



**EVERYTHING COUNTS:  
Building a Control Regime for  
Nonstrategic Nuclear Warheads in Europe**

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Introduction by the Hon. Rose Gottemoeller



Middlebury Institute of  
International Studies at Monterey  
*James Martin Center for Nonproliferation Studies*

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*The views, judgments, and conclusions in this report are the sole representations of the authors and do not necessarily represent either the official position or policy or bear the endorsement CNS or the Middlebury Institute of International Studies at Monterey.*

Cover image: Denis Kabelev/Shutterstock. Russia's Iskander (or SS-26 STONE) road-mobile short-range ballistic missile system can launch both conventional and non-strategic nuclear warheads.

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# List of Acronyms and Other Key Terms

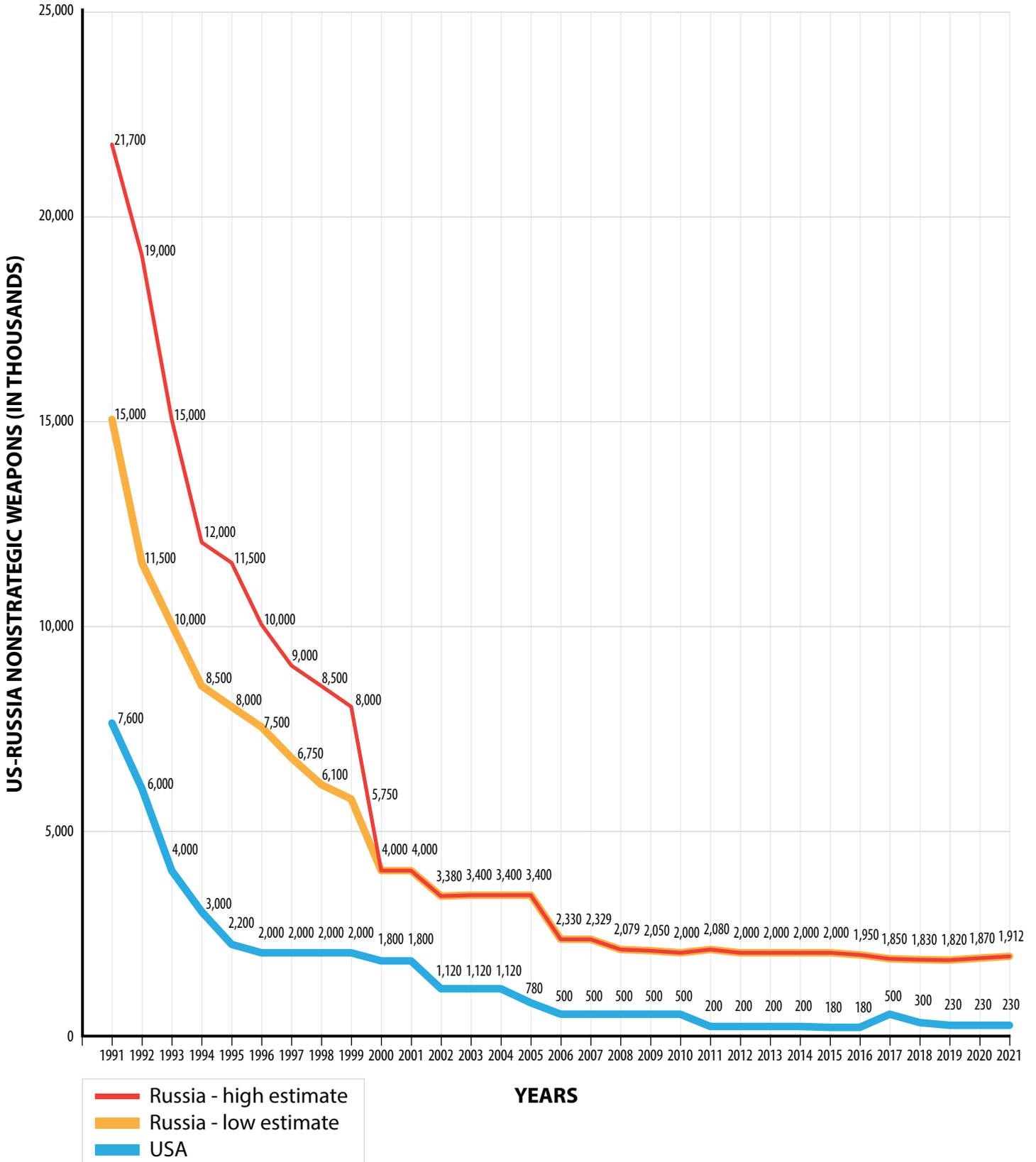
<b>TERM</b>	<b>MEANING</b>
9M729	“SSC-8”—Ground-launched cruise missile (Russia)
12th GUMO	Ministry of Defense, 12th Main Directorate, in charge of nuclear warheads (Russia)
ADM	Atomic demolition munition
AICMS	Automated Inventory Control and Management System (Russia)
ALCM	Air-launched cruise missile
Avangard	Hypersonic glide vehicle (Russia)
A-235	Anti-ballistic-missile system (Russia)
B61	Thermonuclear gravity bomb (US)
CBM	Confidence-building measure
CFE	Treaty Conventional Armed Forces in Europe Treaty
CNS	Center for Nonproliferation Studies
CTR	Cooperative Threat Reduction (program)
CWC	Chemical Weapons Convention
DCA	Dual-capable aircraft
DIAMONDS (US)	Defense Integration and Management of Nuclear Data Services
DLT	Distributed ledger technology
DOD	US Department of Defense
F-15	Tactical fighter aircraft (US)
F-16	Single-engine multirole fighter aircraft (US)
F-18	“Hornet”—supersonic, carrier-capable multirole combat jet (US)
F-35	Stealth multirole combat aircraft (US)
HGV	Hypersonic glide vehicle
HLG	(NATO) High-Level Group
IAEA	International Atomic Energy Agency
ICBM	Intercontinental ballistic missile
INF Treaty	Intermediate-Range Nuclear Forces Treaty (1987)
IPNDV	International Partnership for Nuclear Disarmament Verification
Iskander	“9K720”—mobile short-range ballistic missile system (Russia)
KB	
Khimavtomatika	Spacecraft propulsion and rocket engine design bureau (Russia)
KH-101/102	Air-launched cruise missile (Russia)
Kinzhal	Nuclear-capable air-launched ballistic missile (Russia)
MOD	Ministry of Defense
NCND	Neither confirm nor deny (hosting US nuclear weapons)
NDA	Nondestructive assay
New START	New Strategic Arms Reduction Treaty (2010)
NPG(NATO)	Nuclear Planning Group
NPT	Treaty on the Non-Proliferation of Nuclear Weapons (1968)
NSNW	Nonstrategic nuclear warheads
NTM	National technical means of verification
OSCE	Organization for Security and Cooperation in Europe

