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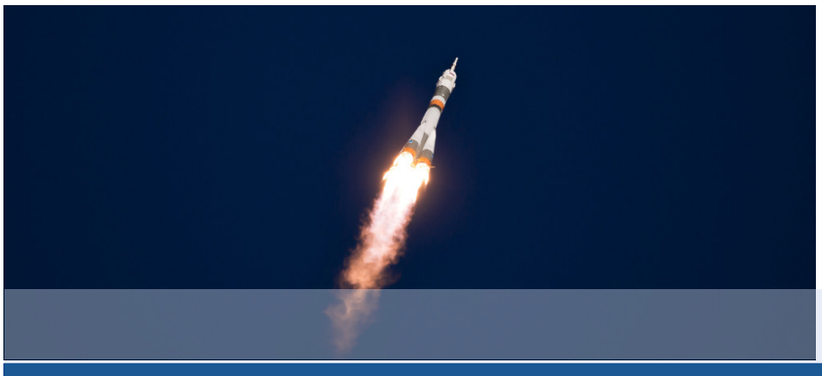

RUSSIA'S SPACE POLICY

The Path of Decline?

Florian VIDAL

January 2021

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Initiative on "European space governance"

This tripartite initiative (Ifri, DGAP, IAI) is intended to provide analysis pertaining to the international space competition and its impact on the European space industry as well as its governance. Through a series of publications and public events, the goal of the initiative is to raise awareness among stakeholders in the European Union on the challenges presented by the transformation of the global space industry. It is coordinated by **Éric-André Martin**, General Secretary of the Study Committee on French-German relations (CERFA) at Ifri.

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Executive Summary

With the advent of New Space, Russia is engaged in a race against time to preserve one of its major industrial assets. In recent decades, the country has managed the space sector like a rental business, whereby it has long enjoyed a quasi-monopoly situation in relation to low-orbit launchers, thanks to the *Soyuz* rocket. While Russia perceives the space sector as an instrument of power, its industry is essentially based on obsolete organization and infrastructure.

The establishment of the Roscosmos State Corporation in 2015 was intended to accelerate the transformation of the space sector, which is lagging behind, while the competition for space now includes several dimensions (military doctrine, development of the market for civil applications, scientific exploration, and new business segments still in development, such as tourism). On the one hand, the reorganization of the sector aims to rationalize its programs according to budget constraints as well as socio-economic, technological and infrastructural realities while Russia is subject to Western sanctions. On the other hand, to enhance the value of this economic segment at the international level, Russia aims to uphold its strategic autonomy; i.e. to have a tool enabling it to act on its own and be able to promote its industry on the global market. To do this, the country is counting on three axes of development: 1) the Vostochny Cosmodrome; 2) the development of a new range of launchers, and 3) the maintenance of a satellite constellation. However, the progress of these three pillars of modernization displays uneven results. Overall, the reforms undertaken since 2015 are too limited in scope to reverse a programmed erosion of market share, even though the sector will retain niche segments that could provide the basis for international cooperation.

Therefore, it is necessary, first of all, to examine the scope of the restructuring of the Russian space sector as well as its limits and, secondly, to put into perspective the successes and failures of a sector threatened by decline. In a highly competitive international environment, the attempt to upgrade this sector challenges Russia's credibility with its partners, particularly Europe. Nevertheless, Russian-European cooperation has proved to be resilient beyond the political and economic circumstances.

Résumé

Avec l'avènement du *New Space*, la Russie est engagée dans une course contre la montre pour préserver l'un de ses principaux atouts industriels. Au cours des dernières décennies, le pays a géré le secteur spatial comme une rente bénéficiant d'une situation de quasi-monopole sur les lanceurs en orbite basse, grâce à la fusée *Soyouz*. Si la Russie perçoit le secteur spatial comme un instrument de puissance, son industrie repose d'abord sur une organisation défaillante et une infrastructure obsolète.

La création de la société d'État Roscosmos en 2015 visait à accélérer la transformation d'un secteur spatial, en difficulté, alors que la compétition pour l'espace comporte désormais plusieurs dimensions (doctrine militaire, marché des applications civiles, exploration scientifique et nouveaux segments commerciaux, encore en développement, comme le tourisme). D'une part, la réorganisation de l'industrie spatiale vise à rationaliser ses programmes en fonction des contraintes budgétaires ainsi que des réalités socio-économiques, technologiques et infrastructurelles alors que la Russie est soumise aux sanctions occidentales. D'autre part, pour valoriser son industrie spatiale au niveau international, la Russie vise à maintenir son autonomie stratégique, c'est-à-dire de disposer d'un outil lui permettant d'agir de manière indépendante et de promouvoir son industrie sur le marché mondial. Pour ce faire, le pays mise sur trois axes de développement : 1) le cosmodrome de Vostochny ; 2) l'introduction d'une nouvelle gamme de lanceurs, et 3) le renforcement d'une constellation de satellites. Cependant, l'avancement de ces trois piliers présente des résultats inégaux. Dans l'ensemble, les réformes entreprises depuis 2015 sont d'une portée trop limitée pour inverser une érosion programmée des parts de marché, même si le secteur conservera des segments de niche qui pourraient servir de base à une coopération internationale.

Il s'agit alors d'examiner, tout d'abord, l'ampleur de la restructuration du secteur spatial russe ainsi que ses limites et, ensuite, de mettre en perspective les succès et les échecs d'un secteur menacé par le déclin. Dans un environnement international très compétitif, la difficulté de mettre à niveau ce secteur met en cause la crédibilité de la Russie auprès de ses partenaires, notamment européens. Néanmoins, la coopération russo-européenne s'est avérée jusque-là résistante au-delà des conjonctures politiques et économiques.

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Introduction

As the planet was confronting the Covid-19 pandemic, the launch of the Falcon 9 rocket from Cape Canaveral in the United States on May 30, 2020 represented a breakthrough in the space industry. On that day, SpaceX successfully completed its first manned flight, in the *Crew Dragon* capsule, with two astronauts on board. It was the first manned flight sent into space by a private company. Meanwhile, the Russian space industry is facing an historic acceleration where the shadow of the decay of its industry appears more tangible. Reminiscent of the Soviet golden age, Roscosmos CEO Dmitry Rogozin recalled that the *Soyuz MS* space vehicle held a record of 173 successful manned flights, while stressing that "American engineers have not yet earned this reputation".[1] Nonetheless, other stakeholders in the Russian space industry are less lyrical, including the cosmonaut Fyodor Yurchikhin, who stressed the need to stop living in the past.[2]

Since the end of the Cold War, the decline of post-Soviet Russia is perceptible both in space exploration and space science. In the last three decades, the industrial and financial decline has highlighted the weakening of corporate governance and the obsolescence of its infrastructures. This sector must now deal with structural deficiencies.

In continuing its activities related to the Soviet space superpower legacy, Russia has not completed the reforms needed to match the new industrial conditions as this sector undergoes radical change. Further to the obsolescence of its industry, which leads to a lack of competitiveness, Western sanctions, in force since 2014, as well as economic stagnation constrain any upgrade.

After decades of renting, how does the Russian space sector intend to preserve its strategic autonomy? What are the key directions that would revitalize both its governance and its weakened industrial base? Considering all the endogenous and exogenous constraints, what can be the international ambitions of the Russian space sector? Also, what type of cooperation can Russia envision with other space powers, especially the European Union (EU)?

