds of munitions ran at twice or three times the level of the first quarter.

However, the privileges accorded to defense industry were of limited use when the supply side as a whole was crumbling under the impact of devastating military blows. Towards the end of 1941 the initial momentum faltered and nearly gave way to collapse. The reasons for this included the need to close down and evacuate many large specialized defense plants from the path of the enemy, before reinstalling and recommissioning them in the country's remote interior, but they were not limited to this. Another important factor was the collapse of the civilian

War] (Moscow, 1967), p. 66, munitions outlays accounted for 35% of budget outlays of the defense commissariat in 1938 and 36% in 1939, falling to 31% in 1940.

¹⁴ Harrison, *Soviet Planning*, p. 57.

¹⁵ See Harrison, *Soviet Planning*, pp. 53-63.

economy, which directly threatened the supply of power, metals, machinery, and transport services to defense industry. According to an official report,

Beginning in September, and right to the end of 1941, a decline in industrial output occurred. At the end of 1941, industrial production amounted to only one-half of the prewar level. The output of nonferrous rolled metal, cable products, and ball bearings, had almost completely ceased. Average daily railway shipments at the beginning of 1942 had fallen to 36-37 thousand truckloads, i.e. one-third of prewar shipments.¹⁶

At the same time, the production of aircraft, heavy and medium tanks, tank and anti-aircraft guns, shells, small arms, and cartridges fell back (table 3), this being compensated only by rapid increases in the production of light tanks, and of other guns of all kinds. Moreover, this was a fatal time for any faltering of the war effort in the rear, since at the front the Germans had occupied most of the Ukraine, the noose had tightened around Leningrad, and the fate of Moscow hung in the balance. With 1942, however, the upward dynamic of war production was resumed.

The squeeze on civilian resources was terrific. Between 1940 and 1942, the economy as a whole contracted by at least two-fifths.¹⁷ At the same time, the needs of the armed forces and defense industry for soldiers and workers, food, industrial products, and transport services rose without interruption. As a result, there were very sharp increases in the share of output claimed for defense purposes. According to various official reports, the share of available resources claimed by the defense industry (not necessarily on a consistent definition, and not counting use by the armed forces themselves) changed as follows):¹⁸

	<i>1940</i>	<i>1942</i>
Rolled steel	13%	49%
of which, high-grade	35%	68%
Fuel, power	19%	75%
Building materials	29%	46%
Transport services	11%	44%

On a GDP basis, at constant factor costs of 1937, it appears that the share of domestically financed budget defense spending rose from 17% (Bergson) or 18% (Harrison) of GDP in 1940 to 70% in 1942; this measures the burden on the domestic

¹⁶ Rossiiskii Tsentri Khraneniia i Izucheniia Dokumentov Noveishei Istorii, f, 71, op. 25, d. 9250, l. 28.

¹⁷ Harrison, "Soviet Production", table 1{GDP at fixed factor costs of 1937}.

¹⁸ Rolled steel from Goskomstat SSSR, Narodnoe khoziaistvo SSSR v Velikoi Otechestvennoi voiny 1941-1945 gg. Statisticheskii sbornik [The USSR National Economy in the Great Patriotic War, 1941-1945: Statistical Collection] (Moscow 1990), p. 13; other items calculated from Tsentral'nyi Gosudarstvennyi Arkhiv Oktiabr'skoi Revoliutsii SSSR, f. 3922/4372, op. 4, d. 115, ll. 19-22.

economy, and excludes the rising share of defense outlays financed from Lend-Lease revenues.¹⁹

In fact, by 1942, the Soviet economy was excessively mobilized, and still on the brink of collapse. Everything that had been done to save the defense industry and expand its output had made matters worse for the economy as a whole. In particular, the celebrated evacuation of defense factories from the zone of German occupation had plunged the interior regions into crisis, since the demands of the new war economy instantly outstripped the workforce, industrial supplies, and residential, service, and transport facilities available in the interior. Throughout 1942 the foundations of war production in the civilian economy remained dangerously unstable. The output of basic industrial materials and power remained limited to one-half or one-third of prewar levels; agriculture and food processing appeared locked into an unstoppable decline, which threatened the basis of human existence throughout the country.

Only in 1943 did serious adjustment begin. After the winter of 1942/43 the military and resource balance ceased to worsen. Victory at Stalingrad marked a strategic turning point in the war. The relocation of industry was now complete, and the rising volume of aid under the American Lend-Lease program also aided the supply side. The national product began its recovery from the post-invasion trough, and the extra domestic resources could be directed to expanding civilian production more than to increasing the unbearable domestic burden of the war effort.

