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NUCLEAR NOTEBOOK



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Hans M. Kristensen and Matt Korda

### ABSTRACT

The Nuclear Notebook is researched and written by Hans M. Kristensen, director of the Nuclear Information Project with the Federation of American Scientists, and Matt Korda, a research associate with the project. The Nuclear Notebook column has been published in the *Bulletin of the Atomic Scientists* since 1987. This issue's column examines Russia's nuclear arsenal, which includes 4,490 warheads that can be delivered via long-range strategic launchers and shorter-range tactical nuclear forces.

### KEYWORDS

Ballistic missile submarines; Russia; delivery systems; bombers; ballistic missiles; nuclear weapons

Russia is in the middle of a decades-long modernization of its strategic and non-strategic nuclear forces to replace Soviet-era weapons with newer systems. These modernizations, combined with an increase in the number and size of military exercises and occasional explicit nuclear threats against other countries, contribute to uncertainty about Russia's long-term intentions and growing international debate about the nature of its nuclear strategy. These concerns, in turn, stimulate increased defense spending, nuclear modernization programs, and political opposition to further nuclear weapons reductions in Western Europe and the United States.

As of early 2019, we estimate that Russia has a stockpile of roughly 4,490 nuclear warheads assigned for use by long-range strategic launchers and shorter-range tactical nuclear forces. Of these, roughly 1,600 strategic warheads are deployed on ballistic missiles and at heavy bomber bases, while another 1,070 strategic warheads are in storage along with about 1,820 non-strategic warheads. In addition to the military stockpile for operational forces, a large number – perhaps almost 2,000 – of retired but still largely intact warheads await dismantlement, for a total inventory of more than 6,490 warheads.<sup>1</sup> (See [Table 1](#).)

Russia has significantly reduced the number of warheads deployed on its ballistic missiles to meet the New START limit of no more than 1,550 deployed strategic warheads. Russia achieved the required reduction by the February 5, 2018 deadline, when it declared 1,444 strategic warheads attributed to 527 launchers (Russian Federation Foreign Affairs Ministry 2018). Since then, Russia has made further reductions, down to 1,420 warheads attributed to 517 launchers as of September 1, 2018 (US State Department 2018b). The numbers indicate that Russia has

reduced the warhead loading on some of its missiles to less than what is typically assumed. We do not know the breakdown of the loadings because Russia, unlike the United States, does not publish an unclassified overview of its strategic forces. However, the most recent reduction may have involved scaling back the number of warheads on each SS-18 and SS-27 Mod 2 intercontinental ballistic missile (ICBM), as well as on each SS-N-32 submarine-launched ballistic missile (SLBM). This indicates that New START places real constraints on Russia's deployed strategic forces. The result appears to be an increased reliance on a strategic reserve of non-deployed warheads that can be loaded onto missiles in a crisis to increase the size of the force – a strategy similar to the one the United States has relied on for several decades.

Overall, Russia's nuclear modernization effort will present the international arms control community with new challenges. Unless a new arms reduction agreement is reached in the near future, the shrinking of Russia's strategic nuclear arsenal that has characterized the past two decades will likely come to an end, with the force leveling out at around 530 launchers with roughly 2,500 assigned warheads. However, Russia's financial crisis represents a significant challenge to maintaining this force level, as exemplified by delays in production of several major weapon systems such as the Sarmat ICBM (SS-29), the RS-26 Rubezh, and the Barzugin rail-based ICBM. Despite these delays, Defense Minister Sergei Shoigu reported in December 2018 that the “modernity level” of the Strategic Nuclear Forces had reached 82 percent as planned (Russian Federation Defence Ministry 2018a).

Russia's nuclear modernization program is motivated in part by Moscow's strong desire to maintain

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**Table 1.** Russian nuclear forces, 2019.

Type/name	Russian Designation	Launchers	Year Deployed	Warheads x yield (kilotons)	Total Warheads
<i>Strategic offensive weapons</i>					
<b>ICBMs</b>					
SS-18 M6 Satan	RS-20V	46	1988	10 × 500/800 (MIRV)	460 <sup>a</sup>
SS-19 M3 Stiletto	RS-18 (UR-100NUTTH)	20 <sup>b</sup>	1980	6 × 400 (MIRV)	120 <sup>c</sup>
SS-19 M4	? (Avangard)	-	(2019)	1 × HGV	-
SS-25 Sickle	RS-12M (Topol)	63	1988	1 × 800	63 <sup>d</sup>
SS-27 Mod 1 (mobile)	RS-12M1 (Topol-M)	18	2006	1 × 800?	18
SS-27 Mod 1 (silo)	RS-12M2 (Topol-M)	60	1997	1 × 800	60
SS-27 Mod 2 (mobile)	RS-24 (Yars)	99	2010	4 × 100? (MIRV)	396 <sup>e</sup>
SS-27 Mod 2 (silo)	RS-24 (Yars)	12	2014	4 × 100? (MIRV)	48
SS-X-27 Mod ? (rail)	Barguzin	-	-	4 × 100? (MIRV)	-
SS-X-28 (mobile)	RS-26 (Yars-M)	-	-	4 × 100? (MIRV)	-
SS-X-29 (silo)	RS-28 (Sarmat)	-	(2020)	10 × 500? (MIRV)	-
<b>Subtotal</b>		<b>318</b>			<b>1165<sup>f</sup></b>
<b>SLBMs</b>					
SS-N-18 M1 Stingray	RSM-50	1/16	1978	3 × 50 (MIRV)	48 <sup>g</sup>
SS-N-23 M1	RSM-54 (Sineva)	6/96	2007	4 × 100 (MIRV) <sup>h</sup>	384 <sup>i</sup>
SS-N-32	RSM-56 (Bulava)	3/48	2014	6 × 100 (MIRV)	288 <sup>j</sup>
<b>Subtotal</b>	<b>10/160<sup>k</sup></b>				<b>720<sup>l</sup></b>
<b>Bombers/weapons</b>					
Bear-H6	Tu-95 MS6	25	1984	6 × AS-15A ALCMs, bombs	150
Bear-H16	Tu-95 MS16	30	1984	16 × AS-15A ALCMs, bombs	480
Blackjack	Tu-160	13	1987	12 × AS-15B ALCMs	156
<b>Subtotal</b>		<b>68<sup>m</sup></b>			<b>786<sup>n</sup></b>
<b>Subtotal strategic offensive forces</b>		<b>546<sup>o</sup></b>			<b>~2,670<sup>p</sup></b>
<i>Nonstrategic and defensive weapons</i>					
<b>ABM/Air/Coastal defense</b>					
S-300/S-400 (SA-20/SA-21)		~1000	1992/2007	1 × low	~290
53T6 Gazelle		68	1986	1 × 10	68 <sup>q</sup>
SSC-1B Sepal (Redut)		8 <sup>r</sup>	1973	1 × 350	4
SSC-5 Stooge (SS-N-26) (K-300P/3M-55)		48	2015	(1 × 10) <sup>s</sup>	24
<b>Land-based air</b>					
Bombers/fighters (Tu-22M3/Su-24M/Su-34/MiG-31K)		300	1974/2006/ 1983	ASMs, bombs	~530
<b>Ground-based</b>					
SS-21 Scarab SSM (9K79, Tochka)		12	1981	1 × 10–100	5
SS-26 Stone SSM (9K720, Iskander-M)		132	2005	1 × 10–100	66
SSC-7 GLCM (9M728) <sup>t</sup>					
SSC-8 GLCM (9M729) <sup>u</sup>		16 <sup>v</sup>	2017	1 × 10–100	16
<b>Naval</b>					
Submarines/surface ships/air				LACM, SLCM, ASW, SAM, DB, torpedoes	820
<b>Subtotal nonstrategic and defensive forces</b>					<b>~1,820<sup>w</sup></b>
<b>Total</b>					<b>~4,490<sup>x</sup></b>
Deployed					1,600
Reserve					2,890
<b>Retired warheads awaiting dismantlement</b>					<b>2,000</b>
<b>Total inventory</b>					<b>6,490</b>

ABM = antiballistic missile; ALCM = air-launched cruise missile; AS = air-to-surface; ASM = air-to-surface missile; ASW = antisubmarine weapon; DB = depth bomb; GLCM = ground-launched cruise missile; ICBM = intercontinental ballistic missile; LACM = Land-Attack Cruise Missile; MIRV = multiple independently targetable reentry vehicle; SAM = surface-to-air missile; SLBM = submarine-launched ballistic missile; SLCM = sea-launched cruise missile; SRAM = short-range attack missile; SSM = surface-to-surface missile

<sup>a</sup>It is possible that the SS-18s now carry only six warheads each to meet the New START limit for deployed strategic warheads.

