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Defense Innovation in Russia: The Current State and Prospects for Revival

Dmitry ADAMSKY

Lauder School of Government, Diplomacy and Strategy, IDC Herzliya

This paper reflects on the current state of defense innovation in Russia. It examines different schools of thought with respect to the role of technology in future warfare; describes leadership commitment to modernization and main efforts in this sphere; looks at the organizational and financial energy devoted to defense innovation, including the establishment of new organizations to spark breakthrough discoveries; and characterizes Russian aspirations in this field. Although it faces many obstacles as it modernizes, an infusion of resources and an inclination toward asymmetrical responses may enable Russia to come up with breakthroughs that can power defense innovation and the civilian economy.

The Nature of the Debate in the Russian Defense Community

It is difficult to identify clear contending schools of thought on the nature of defense innovation in Russia, aside from critiques of the fallacies of the current defense modernization policies, which will be outlined later in this paper. There is, however, a vigorous debate present in the Russian discourse on drivers of innovation on whether or not military theory should have supremacy over scientific-technological aspirations during weapons research, development, and procurement.

Today, three views dominate Russian military thought on the role of technology in future warfare. “Traditionalists” argue for both high-tech and massive forces; “modernists” trade manpower for technology; and “revisionists” give technology top priority. Traditionalists and modernists believe that Russia, “because of the technological lag and limited resources, should respond asymmetrically to the Western technology challenge.” Revisionists believe “that Russia must respond in kind.” Ongoing, radical military reform reflects the first two opinions more than the last one.¹ However, voices promoting radical military innovation have been strongly inspired and supported by the second and the third schools of thought, and the innovation discourse in Russia has often acquired a strong “techno-centric” connotation. For the sake of clarity in this paper, the proponents of the latter view will be dubbed the MTR (military-technological revolution) camp, due to their strong emphasis on technology, while their opponents will be

¹ Tor Bukkvoll, “Iron Can’t Fight: The Role of Technology in Current Russian Military Theory,” *Journal of Strategic Studies* 34, No. 5 (October 2011): 681.

referred to as the RMA (“revolution in military affairs”) camp. Both camps promote the idea of modernization, but differ on several essential points.

For the RMA camp, it is not technologically sophisticated weapons, but a creative and novel concept of operations (and the corresponding force structure) that constitute real innovation. Makhmut Gareev, probably the strongest representative of this view, argues that weapons and military technology research and development (R&D) should be guided by military theory and driven by a vision of future war, not the other way around. Scientific-technological progress, according to him, only outlines the contours of the feasible. It is the character of future war, strategic thought, and operational art that shape weapons R&D and procurement. As such, senior military leadership is not an automatic consumer of the weapons produced by the industry, but the leading conceptual authority in military affairs, responsible for forecasting and foreseeing emerging military regimes. Military theory should guide science and technology (S&T) exploration, R&D, and eventually procurement.²

This approach in a certain way reflects current tensions between the military and the industry during modernization reforms and clashes over the *Gosudarstvennaya Programma Vooruzheniya*, or State Armaments Program (SAP).³ However, there is more to it. This approach, in its essence, strongly resonates with Marshall Nikolai Ogarkov’s professional RMA credo and with the thesis promoted by Andrew Marshall, director of the U.S. Office of Net Assessment, at the dawn of the RMA reforms in the United States. In their view, military science should describe the emerging character and methods of warfare and then distill from it insights for force build-up.

Two implications stem from this approach for the Russian RMA camp. First, since innovation aims to outperform the enemy on the future battlefield, success is not necessarily a technological, but rather a doctrinal one, pertaining mainly to the innovative concept of operations. For instance, Gareev emphasizes repeatedly the importance of developing military science in the conceptual realm, not only in the technological one. Second, the best countermeasure, especially in areas of technological setbacks, should be asymmetrical. This is true in general, and, in the given historical moment, for Russia in particular.⁴

In sum, the RMA school believes that being innovative in military affairs means to be able to diagnose the changing character of war and on the basis of these insights outperform a technologically superior enemy by asymmetrical responses and by superior and more creative doctrine. Consequently, modernization and R&D should be linked to a new theory of victory that is based on a vision of future war.⁵ In some ways, the announced credo of the *Fond Perspektivnykh Issledovaniy* (FPI), the “Russian DARPA,” strongly resonates with this RMA view.

2 An argument that theory should guide practice, which means that doctrine should dictate demands of technology, and technological progress should not lead to new doctrine, goes along the lines of the traditional Soviet military culture and theory. See Dima Adamsky, *The Culture of Military Innovation* (Palo Alto, CA: Stanford, 2010), 42–46; Bukkvoll, 687.

3 Gareev blasts the planning that underpins the SAP. To him, Moscow spent “years” gathering plans for the modernization of the Armed Forces’ branches, presenting this as coordinated effort, while a “general concept” of weapons development simply does not exist. Roger McDermott, “Rogozin Questions Survivability of Russia’s Nuclear Deterrent as Defense Industry Crisis Deepens,” *Eurasia Daily Monitor*, July 9, 2013 and July 16, 2013.