Taking the war as a whole, the Soviet defense industries greatly outproduced Germany, despite various disadvantages – especially the country's lower development level, and the profound shock arising from deep penetration by an invader. On the author's rough estimate, Soviet munitions output, 1941-4, exceeded Germany's roughly in the ratio 5:3. If we take into account the division of German military assets between the eastern and western fronts, then the Soviet advantage over Germany in munitions was at least 2:1. (At the same time the numbers of military personnel deployed by the two sides were roughly similar.) However, the advantage of the western Allies in munitions over Germany in the western and Mediterranean theatres, and over Japan in the Pacific, was probably as high as 7:1.²⁰ This, offsetting Germany's advantage in purely military terms, goes far to explaining the relatively close-fought character of the war on the eastern front.

Given the difficulty of mobilizing resources from the civilian economy, among the most important factors underlying the dramatic increase and ultimately high level of Soviet defense output were sharp reductions in labor and other resource requirements per unit of military output. Output per worker in the main branches of specialized defense industry doubled at least. In other branches of the economy, however, including those supplying intermediate goods to defense industry, and

¹⁹ Harrison, "Soviet Production", table 4.

²⁰ M. Harrison, "The Second World War", in R. W. Davies, M. Harrison, and S. G. Wheatcroft (eds), *The Economic Transformation of the Soviet Union, 1913-1945* (Cambridge, 1993, forthcoming),

food, fuel, and construction goods directly to the armed forces, there was marked productivity decline.²¹

2. Labor and employment

Soviet decision makers of the war period are often justly criticized for lack of foresight. However, when we consider what happened in wartime to the Soviet population and workforce, inability to conceive of the frightful consequences beforehand was in some ways not a bad thing. Had they known, Soviet leaders would surely have been paralysed by fear of the impossible task which they would face. On the demand side were the net mobilization needs for expansion of the armed forces and defense workers generally. From material balances compiled within Gosplan, roughly 14 million defense workers in material production can be identified in 1942 – a quarter of the working population – compared with nine million in 1940 (again, this is an incomplete figure). If we combine this change with the change in military personnel (excluding internal troops of the NKVD), we find that numbers generally employed in supplying military goods and services grew by at least 11 millions in two years. On the supply side was a decline of 32 million in the available working population over the same period. Adding these figures together gives an astonishing total of at least 43 million to be subtracted from prewar nondefense employment.²²

Organizational measures from above, and mass volunteering for war work and the army from below, could do no more than mitigate the horror of the situation. The prewar industrial labor market, already under strain, was heavily regimented under the emergency labor legislation of 1938 and 1940. The war brought further proliferation of controls on workers. Normal hours of leisure time and holidays were reduced immediately, and compulsory overtime was introduced. After some delay, liability to military or civilian service was extended to the entire adult population. However, a year and a half passed before the regime was fully equipped with administrative instruments to control the proportions between military personnel, war workers delivering munitions, fuel and other goods to the armed forces, and civilian workers.²³ None of these factors, however, could compensate for the fact that the resources available were entirely insufficient for the military-economic tasks facing the country in 1941/42. A state of profound crisis and destabilization was inevitable.

At first, the only ameliorative factor was that the defense industry quickly notched up huge increases in output per worker. These increases were observed in all the belligerent countries, and were the product of common factors in each: the changeover from small scale batch production to large scale serial production of weapons, and the mobilization of reserve capacities of fixed capacity and leisure time. This eased the difficulties, especially in 1942/43, because it reduced

²¹ Harrison, "Soviet Production", table 5.

²² Harrison, "Soviet Production", table 3.

²³ See Harrison, *Soviet Planning*, pp. 185-91.

substantially the intake of new workers necessary for defense industry to achieve large increases in output.

Thus, employment in defense industry and the defense complex grew significantly, despite the collapsing total, but by much less than the fourfold increase over 1940 in total munitions output. Table 1 shows that employment in specialized munitions nearly doubled, from 1.6 million in 1940 to 2.4 millions in 1942 and 2.8 millions in 1944. The latter figure is much larger than the 1.7 million production workers employed under the four main commissariats supplying ground and air munitions in September 1943, shown in table 2 (B), but the smaller number omits employment in specialized munitions work both under the commissariats of mortar armament and shipbuilding, and also under various civilian commissariats. Table 4 shows that of the 646,000 workers employed in the ammunition industry in 1943, more than half were outside the ammunition commissariat, and two-fifths were outside the defense complex altogether. Nearer the mark, as measures of defense complex activity, are the employment figures shown for September 1943 and 1944 in table 2 (C) – 2.6 millions and 2.7 millions respectively, including Glavvoenstroï (these figures still exclude defense industry enterprises outside the defense complex, but they also include nonindustrial defense complex employment).

