

## II. Russian nuclear forces

HANS M. KRISTENSEN AND MATT KORDA

As of January 2022, Russia maintained a military stockpile of approximately 4477 nuclear warheads, around 20 fewer than the estimate for January 2021. About 2565 of these were offensive strategic warheads, of which roughly 1588 were deployed on land- and sea-based ballistic missiles and at bomber bases. Russia also possessed approximately 1912 non-strategic (tactical) nuclear warheads. All of the non-strategic warheads are thought to be at central storage sites.<sup>1</sup> An estimated additional 1500 retired warheads were awaiting dismantlement (260 fewer than the estimate for 2021), giving a total inventory of approximately 5977 warheads (see table 10.3).

These estimates are based on publicly available information about the Russian nuclear arsenal and the authors' estimates. Because of a lack of transparency, estimates and analysis of Russia's nuclear weapon developments come with considerable uncertainty, particularly with regard to Russia'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 interviews with military officials.<sup>2</sup>

In September 2021 Russia declared 1458 deployed warheads attributed to 527 strategic launchers, thus remaining in compliance with the final warhead limits prescribed by the 2010 Russian–United States Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START).<sup>3</sup> This treaty places a cap on the numbers of Russian and US deployed strategic nuclear forces. The numbers of deployed warheads presented here differ from the numbers reported under New START because the treaty attributes one weapon to each deployed bomber, even though bombers do not carry weapons under normal circumstances. Additionally, the treaty does not count weapons in storage 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.

<sup>1</sup> For an overview of Russia's nuclear weapon storage facilities see Podvig, P. and Serrat, J., *Lock Them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe* (United Nations Institute for Disarmament Research: Geneva, 2017).

<sup>2</sup> Kristensen, H. M. and Korda, M., 'Estimating world nuclear forces: An overview and assessment of sources', SIPRI Topical Backgrounder, 14 June 2021.

<sup>3</sup> US Department of State, Bureau of Arms Control, Verification and Compliance, 'New START Treaty aggregate numbers of strategic offensive arms', Fact sheet, 1 Sep. 2021. For a summary and other details of New START see annex A, section III. On the negotiation of the renewal of New START see chapter 11, section I, in this volume.

**Table 10.3.** Russian nuclear forces, January 2022

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) <sup>a</sup>	Warheads x yield	No. of warheads <sup>b</sup>
<b>Strategic nuclear forces</b>	<b>516</b>				<b>2 565<sup>c</sup></b>
<i>Aircraft (bombers)</i>	68 <sup>d</sup>				580 <sup>e</sup>
Tu-95MS6/16/M (Bear-H) <sup>f</sup>	55	1984/ 2015	6 500– 10 500	6–16 x 200 kt AS-15A or AS-23B ALCMs	448
Tu-160/M/M2 (Blackjack)	13	1987/ 2021	10 500– 13 200	12 x 200 kt AS-15A or AS-23B ALCMs, bombs	132
<i>Land-based missiles (ICBMs)</i>	306				1 185 <sup>g</sup>
RS-20V Voevoda (SS-18 Satan)	40	1988	11 000– 15 000	10 x 500–800 kt	400 <sup>h</sup>
RS-18 (SS-19 Stiletto)	0	1980	10 000	6 x 400 kt	0 <sup>i</sup>
Avangard (SS-19 Mod 4) <sup>j</sup>	6	2019	10 000	1 x HGV	6
RS-12M Topol (SS-25 Sickle)	9 <sup>k</sup>	1988	10 500	1 x 800 kt	9
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)	153	2010	10 500	[4 x 250 kt]	612 <sup>l</sup>
RS-24 Yars (SS-27 Mod 2/silo)	20	2014	10 500	4 x [250 kt]	80
RS-28 Sarmat (SS-X-29)	..	[2022]	>10 000	[10 x 500 kt]	–
<i>Sea-based missiles (SLBMs)</i>	10/160 <sup>m</sup>				800 <sup>n</sup>
RSM-50 Volna (SS-N-18 M1 Stingray)	0/0	1978	6 500	3 x 50 kt	0 <sup>o</sup>
RSM-54 Sineva/Layner (SS-N-23 M2/3)	5/80	2007/ 2014	9 000	4 x 100 kt <sup>p</sup>	320 <sup>q</sup>
RSM-56 Bulava (SS-N-32)	5/80	2012	>8 050	[6 x 100 kt]	480 <sup>r</sup>
<b>Non-strategic nuclear forces</b>					<b>1 912<sup>s</sup></b>
<i>Navy weapons</i>	..				935
Submarines/surface ships/naval aircraft	..		Land-attack cruise missiles, sea-launched cruise missiles, anti-submarine weapons, surface-to-air missiles, depth bombs, torpedoes <sup>t</sup>		935
<i>Air force weapons</i>	260				500
Tu-22M3 (Backfire-C)	60	1974	..	3 x ASMs, bombs	300
Su-24M/M2 (Fencer-D)	70	1974	..	2 x bombs	70 <sup>u</sup>
Su-34 (Fullback)	120	2006	..	2 x bombs	120 <sup>u</sup>
Su-57 (Felon)	–	[2024]	..	[bombs, ASMs]	..
MiG-31K (Foxhound)	10	2018	..	1 x ALBM	10