<sup>b</sup>This only counts SS-19 silos with missiles; many others are thought to be empty.

<sup>c</sup>It is possible that only one SS-19 brigade with 10 missiles carrying up to 60 warheads remains operational.

<sup>d</sup>The upgrade of SS-25 brigades to SS-27 means the precise number of fielded SS-25s is uncertain.

<sup>e</sup>It is possible that the SS-27 Mod 2s now carry only three warheads each to meet the New START limit on deployed strategic warheads.

<sup>f</sup>Only about 860 of these warheads are deployed. The rest are in storage for potential loading.

<sup>g</sup>The Delta III-class SSBNs are in the process of being retired, with possibly only one remaining fully operational.

<sup>h</sup>The Sineva is a modified SS-N-23 and probably carries four warheads with MIRVs. In 2006, US intelligence estimated that the missile could carry up to 10 warheads, but it lowered the estimate to four in 2009.

<sup>i</sup>At any given time, only 320 of these warheads are deployed on five operational Delta IV submarines, with the sixth boat in overhaul. Often two boats are out.

<sup>j</sup>It is possible that Bulava SLBMs now carry only four warheads each for Russia to meet the New START limit on deployed strategic warheads.

<sup>k</sup>The first figure is the number of operational SSBNs; the second is the total number of missiles (launchers) on the SSBNs. Note that several SSBNs may be in overhaul at any given time.

<sup>l</sup>At any given time, two thirds of the 10 SSBNs are in overhaul and do not carry nuclear weapons, so not all 720 warheads are deployed.

<sup>m</sup>Only about 50 of the bombers are thought to be deployed.

<sup>n</sup>Nuclear weapons are only assigned to the 50 deployed nuclear-capable bombers. The number shows maximum loading although the actual number may be lower. Bomber weapons are not deployed on the aircraft under normal circumstances, but we estimate a couple hundred weapons are present at the two bomber bases, with the remainder in central storage.

<sup>q</sup>This number of total fielded strategic launchers is higher than the 527 listed in the New START aggregate data as of February 5, 2018 because some bombers are not counted as deployed. This is the total number of operational launchers (ICBMs, SLBMs, and bombers) in service. Russia also has more than 252 non-deployed launchers, many of which are mothballed or in the process of being dismantled.

<sup>r</sup>Only about 1,600 of these warheads are deployed on missiles and at bomber bases. New START counts fewer deployed warheads because it does not count weapons in storage and because at any given time, some SSBNs are not fully loaded.

<sup>s</sup>We estimate that the warheads for the remaining Gazelle interceptors are kept in central storage under normal circumstances. All previous 32 Gorgon missiles have been retired.

<sup>t</sup>It is assumed that all SSC-1B units, except a single silo-based version in Crimea, have been replaced by the K-300P by now.

<sup>u</sup>The US National Air and Space Intelligence Center lists the ground-, sea-, and sub-launched 3M55 as "nuclear possible."

<sup>v</sup>The SSC-7 and SS-26 form part of the same Iskander brigades.

<sup>w</sup>It is possible that SSC-8 launchers are co-located with Iskander brigades.

<sup>x</sup>This figure assumes four SSC-8 battalions, each with four launchers. Each launcher has four missiles for a total of 64 plus reloads.

<sup>y</sup>Numbers may not add up due to rounding. All nonstrategic warheads are in central storage. The 1,820 listed make up the estimated nominal load for nuclear-capable delivery platforms. Only some of these may be available for deployment by operational forces. It is possible that more nuclear-capable non-strategic systems exist, in which case the number of warheads would be greater.

<sup>z</sup>Numbers may not add up due to rounding.

overall parity with the United States, but also by the Russian leadership's apparent conviction that the US ballistic missile defense system constitutes a real future risk to the credibility of Russia's retaliatory capability. Policy and strategy aside, the development of multiple weapon systems also indicates the strong influence of the military industrial complex on Russia's nuclear posture planning.

### What is Russia's nuclear strategy?

The international debate about Russia's nuclear strategy has reached a new level of intensity, particularly since the Trump administration published its Nuclear Posture Review in February 2018. The Nuclear Posture Review claims that "Russian strategy and doctrine emphasize the potential coercive and military uses of nuclear weapons. It mistakenly assesses that the threat of nuclear escalation or actual first use of nuclear weapons would serve to 'de-escalate' a conflict on terms favorable to Russia" (US Defense Department 2018, 8). Specifically, the document claims, "Moscow threatens and exercises limited nuclear first use, suggesting a mistaken expectation that coercive nuclear threats or limited first use could paralyze the United States and NATO and thereby end a conflict on terms favorable to Russia." This so-called "escalate to de-escalate" doctrine "follows from Moscow's mistaken assumption of Western capitulation on terms favorable to Moscow" (US Defense Department 2018, 30).

STRATCOM commander Gen. John Hyten has reacted to "Russia's destabilizing doctrine on what some call escalate to de-escalate" by saying: "I really hate that discussion. I've looked at the Russian doctrine. I've looked at Russian writings. It's not escalate to de-escalate, it's escalate to win. Everybody needs to understand that" (Hyten 2017). Some have suggested that Russian leaders are signaling a willingness to use nuclear weapons even *before* an adversary retaliates against a Russian conventional attack by "employing the threat

of selective and limited use of nuclear weapons to *forestall opposition to potential aggression*" (emphasis added) (Miller 2015). The implication is that Russia would potentially use nuclear weapons first to scare an adversary into not even defending itself.

Such characterizations conflict with Russia's publicly stated policy. In his remarks to the Valdai Club in October 2018, Putin said: "[O]ur nuclear weapons doctrine does not provide for a pre-emptive strike." Rather, he went on, "[o]ur concept is based on a reciprocal counter strike... [T]his means that we are prepared and will use nuclear weapons only when we know for certain that some potential aggressor is attacking Russia, our territory" (Russian Federation 2018). This is consistent with Russia's official military strategy, published in December 2014, which says that Russia "shall reserve for itself the right to employ nuclear weapons in response to the use against it and/or its allies of nuclear and other kinds of weapons of mass destruction, as well as in the case of aggression against the Russian Federation with use of conventional weapons when the state's very existence has been threatened" (Russian Federation 2014). This formulation is almost identical to the country's previous version of military strategy published in 2010 (Russian Federation 2010). Although some initial reports interpreted Putin's 2018 Valdai Club comments to mean that Russia might be adopting a nuclear "no first use" policy, this does not seem to be the case; his remarks were more likely meant to respond to the US Nuclear Posture Review's claim that Russia has lowered its threshold for first use of nuclear weapons in a conflict (Stowe-Thurston, Korda, and Kristensen 2018). Because Putin's comments imply that Russia would only use nuclear weapons in retaliation against an existential threat, independent analysts have challenged the Nuclear Posture Review's characterization of the Russian strategy as a misreading of its nuclear doctrine.<sup>2</sup>

Whatever Russia's nuclear strategy is, Moscow seems to be administering it more dynamically and offensively than it did a decade ago. Russian officials have made many statements about nuclear weapons that appear to go beyond the published doctrine, threatening to potentially use them in situations that do not meet the conditions described. For example, officials explicitly threatened to use nuclear weapons against ballistic missile defense facilities, and in regional scenarios that do not threaten Russia's survival or involve attacks with weapons of mass destruction (The Local 2015).

Moreover, the fact that Russian military planners are pursuing a broad range of existing and new versions of nuclear weapons suggests that the real doctrine goes beyond basic deterrence and towards regional war-fighting strategies, or even weapons aimed at causing terror. One widely-cited example involves the so-called Status-6 – known in Russia as “Poseidon” and in the United States as “Kanyon” – a long-range nuclear-powered torpedo that a Russian government document blatantly described as intended to create “areas of wide radioactive contamination that would be unsuitable for military, economic, or other activity for long periods of time” (Podvig 2015). A diagram and description of the proposed weapon, first revealed in a Russian television broadcast, can still be seen on YouTube (YouTube 2015). Last year's Nuclear Posture Review confirmed that the Russian torpedo was under development, Putin mentioned it in his March 2018 speech, and told the Federal Assembly in February 2019 that the first submarine designed to carry the torpedo would be launched this spring (Russian Federation 2019).

