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Russia's Nuclear Deterrent and Its Weapons Procurement

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Methodological and Data Considerations

While the full spectrum of capabilities which Russia might procure is unknown, analysts can estimate possible lines of effort based on capabilities that the Russian defence ecosystem is already discussing and those which are technologically feasible for Russia to procure. Since the author has limited insight into the inner workings of the Russian procurement system, the approach taken here is deductive. The likelihood that a capability will be funded is assessed based on three criteria drawn from the literature on the adoption of technology.¹ These are:

- consistency with identified requirements and doctrinal preferences;
- the material opportunity cost of investing in the capability; and
- the organisational complexity of integrating the capability into Russia's order of battle.

The use of doctrinal preferences provides a means of sidestepping a longstanding analytical debate over whether the Russian system – and before it the Soviet system – primarily responds in a boundedly rational way to external stimuli or is instead shaped by organisational politics and bureaucratic competition.² Doctrine can be interpreted either as a response to external strategic circumstances – which is the author's own analytical view – or as the product of internal contestation over authority, missions and resource allocation. One example of the latter was the Soviet debate over whether the maritime theatre constituted an independent theatre of military operations, a dispute which also reflected a broader struggle for influence between an army-dominated General Staff and Sergei Gorshkov's navy.³ Focusing on doctrinal consistency avoids the traps of this debate. Whether doctrine is understood primarily as a response to the external environment or as the outcome of internal bureaucratic competition, it still provides a useful guide to institutional preferences and strategic priorities. This paper does rely heavily on articles from an institution – the RVSN (Strategic Rocket Forces of the Russian Federation) – which could bias findings towards this institution's interests. However, corroboration is sought both in terms of comparable statements from members of other institutions and verifiable resource allocation choices which have already been made.

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1. Michael Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton: Princeton University Press, 2010), p. 25.
 2. For examples of each view, see Robert Berman and John Baker, *Soviet Strategic Forces: Requirements and Responses* (Washington, DC: Brookings Institution, 1982); Andrew Cockburn, *The Threat: Inside the Soviet Military Machine* (London: New English Library, 1985). For a middle-ground view that ascribes a centralised response mechanism to the Soviets (though not to the US), see Matthew Evangelista, *Innovation and the Arms Race: How the United States and the Soviet Union Develop New Military Technologies* (Ithaca, NY: Cornell University Press, 1989).
 3. Michael Kofman et al., 'Russian Military Strategy: Core Tenets and Operational Concepts', CNA Research Memorandum, October 2021, p. 48, <<https://www.cna.org/analyses/2021/10/russian-military-strategy-core-tenets-and-concepts>>, accessed 17 September 2026.

The second factor examined is how resource-intensive a given capability is and thus the opportunity cost that Russia must accept to field it. It is extremely difficult to estimate the direct costs for producing a given system, not least because the method of approximation (for example, which currency to use) significantly shapes the outcome. Several methodological tools were developed by the CIA during the Cold War to assess the relative costs of a given Russian / Soviet capability – that is, the extent to which investment in the capability represented an opportunity cost. During the Cold War, analysts used US costs for broadly comparative platforms as proxies for Soviet or Russian costs. They then assessed how many alternative US capabilities might be procured for the same cost. For example, if a US intermediate-range ballistic missile (IRBM) cost the equivalent of a given number of US tanks, that ratio could be transposed to the Russian system, assuming that factors which might depress costs in Russia – lower labour costs, for example – were applied similarly across both tanks and IRBMs.⁴ Another approach uses relatively reliable data points regarding known cost ratios between selected Russian systems and their Western analogues to estimate a broader Russian-to-Western cost ratio.

Finally, organisational complexities associated with command and control, and with operations and maintenance, are considered, since these factors have historically influenced Soviet and Russian thinking. The USSR typically limited the amount of throw weight carried on its nuclear ballistic missile submarines, partly due to considerations regarding the possible loss of operational control.⁵ Desk-based operational analysis and information about Russian and Soviet beliefs regarding these challenges is used to assess the impact of these factors. All research was conducted between October 2025 and June 2026. The paper was submitted on 9 June 2026 and approved for copy-editing on 20 August 2026.

Disclaimer

This publication was funded by the Russia Strategic Initiative, US European Command. The views expressed in this publication do not necessarily represent the views of the Department of Defense or the United States Government.

4. Noel E Firth and James H Noren, *Soviet Defense Spending: A History of CIA Estimates, 1950–1990* (College Station, TX: Texas A&M University Press, 1998), pp. 9–33.
5. Olga Oliker, 'Between Rhetoric and Reality: Explaining the Russian Federation's Nuclear Force Posture', PhD thesis, Massachusetts Institute of Technology, 2016, p. 248; M L Abramov, « Российские подводные силы: состояние и перспективы » ['Russian Submarine Forces: Status and Prospects'], *Военная Мысль* (Vol. 3, 2006), pp. 2–4.

Executive Summary

This paper examines how Russia's nuclear arsenal will probably evolve, based on an examination of Russian threat perceptions and the resources at Russia's disposal. The primary threat which Russian planners expect to mitigate over the next decade and beyond is a perceived counterforce threat from the US involving both conventional and nuclear weapons as well as missile defences. Russia can mitigate the threat either through increasing the survivability of the arsenal and its ability to ride out a first strike or through its readiness and ability to employ its nuclear arsenal early. Although both avenues are pursued, the paper argues that the diminishing avenues for defence through passive means, such as dispersion, will probably drive Russia towards the second ideal type. Furthermore, Russia's avenues for increasing the survivability of its arsenal depend on aggressive counterspace operations, which may involve nuclear weapons.

Resource constraints and the fact that the threats driving Russian procurement have been contemplated for some time mean that the structure of the Russian arsenal (in terms of delivery systems) is unlikely to change radically. However, Russia will probably consolidate more of its throw weight and critical payloads in silo-based systems. In addition, systems capable of enabling early strikes against the architecture underpinning both integrated air and missile defence and space-based ISR are likely to be pursued.

It is likely that the importance of the mobile component of the Russian arsenal – ground-based transporter erector launchers (TELs) and fleet nuclear ballistic missile submarines (SSBNs) – will recede in relative (though not always absolute) terms. TELs and SSBNs are expected to function primarily as part of Russia's retaliatory / withhold capability in a context where the capacity to strike on warning or under attack will be increasingly critical.

Introduction

This paper builds on an earlier RUSI paper, created with the support of the US European Command in 2024–25, which examined the evolution of Russian nuclear doctrine and strategic thinking.⁶ The earlier paper found that Russia is increasingly caught between competing strategic imperatives. Moscow perceives a growing counterforce threat to its nuclear arsenal and has therefore sought to improve the survivability and responsiveness of its forces. Yet the steps it needs to take to mitigate this perceived threat – including the suppression of theatre-level systems deemed threats to the Russian nuclear arsenal and the adoption of a launch-on-warning (LOW) declaratory posture – run counter to its incentive to use nuclear weapons as a coercive instrument, since they make escalation harder to manage.

The conventional component of the counterforce threat also poses a specific challenge to the credibility of a LOW posture. Russia thus has strong incentives to pursue an assured retaliation posture, based on the ability to ride out a first strike. This would allow it to use its theatre-level nuclear advantage with fewer concerns that theatre exchanges could escalate to strategic exchanges with the US.

However, in practice, Russia is unlikely to pursue such a posture. Instead, its ability to both pre-empt and launch either on warning or under attack is critical for several reasons, including:

- uncertainty regarding the extent to which Russia's command and control (C2) will be degraded over time;
- the need for a swift nuclear response to the threat of conventional prompt strike (CPS) that operates at a scale large enough to have an impact on Russia's nuclear deterrent;
- the need for a nuclear response to the threat of CPS to which Russia lacks a conventional response; and

6. Sidharth Kaushal and Darya Dolzikova, 'The Evolution of Russian Nuclear Doctrine', *RUSI Occasional Papers* (August 2025), <<https://www.rusi.org/explore-our-research/publications/occasional-papers/evolution-russian-nuclear-doctrine>>, accessed 2 February 2026.

- the perceived requirement to act early to suppress future US missile defences and conventional strike capabilities (which increase the number of missiles Russia requires to achieve set objectives at every stage of a putative exchange in unsustainable ways).

Consequently, Russia will probably favour capabilities that provide assured C2 under attack and multiple vectors of approach. These capabilities create incentives for systems that can be launched on warning with maximum throw weight – in effect, static offence-dominated systems. This preference is reinforced by the perception that mobile systems capable of riding out an attack are increasingly vulnerable to a combination of conventional precision strike and improving ISR, a vulnerability that can only be mitigated through the early suppression and destruction of threatening systems. In effect, Russia's ability to withhold forces for later use depends on its capacity to conduct an effective early strike.

This paper examines how the evolving priorities of Russian officers and policymakers may translate into capability development and the avenues available for capability growth (in a context where treaty limitations imposed by New START are no longer constraints).⁷ The paper contends that the shift throughout the 2010s towards carrying more of Russia's throw weight on mobile systems is likely to eventually reverse, as the heavyweight RS-28 Sarmat ICBM is introduced, following a troubled programme. Efforts to diversify the capabilities carried by silo-based systems are also expected to intensify where this is technically feasible. As a result, future development is likely to place less emphasis on additional mobile systems and more on enabling existing mobile systems through improved counter-ISR capabilities.

The paper finds that Russia would benefit from a survivable retaliatory posture, not least because this would allow it the freedom to use theatre-level systems coercively without fearing an uncontrollable escalatory spiral. However, the paper contends, Russia does not believe that survivability can be guaranteed. Consequently, it will continue to prioritise offensive capabilities which enable prompt response, breakthrough operations and the degradation of US capabilities, while treating mobile retaliatory forces as a hedge rather than the centrepiece of its deterrence. Moreover, while uploading warheads on existing or planned systems can be a cost-effective response, the majority of the headroom for additional capacity to be added will probably be in the silo-based force.

In the first chapter, the paper describes the evolving Russian security environment and the imperatives it creates. The second chapter discusses the constraints within which the Russian system operates. The third chapter provides deductions regarding which capabilities Russia is most likely to prioritise.

7. New Start was a nuclear arms reduction treaty between the US and Russia, which expired in February 2026. 'Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms', 8 April 2010, <<https://2009-017.state.gov/documents/organization/140035.pdf>>, accessed 30 September 2026.

How Counterforce Concerns Drive Russian Systems Requirements

This chapter discusses the changes in Russia's threat environment which provide the strategic context in which decisions regarding procurement are made.

Based on the aforementioned research and subsequent review of Russian academic and military literature, public statements and posture and operational developments, the most important external driver of Russian decision-making with respect to nuclear weapons is the perception that Russia faces an emerging counterforce threat from the US. This threat has two separate but related components:

1. The potential for conventional weapons to inflict a limited clean (meaning non-nuclear) first strike which, while insufficient to eliminate Russia's arsenal, would shift the nuclear balance and thus each side's bargaining position.
2. The prospect of conventional and nuclear capabilities being used in conjunction with improved missile defences to eliminate Russia's nuclear arsenal.

A limited conventional attack would be similar to Strategic Air Command's Cold War 'Target Set B', which sought to destroy part of the Soviet arsenal – while avoiding strikes on leadership or the entire arsenal – to create conditions for ending the war from a position of strength.⁸ With a conventional version of Target Set B, the main risk is not Russia's total disarmament, but the possibility that Russia would be left without credible response options. This concern was articulated by the Deputy Commander of the RVSN, Lieutenant General Igor Fazletdinov, who described a scenario in which the initial phase of an attack on Russia's deterrent was conducted primarily (though not exclusively) with conventional weapons – destroying around 65% of Russia's nuclear

8. Keir A Lieber and Daryl G Press, *The Myth of the Nuclear Revolution: Power Politics in the Atomic Age* (Ithaca, NY and London: Cornell University Press, 2020), p. 61.

capacity.⁹ Faced with an attack that did not produce mass civilian casualties or fallout, Russia would struggle to justify an immediate, unrestricted nuclear response. However, its remaining capabilities might be insufficient to both conduct a counterforce campaign against military targets and maintain enough reserves to threaten cities. Missile defences increase the number of weapons required for counterforce attacks, and the US option for follow-on nuclear strikes exacerbates the problem.¹⁰

As with the limited nuclear options elaborated by the Schlesinger Doctrine during the Cold War, with conventional precision strike Russia's problem is an adversary that has greater flexibility in escalation. Several articles by RVSN officers during the late 2010s and the 2020s similarly emphasised the need to blunt the initial waves of a NATO air campaign – presumed to target elements of Russia's strategic deterrent – and the need for flexible options in a limited counterforce scenario.¹¹

In addition to the challenge of calibration, however, Russia faces a second problem. If a limited conventional attack escalates into a less restricted campaign, or if conventional and nuclear missiles are coordinated from the outset, Russia could plausibly face the risk of a disarming first strike. As officers (including the current deputy head of the Russian air force) note, the challenge is compounded by the fact that intermediate-range systems which might in future be emplaced in Europe present a strategic challenge to Russian C2.¹²

9. I O Fazletdinov and V I Lumpov, « Роль стратегических ракетных войск в противодействии стратегической многодоменной операции НАТО » [‘The Role of Strategic Missile Forces in Countering NATO's Strategic Multidomain Operation’], *Военная Мысль* (Vol. 3, 2023), pp. 53–64.

