

II. Russian nuclear forces

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As of January 2023 the Russian Federation maintained a military stockpile of approximately 4489 nuclear warheads, a slight increase of around 12 warheads compared with the estimate for January 2022. About 2673 of these were strategic warheads, of which roughly 1674 were deployed on land- and sea-based ballistic missiles and at bomber bases. Russia also possessed approximately 1816 non-strategic (tactical) nuclear warheads. All of the non-strategic warheads are assessed to be at central storage sites. An additional 1400 retired warheads were awaiting dismantlement (100 fewer than the previous year's estimate), giving a total estimated inventory of approximately 5889 warheads (see table 7.3).

These estimates are based on publicly available information about the Russian nuclear arsenal and assessments by the authors. Because of a lack of transparency, estimates and analysis of Russia's nuclear weapon developments come with considerable uncertainty, particularly regarding the country's sizable stockpile of non-strategic nuclear weapons. However, it is possible to formulate a reasonable assessment of the progress of Russia's nuclear modernization by reviewing satellite imagery and other forms of open-source intelligence, official statements, industry publications and state media interviews with Russian government officials.¹

This section enumerates Russia's holdings of strategic and non-strategic air-delivered, land-based and sea-based nuclear weapons. Before doing so, it first considers Russia's compliance with its bilateral arms control obligations and describes the role played by nuclear weapons in Russian military doctrine.

Russian compliance with New START

It was a tumultuous and discouraging year for the last remaining bilateral strategic arms control treaty between Russia and the United States, the 2010 Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START). This treaty places a cap on the numbers of Russian and US deployed strategic nuclear forces and allows for on-site inspections to verify compliance.²

At the end of 2022, the USA concluded that it was unable to determine whether or not Russia remained in compliance throughout the year with its

¹ Kristensen, H. M. and Korda, M., 'Estimating world nuclear forces: An overview and assessment of sources', SIPRI Commentary, 14 June 2021.

² For a summary and other details of New START see annex A, section III, in this volume. On related developments in 2022 see chapter 8, section I, in this volume.

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obligation under the treaty to deploy no more than 1550 strategic warheads.³ This was due to Russia's decision to indefinitely suspend treaty inspections.⁴ The US report was careful to note, however, that 'While this is a serious concern, it is not a determination of noncompliance' and also assessed that Russia's deployed warheads were likely to have been under the New START limit at the end of 2022.⁵

In September 2022 Russia declared that it had 1549 deployed warheads attributed to 540 strategic launchers, thus remaining under the final warhead limits of New START.⁶ Just as with the USA, many of Russia's strategic delivery systems carry fewer warheads than their maximum capacity in order to meet the New START limits. If Russia chose to no longer comply with the treaty limits, or if the treaty were to expire without a follow-on agreement, Russia (like the USA) could add reserve warheads to missiles and bombers and potentially double its number of deployed strategic nuclear weapons.⁷

The role of nuclear weapons in Russian military doctrine

Russia's official deterrence policy (last updated in 2020) lays out explicit conditions under which it could launch nuclear weapons: to retaliate against an ongoing attack 'against critical governmental or military sites' by ballistic missiles, nuclear weapons or other weapons of mass destruction (WMD), and to retaliate against 'the use of conventional weapons when the very existence of the state is in jeopardy'.⁸ This formulation is largely consistent with previous public iterations of Russian nuclear policy.

In January 2022 Russia joined the four other permanent members of the United Nations Security Council in stating that 'a nuclear war cannot be won and must never be fought'.⁹ This statement was reiterated by a member of Russia's delegation to the UN General Assembly in November 2022. He specifically noted how Russia's nuclear doctrine remained unchanged after its invasion of Ukraine in 2022: 'In response to today's absolutely ungrounded accusation that Russia allegedly threat[ened] to use nuclear weapons during

³ US Department of State, 'New START treaty annual implementation report', Report to Congress, 31 Jan. 2023, p. 6.

⁴ 'Russia suspends START arms inspections over US travel curbs', Reuters, 8 Aug. 2022; Atwood, K. and Hansler, J., 'Russia postpones nuclear arms control talks with US, State Department says', CNN, 28 Nov. 2022; and US Department of State (note 3), pp. 8–15.

⁵ US Department of State (note 3), pp. 5–6.

⁶ US Department of State, Bureau of Arms Control, Verification and Compliance, 'New START Treaty aggregate numbers of strategic offensive arms', Fact sheet, 1 Sep. 2022.

⁷ Korda, M. and Kristensen, H., 'If arms control collapses, US and Russian strategic nuclear arsenals could double in size', FAS Strategic Security Blog, Federation of American Scientists, 7 Feb. 2023. On the negotiation of the renewal of New START see chapter 8, section I, in this volume.

⁸ Russian Ministry of Foreign Affairs, 'Basic principles of state policy of the Russian Federation on nuclear deterrence', Approved by Russian Presidential Executive Order no. 355, 2 June 2020.

⁹ Joint statement of the leaders of the five nuclear-weapon states on preventing nuclear war and avoiding arms races, 3 Jan. 2022. See also chapter 8, section I, in this volume.

Table 7.3. Russian nuclear forces, January 2023

All figures are approximate and some are based on assessments by the authors.