Type/ Russian designation (NATO designation)	No. of launchers	Year first deployed	Range (km) <sup>a</sup>	Warheads x yield	No. of warheads <sup>b</sup>
<i>Air, coastal and missile defence</i>	886				387
53T6 (SH-08, Gazelle)	68	1986	30	1 x 10 kt	68
S-300/400 (SA-20/21)	750 <sup>v</sup>	1992/ 2007	..	1 x low kt	290
3M55/P-800 Oniks (SS-N-26 Strobile), 3K55/K300-P Bastion (SSC-5 Stooge)	60	2015	>400	1 x [10–100 kt]	25
SPU-35V Redut (SSC-1B Sepal)	8 <sup>w</sup>	1973	500	1 x 350 kt	4
<i>Army weapons</i>	164				90
9K720 Iskander-M (SS-26 Stone), 9M728 Iskander-K (SSC-7 Southpaw)	144	2005	350	1 x [10–100 kt]	70 <sup>x</sup>
9M729 (SSC-8)	20	2016	2 350	1 x [10–100 kt]	20 <sup>y</sup>
<b>Total stockpile</b>					<b>4 477</b>
Deployed warheads					1 588
Reserve warheads					2 889
<b>Retired warheads awaiting dismantlement</b>					<b>1 500</b>
<b>Total inventory</b>					<b>5 977</b>

.. = data 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.

<sup>a</sup> 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.

<sup>b</sup> 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 air bases.

<sup>c</sup> Approximately 1588 of these strategic warheads 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 one 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.

<sup>d</sup> All of Russia's long-range strategic bombers are nuclear-capable. Of these, only about 50 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.

<sup>e</sup> The maximum possible payload on the bombers is more than 800 nuclear weapons but, given that only some of the bombers are fully operational, SIPRI estimates that only about 580 weapons have been assigned to the long-range bomber force, of which approximately 200 might be deployed and stored at the two strategic bomber bases. The remaining weapons are thought to be in central storage facilities.

<sup>f</sup> There are two types of Tu-95MS aircraft: the Tu-95MS6, which can carry 6 AS-15A missiles internally; and the Tu-95MS16, which can carry an additional 10 AS-15A missiles externally, for a total of 16 missiles. Both types were being modernized in 2021. The modernized aircraft (Tu-95MSM) can carry 8 AS-23B missiles externally and possibly 6 internally, for a total of 14 missiles.

<sup>g</sup> These ICBMs can carry a total of 1185 warheads, but SIPRI estimates that they have had their warhead load reduced to approximately 812 warheads, with the remaining warheads in storage.

<sup>h</sup> It is possible that, as of Jan. 2022, the RS-20Vs carried only five warheads each to meet the New START limit for deployed strategic warheads. It is also possible that one of the four RS-20V regiments started an upgrade in late 2021 to convert to the Avangard.

<sup>i</sup> It is possible that the remaining RS-18s have been retired, although activities continued at some regiments.

<sup>j</sup> The missile uses a modified RS-18 ICBM booster with an HGV payload.

<sup>k</sup> It is possible that one regiment at Barnaul, Altai krai, has not yet completed upgrade to RS-24. In 2021 one additional regiment at Yurya, Kirov oblast, had nine RS-12M launchers and was expected to upgrade to the RS-24 in 2022; however, the regiment served a back-up launch transmission function and was not nuclear-armed. Therefore, it is not included in this table.

<sup>l</sup> Two more road-mobile regiments were being upgraded from RS-12M to RS-24. It is possible that, as of Jan. 2022, the RS-24s carried only three warheads each to meet the New START limit on deployed strategic warheads.

<sup>m</sup> 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 10 operational SSBNs in 2021, 1 or 2 were in overhaul at any given time and did not carry their assigned nuclear missiles and warheads (see note n).

<sup>n</sup> 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, one or two SSBNs were in overhaul and did not carry nuclear weapons. Therefore, it is estimated here that only around 576 of the 800 SLBM warheads have been deployed.

<sup>o</sup> The last remaining Delta III-class SSBN was converted to an attack submarine in mid 2021. Therefore, it no longer carries the RSM-50.

<sup>p</sup> 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. In 2006 US intelligence estimated that the 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.

<sup>q</sup> SIPRI estimates that, at any given time, only 256 of these warheads have been deployed on four operational Delta IV submarines, with the fifth boat in overhaul. The actual number may even be lower as two boats often undergo maintenance at the same time.