4 This view accepts that “Russian conventional military technological development should stop striving for parity and/or similarity with the military technological development of the West—in particular the USA. The idea of developing an asymmetric technological response—popular in many nations with more or less strained relations with the West—has become a truism among the Russian traditionalists.” According to the former presidential adviser for military policy, “a crucial element in our plans for the development of new armaments must be an orientation towards an asymmetric response to the development and entering into service of the expensive new systems of the developed foreign countries” (Bukkvoll, 690). Both Russian presidents and the last ministers of defense frequently referred to asymmetrical response: “Asymmetric technologies should: 1) have a disruptive effect on new Western technologies, 2) be developed in areas where the domestic military industry has particular advantages, and 3) be much cheaper to develop and produce than new Western technologies” (Bukkvoll, 690).

5 For an example of the exchange, see Makhmut Gareev, “Isskusstvo Reshitel’nykh Deistvii,” *VPK*, June 12, 2013; “Predchiuvstvovat’ Izmeneniia v Kharaktere Voiny,” *VPK*, May 26, 2013. “Vyrvat’ Eres’ S Kornem,” *VPK*, June 5, 2013; Stepan Tiushkevich and Vladimir Burenok, “Krizis Voennoi Mysli,” *VPK*, June 26, 2013.

Leadership Support for Defense Innovation

How committed is the Russian leadership to supporting defense innovation? The terms “modernization” and “innovation” became buzzwords during Dmitry Medvedev’s tenure and have stayed in vogue during the presidency of Vladimir Putin. How these slogans were used to refer to democratization, civil society, and the rule of law is beyond the scope of this paper, and the discussion here will focus on modernization of the Russian economic, civilian, and military industry and infrastructure. That having been said, the Russian senior leadership is truly committed to defense innovation. Both presidents have seen modernization as a goal; however while Medvedev mainly emphasized “civilian modernization,” Putin emphasizes the primacy and the precedence of military modernization over civilian.

Military reforms launched in 2008—the New Look of the Armed Forces—were probably the most far-reaching Russian military transformation since the Great Patriotic War. The New Look reduced six military districts to four; replaced the four-echelon command structure (district-army-division-regiment) with a three-echelon one (district-army-brigade); put an end to the mass-mobilization army, and significantly reduced force size.⁶ The reforms manifested a clear quest for modernization and innovation in military affairs, as modern technology was central to them. One of the five principal objectives of the reform was “equipping the Armed Forces with modern weapon and support systems.” It entailed “deployment of modern arms and equipment to compensate for diminishing numerical strength,” specifically promoting procurement of prompt global strike, C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance), unmanned aerial vehicles, and additional weapon systems along the lines of the modern IT-RMA type military.⁷

In parallel, a deep modernization of the entire arms industry was started.⁸ Putin, and many commentators who followed suit, frequently compare recent defense modernization and military innovations with Stalin’s industrialization of the 1930s when the Soviet state made a great technological leap forward. The president, in his own words, sees defense modernization as a systemic scientific-industrial effort, aimed to provide Russia with long-term abilities to produce next-generation weapons and competitive military technologies:⁹ “Essentially, we should conduct a powerful, systemic breakthrough in the field of defense modernization, as was conducted in the 1930s.” To him, this leap forward is not confined to the defense sector, but constitutes a national idea of modernization. For Putin, as it was during the last century, the defense sector is a locomotive for economics, politics, and society.¹⁰ “The aim is that S&T achievements generated in the area of defense and security can be used more efficiently in the context of promoting the national innovation system.”¹¹

The Russian innovation policy, “Innovative Russia 2020,” was approved in December 2011.¹² It envisions defense-related R&D as a decisive factor for national security, and as an accelerator of other sectors of the economy.¹³

6 For the New Look and military reforms see Gregory Lannon, “Russia’s New Look Army Reforms and Russian Foreign Policy,” *Journal of Slavic Military Studies* 24 (2011): 26–54; Stephen Blank, “Russia’s Geo-economic Future; The Security Implications of Russia’s Political and Economic Structure,” *Journal of Slavic Military Studies* 24 (2011): 351–95; Charles Bartels, “Defense Reforms of Russian Defense Minister Anatolii Serdyukov,” *Journal of Slavic Military Studies* 24 (2011): 55–80; Alexander Sergunin, “On the Russian Military Reform: A Rejoinder,” *Journal of Slavic Military Studies* 25 (2012): 251–56.

7 Susanne Oxenstierna and Frederik Westerlund, “Arms Procurement and the Russian Defense Industry: Challenges Up to 2020,” *Journal of Slavic Military Studies* 26 (2013): 5.