The importance of the productivity gain in defense industry was magnified by disastrous productivity performance in other sectors, especially in agriculture. This forced the economy to retain millions more workers in branches outside the defense industry, but supplying essential food, fuel and power, materials, and transport and construction services, both to the defense industry itself and to the civilian population. The reasons for the productivity slide in civilian industry and transport included the loss of economic coordination, and the reduced priority of civilian output, which were both expressed in continual supply interruptions. Excessive working hours, and undernourishment, also played a part. Workers' performance was also influenced by the impact of wartime mobilization on the composition of the workforce; in all branches it was the young, skilled adult males who were mobilized first, but defense industry was at least relatively protected, so that the most rapid turnover was inflicted on civilian industry and the nonindustrial branches,

Throughout 1942 the competing demands of the front, of defense industry, and of basic civilian requirements, kept the economy and the management system in continuous crisis. At any moment the cohesion of Soviet institutional structures could be undone at any point shortages of soldiers and guns, of workers to generate power and make steel, and of workers to grow grains for bread, were all equally critical.

Recruitment into the defense industry was something of a problem in the opening phase of the war. In 1941, much of the skilled workforce in the southern and western regions was lost in combat or through enemy occupation. By the first months of 1942, the commissariat for the aircraft industry had 215,000 unfilled vacancies; the commissariats for shipbuilding, and the tank, armament, and ammunition industries, reported a further 150,000 unfilled vacancies between

them.²⁴ Table 5 shows that these vacancies were filled by various means. Of the 853,000 entering employment in the defense complex during the year, the largest single contingent (33%) came from compulsory mobilization of previously non-employed civilians; internal transfers and volunteers (23%) provided the next largest source. Training agencies supplied approximately one-fifth, especially to skilled work in the aircraft industry. The defense commissariat provided conscripts (usually those unfit for combat duties), most of these being directed into tank building and defense industry construction.

Last, the NKVD supplied relatively small contingents to industry across the board, but notably to the ammunition industry, from the population subject to its chief administration of labor camps (Gulag). Stalin's war cabinet ordered the establishment of new forced labor colonies alongside a number of industrial establishments, with a population of 225,000 prisoners. These, like the much larger numbers who remained within the perimeter of the GULAG, were typically employed in mining, logging, and construction.²⁵

Compulsion was applied extensively to Soviet industrial labor in World War II, and not only under the authority of the GULAG. This was especially the case in the defense industry, where workers were brought effectively under a military regime by a decree of 26 December 1941. But the economic effects were probably limited. The main benefit (again confirmed by the experience of other countries at war) was to convince everyone that there would be no "free ride", and that no one would gain by standing aside to watch and wait, while others did their share first. This was a strong temptation to many workers in the opening weeks of the war, when first illusions had been dispelled and defeat seemed a real possibility.²⁶

The degree of compulsion was at times visibly misdirected or overdone. Misdirection was visible in the kind of measures applied to building workers in 1941, coal miners in 1942, and farm laborers throughout the war. Overzealous regimentation was also applied to millions of defense industry workers; little can have been added to national morale by the continual threat of draconian penalties, including bringing 200,000 a year before military tribunals for unauthorized quitting which, under the December 1941 decree, could lead to several years in prison or a labor camp.²⁷

Economic incentives in cash and kind (especially through manipulation of the food rationing system) also played an important part in motivating workers to work. So, too, did national feeling – not so much Soviet patriotism, which was, relatively

²⁴ G. S. Kravchenko, *Ekonomika SSSR v gody Velikoi Otechestvennoi voiny (1941-1945 gg.)* [The Economic System of the USSR in the Years of the Great Patriotic War (1941-1945)] (Moscow, 1970), p. 109,

²⁵ E. Bacon, "Glasnost' and the Gulag: new information on Soviet forced labour around World War II", *Soviet Studies*, 44:6, pp. 1081-2.

²⁶ J. D. Barber, "Popular Reactions in Moscow to the German Invasion of 22 June 1941", Paper to Soviet Industrialisation Project Seminar (Centre for Russian and East European Studies, University of Birmingham, October, 1991).

²⁷ Barber and Harrison, *Soviet Home Front*, pp. 163-7, 171-7.

speaking, an official construction, but rather Russian nationalism. Moreover, these were given greater scope by the blunting of normal incentives to withhold labor and resources.²⁸ To the extent that defeating the invader replaced the quest for a quiet life with an easy bonus in their objective functions, workers suspended peacetime resistance to speeding up the pace of work and working more flexibly; managers, too, tried to run their plants at full stretch rather than conserve spare capacity and conceal reserves.

The comparative productivity record of different branches of industry, however, suggests that in most cases both policy and morale were ineffective in the face of negative factors which were far beyond policy-makers' control. Productivity fell in Soviet coal mining, for example, for exactly the same reasons as in the United Kingdom, Germany, or Japan.²⁹ Common factors also promoted productivity gain in the defense industries of all the great powers, regardless of differing institutions and policy contexts.

3. The structure of controls

As before the war, the scope of economic centralization in wartime reflected the degree of official priority attached to the various production branches and final users. But its nature changed, mainly because in the war's opening phase absolutely nothing was seen to matter beyond the production of weapons, so that official priorities became simplified in the extreme. In the defense complex, the system of overlapping, multi-layer, supraministerial controls through the government Ekonomsovet and the VPK of the defense committee tended to dissolve in the first weeks of war. The main branches of the defense industry, including the biggest factories, were run directly from Stalin's war cabinet (Gosudarstvennyi Komitet Oborony, or GKO) and from Gosplan, while the Ekonomsovet and VPK simply ceased to function.