<sup>r</sup> It is possible that, as of Jan. 2022, Bulava SLBMs carried only four warheads each for Russia to meet the New START limit on deployed strategic warheads.

<sup>s</sup> 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.

<sup>t</sup> Only submarines are assumed to be assigned nuclear torpedoes.

<sup>u</sup> These estimates assume that half of the aircraft have a nuclear role.

<sup>v</sup> As of Jan. 2022, 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.

<sup>w</sup> 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. 2022.

<sup>x</sup> 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’.

<sup>y</sup> This figure assumes that there are five 9M729 battalions, each with four launchers, for a total of 80 missiles. Each launcher is assumed to have at least one 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 about 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), *Nuclear Posture Review 2018* (DOD: Arlington, VA, Feb. 2018); DOD, *2019 Missile Defense Review* (DOD: Arlington, VA, 2019); US Office of the Deputy Assistant Secretary of Defense for Nuclear Matters, *Nuclear Matters Handbook 2020* (DOD: Arlington, VA, 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 role of nuclear weapons in Russian military doctrine

Russia’s 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’.<sup>4</sup> This formulation is largely consistent with previous public iterations of Russian nuclear policy, despite US allegations of a shift towards greater reliance on potential first use of nuclear weapons (see section I).<sup>5</sup>

## Strategic nuclear forces

As of January 2022, Russia had an estimated 2565 warheads assigned for potential use by strategic launchers: long-range bombers, land-based intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs). This is a decrease of approximately 20 warheads compared with January 2021, due to fluctuations in the arsenal caused by the gradual replacement of some heavy ICBMs with newer ICBMs that carry fewer warheads, as well as the dismantlement of two SSBNs.

<sup>4</sup> 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.

<sup>5</sup> US Department of Defense (DOD), *Nuclear Posture Review 2018* (DOD: Arlington, VA, Feb. 2018), p. 30.

*Aircraft and air-delivered weapons*

As of January 2022, Russia's Long-Range Aviation command operated a fleet of approximately 68 operational heavy bombers, comprising 13 Tu-160 (Blackjack) and 55 Tu-95MS (Bear) bombers.<sup>6</sup> Not all of these counted as deployed under New START and some were undergoing various upgrades. The maximum possible payload on the bombers is more than 800 nuclear weapons but, since only some 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.<sup>7</sup>

Modernization of the bombers—which includes upgrades to their avionics suites, engines and long-range nuclear and conventional cruise missiles—continued but remained subject to delays.<sup>8</sup> The upgraded Tu-95MS is known as the Tu-95MSM and the upgraded Tu-160 is known as the Tu-160M. The upgraded bombers are capable of carrying the new Kh-102 (AS-23B) nuclear air-launched cruise missile. In his end-of-year defence report, President Vladimir Putin indicated that four Tu-95MS aircraft were upgraded in 2021 and delivery of two Tu-160Ms was scheduled for 2022.<sup>9</sup> It seems likely that all of the Tu-160s and most of the Tu-95s will eventually be upgraded to maintain a bomber force of perhaps 50–60 operational aircraft. Russia has also resumed production of the Tu-160M airframes to produce at least 10 brand-new Tu-160M2 bombers with new engines and advanced communications suites.<sup>10</sup> The maiden flight of the first Tu-160M2 was initially expected in late 2021, but was delayed until January 2022.<sup>11</sup>

The modernized Tu-95MSM, Tu-160M and Tu-160M2 bombers are intended to be only a temporary bridge to Russia's next-generation bomber: the PAK-DA. This is a subsonic aircraft whose flying-wing design may look similar to that of the USA's B-2 bomber. Construction of the first PAK-DA's cockpit reportedly began in May 2020, with final assembly of the first aircraft postponed from 2021 to 2023, and serial production expected to begin in

<sup>6</sup> 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).

<sup>7</sup> Podvig, P., 'Strategic aviation', Russian Strategic Nuclear Forces, 7 Aug. 2021.

<sup>8</sup> President of Russia, 'Meeting with workers of Gorbunov Kazan aviation factory and Tu-160M pilots', 25 Jan. 2018.

<sup>9</sup> President of Russia, 'Expanded meeting of the Defence Ministry Board', 21 Dec. 2021.

<sup>10</sup> 'Tu-160M2, Tu-22M3M bombers to get communications suite from latest Su-57 fighter', TASS, 12 Aug. 2020.

<sup>11</sup> 'First newly-built Tu-160M to make maiden flight in 4th quarter of 2021', TASS, 30 Dec. 2020; and United Aircraft Corporation (@UAC\_Russia\_eng), 'Today, the first newly manufactured strategic missile carrier Tu-160M performed its maiden flight from the airfield of the Kazan Aviation Plant. The flight took place at an altitude of 600 meters and lasted about 30 minutes', Twitter, 12 Jan. 2022.