## TERM

## MEANING

PNIs	Presidential Nuclear Initiatives (1991)
Project 636.3	Kilo-class diesel-electric submarine (Russian Pacific Fleet)
RS-28 Sarmat	Liquid-fueled ICBM with multiple independent re-entry vehicle system (Russia)
RTP	Rail transfer point
R&D	Research and development
SALT	Strategic Arms Limitation Talks—process that produced treaties signed in 1972 (SALT I) and 1979 (SALT II)
SATAN-2	RS-28 Sarmat (nickname)
SCG	Special Consultative Group (NATO-US, during INF Treaty negotiations)
SLBM	Submarine-launched ballistic missile
SLCM	Sea-launched cruise missile
SNARK	“ZK-SNARK” zero-knowledge succinct non-interactive argument of knowledge (used to query databases)
SOFA	Status of forces agreement
SORT	Strategic Offensive Reductions Treaty (2002)
SSD	Strategic Stability Dialogue
START	Strategic Arms Reduction Treaty
SS-3/R-5	Single-stage missile with detachable warhead re-entry vehicle (USSR)
SS-4/R-12	“Divina”—medium-range ballistic missile (USSR)
SS-5/R-14	“Chusovaya”—single-stage intermediate-range ballistic missile (USSR)
SS-20/RSD-10	“Pioneer”—two-stage solid-fueled missile system (USSR)
SS-21/OTR-21	“Tochka”—tactical ballistic missile (USSR)
SS-23/OTR-23	“Oka”—mobile-deployment theater ballistic-missile system (USSR)
Su-34	“Sukhoi”—Soviet origin supersonic medium-range fighter-bomber (Russia)
Su-24	“Sukhoi”—Supersonic attack aircraft (USSR)
TOBOS	Tekhnologii Obespecheniya Bezopasnosti Opasnykh Sistem (Technologies for Securing the Safety of Dangerous Systems)
TOC	Transfer of custody
Tornado	“Panavia”—Twin-engine multirole combat aircraft (NATO)
Tsirkon	“3M22”—Scramjet anti-ship hypersonic cruise missile (USSR)
Tu-22M3/M	Variable-sweep wing, long-range supersonic strategic bomber (USSR)
Tu-95ms	“Tupolev”—Large strategic bomber and missile platform (USSR)
Tu-160	“Tupolev”—Supersonic heavy strategic bomber (USSR)
T/CBMs	Transparency and confidence-building measures
UNIDIR	United Nations Institute for Disarmament Research
W76-2	Thermonuclear warhead used on SLBMs (US)