10. *Ibid.*

11. For examples, see M L Tikhonov, « Ключевые направления совершенствования теории оперативного искусства стратегических ракетных войск на рубеже 2020-х годов » [‘Key Areas for Improving the Theory of Operational Art of the Strategic Missile Forces at the Turn of the 2020s’], *Военная Мысль* (Vol. 7, 2023), pp. 25–32; A A Tsygankov, « О необходимости создания передовых формирований ВВС и Космических сил для обеспечения прикрытия высокоуровневых командных пунктов и стратегических ядерных сил » [‘On the Need to Establish Advanced Air and Space Force Formations to Provide Cover for High-Level Command Facilities and Strategic Nuclear Forces’], *Военная Мысль* (Vol. 9, 2020), pp. 131–142.

12. Kaushal and Dolzikova, ‘The Evolution of Russian Nuclear Doctrine’, pp. 19, 35.

Russia's Available Responses and Its Predisposition Towards Offensive Options

States in the same predicament as Russia tend to have two distinct options. The first, employed by the Soviets, is to deny outright that a nuclear conflict could remain limited. A state attempting to convince its adversary of this can bolster the credibility of its threat by, for example, adopting a LOW posture and building capabilities geared towards first-strike missions – since such systems are less likely to survive an initial strike. The second option is to provide leaders with a flexible set of options by investing in resilient, redundant C2 and fielding larger numbers of mobile systems capable of absorbing a first strike.

Russia has so far embraced elements of both options but has most closely adhered to the first. The 2024 iteration of Russia's nuclear doctrine treats a massive aerospace attack as a potential criterion for nuclear use.¹³ Nevertheless, contemporary articles written by officers including Colonel General Sergey Karakaev (current head of the RVSN) and Lieutenant General Fazletdinov discuss efforts to improve the survivability of both mobile and silo-based systems under attack and indicate that the ability to ride out an attack is, at a minimum, desirable. However, even articles which indicate a desire to ride out an attack discuss the use of preventive strikes on strategic facilities as a means of stopping a conflict that has escalated to the point of massive aerospace attacks on Russia's arsenal. Karakaev and Fazletdinov both identify launch under attack (LUA) and pre-emption as separate but related core roles for silo-based systems. Other officers suggest establishing dedicated ICBM groupings for early employment in a conflict – a posture intended to force de-escalation.¹⁴

This contradiction can, to some extent, be explained by the apparent belief that the ability to ride out an attack can only be achieved through the disruption of threat capabilities by offensive means. While there is a strategic rationale for an assured retaliation capability, maintaining an ability to pre-empt and to LOW/LUA is clearly viewed as critical and not entirely distinct from assured retaliation.¹⁵ The sheer scale of the aerial threat which Russia perceives itself as facing – the former head of the

13. Russian Ministry of Foreign Affairs, 'Fundamentals of State Policy of the Russian Federation on Nuclear Deterrence', 3 December 2024, <https://www.mid.ru/en/foreign_policy/international_safety/1434131/>, accessed 23 February 2026.

14. Тихонов, « Ключевые направления совершенствования теории оперативного искусства стратегических ракетных войск на рубеже 2020-х годов » ['Key Areas for Improving the Theory of the Operational Art of the Strategic Missile Forces at the Turn of the 2020s']; S V Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » ['On the Use of Strategic Missile Forces in Future Wars'], *Военная Мысль* (Vol. 2, 2023), pp. 7–22; Fazletdinov and Lumpov, « Роль стратегических ракетных войск в противодействии стратегической многодоменной операции НАТО » ['The Role of Strategic Missile Forces in Countering NATO's Strategic Multidomain Operation'].

15. Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » ['On the Use of Strategic Missile Forces in Future Wars'].

Russian navy suggested 1,100 cruise missiles could target Russia from the north alone – cannot be countered by passive measures based on integrated air and missile defence and dispersion.¹⁶ An active posture is essential, both to deter certain types of attack and to mitigate the threat to Russia's deterrent.

The credibility of Moscow's deterrent as a conflict escalates to a nuclear exchange is a function of both the number of missiles it can maintain and the extent to which it can degrade future US missile defences. In effect, Russia must maximise its supply of missiles (by retaining as many as possible) while minimising the demand (by degrading systems which increase the number of missiles needed for a given outcome).¹⁷ Moscow perceives an operational requirement for breakthrough operations – the ability to suppress and degrade adversary missile defences – as part of a nuclear exchange, even in the face of anticipated future improvements in adversary (particularly US) missile defences. This is necessary whether the intention is to inflict a limited nuclear response or to inflict unacceptable damage in a situation where a significant portion of the Russian arsenal has been degraded. Breaking through missile defences and inflicting limited damage at strategic distances appear to represent a single, intermediate step on Russia's escalation ladder in the context of a conventional first strike by an adversary.¹⁸

Russia will therefore probably respond aggressively to a first strike irrespective of its scale or the mix of conventional and nuclear weapons used. Such a response would be limited in terms of its target set but not necessarily in scope or geographical focus.

As stated, Russia seeks to maintain a nuclear reserve to inflict unacceptable damage after the first exchanges. RVSN officers such as Fazletdinov and Karakaev argue that submarine-launched ballistic missiles (SLBMs) and mobile TELs are most relevant to this stage of an operation; they ascribe greater importance to SLBMs, due to their survivability despite poorer accuracy and timing (with respect to C2).¹⁹ While important, SLBMs and mobile TELs are not sufficient for deterrence independent of Russia's offensive capability. This reflects the concerns regarding the portion of the force which would survive first strikes. Moreover, because the capabilities that threaten the survivability of Russian nuclear forces – particularly expanding US ISR architectures, CPS systems and missile defences – would also scale against a larger Russian arsenal, Russia cannot simply build its way out of the problem through numerical expansion. A marginally larger force would present only more targets, signatures and logistical activity for increasingly networked ISR systems to track, while

16. N Yevmenov, V V Puchnin and Y V Yeschenko, « Ключевые изменения в характере и содержании морских военных угроз Российской Федерации » [‘Key Changes in the Nature and Content of Maritime Military Threats to the Russian Federation’], *Военная Мысль* (Vol. 5, 2023), pp. 19–25.

17. Fazletdinov and Lumpov, « Роль стратегических ракетных войск в противодействии стратегической многодоменной операции НАТО » [‘The Role of Strategic Missile Forces in Countering NATO's Strategic Multidomain Operation’].

18. *Ibid.*

19. *Ibid.*; Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » [‘On the Use of Strategic Missile Forces in Future Wars’].

the US can expand its inventory of conventional precision strike weapons more readily than Russia can expand survivable nuclear delivery systems. As a result, the critical variable is not merely arsenal size, but the probability that surviving forces can penetrate defences and deliver a retaliatory strike.

The doctrinal preferences of Moscow will therefore probably be offence-dominated – if not necessarily for reasons of strategically offensive intent. While Russia aims to enable as much of its arsenal as possible to survive an attack, its chosen approach to this appears to be the early use of its RVSN capabilities. The goal would be to destroy the adversary's strategic capabilities and the enablers of its future missile defences where possible, before an aerospace attack has escalated to a full-scale counterforce campaign. Purely defensive countermeasures such as relying on the mobility of some force elements are discussed by Russian officers as well, but in the author's analysis, these countermeasures are viewed as being insufficient by themselves. Nor is it materially viable for Russia to make itself capable of riding out a strike through a substantial expansion of the force itself. Instead, strategic stability will depend on the ability to respond promptly to a massive aerospace attack with strikes on facilities as well as an expansive counterspace campaign.

Why Russia Cannot Build Its Way Out of Its Problems

Having examined the problems Russia might wish to solve with new capabilities, this chapter turns to an examination of Russian capacity for building new systems. This is important since, in theory, one way to mitigate the problems identified in the previous chapter would be a massive expansion of Russia's nuclear arsenal to provide redundancy and thus alleviate concerns regarding first-strike risks. This is, after all, how the USSR mitigated the vulnerabilities it faced in the 1960s, and Russia has a warhead stockpile which should, in principle, be able to support a much larger force than the one it fields. However, as will be shown, the country is unlikely to resort to this solution.

Russia will operate within resource constraints, particularly as nuclear capabilities have to be traded off against the expensive process of reconstituting and modernising conventional forces.²⁰ In relative terms, its arsenal is as costly as that of the US, meaning that an expansion of the arsenal – while simultaneously reconstituting the conventional Russian military – would be as difficult for Russia as it would be for a Western state under similar circumstances. Russia enjoys few of the efficiencies that might make nuclear expansion an attractive option.

Since Russia is a more open society than its Soviet predecessor, its defence industry and press discuss the costs of some systems publicly.²¹ Furthermore, data provided to the UN over the past two decades (a practice which has recently stalled) can provide a useful, if imperfect, glimpse into the cost of the Russian nuclear enterprise.²² Publicly available

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20. Dara Massicot and Richard Connolly, 'Russian Military Reconstitution: 2030 Pathways and Prospects', Carnegie Endowment for International Peace (2024), <<https://carnegieendowment.org/research/2024/09/russian-military-reconstitution-2030-pathways-and-prospects>>, accessed 28 February 2026.
 21. Sergey Smirnov, « Булава » закончилась » ['Bulava is Over'], *Gazeta*, 10 August 2012, <https://www.gazeta.ru/politics/2012/08/10_a_4720661.shtml>, accessed 3 September 2026.
 22. Julian Cooper, 'The Funding of Nuclear Weapons in the Russian Federation', Changing Character of War Centre, October 2018, p. 6, <<https://www.ccw.ox.ac.uk/blog/2018/10/1/the-funding-of-nuclear-weapons-in-the-russian-federation-by-julian-cooper>>, accessed 24 March 2026.

elements of previous defence budgets can also be useful, but the extent of classified spending means that both sources of data must be used with significant caveats.

The key material constraint examined in this paper is capacity. The associated opportunity cost is measured in both financial and industrial terms. While the Russian state can moderate the former – for example, by compelling firms to accept low margins – pre-conflict prices for certain capabilities, and the relative cost differences between them, remain useful as a proxy for the scarcity of inputs relevant to both nuclear weapons and their enabling capabilities.²³

This paper therefore aims to provide, where possible, an assessment of both Russia's capacity for growth in specific areas and the opportunity costs associated with specific systems.

It is apparent that Russia does not have the price advantages one might anticipate with respect to nuclear weapons or complex weapons more generally, when these prices are known. For example, in 2012, Russian journalists quoted a General Staff source who said that the acquisition cost of the Russian Bulava SLBM was \$32 million – roughly the equivalent of the Trident D5.²⁴ One relatively authoritative estimate of the cost of the Topol-M ICBM from 2008 placed the price of the missile at ₪400 million (about \$35 million today), which is 50% cheaper than the unit costs of the Minuteman III ICBM when adjusted for inflation.²⁵ However, in rouble terms (a more reasonable comparison since fewer inputs in nuclear weapons are imported), a missile such as the Topol-M represents a larger opportunity cost than the Minuteman III did in the US, measured in terms of equivalent military platforms which could have been procured for the same cost.²⁶ In other words, the relative costs of Russian systems – including the premium that Russia pays for a new complex weapon, and presumably the input costs underlying this premium – are not much lower than those of the US. Consequently, additional nuclear weapons and complex delivery systems should be expected to impose opportunity costs on Russia analogous to those a Western nation would face if procuring similar capabilities. Russia enjoys less of an advantage here than might be assumed. Opportunity costs can be diluted, however, if a system is multifunctional – something true of many theatre-level missiles that can also play conventional roles.

23. Regarding depressed profit margins, see Jack Watling and Oleksandr Danylyuk, 'Winning the Industrial War: Comparing Russia, Europe and Ukraine, 2022–24', *RUSI Occasional Papers* (April 2025), <<https://www.rusi.org/explore-our-research/publications/occasional-papers/winning-industrial-war-comparing-russia-europe-and-ukraine-2022-24>>, accessed 3 September 2026.

24. Smirnov, « Булава » закончилась » ['Bulava is Over'].

25. Igor Moric and Timur Kadyshchev, 'Forecasting Costs of U.S. Ballistic Missile Defense Against a Major Nuclear Strike', *Defence and Peace Economics* (Vol. 36, No. 2, 2025), pp. 141–66.

26. Based on open source data regarding platform costs, ₪400 million with an inflation multiplier (adjusted for today's prices) is the equivalent of the cost of 15 modernised T-72B3 tanks, while \$35 million would procure three M1A2 Abrams tanks.