8 Roger Roffey, “Russian Science and Technology is Still Having Problems: Implications for Defense Research,” *Journal of Slavic Military Studies* 26 (2013): 185.

9 During the last decade the Russian government allocated 23 trillion rubles (about US\$700 billion) for the modernization of military industrial complex. Andrei Kolesnikov, “Shutki v storonu,” *Komersant*, September 1, 2013.

10 Ibid.

11 Roffey, 186.

12 Ibid., 173–74.

13 Ibid., 174.

The Russian government's 2009–2020 development plan prioritizes the defense-industrial complex in civil high-tech R&D program and technological development. Priority will be given to exchange of knowledge and technology between the defense and civil sectors, development of dual-use technology, weapons development, modernization of military material, and improving methods to fight terrorism.¹⁴

Vice Premier for the Defense Complex Dmitry Rogozin, who chairs the Military-Industrial Committee (VPK) and FPI, the “Russian DARPA,” echoes this analogy and further develops Putin’s modernization directive. To him, the “new industrialization” à la the 1930s, will serve as a basis for innovations in the military realm and beyond.¹⁵ Rogozin acknowledges the gap with the West in “core defense technologies,” which he believes leaves Moscow lagging “by decades.” He suggests this gap “may be narrowed by advancing the work of scientists and technologists to boost the military.”¹⁶ The “[d]efense industry should become a catalyzer of the new industrialization of the state.” The goal is not simply to produce “new military iron” but to “transfer military innovations into the civilian ones;” by using defense funds to boost all Russian state industry, and to take Russia off the “oil-gas needle.”¹⁷

Modernization of the military-industrial complex is modernization of all Russian industry—creating the new labor places, new production facilities, and novel and unique technologies that will be in high demand in the civilian sector of the economics. The importance of [defense innovation] to Russian economics is difficult to over-estimate. Most of the innovative developments, materials, and technologies in our country were produced by the military orders, however only few of them were applied in the civilian life.¹⁸

Current initiatives seek to change this and to turn defense modernization into the “armored back-bone of the economics.”¹⁹

The recently inaugurated FPI is clearly a realization of this vision, where successes in defense innovation and modernization will be translated into the civilian sphere, both in the process of modernization (workplaces) and as a result of its eventual success (conversion of results into the sector of civilian innovations).²⁰

Who Defines and Leads the Russian Approach to Defense Innovation?

No single body or actor among the Russian government, military, defense corporations, or the S&T sector defines and leads the Russian approach to defense innovation. The private S&T sector plays a minor role when compared to the senior political leadership, the military, and the defense industry. Among the government organizations, the VPK, which became more influential recently, and the FPI, the newly-established Russian analog of DARPA, which nominally seems to be the most important body, will be discussed in more detail.

In 2008, the government adopted its “Concept of Long-term Socio-Economic Development of the Russian Federation.”²¹ The set goal of “modernizing the country and achieving a technological edge,” resulted in the establishment of several new organs charged with framing national innovation policy: the Government Military-Industrial Commission (VPK), the MoD’s Council on Scientific and Technical Policy, the Presidential Council for

14 Ibid., 185.

15 As in the 1930s, he calls for emulation of the West, and not reform of existing infrastructure but production of something totally novel. Sergei Ptichkin, “Ne Uproshiai Oruzhie,” *Rossiiskaia Gazeta*, September 26, 2012.

16 McDermott, “Rogozin Questions Survivability of Russia’s Nuclear Deterrent”; Roffey, 186.

17 Ptichkin, “Ne Uproshiai Oruzhie.”

18 Ibid.

19 Ivan Safronov and Viktor Murakhovsky, “Komissiiia rshiriaet polnomochiia,” *Komersant Business Guide*, July 17, 2013.

20 Gregory Voevodin, “Sozdaetsia Rossiiskoe DARPA,” VPK, October 17, 2012.

21 http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ru/policydocument/policydoc_mig_0005.

Economic Modernization and Innovative Development, and the Council for Science and Education, to name just the main ones.²²

The VPK, chaired by Rogozin, coordinates the operations of the defense-industrial complex and implements the innovation strategy of the defense sector.²³ To fulfill its first operational mandate, since 2007 it has produced the State Defense Order (SDO)—the procurement order for weapons and armaments for the military. As such, the VPK serves as a coordination platform between the defense industry, military science, and the military.²⁴

To realize its innovation goals, in 2012 Russia established the *Fond Perspektivnykh Issledovaniï*, or Foundation of Prospective Research (FPI). Although the same person chairs both bodies, the FPI aims beyond the bureaucratic wars pertaining to operations and procurement and has a different professional credo—high-risk, long-term R&D. Its role also differs from the S&T Council of the VPK, which focuses on applied and current topics outlined in the SDO and SAP.²⁵