**FIGURE ES.1. ESTIMATED US AND RUSSIAN NONSTRATEGIC NUCLEAR WEAPONS, 1991-2021**



# Executive Summary

Before the Russian invasion of Ukraine, the Biden administration insisted in arms control talks with Russia that a follow-on agreement to the New Strategic Arms Reduction Treaty (New START) should cover all nuclear weapons and that such an agreement should focus on the nuclear warheads themselves. This would represent a significant change from previous agreements, which focused on delivery vehicles, such as missiles. The United States has been particularly interested in potential limits on nonstrategic nuclear warheads (NSNW). Such weapons have never been subject to an arms control agreement. Because Russia possesses an advantage in the number of such weapons, the US Senate has insisted that negotiators include them in a future agreement, making their inclusion necessary if such an accord is to win Senate approval and ultimately be ratified by Washington. In the wake of Russian nuclear threats in the Ukraine conflict, such demands can only be expected to grow if and when US and Russian negotiators return to the negotiating table.

Such an agreement will face major negotiating and implementation challenges—not only between Washington and Moscow, but also between Washington and NATO European allies. That is because the US side of such an agreement would primarily affect an estimated 100 US B61 gravity bombs deployed at European bases in NATO countries. Yet, these allies have not played a substantive role in US-Russian arms control negotiations since the Intermediate-Range Nuclear Forces (INF) Treaty was completed in the 1980s; inspections under the treaty ended in 2001.<sup>1</sup> As a result, many of these allies and NATO officials have recognized the need to “do their homework” so they can be prepared to engage in substantive consultations with the United States during negotiation of such a treaty and to implement it once it enters into force.

To stimulate this process, four NATO allies (Denmark, Germany, the Netherlands, and Norway) and one NATO partner (Sweden) funded a research team led by the James Martin Center for Nonproliferation Studies and former NATO Deputy Secretary General and New START lead negotiator Rose Gottemoeller. The research focused on the negotiating, policy, legal, and technical issues that allies will likely have to address to reach such an accord. The research team also carried out a series of interviews to understand the views in NATO states on such an agreement and to gauge the constraints they could be expected to face in the process. The interviews and the primary drafting of the report occurred before Russia’s February 2022 invasion of Ukraine.

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<sup>1</sup> “Officials Mark End of INF Treaty Inspections,” *Arms Control Today*, June 2001, <https://www.armscontrol.org/act/2001-06/officials-mark-end-inf-treaty-inspections>.

The following chapters provide detailed insights on these issues. However, a few broad conclusions and recommendations warrant particular attention:

