Russia's nuclear modernization and the defense industry

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Overview

Russia is undertaking one of the most ambitious strategic modernization programs among nuclear weapon states. It has been deploying a range of new land-based intercontinental ballistic missiles (ICBMs) and working on a number of prospective systems that are expected to enter service by the end of the decade. It is building a fleet of new strategic submarines that carry new sea-launched ballistic missile. In 2014, it initiated development work on a new strategic bomber. In addition, Russia has been upgrading its early-warning and command and control systems, deploying a network of new early-warning radars, working on new-generation early-warning satellites, and pursuing modernization of the communication networks that deliver orders to individual launchers.

Modernization of strategic forces is clearly high on the list of priorities of the current Russian political leadership. In 2012, the government announced that the defense industry will receive 23 trillion rubles (about $770 billion at the time) over the next decade; at least ten percent of these funds will be spent on the strategic nuclear forces. Even though the economic growth in Russia has slowed down considerably in recent years and the state budget might come under further pressure as a result of volatility of the oil prices it is likely that the strategic modernization program will not be seriously affected by these developments.

Most importantly, if Russia is to maintain a viable strategic nuclear force, it has to invest in modernization, as most of its currently deployed systems were deployed in 1980s and are reaching the end of their service life. Then, in most cases, the critical investment in research and development has been already completed, so Russia could adjust the deployment rate to match the available resources. Also, in numerical terms, the goal of the modernization program is relatively modest – Russia appears to aim at keeping its strategic force at the level of about 1500 deployed strategic warheads, which it can do in a number of ways. Last, but not the least, the structure of the decision-making process in Russia heavily favors continuing defense expenditures, even at the expense of other governmental programs.

This paper presents an overview of key factors that shape the Russian strategic modernization program and determine the scale and direction of the rearmament effort.

The Soviet legacy

After the breakup of the Soviet Union almost 25 years ago, Russia has undergone a remarkable and very deep transformation that has created new economic and political institutions and changed the nature of the relationships between many actors involved in the development of strategic weapon systems - the defense industry, the military, and the political leadership. However, on some fundamental level, the structure that has emerged from this transformation still bears strong marks of the old Soviet system, especially when it comes to the decision-making process and the role of the defense industry in setting the directions of research and development. This section outlines the elements of the Soviet system that are relevant for understanding the structure that exists today.[1]

In the Soviet Union, the enterprises of the defense industry were subordinated to one of the nine defense ministries. The most important ones were the Ministry of General Machine Building, responsible for development and production of ballistic missiles (ICBMs and SLBMs), space delivery vehicles and military and civilian satellites, the Ministry of Shipbuilding Industry, responsible for military and civilian ships and naval armaments, the Ministry of Aviation Industry, which was in charge of development and production of military and civilian aircraft, aviation equipment, and cruise missiles. The Ministry of Radio Industry was in charge of radars, missile defense and air defense, space surveillance systems, and high-performance computers. The Ministry of Medium Machine Building was responsible for the entire cycle of development of and production of nuclear weapons and for the civilian nuclear power.

Each ministry oversaw design bureaus, research institutions, production and repair facilities. Most of the research and development work was concentrated in design bureaus that played a role of lead contractors and integrators for large projects. Although the design bureaus were formally part of one of the ministries, the largest of them had a certain degree of independence that allowed them to pursue their own interests and agendas. Coordination of the work of the defense industry was performed by the Military-Industrial Commission, which was formally a body subordinated to the Council of Ministers, but in practice reported directly to the political leadership of the country. The commission developed and approved short-term and long-term plans for defense-related research, developments, and production, which consolidated proposals from the ministries and some individual design bureaus. The commission therefore had a significant power over the defense industry. The important exception was the Ministry of Medium Machine Building, which has never been part of the Military-Industrial Commission and which has traditionally enjoyed a very high degree of independence.