### Intercontinental ballistic missiles

Based on what we observe via satellite images, combined with information published under New START by various US government sources, Russia appears to have roughly 318 ICBMs, which we estimate can carry approximately 1,138 warheads. (See Table 2.) The size of the force that we can observe, however, is difficult to square with statements made by Russian officials. In 2016 and again in 2017, the commander of the country's Strategic Rocket Forces, Col. Gen. Sergey Karakayev, told journalists that Russia had approximately 400 ICBMs on combat duty (TASS 2016; Andreyev and Zotoy 2017). But since Russia had 517 deployed strategic launchers in total as of September 2018, a force of 400 ICBMs would mean Russia only deployed 117 SLBMs and bombers, which seems unlikely (Russian Federation Foreign Affairs Ministry 2018).

The ICBMs are organized under the Strategic Rocket Forces in three missile armies with a total of 11

divisions consisting of approximately 39 missile regiments. (The 40th regiment in the 12th division at Yurya is not nuclear-armed). The ICBM force has been declining for three decades and Russia is about two-thirds of the way through a modernization program to replace all Soviet-era missiles with newer types by the early 2020s on a less-than-one-for-one basis. Currently, the remaining Soviet-era ICBMs include:

**SS-18 (RS-20V).** The SS-18 is a silo-based, 10-warhead heavy ICBM first deployed in 1988. It is reaching the end of its service life, with approximately 46 SS-18s with up to 460 warheads remaining in the 13th Missile Division at Dombarovsky and the 62nd Missile Division at Uzhur. The SS-18 is scheduled to begin retiring in the early 2020s, when it will be replaced by the SS-29 (Sarmat or RS-28) ICBM.

**SS-19 (RS-18 or UR-100NUTTH).** The silo-based, six-warhead SS-19 entered service in 1980 and is gradually being retired and replaced by the silo-based SS-27 Mod 2 (RS-24). We estimate that no more than 20 and possibly as few as 10 of these missiles are in service, with the 60th Missile Division at Tatishchevo. The 13th Missile Division at Dombarovsky will receive at least two regiments (12 missiles in total) of the updated version of the SS-19 – the SS-19 Mod 4 with the new Avangard hypersonic glide vehicles – by the end of 2027. The first of these new regiments is scheduled to begin combat duty in 2019 (TASS 2018b).

**SS-25 (RS-12M or Topol).** Russia continues to retire its SS-25 road-mobile missiles at a rate of one or two regiments (nine to 18 missiles) each year, replacing them with the SS-27 Mod 2 (RS-24). There remains some uncertainty about how many SS-25s are fully operational. Base upgrades used to involve significant rebuilding, but satellite images indicate that Russia has started to upgrade the bases by simply replacing the SS-25s with the new SS-27 launchers and their service vehicles, which are maintained under camouflage nets. Satellite photos show a total of nine garages, possibly with 81 intact SS-25 launcher garages. But some of those launcher garages are probably in the process of being converted, leaving an estimated 63 SS-25s in the active force. Karakayev said in December 2016 that the last remaining SS-25s would be retired in 2021–2022 (TV Zvezda 2016).

The new ICBMs include two versions of the SS-27: the SS-27 Mods 1 and 2. The SS-27 Mod 1 is a single-warhead missile, known in Russia as Topol-M, that comes in either mobile (RS-12M1) or silo-based (RS-12M2) variants. Deployment of the SS-27 Mod 1 was completed in 2012 with a total of 78 missiles: 60 silo-based missiles with the 60th Missile Division in Tatishchevo, and 18 road-mobile missiles with the 54th Guards Missile Division at Teykovo.

The focus of the current and bigger phase of Russia's modernization is the SS-27 Mod 2, known in Russia as the RS-24 Yars, which is a modified SS-27 Mod 1 (or Topol-

**Table 2.** Estimated status of Russian ICBM forces 2019.

Locations	Divisions	Regiments (Coordinates)	Missiles*	Status
Barnaul	35th MD	307th MR (53.3128, 84.5080)	9 SS-25 TEL	Active
		479th GMR (53.7709, 83.9580)	9 SS-25 TEL	Active
		480th MR (53.3054, 84.1459)	9 SS-25 TEL	Active
		867th GMR (53.2255, 84.6706)	9 SS-25 TEL	Active
Dombrovskiy Irkutsk	13th MD	3 regiments (51.1766, 60.2224) <sup>a</sup>	18 SS-18 Silos	Active
	29th GMD	92nd GMR (52.5085, 104.3933)	9 SS-27 Mod 2 TEL	Active
Kozelsk	28th GMD	344th GMR (52.6694, 104.5199)	(9 SS-25 TEL)	Upgrading
		586th GMR (52.5505, 104.1584)	9 SS-27 Mod 2 TEL	Active
		74th MR (53.7982, 35.8039)	10 SS-27 Mod 2 silos	Active
Novosibirsk	39th GMD	168th MR (54.0278, 35.4589)	(10 SS-27 Mod 2 silos)	Upgrading
		357th GMR (55.3270, 82.9417)	9 SS-27 Mod 2 TEL	Active
		382nd GMR (55.2844°, 83.0157°)	9 SS-27 Mod 2 TEL	Active <sup>b</sup>
Tagil	42nd MD	428th GMR (55.3134, 83.0291)	9 SS-27 Mod 2 TEL	Active
		308th MR (58.2298, 60.6773)	9 SS-27 Mod 2 TEL	Active
		433rd MR (58.1015, 60.3592)	9 SS-27 Mod 2 TEL	Active <sup>c</sup>
Tatishchevo	60th MD	804th MR (58.1372, 60.5366)	9 SS-27 Mod 2 TEL	Active
		6 regiments (51.8062, 45.6550)	60 SS-27 Mod 1 silos	Active
		1 or 2 regiments <sup>d</sup>	10-20 SS-19 silos	Retiring
Teykovo	54th GMD	235th GMR (56.7041, 40.4403)	9 SS-27 Mod 1 TEL	Active
		285th GMR (56.8091, 40.1710)	9 SS-27 Mod 2 TEL	Active
		321st MR (56.9324, 40.5440)	9 SS-27 Mod 1 TEL	Active
		773rd MR (56.9167, 40.3087)	9 SS-27 Mod 2 TEL	Active
Uzhur	62nd MD	4 regiments (55.2453, 89.9194)	28 SS-18 silos	Active
	Vypolsovo	7th GMD	41st MR (57.8620, 33.6500)	9 SS-25 TEL
Yoshkar-Ola	14th MD	510th GMR (57.7889, 33.8660)	9 SS-25 TEL	Active
		697th MR (56.8328, 48.2370)	9 SS-25 TEL	Active
		702nd MR (56.5601, 48.2144)	(SS-25 TEL)	Upgrading
11 Divisions <sup>e</sup>		779th MR (56.5821, 48.1550)	9 SS-27 Mod 2 TEL	Active
		38 or 39 regiments	318 ICBMs <sup>f</sup>	

GMD = Guards Missile Division; GMR = Guards Missile Regiment; MD = Missile Division; MR = Missile Regiment; TEL = Transporter Erector Launcher.

\*Uses US/NATO missile designations: SS-18 (RS-20V), SS-19 (RS-18), SS-25 (Topol), SS-27 Mod 1 (Topol-M), SS-27 Mod 2 (RS-24).

<sup>a</sup>It is possible that one of these missile regiments, the 621st, has begun upgrading silos for deployment of the new Avangard HGV on, initially, converted SS-19s.

<sup>b</sup>This brigade is not based at a formal garrison but parked in the open under camouflage (55.2844°, 83.0157°). It is possible that this is the 382nd Guards Missile Regiment moved from its former site (55.3181°, 83.1676°) and temporarily based at its current location while awaiting completion of its potential future base at the former 773rd brigade site (55.3810°, 82.9182°).

<sup>c</sup>This garrison has not been rebuilt like the other two. The SS-27 Mod TELs are parked with support vehicles under camouflage while awaiting completion of service buildings.