Type/ Russian designation (NATO designation)	No. of launchers	Year first deployed	Range (km) ^a	Warheads x yield	No. of warheads ^b
Strategic nuclear forces	567				2 673^c
<i>Aircraft (bombers)</i>	<i>70^d</i>				<i>580^e</i>
Tu-95MS/M (Bear-H) ^f	55	1984/ 2015	6 500– 10 500	6–16 x 200 kt Kh-55 (AS-15A) or Kh-102 (AS-23B) ALCMs	448
Tu-160M1/M2 (Blackjack)	15	1987/ 2021	10 500– 13 200	12 x 200 kt Kh-55 or Kh-102 ALCMs, bombs	132
<i>Land-based missiles (ICBMs)</i>	<i>321</i>				<i>1 197^g</i>
RS-20V Voevoda (SS-18 Satan)	34	1988	11 000– 15 000	10 x 500–800 kt ^h	340
RS-18 (SS-19 Stiletto)	–	1980	10 000	6 x 400 kt	– ⁱ
Avangard (SS-19 Mod 4) ^j	7	2019	10 000	1 x HGV	7
RS-12M Topol (SS-25 Sickle)	– ^k	1988	10 500	1 x 800 kt	–
RS-12M1 Topol-M (SS-27 Mod 1/mobile)	18	2006	10 500	1 x [800 kt]	18
RS-12M2 Topol-M (SS-27 Mod 1/silo)	60	1997	10 500	1 x [800 kt]	60
RS-24 Yars (SS-27 Mod 2/mobile)	171	2010	10 500	[4 x 250 kt] ^l	684
RS-24 Yars (SS-27 Mod 2/silo)	22	2014	10 500	4 x [250 kt]	88
RS-28 Sarmat (SS-X-29)	..	[2024]	>10 000	[10 x 500 kt]	–
Sirena-M ^m	9	2022	–	Command and control module	–
<i>Sea-based missiles (SLBMs)</i>	<i>11/176ⁿ</i>				<i>896^o</i>
RSM-54 Sineva/Layner (SS-N-23 M2/3) ^p	5/80	2007/ 2014	9 000	4 x 100 kt ^q	320 ^r
RSM-56 Bulava (SS-N-32)	6/96	2012	>8 050	[6 x 100 kt] ^s	576
Non-strategic nuclear forces					1 816^t
<i>Navy weapons</i>	<i>..</i>				<i>835</i>
Submarines/surface ships/naval aircraft	..	Land-attack cruise missiles, sea-launched cruise missiles, anti-submarine weapons, surface-to-air missiles, depth bombs, torpedoes ^u			835
<i>Air force weapons</i>	<i>266</i>				<i>506</i>
Tu-22M3M (Backfire-C)	60	1974	..	3 x ASMs, bombs	300
Su-24M/M2 (Fencer-D)	70	1974	..	2 x bombs	70 ^v
Su-34 (Fullback)	124	2006	..	2 x bombs	124 ^v
Su-57 (Felon)	–	[2024]	..	[bombs, ASMs]	..
MiG-31K (Foxhound)	12	2018	..	1 x ALBM	12

Type/ Russian designation (NATO designation)	No. of launchers	Year first deployed	Range (km) ^a	Warheads x yield	No. of warheads ^b
<i>Air, coastal and missile defence</i>	882				385
53T6 (SH-08 Gazelle)	68	1986	30	1 x 10 kt	68
S-300/400 (SA-20/21)	750 ^w	1992/ 2007	..	1 x low kt	290
3M55/P-800 Oniks (SS-N-26 Strobile), 3K55/K300-P Bastion (SSC-5 Stooge)	56	2015	>400	1 x [10–100 kt]	23
SPU-35V Redut (SSC-1B Sepal)	8 ^x	1973	500	1 x 350 kt	4
<i>Army weapons</i>	170				90
9K720 Iskander-M (SS-26 Stone), 9M728 Iskander-K (SSC-7 Southpaw)	150	2005	350	1 x [10–100 kt]	70 ^y
9M729 (SSC-8 Screwdriver)	20	2016	2 350	1 x [10–100 kt]	20 ^z
Total stockpile					4 489
Deployed strategic warheads					1 674
Reserve warheads					2 815
Strategic					999
Non-strategic					1 816
Retired warheads awaiting dismantlement					1 400
Total inventory					5 889

.. = not available or not applicable; – = nil or a negligible value; [] = uncertain SIPRI estimate; ALBM = air-launched ballistic missile; ALCM = air-launched cruise missile; ASM = air-to-surface missile; HGV = hypersonic glide vehicle; kt = kiloton; ICBM = intercontinental ballistic missile; NATO = North Atlantic Treaty Organization; SLBM = submarine-launched ballistic missile.

^a For aircraft, the listed range is for illustrative purposes only; actual mission range will vary according to flight profile, weapon payload and in-flight refuelling.

^b These figures show the total number of warheads estimated to be assigned to nuclear-capable delivery systems. Only some of these warheads have been deployed on missiles and at airbases, as described in the notes below.

^c Of these strategic warheads, c. 1674 were deployed on land- and sea-based ballistic missiles and at bomber bases. The remaining warheads were in central storage. This number is different from the number of deployed strategic warheads counted by the 2010 Russian–United States Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START) because the treaty attributes 1 weapon to each deployed bomber, even though bombers do not carry weapons under normal circumstances. Additionally, the treaty does not count weapons stored at bomber bases and, at any given time, some nuclear-powered ballistic missile submarines (SSBNs) are not fully loaded with warheads and are thus not counted under the treaty.

^d All of Russia's long-range strategic bombers are nuclear-capable. Of these, only c. 55 are thought to be counted as deployed under New START. Because of ongoing bomber modernization, there is considerable uncertainty about how many bombers are operational.

^e The maximum possible payload on the bombers is estimated to be c. 800 nuclear weapons but, given that only some of the bombers are fully operational, SIPRI estimates that only c. 580 weapons have been assigned to the long-range bomber force. Of these, c. 200 might be deployed and stored at the 2 strategic bomber bases. The remaining weapons are thought to be in central storage facilities.