2028 or 2029.<sup>12</sup> The PAK-DA will eventually replace all Tu-95s and Tu-160s as well as the Tu-22s deployed with non-strategic forces (see below).<sup>13</sup>

### *Land-based missiles*

As of January 2022, Russia's Strategic Rocket Forces (SRF)—the branch of the armed forces that controls land-based ICBMs—consisted of 12 missile divisions grouped into 3 armies, deploying an estimated 306 ICBMs of different types and variations (see table 10.3).<sup>14</sup> These ICBMs can carry a maximum of about 1185 warheads, but SIPRI estimates that they have had their warhead load reduced to around 812 warheads, to keep Russia below the New START limit for deployed strategic warheads. These ICBMs carry approximately half of Russia's estimated 1588 deployed strategic warheads.

At the end of 2021, Russia's ICBM force was most of the way through a significant modernization programme to replace all Soviet-era missiles with new types. The missiles will not be replaced on a one-for-one basis, meaning that Russia will probably have fewer missiles after the modernization is completed. The programme also involves substantial reconstruction of silos, launch control centres, garrisons and support facilities.<sup>15</sup> The modernization programme, which began in the late 1990s, appears to be progressing more slowly than previously envisioned. In December 2021 Colonel General Sergey Karakaev, commander of the SRF, stated that around 83 per cent of the ICBM force had been modernized, which is significantly lower than the goal announced in 2014 of 97 per cent of modernization completed by the end of 2020.<sup>16</sup> In November 2020 the chief designer of the RS-24 Yars (SS-27 Mod 2) missile suggested that the last Soviet-era ICBM would be phased out by 2024.<sup>17</sup> However, this seems unlikely based on SIPRI's assessment of the probable time frame for replacing the RS-20V (SS-18) (see below).

The bulk of the modernization programme has focused on the RS-24 Yars, a version of the RS-12M1/2 Topol-M (SS-27 Mod 1) deployed with multiple independently targetable re-entry vehicles (MIRVs). In December 2020

<sup>12</sup> '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; and Lavrov, A., Kretsul, R. and Ramm, A., [PAKage agreement: The latest bomber assigned a deadline for production], *Izvestia*, 14 Jan. 2020 (in Russian).

<sup>13</sup> 'Russia to test next-generation stealth strategic bomber', TASS, 2 Aug. 2019.

<sup>14</sup> One of these ICBM divisions, the 40th missile regiment at Yurya, Kirov oblast, was being modernized alongside the rest of the ICBM force; however, the regiment's ICBMs are believed to serve as back-up launch code transmitters and therefore have not been armed with nuclear weapons.

<sup>15</sup> See e.g. Kristensen, H. M., 'Russian ICBM upgrade at Kozelsk', FAS Strategic Security Blog, Federation of American Scientists, 5 Sep. 2018.

<sup>16</sup> [Russia's indisputable argument], Interview with Karakaev, S. V. (Col. Gen.), *Krasnaya Zvezda*, 17 Dec. 2021 (in Russian); and 'Russian TV show announces new ICBM to enter service soon', TRK Petersburg Channel 5, 21 Apr. 2014, Translation from Russian, BBC Monitoring.

<sup>17</sup> 'Russia to complete rearming Strategic Missile Force with advanced Yars ICBMs by 2024', TASS, 2 Nov. 2020.

the Russian Ministry of Defence's television channel declared that approximately 150 mobile and silo-based RS-24 ICBMs had been deployed.<sup>18</sup> SIPRI estimates that, as of January 2022, this number had grown to approximately 173 mobile- and silo-based RS-24 missiles, including four completed mobile divisions (Irkutsk, Nizhniy Tagil, Novosibirsk and Yoshkar-Ola), with two more in progress (Barnaul and Vypolzovo—sometimes referred to as Bologovsky).<sup>19</sup> The upgrade to the Barnaul division was scheduled for completion by April 2022, and 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.<sup>20</sup> In addition, one completed mobile division at Teykovo, Ivanovo oblast, was equipped with both the single-warhead RS-12M1 Topol-M (SS-27 Mod 1) and MIRV-equipped RS-24 ICBMs. The first silo-based RS-24s have been installed at Kozelsk, Kaluga oblast; one regiment of 10 silos was completed in 2018, and the second regiment was completed in 2020.<sup>21</sup> In December 2021 Colonel General Karakaev announced that the third regiment at Kozelsk had begun combat duty with new RS-24 ICBMs; however, commercial satellite imagery indicated that the necessary infrastructure upgrades had only been completed at a couple of the regiment's silos.<sup>22</sup> Given how long it took to upgrade the previous two regiments, it is unlikely that the third regiment will be completed by the 2024 target date. 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 its first regiment of six RS-18 (SS-19 Mod 4) missiles equipped with the Avangard hypersonic glide vehicle (HGV) system.<sup>23</sup> The missiles were installed in former RS-20V silos at Dombarovsky, Orenburg oblast. Russia has been installing Avangard-equipped missiles at a rate of two per year in upgraded complexes with new facilities, fences and Dym-2 perimeter defence systems.<sup>24</sup> Russia plans to install the first two missiles in the second Avangard regiment at Dombarovsky in 2022 or 2023 (construction was already well under way in

<sup>18</sup> Levin, E., [Strategic Rocket Forces commander names the number of Yars complexes entering combat duty], *Krasnaya Zvezda*, 8 Dec. 2020 (in Russian).