While the cost of Russia's nuclear enterprise is relatively low in dollar terms, it has exceeded the relative cost of the US nuclear enterprise as a proportion of the defence budget. In 2012, it was revealed that the modernisation of the Russian nuclear arsenal would absorb roughly 10% of the funds allocated to equipment modernisation within the Russian defence budget, encompassing big-ticket projects such as the replacement of the R-36. Analysts have estimated that this figure has probably risen to 15%. This is consistent with the cost growth on the Bulava and the budgetary inflation identified for other projects, such as the RS-28 Sarmat, the next generation of Russian silo-based ICBMs.²⁷ For reference, the estimated cost of the modernisation of the US nuclear triad (ICBMs, SLBMs and strategic bombers) between 2021 and 2030 is roughly 9% of the US Department of Defense budget for procurement, modernisation and R&D, although some of the costs of modernisation will be borne by the Department of Energy.²⁸ This excludes supporting facilities and operations and maintenance, since estimates of Russian modernisation treat these costs separately.

Of course, the proportion of a budget which is spent on nuclear weapons can fall simply because the spending on the modernisation of conventional capabilities increases. Share-of-budget comparisons should be treated with caution, however, since a nuclear programme's share can fall simply because conventional spending rises. The lower US share partly reflects far higher US spending on conventional capabilities from 2021 to 2030 than Russia's in the period from 2012, and the two periods are not directly comparable. A more reliable measure of opportunity cost is therefore to price nuclear spending in terms of a reference platform.

Since the opportunity cost imposed by additional spending on nuclear weapons is being measured, one corrective might be to price nuclear spending in terms of a reference platform – for example, with reference to attack submarines. This, too, can be distorted by the cross-subsidisation inherent to many Russian defence programmes, though there is reason to expect the distortion to be broadly similar across sectors. Taken in these terms, the average annual cost of Russian nuclear delivery-system procurement from 2010 to 2017 was the equivalent of six *Yasen*-class submarines, rising to around eight at the peak of the state armament programme in 2015; the US nuclear modernisation between 2021 and 2030 is likely to be the equivalent of around six *Virginia*-class submarines, if a multiplier is applied for the Congressional Budget Office's estimated cost uplifts.²⁹ This methodology shows that Russian nuclear enterprise is smaller than the US one in absolute resource terms, but it offers no

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27. Cooper, 'The Funding of Nuclear Weapons in the Russian Federation', p. 6. On the RS-28 Sarmat, see Maxim Starchak, 'Russia's Sarmat ICBM Faces Development Problems', Jamestown Foundation, <<https://jamestown.org/russias-sarmat-icbm-faces-development-problems/>>, accessed 17 September 2026.
 28. US Congressional Budget Office, 'Projected Costs of U.S. Nuclear Forces, 2021 to 2030', May 2021, <<https://www.cbo.gov/publication/57240>>, accessed 6 September 2026.
 29. Costs of Russian nuclear programmes based on author calculations of data in Cooper, 'The Funding of Nuclear Weapons in the Russian Federation'; costs of US programmes based on author calculations of data provided by Congressional Budget Office, 'Projected Costs of U.S. Nuclear Forces, 2021 to 2030'.

evidence of a Russian cost advantage. The relative cost of new nuclear weapons for Russia is comparable to that of the US and has at times exceeded it, notwithstanding significantly lower Russian labour costs.

Some of the costs associated with nuclear weapons are likely to rise, for example, wages. Although evidence is limited, recruitment advertisements suggest that the monthly salary of some 12th Main Directorate (also known as the 12th GUMO) officers in 2016 was around ₺55,000, while in 2016, Rosatom employees were paid an average of ₺67,700 per month.³⁰ Both salaries were highly competitive for the time. However, the Russian economy currently faces overheating, with average salaries peaking at ₺139,727 per month in 2025, before declining to slightly over ₺110,000 in 2026 – meaning that if Rosatom salaries simply tracked inflation since 2016, the average employee would be paid less today than the national average.³¹ In reality, the wage bills for both the 12th GUMO and Rosatom have probably risen considerably to maintain a premium for skilled work. Any expansion of the arsenal which required more of these skilled workers would thus impose a significant resource cost in addition to capital costs.

In effect, the cost of Russia expanding its nuclear arsenal would be broadly analogous, in relative terms, to the cost the US would incur from a similar buildup – and in proportionate terms, it would arguably be higher. Russia's operating costs from the conflict in Ukraine, and the need to resource new commitments in the wake of the conflict (for example, the 44th Army Corps in the Leningrad Military District near the Finnish border, deployed to manage Russia's military posture following Finland's accession to NATO), compound this challenge. Thus, the fiscal headroom available to the Russian system for an expansion of its nuclear arsenal will probably be limited.

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30. The 12th GUMO is the department within the Russian Ministry of Defence responsible for the safety, technical maintenance, storage, transport and disposal of Russia's nuclear arsenal. Cooper, 'The Funding of Nuclear Weapons in the Russian Federation'; РАДУГА инфор « Служба по контракту » ['Contract Service'], No. 44 (1053), 24 June 2016, p. 8, <<https://raduzhnyi-city.ru/adm/files/R-I/Ar-2016/%D0%A0%D0%98-44%20%D0%BE%D1%82%2024%2C06.pdf>>, accessed 17 September 2026.
31. *Trading Economics*, 'Russian Average Monthly Wages', <<https://tradingeconomics.com/russia/wages>>, accessed 6 September 2026; *Известия*, 'The Average Salary in Russia in May Exceeded 110 Thousand Rubles', 29 July 2026, <<https://iz.ru/en/node/2140721>>, accessed 17 September 2026.

Russia's Probable Capability Choices

Based on the incentives and constraints identified in the previous chapters, this chapter outlines Russia's probable capability choices.

The core choice that the counterforce threat poses to Russia is whether to seek redundancy and dispersion or more offensively oriented capabilities. On balance, the author judges that Russia will probably emphasise the latter. This is partly because, for Russian planners, the distinction between offensive capabilities and the ability to ride out a first strike is artificial. Moreover, as discussed here, the threats to the credibility of Russia's retaliatory systems will probably be insensitive to marginal increases in numbers. Thus it is unlikely that the retaliatory / withhold capability that Russia is building around its mobile TELs and SSBNs will grow, but considerable effort will probably be expended on offensive means of improving the survivability of retaliatory systems and the likelihood that they will penetrate defences.

Various Russian officers have also identified the ability to pre-empt a strike (or at least to convey the capacity to do so) as a useful component of deterrence.³² Instruments of brinkmanship – capabilities which are useful if employed pre-emptively due to limited survivability, or which limit an opponent's warning time – are also likely to be part of Russia's capability suite. These capabilities overlap considerably with systems employed in a LOW/LUA posture. The key difference is that these systems face structural pressure to be used early, rather than being reserved for retaliation. Strategic bombers are one example: their vulnerability over time, and their inability to launch as promptly and reliably as silo-based systems, makes early use more attractive than waiting to absorb an attack.

The capabilities associated with LUA and breakthrough operations are likely to be of primary interest, since they are relevant across the spectrum of operations. They can constrain an opponent's perceived freedom of action with respect to launching a first strike, deliver a strategically commensurate response to a first strike, and set the conditions for the second strike to be employed more credibly if necessary. The author

32. See, for example, A K Mariyn, « Особенности стратегического сдерживания в современных условиях » [‘Features of Strategic Deterrence in Modern Conditions’], *Военная Мысль* (Vol. 12, 2023), pp. 1–9.

argues, however, that the force of silo-based systems relevant to LUA and breakthrough operations will probably not grow substantially in quantitative terms. Instead, key developments will probably relate to a diversity of warhead types as well as the nuclear and non-nuclear enabling capabilities which will target adversary ISR as part of a response when under attack.

By contrast, with some notable exceptions, instruments of either pure pre-emption or second strike are likely to develop only marginally beyond programmed systems, since additional capacity in each area offers limited marginal advantages and at considerable cost.

Generating Additional Capacity

LOW/LUA and Breakthrough: Russia's Main Line of Effort

The importance of a front-footed response to a massive aerospace attack means it is vital for Russia to have capabilities which can be employed on a prompt basis under conditions where US ISR and missile defence are largely functional. In consequence, the proportion of Russia's overall throw weight in silo-based systems will grow. This development is already on track, since once the RS-28 Sarmat is fielded, the RVSN's silo-based systems will comprise a greater proportion of Russia's throw weight than at any time since the 1990s. The author expects this trend to continue. The major changes anticipated with respect to silo-based systems relate to the vehicles carried rather than numbers per se, with RVSN officers highlighting three major priorities:

1. The use of new missile types capable of penetrating future missile defences due to, among other things, their fuel types (to shorten a missile's boost phase) and warhead types (probably an allusion to hypersonics).
2. The introduction of means to ensure that the detectability of mobile ICBMs is reduced through the impact of Russia's early-use capabilities.
3. Multi-altitude and multivector attacks.³³

The emphasis on qualitative rather than quantitative improvements reflects both the fact that each silo-based system procured is being built to maximise throw weight – reducing the need for numbers – and also the fact that a limited response to an initial strike must be delivered with as limited a number of missiles as is practical to preclude the conflict entering the next stage of escalation. While figures such as Karakaev make it clear that Russia does not perceive a state of limited nuclear war to be tenable on a protracted

33. Fazletdinov and Lumpov, « Роль стратегических ракетных войск в противодействии многодоменным операциям НАТО » [‘The Role of Strategic Missile Forces in Countering NATO's Multidomain Operations’]; Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » [‘On the Use of Strategic Missile Forces in Future Wars’].

basis, both he and his immediate subordinates appear to be aware that the repulsion of a massive aerospace attack would involve the use of nuclear weapons on a global scale – albeit with a focus on military targets probably including ballistic missile defence (BMD) capabilities, storage sites for precision-guided munitions and possibly ICBM silos.³⁴ While not small, the envisioned Russian response is thus functionally limited.

If, as multiple RVSN officers argue,³⁵ Russia's immediate response to a first strike must be both prompt and occur in conjunction with the degradation of US missile defences (meaning that these will be operational for at least part of an LUA or LOW), then maximising both operational control and throw weight has value – all of which incentivises a focus on silo-based systems. Operational control is more easily achieved with static silo-based systems, since multiple redundant avenues can be used to maintain links. Furthermore, a system with considerable throw weight has a better chance of penetrating functional missile defences. Fazletdinov and Lumpov allude to the greater accuracy of the RVSN's ICBMs, which is relevant in an initial wave of counterforce attacks on specific facilities.³⁶ Furthermore, the value of mobile launchers is somewhat constrained by US ISR capabilities that are probably still functional at the outset of an exchange and can also track additional targets. While mobility still has value – particularly if US ISR can be disrupted – this value does not rise in proportion to the number of mobile systems. Rather, the mobile TELs which survive an initial exchange are discussed in Russian sources as a withhold capability. For the initial response, throw weight supersedes stealth, since at this stage the stealth of mobile systems cannot be guaranteed.³⁷

The next generation of Russian silo-based ICBMs, the RS-28 Sarmat, will have the capacity to carry significantly more multiple independently targetable re-entry vehicles (MIRVs) than the current generation of R-36 ICBMs. The heavy payload of the missile was explicitly described by Yuri Borisov (then deputy defence minister) as a riposte against missile defences.³⁸ Several other features of the Sarmat are seemingly optimised against US BMD. For example, the missile has been described by Russian President Vladimir Putin as having a short boost phase, which compresses the window

34. Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » [‘On the Use of Strategic Missile Forces in Future Wars’].

35. *Ibid.*

36. Fazletdinov and Lumpov, « Роль стратегических ракетных войск в противодействии многодоменным операциям НАТО » [‘The Role of Strategic Missile Forces in Countering NATO's Multidomain Operations’], p. 65.

37. Fazletdinov and Lumpov, « Роль стратегических ракетных войск в противодействии многодоменным операциям НАТО » [‘The Role of Strategic Missile Forces in Countering NATO's Multidomain Operations’].

38. Interfax, « Минобороны рассказали о крылатой ракете с ядерным двигателем и другом оружии из послания Путина » [‘The Defense Ministry Spoke about a Nuclear-Powered Cruise Missile and Other Weapons from Putin's Address’], 12 March 2018, <<https://www.interfax.ru/russia/603129>>, accessed 3 September 2026.

for it to be detected and classified by the US Space-Based Infrared System.³⁹ This has probably been achieved through the use of a stepped liquid engine which employs multiple combustion chambers with different mixes of fuel and oxidiser at different stages of the missile's flight, along with the employment of a lighter orthogrid structure on the missile itself.⁴⁰ Russia's acceptance of a design feature which has made fielding a new silo-based missile more difficult illustrates the importance attached to the Sarmat's value in countering anti-ballistic missiles.