^f Two types of Tu-95MS aircraft were produced: the Tu-95MS6 (Bear-H6), which can carry 6 Kh-55 (AS-15A) missiles internally; and the Tu-95MS16 (Bear-H16), which can carry a total of 16 missiles, including 10 Kh-55 missiles externally. Both types were being modernized in 2022. The modernized aircraft, the Tu-95MSM, can carry 8 Kh-102 (AS-23B) missiles externally and possibly 6 internally, for a total of 14 missiles.

^g These ICBMs can carry a total of 1197 warheads, but SIPRI estimates that they have had their warhead load reduced to c. 834 warheads, with the remaining warheads in storage.

^h It is possible that, as of Jan. 2023, the RS-20Vs carried only 5 warheads each to meet the New START limit for deployed strategic warheads.

ⁱ It is believed that the remaining RS-18s have been retired, although activities continued at some regiments.

^j The missile uses a modified RS-18 ICBM booster with an HGV payload.

^k Although the final division at Vypolzovo had not yet completed its upgrade to the RS-24 by the end of 2022, it is believed that its legacy RS-12M missiles had been removed in preparation for the upgrade.

^l It is possible that, as of Jan. 2023, the RS-24s carried only 3 warheads each to meet the New START limit on deployed strategic warheads.

^m The division at Yurya is equipped with the new Sirena-M nuclear command and control missile, which is based on the RS-24 ICBM. The missiles are not nuclear-armed, but rather serve as an emergency launch communication module. They are included in this table because their launchers are counted against the limits permitted under New START.

ⁿ The first figure is the total number of nuclear-powered ballistic missile submarines (SSBNs) in the Russian fleet; the second is the maximum number of missiles that they can carry. Of Russia's 11 operational SSBNs (as of Jan. 2023), 1–2 are in overhaul at any given time and do not carry their assigned nuclear missiles and warheads (see note o).

^o The warhead load on SLBMs is thought to have been reduced for Russia to stay below the New START warhead limit. Additionally, at any given time, 1–2 SSBNs are in overhaul and do not carry nuclear weapons. Therefore, it is estimated here that only c. 640 of the 896 SLBM warheads have been deployed.

^p The current version of the RSM-54 SLBM might be the Layner (SS-N-23 M3), a modification of the previous version—the Sineva (SS-N-23 M2). However, the US Air Force's National Air and Space Intelligence Center (NASIC) did not include the Layner in its 2020 report on ballistic and cruise missile threats, and there is some uncertainty regarding its status and capability.

^q In 2006 US intelligence estimated that the RSM-54 missile could carry up to 10 warheads, but it lowered the estimate to 4 in 2009. The average number of warheads carried on each missile has probably been limited to 4 multiple independently targetable re-entry vehicles (MIRVs) to meet the New START limits.

^r SIPRI estimates that, at any given time, only 256 of these warheads are deployed on 4 operational Delta IV submarines, with the fifth boat in overhaul. The actual number may even be lower as 2 boats often undergo maintenance at the same time.

^s It is possible that, as of Jan. 2023, RSM-56 Bulava (SS-N-32) SLBMs carried only 4 warheads each for Russia to meet the New START limit on deployed strategic warheads.

^t According to the Russian government, non-strategic nuclear warheads are not deployed with their delivery systems but are kept in storage facilities. Some storage facilities are near operational bases. It is possible that there are more unreported nuclear-capable non-strategic systems.

^u Only submarines are assumed to be assigned nuclear torpedoes.

^v These estimates assume that half of the aircraft have a nuclear role.

^w As of Jan. 2023 there were at least 80 S-300/400 sites across Russia, each with an average of 12 launchers, each with 2–4 interceptors. Each launcher has several reloads, which are assumed likely to be conventional.

^x It is assumed that all SPU-35V Redut units, except for a single silo-based version in Crimea, had been replaced by the K-300P Bastion by Jan. 2023.

^y This estimate assumes that around half of the dual-capable launchers have a secondary nuclear role. In its 2020 report, NASIC listed the 9M728 as ‘Conventional, Nuclear Possible’.

^z This figure assumes that there are 5 9M729 battalions, each with 4 launchers, for a total of 80 missiles. Each launcher is assumed to have at least 1 reload, for a total of at least 160 missiles. Most missiles are thought to be conventional, with 4–5 nuclear warheads per battalion, for a total of c. 20.

Sources: Russian Ministry of Defence, various press releases; US Department of State, START Treaty Memoranda of Understanding, 1990–July 2009; New START aggregate data releases, various years; US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat 2020* (NASIC: Wright-Patterson Air Force Base, OH, July 2020); US Department of Defense (DOD), *2022 National Defense Strategy of the United States of America* (DOD: Washington, DC, Oct. 2022); US Office of the Deputy Assistant Secretary of Defense for Nuclear Matters, *Nuclear Matters Handbook 2020* (DOD: Washington, DC, Mar. 2020); DOD, various Congressional testimonies; BBC Monitoring; Russian news media; Russian Strategic Nuclear Forces website; International Institute for Strategic Studies, *The Military Balance*, various years; Cochran, T. B. et al., *Nuclear Weapons Databook*, vol. 4, *Soviet Nuclear Weapons* (Harper & Row: New York, 1989); *IHS Jane’s Strategic Weapon Systems*, various issues; US Naval Institute, *Proceedings*, various issues; *Bulletin of the Atomic Scientists*, ‘Nuclear notebook’, various issues; and authors’ estimates.

the special military operation in Ukraine, we would like to stress once again that Russia’s doctrine in this sphere is purely defensive and does not allow any broad interpretation’.¹⁰

Nonetheless, the invasion of Ukraine has raised questions about Russia’s nuclear doctrine, and about where, when and how Russia might use nuclear weapons. Several speeches made by Russian President Vladimir Putin and senior Russian officials and commentators alluding to the potential use of nuclear weapons in the conflict have added to the uncertainty.¹¹

A few days after the invasion, Putin placed Russia’s nuclear arsenal on ‘high combat alert’, saying that ‘aggressive statements’ from the North Atlantic Treaty Organization (NATO) had caused him to increase Russia’s nuclear readiness.¹² However, it appears that this order did not involve deployment of additional nuclear systems; it was primarily related to enhancing staffing levels and nuclear command and control. By the end of 2022 none of Russia’s nuclear forces had conducted any unusual deployment patterns in the context of the war in Ukraine.