In September 2010, during a meeting dedicated to the innovation and modernization of Russian military-industrial complex, then President Medvedev emphasized the need to establish an organ exploring and ordering risky, prospective breakthrough technologies in the field of defense, and used the U.S. Defense Advanced Research Projects Agency (DARPA) as an example.²⁶ To him, Russia needed not just to continue to upgrade Soviet-developed materiel and to procure new armaments, but also to develop its own high-tech base. A DARPA-like organization could fulfill this task and strengthen the defense industry.²⁷ Moreover, the results of its work could be spun off to the civilian sector. The intellectual sources of this quest can be found in Andrey Kokoshin’s initiatives in early 1990s, and also in several minor additional efforts of the Russian defense leadership.²⁸ Russian experts had been arguing for some time for using the U.S. experience as a benchmark in their defense modernization efforts and for creative emulation of the DARPA experience.²⁹

The new agency was established in October 2012. According to federal law, FPI is charged with facilitating high-risk, fundamental scientific R&D, for the purpose of designating and cultivating prospective, breakthrough military and dual-use innovative technologies.³⁰ As a kind of defense counterpart of the Skolkovo Innovation Center, FPI is also charged with bridging the significant lag in the sphere of high S&T in the realm of defense. It will inform leadership on projects that ensure defense technological superiority and will analyze technological backwardness.³¹ FPI, according to Rogozin, should produce the most optimal long-term linkages between “fundamental sciences,” “applied research,” and “defense industry,” and ensure “a genuine qualitative-revolutionary leap forward in Russian development.”³²

Rank and file defense S&T research bodies preoccupied with current issues do not have the time and capacity

22 Roffey, 165, 182. The Council on Scientific and Technical Policy is “chaired by the Minister of Defense and vice-chaired by the Chief of General Staff, and is responsible for drafting and implementing decisions on R&D with a view to developing new material based on proposals from institutes and defense services. It controls 5 new military scientific research institutes, formed from 19 military science committees and 38 scientific research organizations” (Roffey, 184).

23 Ibid., 182.

24 Rogozin has more administrative power than his predecessor Sergey Ivanov, to coordinate between the industry and the MoD, and even to impose its arbitrary will; however, any failure with the SAP or SDO is strongly associated with him.

25 Safronov and Murakhovsky, “Komissii rshiriaet polnomochiia.”

26 Voevodin, “Sozdaetsia Rossiiskoe DARPA”; Valdimir Ivanov, “Rossiia Zaplaniroval Tehnologicheskii Proryv,” *NVO*, March 23, 2012.

27 Roffey, 186.

28 Voevodin, “Sozdaetsia Rossiiskoe DARPA”; Ivanov, “Rossiia Zaplaniroval Tehnologicheskii Proryv”; Vladimir Neelov, “Fond Perspektivnykh Issledovaniï: Kopiai Amerikanskogo DARPA,” *Novosti VPK*, April 19, 2013.

29 Neelov, “Fond Perspektivnykh Issledovaniï.”

30 Ibid.

31 Roffey, 186; Neelov, “Fond Perspektivnykh Issledovaniï.”

32 Ptichkin, 26 September, 2012.

to look into the distant future and to devote attention to “risky” and futuristic projects.³³ According to Andrei Grigor’ev, the recently-nominated director general of the FPI, the foundation is responsible for foreseeing emerging S&T revolutions and coordinating R&D accordingly. FPI’s time horizon will be 15–20 years and it will only produce demo prototypes.³⁴

Although some experts claim that DARPA served as a “prototype” for the establishment of the FPI, it is unclear to what extent the FPI essentially resonates with DARPA. Some Russian commentators reflecting on the FPI law argue that it will follow three main DARPA efforts: 1) to diagnose future military regime and prospective threats (forthcoming RMAs); 2) to identify on this basis break-through scientific directions; and 3) to find specialists for R&D in this direction and curatorship of projects.³⁵

The exact number of FPI staff is unclear. Estimates vary from 100–150 to 250–350 experts.³⁶ FPI’s budget is not known at this stage either. Some Russian sources indicate that the annual budget will be in a range from US\$3 to 12 billion. If this is the case, then Russian funding of the FPI is much more than DARPA’s funding. According to some Russian experts, DARPA is using 0.45 percent of the annual defense budget, while if the 2012 Russian defense budget numbers are correct, then FPI will be allocated 4–16 percent of the Russian defense budget.³⁷ Other sources, however, mention the same numbers but in Russian rubles, which is definitely much smaller but still a rather significant amount.³⁸ Alternative estimates spoke about a budget of 3–4 percent of the SAP.³⁹

The FPI has already received criticism along three lines:

Redundancy. In parallel with nominating Andrei Grigor’ev to the position of director general of FPI, Russian authorities announced their intention to establish a similar body inside the MoD. Dubbed a “department of the break-through technologies,” it is led by Deputy Minister of Defense Gen. Col. Oleg Ostapenko, who is also responsible for all S&T activities of the MoD, including the department of innovations and the S&T department analyzing foreign advanced technologies.⁴⁰ The division of labor between the two bodies is not clear-cut and they may substantially overlap.