<sup>d</sup>It is possible that only one SS-19 regiment remains active at Tatishchevo. Some SS-19s will start deploying the Avangard hypersonic glide vehicle in late 2019.

<sup>e</sup>A 12th division at Yurya has one SS-25 regiment that does not carry warheads but serves as a back-up ICBM launch code transmitter.

<sup>f</sup>The number 318 is uncertain because some SS-25 regiments are in the process of standing down for conversion to SS-27 Mod 2 and some newly converted SS-27 Mod 2 regiments have yet to reach full operational capacity.

M) that can carry up to four multiple independently targetable reentry vehicles (MIRVs). Following initial deployment from 2010 to 2012 of the first 18 missiles in two regiments with the 54th Guards Missile Division at Teykovo, deployment of 54 mobile SS-27 Mod 2s now appears nearly complete at the Novosibirsk and Tagil divisions, while an upgrade to the first garrisons has started at Irkutsk and Yoshkar-Ola. Finally, installation of the silo-based version of the SS-27 Mod 2 is well underway at the Kozelsk division. The first regiment (the 74th Missile Regiment) officially began combat duty with its full complement of 10 missiles in November 2018, after initially being declared operational (likely with just six missiles) in 2015 (Russian Federation Defence Ministry 2018b). Conversion of a second regiment (the 168th Missile Regiment) is underway at half of the 10 silos, going more slowly than expected with only two silos appearing to have been completed by the end of 2018 (one of which is the launch control center for the entire launch group).

Upgrades to the remaining silos will likely begin in 2019 or 2020. Final development and deployment of the compact SS-27 version, known as Rubezh (Yars-M or RS-26), as well as a rail-based version known as Barguzin, appear to have been postponed until the current armament program is completed in 2027 (TASS 2018a).<sup>3</sup>

Russia is also developing the SS-29, or Sarmat (RS-28), which will begin replacing the SS-18 (RS-20V) by 2021 and possibly continue to do so into the 2030s. Three ejection tests were conducted in December 2017, March 2018, and May 2018 at the Plesetsk Space Center, involving cold launch and test firing of the Sarmat's first stage and booster engine. Full flight tests, which will involve the firing of the second – and third-stage engines, are scheduled for 2019, following which the Sarmat will officially be handed over to the military. Serial production is expected to begin in 2020 (Gady 2018a).

There are many rumors about the SS-29, which some in the media have dubbed the “Son of Satan”

because it is a follow-on to the SS-18, which the United States and NATO designated “Satan” – presumably to reflect its extraordinary destructive capability. Rumors that the SS-29 could carry 15 or more MIRV warheads, though, seem exaggerated. We expect that it will carry about the same number as the SS-18, or a smaller number of hypersonic glide vehicles, which are intended to be capable of evading US ballistic missile defenses. The SS-29 is expected to be deployed in seven regiments (46 missiles total) within the 13th Missile Division at Dombarovsky and the 62nd Missile Division at Uzhur (RIA Novosti 2014).

After completing its final test in December 2018, Russia plans to begin deployment of the Avangard boost-glide system in 2019. Avangard is designed to evade missile defenses at hypersonic speeds, and will initially be fitted atop existing SS-19s and later deployed in refitted SS-18 silos at Dombarovsky and Uzhur. The first two upgraded missiles will begin combat duty by the end of 2019, with the regiment eventually receiving a full complement of six missiles. A second regiment of six missiles will reportedly be added by the end of 2027, to coincide with the completion of the current state armament program (TASS 2018b). Likely in preparation for these deployments, one of the former SS-18 launch groups (the 621st Missile Regiment) at Dombarovsky appears to be upgrading four silos with new and different security perimeters, in addition to new buildings for crew and guards. It is possible that the silos will have some form of air- or missile defense system. The remaining silos of the regiment presumably will also be upgraded.

While the 2018 Nuclear Posture Review anticipated that Russian missile forces will increase over time, that will not necessarily be the case. The US National Air and Space Intelligence Center predicted in 2017 that “the number of missiles in the Russian ICBM force will continue to decrease because of arms control agreements, aging missiles, and resource constraints” (US Air Force 2017). So unless New START is jeopardized, that trend will likely continue. (The treaty is due to expire in 2021, but can be extended for five years with approval by the Russian and US presidents.)

### Submarines and submarine-launched ballistic missiles

The Russian Navy operates 10 nuclear-powered ballistic missile submarines (SSBNs) of three classes: six Delta IV (Project 667BDRM), one Delta III (Project 667BRD), and three Borei (Project 955).<sup>4</sup> Each submarine can carry 16 SLBMs, and each SLBM can carry several MIRVs, for a combined maximum loading of more than 700 warheads. Only some of these

submarines are operational and the warhead loading on some of the missiles may have been reduced as part of New START implementation, however, so the total number of warheads carried is lower, possibly around 600.

Until the mid-2020s, the mainstay of Russia’s nuclear submarine force will continue to be the six third-generation Delta IVs built between 1985 and 1992, each equipped with 16 SLBMs. All Delta IVs are part of the Northern Fleet and based at Yagelnaya Bay (Gadzhiev) on the Kola Peninsula. Russia has upgraded the Delta IVs to carry modified SS-N-23 SLBMs known as Sinevas, each of which carries up to four warheads. A modified Sineva known as Layner (or Liner), may carry a modified payload. Normally four to five of the six Delta IVs are operational at any given time.

Two Delta III nuclear submarines (*K-223 Podolsk* and *K-433 Svyatoy Georgiy Pobedonosets*) were reportedly decommissioned in early 2018, leaving one Delta III – *Ryazan (K-44)* – operational with Russia’s Pacific Fleet on the Kamchatka Peninsula. The Delta III is equipped with 16 SS-N-18 M1 Stingray (RSM-50) SLBMs with three warheads each. The decommissioned Delta IIIs will be replaced by Borei-class SSBNs in the near future, starting with reactor de-fueling of two boats in late 2019 (Podvig 2018b).

The Delta IIIs and Delta IVs will be replaced by the new class of Borei (Project 955/A) SSBNs. Each boat is armed with 16 SS-N-32 (Bulava) SLBMs that can carry up to six warheads each, though it is possible that the missile payload has been lowered to four warheads each to meet the New START treaty limit on deployed strategic warheads. In May 2018, one of the new boats, *Yuri Dolgoruki (K-535)*, salvo-fired four Bulavas as part of a test launch (Russian Federation Defence Ministry 2018a). Three boats are currently in service, with another five in various stages of construction. The first boat, *Yuri Dolgoruki*, is based at Yagelnaya in the Northern Fleet. The second boat, *Alexander Nevsky (K-550)*, arrived at its home base at Rybachiy near Petropavlovsk in September 2015, where it was joined by the third Borei, *Vladimir Monomakh (K-551)*, in September 2016.

The first of the improved Borei-A/II (Project 955A) SSBNs and the fourth Borei submarine in total, *Knyaz Vladimir (K-549)*, has faced delays but recently began sea trials after leaving dry dock in November 2017 (Podvig 2018a). Despite previous rumors that the improved Borei class would have 20 missile tubes, satellite images taken of the first unit in 2018 showed only 16 tubes (Kristensen 2018). After a scheduled Bulava test in autumn 2019 and final sea trials, the *Knyaz Vladimir* will join the Northern

Fleet in December 2019 (TASS 2018c). The fifth boat under construction – *Knyaz Oleg* – underwent hull pressure tests in November 2016 and was originally scheduled for delivery in 2018, but will be delayed until at least late 2019, possibly 2020. The keel of the sixth boat – *Generalissimus Suvorov* – was laid down in December 2014 for possible completion in 2018, but will also be delayed. The keel for the seventh boat, the *Emperor Alexander III*, was laid down in December 2015 for delivery in 2019, but will most likely also be delayed. The keel for the eighth Borei SSBN – *Knyaz Pozharsky* – was laid in December 2016 for potential delivery between 2021 and 2023. Russia will also build two more Borei-A SSBNs for expected delivery in 2026 and 2027, respectively, bringing the total fleet up to ten boats. Five SSBNs will be assigned to the Northern Fleet, and five will be assigned to the Pacific (TASS 2018d).