¹⁰ ‘Russia’s nuclear doctrine is purely defensive, says Russian diplomat’, TASS, 9 Nov. 2022.

¹¹ See e.g. President of Russia, ‘Address by the president of the Russian Federation’, 24 Feb. 2022; President of Russia, ‘Address by the president of the Russian Federation’, 21 Sep. 2022; and ‘Russia can defend new regions with nuclear weapons: Medvedev’, Al Jazeera, 22 Sep. 2022.

¹² President of Russia, ‘Meeting with Sergei Shoigu and Valery Gerasimov’, 27 Feb. 2022.

Strategic nuclear forces

As of January 2023 Russia had an estimated 2673 warheads assigned for potential use by strategic launchers: heavy bombers, land-based intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs). This is an increase of approximately 108 warheads compared with January 2022 due to fluctuations in the arsenal caused by the deployment of newer ICBMs with multiple independently targetable re-entry vehicles (MIRVs) as well as the introduction of a new nuclear-powered ballistic missile submarine (SSBN).

Aircraft and air-delivered weapons

As of January 2023 the Long-Range Aviation command of the Russian Air Force operated a fleet of approximately 70 operational heavy bombers, comprising 15 Tu-160 (Blackjack) and 55 Tu-95MS (Bear) bombers.¹³ Not all of these counted as deployed under New START and some were undergoing various upgrades. The maximum possible payload on the bombers is approximately 800 nuclear weapons. However, since not all of the bombers were fully operational, it is estimated here that the number of assigned weapons was lower—around 580. SIPRI estimates that approximately 200 of these weapons were probably stored at the two strategic bomber bases: Engels in Saratov oblast and Ukrainka in Amur oblast.¹⁴

Modernization of the bombers—which includes upgrades to their avionics suites, engines and long-range nuclear and conventional cruise missiles—continued throughout 2022 but remained subject to delays.¹⁵ It seems likely that all of the Tu-160s (including at least 10 brand-new Tu-160M2 bombers) and most of the Tu-95s will eventually be upgraded to maintain a bomber force of perhaps 50–60 operational aircraft. These modernized bombers are intended to be a temporary bridge to Russia's next-generation bomber: the PAK-DA, serial production of which is planned to begin in 2028–29.¹⁶ The

¹³ For the missiles, aircraft and submarines discussed in this section, a designation in parentheses (e.g. Blackjack) following the Russian designation (e.g. Tu-160) is that assigned by the North Atlantic Treaty Organization (NATO). The Tu-95MS exists in two versions: the Tu-95MS16 (Bear-H16) and the Tu-95MS6 (Bear-H6).

¹⁴ Podvig, P., 'Strategic aviation', Russian Strategic Nuclear Forces, 7 Aug. 2021.

¹⁵ President of Russia, 'Meeting with workers of Gorbunov Kazan aviation factory and Tu-160M pilots', 25 Jan. 2018; Ignatyeva, L., 'New Kazan strategic bombardier hits the sky', *Realnoe Vremya*, 11 Jan. 2023; and President of Russia, 'Заседание коллегии Министерства обороны' [Ministry of Defence Board meeting], 21 Dec. 2022.

¹⁶ PAK DA demonstrational model to be ready by 2023—Source', TASS, 2 Aug. 2021; 'Russia begins construction of the first PAK DA strategic bomber—Sources', TASS, 26 May 2020; Lavrov, A., Kretsul, R. and Ramm, A., 'ПАКетное соглашение: новейшему бомбардировщику назначили сроки выхода в серию' [PAKage agreement: The latest bomber assigned a deadline for production], *Izvestia*, 14 Jan. 2020; and 'Russia tests engine for next-generation strategic missile-carrying bomber', TASS, 31 Oct. 2022.

PAK-DA will also eventually replace all bombers deployed with non-strategic forces (see below).¹⁷

Both the Tu-160 and the Tu-95 strategic bombers currently carry the Kh-55 (AS-15) air-launched cruise missile (ALCM), but this is being replaced on the upgraded bombers by the new Kh-102 (AS-23B) ALCM. In November 2022 the British Ministry of Defence assessed that Russia was ‘likely removing the nuclear warheads from ageing [Kh-55] nuclear cruise missiles and firing the unarmed munitions at Ukraine’.¹⁸ Russia has used both types of bomber to conduct attacks on Ukraine. Some of Russia’s strategic bombers have thus been damaged; at least two Tu-95 bombers were visibly damaged from a probable Ukrainian strike on Engels Airbase in December 2022.¹⁹

Land-based missiles

As of January 2023 the Strategic Rocket Forces (SRF)—the branch of the Russian armed forces that controls land-based ICBMs—consisted of 12 missile divisions grouped into 3 armies, deploying an estimated 321 ICBMs of different types and variations (see table 7.3).²⁰ These ICBMs can carry a maximum of about 1197 warheads, but SIPRI estimates that they have had their warhead load reduced to around 834 warheads to keep Russia below the New START limit for deployed strategic warheads. These ICBMs carry approximately half of Russia’s estimated 1674 deployed strategic warheads.