Bureaucracy. Despite its proposers’ original intentions, from the start FPI was over-bureaucratized, with several echelons of senior managers and an unnecessarily long chain of command. The enormous number of superiors, managers, and advisory boards may downgrade the flexibility and scientific rigor of the new body and curtail its innovative and futuristic spirit.⁴¹ In addition to this cumbersome vertical structure, with the Russian president at the top, unlike DARPA FPI is not part of the defense ministry and thus may lack administrative power. Russian commentators see this as a weakness. They are concerned that FPI will not have its own base for scientific exploration; instead it will mainly coordinate scientific agendas and financial streams among other research bodies that are mostly focused on current and applied projects and not on the future of military science.

Corruption. An underlying concern is that FPI may deteriorate into an additional “*raspil/otkat*” (“splitting the loot/kick-back”) device.⁴² Lack of tenders and the ability to choose projects without much oversight opens the door to classic Russian corruption schemes.⁴³

33 Neelov, “Fond Perspektivnykh Issledovaniy.”

34 Editorial, “Utverzhden Plan Raboty FPI na Tri Goda,” *E-Tver*, August 12, 2013.

35 Neelov, “Fond Perspektivnykh Issledovaniy.”

36 Ibid.

37 Voevodin, “Sozdaetsia Rossiiskoe DARPA.”

38 Ivanov, “Rossiia Zaplaniroval Tehnologicheskii Proryv”; editorial, “Naznacheni Gendir FPI,” *Lenta.ru*, February 1, 2013.

39 Konstantin Bogdanov, “Proryv v neopredelennom napravlenii,” *VPK*, July 20, 2011.

40 Editorial, “Naznacheni Gendir FPI”; “V MO Poiavitsia Departament Proruvnukh tekhnologii,” *Lenta.ru* 30 January 2013.

41 Neelov, “Fond Perspektivnykh Issledovaniy”; Viktor Miasnikov, “DARPA po Russki, vovse ne DARPA,” *NVO*, August 3, 2012.

42 Voevodin, 17 October 2012; Also see Bogdanov, “Proryv v neopredelennom napravlenii.”

43 Miasnikov, “DARPA po Russki, vovse ne DARPA.”

Resources Devoted to Defense Innovation

Russian authorities devote significant financial and organizational resources to defense innovation. However, the current shape of the Russian defense industry, its R&D, and the state of Russian S&T do not always match the modernization rhetoric about a quantum leap in innovation.

Russian S&T

Acceleration of Russian S&T and R&D is high on the declared civilian and military innovation policy agenda.⁴⁴ Moscow invested substantial funds into its traditionally strong science base and into ambitious programs, such as Skolkovo, that encourage high-tech research and innovation and attract foreign researchers and enterprises.⁴⁵ Today,

four bodies dispose of a major share of the state civil R&D budget: the Russian Academy of Sciences (RAS) with 50,000 scientists, around 400 institutes and spending a third of the civil research budget, the Federal Space Agency (Roscosmos), responsible for Russia's space program, the State Corporation for Atomic Energy (Rosatom), and the Ministry of Industry and Trade. A further three bodies, the Russian Foundation for Basic Research (RFBR), the Russian Foundation for Humanities (RFH), and the Foundation for Promotion of Small Enterprises and Technology (FASIE) share a smaller portion of the R&D budget through a competitive procedure. In addition, certain ministries, including the Ministry of Defense, have their own R&D budgets. There are also around nine venture funds, including Russian Venture Company (RVC) and Russian Corporation of Nanotechnologies (RUSNANO) for investing in innovations.⁴⁶

Moscow increased R&D spending in terms of the share of GDP dedicated to it and plans to double R&D investment over the next decade, so that it will be up to 2.5–3 percent of GDP.⁴⁷

However, all of the above has only to a limited extent generated “competitive innovative products and services,” and Russian high-tech products account only for 0.3 percent of the global high-tech market.⁴⁸ “The strength of Russian research lies traditionally in fundamental research, while applied research is lagging behind in comparison to OECD countries.”⁴⁹ According to some estimates, Russian S&T “will be unable to meet international competitiveness except in certain limited areas,” in part because “funding is being increasingly directed towards applied research at the expense of essential basic research.”⁵⁰

R&D in the Defense Sector

The defense sector plays a dominant role in the Russian R&D system and in its innovation. It employs 50 percent of all researchers, receives about 35–40 percent of total R&D funding, accounts for 70 percent of all high-technology products, and around 42 percent of its production goes for the civilian market.⁵¹ Its approach is characterized by the following:

44 Roffey, 162. “Innovation refers to the ability to develop new, commercially viable products on the basis of R&D” (Roffey, 163).