In addition to their utility in an immediate response, these characteristics can also allow silo-based systems not employed at the outset of an exchange to contribute disproportionately to meeting unacceptable damage criteria. Given the throw weight of the Sarmat, only 14 missiles would need to leak through US missile defences to meet a definition of unacceptable damage comparable to the Brown criterion (200 warheads).⁴¹

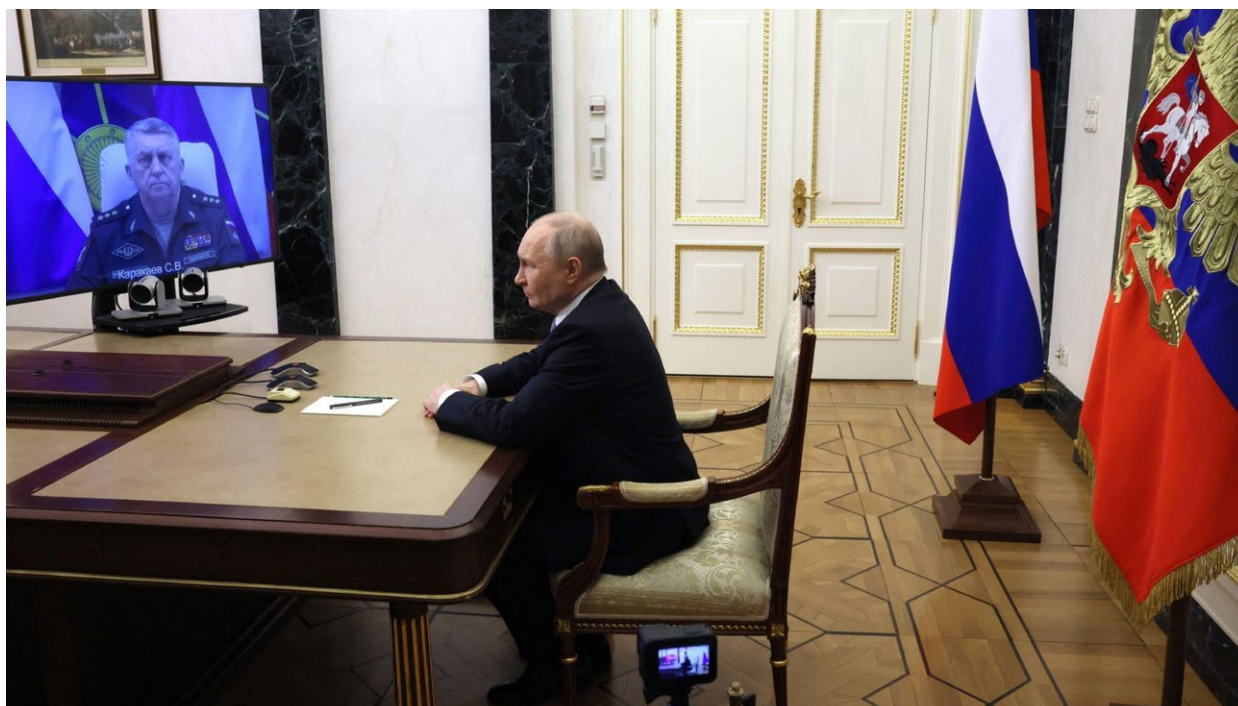
The Sarmat represents a considerable investment based on what is known about comparable US programmes, such as Sentinel, and the fact that Russia has not demonstrated major cost efficiencies. The opportunity costs of both the Sarmat programme and additional missiles within it are considerable. Moreover, silo-based systems are themselves vulnerable to nuclear first strikes, and Russia's ability to posture them visibly for employment is limited. The use of the Sarmat as a carrier for systems like Avangard, which can be employed in a limited and coercive way, is a partial rejoinder to this point. Yet, the fact remains that the missile is a comparatively inflexible tool serving largely as a hedge against worst-case scenarios. Much of its value appears to lie in the prospect of achieving objectives with fewer missiles by maximising both penetration prospects and missile throw weight – presumably indicating a desire to avoid a massive missile buildup. As such, the author deems it probable that the planned procurement numbers for the Sarmat will remain stable.

39. TACC, 'Key Facts about Russia's Advanced Sarmat ICBM System', 1 March 2018, <<https://tass.com/defense/992360>>, accessed 3 September 2026.

40. An orthogrid structure typically incorporates a repeating pattern of rectangular stiffening ribs to improve structural strength. See Mike Richardson, 'Forming for the Final Frontier', *Aerospace Manufacturing*, 16 January 2015, <<https://www.aero-mag.com/forming-for-the-final-frontier>>, accessed 21 September 2026. For its use with the Sarmat, see Sidharth Kaushal, 'Russia's Sarmat Test Failure: Implications for the Strategic Balance', *RUSI Commentary*, 22 October 2024, <<https://www.rusi.org/explore-our-research/publications/commentary/russias-sarmat-test-failure-implications-strategic-balance>>, accessed 8 September 2026.

41. CSIS Missile Defense Project, 'RS-28 Sarmat', 23 April 2024, <<https://missilethreat.csis.org/missile/rs-28-sarmat/>>, accessed 17 September 2026. The Brown criterion was the assessed number of warheads needed to ensure that the USSR would be incapable of recovery as a modern industrial society. See Roger D Speed, *Strategic Forces: Future Requirements and Options* (Livermore, CA: Lawrence Livermore National Laboratory, 1990), p. 2.

Figure 1: President Vladimir Putin Conferring with Colonel General Sergey Karakaev on the Successful RS-28 Sarmat Test



Source: Mikhail Metzel / Russian Government / Alamy.

The main choices Russia will face relate to payloads rather than missile numbers. Given the requirement for LUA while missile defences are functional, silo-based systems such as hypersonic glide vehicles (HGVs) capable of flying on non-parabolic trajectories would represent an obvious – and already fielded – solution. Indeed, Karakaev makes the point that silo-based systems are resilient to both nuclear and conventional strikes when discussing their utility as a means of immediate response.⁴² Given past concerns among Russian authors that ballistic missile defences could leave Russia unable to calibrate damage, HGVs would represent an obvious solution.⁴³ This use-case implies a requirement for a relatively limited number of HGVs capable of intercontinental strikes – which is consistent with public statements regarding the small number of Avangard HGVs deployed under the 2027 state armament programme (fewer than 20 launchers across two regiments).⁴⁴

42. Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » [‘On the Use of Strategic Missile Forces in Future Wars’].

43. A V Skrypnik, « О возможном подходе к определению роли и места оружия направленной электромагнитной энергии в механизме силового стратегического сдерживания » [‘On a Possible Approach to Defining the Role and Place of Directed Electromagnetic Energy Weapons in the Mechanism of Forceful Strategic Deterrence’], *Вооружение и экономика* (Vol. 2, No. 19, 2012), pp. 42–48.

44. ТАСС, « Источник: первые комплексы «Авангард» встанут на боевое дежурство в 2019 году » [‘First “Avangard” Missiles to Go Online by 2019’], 28 October 2018, <<https://tass.ru/armiya-i-opk/5731436>>, accessed 3 September 2026.

One additional factor could limit the scale of deployment of intercontinental HGVs: that they compete for space amid a finite arsenal of silo-based ICBMs. It is likely that the decision to field Avangard on the UR-100N UTTH ICBM was due to its superior thrust generation, which could power a missile through the Earth's atmosphere at hypersonic speeds. The fact that other missiles cited as potential carriers for the HGV include the Sarmat appears to validate this argument. This does mean, however, that the ability of a missile like the Sarmat to carry a very large number of MIRVs would compete with the allocation of the system as an Avangard carrier, since the system can reportedly carry three Avangard HGVs as opposed to 10–15 MIRVs.

In principle, the replacement of the R-36 with the Sarmat – which carries a 20% heavier payload – means that Russia may calculate that it could help to meet the quantitative threshold for unacceptable damage with a smaller number of silo-based systems. This, in turn, is an incentive to field the Avangard on a proportionately larger number of silo-based systems.⁴⁵ However, if the value of a system such as the Avangard lies in its potential for use in relatively small numbers, a large HGV arsenal would be operationally superfluous. There is also a considerable financial opportunity cost associated with hypersonics. The cost of the roughly analogous US HTV-2 was estimated as \$36 million in 2006 (\$57 million today).⁴⁶ In effect, a strategic HGV costs more than an SLBM and marginally less than an ICBM – assuming that the relative Russian prices are comparable to relative US ones. There are also indications that Russia has struggled to produce many of the inputs associated with the Avangard, resulting in an initial production run of around 60 warheads.⁴⁷ However, the additional value of HGVs (in the context of Russia's doctrinal preferences) is considerably greater than that of SLBMs in a second-strike role. To the extent that material circumstances allow, the expansion of HGV production is therefore probable, even at considerable material cost.

A more open-ended question is whether the Avangard is deployed as a fractional orbital bombardment system (FOBS) on the Sarmat – once the latter is fielded – much in the way that its predecessor, the R-36, was fielded with the R-36-0 FOBS variant.⁴⁸ The Sarmat is described as being capable of attacks via the South Pole, albeit on a normal trajectory, meaning that the value of an orbital system with respect to confounding ground-based radar would be limited and the costs a FOBS imposes with respect to

45. On the throw weight of RS-28, see Kaushal, 'Russia's Sarmat Test Failure'.

46. James M Acton, 'Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike', Carnegie Endowment for International Peace, September 2013, p. 48, <<https://carnegieendowment.org/russia-eurasia/research/2014/11/silver-bullet-asking-the-right-questions-about-conventional-prompt-global-strike>>, accessed 3 September 2026.

47. Franz-Stefan Gady, 'Report: Russia to Produce 60 Avangard Hypersonic Boost-Glide Warheads', *The Diplomat*, 4 July 2019, <<https://thediplomat.com/2019/07/report-russia-to-produce-60-avangard-hypersonic-boost-glide-warheads/>>, accessed 3 September 2026.

48. *Global Security*, 'Weapons of Mass Destruction (WMD): R-36-O / SL-X-? FOBS', <<https://www.globalsecurity.org/wmd/world/russia/r-36o.htm>>, accessed 3 September 2026.

reduced accuracy would be considerable.⁴⁹ However, an orbital trajectory would provide a hedge against space-based sensors. This is not because space-based sensors cannot track an orbital trajectory, but rather because predicting when a missile will deorbit is more complicated than calculating its trajectory based on a ballistic arc. Furthermore, as demonstrated by China in the employment of the DF-ZF on a FOBS, HGVs can help mitigate the challenge of terminal phase accuracy.⁵⁰ If Russia did opt for a FOBS version of the Sarmat, based on the precedent of the R-36, the missile itself would not need to be redesigned. The R-36-0 required a separately designed deorbiting stage, the 8F021, which used a liquid-fuelled deorbit engine turbopump.⁵¹ While complex, the addition of this latter stage of the missile did not force a complete redesign and the weight it added was compensated for in other ways (for example, by sacrificing penetration aids deemed superfluous to a FOBS).⁵² Currently, there is no concrete indication of a Russian pursuit of a FOBS. However, employing the same framework used throughout this paper, a FOBS' consistency with Russian priorities (specifically, the stated focus on multiple vectors of attack and the ability to launch coordinated salvos from multiple directions) and resourcing can be assessed.

Enablers and Counter-ISR

A Russian nuclear operation, and in particular the phase in which Russian forces seek to break through adversary defences, will probably involve more than nuclear weapons themselves. Blunting US space-based ISR is critical to every step of a nuclear operation, from weakening the impact of a first strike (particularly a conventional one) to breakthrough and ensuring the survivability of a mobile withhold capability. Depriving US forces of the means to strike Russian strategic capabilities can substantially help mobile systems to survive a first strike. Subsequent efforts to deliver limited strikes against targets, including those associated with missile defences, will depend on the suppression of space-based ISR – a task which will become increasingly important as the US fields a space-based sensor layer. While many of the capabilities Russia might pursue to support such an operation are not nuclear capabilities, they should be regarded as integral components of a nuclear operation.

49. Malcolm Davis, 'The RS-28 Sarmat and the Future US Nuclear Triad', Australian Strategic Policy Institute, 16 February 2017, <<https://www.aspistrategist.org.au/rs-28-sarmat-future-us-nuclear-triad/>>, accessed 3 September 2026.

50. Sidharth Kaushal and Sam Cranny-Evans, 'China's New Hypersonic Capability', *RUSI Commentary*, 26 October 2021, <<https://www.rusi.org/explore-our-research/publications/commentary/chinas-new-hypersonic-capability>>, accessed 3 September 2026.

51. Miroslav Gyűrösi, 'The Soviet Fractional Orbital Bombardment System Program', Air Power Australia, April 2012, <<https://www.ausairpower.net/APA-Sov-FOBS-Program.html>>, accessed 3 September 2026.

52. *Ibid.*

Counterspace Tools

The use of directed-energy weapons and other non-kinetic capabilities as counterspace tools has received particular attention since the 2010s.⁵³ Non-kinetic capabilities could be employed both prior to and during an attack, making them doctrinally consistent with a focus on active defence. Capabilities which could potentially play this role include the Peresvet (the directed-energy weapon which patrols with Russian ICBMs), as well as the stationary Kalina system and an airborne directed-energy weapon called Sokol-Eshelon (carried on the A-60, though the fate of the latter programme is uncertain).⁵⁴ There is some speculation about whether the Peresvet is powered by nuclear power or explosive iodine photodissociation lasers.⁵⁵ Both modes of operation appear excessively complex for systems which travel alongside mobile ICBMs. This suggests that the Peresvet's role is closer to point defence: temporarily dazzling Earth observation satellites rather than destroying them. However, if the intention were to cause more permanent damage to space assets, more complex systems capable of generating higher peak emissions would probably be necessary.