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1. "This War Is Theirs – Not Ours': Dmitry Rogozin on Elon Musk's Crew Dragon Launch", Roscosmos, 8 June 2020, available at: www.roscosmos.ru.
2. "Proshlym mozhno gordit'sia, no im nel'zia zhit'" [You Can Be Proud of the Past, But You Can't Live with It], *Kommersant*, 8 June 2020, available at: www.kommersant.ru.

At a time when Russia can no longer compete alone with the United States, and when China appears to be a rising power in this field, the survival of its space industry requires major modernization, which would involve a contraction of its ecosystem, with all the different actors that make it up interacting with each other so as to implement a joint strategy. Such a strategy would be aimed at supporting innovation and creating favorable conditions for private actors. In that regard, cooperation with Europe remains for Roscosmos one of the pillars in the international policy agenda. Nonetheless, the opportunity is shutting down, threatening Russia's position as a reliable and long-term international partner.

What Role Will Russia Play in Space in the 21st Century?

A "nostalgic power" in search of a new national narrative

Space has a unique place in the Russian national narrative. As a matter of pride and a symbol of power, the Soviet space odyssey remains an important marker. Yuri Gagarin's flight in April 1961 is still fresh in the Russian collective memory, and the Soviet space program is one of the greatest technological and geopolitical achievements of the past century. Part of a historical continuum, the memory of a power at the cutting edge of science and technology still fascinates Russian society.

As a result, Russian public opinion still displays strong interest in space: 31% of Russians surveyed said they closely follow space exploration news, while 59% believe it is important for the country to maintain its leadership in this field.[3] Similarly, most of this public opinion is optimistic (53%) that Russia will have retained its position as a driving force in space exploration by 2030. In order to stand as a major space power, Russia has declared its intent to follow the path of planetary explorations. In September 2020, Dmitry Rogozin recalled that the Soviet Union was the first country to send a probe to Venus. Echoing the Soviet *Venera* program, he underlined that the upcoming draft federal state program on space activities for the period 2021-2030 will include further projects of exploration on Earth's "Evil Twin". For several years, Roscosmos has been in discussions with NASA about sending a new mission to Venus, planned to launch during the coming decade.[4]

Under the impetus of the federal authorities, space policy stands as an instrument for reaffirming the country's national sovereignty and power, and also as an effective communication channel. In other words, the

3. "O kosmose" [On Space], *FOM*, 12 April 2019, available at: www.fom.ru.
4. "Rogozin zaiaval, chto Rossiia planiruet otpravit' sobstvennuiu missiiu na Veneru" [Rogozin Said that Russia Was Planning to Send Its Own Mission to Venus], *TASS*, 15 September 2020, available at: www.tass.ru; J. Leman, "Venus Is a Russian Planet… Says Russia", *Popular Mechanics*, 18 September 2020, available at: www.popularmechanics.com.

projected image is part of a nostalgic vision.[5] To reaffirm its space autonomy in this domain, Russia intends to redeploy its infrastructure on its own territory with the aim of developing a new national narrative. The point for Russia is not only to break with an industrial and geographic organization inherited from the Soviet Union, but also to become self-reliant. The recent shift from the Baikonur Cosmodrome in Kazakhstan to the newly built Vostochny Cosmodrome in Eastern Siberia perfectly illustrates this shift.

Russia's position in the New Space

The advent of New Space in the 21st century – i.e. the entry into a new stage for the space sector, marked by the appearance of new stakeholders (states and non-states), the speeding-up of the innovation race, and the significant costs reduction – embodies the greatest challenge for the Russian industry.

While some states are gaining ground (China, India, and Japan) and private companies are quickening the international competition, Russia is striving to reposition itself. On the one hand, its military component is strengthening its influence as a geopolitical power. On the other hand, the country is losing its longtime and prominent position in international cooperation.

The looming threat of Russian space decay?

Although Russian officials maintain an ambitious stance regarding the role and projects envisaged in the space sector, the first conclusion is nonetheless irrefutable: the competitiveness of its industry is being seriously eroded by the international competition. For experts in the Russian space community, Russia has no longer the means to streamline a sector that is now in survival mode.[6] Without major commercial and scientific achievements, it is difficult to remain at the forefront of space technology and industry on the one hand, and to compete with other powers on the other.

In the first place, the rise of new players in the United States in the framework of the "New Space" policy, such as Blue Origin and SpaceX, means that Russian market share will be reduced in the launcher segment. These competitors follow different logics, in which the market stimulates innovation and cost reduction. As a result of US strategic orientations aiming at independence in access to space, Russia is about to lose two crucial

5. M. Bodner, "60 Years After Sputnik, Russia Is Lost in Space", *Space News*, 4 October 2017, available at: https://spacenews.com.
6. A. Borisov, "Poletali i hvatit" [Flying and That's Enough!], *Lenta*, 18 July 2018, available at: https://lenta.ru.

market products that it supplies to the United States: the *Soyuz-2* rocket's manned flights and RD-180 engines.

Second, the entry of new state actors is about to overhaul the geopolitical landscape when it comes to space. Asia is emerging as the new epicenter of space competition.[7] In recent decades, China, India and Japan have asserted their aspirations with the launch of national space programs. China is a powerful contender on the verge of surpassing Russia in this geopolitical competition. Clearly, China intends above all to take the lead in the emerging small-satellite segment market, with massive financial support for its startups.

In sum, Russia is facing double competition on the one hand, with the irruption of private companies, and, on the other, the rapid emergence of new state actors. Unlike its competitors, the country is ill-equipped to meet new standards in this tense market competition.

Military aspect of the Russian space program

Unlike its counterparts at NASA and the European Space Agency (ESA), Roscosmos includes a military component in the development of space activities. These are directly steered by the Russian Space Forces (*Voenno Kosmitcheskie Sily*) under the leadership of Colonel General Aleksandr Golovko. In this respect, Russia's space strategy is defined jointly by Roscosmos and the Ministry of Defense (*Minoborony*). Both are competing to control key space infrastructure assets, which indicates the *Minoborony*'s increasing influence in the space program.[8] Russian military doctrine on the use of space is based on two principles: the possibilities of jamming and radio interference, and offensive capabilities against ground-based space infrastructures. In addition to these principles, electronic warfare has equally an obvious strategic dimension.

Regarding space infrastructures, Roscosmos supervises companies responsible for manufacturing ballistic and cruise missiles.[9] As for the Plesetsk Cosmodrome, this Russian spaceport is in Mirny, Arkhangelsk Oblast. Based in the Arctic region, its use is solely devoted to launching military satellites. In recent years, these activities have increased significantly, becoming an indispensable pillar in Russia's geopolitical ambitions. In the wake of the Russian involvement in Syria, starting in 2015,

7. X. Pasco, *Le nouvel âge spatial. De la Guerre froide au 'New Space'* [The New Space Era. From the Cold War to the 'New Space'], Paris: CNRS Éditions, 2017, p. 55.
8. P. Baev, "Political Farce Russian-Style: Putin Complains About Corruption", *Eurasia Daily Report*, The Jamestown Foundation, 18 November 2019, available at: www.jamestown.org.
9. A. Zak, "Russian Space Program in the 2010s: Decadal Review", *Russian Space Web*, 27 August 2019, available at: www.russianspaceweb.com.