<sup>19</sup> Tikhonov, A., [You won't catch them by surprise], *Krasnaya Zvezda*, 28 May 2018 (in Russian); and [The commander of the Strategic Missile Forces announced the completion of the rearmament of the Tagil division], RIA Novosti, 29 Mar. 2018 (in Russian).

<sup>20</sup> [The Barnaul division of the Strategic Missile Forces will be completely re-equipped with the Yars complex in 2022], TASS, 20 Jan. 2022 (in Russian); and authors' estimates.

<sup>21</sup> [Two regiments of the Strategic Rocket Forces will be re-equipped with 'Yars' missile systems in 2021], TASS, 21 Dec. 2020 (in Russian); and authors' assessment based on observation of satellite imagery.

<sup>22</sup> [Russia's indisputable argument] (note 16); and authors' assessment based on observation of satellite imagery.

<sup>23</sup> President of Russia (note 9).

<sup>24</sup> Russia Insight, 'BREAKING! Russia's new top secret "toy" revealed: "Dym" small arms system protects RS-24 Yars ICBMs', YouTube, 21 Dec. 2018.



2021), with the entire regiment's rearmament scheduled for completion by the end of 2027.<sup>25</sup>

Russia has also been developing a new 'heavy' liquid-fuelled, silo-based ICBM, known as the RS-28 Sarmat (SS-X-29), as a replacement for the RS-20V. Like its predecessor, the RS-28 is expected to carry a large number of MIRVs (possibly as many as 10), but some might be equipped with one or more Avangard HGVs. After manufacturing-related delays, full-scale flight testing of the RS-28 was scheduled to begin in early 2022 at the new proving ground at Severo-Yeniseysky, Krasnoyarsk krai, with serial production expected to begin in mid 2022—although this would depend on a successful flight-test programme.<sup>26</sup> In December 2021 Colonel General Karakaev announced that the first RS-28 ICBMs would assume combat duty at the ICBM complex at Uzhur, Krasnoyarsk krai, sometime in 2022.<sup>27</sup> Satellite imagery indicates that, as of January 2022, the regiment's older RS-20Vs had already been removed to prepare for the incoming RS-28 ICBMs.<sup>28</sup>

In December 2021 Karakaev also declared the development of 'a new mobile ground-based missile system'. This could be a reference to the development programme for the future Osina-RV ICBM, which is reportedly derived from the RS-24.<sup>29</sup> It is also possible that Karakaev was referring to Russia's 'Kedr' project, which reportedly includes research and development on next-generation missile systems.<sup>30</sup> The Kedr ICBM will probably be fielded sometime around 2030.

Russia conducted several small- and larger-scale exercises with road-mobile and silo-based ICBMs during 2021. These included combat patrols for road-mobile regiments, simulated launch exercises for silo-based regiments, and participation in command staff exercises.<sup>31</sup>

### *Sea-based missiles*

As of January 2022, the Russian Navy had a fleet of 10 operational nuclear-armed SSBNs. The fleet included five Soviet-era Delfin-class or Project 667BDRM (Delta IV) SSBNs and five (of a planned total of 10) Borei-class or Project 955 (Dolgorukiy) SSBNs. The number of SSBNs is lower

<sup>25</sup> [Russia's indisputable argument] (note 16); and 'Russia's 1st regiment of Avangard hypersonic missiles to go on combat alert by yearend', TASS, 10 Aug. 2021.

<sup>26</sup> President of Russia (note 9); Safronov, I. and Nikolsky, A., [Tests of the latest Russian nuclear missile start at the beginning of the year], *Vedomosti*, 29 Oct. 2019 (in Russian); and Военно-болтовой (@warbolts), [This is not the first time in the course of litigation details are revealed about the progress of the ROC on the creation of advanced weapons. . .], Telegram, 4 Jan. 2022 (in Russian).

<sup>27</sup> [Russia's indisputable argument] (note 16).

<sup>28</sup> Authors' assessment based on observation of satellite imagery.

<sup>29</sup> [Russia's indisputable argument] (note 16); and Военно-болтовой (@warbolts), [The missile system with the index '15P182' is being created by JSC 'Corporation' MIT], Telegram, 15 June 2021 (in Russian).

<sup>30</sup> 'Russia develops new-generation Kedr strategic missiles system', TASS, 1 Mar. 2021.