Operational Complexity

Operational complexity represents another apparent constraint. Fixed systems such as the Kalina are, by their nature, vulnerable to early suppression. Mobile systems have other complications; it is unclear how Peresvet receives space situational awareness, but it is clearly not organic to the system since it uses communication which creates electronic emissions. Airborne systems would probably struggle to carry a system directly comparable to Peresvet, which requires four support trailers, despite some indication from then-deputy defence minister Alexei Krivoruchko that this is being considered.⁵⁶ The Sokol-Eshelon appears to be a distinct system, with some sources suggesting an explosively pumped iodine photodissociation laser, which would produce high peak energy but make an airborne system extremely complex.⁵⁷ The programme has been discussed since the mid-2010s, and according to its chief designer, work on it

53. Skrypnik, « О возможном подходе к определению роли и места оружия направленной электромагнитной энергии в механизме силового стратегического сдерживания » [‘On a Possible Approach to Defining the Role and Place of Directed Electromagnetic Energy Weapons in the Mechanism of Forceful Strategic Deterrence’].

54. Clint Reach et al., *Russia's Evolution Toward a Unified Strategic Operation: The Influence of Geography and Conventional Capacity* (Santa Monica, CA: RAND, 2023), p. 104; A V Evsukov and A L Khryapin, « Роль новых стратегических систем вооружения в обеспечении стратегического сдерживания » [‘The Role of New Strategic Weapons Systems in Ensuring Strategic Deterrence’], *Военная Мысль* (Vol. 12, 2020), pp. 26–31.

55. Bart Hendrickx, ‘Peresvet: a Russian Mobile Laser System to Dazzle Enemy Satellites’, *Space Review*, 15 June 2020, <<https://www.thespacereview.com/article/3967/1>>, accessed 17 September 2026.

56. Andrey Mitrofanov, ‘Aviation Performance of the Peresvet Combat Laser System: Carriers, Targets, Tactics of Application’, *Military Review*, 28 February 2020, <<https://en.topwar.ru/168374-aviacionnoe-ispolnenie-boevogo-lazernogo-kompleksa-peresvet-nositeli-celi-taktika-primeneniya.html>>, accessed 3 June 2026.

57. Vladimir Teslenko, « Боевой летающий лазер » [‘Combat Flying Laser’], *Коммерсантъ*, March 2020, <<https://www.kommersant.ru/doc/4291662>>, accessed 3 September 2026.

began after the Anti-Ballistic Missile Treaty was rendered defunct.⁵⁸ All of this suggests that progress has been limited. While directed-energy weapons offer a means of targeting both highly sensitive systems, such as Keyhole satellites, and less sensitive but more numerous ones, they are limited in their utility to countering highly proliferated space-based Earth observation systems. The financial costs of these systems, and thus the opportunity cost that they impose, is likely to be considerable, limiting the scale at which they are fielded. For example, the Boeing YAL-1 airborne chemical laser testbed cost up to \$1.5 billion per aircraft when the programme was cancelled.⁵⁹ Ground-based systems to clear space debris in low Earth orbit (a rough analogue to the Kalina) are somewhat more cost-effective but still entail considerable unit costs, with installations costing \$725 million.⁶⁰ In opportunity cost terms, this equates to roughly one fifth of the cost of a submarine, for example. As commercial space-based intelligence proliferates, directed-energy weapons – which are limited by line of sight – will become less useful, because they would need to suppress a much larger number of targets.⁶¹

Space-Based Electronic Warfare

An alternative would be the use of space-based electronic warfare (EW). The employment of space-based systems against adversary satellites has been discussed regularly. Such systems include nuclear-powered EW satellites, which were proposed to the Russian Ministry of Defence by Roscosmos as early as 2014, as well as space-based nuclear weapons and plasma-based weapons.⁶² Since Roscosmos has already conducted preliminary development on systems like space-based nuclear reactors, Russia can quickly field weaponised capabilities based on the underlying technology using solutions its defence sector developed over a decade ago. A space-based jammer of the kind discussed by Roscosmos would be a particularly effective tool against space-based radar used in BMD roles. This is because even relatively low levels of interference can

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58. Alexei Mikaylov, « Министерство обороны возобновит разработку боевого лазера » [‘The Ministry of Defence Will Resume Development of a Combat Laser’], *Известия*, 13 November 2012, <<https://iz.ru/news/539185>>, accessed 3 September 2026.
 59. David Willis, ‘Whatever Happened to the USAFs YAL-1A Airborne Laser Testbed?’ *Key Aero*, 9 March 2022, <<https://www.key.aero/article/whatever-happened-usafs-yal-1a-airborne-laser-testbed>>, accessed 3 September 2026.
 60. Alexander Berthelot, ‘Methods of Space Debris Removal in LEO [Low Earth Orbit]’, paper presented to the American Institute of Aeronautics and Astronautics Regional Student Conferences, 4 April 2025, p. 3, <<https://doi.org/10.2514/6.2025-99590>>, accessed 5 March 2026.
 61. A Scherbakov and N С В Nikulin, « проблемы информационно-космического обеспечения стратегических операций » [‘Views of the Leadership of the US Armed Forces and Their Allies on the Problems of Information and Space Support for Strategic Operations’], *Военная Мысль* (Vol. 10, 2023), pp. 126–141.
 62. Ivan Cheberko, « «Роскосмос» нашел применение ядерным двигателям » [‘Roscosmos has Found a Use for Nuclear Engines’], *Известия*, 31 August 2016, <<https://iz.ru/news/629623>>, accessed 3 September 2026; В А Andruschenko and Е L Stupitsky, ‘Numerical Studies of the Structure of Eruptive Regions Formed by Powerful Explosions at Different Heights. A Review’, *Computer Research and Modeling* (Vol. 12, No. 1, 2020), pp. 97–140.

compromise a space-based radar tracking a missile over long distances, given the very small margins of error tolerable in BMD.⁶³ A hostile EW system can achieve a favourable signal-to-noise ratio because a radar echo weakens with distance at twice the rate of a one-way jamming signal. As a result, a jammer that is not limited by the horizon could theoretically interfere with a space-based radar at very long range.⁶⁴ Modern radars mitigate risks through processing gain, beam control and frequency agility, but these countermeasures trade against dwell time and capacity, making interference a persistent concern with respect to midcourse tracking. A space-based EW system could not knock out a space-based radar, but it could rob it of seconds of decision-making time (which are crucial to effective BMD or to countering hypersonics). The non-permanent nature of the disruption would also make the system an effective signalling tool even before a conflict escalated, as noted by some Russian authors.⁶⁵ Space-based jammers could also provide some degree of protection against electronic intelligence satellites. Given the absence of either direct cost estimates or immediate Western analogues, it is difficult to estimate unit costs even in opportunity cost terms. However, it is worth noting that costs will be offset by relative multifunctionality and wide area effects achieved from a single system.

Multidomain Jamming

Russian authors have considered the idea of a multidomain jamming complex, often using the concept to describe the way they view US capabilities being employed.⁶⁶ The coordination of space-based jammers with terrestrial systems like the Krasukha-4 and Murmansk-BN might thus be expected. However, space-based jammers have two limitations. The first relates to organisational complexity. Since space-based systems are held within the Russian air force, while the RVSN holds primary responsibility for much of Russia's missile throw weight, it is unclear how the former would be coordinated with the latter if space-based systems were to support breakthrough operations. In a defensive role, the coordination of space-based assets with ground-based systems held under Russia's joint strategic commands would also introduce

63. See Warren J Boord and John B Hoffman, *Air and Missile Defense Systems Engineering* (Boca Raton, FL: CRC Press, 2016), p. 61.

64. For a useful primer on the underlying mathematics, see G P Kefalas, 'Radar Noise Jamming Equations Simplified', *IEEE Transactions on Aerospace and Electronic Systems* (Vol. AES-17, No. 2, 1981), pp. 297–300; Skrypnik, « О возможном подходе к определению роли и места оружия направленной электромагнитной энергии в механизме силового стратегического сдерживания » ['On a Possible Approach to Defining the Role and Place of Directed Electromagnetic Energy Weapons in the Mechanism of Forceful Strategic Deterrence'].

65. Fazletdinov and Lumpov, « Роль стратегических ракетных войск в противодействии многодоменным операциям НАТО » ['The Role of Strategic Missile Forces in Countering NATO's Multidomain Operations']; Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » ['On the Use of Strategic Missile Forces in Future Wars'].

66. For example, see A A Chubykin and V A Katenin, « Технологии координации информации поддерживают ответные действия, когда противник наносит «разоружение первым ударом» » ['Technologies of Coordinate Information Support Response Actions When the Enemy Strikes With A "Disarming First Strike"'], *Вестник Академии военных наук* (Vol. 2, 2024), pp. 113–126.

complexity. Second, Russian commentators have noted the difficulties that the frequency agility of Western satellite data links poses for Russian EW. This may undercut faith in jamming alone, since communications links can be made resilient with fewer trade-offs than radar.⁶⁷ It is likely that space-based jammers will involve high platform costs, and their coordination with other EW assets and with Russia's nuclear forces would introduce considerable organisational complexity. However, these capabilities also enable wide area effects and offer a degree of flexibility owing to their potential for peacetime employment.

Space-Based Nuclear Assets

A more brute-force approach examined in detail by state-affiliated academics would involve space-based nuclear assets.⁶⁸ The effect of a nuclear weapon detonating outside the Earth's atmosphere is not primarily a function of the blast itself. Above 120 km from the Earth, the explosion behaves like a magnetically guided plasma structure shaped by the geomagnetic field, with jet-like plasma flows extending across thousands of kilometres. Because these flows cannot be directed, the prospect of synchronised explosions of up to 20 weapons is discussed by Russian analysts. This would effectively amount to an area-denial approach based on ionospheric disruption and plasma damage.⁶⁹ Neither form of damage is necessarily permanent – particularly against military satellites, which are typically built to withstand the effects of plasma – but detonations can still inflict transient disruption during a critical period. A single detonation of a 110 kiloton weapon in space has the potential to have an impact on around 20% of the satellites in orbit, also potentially mitigating the problem of proliferating commercial ISR.⁷⁰ Considering Russian concerns regarding nuclear flexibility, a nuclear weapon in space (which can cause considerable disruption without the loss of life associated with nuclear use) could also provide Russia with another means of delivering the type of intermediate step required for its escalation ladder as a riposte to large-scale conventional attacks. From the standpoint of military utility and opportunity cost, there appears to be a strong case for Russia to eventually field space-based nuclear weapons.

The fielding of space-based nuclear weapons would also hedge against systems such as IR satellites, which cannot as easily be impacted by jamming since, unlike space-based radar, EW has no inherent power advantage over downlink and uplink

67. Scherbakov and Nikulin, « Взгляды руководства Вооруженных сил США и их союзников на проблемы информационной и космической поддержки стратегических операций » [‘Views of the Leadership of the US Armed Forces and Their Allies on the Problems of Information and Space Support for Strategic Operations’].

68. See, for example, Andruschenko and Stupitsky, ‘Numerical Studies of the Structure of Eruptive Regions Formed by Powerful Explosions at Different Heights’.

69. *Ibid.*

70. Don Snyder et al., *The Effects of High-Altitude Nuclear Explosions on Non-Military Satellites* (Santa Monica, CA: RAND, 2025), p. 5.

jammers. The major limitation of the system would be political, as it would represent a violation of the UN's Outer Space Treaty.⁷¹ However, it is likely that the approach taken by Russia's delegation at the UN when the US and Japan proposed a resolution banning space-based nuclear weapons – which the Russians vetoed in favour of a resolution banning all weapons in space – will presage the wider Russian approach to managing political fallout.⁷²

Kinetic kill options have more limited value, primarily due to probable industrial capacity limitations. This is not for want of technology; Russia has tested the PL-19 Nudol anti-ballistic missile in an anti-satellite (ASAT) role at an altitude of 480 km. The Russian military also retains Soviet-era kinetic kill options such as the 79M6 Kontakt, and the development of an exoatmospheric kill vehicle called Aerostat (based on the Topol-M ICBM) has been discussed, too.⁷³ The use of ASAT missiles to target a proliferated, space-based missile defence architecture would, however, require a relatively large number of missiles. Even though the debris from a single attack can have an impact on other satellites in orbit, this would not provide certainty of effect. A relatively large number of interceptors would be required to damage all or most targets of interest.⁷⁴ Resource allocation also bears considering; the PL-19 is primarily an exoatmospheric BMD system, and interceptors will need to be allocated between BMD and ASAT missions (with the former probably taking precedence). Based on US production rates for the roughly analogous SM-3 ballistic missile interceptor (with 55 missiles due for delivery by 2031), it is unlikely that Russia will have a large number of PL-19 interceptors in the near to medium term even with significantly better production rates than the US.⁷⁵

The organisational challenges of coordinating counterspace capabilities – many of which will probably sit within the aerospace forces – and silo-based systems (which comprise an important part of the early stages of a Russian response) are liable to be considerable. Many ASAT capabilities will probably sit within the remit of the aerospace forces, while the status of space-based jammers and nuclear weapons is unclear. This represents a constraint on their effective use which will potentially drive a requirement for a unified model coordinating the RVSN's capabilities and those of

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71. UN Office for Outer Space Affairs, 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies', 19 December 1966, <<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>>, accessed 3 September 2026.
 72. Christy Cooney, 'Russia Vetoes UN Vote on Stopping Arms Race in Outer Space', *BBC News*, 25 April 2024.
 73. For a useful discussion, see Bart Hendrickx, 'Aerostat: a Russian Long-Range Anti-Ballistic Missile System with Possible Counterspace Capabilities', *Space Review*, 11 October 2021, <<https://www.thespacereview.com/article/4262/1>>, accessed 3 September 2026.
 74. For a useful analysis of the number of missiles needed to strike a well-distributed architecture, see Jaganath Sankaran, 'Limits of the Chinese Antisatellite Threat to the United States', *Strategic Studies Quarterly* (Vol. 8, No. 4, Winter 2014), pp. 19–46.
 75. Jen Judson, 'Raytheon Aims to Boost SM-3 Missile Production Rates', *Defense News*, 15 January 2025, <<https://www.defensenews.com/naval/2025/01/15/raytheon-aims-to-boost-sm-3-missile-production-rates/>>, accessed 3 September 2026.

other organisations. There is some indication that Russian operational concepts are evolving towards the coordination of capabilities employed under distinct strategic operations.⁷⁶ The practical complexities associated with this are liable to be a constraint, however. As an illustrative example, nuclear and conventional planners may have different preferences regarding when specific counterspace capabilities are employed.