the army requested the support of ten spacecraft, including civilian remote sensing satellites (notably the *Resurs-P* and *Kanopus* satellites). According to Chief of Staff Valery Gerasimov, their use made it possible to cover the conflict zone and increase the precision of the targets identified.[10] On 15 July 2020, Russia carried out a non-destructive test of an anti-satellite weapon (ASAT) from the *Kosmos-2543* satellite, which launched a small projectile into orbit at a speed of 500 km/h.[11] This test echoed another launch from the Plesetsk Cosmodrome that took place in April 2020: a low-orbit launch of its *PL-19 Nudol* direct-ascent anti-satellite missile system (DA-ASAT).[12] The development of these two techniques would therefore suggest a more offensive orientation of the military space component that could include jamming activities as well as the possibility of colliding a satellite with a killer satellite. In 2017, the *Luch-Olymp* craft would lead spy activities against Athena-Fidus (a French-Italian dual-use satellite) that provides secure communications for the military.[13]

Each year, Russia spends nearly $1.6 billion on the military branch of its space program.[14] In comparison, the United States 2021 budget allocates $18 billion for military space activities, including $15.4 billion for the US Space Force.[15] In real terms, Russia ranks far behind the United States, and probably China, whose funding of the military component of its space program appears to be opaque.[16]

International cooperation without consistent strategy

On the eve of the annexation of Crimea in 2014, Western countries implemented economic and financial sanctions against Russia, especially by targeting the country's energy sector. The reduced access to the international

10. A. Zak, "Spooky World of Military Satellites", *Russian Space Web*, 23 May 2020, available at: www.russianspaceweb.com.
11. "Russia Conducts Space-Based Anti-Satellite Weapons Test", US Space Command Public Affairs Office, 23 July 2020, available at: www.spacecom.mil. See also: M. Boulegue and B. Unal, "Russia's Behaviour Risks Weaponizing Outer Space", Chatham House, 27 July 2020, available at: www.chathamhouse.org.
12. L. Grosh, "Russia Conducts Another Test of Its Missile System to Take Out Satellites", *The Verge*, 16 April 2020, available at: www.theverge.com.
13. A. Chrisafis, "'Act of Espionage': France Accuses Russia of Trying to Spy on Satellite Data", *The Guardian*, 7 September 2018, available at: www.theguardian.com.
14. P. Luzin, "Cena i perspektivy voennoj kosmicheskoj pogrammy" [Military Space Program Prices and Prospects], *Riddle*, 22 May 2020, available at: www.ridl.io.
15. "DOD Releases Fiscal Year 2021 Budget Proposal", US Department of Defense, 10 February 2020, available at: www.defense.gov.
16. China's space budget (both civil and military) is estimated at $5.8 billion for the year 2018. See also S. Seminari, "Op-ed | Global Government Space Budgets Continues Multiyear Rebound", *Space News*, 24 November 2019, available at: https://spacenews.com.

financial markets contributes to limiting Russia's attractiveness for cooperation programs, even as regards space.[17] Furthermore, the Russian space sector suffers from legal disputes that affect its cooperation with its Western partners.[18] Consequently, the country has undertaken an ambitious policy to diversify its partnerships. Within a decade, partnership agreements were multiplied with industrial and technological powers (South Korea, Israel, Japan) on the one hand, and BRICS countries (Brazil, China, India) on the other. This cooperation can be achieved either by joint activities or technology transfer. For instance, the cooperation between Russia and South Korea in the space field has been uneasy as the two countries' different styles of diplomacy may conflict.[19] In brief, bilateral space cooperation did not proceed with ease; it included problems such as delays in launching, astronaut replacement a month before a scheduled spaceflight, interruptions and upheavals.

This diversification policy aimed at breaking the strategic dependence of Russian space activities on the major Western powers reveals the absence of a global strategy.[20] For example, the space cooperation initiated within the BRICS holds "a mismatch in interests, priorities and capabilities".[21] These partnerships are fragile links that fail to tackle Russia's technological and industrial decline.

Russia-China space cooperation: Where does it stand?

In the last decade, Russia and China have increased their cooperation in the space field in several aspects. On the one hand, they jointly coordinate the diplomatic channel as they defend a common vision on the use of space. Together, they are working on a treaty on the "Prevention of an Arms Race in Outer Space" (PAROS). In 2014, they submitted a new draft "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or

17. Since 2014, Dimitry Rogozin has been on the American and European lists of sanctioned personalities, which includes freezing of assets and visa restrictions. This *de facto* limits exchanges with his Western counterparts, including those of NASA.

18. See P. de Selding, "Roscosmos Says Galileo, Other European Space Programs Could Suffer from Payment Dispute", *Space News*, 25 October 2016, available at: www.spacenews.com. In 2014, former shareholders of Russia's Yukos oil company won an initial award of $50 billion from an international arbitration panel in The Hague against the Russian government for dismantling the company. Following this decision, these shareholders tried to collect Russian government assets wherever they could. As a result, shareholders' representatives sought seizure of Eutelsat, which owes the Russian Satellite Communications Co. (RSCC) of Moscow around $300 million for services related to Eutelsat use of RSCC satellites.

19. O. Krasnyak, "South Korean-Russian Space Cooperation: Mistrust & National Diplomatic Styles", USC Center on Public Diplomacy, 18 July 2017, available at: www.uscpublicdiplomacy.org.

20. M. Aliberti and K. Lisitsyna, *Russia's Posture in Space: Prospects for Europe*, Cham: Springer, 2019, p. 61.

21. *Ibid*, p. 89.

Use of Force against Outer Space Objects" (PPWT). Within the framework of the UN institutions, Russia and China advocate a feasible approach for the international community to prevent the weaponization of and an arms race in outer space in a legally binding form. Yet, both countries cooperate in joint military space programs. For instance, Russia is helping China's efforts to build an early-warning system, which is part of the ever-growing "strategic partnership". The system includes a space-based echelon, which comprises satellites that can detect launches of ballistic missiles from the territory of any state in real time.[22]

On the other hand, civil scientific and technical cooperation is mainly based on the space cooperation program for 2018-2022. Under the guidance of Roscosmos and the China National Space Administration (CNSA), this program includes six sections, with working subgroups. Among cooperation items, both sides agreed to commit to establishing a joint lunar and deep-space data center.[23] While it is limited to technical cooperation, this five-year agreement includes also special-materials development, collaboration in the area of satellite systems, Earth remote sensing, and space-debris research.

From the ISS to the ExoMars astrobiology program: Cooperation with Europe at risk?

Since the end of the Cold War, Russian scientific cooperation with the West in the space domain has been a critical pillar of the internationalization strategy. Indeed, its involvement in major international programs, such as the International Space Station (ISS), allows the country to maintain a strategic presence. Space scientific cooperation has not been disrupted by the geopolitical crises that erupted between the West and Russia.[24] In the same vein, this scientific diplomacy is an opportune instrument for Moscow. In the long term, this working cooperative link may in due course facilitate confidence-building with its Western partners.[25] While the ISS is likely to operate until 2028,[26] Roscosmos has declared its interest in developing a Russian orbital station (ROS).

22. "Russia Achieves Certain Success in Helping China Set Up Its Missile Attack Warning System", *TASS*, 24 August 2020, available at: www.tass.com.
23. A. Jones, "China, Russia to Cooperate on Lunar Orbiter, Landing Mission", *Space News*, 19 September 2019, available at: www.spacenews.com.
24. M. Byers, "Cold, Dark, and Dangerous: International Cooperation in the Arctic and Space", *Polar Record*, 10 June 2019, available at: www.cambridge.org.
25. O. Krasnyak, "Rebuilding Trust with Russia through Science Diplomacy", USC Center on Public Diplomacy, 7 May 2018, available at: www.uscpublicdiplomacy.org.
26. M. Wall, "What's Next After The International Space Station? Plans Afoot for More Off-Earth Outposts", *Space.com*, 2 November 2020, available at: www.space.com.