<sup>31</sup> See e.g. 'Yars ICBM launchers embark on combat patrols in Siberia drills', TASS, 26 July 2021.

than the previous year's estimate because in 2021 Russia's last Kalmar-class or Project 667BDR (Delta III) SSBN was reclassified as a multi-purpose submarine, and one Delfin-class SSBN was withdrawn from the navy to prepare for its disposal in 2022.<sup>32</sup>

The two newest Borei submarines 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.<sup>33</sup> The second Borei-A was delivered to the navy in December 2021, following a test launch of a Bulava SLBM from the vessel in October.<sup>34</sup> The third Borei-A was launched in December 2021, meaning that it is not expected to be delivered to the navy before December 2022.<sup>35</sup> The next four Borei-A SSBNs are scheduled for delivery in the mid to late 2020s; the first two keels were laid in 2015 and 2016, while the last two keels were laid in August 2021.<sup>36</sup> Eventually, five Borei SSBNs will be assigned to the Northern Fleet (in the Arctic Ocean) and five will be assigned to the Pacific Fleet, replacing all remaining Delfin-class SSBNs.<sup>37</sup>

Each of the 10 operational SSBNs can be equipped with 16 ballistic missiles and the Russian SSBN fleet can carry a total of 800 warheads.<sup>38</sup> However, one or two SSBNs are normally undergoing repairs and maintenance at any given time and are 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 576 of the 800 warheads have been deployed.

In 2021 the Russian Navy continued to develop the Poseidon or Status-6 (Kanyon), a long-range, strategic nuclear-powered torpedo intended for future deployment on two new types of special-purpose submarine: (a) the K-329 Belgorod or Project 09852—a converted Antei-class or Project 949A (Oscar-II) guided-missile submarine (SSGN)—and (b) the Khabarovsk-class

<sup>32</sup> [Guarantor of stability in the Asia-Pacific region], Interview with Dmitriev, V. (Vice Admiral), *Krasnaya Zvezda*, 19 Mar. 2021 (in Russian); and 'Russian Navy to decommission Delta IV-class strategic nuclear-powered submarine in 2022', TASS, 28 Apr. 2021.

<sup>33</sup> Russian Ministry of Defence, [On Russia Day, the newest Borei-A class strategic missile submarine 'Prince Vladimir' was inaugurated into the Navy], 12 June 2020 (in Russian).

<sup>34</sup> Sevmas, [The ceremony of handing over to the Navy of two nuclear submarines 'Prince Oleg' and 'Novosibirsk' took place at Sevmas], 21 Dec. 2021 (in Russian); and Lindemann, I., [Missile submarine 'Prince Oleg' launched 'Bulava' from the White Sea], *TV Zvezda*, 21 Oct. 2021 (in Russian).

<sup>35</sup> Sevmas, [The ceremony of pulling out of the boathouse of the nuclear submarine 'Generalissimo Suvorov' took place at Sevmas], 25 Dec. 2021 (in Russian).

<sup>36</sup> Sevmas, [Nuclear-powered submarine cruisers 'Dmitry Donskoy' and 'Prince Potemkin' laid down at Sevmas], 23 Aug. 2021 (in Russian).

<sup>37</sup> [Source: Two more 'Borei-A' strategic submarines will be built at 'Sevmas' by 2028], TASS, 30 Nov. 2020 (in Russian).

<sup>38</sup> The Delfin-class or Project 667BDRM (Delta IV) SSBNs carry RSM-54 Sineva/Layner (SS-N-23 M2/3) SLBMs, while the Borei(-A)-class or Project 955(A) SSBNs carry RSM-56 Bulava (SS-N-32) SLBMs. Each RSM-54 can carry up to four warheads, while each RSM-56 can carry up to six warheads. It is assumed that each RSM-56 has had its warhead load reduced to four warheads, to meet New START limits.

or Project 09851 submarine, based on the Borei-class SSBN hull.<sup>39</sup> The Belgorod was originally scheduled for delivery to the navy by the end of 2020 but returned to dry dock in October 2021 following delayed sea trials.<sup>40</sup> The official transfer of the Belgorod to the Pacific Fleet was expected to take place in July 2022.<sup>41</sup> The Belgorod and the Khabarovsk submarines will each be capable of carrying up to six Poseidon torpedoes.<sup>42</sup>

The Russian Navy conducted military exercises with its ballistic missile submarines throughout 2021. Notably, in March 2021 three SSBNs—two Delfin-class vessels and possibly a Borei-class vessel—simultaneously surfaced alongside each other near the North Pole during Russia's Umka-2021 major Arctic exercise.<sup>43</sup>

### **Non-strategic nuclear forces**

There is no universally accepted definition of 'tactical', 'non-strategic' or 'theatre' nuclear weapons. Generally speaking, these terms refer to shorter-range weapons that are not covered by arms control agreements regulating long-range strategic forces.