### Strategic bombers

Russia operates two types of nuclear-capable heavy bombers: the Tu-160 Blackjack and the Tu-95MS Bear H. We estimate that there are 60 to 70 bombers in the inventory, of which perhaps only 50 are counted as deployed under New START. Both bomber types can carry the nuclear AS-15 Kent (Kh-55) air-launched cruise missile<sup>5</sup> and possibly gravity bombs, and upgraded versions are being equipped to carry the new AS-23B (Kh-102) cruise missile.<sup>6</sup> The Tu-160 was also equipped to carry the nuclear AS-16 Kickback (Kh-15) short-range attack missile, but the status of this weapon is uncertain.<sup>7</sup>

It is unclear how many nuclear weapons are assigned to the heavy bombers. Each Tu-160 can carry up to 12 nuclear AS-15B air-launched cruise missiles. The Tu-95MS can carry six to 16 cruise missiles, depending on configuration. Combined, the bombers could potentially carry more than 700 cruise missiles. The Tu-160 may also have a secondary mission with nuclear gravity bombs, but it seems unlikely that the old and slow Tu-95 would stand much of a chance against modern air defense systems. Most of the nuclear weapons assigned to the bombers are thought to be in central storage, with only a couple hundred deployed at the two bomber bases.<sup>8</sup>

Nearly all of the ageing Tu-160s and most of the Tu-95MSs are undergoing various upgrades. The first seven upgraded Tu-160s and Tu-95MSs returned to service in 2014, another nine followed in 2016, and five more were added in 2018. Only a few dozen of the Tu-95MSs – perhaps around 44 – will be modernized, while at least 10 Tu-160s will be modernized by 2019, although there has been some production delay. The upgrade program adds new weapons including the conventional cruise missile Kh-101 (AS-23A) and the nuclear cruise missile Kh-

102 (AS-23B). The AS-23B will likely replace the AS-15. The future bomber force will likely include 50 to 60 aircraft.

Russia is also planning to field an upgraded, stealthier version of the Tu-160, known as Tu-160M2, which is scheduled to begin production sometime after 2023, with delivery completed around 2030 (Sputnik News 2015). The Russian Aerospace Force (VKS) has reportedly ordered 50 of the new version, however, since there are currently only 16 Tu-160s in the inventory, Russia will have to build completely new airframes to accommodate the modernization program (Johnson 2018). Serial production of the Tu-160M2 is expected to begin in 2023 at a rate of three aircraft per year, and the first ten Tu-160M2s are expected to be delivered before 2027 (Zudin 2018). It is possible that the eventual target of 50 new Tu-160M2 bombers might be exaggerated, but if it is accurate, it would probably result in the retirement of most, if not all, of the remaining Tu-95MSs, which are expected to be retired no later than 2035.

The Tu-160M2, meanwhile, is only a temporary bridge to the next-generation bomber known as PAK-DA, the development of which has been underway for several years. The Russian government signed a contract with manufacturer Tupolev in 2013 to construct the PAK-DA at the Kazan factory. The first flight is expected in 2025 or 2026, followed by serial production beginning in 2028 or 2029, but it seems unlikely that the Russian aviation industry has enough capacity to develop and produce two strategic bombers at the same time.

### Nonstrategic nuclear weapons

Russia is updating many of its shorter-range, so-called nonstrategic nuclear weapons, and introducing new types. This effort is less clear and comprehensive than the strategic forces modernization plan, but also involves phasing out Soviet-era weapons and replacing them with newer versions. New systems are being added, and the Trump administration's Nuclear Posture Review accused Russia of "increasing the total number of [non-strategic nuclear] weapons in its arsenal, while significantly improving its delivery capabilities" (US Defense Department 2018, 9). The details of such an increase are still unclear but in the longer term, the emergence of more advanced conventional weapons could potentially result in reduction or retirement of some existing non-strategic weapons.

Nonetheless, the Russian military continues to attribute importance to non-strategic nuclear weapons for use by naval, tactical air, and air- and missile-defense forces, as well as on short-range ballistic missiles. Part

of the rationale appears to be that non-strategic nuclear weapons are needed to offset the superior conventional forces of NATO and particularly the United States. Russia also appears to be motivated by a desire to counter China's large and increasingly capable conventional forces in the Far East (although this now seems less important than countering NATO), and by the fact that having a sizable inventory of non-strategic nuclear weapons helps Moscow keep overall nuclear parity with the combined nuclear forces of the United States, Britain, and France.

We estimate that Russia has roughly 1,830 non-strategic nuclear warheads assigned for delivery by air, naval, ground, and various defensive forces.<sup>9</sup> It is possible that there are more nuclear-capable systems and that this inventory is growing, but the public evidence is scarce. This estimate, and the categories of Russian weapons that we have been describing in the Nuclear Notebook for years, were confirmed by the Nuclear Posture Review, which said:

“Russia is modernizing an active stockpile of up to 2,000 non-strategic nuclear weapons, including those employable by ships, planes, and ground forces. These include air-to-surface missiles, short range ballistic missiles, gravity bombs, and depth charges for medium-range bombers, tactical bombers, and naval aviation, as well as anti-ship, anti-submarine, and anti-aircraft missiles and torpedoes for surface ships and submarines, a nuclear ground-launched cruise missile in violation of the 1987 INF Treaty, and Moscow's antiballistic missile system” (US Defense Department 2018, 53).

The Nuclear Posture Review also said:

“Russia possesses significant advantages in its nuclear weapons production capacity and in non-strategic nuclear forces over the U.S. and allies. It is also building a large, diverse, and modern set of non-strategic systems that are dual-capable (may be armed with nuclear or conventional weapons). These theater- and tactical-range systems are not accountable under the New START Treaty, and Russia's non-strategic nuclear weapons modernization is increasing the total number of such weapons in its arsenal, while significantly improving its delivery capabilities. This includes the production, possession, and flight testing of a ground-launched cruise missile in violation of the INF Treaty. Moscow believes these systems may provide useful options for escalation advantage. Finally, despite Moscow's frequent criticism of US missile defense, Russia is also modernizing its long-standing nuclear-armed ballistic missile defense system and designing a new ballistic missile defense interceptor” (US Defense Department 2018, 9).

These paragraphs constitute the first substantial official US public statement on the status and composition of the Russian non-strategic nuclear arsenal in more than two decades, even though the paragraphs also raise questions

about assumptions and counting rules. Most of the non-strategic weapon systems are dual-capable, which means not all platforms may be assigned nuclear missions, and not all operations are nuclear. Moreover, many of the delivery platforms are in various stages of overhaul and would not be able to launch nuclear weapons at this time.

As far as we can ascertain, the biggest user of non-strategic nuclear weapons in the Russian military is the navy, which we estimate has an inventory of approximately 820 warheads for use by land-attack cruise missiles, anti-ship cruise missiles, anti-submarine rockets, anti-aircraft missiles, torpedoes, and depth charges. These weapons may be used by submarines, aircraft carriers, cruisers, destroyers, frigates, corvettes, and naval aircraft.

Major naval modernization programs focus on the next class of nuclear attack submarines, known in Russia as Project 885/M or Yasen/M. The first of these boats, known as *Severodvinsk*, entered service in 2015 and is thought to be equipped with a nuclear version of the Kalibr land-attack sea-launched cruise missile (the SS-N-30A) (Gertz 2015). It can also launch the SS-N-26 (3M-55) anti-ship/land-attack cruise missile, which the National Air and Space Intelligence Center says is “nuclear possibly” (US Air Force 2017, 37). The second boat, and the first of the improved Yasen-M class – known as *Kazan* – will begin sea trials in summer 2019 and undergo live firing tests in the autumn, after which it will join the Northern Fleet in late 2019 (TASS 2018e). The *Severodvinsk* is reportedly 10 to 12 meters longer than the *Kazan* and can therefore accommodate 40 Kalibr missiles, eight more than the *Kazan* (Gady 2018b). Six more Yasen-M boats are planned. The Yasen-class submarines will also be able to deliver the SS-N-16 (Veter) nuclear anti-submarine rockets, as well as nuclear torpedoes. Production of new attack submarines is slow, however, so Russia is upgrading older submarines, including the Sierra class (Project 945), the Oscar II class (Project 949A), and the Akula class (Project 971). While the conventional version of the Kalibr is being fielded on a wide range of submarines and ships, the nuclear version will likely replace the current SS-N-21 nuclear land-attack cruise missile on select attack submarines.