Another program – the ExoMars astrobiology program – highlights the difficulties in overcoming widening cracks between Europe and Russia. It reflects current challenges relating to different standards in procedures, growing technological gaps, and lack of transparency in Russian programs. While the US pulled out of this program, ESA had to make a default choice and pick Russia as a teammate. As a result, ESA and Roscosmos signed a cooperation agreement in March 2013, making Russia a full partner. Under this joint program, the Mars robotics exploration project included two missions. The first took place in 2016, while the second, scheduled for 2020, was postponed to 2022 following the identification of technical difficulties as well as because of the Covid-19 pandemic. The main objective of this international scientific program is the search for evidence of life on Mars. In the framework of the ExoMars2020 mission, ESA and Roscosmos jointly cooperated to provide the Rosalind Franklin rover and the Kazachok landing platform, respectively.[27]

All in all, it appears that cooperation with Europe will be standing at a crossroads in the coming decade, even though participation in scientific cooperation programs is a prerequisite to guaranteeing Russia's credibility and high scientific level in the space field.[28]

27. "ExoMars to Take Off for the Red Planet in 2022", ESA, 12 March 2020, available at: available at: www.esa.int.

28. I. Facon and I. Sourbes-Verger, "Enjeux de la modernisation de l'industrie de défense russe. Le cas du secteur spatial : technologie, géopolitique et prospective" [Challenges of the Modernization of the Russian Defense Industry. The Case of the Space Sector: Technology, Geopolitics and Foresight], FRS/CSFRS, 2015, p. 78.

The Long Journey toward Institutional and Industrial Renovation

In order to preserve the competitiveness of its space industry and its influence as a strategic asset, the Russian authorities undertook in recent years a major institutional reorganization. To merge the space sector, Roscosmos' mission is to make it consistent and efficient in a difficult financial context. At a time when technological innovation remains a critical factor, the industrial base must be modernized.

Russian space governance: a quest for survival

The reform of the Russian space sector comes at a time when the governance of its industry appears to be permanently weakened. This organizational and financial overhaul is now an operation to ensure its survival.

Roscosmos: a body to streamline the whole space sector

To reform the space sector, the government was first inspired by the Rosatom State Atomic Energy Corporation, which includes more than 300 companies and oversees the entire nuclear industry. It was established as a true model, and Russian authorities aimed to duplicate it when Roscosmos was created. The creation of Roscosmos in 2015 came after a long period of aborted reforms of Russian space governance, which started in 2004. One reason for these failures was the high turnover in top management. The lack of political vision has become a major hurdle to any industrial development.

After a vertical reshuffle, Roscosmos constitutes the backbone of the Russian space industry. It is organized into eight operating areas: 1) manned space flights; 2) launch systems; 3) unmanned spacecraft; 4) rocket propulsion; 5) military missiles; 6) space avionics; 7) special military space systems, and 8) flight control systems. Composed of many public companies, these deploy the space industry value chain – from R&D to commercialized

products. This myriad of subsidiaries remains an essential part of Russia's space ecosystem to this day, while the emergence of major private companies is barely perceptible.

In the context of budget cuts, Roscosmos aims to rationalize the space industry in order to become more flexible and compact while remaining market-oriented.[29] To achieve this, several objectives were developed at the time of its creation:

- avoid duplication of functions and legal difficulties regarding the state's ownership responsibilities;
- eliminate excess production capacity;
- better address quality-control issues;
- standardize the procurement of foreign components, with increased buying power able to negotiate volume-based discounts.[30]

However, this attempt to reframe Russian space activities is subject to elements that curb its span. First, the culture of secrecy in the development of plans remains very present. Second, the persistent change in the plans enacted is confusing, also due to a lack of global strategic perspective. Finally, the country's economic instability does not allow much flexibility when dealing with financing activities.

Limited financial resources

In 2016, the Russian government approved a new funding plan for the Federal Space Program for the period 2016-2025 (FKP-2016-2025). The initially envisaged budget of 2.3 trillion roubles (€29.45 billion) was gradually reduced from 2015 onwards in the light of unfavorable economic conditions. Despite these constraints, the government finally granted a budget of 1.4 trillion roubles (€17.93 billion) until 2025. Against the backdrop of structural deficiencies, Russia still emerges as a key player in space activities. Behind the United States and China, the country's space budget ranks in the third position, ahead of France and Japan.[31]

In recent years, the financial results of Roscosmos indicate substantial financial losses. For 2016 and 2017, the accumulated losses reached more than €350 million, while in 2018 the financial results displayed a positive balance of €25 million. For 2019, Roscosmos' net profit target was

29. M. Bodner, "60 Years After Sputnik, Russia Is Lost in Space", *op. cit.*
30. M. Aliberti and K. Lisitsyna, *Russia's Posture in Space: Prospects for Europe*, *op. cit.*, p. 25.
31. For further details, see S. Seminari, "A Euroconsult Analysis: Examining Government Space Budget", *SatMagazine*, July 2019, available at: www.satmagazine.com.

between €110 and 140 million. In July 2020, no results were published, which cast doubt on the achievement of the financial objectives.[32] The small volume of the private space market in the country, equivalent to 100 million roubles (€1.12 million),[33] is a further factor. With low profitability, public funding is essential to maintain space activities. This support takes various forms, including government contracts, public subsidies and other forms of investment. Also, in the next Federal Space Program (2026-2035), Roscosmos is working to streamline the organization so that it becomes effective and cost-efficient, with a single program.[34]

However, the stagnation of the Russian economy, which is largely dependent on tax revenues from the hydrocarbon sector, and the application of economic sanctions against Russia since 2014 limit the scope for financial flexibility. In the same way, Roscosmos' financial supervision is questionable as it has begun construction of a tower to house the new general headquarters on the premises of the Khrunichev Space Center in Moscow.[35] In a climate of budgetary restraint, this type of lavish investment is more part of a prestige policy than a long-term and effective policy to challenge its main competitors.

Reshaping the industrial base

In order to modernize an ageing space industry riddled with problems, its shakeup is based on private companies upgrading, on the one hand, and innovation support in this industrial ecosystem, on the other.

A crippled industry affected by endogenous issues

Against the backdrop of the global economic situation in Russia, the space industry has to deal with inherent difficulties, including an unfavorable business and investment environment. Corruption and embezzlement are systemic in nature. For instance, a substantial part of the federal budget for major space programs is regularly reported to have been misappropriated. Concerning the extent of the phenomenon, the case of the Vostochny

32. P. Luzin, "Endless Rumbles of Roscosmos Reform", Riddle, 26 August 2020, available at: www.ridl.io.
33. P. Konstatinova, "Chto proishodit na rynke chastnogo kosmosa v Rossii" [What is Going On in the Private Space Market in Russia?], *Rubase*, 12 April 2019, available at: www.rb.ru.
34. A. Bandenko, "Dmitrij Rogozin: moj gorizont planirovaniia beskonechen" [Dmitry Rogozin: My Planning Horizon is Endless], *TASS*, 8 October 2020, available at: www.tass.ru.
35. N. Vedeneeva, "Nakanune aresta Ivana Safronova Putin otmenil vstrechu s Rogozinym" [On the Eve of Ivan Safronov's Arrest, Putin Canceled his Meeting with Rogozin], *Moskovski Komsomolets*, 7 July 2020, available at: www.mk.ru.

cosmodrome is the most emblematic. During its construction, one of the subcontractors diverted nearly 16 billion roubles (€189.5 million), the equivalent of 13% of the total budget allocated to the project.[36] Even if Rogozin promised to lead a "crusade" against corruption, the federal space agency is plagued with long-time malpractices.