Offence-dominated capabilities are consistent with both the perceived requirement for an early capacity to suppress threats and break through US missile defences – aligning well with Russia's doctrinal imperatives. These capabilities generally provide Russia with greater surety of control in the early stages of a conflict, though the coordination of nuclear and counterspace capabilities represents an organisational challenge. While these capabilities impose opportunity costs, which limits the numbers in which they are fielded, they are also likely to have an anticipated effect that is disproportionate to their numbers. Moreover, in many cases, choices relate to enhancing the effect of existing or planned systems – for example silo-based missiles – rather than building new capabilities. Some capabilities will prove difficult to field at scale, with examples including kinetic ASAT systems, and it is unlikely that large-scale growth in the numbers of such capabilities will be fielded. While not anticipating radical shifts to existing Russian plans, the author's view is that the trend towards a greater role for the silo-based ICBM force and the emphasis on offence-dominated options is liable to continue, and potential additional capability growth will probably be most substantial in these areas.

Caution About Capability Growth

Instruments of Brinkmanship as a Deterrence Tool

As noted in previous sections, several Russian officers have highlighted the importance of Russia being able to maintain strategic initiative and the potential utility of brinkmanship. This preference would be consistent with the procurement of systems which compress warning times through launching positions and missile trajectories.

Not all capabilities are easily categorised. For example, silo-based ICBMs can be viewed as being consistent with either a LOW or LUA posture: they are vulnerable to first strikes but also have more resilient C2. ICBMs also have the throw weight to ensure that even a small number can carry many warheads. Other systems, such as longer-range cruise missiles launched from either bombers or subsurface assets, are closer to being tools of brinkmanship in that they pose a risk of low-warning strikes. They also become considerably more difficult to use as a conflict progresses, owing

76. Reach et al., *Russia's Evolution Toward a Unified Strategic Operation*.

either to a loss of control over platforms – for example, submarines on distant patrols – or to the loss of platforms themselves, as in the case of bombers.

Instruments of brinkmanship have some deterrent utility but can become a wasting asset if deterrence fails. Given this relatively bounded utility, the author argues that, while Russia will seek to demonstrate the capacity for brinkmanship, it will do so through the incremental improvements to existing systems rather than efforts to develop bespoke systems for this role.

The role of naval platforms as an instrument with which to hold at risk major military and industrial targets receives particular attention – even from RVSN officers, who have a limited organisational incentive to make this case.⁷⁷ Russia's guided missile submarines (SSGN) fleet would represent a particularly useful instrument with which to achieve this end, given that SSGNs represent a comparatively stealthy capability which can launch attacks at low warning – which often has a multiplying psychological effect. The definition of nuclear sea-launched cruise missiles (SLCMs) as a purely pre-emptive tool might be contested. The platform is survivable, and this has the advantage of multifunctionality as an instrument which can serve both conventional and nuclear roles. The ability to fire cruise missiles with short warning times from unexpected vectors could be useful at every stage of an exchange. Historically, however, SLCMs formed part of the Soviet analogous response posture, matching deployments of US theatre-range missiles (a tool the Soviets saw as having pre-emptive utility) with a comparable low warning threat – suggesting that SLCMs are seen as an instrument of pre-emption even if this is not their only role.⁷⁸ Moreover, the potential loss of communication with more distant submarines (as compared with SSBNs in bastions) in the context of an attack further reinforces the case for viewing them primarily as a means of threatening pre-emption, even if this is not automatically the case, and SSGNs will also play a number of important conventional roles.

Although expensive, as a naval platform funded for multiple roles, SSGNs would impose no additional costs on the budget for nuclear modernisation. The missiles they carry (such as the 3M-14 Kalibr) are comparatively inexpensive capabilities which Russia will probably produce in large numbers for conventional operations. Cruise-missile submarines equipped with nuclear-armed variants of the same weapons could strike targets such as C2 nodes, storage sites for deep strike capabilities and airbases housing strategic bombers. It might be deemed plausible that in a large-scale war, these submarines would carry nuclear weapons for two reasons. First, the vertical launch system loadout of an individual SSGN could achieve a limited impact with conventional weapons. A *Yasen*-class SSGN, for example, will be able to carry up to 32 SLCMs, fewer

77. A K Maryin, « Особенности стратегического сдерживания в современных условиях » [‘Features of Strategic Deterrence in Modern Conditions’], *Военная Мысль* (Vol. 12, 2023), pp. 21–29.

78. Sidharth Kaushal and Edward Black, ‘The Atlantic Bastion’, *RUSI Research Papers* (December 2025), <<https://www.rusi.org/explore-our-research/publications/research-papers/atlantic-bastion>>, accessed 17 September 2026.

than would be necessary to reliably saturate multiple well-defended targets, based on data from Ukraine.⁷⁹ Moreover, Russian authors have long argued that, in a regional war, SSGNs would carry nuclear weapons for both tactical and strategic missions.⁸⁰ Second, in a more tactical role, SSGNs would probably have to compensate for the poor availability of Russian ISR at longer distances – and Russia's naval doctrine has, since 2017, included the destruction of an adversary fleet with nuclear weapons as a core fleet task.⁸¹

The Russian navy is now on the cusp of maintaining a year-round SSGN presence off US coastlines. Consider that the *Yasen*-class submarine was designed in the late 1980s as a platform specifically optimised for the Soviet 'analogous response' policy, which involved maintaining submarines with nuclear cruise missiles off US coastlines as a means of striking key targets with low warning.⁸² Since 2015, Russian officers have alluded to this as a core role for the *Yasen* class and also appear to calculate that the protection of US carrier strike groups will leave limited surface-based antisubmarine warfare capability for homeland defence.⁸³ A *Yasen*-class submarine was also deployed to Cuba in recent years with considerable accompanying messaging.⁸⁴ The imminent Russian maintenance of a year-round presence off at least one US coast with a small *Yasen* fleet of five submarines probably absorbs the bulk of this fleet's capacity (since roughly four submarines are needed to keep one in position at any time).⁸⁵ This indicates the importance attached to these deployments and also suggests that the decision by Russia to highlight the Cuba deployment extends beyond simple great power posturing and is instead a component of Russia's messaging about the threat of pre-emption.

The current commander-in-chief of the Russian navy, Admiral Alexander Moiseev, has confirmed that the navy will replace all of its third generation SSNs/SSGNs (of the *Oscar*, *Sierra* and *Akula* class) with the *Yasen* in the next decade.⁸⁶ Since operating costs

79. Ian Williams, *Putin's Missile War* (Washington, DC: Center for Strategic and International Studies, 2023), pp. 1–10.

80. See, for example, Konstantin Sivkov, « «Хлеб» с изюминкой » [“Loaves” with a Twist’], *Военно-промышленный курьер* (No. 13, 3 April 2018).

81. President of Russia, « Указ Президента Российской Федерации от 20.07.2017 г. № 327 Об утверждении Основ государственной политики Российской Федерации в области военно-морской деятельности на период до 2030 года » [‘Decree of the President of the Russian Federation of July 20, 2017 No. 327 on the Fundamentals of the State Policy of the Russian Federation in the Field of Naval Activities for the Period Up to 2030’], 20 July 2017, <<http://kremlin.ru/acts/bank/42117>>, accessed 3 September 2026.

82. Kaushal and Black, ‘The Atlantic Bastion’.

83. For example, see A Mozgovoy, « Лучше не открывать ящик Пандоры » [‘It Would Be Better to Not Open Pandora's Box’], *Морской Сборник* (2015), pp. 56–63.

84. Thomas Nilsen, ‘62 Years After the Cuban Missile Crisis, Northern Fleet Nuclear-Powered Submarine is Headed for Havana’, *Barents Observer*, 6 June 2024, <<https://www.thebarentsobserver.com/security/62years-after-the-cuban-missile-crisis-northern-fleet-nuclearpowered-submarine-is-headed-forhavana/167561>>, accessed 3 September 2026.

85. Kaushal and Black, ‘The Atlantic Bastion’.

86. ТАСС, « Главнокомандующий ВМС: Проект «Ясен» заменит все атомные подводные лодки третьего поколения » ‘Navy Commander-in-Chief: Project Yasen Will Replace All Third-Generation Nuclear Submarines’, 18 March 2026, <<https://tass.ru/armiya-i-opk/26811519>>, accessed 3 September 2026.

of older vessels are liable to be significant, particularly given the much higher tempo of activity which is visible within the Northern Fleet's submarine force, some of the costs of new SSGNs may be offset by reduced operating costs.⁸⁷ A fleet at higher readiness would also ensure that the nuclear role does not effectively rob the Russian navy of the ability to use the *Yasen* class in other ways.

The organisational cost of integrating SSGNs into nuclear planning is perhaps Russia's greatest challenge. First, it is easier to lose operational control over subsurface assets than ground-based ones – one of the reasons why Soviet leaders historically preferred to concentrate throw weight on ground-based systems rather than SSBNs.⁸⁸ Second, a policy of emplacing nuclear weapons on assets also used in conventional roles presents opponents with a discrimination problem which can also constrain the conventional employment of an asset. Finally, there are some indicators that the management of nuclear weapons is a proficiency which is not generalised throughout the navy outside the SSBN force. In an interview accompanying the launch of a book he coauthored, the former commander of the Russian Pacific Fleet, Sergey Avakyants, opined that Russian naval units were unfamiliar with the handling of nuclear munitions and that this muscle memory would have to be rebuilt.⁸⁹ This might be less true of units in submarines than in surface vessels, and Avakyants' opinion may be difficult to generalise, but it is a noteworthy insight.

The advantage of SSGNs as a nuclear asset is that Russia will procure them for conventional roles in any case. The Soviet analogous response posture also illustrates that the issues of C2 did not preclude the use of the nuclear attack submarine fleet in deterrent roles. Recent statements by figures such as Admiral Moiseev appear to reinforce the idea of the Russian navy's platforms being equipped with nuclear weapons. Using nuclear SLCMs more regularly on SSGNs is thus consistent with doctrinal imperatives and the organisational cost is one which the Russian navy has apparently accepted with naval nuclear weapons more broadly.

Air-launched cruise missiles can also play a role in dissuasion through the threat of pre-emption and can also serve as an incremental means of ensuring that existing platforms can contribute to deterrence.

Since strategic bombers are at their most survivable and thus usable in the initial stages of a conflict, they are generally coded as first-strike assets.⁹⁰ The challenge Russia faces is that it presently fields a relatively old fleet of bombers, such as the Tu-95 and Tu-160, while the ability to deliver the planned future PAK DA bomber is uncertain.

87. Author interview with Royal Navy subject matter expert, Stonehouse Barracks, Plymouth, 23 February 2026.

88. Olikier, 'Between Rhetoric and Reality', p. 248.

89. Vyacheslav Terekhov, « К устрашению: эксперты предложили свое видение ядерного сдерживания » [“Towards Intimidation”: Experts Offer their Vision of Nuclear Deterrence], *Интерфакс*, 30 October 2024, <<https://www.interfax.ru/russia/989287>>, accessed 23 June 2025.