In the war's first phase, high-level decisions about defense industry management were taken informally by individual leaders of the GKO and party Politburo, charged with supreme personal responsibility and acting largely on their own initiative. This governed the crash programme to evacuate industry from war zones to the interior, which was improvised by Kaganovich, Shvernik, and Kosygin, without any planning beforehand. Individual leaders such as Beria, Kaganovich, Mikoian, Molotov, and Voznesenskii, also took on key tasks of defense industry mobilization and conversion, armed with unlimited personal powers.

²⁸ Barber and Harrison, *Soviet Home Front*, pp. 68-71, 176-7, 199.

²⁹ On the Soviet coal industry see Barber and Harrison, *Soviet Home Front*, pp. 166-7. Many problems identified by Soviet officials would have been all too familiar to their British opposite numbers; see W. H. B. Court, *Coal* (London, 1951), pp. 107-24. Japan was no different; the records of the Mitsubishi Mining Company (responsible for 13.5% of Japanese coal mined in 1940) show output per employee declining continuously after 1941. See Jerome B. Cohen, *Japan's economy in war and reconstruction* (Minneapolis, 1949), p. 167.

All this was carried on regardless of economic plans and attempts at high level coordination, which were irrelevant to the needs of the situation. Soviet territory shrank, and vital military-industrial centres fell one after another under German occupation; military resources also evaporated while military requirements multiplied. Meanwhile, Gosplan went on compiling plans which were already out of date, and coordinating supplies which no longer existed. Gosplan's defense industry department received daily reports from 120 largescale defense producers, and compiled their monthly and quarterly plans directly. But the rest of Gosplan might as well have ceased to exist.

Only the Army's voenpred system of control over defense industry management maintained continuity with peacetime and, if anything, tightened its grip on the production and procurement process.

The restoration of true centralization took a long time, and was completed only at the end of 1942. A centralized system for coordinating the labor supply was achieved in November 1942, when competition between rival claimants on the country's available working population was finally eliminated. Shortly afterwards, in December, the responsibilities of economic leadership were shifted from the top GKO and Politburo members who had wielded them informally, and were devolved upon a new, powerful, supraministerial cabinet subcommittee, the Operativnyi biuro GKO (GKO Operations Bureau); this also marked the reestablishment of supraministerial economic coordination. After this, the work of Gosplan was also marked by the restoration of normal planning procedures; the plans themselves became more stable, less liable to be overridden by crash programmes and panic measures, and increasingly focused on tasks of reconstruction extending into the postwar period.³⁰

Even in the defense complex, the coordination problem remained colossal. At the forefront of modern technology, the coordination of aircraft production alone was an operation of awesome complexity, involving the marrying of service requirements with the supply of airframes, engines, propellers, wheels and tyres, hydraulics, instrumentation and radio equipment, fuel tanks, and an endless list of further components and spares. Managing what went on within the perimeter of the big assembly plants was just the tip of the iceberg. Between 1940 and 1942 the share of the territory east of the Urals in Soviet aircraft factories changed from 7% to 77%, a bigger shift than for any other branch of the defense complex.³¹ Exactly how this was accomplished, while maintaining coordination with suppliers and increasing the procurement of flight-ready aircraft from less than 900 to more than 2,100 per month (table 3), is a story not yet fully explained, at least in the west.

At the other end of the technological spectrum was the production of ammunition which, in distinction from aircraft production, involved a monthly supply of tens or hundreds of millions of relatively standardized units, with relatively

³⁰ Harrison, *Soviet Planning*, pp. 175-85.

³¹ *Istoriia Velikoi Otechestvennoi voiny Sovetskogo Soiuz: 1941-1945 gg.* [History of the Great Patriotic War of the Soviet Union: 1941-1945], vol. 2 (Moscow, 1961), p. 498.

simple parts, including detonators and fuzes. Here the coordination problem was the converse of that involved in aircraft. The product was simple, but was required in such huge volume that concentration of production in a few large assembly plants was impossible. Official estimates in table 4 show that, at the peak of the war effort, when more than half a million workers and hundreds of plants were involved, barely half of the ammunition industry's ruble output and employment was contained within the ammunition commissariat; the commissariat for mortar armament accounted for a significant further share, but at least one-third of ammunition production and employment was scattered under the purview of dozens of other agencies, many of them drawn from far outside the limits of the defense complex. Here too was a coordination problem of dizzying size, which also illustrates how the distinction between "defense complex" and "defense industry" had real, operational significance.