In what was one of the most important feature of the Soviet system, the Military-Industrial Commission had full control over the resources that were directed to the

[1] The discussion of post-Soviet evolution of the military industry is based on Pavel Podvig, ed., *Russian Strategic Nuclear Forces* (Cambridge, Mass.: MIT Press, 2001).

development and procurement of new weapon systems. Since the long-term armament programs were built on the basis of proposals from the industry, it meant that the military had little control over the direction of the military programs and the procurement decisions. Although the Ministry of Defense did have a formal role in the development of new weapon systems, as it was responsible for drawing technical requirements for new weapons and could state its preferences in the early stages of the process, in practice it largely had to accept the decisions that reflected the capabilities of the defense industry rather than specific military mission requirements. More often than not, this led to duplication of efforts and misallocation of resources. For example, in the 1980s, the Strategic Rocket Forces had eight different types of ICBMs and five types of SLBMs in service.

Transformation of the defense industry

After the breakup of the Soviet Union, most of the defense industry ministries and the Military-Industrial Commission were liquidated. The only exceptions were the Ministry of the Medium Machine Building, which was transformed into the Ministry of Atomic Power (Minatom), and a group of enterprises of the Ministry of General Machine Building which were consolidated in the Russian Space Agency (Roskosmos). All other design bureaus, research institutions and serial production plants were subordinated to the Ministry of Industry. In the following years, the industry underwent a number of reorganizations that involved a change of an ownership structure of most enterprises. However, until recently the basic structure of the industry remained largely the same. All of the nuclear weapon production complex and the civilian nuclear industry has been consolidated in the State Atomic Energy Corporation Rosatom, the space industry has been concentrated in the Federal Space Agency, while most other enterprises either exist as independent companies or are included in defense holdings controlled by the government. In recent years there has been an effort to consolidate the industry in a number of large holding corporations, but this process is unlikely to affect the fundamental arrangements within the industry.

With the dissolution of the Military-Industrial Commission, the responsibility for managing the development and procurement resources was formally transferred to the ministry of defense. However, at the time, this measure was largely symbolic as the government did not have the money to support large development programs or purchase new military equipment. The new lines of responsibility also were not entirely clear, so the work that was done in the 1990s was done largely to preserve the programs that were started before the breakup of the Soviet Union. In another major challenge facing Russia's defense industry, some critical facilities remained outside of Russia, so a significant effort had to be invested in consolidating all production on the Russian territory.

While the industry was undergoing this transformation it had to ensure that Russia can fulfill its obligations under the U.S.-Russian arms control treaties. Moreover, it was generally expected that Russia would maintain its strategic nuclear forces at a level comparable to that of the United States. While the United States provided significant support with eliminating the old missiles and submarines through the

Cooperative Threat Reduction program, Russia had to find its own resources to maintain its strategic forces.

The problem that Russia was facing at the time was a result of a combination of the aging delivery vehicles and the limits on the structure of the strategic forces imposed by the START II treaty that was signed in January 1993. Unlike its predecessor, START, the new treaty required both countries to eliminate all their multiple-warhead land-based missiles (the treaty allowed to convert some of them to single-warhead ones). Since these missiles accounted for the bulk of the strategic warheads in the Russian arsenal at the time, it would have resulted in a precipitous decline of the total number of deployed warheads—an outcome that was extremely unpopular in Russia. The opposition from the Strategic Rocket Forces was especially strong, since the elimination of multiple-warhead missiles would have removed from service relatively new ICBMs, such as R-36MUTTH and R-36M2 (known as SS-18) that carried ten warheads each. The only alternative to these missiles was the single-warhead ICBM, Topol-M/SS-27. Development of this missile began in the 1980s and since some of the work was done in Ukraine, it took Russia some time to transfer the production of all components to its own enterprises. The first two missiles of this type were deployed in 1997, but it was clear that Russia would not be able to produce Topol-M in quantities that would ensure an adequate replacement for the older multiple-warhead ICBMs that were supposed to retire.