90. For example, see Olikier, 'Between Rhetoric and Reality', p. 45.

One hedge against programmatic failures with respect to a complex low-profile bomber such as the PAK DA (which should be anticipated in any country) is extending the range and thus survivability of older systems. The KH-BD, with its 6,500-km range, has the potential to render Russia's bomber fleet a credible intercontinental threat once more. During the late 1990s, figures such as Makhmut Gareev, former deputy chief of the General Staff, noted that Russia's loss of its tanker capability had significantly constrained the strategic utility of the Russian bomber fleet.⁹¹ Since then, Russia has not significantly increased its air-to-air refuelling capability, and future projects such as the PAK DA bomber appear to have shown no significant progress. Thus, it can be assumed that these constraints still hold – which would also be consistent with the repurposing of bombers such as the Tu-95 and Tu-160 for theatre roles.⁹² The addition of a cruise missile with a 6,500-km range to the Russian bomber fleet's air-launched standoff capability would significantly shorten flight times to launch positions for intercontinental strikes, mitigating some of these challenges. Launch positions for a missile such as the KH-BD could be over areas such as Alexandra Land, where bombers would benefit from the protection provided by Russia's growing air defence network in the north.⁹³ The KH-BD would also offer a hedge against future US missile defences. A cruise missile could circumvent some of the layers of a future US homeland defence architecture and could, in theory, present a low-warning threat to key targets – particularly given the probable challenges of tracking low radar cross-section (RCS) objects over clutter in the north. This advantage is offset, however, by the fact that the US has demonstrated an effective capability to track the loading of bombers in the context of the conflict in Ukraine. If one of the challenges Russia fears is a massive US missile strike, this visible process would invite pre-emption at the small number of bases, such as Olenya and Engels, from which these bombers operate, particularly given that the preparation of bombers to carry nuclear missiles would also involve steps such as warheads being released by 12th GUMO and assurance practices which normally precede the pairing of warheads with platforms.⁹⁴ The challenge is shared by other platforms such as submarines, but given their longer loiter times, these platforms can be loaded and sent on patrol some time before a crisis has escalated to the verge of conflict – which is less true of bombers.

91. Makhmut Gareev, *If War Comes Tomorrow? The Contours of Future Armed Conflict*, translated by V V Fromenko (New York, NY: Frank Cass, 1998).

92. Nikolai Sokov, 'The New, 2010 Russian Military Doctrine: The Nuclear Angle', Middlebury Institute of International Studies at Monterey, 5 February 2010, <<https://nonproliferation.org/new-2010-russian-military-doctrine/>>, accessed 17 September 2026.

93. Sidharth Kaushal et al., *The Balance of Power Between NATO and Russia in the Arctic and High North*, RUSI Whitehall Paper 100 (Abingdon: Taylor & Francis, 2021) pp. 56–65.

94. Based on both Soviet practice and current Western practice. See CIA, 'Naval Missile Facilities, USSR', NPIC/R-98/63, June 1963, <<https://www.cia.gov/readingroom/document/cia-rdp78b04560a000600010015-6>>, accessed 17 September 2026.

Even so, longer-range missiles (which allow shorter transits to patrolling areas) could ensure that a larger portion of the bomber fleet can be kept airborne at any given time and represent the most viable pathway towards retaining Russia's air leg as a strategic asset in the absence of a radical improvement in the production of future bombers. Greater standoff on an existing bomber fleet would appear to impose limited opportunity costs – beyond the possibility of KH-BD competing with theatre systems like KH-101 for rail space on bombers. A purely nuclear role for the KH-BD would not necessitate large production runs and KH-101/102 might remain the primary Russian air-launched standoff capability. Doctrinally, long-range, low-altitude capabilities could be a hedge against airspace and surface radar, particularly over northern routes where phenomena like backscatter make it difficult to track low RCS objects. The KH-BD appears to be a dominant option in the brinkmanship role. Relatively high levels of operational control can be maintained over bombers; they are primarily a first-strike capability and the extension of a bomber's effective range is a hedge against the possible failure of the PAK DA. If used primarily as a tool of brinkmanship, however, large numbers of the KH-BD would probably not be required.

The Burevestnik, a cruise missile powered by a nuclear reactor, has also been explored. The programme has been plagued by technical issues related to its inherent complexity, resulting in several failed tests before the missile's first successful test.⁹⁵ Nuclear-powered cruise missiles could, in principle, help mitigate the challenge of future US ballistic missile defence by flying at altitudes which limit the utility of both surface and space-based sensors. As such, it is perhaps unsurprising that the capability has been explicitly described as a means of circumventing missile defences by Chief of the General Staff General Valery Gerasimov in a publicised briefing to Putin.⁹⁶ The capability has received considerable public attention within Russia, but specific limitations affect the likelihood of its being fielded.

A capability such as Burevestnik would potentially meet some of Russia's procurement criteria – particularly with respect to cost asymmetries and hedging against US missile defences – but would fall short in other respects. In terms of cost and opportunity cost, while there is limited public evidence regarding what the programme costs and what serial production would probably entail, inferences can be drawn from past programmes such as Project Pluto – a 1960s US programme to deliver a nuclear-powered ramjet missile. The estimated unit cost of 50 missiles without warheads in the 1960s was around \$50 million.⁹⁷ Since the missile was never built, its real costs cannot

95. Thomas Nilsen, 'Russia Readies for Burevestnik Test Season', *Barents Observer*, 24 August 2026, <<https://www.thebarentsobserver.com/security/russia-readies-for-burevestnik-test-season/456392>>, accessed 27 September 2026.

96. President of Russia, 'Visit to the Joint Forces Command Post', <<https://en.kremlin.ru/events/president/news/80222>>, accessed 3 September 2026.

97. Gregg Herken, 'The Flying Crowbar', *Air and Space Magazine* (Vol. 5, No. 1, April/May 1990), p. 28, archived via the Wayback Machine 14 February 2007, <<https://web.archive.org/web/20200329022906/http://www.merkle.com/pluto/pluto.html>>, accessed 26 February 2026.

be known, but applying what is known about major defence programmes (with 60% of US programmes in 2016 ending up 92% over cost), it is probable that the unit cost would have been double this amount. The real cost of the system, then, would have been substantially higher than a contemporary ICBM such as the Minuteman I by a factor of 1.5 to 1, even before the costs of supporting infrastructure, operations and maintenance were included.⁹⁸ As such, a rough, low-end estimate of the opportunity cost of a missile such as Burevestnik is the equivalent of two ICBMs. The missile would also perform relatively poorly with respect to dispersal as a means of mitigating its vulnerability to a first strike, given the oversight and maintenance associated with a nuclear reactor. This may, however, reinforce the adversary's perception of it as a capability which must be used or lost in a crisis. Such a perception could be useful if Russia views a degree of crisis instability as reinforcing broader strategic stability by raising the risks of initiating a crisis. The missile also probably requires complex inputs such as high-temperature ceramics to manage heat produced by the reactor and rocket boosters for the first stage of its flight,⁹⁹ meaning the missile would compete for inputs with capabilities such as HGVs. The opportunity costs of the missile therefore appear to exceed its value, unless it is fielded in relatively small numbers. A statement by Major General Andrey Sterlin (former head of main operations directorate of the General Staff) provides an authoritative indicator of Russian thinking. He notes that since lawmakers and policymakers in the US do not always understand operational practicalities related to more traditional nuclear capabilities, novel systems with 'small nuclear reactors' capable of circumventing missile defences can serve as part of an approach to disabuse these less-informed decision-makers of the practicality of nullifying Russia's arsenal.¹⁰⁰ This would seem to strongly imply that psychological impact, rather than military utility, is the system's core function.

98. On the minuteman cost, see P K Ghosh, 'Economic Dimensions of the Strategic Nuclear Triad', *Strategic Analysis* (Vol. 26, No. 2, April–June 2002); Leandro Bolzan de Renzede et al., 'The Main Project Complexity Factors and Their Interdependencies in Defence Projects', *Project Leadership and Society* (Vol. 3, 2022).

99. Theodore C Merkle, *The Nuclear Ramjet Propulsion System* (Livermore, CA: University of California Lawrence Radiation Laboratory, 1959), p. 12.

100. A E Sterlin, A A Protasov and A V Kreidin, « Современные трансформации И концепций и силовых инструментов стратегического сдерживания » ['Modern Transformations of the Concept and Force Instruments of Strategic Deterrence'], *Военная Мысль* (Vol. 8, 2019), pp. 7–17. DeepL translation.

Figure 2: Russian *Borei*-Class Submarine in Arctic Waters



Source: Marsea / Adobe Stock.

In terms of optimisation, the Burevestnik programme is consistent with the requirement of presenting a pre-emptive threat. It is, however, a more complex and cost inefficient means of meeting this requirement than available alternatives. The utility of the system is highly contingency bound – unlike other capabilities such as sea-launched and air-launched cruise missiles, which have broader operational value. Consequently, the author's assessment is that the programme will probably either see investment decrease or be maintained at a level of minimum viability for a system at initial operating capability or limited rate production. The only context in which this is likely to change is one in which the availability of alternatives declines rapidly – for example, if Russia loses the ability to maintain enough ageing strategic bombers capable of carrying missiles like the KH-BD.

One area where Russia's capacity for pre-emption will probably grow is at the theatre level. As demonstrated in Ukraine, Russia has retained the RS-26 programme, originally terminated in 2017, with the missile revived as the Oreshnik. Mobile IRBMs are subject to the same risks as any other mobile system, but they could be employed pre-emptively to destroy key theatre-level targets, including aircraft carrying tactical nuclear weapons and intermediate-range prompt strike capabilities such as Dark Eagle.

This would also add an intermediate step to Russia's escalation ladder. In effect, an IRBM capability would play the same role which missiles such as the SS-20 played during the Cold War. An IRBM is not automatically a tool of pre-emption; even so, the time-sensitivity of the theatre-level threats which Russia deems critical, and Russia's understanding of its own ISR limitations against dynamic targets once they disperse, would imply a pre-emptive role for IRBMs.¹⁰¹

The ability to pre-emptively destroy key targets at the theatre level would add an element of credibility to the Russian threat to treat a massive (potentially) conventional aerospace attack as a basis for nuclear use, given the risks of an actual pre-emptive strategic escalation with the US. RVSN officers specifically describe one of the functions of special purpose groupings of ballistic missiles as the elimination of nuclear threats posed from the territory of key US allies.¹⁰² Russia requires large salvos of cruise missiles to achieve effect. As demonstrated in Ukraine, this requirement militates against prompt attacks on key targets, since large salvos require considerable preparatory planning.¹⁰³ By contrast, the limited theatre-level, upper-tier BMD in Europe would make a missile like the Oreshnik a more reliable means of delivery. This does not automatically entail a nuclear role for a missile which has been employed conventionally in Ukraine. However, the probable production rates of IRBMs will be limited. The USSR, with considerably more industrial capacity than Russia, produced around 40 SS-20 IRBMs a year.¹⁰⁴ In the author's view, a small initial arsenal of IRBMs would most rationally be employed as a nuclear capability (which would also compensate for Russia's ISR deficiencies), though the role of the system might change with time. The capacity for serial production of IRBMs is likely to impose considerable opportunity costs, but the system's utility with respect to Russian concerns about the theatre-level balance will probably make it a priority line of effort. Even so, the system is likely to be available in relatively limited numbers in the short-to-medium term due to industrial constraints.

Capabilities relevant to pre-emption at the theatre and strategic levels will probably see some growth. This is doctrinally consistent with Russian beliefs about the utility of a pre-emptive threat and with the requirement to suppress theatre-level capabilities which, for Russia, have an impact on strategic balance. Since the utility of these systems often diminishes under attack, they will represent an economy-of-force line of

101. Roy Allison, 'Averting Acute Escalation in Russia's War Against Ukraine', *International Affairs* (Vol. 101, No. 5, September 2025), pp. 1769–1791.

102. See, for example, Tikhonov, « Ключевые направления совершенствования теории оперативного искусства стратегических ракетных войск на рубеже 2030-х годов » ['Key Areas for Improving the Theory of Operational Art of the Strategic Missile Forces at the Turn of the 2030s'].

103. S V Dronov et al., « Особенности авиационной тактики в современных боевых действиях и способы ее совершенствования » ['Features of Aviation Tactics in Modern Combat Operations and How to Improve Them'], *Военная Мысль* (Vol. 1, 2024), pp. 17–27.

104. Sidharth Kaushal, 'An Integrated Air and Missile Defence Architecture for the UK', *RUSI Occasional Papers* (August 2025), p. 35, <<https://www.rusi.org/explore-our-research/publications/occasional-papers/integrated-air-and-missile-defence-architecture-uk>>, accessed 3 September 2026.

effort where possible – with the use of nuclear weapons on existing platforms likely to be a priority. More novel programmes, such as Burevestnik, will probably see limited additional resourcing given the considerable opportunity costs they impose. The capability area with the greatest probable level of investment is Russia's capacity to strike theatre-level targets pre-emptively, given the merging of theatre and strategic threats in Russia's view. This merging makes the task an operational necessity rather than merely a strategic deterrent.

■ The Russian Second Strike: More Stasis than Change

The ability to backstop a full-scale counterforce threat can be achieved either through mobility and dispersion or the maintenance of a deep second-strike capability. The ability to carry a large number of warheads on even a small number of surviving missiles will carry payloads sufficient to inflict unacceptable damage.

There is some ambiguity regarding perceptions of the survivability of silo-based systems and thus their role as a withhold capability. While Karakaev indicates growing confidence in a level of hardening consistent with an LUA posture, other Russian officers have indicated a belief that CPS can target silos.¹⁰⁵ It is probable that silo-based systems will be part of Russia's withhold capacity, since not many have to be used to help meet an unacceptable damage criterion. However, SSBNs and TEL bases' systems, such as the RS-24, will play a larger role.