- NATO allies want to keep existing NSNW, *and* they want an agreement limiting Russian NSNW, *and they expect* to be substantively consulted before each round of negotiations. A decade ago, some US allies, such as Germany, appeared close to parting with the weapons because of public pressure despite considerable opposition within the alliance, particularly from newer allies with territory closer to Russian borders. While US Secretary of State Hillary Clinton managed to paper over these differences at the time, Russia's behavior, including the 2014 annexation of Crimea and the 2022 invasion of Ukraine, has helped reinforce allied views that under the present circumstances, maintaining NATO's current nuclear-sharing arrangements is the right approach. At the same time, the Ukraine invasion may further reinforce some allies' doubts about the value of such agreements with Russia. All allies will need to be reassured that arms control and deterrence do not clash, but rather complement each other. US leadership and willingness to engage in substantive consultations will be crucial in maintaining unity. The allies' experience in negotiating the INF Treaty and the Biden administration's current close work with NATO on Ukraine provide useful models.
- Most of the Russian NSNW arsenal today is designed to support specific missions (as a backup to its emerging long-range conventional capability) and, from the perspective of the Russian military (particularly the Navy), will be tough to bargain away.
- Addressing NSNW will require overcoming operational and technical verification challenges that are made more difficult by issues of information security, definitions, and stockpile disparities. Nuclear-warhead design, composition, and capabilities are among the most closely held secrets of the nuclear-weapon states, and warhead movements pose the most sensitive nuclear-security concerns. Because parts of a nuclear warhead are replaced on a regular basis and warhead configurations can differ greatly, it could prove challenging to establish a universal definition of a warhead, and their size and mobility present major obstacles to accounting for and tracking individual warheads. US and Russian NSNW stockpiles also differ significantly in types and numbers.
- The experience in implementing the INF Treaty provides a useful starting point for considering how the new treaty might

be implemented. Other agreements and inspection regimes to which many NATO allies are party also provide useful practical experience in preparing to host Russian inspectors. In advance of negotiations, allies should carry out a legal assessment to determine how domestic laws might need to be amended to carry out on-site inspections and other measures on their territory and a technical-capability assessment to determine how they might need to improve their staffing of national verification entities to implement an agreement.

- Allies also need to enhance the analytical and legal capabilities of their foreign and defense ministries when it comes to NSNW and arms control. In most countries, such expertise has withered in the decades since the end of the Cold War; newer allies were never involved in INF Treaty negotiations or implementation, even indirectly.
- US and allied research on verification measures for NSNW has largely focused on scientific and technical tools to conduct on-site inspections. The research team has developed an original and unique methodology for a data exchange employing historic stockpile data and taking advantage of past US-Russian cooperation and cryptography. This data exchange would serve as the critical backbone for other verification measures, no matter the type of warhead or the type of agreement (freeze, limitation, or reduction).

Finally, sustained political engagement at the highest level will be essential to the success of any arms control initiative involving allies. If there is a lesson from the past three decades of arms control in the Euro-Atlantic region, it is that a penny-wise and pound-foolish approach has decimated the personnel and the intellectual investment in arms control. When arms control has been pursued in recent years, it often has been done in isolation from security policy, national strategy, and military planning, rendering it at best a curio within foreign ministries. Until this topic is taken seriously as an instrument of hard power, to reinforce deterrence as one of the most important ways nations seek to avoid or limit war, it will not find purchase on the rocky ground of great-power competition.



# Introduction

*Rose Gottemoeller*

The scene appeared set for further progress on nuclear arms control when President Joe Biden entered office in January 2021. As one of his first foreign-policy acts, he agreed with Russian President Vladimir Putin to extend the 2011 New Strategic Arms Reduction Treaty (New START) by five years, until February 2026. Biden and Putin subsequently spoke on the phone in April and met in Geneva in June 2021 to launch a strategic stability dialogue (SSD). The goal of the dialogue begun before the February 2022 Russian invasion of Ukraine was twofold: first, to begin the process of replacing New START, and second, to conduct a wide-ranging discussion of issues affecting strategic stability. These issues include traditional topics on the US-Russian agenda such as missile defense and conventional long-range weapon systems—the latter in the context of what the Russians call “conventional weapons having strategic effect.” The talks were also to cover the emergence of new and disruptive technologies in the cyber arena and in artificial intelligence and quantum computing, synthetic biology, and other realms.

Even before the Russian invasion of Ukraine, all of this would have taken much time and focused effort. The United States and Russia would have had to consider how to include China in the discussion—ideally, directly at the table, either in a parallel bilateral setting or in a trilateral or P5 setting.<sup>1</sup> Early on, however, the most important step seemed to be for Washington and Moscow to consider the implications of China’s evident nuclear buildup.

Russia’s invasion of Ukraine upended the European security order and US arms control priorities and led the United States to suspend the SSD. In the short term, the US-Russian bilateral agenda is in a very negative place and arms control is taking a back seat to addressing the Ukraine crisis.