Russia is close to completing the replacement of Soviet-era ICBMs with new types, although this process has taken much longer than expected. In December 2022 Colonel General Sergei Karakaev, commander of the SRF, stated that around 85 per cent of the ICBM force had been modernized.²¹ The bulk of the modernization programme has focused on the RS-24 Yars (SS-27 Mod 2), a MIRVed version of the RS-12M1/2 Topol-M (SS-27 Mod 1). SIPRI estimates that, as of January 2023, the number of deployed RS-24s had grown to approximately 193 mobile- and silo-based RS-24 missiles, including five completed mobile divisions (at Barnaul, Irkutsk, Nizhniy Tagil, Novosibirsk and Yoshkar-Ola), with one more in progress (at Vypolzovo—sometimes referred to as Bologovsky).²² Karakaev

¹⁷ ‘Russia to test next-generation stealth strategic bomber’, TASS, 2 Aug. 2019.

¹⁸ British Ministry of Defence (@DefenceHQ), Twitter, 26 Nov. 2022, <<https://twitter.com/DefenceHQ/status/1596389927733927937>>.

¹⁹ Cenciotti, D., ‘Explosion hits Engels-2 Airbase, Russia, reportedly damaging at least two Tu-95 bombers’, The Aviationist, 5 Dec. 2022.

²⁰ One of these ICBM divisions, the 8th Missile Division at Yurya, Kirov oblast, was being modernized alongside the rest of the ICBM force; however, the division’s Sirena-M ICBMs are believed to serve as back-up launch code transmitters and therefore have not been armed with nuclear weapons.

²¹ Karakaev, S. V. (Col. Gen.), interviewed in Biryulin, R., Andreev, D. and Reznik, A., ‘Ядерный щит России по-прежнему надёжен’ [Russia’s nuclear shield is still reliable], *Krasnaya Zvezda*, 16 Dec. 2022; and ‘Russian TV show announces new ICBM to enter service soon’, TRK Petersburg Channel 5, 21 Apr. 2014, Translation from Russian, BBC Monitoring.

²² Karakaev (note 21); and authors’ estimates.

stated that one regiment of the Vypolzovo division had begun combat duty by the end of 2022, and the entire division's upgrade to the RS-24 would be completed in 2023.²³ SIPRI estimates that this division has already been fully disarmed of its older RS-12M Topol (SS-25) ICBMs in preparation for receiving the new RS-24, indicating that the Topol ICBM is now fully out of service across the SRF.²⁴

Deployment of the silo-based RS-24s continues at Kozelsk, Kaluga oblast, with one regiment of 10 silos completed in 2018 and the second completed in 2020.²⁵ The third regiment began combat duty in December 2021 and the regiment's first two missiles were placed into their silos in 2022.²⁶ However, commercial satellite imagery indicates that the necessary infrastructure upgrades are unlikely to be completed by the 2024 target date.²⁷ It is likely that the 60 RS-12M2 Topol-M (SS-27 Mod 1) silos at Tatishchevo, Saratov oblast, will eventually also be upgraded to the RS-24.

In December 2021 Russia completed the rearmament of the first of the former RS-20V regiments at Dombarovsky, Orenburg oblast, with six RS-18 (SS-19 Mod 4) missiles equipped with the Avangard hypersonic glide vehicle (HGV) system.²⁸ Russia has been installing Avangard-equipped missiles at a rate of two per year in upgraded complexes. In 2022 it installed the first missile in the second Avangard regiment at Dombarovsky. The entire regiment's rearmament is scheduled for completion by the end of 2027 with a total of 12 Avangard-equipped missiles.²⁹

Russia has also been developing a new 'heavy' liquid-fuelled, silo-based ICBM, known as the RS-28 Sarmat (SS-X-29), as an additional replacement for the RS-20V. After many years of delay, Russia flight-tested its first RS-28 ICBM in April 2022.³⁰ However, no other RS-28 tests occurred in 2022, further delaying operational deployment of the missile.³¹ Despite the lack of tests, in November 2022 the general director of the Makeyeva State

²³ Karakaev (note 21).

²⁴ Karakaev (note 21); and authors' estimates.

²⁵ 'Два полка РВЧН в 2021 году будут перевооружены на ракетные комплексы "Ярс"' [Two regiments of the Strategic Rocket Forces will be re-equipped with 'Yars' missile systems in 2021], TASS, 21 Dec. 2020; Karakaev (note 21); and authors' assessment based on analysis of satellite imagery.

²⁶ Karakaev, S. V. (Col. Gen.), interviewed in Biryulin, R. and Andreev, D., 'Бесспорный аргумент России' [Russia's indisputable argument], *Krasnaya Zvezda*, 17 Dec. 2021; and Karakaev (note 21).

²⁷ Authors' assessment based on analysis of satellite imagery.

²⁸ President of Russia, 'Expanded meeting of the Defence Ministry Board', 21 Dec. 2021.

²⁹ President of Russia, [Ministry of Defence Board meeting] (note 15); and Karakaev (note 21).

³⁰ President of Russia, 'Test launch of Sarmat ICBM', 20 Apr. 2022.

³¹ 'Russia re-adjusts Sarmat intercontinental ballistic missiles' test-launch program—Source', TASS, 8 Nov. 2021; 'Часть районов Камчатки закроют на время испытания межконтинентальной баллистической ракеты' [Some areas of Kamchatka will be closed for the duration of the test of an intercontinental ballistic missile], *Kamchatka-Info*, 2 June 2022; and 'Путин: системы ПВО С-500 начали поступать в войска, МБР "Сармат" встанет на боевое дежурство до конца года' [Putin: S-500 air defence systems began to arrive with the troops, the Sarmat ICBM will be on combat duty before the end of the year], *Interfax*, 21 June 2022.

Rocket Centre stated that the RS-28 had already entered serial production.³² The first division to receive RS-28 ICBMs will be the ICBM division at Uzhur, Krasnoyarsk krai.³³ Satellite imagery indicates that one regiment's older RS-20Vs have already been removed to prepare for the incoming RS-28 ICBMs, although it is unlikely that any had been loaded into these silos by the end of 2022.