The strategic fleet faced some serious challenges as well. During the 1990s, Russia has to decommission a large number of old missile submarines and had some difficulty in keeping the newer ones in service. The plan that existed in the early 1990s called for development of a new SLBM, known as Bark, which was a modification of the R-39/SS-N-20 missile deployed on large submarines of the Typhoon/Project 941 class. To carry the new Bark SLBM, in 1996 Russia laid down the first submarine of the Borey/Project 955 class. Older Typhoon submarines were also expected to undergo modernization to carry the Bark missile. However, flight tests of the missile were unsuccessful and by 1998 it was unclear whether the industry could complete its development within reasonable time. As with its land-based missile force, Russia was facing a prospect of a significant drop in the number of SLBMs that it could deploy.

To deal with this situation, Russia took a somewhat unusual step and set up a governmental commission that conducted a thorough review of the available options. The commission finished its work in the fall of 1998, issuing a number of recommendations that determined the direction of the strategic modernization for more than a decade. Indeed, the current modernization program still largely follows the path outlined in 1998.

The 1998 commission supported continuing development of the Topol-M/SS-27 missile, which was supposed to become the main ICBM of the strategic rocket forces. At the same time, following the commission's recommendations, the government launched the program that would extend service life of the ICBMs that were deployed at the time. As far as the sea-based component of the strategic triad was concerned, the government terminated the development of the Bark SLBM and

authorized development of a new submarine-launched missile, Bulava. The first Borey submarine, which was already under construction, were to be converted to the carry the new missile. In total, eight submarines of the Borey class were expected to enter service. To maintain the strategic fleet during the time required to develop Bulava and build the new submarines, the program authorized an overhaul of the older Project 667BDRM/Delta IV submarines that resumed production of R-29RM/SS-N-23 missiles that they carry. This would allow to keep the submarines and the missiles in service until 2015-2020. No major decisions were made regarding strategic aviation, although the bombers were expected to undergo overhaul and an upgrade.

The measures adopted in 1998 were largely dictated by the budgetary constraints of that time. In particular, the decision to begin development of the Bulava SLBM was justified primarily as a cost-reducing measure, since its developers offered to build the missile using the technology of the Topol-M ICBM to the maximum extent. These measures also became a test for the new roles of the military and the defense industry in the decision-making process. To a large extent the new modernization program was designed to support the defense industry by ensuring that the key defense design bureaus and production enterprises that did not have civilian orders (for example, related to space) received their share of the work. The biggest winner was the Moscow Institute of Thermal Technology (MITT), which was entrusted with the development of Topol-M and Bulava. The new production of R-29RM SLBMs ensured that the Makeyev Design Bureau, which designed the missile, and the Krasnoyarsk Machine-Building Plant, which was producing it, received contracts as well.

Evolution of the modernization program

The subsequent evolution of the modernization program showed that most of the decisions made in 1998 withstood the test of time, although implementation of some of the programs took considerably longer than expected. Also, the program proved to be flexible enough to adapt to the changing circumstances. The first significant change was the termination of the START II treaty, which limited deployment of multiple-warhead ICBMs. In 2002, the United States and Russia abandoned START II in favor of the Strategic Offensive Reductions Treaty (Moscow Treaty or SORT), which did not place any limits on MIRVed ICBMs. This allowed Russia to take advantage of the ICBM life extension program and keep a significant number of older SS-19 (UR-100NUTTH) and SS-18 (R-36M2) missiles in service. It should be noted that this work normally did not involve refurbishing of the missile; it was done primarily by an analysis of the status of the missiles that remained in service confirmed by periodic flight tests. As a result of this program, the service life of the SS-19 was extended to 36 years and that of the SS-18 – to at least 27 years (it is expected to be extended even further, to 33 years). This would allow the missiles to stay in service beyond 2020. This is an important development, as the ICBMs of these two types account for almost 800 deployed warheads – about half of all operationally deployed warheads that Russia reports under the New START treaty.

Even though the life extension program allowed keeping older MIRVed missiles in service for the time being, Russia still needed a multiple-warhead missile to replace them when they retire. However, as long as the START treaty was in force, it placed a number of constraints on the development of MIRVed missiles. In particular, it prohibited the most direct route to increase the number of ICBM warheads by deploying multiple-warhead version of the Topol-M missile. Russia, however, began tests of this new version, designated RS-24 Yars, two years before the end of the START treaty and proceeded to deploy the first missiles of this type in 2010, several months after the START treaty expired. Starting in 2011, all new missiles of the Topol-M/Yars type were deployed with multiple warheads. In the years that followed, Russia has deployed about 50 new RS-24 Yars missiles, which are expected to become the mainstay of the Strategic Rocket Forces.