The permanent return to a more ordered system of central coordination required certain conditions to be met. These included the turn in the military tide marked by Stalingrad, the completed relocation of industry, the shift of Lend-lease transfers into a higher gear in 1943, and the beginnings of recovery in civilian industry. In the civilian economy, moreover, a continual recurrence of emergencies and panics remained unavoidable, especially as food and consumer conditions worsened through 1943; in agriculture, the crisis atmosphere persisted through 1944.

Wartime economic centralization had intrinsic limits. Economic units outside the defense complex and its key suppliers found themselves in an environment of harsh instability. As the sphere of centralization expanded in terms of the share of output and food rations commanded by the war effort, and since official supplies were concentrated on the army and a few key defense factories, great numbers of people and enterprises were cut loose from the central plan. On the whole they survived, if at all only by means of market and barter transactions, combined with strategies of increased self-sufficiency. Households grew their own food, and sold or bartered their own possessions; if they could not, they starved. Factories developed sideline farming for their workers, and were also forced into still greater self-reliance for power, materials, and components; those unable to do so were forced out of commission.³²

Even the privileged factories of the defense complex were not immune to these tendencies. By comparison with the prewar years, they were forced to become significantly more self-sufficient in instrumentation, machine tools, all kinds of semi-manufactures, construction services, building materials, and food supplies.

III. The transition to peace

1. *The lessons of war*

The defense complex emerged from World War 11 with tremendous prestige, and permanently increased power to command national resources in peacetime. After

³² Harrison, *Soviet Planning*, pp. 207-8.

an initial, very strained, and difficult phase of reverse evacuation, demobilization, and industrial reconversion, the Soviet defense industry began to grow again under the twin impulses of the U.S. nuclear monopoly and the outbreak of war in Korea.

The militarization of the postwar Soviet economy was not unopposed. The war had also given rise to new currents favoring both international and domestic relaxation, with less civilian discipline and sacrifice, and more emphasis on openness and the peaceful use of resources. The terrible costs of the war, the painful defeats of the initial phase, the horrors and privations of the struggle, and the appalling price paid for ultimate victory, served to raise questions about the wisdom of the Soviet Union's prewar leadership, the role played by Stalin, and the necessity of renewed military competition with the USSR's former wartime Allies. However, these new stirrings lacked a public voice, and remained incoherent for ten years after 1945. When they finally emerged under Khrushchev, it was in a permanently weakened form, which explains much of the failure of post-1955 gropings towards an effective model of socialist reform. In contrast, the new military-industrial elite was entrenched in its positions, and the conservative tendencies strengthening authoritarian rule and favoring the continuation of a militarized economy found easy legitimacy.³³ Consequently, Soviet postwar economic development was permanently distorted by a heavy peacetime defense burden "fully comparable with 1940".³⁴

The lessons of the war had practical consequences which also tended to consolidate the wartime structures of the defense complex.³⁵ In 1941, lack of preparedness had plunged the economy into a hand-to-mouth, improvised conversion process. In the postwar years a high level of peacetime economic preparedness was sought in order to avoid any lengthy conversion period in the opening phase (which was naturally expected to be decisive) of the next war. This necessarily implied a high level of commitment of current and capital resources to the military and the defense complex, both for procurement of combat-ready stocks of weapons, and to maintain reserve production capacities which could quickly be brought into operation at need.

The war was also held to have illustrated the virtues of vertically integrated, largescale production for the supply of a mass army with low-cost munitions. Before World War II, defense plants were heavily concentrated in the western and southern regions of the USSR's European part, often relying on far-flung sources of materials and components.³⁶ In 1941-2, in the war's chaotic evacuation and conversion phase, a new war economy was laid down around the country's protected coal-metallurgical resources of the Urals and western Siberia; huge evacuated factories

³³ Barber and Harrison, *Soviet Home Front*, pp. 206-11.

³⁴ S. Rogov, "Kakoi budet voennaia reforma? [What sort of military reform will there be?]", *Kommunist* (1991), no. 6, p. 94.

³⁵ C. L. Gibson, "Preparing for War: Economic and Military Mobilization, Past and Present", in J. R. Adelman and C. L. Gibson (eds), *Contemporary Soviet Military Affairs: the Legacy of World War II* (Boston, MA, 1989), pp. 92-3.

³⁶ E.g. Harrison, *Soviet Planning*, pp. 205-6.

and new workplace communities were grafted onto localities which now experienced their second industrial revolution in ten years. As a result, the centre of gravity of the whole Soviet defense industry was shifted eastward by hundreds of kilometres; its concentration on the territory of the Russian Federation was also strengthened. After the war, despite a westward evacuation in reverse, the new war economy of the Urals and Siberia was kept in existence. The weapons factories of the remote interior were developed into closed “company towns” forming giant, vertically integrated production subsystems of the defense complex; they were literally taken off the map, and their very existence became a closely guarded secret.³⁷

The wartime telescoping of the time dimension of Soviet weapons procurement was also held to carry lessons for the postwar research, development, testing, and experimentation process. The Soviet design philosophies of evolutionary change or incrementalism in military-technical development, standardization, and interchangeability of parts, were stimulated by wartime experience, especially in the artillery and tank industries.³⁸

2. The mechanisms of continuity

Continuity from wartime success to postwar consolidation of the Soviet defense complex rested upon the integration of the political economy in two major respects: Soviet patriotism, and party guidance.