The Russian navy is also developing the Status-6 (Poseidon) mentioned above – a nuclear-powered, very long range, nuclear-armed torpedo. Underwater trials began in December 2018. If completed and fielded, the weapon would be carried by specially configured Oscar submarines.

The Russian Air Force is the military's second-largest user of non-strategic nuclear weapons, with an estimated 530 such weapons assigned for delivery by Tu-22M3 (Backfire) intermediate-range bombers, Su-24M

(Fencer-D) fighter-bombers, the new Su-34 (Fullback) fighter bomber, and the MiG-31K. All types can deliver nuclear gravity bombs. The Tu-22M3 can also deliver Kh-22 (AS-4 Kitchen) air-launched cruise missiles. An upgraded missile known as Kh-32 is in development to replace the Kh-22. It is possible the Russian Air Force also has various types of other guided bombs, air-to-surface missiles, and air-to-air missiles with nuclear capability, in which case the Air Force's inventory of warheads – and thus also Russia's total number of non-strategic warheads – would be greater. The Tu-22M3 and Su-24M are also being upgraded, but will eventually be replaced by the Su-34, which has already started deploying to air bases in all military districts. A total of 120 Su-34s are planned through 2020.

Russia has also developed a new long-range dual-capable air-to-surface missile known as the Kh-47M2 Kinzhal. The missile, which appears similar to the ground-launched SS-26 short-range ballistic missile used on the Iskander system, allegedly has a range of up to 2,000 km and is launched from the center-pylon of specially modified MiG-31K (Foxhound) air interceptors. The Kinzhal could potentially be used against targets on both land and sea, and has reportedly been deployed on experimental combat duty in the Southern Military District since December 2017 (TASS 2018f).

Additionally, the Russian Aerospace Force is expected to receive its first batch of 12 Su-57 fighter jets in 2019. They will reportedly be equipped with hypersonic “missiles with characteristics similar to that of the Kinzhal,” indicating that the Su-57s may also have a nuclear strike mission (TASS 2018g).

The Nuclear Posture Review also confirmed that Russia continues to use nuclear warheads in its air and missile defense forces. The missile defense forces use the Gazelle interceptor, but the Nuclear Posture Review did not identify which air defense system has dual-capability or how many are assigned nuclear warheads. The US Defense Intelligence Agency said in its March 2018 Worldwide Threat Assessment that “Russia may also have warheads for surface-to-air and other aerospace defense missile systems” (Ashley 2018). The S-300 is gradually being replaced by the S-400 system with SA-21 interceptors, and US government sources privately indicate that both the S-300 (SA-20) and S-400 (SA-21) are dual-capable. An upgrade of the nuclear-tipped A-135 anti-ballistic missile defense system around Moscow is underway, known as A-235 (Red Star 2017).

Russian officials said over a decade ago that about 40 percent of the country's 1991 stockpile of air defense nuclear warheads remained. Alexei Arbatov, then a member of the Russian Federation State Duma defense committee, wrote in 1999 that the 1991 inventory included

3,000 air defense warheads (Arbatov 1999). Many of those were probably from systems that had been retired, and US intelligence officials estimated that the number had declined to around 2,500 by the late 1980s (Cochran et al. 1989), in which case the 1991 inventory might have been closer to 2,000 air defense warheads. In 1992, Russia promised to destroy half of its nuclear air defense warheads, and Russian officials said in 2007 that 60 percent had been destroyed (Pravda 2007).

If those statements were accurate, the number of nuclear warheads for Russian air defense forces might have been 800 to 1,000 a decade ago. Assuming that the inventory has shrunk since (due to the improving capabilities of conventional air-defense interceptors and continued retirement of excess warheads), we estimate that nearly 300 nuclear warheads remain for air defense forces today, plus an additional roughly 100 for the Moscow A-135 missile defense system and coastal defense units, for a total inventory of about 380 warheads. However, it must be emphasized that this estimate comes with considerable uncertainty.

The Russian Army is in the final phase of a modernization of its short-range ballistic missile force that involves replacing the SS-21 (Tochka) with the SS-26 (Iskander-M). Both are nuclear-capable. Whereas the SS-21 launcher carries a single missile with a range of 120 kilometers (km), the SS-26 launcher carries two missiles with a range of about 350 km. We estimate there are at least 70 warheads for short-range ballistic missiles. There are also unconfirmed rumors that the SSC-7 (9M728 or R-500) ground-launched cruise missile and some Russian multiple rocket launchers may have nuclear capability.

US government sources also say Russia has developed and deployed a dual-capable ground-launched cruise missile in violation of the Intermediate-Range Nuclear Forces (INF) Treaty. In November 2017, after years of refusing to identify the missile in public, the US government identified it as the 9M729 (SSC-8) (US State Department 2019a). According to Director of National Intelligence Dan Coats, Russia initially tested the 9M729 to prohibited ranges from a fixed launcher, then tested it to ranges below 500 km from a mobile launcher (Office of the Director National Intelligence 2018). Russia deployed the first two battalions in late 2017 (Gordon 2017), and US intelligence sources have since indicated that Russia has deployed four battalions in the Western, Southern, Central, and Eastern military districts with nearly 100 missiles (including spares) (Gordon 2019). Each battalion is thought to include four launchers, each with four missiles (and four reloads), for a total of 64 missiles plus spares. The four battalions reportedly are co-located with Iskander units at Elanskiy, Kapustin Yar, Mozdok, and Shuya (Der Spiegel 2019).

Gen. Paul Selva, vice chairman of the Joint Chiefs of Staff, however, told Congress in 2017 that the 9M729 at that time did not give Russia a military advantage: “Given the location of the specific missiles and deployment, they don’t gain any advantage in Europe,” he said (Brissett 2017). Despite Selva’s remarks, the Trump Administration in December 2018 declared Russia to be in material breach of the INF Treaty and threatened to withdraw from it altogether if Russia does not come back into compliance within 60 days (US State Department 2018a). On February 1, 2019, US Secretary of State Michael Pompeo formally announced the United States would withdraw from the INF Treaty effective in August 2019 (US Department of State 2019b).

## Notes

1. We estimate that Russia stores its nuclear weapons at approximately 40 permanent storage sites across the country, including about 10 national-level central storage sites (Kristensen and Norris 2014, 2–9). Essential references for following Russian strategic nuclear forces include the general New START aggregate data that the US and Russian governments release biannually; BBC Monitoring; Pavel Podvig’s website on Russian strategic nuclear forces (Podvig n.d.); and the Russia profile maintained by the James Martin Center for Nonproliferation Studies (2012) on the Nuclear Threat Initiative (2012).
2. For examples of such analyses, see Oliker (2018), Tertrais (2018), Oliker and Baklitskiy (2018), Bruusgaard (2016), and Bruusgaard (2017).
3. For details of the RS-26, see the Nuclear Notebook “Russian nuclear forces, 2016” (Kristensen and Norris 2016).
4. Three Typhoon-class (Project 941) submarines also remain afloat. One has been converted to a missile test platform. None of these submarines carry nuclear weapons.
5. The Tu-95MS is equipped with the AS-15A and the Tu-160 with the AS-15B, which has a longer range. Each bomber can carry six to 16 weapons, depending on type. Hence it would be possible for 50 deployed bombers to be loaded with approximately 600 warheads, but still only be counted as 50 warheads under New START.
6. One normally well-informed source says there are no nuclear gravity bombs for the Tu-95MS and Tu-160 aircraft (Podvig 2005).
7. There are rumors that the AS-16 may have been retired or placed in storage.
8. Russia is also adding conventional cruise missiles to its bomber fleet, a capability that was showcased in September 2015 when Tu-160 and Tu-95MS bombers launched several long-range conventional Kh-555 and Kh-101 cruise missiles against targets in Syria. New storage facilities have been added to Russia’s bomber bases over the past few years that might be related to the introduction of conventional cruise missiles.
9. A US government telegram stated in September 2009 that Russia had “3,000–5,000 plus” nonstrategic nuclear

weapons (Hedgehogs.net 2010), a number that comes close to our estimate at the time (Kristensen 2009). The US principle deputy undersecretary of defense for policy, James Miller, stated in 2011 that non-governmental sources estimated Russia might have 2,000 to 4,000 non-strategic nuclear weapons (Miller 2011). For a more in-depth overview of Russian and US non-strategic nuclear weapons, see Kristensen (2012). Some analysts estimate that Russia has significantly fewer warheads assigned to non-strategic forces (Sutyagin 2012).