45 The Skolkovo initiative “can mainly be seen as a symbol of innovation, elite research, and an instrument for marketing Russia as an innovative, investor-friendly economy. The government will open more high-tech research centers across Russia and 25 pilot innovative territorial clusters have been selected in 2012 that can receive benefits of the Skolkovo Center residents.”

46 Roffey, 167.

47 Ibid., 170–71, 188.

48 Ibid., 188.

49 Ibid., 167.

50 Ibid., 187.

51 Ibid., 182–83.

- R&D is dominated by government organizations receiving funding on a non-competitive basis (with incremental shifts to more competition).⁵²
- R&D activities are controlled from the top down.
- The high proportion of military research is an unreformed legacy of the Soviet R&D system.
- “Research is fragmented and poorly linked to the education system and market needs.”⁵³

The following pathologies reduce the effectiveness of the Russian quest for innovation and hamper Russia’s ability to manufacture high quality, high-tech products:

- a “limited absorption capacity for innovations—a lack of linkages between companies and R&D performers;”
- disruption of ties between research institutes and production facilities that hampers conversion of R&D results into commercial products;
- low levels of foreign investment;
- poor conditions for innovation, including “weak competition, extensive regulations, widespread corruption, and inadequate infrastructure;
- institutional affiliation and personal contacts determine allocation of funding;”
- a brain drain in basic sciences (mathematics, physics, biology, and chemistry);
- low international competitiveness in terms of all published papers, and in the number of researchers.⁵⁴

Factors that could contribute to innovation include:

- long-standing high education standards in technical and natural sciences;
- cutting-edge expertise in several important areas of S&T;
- policy initiatives launched to build on these strengths; and
- a growing number of technology-based companies.⁵⁵

The State Armament Program

The 2008 Georgia war, together with major setbacks to modernization aspirations and rearmament plans, accelerated leadership’s attention to Russian defense procurement issues.⁵⁶ Pouring substantial funding into the problematic industry under the banner of “innovation” and defense modernization did not automatically ensure results. Russia faces several problems with the defense industry that hamper its ability to achieve its military innovation aspirations. SAP 2020 demonstrates these challenges very well on both sides of the equation: procurement through the MoD and supply through the defense industry.

52 “Fifty-one Federal Target Programs (FTP), inspired by the EU Framework Programs for R&D, have been introduced in order to speed up Russia’s modernization. Twelve of these target programs are concerned with science, technology, and innovation. These programs mark a shift from block funding toward more competitive allocation of funds and to enhance public private collaboration in funded projects. The purpose of FTP is to speed up technological and scientific development in priority areas appearing on a list of critical technologies.” “Putin promised before the presidential election in 2012 to substantially increase public funding for basic and applied research. In addition, he indicated that the criticized lack of fair grant assessment procedures must become more transparent and open to genuine competition” (Roffey, 172–73).

53 Ibid., 163, 171.

54 Roffey, 163, 164, 166, 180, 184.

55 Ibid., 179.

56 These include failed GLONASS launches from Baikonur, failed Bulava tests, prolonged modernization of the Russian submarines’ fleet, numerous weapons failures and accidents reported during snap inspections. Partially to solve these problems, military representatives were recently re-introduced into the defense industry to determine the quality and the prices of the products. Roger McDermott, “Rogozin Questions Survivability of Russia’s Nuclear Deterrent as Defense Industry Crisis Deepens,” *Eurasia Daily Monitor*, July 9, 2013; Roger McDermott, “Putin Blasts Rogozin Over Rearmament Failures,” *Eurasia Daily Monitor*, August 6, 2013.

To support military modernization, the Russian defense budget has been steadily growing. In the budget for 2012–2015, the stake of defense spending rises from 3.1 percent of GDP in 2012 to 3.8 percent GDP in 2014 and then declines to 3.5 percent GDP in 2015.⁵⁷ In parallel, the SAPs have been prioritizing new arms procurement. About 80 percent of the total budget over the period 2011–2020 (19 trillion rubles, or roughly \$US 630 billion) was dedicated to purchases of arms; 10 percent to R&D (in absolute terms, there is an increase in R&D spending) and 10 percent to repair and upgrades.⁵⁸ The following fields are prioritized: multifunctional weapon systems; high-precision weapon systems; irregular warfare capabilities; and C4ISR.⁵⁹

The government plans massive investments to modernize the defense industry. Beside the SAP 2020, there is a special Federal Target Program of 3 trillion rubles (\$US 100 billion) that is allocated to upgrade the industry production apparatus. According to assessments, the defense industry could receive 1.5 trillion rubles (\$US 50 billion) in government support up to 2013 for the renewal of its technological base.⁶⁰

The SAP 2020 seeks to achieve 70 percent new military equipment and to invest “3 trillion rubles (US\$100 billion) in the development of the country’s defense industry in the next decade.”⁶¹ However, parts of the 2020 SAP appear difficult to achieve. Putting aside the unrealistically high program costs (4.2 percent of GDP),⁶² deficiencies in the defense complex procurement system, technological base, and performance present serious obstacles to the fulfillment of the program.⁶³ Some of these include:

- deficiencies in the organization and the corrupt practices in the procurement system;⁶⁴
- obsolete production apparatus, especially in the field of electronics necessary for C4ISR and stand-off precision-guided munitions (about 75 percent of production assets are obsolete and 50 percent worn-out);⁶⁵
- lack of transparency on prices and procurement process and burdensome administrative requirements;⁶⁶
- the legacy of the inefficient Soviet non-market command system approach;⁶⁷
- disagreements over prices, which then cause contract delays;
- a corrupt system (about 20–30 percent of the defense budget disappears annually);⁶⁸ and
- A monopolistic state-owned holding company (Rostekhnologii).⁶⁹

Given these obstacles, is there a Russian appetite for advanced types of innovation, such as disruptive, break-through, or leapfrog innovation? Or is the overwhelming focus of Russian defense innovation on lower-risk, incremental innovation approaches? Russian leadership clearly refers in its modernization visions and initiatives to conducting break-through military innovations. Speaking about the roles of the FPI, Rogozin clearly refers to the high-risk, non-incremental, disruptive approaches to research in basic and applied sciences.⁷⁰ DARPA is held up as

57 Oxenstierna and Westerlund, 7.

58 Ibid., 5–6.

59 In 2009–2011 SAP experienced “a serious crisis because of either inability of the defense industry to produce modern weaponry or MoD’s unwillingness to buy outdated armaments” (Sergunin, 255).

60 Oxenstierna and Westerlund, 6–7.

61 Roffey, 185.

62 Oxenstierna and Westerlund, 23. “Arms procurement, as a share of GDP, rose from 0.7 percent to just over 1 percent over the period 2000–2010, and is expected to double to almost 2 percent of GDP up to 2014. Total of almost 20 trillion RUR is intended to be spent on arms and military equipment under the program” (Oxenstierna and Westerlund, 2).

63 Oxenstierna and Westerlund, 1.

64 Ibid., 23.

65 Ibid.; McDermott, “Putin Blasts Rogozin Over Rearmament Failures”; Roffey, 183.

66 Oxenstierna and Westerlund, 23; McDermott, “Putin Blasts Rogozin Over Rearmament Failures.”

67 Oxenstierna and Westerlund, 2.

68 Oxenstierna and Westerlund, 10,12; McDermott, “Putin Blasts Rogozin Over Rearmament Failures.”

69 Oxenstierna and Westerlund, 6, 13.

70 Ivanov, “Rossiia Zaplaniroval Tehnologicheskii Proryv.”

a model of how such an approach pays off in the long run both in the military and the civilian sectors. According to the Russian view, 60 percent of DARPA projects have been “high-risk, high-output” types of interdisciplinary, initially non-applied, but basic research projects. Russian experts state that among the “mountains of garbage” produced by DARPA, there were “pearls” that shifted the established paradigms in the revolutionary way. To them, the FPI should emulate this approach.⁷¹

This is more than just rhetoric. According to Roffey,

Russia is an example of a country that specifically targets technologies, such as nanotechnology and biotechnology, to concentrate resources where breakthroughs are hoped, rather than spreading resources in all potential innovation areas. The Russian government is also one of the world’s largest investors in nanotechnology R&D and it is hoped that this will push the entire innovation area forward in Russia.⁷²

Also, expected breakthroughs, according to the Russian view, “can be used for international specialization and provide important competitive advantages on a world-wide scale.”⁷³ There are grounds to expect that this approach will continue in military realm in the observable future.

Priorities Over the Next 10, 20, and 30 Years

It is not possible to identify exactly the prioritized areas of defense innovation in Russian defense, civilian, or dual-use areas, but some observations are still possible. A Strategy (2006) and a Comprehensive Program (2007) for the Development of Science and Innovation in Russia up to the year 2015 elaborate on the detailed priorities specified in the List of Critical Technologies set by the president in 2005. “The priority areas of S&T were: security and antiterrorism; life sciences; industry of nano-systems and materials; information and telecommunication systems; advanced weapons, military and special technologies; sustainable use of environment; transport, aviation and space systems; and energy and energy saving.”⁷⁴ In response, Skolkovo has been focusing on “energy efficiency and energy-saving, nuclear energy technology, space technology, health technology, strategic computer technology, and software.” Despite some major setbacks and failures, experts accept that Russia is regarded as relatively successful in a number of areas, including nuclear technology, space exploration, and information technology (soft and cyber).⁷⁵

In the last decade, Russian political leadership and military leaders discussing sixth-generation warfare refer to the new generations of bio-, nano-, and information breakthrough technologies that will influence warfare by 2020. Frequent references are made to the need to develop and procure weapons based on new principles (i.e., radiation, geophysical, wave, genetic, and psycho-physical). These weapons are expected to provide entirely new means for achieving strategic goals by 2020.⁷⁶ At least in theory, FPI and its newly established counterpart in the MoD should facilitate these plans.