The principle of party guidance (*partiinoe rukovodstvo*) was embodied in the coalescence of the party and state hierarchies. At every level, the hierarchy of state, which transmitted the orders of government via the ministerial system to the economy’s productive agencies, was paralleled by a party hierarchy with its own apparatus designed for formulating goals, monitoring progress, solving problems, giving life to the otherwise dead hand of government bureaucracy. More than this, personnel moved between and sometimes combined party and state positions within the defense complex, and were selected for both on the basis of industrial experience and professional competence, not political qualifications alone.³⁹ In defense industry the identification of the interests of society with those of the party became absolute. Imbued with party-mindedness, the official stratum as a whole ensured implementation of party policies which secured the privileged position of military-economic interests, determining priorities first on paper, and then making them effective in practice.

The real, unvarnished history of the war shows that party guidance in this collective sense had limits. At every level the independence of the party was

³⁷ Cooper, *Soviet Defence Industry*, pp. 21-2.

³⁸ P. Almquist, “The Soviet Defense Industry in War and Peace”, in Adelman and Gibson (eds), *Contemporary Soviet Military Affairs*, pp. 106-12.

³⁹ J. Cooper, “The Elite of the Defence Industry Complex”, in D. Lane (ed.), *Elites and Political Power in the USSR* (Aldershot, 1988), pp. 174-5. Movement between the armed forces and the defense complex, however, was slight or nonexistent (*ibid.*, p. 182).

circumscribed by security considerations; party life was comprehensively monitored by the security organs, in which the interpenetration of political and governmental functions reached its maximum extent. At higher levels, the despotic figure of Stalin loomed over individual and collective party authorities alike. At lower levels the party was often weakened by the drafting of its younger, militant, male stratum into combat. This was especially the case in the countryside, where the party was weak to begin with, and where many party cells ceased to exist, being replaced temporarily by the notorious political sections (*politotdely*) of the state farms and machine-tractor stations serving the collective farms. To the extent that the workforce of the defense industry was relatively protected against conscription, however, party units retained greater continuity with peacetime.

The principle of Soviet patriotism was also embodied in the defense complex. Soviet patriotism meant unified control from Moscow over all the resources of the all-Union state, regardless of particular ethnic, national and republican boundaries and interests. Soviet patriotism was explicitly multinational, but within the Soviet brotherhood of nations the Russians were accorded a special place – elder brother (*starshii brat'*) to the rest. This special place reflected the Russians' historic colonizing role within the limits of the old Empire, which gave Moscow its political centrality, and the Russians their social, numerical, and linguistic predominance within Soviet frontiers; in wartime it was also based on revived Russian national military pride and great-power traditions, the special role played by Russians in rebuffing the German invader after loss of the Baltic, Belorussia, and the Ukraine, and the terrible costs which were suffered by the Russian people, not just as victims faced with slavery and extermination, but as soldiers and war workers – as active, eventually victorious participants.

The principle of Soviet patriotism gave Soviet leaders the unchallenged right to mobilise resources towards the shared military-economic goals of the party and state, which in turn guaranteed the privileged position of the defense complex. But despite the multinational ethic of Soviet patriotism, the leadership of the defense complex remained dominated ethnically by Russians.⁴⁰

The war gave a huge boost to this concept of patriotic unity, which was insisted upon in postwar historiography; however, those factors which might have tended to qualify it were brushed aside. Thus the tragic wartime fate of those non-Russian minorities accused of Nazi collaboration, rounded up and deported in cattle trucks from their homelands to the remote interior by the security organs, was suppressed. Inequalities in the sharing of military and economic burdens between regions and ethnic groups were also played down; a special case of this was the unique suffering of Russian and Ukrainian Jews, which was entirely ignored.

This system of forced integration of political, economic, and military life made a major contribution to postwar avoidance of military-civilian conflict. The defense industry was protected from criticism, and its leaders found little need to take an active political role.

⁴⁰ Cooper, "Elite", p. 176.

The key position now occupied by the defense complex became obvious from the first years after the war. It was visible not only in terms of resource allocation, but also in the extraordinary continuity of its leadership. It can hardly be overemphasised that, when we speak of the “Brezhnev generation”, which dominated Soviet political life through the 1960s, 1970s, and 1980s, we mean above all the leaders of the Soviet defense complex who gained office in the last years before World War II, proved themselves in wartime, and retained their hold on the levers of power until dying in office many decades later.⁴¹

To understand the staying power of the postwar leaders of the defense complex, it is important to understand that they were once young and innovative, not conservative or mediocre. The trademark of the best of them – Kosygin, Mikoian, Voznesenskii, to name a few – was a commitment to a realistic, adaptive concept of authority; they understood that the power to command must be continually informed by experience and expertise, and they rejected the crudest forms of Stalinist despotism.⁴² They had proved themselves in World War II, and were receptive to post-Stalin ideas about peaceful evolution of the political and economic system.