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## References

- Andreyev, D., and I. Zotov. 2017. “The Nuclear Shield is Reliable.” *Red Star*, December 14. <http://redstar.ru/index.php/component/k2/item/35401-yadernyj-shchit-nadjozhen>
- Arbatov, A. 1999. “Deep Cuts and De-alerting: A Russian Perspective.” In *The Nuclear Turning Point: A blueprint for Deep Cuts and De-Alerting of Nuclear Weapons*, edited by

- H. A. Feiveson, 319. Washington, DC: Brookings Institution Press.
- Ashley, R. 2018. "Statement for the Record: Worldwide Threat Assessment." Prepared statement to the Senate Armed Services Committee, March 6, 12. [https://www.armed-services.senate.gov/imo/media/doc/Ashley\\_03-06-18.pdf](https://www.armed-services.senate.gov/imo/media/doc/Ashley_03-06-18.pdf)
- Brissett, W. 2017. "US-Can-Respond-to-Russian-Violations-Without-Breaking-INF-Treaty." *Air Force Magazine*, July 20. <http://www.airforcemag.com/Features/Pages/2017/July%202017/US-Can-Respond-to-Russian-Violations-Without-Breaking-INF-Treaty.aspx>
- Bruusgaard, K. V. 2016. "Russian Strategic Deterrence." *Survival* 58 (4). July 19. doi:10.1080/00396338.2016.1207945.
- Bruusgaard, K. V. 2017. "The Myth of Russia's Lowered Nuclear Threshold." *War On The Rocks*, September 22. <https://warontherocks.com/2017/09/the-myth-of-russias-lowered-nuclear-threshold/>
- Cochran, T. B., W. M. Arkin, R. S. Norris., and J. I. Sands. 1989. *Nuclear Weapons Databook Volume IV: Soviet Nuclear Weapons*, 32. New York, NY: Harper & Row.
- Der Spiegel. 2019. "Russland hat offenbar mehr umstrittene Raketen stationiert als bekannt." February 9. <http://www.spiegel.de/politik/ausland/russland-hat-offenbar-mehr-umstrittene-raketen-stationiert-als-bekannt-a-1252500.html>
- Gady, F. -S. 2018a. "Russia to Test Fire RS-28 Sarmat ICBM in Early 2019." *The Diplomat*, October 3. <https://thediplomat.com/2018/10/russia-to-test-fire-rs-28-sarmat-icbm-in-early-2019/>
- Gady, F. -S. 2018b. "Russia's First Yasen-M Attack Sub to Begin State Trials in 2019." *The Diplomat*, December 8. <https://thediplomat.com/2018/12/russias-first-yasen-m-attack-sub-to-begin-state-trials-in-2019/>
- Gertz, B. 2015. "Russia Nearing Deployment of New Intermediate-range Naval Missile." *Washington Free Beacon*, August 21. <http://freebeacon.com/national-security/russia-nearing-deployment-of-new-intermediate-range-naval-missile/>
- Gordon, M. 2017. "Russian Cruise Missile, Deployed Secretly, Violates Treaty, Officials Say." *New York Times*, February 14. <https://mobile.nytimes.com/2017/02/14/world/europe/russia-cruise-missile-arms-control-treaty.html>
- Gordon, M. 2019. "On Brink Of Arms Treaty Exit, U.S. Finds More Offending Russian Missiles." *Wall Street Journal*, January 31. <https://www.wsj.com/articles/on-brink-of-arms-treaty-exit-u-s-finds-more-offending-russian-missiles-11548980645>
- Hedgehogs.net. 2010. "US Embassy Cables: US Targets Terrorists with Conventional Warheads Fitted to Nuclear Weapons." *Wikileaks document*. Previously available at: [www.hedgehogs.net/pg/newsfeeds/hhwebadmin/item/6728052/us-embassy-cables-us-targets-terrorists-with-conventional-warheads-fitted-to-nuclear-weapons](http://www.hedgehogs.net/pg/newsfeeds/hhwebadmin/item/6728052/us-embassy-cables-us-targets-terrorists-with-conventional-warheads-fitted-to-nuclear-weapons)
- Hyten, J. E. 2017. "2017 Deterrence Symposium Closing Remarks." July 27. <http://www.stratcom.mil/Media/Speeches/Article/1264664/2017-deterrence-symposium-closing-remarks/>
- James Martin Center for Nonproliferation Studies. 2012. "Russia: Nuclear." *Nuclear Threat Initiative*. <http://www.nti.org/country-profiles/russia/nuclear/>
- Johnson, R. 2018. "Russia's Strategic Bomber Force Extends Long Arm." *Jane's Defence Weekly*, April 9. [https://janes.ihs.com/Janes/Display/FG\\_899161-JDW](https://janes.ihs.com/Janes/Display/FG_899161-JDW)
- Kristensen, H. M. 2009. "Russian Tactical Nuclear Weapons." *FAS Strategic Security Blog*, March 25. <http://www.fas.org/blog/ssp/2009/03/russia-2.php>
- Kristensen, H. M. 2012. "Non-Strategic Nuclear Weapons." In *Special Report No. 3*. Federation of American Scientists. May. [http://www.fas.org/\\_docs/Non\\_Strategic\\_Nuclear\\_Weapons.pdf](http://www.fas.org/_docs/Non_Strategic_Nuclear_Weapons.pdf)
- Kristensen, H. M. 2015. "Kalibr: Savior of INF treaty?" *FAS Strategic Security Blog*, December 14. <https://fas.org/blogs/security/2015/12/kalibr/>
- Kristensen, H. M. 2018. "Tweet Posted October 19." <https://twitter.com/nukestrat/status/1053370585831653376>
- Kristensen, H. M., and R. S. Norris. 2014. "Nuclear Notebook: Worldwide Deployments of Nuclear Weapons, 2014." *Bulletin of the Atomic Scientists*, September. <http://bos.sagepub.com/content/early/2014/08/26/0096340214547619.full.pdf+html>
- Kristensen, H. M., and R. S. Norris 2016. "Nuclear Notebook: Russian Nuclear Forces, 2016." *Bulletin of the Atomic Scientists*, May. <http://www.tandfonline.com/doi/pdf/10.1080/00963402.2016.1170359>
- Miller, F. 2015. "Keynote Speech at the 2015 USSTRATCOM Deterrence Symposium." July 29. [https://www.stratcom.mil/speeches/2015/137/Keynote\\_2015\\_USSTRATCOM\\_Deterrence\\_Symposium/](https://www.stratcom.mil/speeches/2015/137/Keynote_2015_USSTRATCOM_Deterrence_Symposium/)
- Miller, J. M. 2011. "Statement before the House Armed Services Committee." [http://armedservices.house.gov/index.cfm/files/serve?File\\_id=faad05df-9016-42c5-86bc-b83144c635c9](http://armedservices.house.gov/index.cfm/files/serve?File_id=faad05df-9016-42c5-86bc-b83144c635c9)
- Office of the Director of National Intelligence. 2018 "Director of National Intelligence Daniel Coats on Russia's Intermediate-range Nuclear Forces (INF) Treaty Violation." November 30. <https://www.dni.gov/index.php/newsroom/speeches-interviews/item/1923-director-of-national-intelligence-daniel-coats-on-russia-s-inf-treaty-violation>
- Oliker, O. 2018. "Russia's Nuclear Enigma." *Foreign Affairs*, November. <https://www.foreignaffairs.com/articles/russian-federation/2018-10-15/moscows-nuclear-enigma>
- Oliker, O., and A. Baklitskiy. 2018. "The Nuclear Posture Review and Russian 'De-escalation': A Dangerous Solution to a Nonexistent Problem." *War On The Rocks*, February 20. <https://warontherocks.com/2018/02/nuclear-posture-review-russian-de-escalation-dangerous-solution-nonexistent-problem/>
- Podvig, P. 2005. "Test of a Kh-555 Cruise Missile." *Russian Strategic Nuclear Forces*, May 26. [http://russianforces.org/blog/2005/05/test\\_of\\_a\\_kh555\\_cruise\\_missile.shtml](http://russianforces.org/blog/2005/05/test_of_a_kh555_cruise_missile.shtml)
- Podvig, P. 2015. "Is Russia Working on a Massive Dirty Bomb." *Russian Strategic Nuclear Forces*, November 10. [http://russianforces.org/blog/2015/11/is\\_russia\\_working\\_on\\_a\\_massive.shtml](http://russianforces.org/blog/2015/11/is_russia_working_on_a_massive.shtml)
- Podvig, P. 2018a. "Two More Borey-A Submarines to be Built by 2028." *Russian Strategic Nuclear Forces*, December 4. [http://russianforces.org/blog/2018/12/two\\_more\\_borey-a\\_submarines\\_to.shtml](http://russianforces.org/blog/2018/12/two_more_borey-a_submarines_to.shtml)
- Podvig, P. 2018b. "Two Project 667BDR Submarines Withdrawn from Service." *Russian Strategic Nuclear Forces*, March 14. [http://russianforces.org/blog/2018/03/two\\_project\\_667bdr\\_submarines.shtml](http://russianforces.org/blog/2018/03/two_project_667bdr_submarines.shtml)