Further to this, the Russian space sector suffers from specific deficiencies. Four critical problems have been identified:

1. *An obsolete infrastructure scattered throughout the territory*

The Russian space sector is based on an industrial fabric built up during the Soviet period; the various sites were mainly constructed in closed cities and scattered throughout the territory. They were located along the Trans-Siberian Railway, there are too many of them, and 90% of the infrastructure was more than 20 years old in 2013.[37] Thus, development and operating facilities were organized around separate entities, often with redundant tasks.

2. *A systemic failure of controls and traceability in the space industry*

The poor management of space activities is the cause of numerous technical failures. The companies responsible for defective parts and equipment had no liability, and the government bore all the costs related to these failures.

3. *An ageing population and low productivity*

In addition to an outdated production infrastructure, the ageing workforce affects labor productivity, which is reported to be two to four times lower than that of other space powers. The sector is preparing for the retirement of part of its workforce over the next decade. With just under 250,000 people, the space sector will require at least 100,000 highly qualified professionals by 2030 to maintain the current workforce (i.e., a 40% turnover rate).[38]

4. *The sector's lack of attractiveness to young graduates*

The shortage of a young and qualified workforce is accelerating the slow loss of industrial knowhow. In the context of a vocational crisis, the space industry no longer attracts the new generation, who turn away in favour of the oil and gas (O&G) sector as well as IT companies with better conditions of remuneration for young graduates.[39]

36. Y. Karash, "Russian Space Programme: Financial State, Current Plans, Ambitions and Cooperation with the United States", *The Space Congress Proceedings*, Vol. 27, 2016, available at: https://commons.erau.edu.
37. M. Aliberti and K. Lisitsyna, *Russia's Posture in Space: Prospects for Europe*, *op. cit.*, p. 15.
38. *Ibid*, p. 27.
39. In 2016, the average salary in the space sector was 46,000 roubles per month (€543).

Emerging stakeholders in the industrial ecosystem

The current reshuffle is aimed at streamlining a sector inherited from the Soviet military-industrial complex. This involves a shift towards a model that encourages innovation, focuses on customer needs, whether domestic or international, and is open to public-private partnerships. In recent decades, the federal authorities contributed to the slow emergence of the private sector and the entry of new industrial players such as Gazprom Space Systems, Scanex and S7. First, Gazprom Space Systems, an affiliated company of the Gazprom giant gas producer, operates the Yamal satellite communication system and provides telecommunication and geo-information services. In 2019, it established a business partnership with Thales Alenia Space to take part in Gazprom's project to set up a civil spacecraft assembly facility in the Moscow region.[40] Scanex, founded in 1989, is a prominent Russian company holding a portfolio that includes ground station solutions, advanced remote sensing software, geospatial services and information dissemination platforms. It secured a contract with Airbus Defence and Space for access to optical satellite imagery via the One Atlas platform, benefiting the Russian search engine Yandex. Overall, these companies succeeded in implementing commercial agreements with the European space industry. However, owing to their limited space activities, their products and services suffer structural deficiencies when it comes to gaining larger market shares.

Finally, the S7 group, the Russian airline company, founded its subsidiary S7 Space in order to develop a launch service and an R&D center, consisting of experienced engineers, dedicated to rockets.[41] In April 2018, S7 Space acquired the Sea Launch floating cosmodrome for $160 million.[42] However, the global health crisis in 2020 plunged the group into great financial difficulties, which led to the direct involvement of the Russian state in restoring this infrastructure. With an assessed contribution of 35 billion roubles (€394.36 million), an operating company will be formed for this purpose within the framework of a public-private partnership.[43] Apart from

40. "Gazprom and Thales Alenia Space Intent on Joining Efforts in Spacecraft Production", Gazprom, 3 October 2019, available at: www.gazprom.com.
41. P. Konstatinova, "Chto proishodit na rynke chastnogo kosmosa v Rossii" [What is Going On in the Private Space Market in Russia?], *op. cit.*
42. The infrastructure included the Sea Launch Commander, the Odyssey platform and ground equipment located at the time in the Port of Long Beach, California.
43. "Rossiia vosstanovit plavuchij kosmodrom *Morskoj start* za 35 mlrd rublej" [Russia to Restore Sea Launch Floating Spaceport for 35 billion Roubles], *Gazeta.ru*, 24 August 2020, available at: www.gazeta.ru; D. Rešetnikov, "Rogozin: sekvestr finansirovaniia privedet k degradacii kosmicheskoj otrasli" [Rogozin: Sequestration of Funding Will Lead to the Degradation of the Space Industry], *TASS*,

this example, most Russian venture-capital investors remain reluctant to take part in these industrial projects as they are considered too risky and require massive cash injections over long periods of time.

Coupled with these leading industrial groups, there is an attempt to develop a core of SMEs in the sector through the Skolkovo cluster. The creation of this space cluster was initially intended to establish better conditions for SMEs, including tax advantages and access to venture-capital investment. Organized as an exchange platform between stakeholders, this cluster is intended to be a vector for establishing joint ventures with foreign companies. Some small-sized companies have emerged in this industrial ecosystem. As an illustration, KosmoKurs has developed an ultra-light, 19-meter, two-stage rocket launcher capable of propelling a 265-kg payload into orbit.[44] This development program is central at a time when Russia does not own launchers in this range. For Russian start-ups, however, entry into the space sector and full incorporation into the industrial value chain look extremely difficult.[45]

Innovation as key factor for space industry upgrading

As we have seen, innovation is also a key factor for competitiveness in the space sector. For Russia, it is critical – due, on the one hand, to the persistence of the structural problems mentioned above and, on the other, to the growing competition stirred by the rise of powerful players such as China and SpaceX. In order to support innovation, the main priority is to implement new funding sources, notably through venture capital. In 2017, a venture-capital fund was formed to this end, with the support of the Russian state.

The development of clusters has been accompanied by mechanisms to finance companies. These mechanisms are part of the regional funds and allow a more flexible approach in the use of funding from the federal government.[46] Other institutions give funding support for innovation programs such as the Vnesheconombank (VEB – Development Bank of the Russian Federation) and the Foundation for the Promotion of Small Businesses in the Technical and Scientific Sphere. In the same way,

25 August 2020, available at: https://tass.ru. Once restored, the *Sea Launch* platform will be able to accommodate up to five launches per year.

44. "Rossijskaia chastnaâ kompaniia podgotovila proekt sverhlegkoj rakety" [A Private Russian Company has Launched a Project for an Ultra-light Launcher], *Ria Novosti*, 8 June 2020, available at: https://ria.ru.

45. M. Aliberti and K. Lisitsyna, *Russia's Posture in Space: Prospects for Europe*, *op. cit.*, p. 32.

46. A. Edelkina and O. Karasev, *Space Policy Strategies and Priorities in Russia*, Moscow: HSE, 2015, p. 11.

technology innovation programs are effective instruments for regulating activities led by the key space industries in the country.[47] These financial mechanisms to support SMEs' R&D programs are essential in order to preserve the sector's international competitiveness.

47. *Ibid*, p. 9.