However, their willingness to countenance radical changes was also limited by their historical experience of the 1930s and 1940s which was highly defective as training for the second half of the twentieth century. These people were promoted in the midst of the late 1930s’ purges, through a competition for jobs in which the losers were often the victims of terror. They experienced a terrifying and colossal war, and then after the war they had to survive new purges through which Stalin sought to suppress the new forces for relaxation and openness which the war had stimulated. These experiences had a fatally narrowing effect on the horizons of the “Brezhnev generation”. Already by the mid-1950s and 1960s, when their time had come to consider new options for Soviet society as a whole, their readiness to endure the further upheavals and uncertainties associated with reformist models of socialism was tragically limited.

At the same time the onset of Cold War, and then the hostilities in Korea, appeared to confirm the correctness of Stalin’s belief in the inevitability of another war between socialism and imperialism; the need to acquire nuclear weapons, combined with rearmament for the Korean war, reversed the directions of post-1945 economic demobilization, and propelled the Soviet defense complex on a new expansion course.

⁴¹ On continuity of leadership in the first postwar decade, see Crowfoot and Harrison, “USSR Council of Ministers”, pp. 53-5.

⁴² On Voznesenskii see Harrison, *Soviet Planning*, pp. 230-5.

Tables

Table 1. Soviet employment, 1940-1945 (millions)

	1940	1941	1942	1943	1944	1945
Agriculture	49.3	36.9	24.3	25.5	31.3	36.1
Industry	13.9	12.8	8.8	9.1	10.3	11,7
defense	1.6	1.8	2.4	2_6	2.8	2.2
civilian	12.4	11.0	6,4	6.5	7.5	9.5
Construction	2.6	2.5	1.8	1.7	2.1	2.3
Transport, communications	4.0	3.5	2.4	2.4	3,0	3.6
Trade, catering	3.3	2.8	1.7	1.7	2.1	2.5
Civilian services	9.1	7.7	4.8	5.1	6.5	7.7
Military services	5.0	7.1	11.3	11.9	12.2	12.1
Working population	87.2	73.4	55.1	57.5	67.4	76.0

Source: M. Harrison, "Soviet production and employment in World War II: a. 1993 update", Soviet Industrialisation Project Series, no. 35 (Centre for Russian and East European Studies, University of Birmingham, 1993), table 2.

Note: Defense industry covers specialized employment in military machine building and metalworking.

Table 2. Employment in the Soviet defense complex, 1939-44 (000s)

(A) Industrial production personnel: workers, staff, and ITR, total and in the defense complex

	1939	1940	1940
	4th qtr	2nd qtr	June
Industry, total	15,519	15,641	15,627
Commissariats of "defense industry"	2,187	2,358	2,329

(B) Industrial production personnel, total and in the defense complex

	1942	1943
	4th qtr	June
Industry, total	7,153	7,418
Commissariats of aircraft, armament, ammunition, and tank industries	1,574	1,695

(C) Total (industrial and nonindustrial) employment in the defense complex, by commissariat

	1943	1944
	Sept.	Sept.
Aircraft industry	817	825
Tank industry	281	300
Armament	527	524
Ammunition	505	524
Mortar armament	195	205
Shipbuilding	127	155
Subtotal	2,453	2,532
Glavvoenstroï	119	176

Sources: (A) Calculated from Tsentral'nyi Gosudarstvennyi Arkhiv Narodnogo Khoziaistva (TsGANKh), f. 4372, op. 41, d. 553, l. 108. The "defense industry" probably comprised the commissariats of the aircraft, shipbuilding, armament, and ammunition industries. (B) TsGANKh, f. 4372, cp. 44, d. 450, l. 11. (C) TsGANKh, f. 4372, op. 3, d. 1336, l. 74.

Notes: Total employment under each commissariat is classified into industrial and nonindustrial employment. Industrial employment ("industrial production personnel") is further subdivided into (manual) workers, (nonmanual) staff, ITR (engineering and technical workers), youth workers ("junior service personnel"), and security staff.

Glavvoenstroï: the chief administration for defense industry construction.