- Podvig, P. n.d. “Russian Strategic Nuclear Forces Website.” <http://www.russianforces.org>
- Pravda. 2007. “Russia Determined to Keep Tactical Nuclear Arms for Potential Aggressors.” October 31. [english.pravda.ru/russia/kremlin/31-10-2007/99911-nuclear\\_arms-0/](http://english.pravda.ru/russia/kremlin/31-10-2007/99911-nuclear_arms-0/)
- RIA Novosti. 2014. “Источник: МБР “Сармат” будут вооружены семь ракетных полков РВСН.” December 26. <https://ria.ru/20141226/1040266880.html>
- Russian Federation. 2010. *The Military Doctrine of the Russian Federation, approved by Russian Federation presidential edict on 5 February 2010*. Published on the Russian presidential website on February 8. Translation by Open Source Center via World News Connection.
- Russian Federation. 2014. *Military Doctrine of the Russian Federation, approved by Russian Federation President V. Putin*. Published on the Russian presidential website on December 26, Section 27. The document is not available on the English version of the web site. Translation via BBC Monitoring.
- Russian Federation. 2018. “Meeting of the Valdai International Discussion Club.” *Transcript*, October 18. <http://en.kremlin.ru/events/president/news/58848>
- Russian Federation. 2019. “President’s Address to Federal Assembly.” February 20. <http://en.kremlin.ru/events/president/news/59863>
- Russian Federation Defence Ministry. 2018a. “Supreme commander-in-chief of the Russian Federation Attends Extended Session of the Russian Defence Ministry Board Session.” Press Release, December 18. [http://eng.mil.ru/en/news\\_page/country/more.htm?id=12208613@egNews](http://eng.mil.ru/en/news_page/country/more.htm?id=12208613@egNews)
- Russian Federation Defence Ministry. 2018b. “The First Regiment of the Yars Missile Systems at the Kozelsk Missile Unit took up Combat Duty.” Press Release, December 14. [https://function.mil.ru/news\\_page/country/more.htm?id=12208196@egNews](https://function.mil.ru/news_page/country/more.htm?id=12208196@egNews)
- Russian Federation Foreign Affairs Ministry. 2018. “Foreign Ministry Statement.” February 5. [http://www.mid.ru/foreign\\_policy/news/-/asset\\_publisher/cKNonkJE02Bw/content/id/3054864](http://www.mid.ru/foreign_policy/news/-/asset_publisher/cKNonkJE02Bw/content/id/3054864)
- Sputnik News. 2015. “Russia to Produce Successor of Tu-160 Bomber after 2023.” June 4. <http://sputniknews.com/military/20150604/1022954769.html>
- Star, R. 2017. “Система русской ПРОбы.” January 22. <http://www.redstar.ru/index.php/component/k2/item/31990-sistema-russkoj-proby>
- Stowe-Thurston, A., M. Korda, and H. M. Kristensen. 2018. “Putin Deepens Confusion about Russian Nuclear Policy.” *Russia Matters*, October 25. <https://www.russiamatters.org/analysis/putin-deepens-confusion-about-russian-nuclear-policy>
- Sutyagin, I. 2012. *Atomic Accounting: A New Estimate of Russia’s Non-Strategic Nuclear Forces*. Occasional Paper. London: Royal United Services Institute. November. <http://www.rusi.org/publications/occasionalpapers/ref:O509A82F347BFC/>
- TASS. 2016. “Around 400 Missiles on Combat Duty in Russian Missile Forces – Commander.” December 16. <http://tass.ru/en/russia/767157>
- TASS. 2018a. “Avanguard Hypersonic Missiles Replace Rubezh ICBMs in Russia’s Armament Plan through 2027.” March 22. <http://tass.com/defense/995628>
- TASS. 2018b. “Источник: первые комплексы “Авангард” встанут на боевое дежурство в 2019 году.” October 29. <https://tass.ru/armiya-i-opk/5731436>
- TASS. 2018c. “Nuclear Submarine Knyaz Vladimir to Fire with Bulava During Tests—Source.” December 19. <http://tass.com/defense/1036706>
- TASS. 2018d. “Источник: еще две стратегические подлодки “Борей-А” построят на “Севмаше” к 2028 году.” November 30. <https://tass.ru/armiya-i-opk/5856741>
- TASS. 2018e. “Russia’s Yasen-class Nuclear Attack Submarine Kazan to Begin State Trials Next Summer.” December 7. <http://tass.com/defense/1034816>
- TASS. 2018f. “Russia Picks MiG-31 Fighter as a Carrier for Cutting-edge Hypersonic Weapon.” April 6. <http://tass.com/defense/998221>
- TASS. 2018g. “Su-57 Jets will be Equipped with Hypersonic Missiles Similar to Kinzhal—Source.” December 6. <http://tass.com/defense/1034559>
- Tertrais, B. 2018. “Russia’s Nuclear Policy: Worrying for the Wrong Reasons.” *Survival* 60 (2). May. <https://www.iiss.org/-/media/silos/survival/2018/survival-60-2/60-2-03-tertrais-cm/60-2-03-tertrais-cm.pdf>
- The Local. 2015. “Russia Delivers Nuclear Threat to Denmark.” March 21. <http://www.thelocal.dk/20150321/russia-threatens-denmark-with-nuclear-attack>
- TV Zvezda. 2016. “Missile System ‘Topol’ will be Removed from Service in 2022.” December 15. <http://tvzvezda.ru/news/opk/content/201612151215-kfyv.htm>
- US Air Force, National Air and Space Intelligence Center (NASIC). 2017. *Ballistic Missile and Cruise Missile Threat*, 26. July 21. [http://www.nasic.af.mil/Portals/19/images/Fact%20Sheet%20Images/2017%20Ballistic%20and%20Cruise%20Missile%20Threat\\_Final\\_small.pdf?ver=2017-07-21-083234-343](http://www.nasic.af.mil/Portals/19/images/Fact%20Sheet%20Images/2017%20Ballistic%20and%20Cruise%20Missile%20Threat_Final_small.pdf?ver=2017-07-21-083234-343)
- US Defense Department. 2018. “Office of the Secretary of Defense.” *Nuclear Posture Review*. February. <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>
- US State Department. 2018a. “New START Treaty Aggregate Numbers of Strategic Offensive Arms.” September 1. <https://www.state.gov/t/avc/newstart/286466.htm>
- US State Department. 2018b. “Press Availability at NATO Headquarters: Press Availability, Michael R. Pompeo, Secretary of State, Brussels, Belgium, December 4, 2018.” December 4. <https://www.state.gov/secretary/remarks/2018/12/287873.htm>
- US State Department. 2019a. “INF Diplomatic Timeline.” February 1. <https://www.state.gov/t/avc/inf/287411.htm>
- US State Department. 2019b. “Remarks to the Press.” February 1. <https://www.state.gov/secretary/remarks/2019/02/288712.htm>
- YouTube. 2015. “Video.” [https://www.youtube.com/watch?v=\\_FgPBGteLzU](https://www.youtube.com/watch?v=_FgPBGteLzU)
- Zudin, A. 2018. “Russia Orders First 10 Tu-160M2 Bombers.” *Jane’s Defence Weekly*, January 30. [https://janes.ihs.com/Janes/Display/FG\\_728439-JDW](https://janes.ihs.com/Janes/Display/FG_728439-JDW)