In terms of the number of warheads, however, RS-24 Yars was not an adequate replacement for the large missiles, such as SS-18. The new ICBM is believed to carry four to six warheads, while SS-18 is deployed with ten. Also, as the military budget increased dramatically in the second half of the 2000s, the defense industry began lobbying for new projects that would give development contracts to the design bureaus that were not involved in the Topol-M/Yars program. As a result of this pressure, in 2009 the Strategic Rocket Forces announced a plan to build a new "heavy" liquid-fuel ICBM. The key argument in favor of the new missile was its projected large throw-weight that would allow it to carry multiple warheads as well as missile defense penetration aids. The development of the new missile, later to become known as Sarmat, was approved in 2011; it is expected to enter service in 2018-2019, although it has not yet reached the stage of flight tests. In terms of numbers, it appears that one new missile will be deployed for each of the 46 SS-18 ICBMs that are currently believed to be operational.[2]

The Sarmat project is not the only new ICBM development program that has emerged in the 2010s. In 2011 Russia began flight tests of another missile, known as RS-26 Rubezh. The missile appears to be a lightweight version of the RS-24 Yars and is suspected to be an intermediate-range missile, similar to SS-20 that the Soviet Union deployed in Europe in the late 1970s-early 1980s. While the main argument in favor of Sarmat is that it could deliver heavy payloads, RS-26 is believed to provide greater mobility. If it is indeed an intermediate-range missile, it could also provide the Strategic Rocket Forces with additional operational flexibility.[3]

Yet another project that is currently considered by the Strategic Rocket Forces, is a rail-based mobile ICBM. The Soviet Union deployed a number of rail-mobile SS-24 (RT-23UTTH) missiles in the late 1980s, but they were withdrawn from service in the 1990s. Development of the new rail-mobile ICBM system, named Barguzin, was

[2] Pavel Podvig, "Sarmat Deployment Plans," *Russian Strategic Nuclear Forces*, December 27, 2014, http://russianforces.org/blog/2014/12/sarmat_deployment_plans.shtml.
[3] Pavel Podvig, "More News about RS-26 Missile," *Russian Strategic Nuclear Forces*, December 18, 2013, http://russianforces.org/blog/2013/12/more_news_about_rs-26_missile.shtml.

approved in December 2014.[4] The system will reportedly incorporate the RS-24 Yars missile and will be deployed in limited numbers – one division of 30 missiles is expected to be deployed.

Finally, Russia appears to be working on an advanced warhead, probably based on the boost-glide concept similar to the one considered for the U.S. Prompt Global Strike. This program, known as Project 4202, apparently envisions that the new warheads will initially be deployed on old SS-19 (UR-100NUTTH) missiles, deployed at the missile division in Dombarovskiy. The system is being developed by the NPO Mashinostroyeniya (NPOMash, also known as Chelomey Design Bureau). However, the information about this project is rather scarce.[5]

As this brief outline of the existing ICBM development programs shows, Russia encounters the same problem that plagued the Soviet Union. Instead of concentrating its efforts on one program, Russia is carrying out three or four different ICBM developments projects; at least one more project is under consideration. Even though each individual development effort seems to have valid arguments to support it, it is unlikely that some of the new missiles will be deployed in sufficiently large numbers to justify the development cost.

Overall, the multiplicity of programs indicates the lack of discipline in the decision-making process. It also suggests that despite the efforts to shift the responsibility for procurement decisions to the military, the industry still plays a key role in the process. Specifically, it appears that the key design bureaus, such as MITT or NPOMash, have significant influence over the development decisions. It is known, for example, that the military initially rejected the plan to develop a new rail-mobile ICBM system. However, the project was eventually approved. In another example, it is not clear if the Project 4202 system, which appears to be a major NPOMash contract, has any significant military mission that would justify the development cost.