In August 2013, the first three-year plan for the FPI was approved with eight prospective projects and an estimated budget of 2.3 billion rubles. Documentation for seven of the projects is still unavailable; however, the first announced project (probably part of the “robotics” prospective direction) is the “future soldier.” The project aims to

71 Bogdanov, “Proryv v neopredelennom napravlenii.”

72 Roffey, 165.

73 Ibid., 181–82.

74 Ibid., 168; also see “Development Priorities in Science, Technology, and Engineering in the Russian Federation Have Been Approved,” announcement on Kremlin website, July 7, 2011, <http://eng.state.kremlin.ru/face/2530>.

75 Roffey, 170.

76 Ibid., 185.

enable an individual soldier to operate a family of battlefield robots in a standoff manner. The Kurchatov Institute, the winner of the project, will be allocated 170 million rubles to deliver the project to the military by 2020.⁷⁷ In general, this coincides with the earlier statements of VPK and the FPI chairman that the prioritized, break-through technologies that FPI should focus on are: robotics; new materials (most probably nanotechnology); micro-electronics; cyber issues; and hyper-sound.⁷⁸

Conclusions

Although the Russian defense industry is among the five largest in the world, the prospects of major government initiatives and aspirations in the field of defense innovation are not clear.⁷⁹ Russia's innovation vision will not be realized overnight. So far there is a strong imbalance between the resources provided to strengthen R&D and innovation and defense innovation output.⁸⁰

According to outside observers, Russian military "R&D is slowly recovering from the 1990s," but it "will probably take around 10 years with current investment levels to achieve tangible results in military and civilian fields."⁸¹ Russian experts and policymakers realize this and have invested heavily to overcome the long-lasting shadow of the 1990s. Overall, they are optimistic and draw on inspiration from the "glorious" past of the 1930s.

In the Russian strategic mentality, the current situation resonates with the industrialization of the 1930s—a story of successful innovation and a leap forward from the agrarian past to great power status. External observers are skeptical, however: "[t]he Soviet industrial leap of the 1930s is hard to duplicate, as the technological and managerial competence necessary to develop and produce modern armaments cannot simply be bought and applied."⁸² Some in Russia will probably agree with this view, but others, the Kremlin in particular, are likely to disagree.

Whether Russia can deliver success in defense innovation, and in the SAP 2020 in particular, depends on many factors. Three important ones are a sense of strategic optimism, a stable internal political situation, and a "super" manager. For the realization of the national idea à la the 1930s, according to some Russian commentators, Russia may need a "person from the 1930s."⁸³ Indeed, under Stalin modern Russia saw examples of great and successful leaps forward in the 1930s and in the 1950s. Older Russian history also provides an example of the tsar that enabled Russia to make an innovative military leap forward against all odds: Peter the Great, whose portrait hangs in President's Putin study.

The Russian inclination toward asymmetrical responses may enable it to come out with revolutionary conceptual breakthroughs and to become one of the leading actors in the following fields, at least in terms of scientific and military theory development:

- fourth-generation nuclear weapons (battlefield use nuclear weapons with tailored effects)
- cyber (merging the soft and kinetic approaches)
- space (planetary active defense against asteroids)
- undersea and arctic warfare

77 Petr Svoekoshtnyi, "Dmitry Rogozin I Soldaty Budushego," Polit.ru, August 12, 2013; editorial, "Utverzhdzen Plan Raboty FPI na Tri Goda," *E-Tver*, August 12, 2013; editorial, "Kurchatovski Institut Potrati 170 Milionov na Soldata Budushego," *Lenta.ru*, August 9, 2013.

78 Neelov, "Fond Perspektivnykh Issledovaniy."

79 Oxenstierna and Westerlund, 13.

80 Roffey, 187.

81 Ibid.

82 Oxenstierna and Westerlund, 24.

83 Kolesnikov, "Shutki v storonu."

The actual ability of Russia to modernize itself in these innovative areas is questionable. However, strategic imagination unconstrained by current capabilities may result in rather original ideas, and we should not disregard futuristic and innovative ideas even if they are incompatible with an opponent's actual capabilities to implement them. A reminder from history will serve as a cautionary example: in the early 1980s, Andrew Marshall and ONA experts outperformed other segments of the U.S. strategic community that regarded Soviet MTR as futuristic nonsense. In contrast, Marshall and his experts accurately assessed that Soviet military theoreticians might be right in their outline of the contours of the emerging military regime. Back then, although Soviet futuristic ideas were incompatible with their actual capabilities to materialize them, the Soviets got it right. This example may be a good guidance for analysts of current Russian thinking on military innovations. Russia's doctrinal notions, although seemingly unrealistic, might again turn out to be even more innovative than those of their counterparts.