Contrasting Prospects

A race toward technological progress with chimerical ambitions

Since 2015, the impetus of the federal authorities to reclaim a sector in difficulty demonstrates substantial limits. The current layout of the Russian space industry indicates its inability to bring out powerful new industrial players – whether in the public or private sector. Besides, the fragility of financial resources is jeopardizing the return of major space programs, while the ongoing program on next-generation launchers is experiencing major delays that could undermine Russia's position in this segment.

The space industry on the brink of marginalization?

Although Roscosmos has managed to save most of the companies in the sector, the space industry has lost its effectiveness. The consolidation of assets has not succeeded in maintaining the competence of its workforce and attractive salaries.[48] In this weakened and not very dynamic industrial environment, private companies do not have the means to take over. Consequently, the delay in the world race for innovation in a sector with high added value seems insurmountable

In the same way, the Russian state, as a guarantor in the establishment of a stable and dynamic institutional environment in this very competitive sector, remains the main driving force for implementing any industrial policy or regulatory framework, and incentive measures.[49] Yet, without stable conditions, the influence of the private sector is circumscribed to SMEs, which are mainly positioned in niche markets. Difficult to achieve, the modernization of this industry remains penalized both by the reduction in public funding and a situation of rent in place since the 1990s.

First, Russian state orders decreased following the reduction in public spending in the space program, even though the latter still stands as the

48. O. Faličev and M. Kalašnikov, "*Lunnij proekt* dlia Rossii" [Lunar Project for Russia], *VKP*, 10 June 2020, available at: https://vpk-news.ru.
49. I. Kosenkov, "Novye kosmicheskie rynki" [The New Space Markets], *Izvestia*, 29 June 2018, available at: https://iz.ru.

main sponsor on the market. Second, the Russian program's dependence on a rent-based marketing policy is coming to an end. For several decades, US partnership has been a major source of revenue for the Russian space industry. Since 2006, NASA has been buying seats for manned flights from *Soyuz* rockets: over the period 2006-2020, revenues totaled $3.9 billion (for 70 seats allocated).[50] Similarly, Energomash, a Roscosmos subsidiary, has been supplying the RD-180 engine to ULA (United Launch Alliance) for its *Atlas V* rockets since the end of the 1990s. At a price of $15 million per unit, the Russian company has delivered a total of 116 rockets.[51] However, political decisions in the United States to ban Russian supplies led to a shift away from this partnership. Driven by SpaceX and Blue Origin, the American space industry is experiencing a new market dynamic. To put it simply, the expansion of manned flights and the design of new engines,[52] alternatives to the RD-180, could reduce the financial incomes that are essential for maintaining Russian space ambitions over this decade.

In the last decades, the Russian space industry was not even able to promote and sustain its position in the space innovation market share. In conjunction with the Skolkovo cluster, it has eased the emergence of SMEs but remains subject to major regulatory and financial blockages. In fact, companies face obstacles that are difficult to overcome, "making the kind of commercial space *innovation hubs* present in the United States unlikely to be developed or duplicated any time soon".[53] In other words, the Russian space industry looks to be lagging behind, or even having difficulty in catching up with, a trajectory that diverges from that of its main competitors.

The difficult succession of Soyuz-2

The replacement of the ageing *Soyuz-2* range is a strategic priority in order to uphold Russia's rank in manned space flights. In this regard, the launcher asset remains "a required crossing point for all space activities".[54] In recent decades, *Soyuz-2* has been dominant in this space market share that led to this situation of rent for the country. Nevertheless, the rise in the number of space launch failures in the early 2010s has highlighted the ageing

50. P. Luzin, "US-Russia Space Cooperation: Eroding Interdependence Followed by Symbolic Partnership", *Russian Analytical Digest*, No.23, 18 June 2020, available at: https://css.ethz.ch. It should be noted that the price of a seat for a manned flight on Soyuz has risen sharply, from $21.3 million to $86 million in 2019.

51. Six additional engines were scheduled to be delivered in 2020.

52. See M. Bodner, "Can SpaceX and Blue Origin Best a Decades-Old Russian Rocket Engine Design?", *MIT Technology Review*, 26 June 2019, available at: www.technologyreview.com.

53. J. Clay Moltz, "The Changing Dynamics of Twenty-First-Century Space Power", *Strategic Studies Quaterly*, Spring 2019, p. 85.

54. G. Pennent, "L'espace au XXIe siècle : à la recherche d'un nouvel équilibre" [Space in the 21st Century: in Search of a New Balance], *Politique étrangère*, Vol. 85, No. 1, Ifri, 2020, p. 151.

technology, underlining therefore the necessity for its modernization. Despite these mishaps, the *Soyuz-2* rocket still appears as an invaluable asset for the Russian space industry.

Several projects, in different stages of development, have been publicly stated to replace *Soyuz-2*. Due to the increasing competition in this segment, the Russian authorities feel the urgency to act faster. Also, these projects are not yet able to fully operate, while the dispersion of efforts and resources could be a costly mistake in the long run.

Angara launcher family

To counter the effects of technological obsolescence, the Russian space industry has undertaken the manufacturing of the *Angara* rocket family. The first design of the heavy rocket was conceived back in 1995 and can be viewed as the largest launcher program in the post-Soviet era. Composed of five versions with an increasing range power (A1.2, A3, A5 and A7), the A5 version completed its first launch in December 2014, from the Plesetsk Cosmodrome. In November 2020, a second flight of this model was scheduled, however, owing to technical problems, it has been postponed for few weeks. The heavy-lift rocket has been successfully launched on December 14, 2020, which included the Breeze-M upper stage separation after the liftoff. Later on, Roscosmos plans two additional flights, including an A1.2 launcher, a lighter version of this rocket family.[55] As a reminder, the A5 model is programmed to succeed the *Proton-M* rocket as the latter should be decommissioned in 2025.

On the financial front, Russia has spent more than 110 billion roubles (€1.2 billion) on the Angara project and plans to allocate another 32 billion (€350 million) in the coming years. In addition, delays in its improvement and production cast doubts about its financial profitability. According to the Khrunichev Center's 2019 financial report, the cost of production of the Angara-A5 launcher is estimated at seven billion roubles (€79 million), corresponding to three times that of the produced *Proton-M*.[56] Also, this rocket family includes thrusters with prohibitive costs compared with those on the market supplied by other international competitors, specifically the SpaceX *Falcon 9* rocket. Due to these costs, the *Angara* rocket cannot financially compete on this market with its American counterpart. However, it essentially remains an instrument to ensure Russian strategic autonomy.

55. D. Rešetnikov, "Rogozin: sekvestr finansirovaniia privedet k degradacii kosmicheskoj otrasli" [Rogozin: Sequestration of Funding Will Lead to the Degradation of the Space Industry], *op. cit.*
56. "Raketa *Angara* okazalas' v tri raza dorozhe *Protona*" [The Angara Rocket Is Three Times More Expensive Than the Proton], *Ria Novosti*, 29 June 2020, available at: https://ria.ru.

Soyuz-5 and Soyuz-6 launchers

In order to face the cost competition on thrusters and to deal with this aggressive strategy, another project emerged. In 2015, Roscosmos introduced another launch vehicle project aimed at replacing both the *Soyuz-2* and *Zenit* rockets. The *Soyuz-5* program, being developed by Energia Space Rocket Corporation, started in 2017. With the first launch scheduled as soon as 2023, this program suffered several technical delays in recent years. Regarding the financial aspect, the cost has increased from 30 to 52 billion roubles (€330-572 million).[57] After a bilateral agreement between Kazakhstan and Russia, the Baikonur Cosmodrome will welcome future launches of the *Soyuz-5* rocket as the Baiterek rocket complex will be built in order to upgrade the infrastructure.