The SLBM development program has been more constrained, partly because it involves much larger investments in the construction of submarines. At the same time, it demonstrated that the industry is experiencing a number of problems when it comes to developing entirely new systems rather than building on the old Soviet projects. The main effort in this area was focused on the development of the Bulava SLBM and construction of the fleet of Project 955/Borey class submarines. However, the Bulava program was not ready to begin flight tests until 2005—eight years after the program was officially approved. The subsequent tests uncovered serious problems with the missile. When the flight tests eventually began, it was projected that the missile would enter service in 2009. However, the first flight that was described as fully successful took place only in 2008 and the missile failed in eight

[4] Pavel Podvig, "Rail-Mobile ICBM, Barguzin, Gets a Green Light," *Russian Strategic Nuclear Forces*, December 17, 2014, http://russianforces.org/blog/2014/12/rail-mobile_icbm_barguzin_gets.shtml.
[5] Pavel Podvig, "Russian Hypersonic Vehicle - More Dots Added to Project 4202," *Russian Strategic Nuclear Forces*, August 26, 2014, http://russianforces.org/blog/2014/08/russian_hypersonic_vehicle_-_m.shtml.

out of twelve tests conducted in 2005-2009. Although this kind of failure rate is not unprecedented for a new missile, it resulted in a significant delay of the program. In 2010-2011 the program had a series of consecutive successful flight tests and in 2013 the first Borey submarine was preparing to join the active service. However, Bulava failed again in September 2013, raising doubts about reliability of the missile (see the box). By the end of 2014, three submarines of the Borey class had been formally accepted for service, but only one of them has a full complement of missiles on board.[6]

Development of the Bulava missile

Development of the Bulava SLBM has become an illustration of the numerous problems experienced by the Russian defense industry after the breakup of the Soviet Union. It also suggests that the industry has demonstrated the capability to carry out large successful development programs, albeit with some difficulty.

The decision to begin development of the new solid-propellant SLBM, later named Bulava, was taken in 1998 as part of a major re-evaluation of the strategic modernization program. One of the key arguments in favor of Bulava was the prospect of using the technologies already developed for the land-based ICBM, Topol-M. Since this unification promised significant decrease of the program cost, Bulava was chosen over its predecessor and competitor, solid-propellant SS-N-20 Bark.

As the funding of the new development projects was uneven and the unification proved more difficult than expected, the development of the missile took longer than expected and the first "pop-up" tests from a submarine took place only in 2003-2004.[7] The first flight test of the new SLBM was conducted in September 2005. It was reported to be successful, although some reports suggested malfunction of the third stage of the missile. The series of tests that followed discovered a number of other problems. It was only the ninth launch, in November 2008, which was reported to be the first fully successful flight test. However, all three launches that followed ended in failure. In itself, this failure rate is not unprecedented for a new missile system. However, none of the problems appeared to be persistent or reproducible, which complicated the efforts to address them and raised questions about the reliability of the missile.

The effort to address the design and quality control issues eventually resulted in a series of successful test launches – five tests conducted in October 2010-December 2011 were successful (including one salvo launch of two missiles). Based on the results of this series, the missile was prepared for service and no more tests of the

[6] Pavel Podvig, "Ekaterinburg and Vladimir Monomakh Join the Fleet," *Russian Strategic Nuclear Forces*, December 19, 2014, http://russianforces.org/blog/2014/12/ekaterinburg_and_vladimir_mono.shtml.
[7] "Bulava Missile Test History," *Russian Strategic Nuclear Forces*, accessed February 26, 2015, http://russianforces.org/navy/slbms/bulava.shtml.

missile were deemed necessary. However, in the next flight test, conducted in September 2013 as part of the acceptance trials of the new submarine, Alexander Nevskiy, the missile failed again.[8] As it was a serially produced missile, the failure resulted in a re-examination of all missiles produced by that date. By September 2014 all the issues appeared to be resolved, as demonstrated in a new series of tests. The lead submarine of the Borey class, Yuri Dolgorukiy, received a full complement of missiles by the end of 2014 and two other submarines are expected to be loaded with Bulava missiles in 2015.