An expansion in the number of mobile systems might represent one means of ensuring retaliatory capability. However, the underlying problem is pervasive ISR and the massive expansion in the number of effectors – both conventional and nuclear – that Russia must now consider as threats to soft-skinned systems. This problem is unlikely to be resolved by marginal numerical increases. Moreover, missile defence adds coordination to the equation; mobile systems are easier to lose contact with, and a missile defence system can potentially contend with a larger but uncoordinated salvo. Because TEL-based missiles like the RS-24 carry fewer warheads than silo-based systems, more of these missiles must also be coordinated to achieve a given throw weight. In effect, increasing the likelihood of penetration matters more than saturation. SSBNs offer fewer challenges with respect to coordinating salvos, but the possibility of a loss of communications and control – and thus temporal gaps in their ability to respond – remains.

At the point when unacceptable damage is being inflicted – after a breakthrough and a limited response – the levels of mutual disorientation likely to affect both sides is expected to make the challenges facing SSBNs and TEL-based systems – including the potential loss of operational control and the resulting difficulty in sequencing attacks – less of a consideration. The value of both SSBNs and TELs is greatest when both the

105. For a discussion of this subject, see Kaushal and Dolzikova, 'The Evolution of Russian Nuclear Doctrine', p. 41.

Russian system and its opponents' systems are broken-backed.¹⁰⁶ Since this is the case, a numerical expansion in planned numbers is unlikely; Russia's theory of success depends on not having to achieve perfect coordination to saturate a still-functioning future missile defence system.

Uploading warheads to existing systems might offer a relatively low-cost avenue for Russia. While there have been some suggestions that the RS-24 can carry more MIRVs than currently, based on what can be verified, the headroom for growth is limited in this area.¹⁰⁷ Although Russia maintains a higher surge capacity in its SSBN force than Western counterparts, the number of boats it can put to sea will be bounded by readiness thresholds. This means that not all of the SLBMs which the sea leg of the triad can hold can be put to sea, while those in port are effectively soft-skinned targets. Second, the Delta IV SSBN (which will be retired over the next decade) can launch the Layner SLBM (capable of carrying 12 warheads) for the *Borei*-class SSBN, which will field the Bulava SLBM, declared to carry six MIRVs. So, some of the existing upload capacity is transitional, as contrasted with the additional headroom on silo-based systems, which will grow steadily if the Sarmat is fielded.¹⁰⁸ In any case, additional warheads on the sea leg would add weight to a force already assigned the retaliatory role. Russian officers explicitly ascribe the 'nuclear retaliation' mission to naval strategic forces on the grounds of their survivability – while conceding their inferiority to the RVSN in timing, accuracy and yield – rather than altering the balance between prompt and withhold capabilities.

There are also real opportunity costs to fielding mobile ICBMs. The RS-24 uses many of the same inputs as the RS-26 / Oreshnik IRBM – a capability which fills a gap in terms of Russia's ability to strike targets at the theatre level more promptly, and with a higher probability of penetration, than cruise missiles. Since theatre-level missiles (which can strike Moscow and other C2 nodes with low warning) are a matter of concern, the ability to pre-emptively strike their launchers is a pressing consideration. The Oreshnik is likely to be Russia's response both to any future US decision to field capabilities such as Dark Eagle in Europe and to European prompt-strike capabilities.¹⁰⁹ Expanded RS-24 production would thus draw resources from a necessary theatre-level

106. A broken-backed strike involves fewer warheads and poorer coordination than planners would ideally wish to have, largely as a function of adversary disruption.

107. Hans Kristensen, Matt Korda and Eliana Reynolds, 'Nuclear Notebook: Russian Nuclear Weapons, 2023', *Bulletin of the Atomic Scientists* (Vol. 79, No. 3, May 2023), pp. 174–99.

108. Tomasz Grotnik, 'With Putin's Blessing: Russia Commissions Fifth Borei-A SSBN', *Naval News*, 28 July 2025, <<https://www.navalnews.com/naval-news/2025/07/with-putins-blessing-russia-commissions-fifth-borei-a-ssbn/>>, accessed 11 September 2026.

109. *PBS News*, 'Russia Will No Longer Abide by Self-Imposed Moratorium on Intermediate-Range Missiles', 5 August 2025, <<https://www.pbs.org/newshour/world/russia-will-no-longer-abide-by-self-imposed-moratorium-on-intermediate-range-missiles>>, accessed 6 September 2026.

capability.¹¹⁰ Additionally, based on estimates of US costs (which appear to track Russian costs closely in relative terms), mobile systems are liable to be substantially more costly than silo-based systems – particularly since more missiles are needed for the same throw weight. Enablers such as bases, crews trained for short-notice patrols and directed-energy weapons like Peresvet further add to the cost of mobile systems. Organisationally, the management of additional patrols to maintain readiness is also a challenge requiring significant human capital.

Because the perceived vulnerability of mobile systems is seen as a function of both improving US ISR capabilities and the proliferation of munitions capable of striking them, increasing the number of launchers would not fundamentally alter Russia's problem set unless the expansion in numbers was on a potentially unaffordable scale. Instead, as Karakaev hints,¹¹¹ the survivability of mobile systems depends primarily on Russia's ability to preserve their stealth, which in turn rests on the effectiveness of its counter-ISR capabilities.

The requirement for stealth and mobility could also, however, be met through a rail-based system such as the cancelled Barguzin.¹¹² Such a system might provide greater throw weight by allowing multiple ICBMs to be carried on a single system – the Barguzin could carry six RS-24 missiles, for example – and could, in principle, be liquid-fuelled, given the greater stability of its environment compared to road-based systems. A rail-based system would meet the requirement for a capability which could rapidly change its launch position, and thus its axis of attack, since trains can move faster than road-mobile launchers. The Barguzin project also reportedly had support from figures like Karakaev.¹¹³ Indeed, other than SSBNs, a rail-mobile system is one of the few systems which could meet his stated requirement for systems which could rapidly change their location and thus direction of attack.

While there is limited data on what a system such as Barguzin would cost, if it carried the RS-24 it would not involve the production of an additional missile – it would merely require a change in how an already-planned system was deployed. That said, such a system would face serious challenges: the vulnerability of Russia's rail grid and its supporting electrical infrastructure to conventional and cyberattacks, and the need for security against infiltrators, which would make the train more conspicuous. Since Russia has targeted substations supporting Ukraine's rail grid during the ongoing

110. Michael Kofman, 'Running to Stand Still: Russian Nuclear Modernization after New START', *War on the Rocks*, 13 February 2026, <<https://warontherocks.com/running-to-stand-still-russian-nuclear-modernization-after-new-start/>>, accessed 6 September 2026.

111. Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » ['On the Use of Strategic Missile Forces in Future Wars'].

112. Maxim Starchak, 'Russia Terminates the Development of New Rail-Mobile Ballistic Missile,' Jamestown Foundation, 13 December 2017, <<https://jamestown.org/russia-terminates-development-new-rail-mobile-ballistic-missile/>>, accessed 3 September 2026.

113. Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » ['On the Use of Strategic Missile Forces in Future Wars'].

conflict, its planners are probably alert to this challenge. Even so, inconspicuous rail-based launchers could represent one solution to the problem of pervasive ISR. While it remains probable, in the author's view, that the mobile component of Russia's deterrent will not grow much, if it does expand, a rail-based component is the probable avenue.

The subsurface component of the Russian deterrent has also long been critical to its second strike. Although the *Borei*-class SSBN is liable to represent an improvement over the current Delta IV in terms of quietness, its Bulava SLBM will not increase the total throw weight of the subsurface leg of the Russian triad. As with TELs, communication with SSBNs cannot be assured, although each boat can carry 96 warheads, imposing a less taxing requirement for coordination. The mobility of SSBNs – with the *Borei* capable of under-ice transit – would also allow Russia to hedge against future missile defences by concentrating attacks from different vectors, as Karakaev has described.¹¹⁴ For example, in the Umka 2021 exercise, SSBNs demonstrated the ability to surface through thick ice north of Alexandra Land, in a position from which an SLBM's trajectory to the continental US would be relatively short. On the other hand, communications with SSBNs can be lost if Russia's C2 architecture is damaged. While SSBNs partly meet Russia's requirements, they represent a major investment and would compete directly with nuclear attack submarines for capacity at the Sevmash shipyard. Additionally, the historical Russian preference for ground-based options and the primacy of the RVSN would, together with the associated opportunity cost, seem to lock in the size of Russia's planned SSBN fleet.

The same is probably true of Russia's other means of conducting strategic nuclear attacks from the sea, notably Poseidon, an intercontinental nuclear-powered torpedo with a 2-megaton warhead. It is hosted on special-purpose submarines such as the Belgorod (a stretched *Oscar*-class submarine) and the *Khabarovsk*-class submarine.

While Poseidon would be a useful means of delivering a large payload against targets such as cities, if Russia's ballistic missile arsenal became less reliable, it has limited flexibility as a weapon precisely because of its huge payload. It is unlikely that the system can be used as a counterforce tool against targets such as SSBNs or surface ships. This stems from the fact that nuclear weapons must detonate much closer to a hull than is sometimes assumed to inflict critical damage. Against surface ships, part of the shockwave bends upwards into the air and the resulting rarefaction reflects a negative pressure wave back into the water, where the two waves cancel out. This leads to rapid shock dissipation.¹¹⁵ Use against targets deep within the water (such as SSBNs) is more viable, but achieving levels of overpressure sufficient to damage a pressure-

114. Karakaev, « Об использовании стратегических ракетных войск в войнах будущего » [‘On the Use of Strategic Missile Forces in Future Wars’].

115. Sidharth Kaushal, ‘Nuclear Weapons at Sea – Is Their Use Viable?’ *European Security and Defence*, 22 April 2024, <<https://euro-sd.com/2024/04/articles/37574/nuclear-weapons-at-sea-is-their-use-viable/>>, accessed 3 September 2026.

resistant hull would still require a detonation within less than 10 km of the target.¹¹⁶ Against a moving target, firing at long distances of hundreds of kilometres based on limited information would be impractical, since an SSBN travelling at 5 knots expands the radius of uncertainty by 9 km in an hour: the margin of uncertainty would exceed the weapon's area of effect within a relatively short period. At shorter distances, however, conventional attack would be feasible. The Belgorod and *Khabarovsk* are meant to be employed as motherships by Russia's Main Directorate of Deep-Sea Research (GUGI) for tasks such as sabotage and intelligence gathering. However, they are under naval command when used as Poseidon launchers, adding an element of organisational complexity to their employment. A combination of high opportunity cost and the organisational complexity of integrating the capability suggests that Russia is unlikely to field Poseidon on a larger scale.

Broadly speaking, Russia is likely to attempt to enhance the survivability of its withhold capability and its odds of penetrating, rather than increasing, available numbers. There is a limited case for additional numbers, since Russia's perceived operational requirement would not change with a marginal increase in mobile TEL numbers. Other modes of assuring second strike, such as nuclear torpedoes, impose considerable industrial and operational opportunity costs, given the expensive platforms needed for these systems. The Russian second strike is unlikely to grow much beyond already programmed capabilities.

116. Derived from Tom Stefanick, *Strategic Antisubmarine Warfare and Naval Strategy* (Lexington, VA: Lexington Books, 1987), p. 37.

Conclusion

The key finding of this paper is that the structure of the Russian nuclear arsenal will be characterised more by consistency than by change. This is partly a function of material constraints and opportunity costs. However, it also reflects a commitment to qualitative improvements in accuracy and penetration probabilities rather than increases in numbers. That commitment is driven by both the perceived need for a nuclear riposte to a conventional attack with strategic consequences and the requirement to overcome future US missile defences.

It appears that, in terms of opportunity cost, the Russian nuclear triad costs roughly the same as its US counterpart, and the comparative Russian advantage in some input costs does not make an expansion of nuclear capabilities easier than it would be for the US.

Funding will probably remain relatively secure in the coming decade for capabilities which can serve the aims of either brinkmanship or LOW. These include evolutionary capabilities such as the KH-BD and more novel systems like Avangard. There is also room for marginal capability improvements, such as the fielding of a FOBS-capable variant of Avangard in a manner comparable to the Chinese FOBS. Intermediate-range systems such as Oreshnik will also be a priority area for capability growth.

Enablers which are not specific to Russia's nuclear arsenal but overlap with it considerably – either by being operationally linked to the arsenal or by relying on nuclear payloads themselves – are an area where considerable capability growth might be expected. This is particularly true of counterspace capabilities, many of which are potentially nuclear-powered (in the case of some directed-energy weapons) or represent nuclear systems themselves. The ability to disrupt adversary use of space is relevant to multiple operational and strategic lines of effort, spreading the cost of any counterspace system across its contributions in multiple areas. However, more brute-force counterspace capabilities involve fewer opportunity costs overall, providing a strong incentive for Russia to produce space-based nuclear weapons.

The author expects the least capability growth in mobile second-strike systems, as industrial capacity limitations and Russian assumptions about its requirements make marginal capability expansion less probable.

In effect, the Russian arsenal is likely to revert to a model somewhat closer, but not identical, to its Soviet predecessor, with a heavy emphasis on capabilities associated with early strikes.

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