Other reported development programmes for future ICBMs include the Osina-RV (derived from the RS-24) and the Kedr project, which purportedly includes research and development on next-generation missile systems.³⁴

Russia reportedly conducted more than 200 small- and larger-scale exercises with road-mobile and silo-based ICBMs during 2022. These included combat patrols for road-mobile regiments, simulated launch exercises for silo-based regiments and participation in command staff exercises.³⁵ In December 2022 Karakaev noted that Russia plans to conduct eight ICBM flight tests in 2023, double the number of such tests in 2022.³⁶

Sea-based missiles

As of January 2023 the Russian Navy had a fleet of 11 operational nuclear-armed SSBNs. The fleet included five Soviet-era Delfin-class or Project 667BDRM (Delta IV) SSBNs and six Borei-class or Project 955 (Dolgorukiy) SSBNs. One new Borei-class SSBN entered service in 2022.³⁷

Russia plans to have a total of 10 Borei-class SSBNs, 5 assigned to the Northern Fleet (in the Arctic Ocean) and 5 to the Pacific Fleet, replacing all remaining Delfin-class SSBNs.³⁸ The three newest are of an improved design, known as Borei-A or Project 955A. After delays due to technical issues during sea trials, the first Borei-A was accepted into the navy in June 2020, the second in December 2021 and the third—the *Generalissimus Suvorov*—in December 2022.³⁹ A fourth Borei-A was launched in December 2022 and is

³² Emelyanenko, A., 'Генеральный конструктор Владимир Дегтярь: "Сармат" запущен в серийное производство' [General designer Vladimir Degtyar: 'Sarmat' has entered mass production], *Rossiiskaya Gazeta*, 23 Nov. 2022.

³³ Karakaev (note 21).

³⁴ Karakaev (note 26); Военно-болтовой (@warbolts), Telegram, 15 June 2021, <<https://t.me/warbolts/439>>; 'Russia develops new-generation Kedr strategic missiles system', TASS, 1 Mar. 2021; and 'Источник сообщил, что работа по созданию ракеты "Кедр" начнется в 2023–2024 годах' [Source says work on 'Kedr' rocket will begin in 2023–2024], TASS, 2 Apr. 2021.

³⁵ Karakaev (note 21).

³⁶ Karakaev (note 21).

³⁷ President of Russia, 'Церемония подъема флага на поступающих в состав ВМФ кораблях и спуска на воду атомной подлодки «Император Александр III»' [The ceremony of raising the flag on ships entering the Navy and launching the nuclear submarine 'Emperor Alexander III'], 29 Dec. 2022; and 'Russia's nuclear sub successfully tests Bulava missile', TASS, 3 Nov. 2022.

³⁸ 'Источник: еще две стратегические подлодки "Борей-А" построят на "Севмаше" к 2028 году' [Source: Two more 'Borei-A' strategic submarines to be built at 'Sevmash' by 2028], TASS, 30 Nov. 2020.

³⁹ 'Sevmash, 'На Севмаше состоялась церемония вывода из эллинга атомной подводной лодки «Генералиссимус Суворов»' [The commissioning ceremony of the nuclear submarine 'Generalissimus Suvorov' took place at Sevmash], 25 Dec. 2021; and President of Russia (note 37).

likely to be delivered to the navy no earlier than December 2023.⁴⁰ The next three Borei-A SSBNs are scheduled for delivery in the mid to late 2020s.⁴¹

Each of the 11 operational SSBNs can be equipped with 16 ballistic missiles and the Russian SSBN fleet can carry a total of 896 warheads.⁴² However, one or two SSBNs is normally undergoing repairs and maintenance at any given time and is not armed. It is also possible that the warhead load on some missiles has been reduced to meet the total warhead limit under New START. As a result, SIPRI estimates that only about 640 of the 896 warheads have been deployed. The Delfin SSBNs are thought to carry RSM-54 SLBMs, either the Sineva (SS-N-23 M2) or a modified version, known as Layner (SS-N-23 M3), while the Borei and Borei-A SSBNs carry newer RSM-56 Bulava (SS-N-32) SLBMs.

In 2022 the Russian Navy continued to develop the Poseidon or Status-6 (Kanyon), a long-range, strategic nuclear-powered torpedo intended for deployment on two new types of special-purpose submarine: the K-329 *Belgorod* or Project 09852—a converted Antei-class or Project 949A (Oscar II) nuclear-powered guided-missile submarine (SSGN); and the Khabarovsk class or Project 09851.⁴³ Despite an apparent aborted test of the torpedo in November 2022, Russian defence sources indicated that ‘the first batch’ of Poseidon torpedoes had been produced and would soon be delivered to the *Belgorod*.⁴⁴ The official handover of the *Belgorod* to the Russian fleet took place in July 2022.⁴⁵ Following its delivery, the submarine was spotted operating in the Barents Sea throughout September 2022.⁴⁶ The *Belgorod* and the Khabarovsk submarines will each be capable of carrying up to six Poseidon torpedoes.⁴⁷

⁴⁰ President of Russia (note 37).

⁴¹ Sevmasht, ‘На Севмаше заложили атомные подводные крейсера «Дмитрий Донской» и «Князь Потемкин»’ [Nuclear-powered submarine cruisers ‘Dmitry Donskoy’ and ‘Prince Potemkin’ laid down at Sevmasht], 23 Aug. 2021.

⁴² The Delfin-class SSBNs carry RSM-54 Sineva/Layner (SS-N-23 M2/3) SLBMs, while the Borei and Borei-A SSBNs carry RSM-56 Bulava (SS-N-32) SLBMs. Each RSM-54 can carry up to 4 warheads, while each RSM-56 can carry up to 6 warheads. It is assumed that each RSM-56 has had its warhead load reduced to 4 warheads, to meet New START limits.