Unlike the development of the Bulava missile, the submarine construction program proceeded without significant problems, even if the lead submarine, which had to be converted to carry a different missile system, took more than 15 years to build. Construction of the second and third submarines has taken about eight years. With two new hulls currently under construction, it seems plausible that the all eight originally planned Borey-class ships will be ready for service in 2022-2023. It is possible that the program will continue beyond that, bringing the total number of strategic submarines to ten.

The delay of the Bulava program gave new urgency to maintaining the fleet of older Project 667BDRM/Delta IV submarines. In the past decade or so, all six submarines of this class underwent extensive overhaul (as well as moderate repairs), which apparently included fitting them with newly produced R-29RM/SS-N-23 SLBMs. This will probably allow Russia to keep these submarines and missiles in service until 2020-2022, when they could be replaced by the Borey ships. The work on the missile has continued as well—instead of simply reproducing the old missile, the Makeyev Design Bureau developed a modified version, known as Liner, which could carry up to ten warheads instead of four.[9] The investment in the upgrade may indicate that the industry may raise the issue of keeping the liquid-fuel R-29RM SLBMs or their follow-on in service when the current submarines and missiles reach the end of their service lives.

With the modernization of two legs of the strategic triad underway, it was a matter of time before the modernization affects the strategic aviation. Most strategic aircraft that are currently in service with Russia's long-range aviation were produced in the 1980s, which means they could remain in service for a number of years. The modernization effort therefore concentrated on a moderate upgrade the existing bomber fleet. The supersonic turbojet Tu-160 bombers are undergoing overhaul that equips them with new avionics and provides them with capability to use conventional weapons. This capability appears to be linked to the development

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[8] Pavel Podvig, "Bulava Failures Come Back," *Russian Strategic Nuclear Forces*, September 6, 2013, http://russianforces.org/blog/2013/09/bulava_failures_come_back.shtml.
[9] Pavel Podvig, "Liner SLBM Explained," *Russian Strategic Nuclear Forces*, October 4, 2011, http://russianforces.org/blog/2011/10/liner_slbm_explained.shtml.

and deployment of a new dual-capable air-launched cruise missile, known as Kh-101/Kh-102. The new avionics is supposed to provide the necessary targeting capability. The turboprop Tu-95MS aircraft are also receiving new avionics and undergoing repairs, although it appears that they will continue to have only nuclear missions.

In 2009-2011, the Tupolev Design Bureau, which traditionally has the monopoly on strategic bombers, began research on a new bomber, known as PAK DA (after the Russian Future Aircraft System of Long-range Aviation). The contract on development of the system was signed in February 2014. It is projected that the aircraft will make its first flight in 2019 and will enter service in 2023-2025. The new bomber is reported to be a subsonic bomber that will be able to carry nuclear as well as conventional bombs and air-launched cruise missiles.[10]

In another important development, Russia initiated a major program to upgrade the infrastructure that supports operations of its strategic nuclear forces. The most visible part of this program is the construction of new early-warning radars. The new network is replacing the old radars, most of which were built in the 1970s. More than half of these radars were located outside of the Russian territory, which means that Russia lost control over them after the breakup of the Soviet Union. The construction of new radars, of two types (Voronezh-M and Voronezh-DM) is one of the most successful programs of the last decade – since the first of them began experimental operations in 2005, nine radars are being built and at least three operate in full combat mode. The progress with the space tier of the early-warning system is less prominent. Although Russia continues to maintain elements of the infrastructure that supports space-based early-warning system, by the early 2015 it lost all its early-warning satellites.[11] Flight tests of new early-warning spacecraft, referred to as Tundra, were expected to begin in 2009. According to the current plan, the first Tundra spacecraft will be launched in 2015 and the deployment of the system (known as EKS) with ten satellites, will be completed in 2018. These projections, however, appear unrealistic and the deployment of the full constellation is likely to take considerably longer.