Above all, the *Soyuz-5* rocket, renamed *Irtysh*, is intended to be a response to competitive costs in force now on the international market. However, this rocket version would be limited to flights in the Low Earth Orbit (LEO) and it is not expected to enter into service before 2025.

Finally, Roscosmos announced in May 2020 the development of the *Soyuz-6* rocket carrier, with the *Soyuz-5* launch vehicle used as its basis.[58] The Samara-based Progress Space Rocket Center is entitled to work on the conceptual design jointly with the Energia Space Rocket Corporation. Yet, the first test of this new carrier is unlikely to take place before 2025, at the Baikonur Cosmodrome.

Amur launcher

In October 2020, a new announcement was widely disseminated in the Russian media regarding another launcher project for its space industry. Following a signed contract between Roscosmos and Progress Rocket Space Center, this new rocket will be developed in the next few years. Following the *Angara* family and the *Soyuz-5* launcher – still under development – this new launch vehicle, *Amur,* is, in short, a duplicate of the *Falcon 9* rocket. According to Roscosmos claims, it is planned to launch it from the Vostochny Cosmodrome as it could become the first Russian rocket involving a first-stage reusable methane rocket. The estimated cost of the *Amur* launcher is about $22 million and it is expected to undergo its first launching in 2026. At the end of the day, the chosen technology has to be

57. O. Ian, "Goskorporatsiia po planirovaniiu: iadernij kosmicheskij korabl' i drugie obeshchaniia Roskosmosa" [State Corporation Planning: Nuclear Spacecraft and Other Roscosmos Promises], *MBX Media*, 13 October 2020, available at: https://mbk-news.appspot.com.
58. "Russian Space Firm Starts Work on New Soyuz-6 Carrier Rocket", *TASS*, 24 August 2020, available at: www.tass.com.

more reliable and cost-effective, inasmuch as it could prove to be correspondingly competitive in the launch services market.

Regarding technical aspects, it has been stated that the first-stage *Amur* rocket will be equipped with five methane-oxygen RD-0169A engines with an anticipated 100 tons thrust. As the first stage would be used up to ten times in the first years of launch services, the second stage is expected to have one RD-0169A engine and not be reusable.[59] In spite of its major announcement, however, the prospects for this project are not yet clear as this new launcher has yet to prove itself and its funding has not yet been earmarked.

59. D. Reshentikov, "Bezotkaznaia, kak avtomat Kalashnikova. Roskosmos o metanovoj rakete *Amur*" [Unbreakable, Like a Kalashnikov Automatic Rifle – Roskosmos on Methane Rocket *Amur*], *TASS*, 5 October 2020, available at: www.tass.ru.

Key programs to uphold strategic autonomy

The Vostochny Cosmodrome, a critical infrastructure for Russia's space ambitions

The opening of the Vostochny Cosmodrome, with an inaugural launch of the *Soyuz-2.1a* rocket in 2016, is a symbol of Russia's renewed ambitions in the space sector. To date, and apart from the construction of the Crimean Bridge, this is the largest infrastructural, economic and political project undertaken by Russia in the 21st century. With an estimated cost of 150 billion roubles (€1.69 million), the construction of the site, which began in 2007, in the Amur oblast underlines the strategic dimension of the project. In breaking its dependence on the ageing Baikonur Cosmodrome in Kazakhstan, Russia intends to achieve two objectives: strengthening its strategic autonomy and creating fresh infrastructure.

To this end, the cosmodrome has a fully integrated infrastructure where the entire process of assembling and launching is optimally arranged on the site.[60] Delivered in separate parts by rail transport from the Samarra industrial sites, the launchers are then assembled on the Vostochny site. In other words, the new cosmodrome embodies the center of gravity of all key Russian space activities as it will soon enable the launch of the full range of rockets – from light to extra heavy.

The construction of a second launch pad, scheduled to be completed in 2021, is designed to accommodate the new *Angara* family. The first launch of the *Angara-A5* rocket on the cosmodrome is scheduled for 2023, while the launch pad infrastructure, coming from Severodvinsk, located in the Arctic region, should be delivered in September 2020. Once in operation, the complex aims to enable ten launches per year of the Angara rocket family.[61]

60. M. Bodner, "The Long Road to Vostochny: Inside Russia's Newest Launch Facility", *Space News*, 30 January 2019, available at: https://spacenews.com.
61. I. Afanasyev and V. Yazykov, "Vostochnyj Ekspress sleduet bez ostanovok" [The Orient Express Drives Non-Stop], *Russkij Kosmos*, June 2020, p. 7.

The constellation of low-Earth orbiting satellites (LEOs)

A significant part of Russia's federal space program for the period 2016-2025 includes a bolstering of the fleet of orbital spacecraft. Due to the vastness of Russian territory, satellites and ground complexes for data processing are crucial in order to solve multidimensional issues: Internet and communications, infrastructure control, and the monitoring of pollution, wildfires and illegal logging. This fleet consists of three critical components:

- Earth-based meteorological observation systems
- Communication satellites
- Navigation satellites

According to the FKP 2016-2025 program, a special effort should be made to build up a constellation of remote sensing satellites through an allocation of 312 billion roubles (€3.69 billion) in order to increase the number from eight to 23 satellites.[62] With such a strengthening of satellite coverage, commercial objectives include ramping up the sale of data to institutional and private clients. As for communication satellites, the objective is to provide a constellation of 46 satellites by 2030.

Navigation satellites are funded by another federal state program, "Development, use and maintenance of the GLONASS system for the period 2012-2020". This program puts particular emphasis on the maintenance and operation of the system, as well as the development of commercial activities. Moreover, the development of a third generation of satellites should facilitate access to improved services. The GLONASS system is defined by its terrestrial infrastructure, consisting of an extensive network of ground-based systems. These stations are installed in surrounding countries such as Belarus and Kazakhstan, and also in Brazil. In line with a strategy of continuous reinforcement, the opening of new stations is planned in countries traditionally allied with Russia (Cuba, Iran, Vietnam) and in Western countries (Australia, Spain).[63]

62. See the Russian Federal Program "Russian Federal Space Program for 2016-2025" (FKP 2016-2025), approved by Government Decree of the Russian Federation No. 230 of March 23, 2016.
63. M. Aliberti and K. Lisitsyna, *Russia's Posture in Space: Prospects for Europe*, *op. cit.*, p. 46.

Dual use as a driving force for spatial technological development

The military component of the Russian space program is an essential pillar of the strategic autonomy envisaged by the federal authorities. Although space programs in the civilian sector are experiencing notorious difficulties, Russia seems in a position to hold significant military capabilities in this domain.

In that respect, *Minoborony* demonstrates its central role in the development of the Russian space sector. Most notably, it is actively involved in the validation of the Federal Space Program (FKP) budget. Besides, as part of its own budget, it can encompass a space component. For instance, the state armament program (GPV 2027), related to all military purchases until 2027 by the Ministry, encompasses the development of defense systems to protect Russian satellites.[64] Its orders and activities in the satellite segment are becoming increasingly apparent.

Its significance permeates space activity and boosts innovation in the sector. Among the 160 satellites in orbit, nearly a hundred are dedicated to military activities. In particular, the program includes the development of a constellation of ten GEO (geostationary earth orbit) and HEO (highly elliptical orbit) satellites to integrate the *Tundra* early-warning system. Consisting of four satellites for now,[65] the system will provide constant coverage of all potential missile launch areas.[66] Furthermore, the Russian global navigation system GLONASS fully operates under *Minoborony* control. The latter also conducts innovative activities such as the launch of inspection satellites. The objective of these missions is to carry out an external inspection of another satellite by establishing a non-contact technical diagnosis.[67] This sensitive operation requires getting as close as possible to the satellite to be inspected.