⁴³ Sutton, H. I., ‘Khabarovsk-class-submarine’, *Covert Shores*, 20 Nov. 2020; and Sutton, H. I., ‘Poseidon torpedo’, *Covert Shores*, 22 Feb. 2019.

⁴⁴ Sciutto, J., ‘US observed Russian navy preparing for possible test of nuclear-powered torpedo’, CNN, 10 Nov. 2022; and ‘First batch of nuclear-armed drones Poseidon manufactured for special-purpose sub Belgorod’, TASS, 15 Jan. 2023.

⁴⁵ ‘Shipbuilders deliver special-purpose sub with nuclear-powered drones to Russian Navy’, TASS, 8 July 2022.

⁴⁶ Sutton, H. I., ‘New images reveal Russia’s “missing” submarine Belgorod in Arctic’, *Naval News*, 5 Oct. 2022.

⁴⁷ ‘Вторую подлодку-носитель “Посейдонов” планируют спустить на воду весной–летом 2021 года’ [Second ‘Poseidon’ carrier submarine to be launched in spring–summer 2021], TASS, 6 Nov. 2020.

Non-strategic nuclear forces

There is no universally accepted definition of ‘tactical’, ‘non-strategic’ or ‘theatre’ nuclear weapons. These terms generally refer to shorter-range weapons that are not covered by arms control agreements regulating long-range strategic forces. Russia’s non-strategic nuclear weapons chiefly serve to compensate for perceived conventional inferiority relative to NATO forces; to provide regional (as opposed to intercontinental) deterrence options; and to maintain overall parity with the total US nuclear force level. There has been considerable debate among Western officials and experts about the role that non-strategic nuclear weapons have in Russian nuclear strategy, including potential first use.⁴⁸

The US Defense Intelligence Agency estimated in 2021 that Russia had 1000–2000 non-strategic warheads.⁴⁹ SIPRI estimates that, as of January 2023, Russia had approximately 1816 warheads assigned for potential use by non-strategic forces—around 96 fewer than the previous year due to a reduction in the number of older launchers; however, these estimates come with a high degree of uncertainty. Most Russian delivery systems for non-strategic nuclear weapons are dual-capable, meaning that they can also deliver conventional warheads. They are intended for use by ships and submarines, aircraft, air- and missile-defence systems, and in army missiles.

Navy weapons

The Russian navy is estimated to have 835 warheads assigned for use by land-attack cruise missiles, anti-ship cruise missiles, anti-submarine rockets, depth bombs, and torpedoes delivered by surface ships, submarines and naval aviation.

The nuclear version of the long-range, land-attack Kalibr sea-launched cruise missile (SLCM), also known as the 3M-14 (SS-N-30A), is a significant

⁴⁸ On this debate see e.g. US Department of Defense, *Nuclear Posture Review 2018* (DOD: Washington, DC, Feb. 2018), p. 30; Kofman, M. and Fink, A. L., ‘Escalation management and nuclear employment in Russian military strategy’, *War on the Rocks*, 23 June 2020; Oliker, O., ‘Moscow’s nuclear enigma: What is Russia’s arsenal really for?’, *Foreign Affairs*, Nov./Dec. 2018; Stowe-Thurston, A., Korda, M. and Kristensen, H. M., ‘Putin deepens confusion about Russian nuclear policy’, *Russia Matters*, Harvard Kennedy School, 25 Oct. 2018; Tertrais, B., ‘Russia’s nuclear policy: Worrying for the wrong reasons’, *Survival*, vol. 60, no. 2 (Apr. 2018); Ven Bruusgaard, K., ‘The myth of Russia’s lowered nuclear threshold’, *War on the Rocks*, 22 Sep. 2017; and Kaushal, S. and Cranny-Evans, S., ‘Russia’s nonstrategic nuclear weapons and its views on limited nuclear war’, *Royal United Services Institute*, 21 June 2022.

⁴⁹ Berrier, S., Director, US Defense Intelligence Agency, ‘Worldwide threat assessment’, Statement for the record, US Senate, Armed Services Committee, 26 Apr. 2021.

new addition to the navy's stock of weapons.⁵⁰ It has been integrated on numerous types of surface ship and attack submarine, including the new Yasen/Yasen-M or Project 885/885M (Severodvinsk) SSGN.⁵¹ The third boat of this class was delivered to the Pacific Fleet in December 2021 and became operational in 2022.⁵² Three additional Project 885M SSGNs are currently being built.

In addition to the 3M-14, the Project 855M SSGNs will be armed with the 3M-55 (SS-N-26) SLCM and the future 3M-22 Tsirkon (SS-NX-33) hypersonic anti-ship missile. Test launches of the latter missile were conducted in October 2022, and it is scheduled to enter service in 2026.⁵³

Air force weapons

Approximately 506 non-strategic nuclear weapons are assigned to the Russian Air Force for use by Tu-22M3M (Backfire-C) intermediate-range bombers, Su-24M (Fencer-D) fighter-bombers, Su-34 (Fullback) fighter-bombers and MiG-31K (Foxhound) attack aircraft.⁵⁴ The new Su-57 (Felon) combat aircraft is also dual-capable. Deliveries began in 2020 and continued in 2022.⁵⁵

The MiG-31K is equipped with the new 9A-7760 Kinzhal air-launched ballistic missile (ALBM). In 2022 it was operational with the Southern Military District and Northern Fleet and will eventually be integrated into the Western and Central Military Districts by 2024.⁵⁶ The first combat use of a conventional Kinzhal took place in March 2022 during the invasion of

⁵⁰ There is considerable confusion about the designation of what is commonly referred to as the Kalibr missile. The Kalibr designation actually refers not to a specific missile but to a launcher for a family of weapons that, in addition to the 3M-14 (SS-N-30/A) land-attack versions, includes the 3M-54 (SS-N-27) anti-ship cruise missile and the 91R anti-submarine missile. For further detail see US Navy, Office of Naval Intelligence (ONI), *The Russian Navy: A Historic Transition* (ONI: Washington, DC, Dec. 2015), pp. 34–35.