Table 3. Soviet ground and air munitions output, 1930-45 (units, monthly average)

		AFV					Small arms Thou.	Cart- ridges Mn
		Aircraft Units	Total Units	Heavy, medium		Light Units		
				Units	Units			
1930		96	14	...	...	...	...
1933		343	292	...	...	...	...
1937		503	130	...	...	...	...
1940		880	233	229	3	1(1)	251	
1941	Q1	993	349	265	83	162	305	
	Q2	993	455	365	90	179	346	
	Q3	2,200	660	477	184	347	510	
	Q4	1,059	732	384	348	291	284	
1942	Q1	1,247	1,561	715	845	370	243	
	Q2	2,001	2,112	1,084	1,029	443	333	
	Q3	2,463	2,366	1,549	818	501	395	
	Q4	2,768	2,200	1,688	512	472	400	
1943		2,904	2,001	1,551	449	423	496	
1944		3,354	2,415	1,819	596	337	617	
1945	Q1-3	3,350	2,510	1,914	596	157	404	

		Guns				Shells, bombs, mortar shells Mn
		Total Units	Tank Units	Anti-air Units	Other Units	
1930		79	...	...	...	...
1933		387	...	...	...	...
1937		456	...	...	...	...
1940		1,279	318	230	731	3.6
1941	Q1	1,247	320	385	542	3.8
	Q2	2,020	693	532	794	5.3
	Q3	4,605	753	911	2942	9.9
	Q4	5,644	538	201	4904	8.7
1942	Q1	7,990	1,034	274	6582	6.3
	Q2	9,889	1,513	578	7798	8.7
	Q3	12,781	2,347	722	9713	13.7
	Q4	12,037	2,397	726	8914	14.7
1943		10,858	1,771	937	8149	14.6
1944		10,199	1,480	938	7780	15.3
1945	Q1-3	8567	1573	355	6629	9.8

Sources: Aircraft, 1930-7: calculated from G. V. Kostyrchenko, "Organizatsiia krupnoseriinogo aviatsionnogo proizvodstva", in Biushgens, G. S., ed., *Samoletostroenie v SSSR*, vol. 1 (Moscow, 1992), 432-5; 1940-5: calculated from M.

Harrison, *Soviet Planning in Peace and War, 1938-1945* (Cambridge, 1985), pp. 250-1. Figures for 1941/Q1-2 and 1945/Q1-3 are monthly averages for the first half of the year. Other items, 1930-7: calculated from Harrison, *op. cit.*, pp. 250-1. 1940-5, calculated from TsGANKh, f. 71, op. 25, d, 7882, ll. 4-20. Small arms comprise rifles and carbines, automatic weapons, antitank rifles, and sidearms.

Table 4. Production and employment in the Soviet ammunition industry, 1943-4

	Gross value of output (billion rubles)		Workers (thou.)	
	1943	1944	1943	1944
	Total	25,0	26,2	646	577
By commissariat:				
Ammunition	50.5%	55.5%	47.7%	52.9%
Mortar armament	11.3%	9,8%	10.1%	5.7%
Medium engineering	7.4%	5.0%	3.8%	3.1%
Ferrous metals	2.5%	3.5%	...	...
Transport	2,2%	2.1%	3.1%	2.6%
Chemical industry	2.2%	1_6%	1.3%	0.9%
NKVD	2.1%	2.4%	3.1%	3.0%
Tank industry	2,0%	2.3%	1.7%	1.7%
Electrical industry	1.5%	1.2%	0.7%	0,4%
Shipbuilding	1.4%	1.5%	2.5%	2.3%
Armament	1.4%	1.3%	1.0%	1.1%
Heavy engineering	1.2%	1.5%	1,9%	1.7%
Timber industry	1.2%	1.2%	3,1%	3.1%
Nonferrous metals	1.1%	1.2%	0.5%	0.6%
Social services	1.3%	1.1%	1.0%	0.6%
Local industry of RSFSR	0.9%	1.0%	1.2%	1.1%
41 others	9.7%	7.7%	14.3%	11.9%

Source; Tsentral'nyi Gosudarstvennyi Arkhiv Oktiabr'skoi Revoliutsii (TsGAOR), f. 3922/4372, op. 4, d. 313, ll. 165-9.

Table 5. Recruitment of workers into the Soviet defense complex, 1942 (thousands)

<i>Commissariats and other agencies</i>	<i>Total</i>	<i>Numbers compulsorily mobilized</i>				<i>Other sources</i>
		<i>Training agencies</i>	<i>Military conscripts</i>	<i>NKVD spetskont.</i>	<i>Civilians</i>	
Total, 31 agencies	3,129	495	530	240	892	971
Aircraft industry	208	64	17	14	54	60
Tank industry	93	15	39	10	14	15
Ammunition	180	30	12	24	48	66
Armament	225	41	51	11	80	41
Mortar armament	108	14	5	8	81	0
Shipbuilding	39	11	5	1	7	14
Subtotal	853	175	129	68	285	196
Glavvoenstroï	39	4	24	2	9	0

Source: calculated from TsGANKh, f. 4372, op. 42, d. 986, l. 118.

Notes: The "NKVD spetskontingent": workers subcontracted to the agencies listed from the camps, colonies and settlements administered by the NKVD chief administration of labor camps (Gulag). "Other sources" include volunteers from the non-employed civilian population, transfers of administrative staff to productive work, and other sources not specified.