Regarding the future launches of the *Angara-A5* rocket, *Minoborony* signed a contract with the Khrunichev Space Center for the mass production of this heavy launcher.[68] As it is in full contol of the Plesetsk Cosmodrome, it has planned new launches over the next few years. In order to go further,

64. A. Zak, "Spooky World of Military Satellites", *op. cit.*
65. The first four satellites were respectively launched in November 2015, May 2017, November 2019 and May 2020.
66. Section "Voennij Sovet" [Military Council Section], *Ekho Moskvy*, 5 October 2019, available at: https://echo.msk.ru.
67. "Minoborony protestirovalo novejšij sputnik-inspektor" [The Ministry of Defense Has Tested the Latest Inspector Satellite], *Ria Novosti*, 29 June 2020, available at: https://ria.ru.
68. "Istočnik: Minoborony zakazalo četyre rakety *Angara*" [Source: The Ministry of Defense Has Ordered Four Angara Rockets], *Ria Novosti*, 3 July 2020, available at: https://ria.ru.

the Russian Ministry of Defense has a catalysing role for innovative projects. Under its supervision, a long-term project led by the company KB Arsenal is underway since the beginning of the 21st century. Based in St Petersburg, it is developing the Transport and Energy Module, TEM, a very large space tug propelled by electric engines and powered by a nuclear source.[69] Furthermore, Rosatom has confirmed that it will participate in the design of this space tug and claimed that it could reach Mars in a month and a half. However, this bold project highlights uncertainties as its cost has constantly increased since 2012, and there is not a clear timetable and course of action for flight testing.

All in all, these various activities confirm the Ministry's influence in defining critical space achievements in the next decade. In other words, this key stakeholder is a pillar for both the Russian space program architecture and its financial support.

69. A. Zak, "Russia Reveals a Formidable Nuclear-Powered Space Tug", *Russian Space Web*, 17 September 2020, available at: www.russianspaceweb.com.

Conclusion:
A Pragmatic Space Power?

The Russian space industry, a legacy of the Soviet period, is a crucial stakeholder in the international space landscape. Nevertheless, its slow decline has prompted key decision-makers to reconsider Russia's position with reduced ambitions. In present circumstances, the country intends to focus on three priorities:

- Uphold its strategic autonomy assets, namely: the expansion of a constellation of civil and military satellites, the use of a civil cosmodrome on Russian territory, and the possession of a range of launchers.
- Safeguard participation in diverse international cooperation projects, enabling Russia to pursue its streamlining and renovation. As a result, Roscosmos stated its readiness to join the American lunar program "Artemis" but finally declined as Russia sees the project as an American one. Instead, Russian authorities are discussing with China the prospective development of a joint lunar base.
- Promote a commercial approach in certain business areas (geolocation services, manned flights, etc). This might enable the country to diversify its partnerships and market share.

To retain its position as a key player in the long term, Russia may need to undertake iconic projects. Recently, Roscosmos stated its willingness to build a new space station that would strengthen its presence in the low Earth orbit. With a similar design to the Soviet orbital station *Mir*, it could consist of at least five modules, including a commercial module for four tourists. The Russian orbital station would be launched after 2030, once the ISS had been deorbited, but no funding is earmarked at this stage.[70] Once again, this statement looks more like a mirage than a concrete and financed project.

Many uncertainties surround Russian space achievements in recent years. The cumulative delays as well as the financial difficulties highlight the weakening of the civil space sector. At the same time the military branch keeps this industry afloat. This development is the result of both Russia's

70. "V novoj rossijskoj kosmicheskoj stantsii budut mesta dlia chetyrekh turistov" [There Will Be Places for Four Tourists in the New Russian Space Station], *Ria Novosti*, 3 October 2020, available at: www.ria.ru.

geopolitical aspirations and political deadlock with Western countries. On a broader level, this could affect the pace and scale of Russia's digital transition, forcing Moscow to rely on third-party players to provide it with the necessary technologies and services.

China: the risk of becoming a junior partner

In the space field, cooperation between Russia and China unveils a differentiation strategy. While Russia may currently enjoy significant advantages in technology and experience, this will be challenged during the coming decade.

On the diplomatic side, the two countries share a common vision and interests as they are in competition with Western countries in the potential space arms race. In line with this strategy, they are collaborating on the establishment of an early-warning system. This alignment is likely to be maintained in the near future.

Regarding the advancement of civil cooperation, it remains of low intensity, and is limited to technical aspects in the framework of the Roscosmos-CNSA agreement, in place until 2022. Moreover, this cooperation relies on "how much money the two [are] willing to shell out".[71] As China is fully engaged in the Moon race with the United States, and its related program "Artemis", Russia is ill-equipped to jump in. As mentioned above, there is no sealed agreement between China and Russia regarding the future lunar base. Following impressive Chinese progress in space, the country's strategic autonomy will intensify – and Russia might well be viewed as a junior partner in that enterprise.

What are the prospects for Russian-European space cooperation?

Despite the looming decay of its ageing industrial apparatus, Russia's space cooperation with Europe has so far proved resilient. Geopolitical tensions, including the sanctions regime implemented by the EU since 2014, have not altered this cooperation. Beyond the current crisis, this cooperation is taking place in an open and constructive atmosphere that underscores the good relationship between Roscosmos and the European Space Agency (ESA).[72] Indeed, in the launch service market, Europe still relies on Russian

71. M. Aliberti, T. Hrozensky and M. Bataille, *European Space Strategy in a Global Context*, ESPI Report 75, ESPI, November 2020, p. 45.
72. "Roscosmos, ESA Cooperate Despite Anti-Russian Sanctions", *TASS*, 12 February 2019, available at: www.tass.com.

launchers. In the two last decades, 40% of Europe's total launch needs have been satisfied by Russian carrier rockets.[73]

While the field of telecommunications is a robust point of cooperation between the two partners, issues are acknowledged in the field of Earth Observation (EO) and its connected applications. Cooperation in this field could be pursued in relation to observation measurements on climate change. As such, Roscosmos has proven to be a trustworthy partner to Europeans, consistent with its commitments regardless of increasing budgetary constraints and unstable leadership in recent years.

Russia faces, however, technological and financial locks as part of the negative effects of the Western sanctions. If Russia is economically less reliant on its space infrastructure than the United States and China, the country could see its modernization program critically threatened: Russian satellites, for instance, rely on Western components that can no longer be accessed. In turn, the satellite program could be sharply undermined. This is increasing the already significant critical gaps in technology standards vis-à-vis other space powers.

All things considered, Russia cannot lead major international space projects on its own, and could eye cooperation with Europe as a stable anchor to avert speedy decline. One option could be for European space stakeholders to build on the long experience of the Russian space program. In turn, Russia could reduce the technological gaps, including to regain access to microelectronics. For instance, better interoperability could be a breakthrough as Russia maintains several launchpads that are critical to sustaining the pace of a European satellite constellation. For both Russia and Europe, it is a way to uphold their strategic autonomy in the long run.

73. Y. Ishikawa and T. Hadan, "Russia Pulls China Closer with Ties in Space Exploration and Energy", *Nikkei Asia*, 28 May 2020, available at: www.asia.nikkei.com.

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