Overall, it appears that the main directions of the modernization program have been determined and Russia appears committed to having a strategic force with about 1,500 operational warheads spread across three legs of the traditional nuclear triad. The land-based missile force will remain the strongest component of the force, with probably about 1,000 warheads. A significant fraction of these warheads will be deployed on mobile ICBMs (whether road- or rail-mobile), but Russia also intends to keep a fairly large silo-based ICBM force. In the strategic fleet, the eight new Borey submarines with Bulava missiles will eventually replace older submarines, although it is possible that the program will be expanded to increase the number of Borey

[10] Pavel Podvig, "Plans for the New Strategic Bomber," *Russian Strategic Nuclear Forces*, May 22, 2014, http://russianforces.org/blog/2014/05/plans_for_the_new_strategic_bo.shtml.
[11] Pavel Podvig, "Russia Lost All Its Early-Warning Satellites," *Russian Strategic Nuclear Forces*, February 11, 2015, http://russianforces.org/blog/2015/02/russia_lost_all_its_early-warn.shtml.

submarines with Bulava missiles. Assuming that the development of the new strategic bomber remains on track, the new aircraft will begin replacing old Tu-95MS and probably Tu-160 bombers some time after 2025.

Consolidation in the defense industry

Among the numerous changes in the Russian defense industry and its relationships with the military, the dissolution of the Military-Industrial Commission and the transfer of the purchasing power to the Ministry of Defense was particularly important. Technically, the new system was supposed to create the development and acquisition cycle that would respond to specific military requirements as formulated by the Ministry of Defense. The transition, however, was not entirely successful, partly because of the underfinancing of the defense budget during the 1990s and partly because the Ministry of Defense did not have the institutional structure and expertise that would allow it to successfully coordinate the activity that was previously managed by the Military-Industrial Commission. Another important factor was the loss of control over the cost of the development programs and procurement since most suppliers enjoyed a monopoly on their products and services.

In an attempt to bring the situation under control, the Russian government turned to the Soviet experience. In June 1999 it established the Commission on Military-Industry, chaired by the prime minister. In 2006 it was formally reorganized as the Military-Industrial Commission, under one of the Deputy Prime Ministers (Sergey Ivanov). In 2012 he was replaced by another Deputy Prime Minister, Dmitry Rogozin, who made a very visible effort to strengthen its role. In 2014, the commission underwent another major reorganization, with President Putin assuming the chairmanship and Rogozin becoming the deputy chair.[12] Although this reorganization is expected to elevate the status of the commission, it is not clear if it will able to emulate the experience of its Soviet counterpart. The main difference between the two bodies is in the control over the resources that are directed to the defense industry. Although today's Military-Industrial Commission takes part in the decision-making process, most procurement decisions are made at the Ministry of Defense.

The Ministry of Defense is the lead agency that is responsible for the development of the medium-term State Armament Program, which outlines the key procurement decisions for the period of five to ten years. It covers all military procurement, including the strategic nuclear forces. The first such program was approved in 1996, for the period of 1996-2005; since then a new program is adopted every five years. If the first programs concentrated on maintaining the existing equipment, the current State Armament Program for the period of 2011-2020 included a massive increase of resources directed to the defense industry. The procurement budget was set at 20 trillion rubles (about $700 billion at the time), of which about ten percent

[12] "Executive order establishing the Military-Industrial Commission," *President of Russia*, September 10, 2014, http://eng.kremlin.ru/news/22932.

was to be spent on strategic forces modernization. In addition to that, the 2011-2020 program included 3 trillion rubles of direct funding for the defense industry. The next State Armament Program is expected to be even more ambitious – the military initially requested 56 trillion rubles, even though it appears that this request will be scaled down to about 30 trillion rubles when the program is approved.[13]

The State Armament Program is used by the government as a basis for an annual State Defense Order, which determines the research and development budget and sets procurement goals for each year. In the 1990s and early 2000s, when Russia was still experiencing significant problems with its budget, these orders were often underfinanced – according to one estimate, in the 1990s only about 30 percent of the money allocated for procurement actually reached the industry. In recent years, however, the situation has changed quite dramatically and the industry now has a different problem—it has some difficulty in delivering the orders placed by the military. For example, the 2006-2015 State Armament Program called for finishing the construction of seven Borey-class submarines. As of the end of 2014, only three have been built and because of the delay with the Bulava missile, the first submarines of this class will not enter active service until 2015. The missile production and deployment plans have been scaled back as well. Development of a number of key systems is far behind the schedule. For example, flight tests of new early-warning satellites, Tundra, were expected to begin in 2009. However, as of 2015, it is not known when the flight will take place or when the new system will become operational.[14]