Different agencies within the US intelligence community have offered varying estimates of Russian non-strategic nuclear weapons. The 2018 US Nuclear Posture Review stated that Russia had 'up to 2000' non-strategic nuclear weapons, while the US Defense Intelligence Agency in 2021 suggested a lower range of '1000 to 2000'.<sup>44</sup> These examples reflect both the degree of uncertainty associated with estimating Russian non-strategic nuclear forces, and the variations in estimates between different US governmental agencies.

SIPRI estimates that, as of January 2022, Russia had approximately 1912 warheads assigned for potential use by non-strategic forces—an unchanged estimate from the previous year. Russia's non-strategic nuclear weapons—most of which are dual-capable, meaning that they can also be

<sup>39</sup> Sutton, H. I., 'Khabarovsk-class-submarine', *Covert Shores*, 20 Nov. 2020; and Sutton, H. I., 'Poseidon torpedo', *Covert Shores*, 22 Feb. 2019.

<sup>40</sup> ['Poseidon' drone carrier submarine 'Belgorod' to be handed over to the fleet in 2021], TASS, 24 Dec. 2020 (in Russian); and Sutton, H. I., 'The submarine which came in from the cold: Belgorod under cover', *Covert Shores*, 6 Oct. 2021.

<sup>41</sup> 'Russian Navy to receive special-purpose sub with nuclear-armed drones in summer: Sources', TASS, 26 Jan. 2022.

<sup>42</sup> [Second 'Poseidon' carrier submarine planned to be launched in spring–summer 2021], TASS, 6 Nov. 2020 (in Russian).

<sup>43</sup> Russian Ministry of Defence, [Integrated arctic expedition of the Russian Navy and the Russian Geographical Society 'Umka-21'], YouTube, 26 Mar. 2021 (in Russian).

<sup>44</sup> US Department of Defense (note 5), p. 53; and Berrier, S., Director, US Defense Intelligence Agency, 'Worldwide threat assessment', Statement for the record, US Senate Armed Services Committee, 26 Apr. 2021.

armed with conventional warheads—are intended for use by ships and submarines, aircraft, air- and missile-defence systems, and army missiles.

Russia's non-strategic nuclear weapons chiefly serve to compensate for perceived weaknesses in its conventional forces, to provide regional attack options, and to maintain overall parity with the total US nuclear force level. There has been considerable debate about the role that non-strategic nuclear weapons have in Russian nuclear strategy, including potential first use.<sup>45</sup>

### *Navy weapons*

The Russian military service that is thought to be assigned the highest number of non-strategic nuclear weapons is the navy, with an estimated 935 warheads for use by land-attack cruise missiles, anti-ship cruise missiles, anti-submarine rockets, depth bombs, and torpedoes delivered by ships, submarines and naval aviation.

The nuclear version of the long-range, land-attack Kalibr submarine-launched cruise missile (SLCM), also known as the 3M-14 (SS-N-30A), is a significant new addition to the navy's stock of weapons.<sup>46</sup> It has been integrated on numerous types of surface ship and attack submarine, including the new Yasen/-M or Project 885/M (Severodvinsk) SSGN.<sup>47</sup> The second boat of this class completed its sea trials in late 2020, hitting a target over 1000 kilometres away with a Kalibr cruise missile, and became operational with the Northern Fleet in 2021.<sup>48</sup> The next Yasen-M SSGN was delivered to the Pacific Fleet in December 2021, indicating that it will probably become operational in 2022.<sup>49</sup>

Other notable navy weapons include the 3M-55 (SS-N-26) SLCM and the future 3M-22 Tsirkon (SS-NX-33) hypersonic anti-ship missile (although

<sup>45</sup> On this debate see e.g. US Department of Defense (note 5), 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*, vol. 97, no. 6 (Nov./Dec. 2018); Stowe-Thurston, A., Korda, M. and Kristensen, H. M., 'Putin deepens confusion about Russian nuclear policy', *Russia Matters*, 25 Oct. 2018; Tertrais, B., 'Russia's nuclear policy: Worrying for the wrong reasons', *Survival*, vol. 60, no. 2 (Apr. 2018); and Ven Bruusgaard, K., 'The myth of Russia's lowered nuclear threshold', *War on the Rocks*, 22 Sep. 2017.

<sup>46</sup> 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.

<sup>47</sup> 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.

<sup>48</sup> 'Newest Russian submarine hits target 1000 km away with Kalibr cruise missile', TASS, 23 Nov. 2020; and 'Defense ministry announces Kazan missile-carrying submarine joins Russian Navy', TASS, 7 May 2021.