⁵¹ It is important to caution that, although a growing number of vessels are capable of launching the dual-capable 3M-14, it is uncertain how many of them have been assigned a nuclear role.

⁵² Manaranche, M., 'Yasen-M class SSGN "Novosibirsk" begins its sea trials', *Naval News*, 2 July 2021; Sevmash, 'На Севмаше состоялась церемония передачи Военно-морскому флоту двух атомных подводных лодок—"Князь Олег" и "Новосибирск"' [Sevmash held a hand-over to the Navy ceremony of two nuclear submarines—"Prince Oleg" and 'Novosibirsk'], 21 Dec. 2021; and 'Perm sub with Tsirkon hypersonic missiles to enter service with Russian Navy in 2026', TASS, 5 Jan. 2023.

⁵³ 'Perm sub with Tsirkon hypersonic missiles to enter service' (note 52).

⁵⁴ US Department of Defense, 'US nuclear deterrence policy', 1 Apr. 2019, p. 3; International Institute for Strategic Studies, *The Military Balance 2021* (Routledge: London, 2021); and authors' estimates. It is possible that the Su-30SM is also capable of delivering nuclear weapons.

⁵⁵ D'Urso, S., 'First serial production Su-57 Felon delivered to the Russian Aerospace Forces', *The Aviationist*, 30 Dec. 2020; Rob Lee (@RALee85), Twitter, 3 Feb. 2022, <<https://twitter.com/RALee85/status/1489302156729593869>>; and United Aircraft Corporation (UAC), 'ОАК передала Минобороны очередную партию серийных самолетов пятого поколения Су-57' [UAC handed over another batch fifth-generation Su-57s to the Defence Ministry], 28 Dec. 2022.

⁵⁶ President of Russia (note 28); 'Russia's upgraded MiG-31 fighters to provide security for Northern Sea Route', TASS, 26 Nov. 2021; and Kretsul, R. and Cherepanova, A., 'Прибавить гиперзвук: еще один военный округ вооружат «Кинжалами»' [Hypersonic boost: Another military district to be armed with 'Daggers'], *Izvestia*, 7 June 2021.

Ukraine: according to Sergei Shoigu, the Russian minister of defence, it had been used at least three times as of August 2022.⁵⁷

Russia has also begun introducing the nuclear-capable Kh-32 (AS-4A) air-to-surface missile. This is an upgrade of the Kh-22N (AS-4) used on the Tu-22M3.⁵⁸

Air-, coastal- and missile-defence weapons

Russian air-, coastal- and missile-defence forces are estimated to have around 385 nuclear warheads. Most have been assigned for use by dual-capable S-300 and S-400 air-defence forces and the Moscow A-135 missile-defence system. Russian coastal-defence units are believed to have been assigned a small number of nuclear weapons for anti-ship missions.

It is likely that the stock of warheads associated with Russia's air-, coastal- and missile-defence forces will eventually decrease as conventional air-defences improve—including the Nudol and Aerostat systems under development in 2022—and as legacy warheads are retired.

Army weapons

The Russian Army has an estimated 90 warheads to arm 9K720 Iskander-M (SS-26) short-range ballistic missiles (SRBMs) and 9M729 (SSC-8) ground-launched cruise missiles (GLCMs). As of January 2023 the dual-capable Iskander-M had completely replaced the Tochka (SS-21) SRBM in 12 missile brigades.⁵⁹ Unconfirmed rumours suggest that the 9M728 (SSC-7) may also have a nuclear capability.

The dual-capable 9M729 GLCM was cited by the USA as its main reason for withdrawing from the 1987 Treaty on the Elimination of Intermediate-range and Shorter-range Missiles (INF Treaty) in 2019.⁶⁰ SIPRI estimates that four or five 9M729 battalions have so far been co-deployed with four or five of the Iskander-M brigades. In 2020 and 2021 Russia indicated a willingness to impose a moratorium or a ban on future 9M729 deployments in European territory, subject to conditions.⁶¹

⁵⁷ 'Shoigu reveals Kinzhal hypersonic missile was used three times during special operation', TASS, 21 Aug. 2022.

⁵⁸ US Department of Defense (note 48), p. 8.

⁵⁹ Authors' assessment based on analysis of satellite imagery.

⁶⁰ US Department of State, Bureau of Arms Control, Verification and Compliance, 'INF Treaty at a glance', Fact sheet, 8 Dec. 2017. For a summary and other details of the INF Treaty see annex A, section III, in this volume. See also Topychkanov, P. and Davis, I., 'Russian-US nuclear arms control and disarmament', *SIPRI Yearbook 2020*; and Kile, S. N., 'Russian-US nuclear arms control and disarmament', *SIPRI Yearbook 2018*.

⁶¹ President of Russia, 'Statement by Vladimir Putin on additional steps to de-escalate the situation in Europe after the termination of the Intermediate-Range Nuclear Forces Treaty (INF Treaty)', 26 Oct. 2020; and Russian Ministry of Foreign Affairs, 'Agreement on Measures to Ensure the Security of the Russian Federation and Member States of the North Atlantic Treaty Organization: Draft', Unofficial translation, 17 Dec. 2021. See also Kristensen, H. M. and Korda, M., 'Russian nuclear forces', *SIPRI Yearbook 2020*, p. 356.