Another problem that has been plaguing the relationship between the defense industry and the military is the issue of cost and the quality of the new equipment. While the Ministry of Defense has control over spending, it has little or no leverage over the price it has to pay for new submarines, missiles, or aircraft. This led to a number of high-profile disputes over some contracts, which were resolved only after an intervention of the political leadership. For example, in 2011 the long-term contract for the construction of strategic and attack submarines was signed only after a personal involvement of then Prime Minister Putin. It was reported that the initial price quoted by the industry was almost 50 percent higher than what the ministry of defense was willing to pay.[15]

Starting in 2008, the Ministry of Defense, headed at the time by Anatoly Serdykov, initiated a significant reform that affected, among other things, the relationships between the military and the defense industry. The ministry attempted to use its procurement authority to exert influence over the industry, reversing the traditional

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[13] Дмитрий Бутрин and Иван Сафронов, "Вооружения вступили в бой с возражениями," *Газета "Коммерсантъ,"* February 19, 2015, http://www.kommersant.ru/doc/2670562.
[14] Pavel Podvig, "Russia Lost All Its Early-Warning Satellites."
[15] "Минобороны подписало контракты на 280 млрд рублей," *Газета РБК*, November 9, 2011, http://rbcdaily.ru/politics/562949981997439; Иван Сафронов, "Игорь Сечин идет на крайние цены," *Газета "Коммерсантъ,"* April 14, 2012.

relationship that goes back to the Soviet days. In some areas, the military placed high-profile orders abroad—the order of two Mistral-class helicopter carriers from France being the most visible one. As this option was not available for strategic weapon systems, the Ministry of Defense tried to cap the price it pays to the industry, leading to disputes about the cost such as the one described earlier. In the end, it appears that the attempt to break the old Soviet-style order, when the defense industry was in control over the development and procurement, was largely unsuccessful. A number of recent changes, specifically the replacement of Serdykov as the minister of defense in 2012, the appointment of Dmitry Rogozin to the Military-Industrial Commission and the elevation of the status of the commission, indicate that the industry has managed to retain its traditional role.

While the defense industry has been making the effort to consolidate its position, it has been trying to confront what emerged as the major problem of the new system—the escalating cost of the development and construction of new armaments. In the traditional Soviet arrangement that problem was solved by a tight centralized control over all stages of development and production and, to some extent, the existence of competing design bureaus and manufacturers. In Russia, the situation has changed—enterprises of the defense industry operate as independent entities and in most areas, especially when it comes to strategic armaments, contractors and subcontractors enjoy a *de facto* monopoly, which distorts prices throughout the entire supply chain. Today, the attempt to control the cost is focused on creating large integrated companies that are supposed to ensure that the cost of production stays within a certain limit. Among these companies are the United Ship-Building Corporation, United Aircraft-Building Corporation, United Rocket and Space Corporation. The process of bringing all enterprises of the defense industry into these corporations is still underway, but it will probably be completed in the next few years. The effect on this consolidation on the cost of new military equipment is hard to predict—so far the new structure of the defense industry has not brought the desired result.

Even though the consolidation of the defense industry is still ongoing, at this point it appears that it reached a certain point where it achieved a balance between the traditional arrangements and the realities of the market economy. However, the structure that has emerged does not seem to provide efficient allocation of resources and may not be able to deliver the armaments that the Russian military needs. The situation where the industry dominates the decision-making process tends to lead to duplication of efforts, development of unnecessary systems, and wasteful spending. The current political leadership of Russia is clearly committed to maintaining the high level of military spending, often at the expense of social programs, so there is little incentive for the industry to change its ways. As the Soviet experience showed, this course of action may not be sustainable and is unlikely to ensure the long-term security of the country.