<sup>49</sup> Manaranche, M., 'Yasen-M class SSGN "Novosibirsk" begins its sea trials', *Naval News*, 2 July 2021; and Sevmarsh (note 34).

it is unclear whether the Tsirkon is dual-capable), which will begin serial production and delivery to the navy in 2022.<sup>50</sup>

#### *Air force weapons*

The second largest stock of non-strategic nuclear weapons is assigned to the Russian Air Force, which is estimated to have approximately 500 nuclear warheads for use by Tu-22M3 (Backfire-C) intermediate-range bombers, Su-24M (Fencer-D) fighter-bombers, Su-34 (Fullback) fighter-bombers and MiG-31K (Foxhound) attack aircraft.<sup>51</sup> The new Su-57 (Felon) combat aircraft, also known as PAK-FA, is dual-capable, and the first serial production units were delivered in 2020 and 2021.<sup>52</sup>

The MiG-31K is equipped with the new 9A-7760 Kinzhal air-launched ballistic missile, which in 2021 was operational with the Southern Military District and Northern Fleet, and will eventually be integrated into the Western and Central Military Districts by 2024.<sup>53</sup> Russia has also begun introducing the nuclear-capable Kh-32 air-to-surface missile, an upgrade of the Kh-22N (AS-4) used on the Tu-22M3.<sup>54</sup>

#### *Air-, coastal- and missile-defence weapons*

The third largest stock of non-strategic nuclear weapons is assigned to Russian air-, coastal- and missile-defence forces, which are estimated to have around 387 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. Russia has also been developing the S-500 air-defence system, which might potentially be dual-capable, but there is no publicly available authoritative information confirming a nuclear role.<sup>55</sup> It is likely that the stock of warheads associated with Russia's air-, coastal- and missile-defence forces will eventually decrease due to the improving capabilities of conventional air-defence interceptors—including

<sup>50</sup> 'Russia's Tsirkon sea-launched hypersonic missile enters final stage of trials: Top brass', TASS, 20 Jan. 2022.

<sup>51</sup> US Department of Defense, 'US nuclear deterrence policy', Fact sheet, 1 Apr. 2019, p. 3; International Institute for Strategic Studies, *The Military Balance 2021* (Routledge: London, 2021); and authors' estimate. It is possible that the Su-30SM is also capable of delivering nuclear weapons.

<sup>52</sup> D'Urso, S., 'First serial production Su-57 Felon delivered to the Russian Aerospace Forces', *The Aviatorist*, 30 Dec. 2020; and Rob Lee (@RALee85), 'Two new "serial" Su-57 fighters (bort red 02 and 52, including RF-81775) photographed in Novosibirsk', Twitter, 3 Feb. 2022.

<sup>53</sup> President of Russia (note 9); 'Russia's upgraded MiG-31 fighters to provide security for Northern Sea Route', TASS, 26 Nov. 2021; and [Add hypersonic: Another military district will be armed with 'Daggers'], *Izvestia*, 7 June 2021 (in Russian).

<sup>54</sup> US Department of Defense (note 5), p. 8.

<sup>55</sup> Podvig, P., 'Missile defense in Russia', Working paper, Federation of American Scientists (FAS), Project on Nuclear Dynamics in a Multipolar Strategic BMD World, May 2017.

the Nudol and Aerostat systems under development in 2021—and the retirement of legacy warheads.

### *Army weapons*

The Russian Army has the smallest stock of non-strategic nuclear weapons, 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 2022, the dual-capable Iskander-M had completely replaced the Tochka (SS-21) SRBM in 12 missile brigades.<sup>56</sup> The 9M728 Iskander-K (SSC-7) GLCM might also be dual-capable.

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.<sup>57</sup> SIPRI estimates that four or five 9M729 battalions have so far been co-deployed with four or five of the Iskander-M brigades. Following President Putin's October 2020 declaration of willingness to impose a moratorium on future 9M729 deployments in European territory, subject to conditions, the Russian foreign ministry in December 2021 published a draft security agreement that included a ban on deployment of Russian and US missiles with ranges previously covered by the now defunct INF Treaty in areas where they could reach the other side's territory.<sup>58</sup>

There have been suggestions that the Russian Army may also have stocks of nuclear artillery shells and landmines, but the publicly available evidence is conflicting.<sup>59</sup>

<sup>56</sup> Authors' assessment based on observation of satellite imagery.

<sup>57</sup> 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*.

<sup>58</sup> 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, Unofficial translation, 17 Dec. 2021. See also Kristensen, H. M. and Korda, M., 'Russian nuclear forces', *SIPRI Yearbook 2020*, p. 356.

<sup>59</sup> E.g. the 2018 US Nuclear Posture Review did not list nuclear artillery shells or landmines, but a statement by former US Department of Defense official Ellen M. Lord before a US Senate subcommittee in May 2019 did mention them. US Department of Defense (note 5); and Lord, E. M., Under Secretary for Acquisition and Sustainment, Statement before the Subcommittee on Strategic Forces, US Senate Armed Services Committee, 1 May 2019, p. 3.