Nonetheless, the 2026 expiration of New START looms. At some point, both sides are likely to see the benefit of returning to the negotiating table to develop a follow-on to New START, no matter how the Ukraine conflict turns out. Somewhat heartening in this dreadful period is the fact that as of this writing, both sides continue to implement New START without interruption. Nuclear arms control, therefore, might become an early priority for resuming interaction.

<sup>1</sup> Because the five countries that the Treaty on the Non-Proliferation of Nuclear Weapons recognizes as nuclear-weapon states—China, France, Russia, the United Kingdom, and the United States—also are the five permanent members of the United Nations Security Council, the group is often known as the P5.

As is frequently the case with new negotiations, the two sides have quite different starting positions and priorities. The Russians have already been clear that they continue to be concerned about US missile defenses, and they have said clearly that they want to see limits on the US conventionally armed missiles that have strategic effect. These limits will no doubt include US conventional hypersonic glide vehicles (HGVs). Russia also continues to seek the removal of US nuclear weapons from Europe and the elimination of NATO's nuclear-sharing arrangements and related infrastructure as a condition for any talks on nonstrategic nuclear weapons.

The United States, for its part, is focused on constraining the new “exotic” Russian systems (the six systems Putin announced in his March 2018 speech)—in particular, the air-launched ballistic missile (the Kinzhal or Killjoy),<sup>2</sup> the nuclear-powered cruise missile (Burevestnik or Skyfall), and the nuclear-propelled, nuclear-armed unmanned undersea vehicle (Kanyon or Poseidon). The new multiwarhead, heavy, liquid-fueled ICBM (the Sarmat or Satan 2), and the new nuclear HGV (the Avangard warhead to be launched from existing ICBMs) already fall under the limits of New START. The sixth system is not a missile system but a ground-based mobile dazzling laser (Peresevet).

The United States for many years has also been clear that it places a priority on limiting Russian warheads designated for nonstrategic delivery systems (gravity bombs and air-, sea-, and land-launched theater and shorter-range missiles). These warheads are deployed on aircraft, ships, and missiles—many of them within range of US allies in NATO Europe and Asia—or are held in reserve in central storage facilities. This will be the second major objective of the United States in the negotiations, and it is important to both Republican and Democratic political players. It is enshrined in US law as part of the Resolution of Ratification of the New START Treaty. A treaty limiting nonstrategic nuclear warheads on the Russian side could thus gain bipartisan support in the executive branch of the government and in the Senate.

Bringing these different Russian and US objectives together will be tough work for negotiators, but it is doable. The United States has already made it clear, for example, that it will not accept demands to limit its missile-defense systems without consideration of the new Russian missile-defense systems that are being built and deployed, especially the S-500. Therefore, the discussion will not be all about limiting US systems, but about what the two sides are willing to do to build confidence that they will not seek to subvert each other's missile-defense capabilities in the future. As one Russian expert has put it, we each should be willing to allow the other to build and maintain a limited defense of its homeland.

<sup>2</sup> In this list of missiles, the first name is the Russian designation and the second is the NATO designation.

Russia has also made it clear that it is not willing to consider limits on its nonstrategic nuclear warheads if the United States will not constrain its warheads available for upload onto strategic delivery systems—ICBMs and submarine-launched ballistic missiles. Thus, the stage is set for direct limits on all warheads—strategic and nonstrategic, deployed and non-deployed. Before the Ukraine invasion, some Russian experts had again been saying that the Russian position is to support the freeze on all warheads first proposed by President Donald Trump in 2020. They saw such a freeze as a first step toward verifiable limits on warheads, which can be considered only once a monitoring regime is developed and agreed between the two sides.

It is this monitoring regime for verification of warhead limits that is at the heart of the CNS project. The United States and Russia have never before tried to limit warheads directly because of the great sensitivity of warhead storage, handling, and maintenance facilities, as well as deployment sites. Past agreements have focused on missiles and their launchers because they are large pieces of hardware that can be easily seen and accounted for, even from outer space. Once missiles and launchers are eliminated under a treaty, their warheads are returned to storage and are considered “eliminated” for purposes of the treaty but can be repurposed unless eliminated in a verifiable manner—a goal for the START III framework agreed in 1997, but never implemented. Miles A. Pomper and Nikolai Sokov provide information on US and Russian nonstrategic-nuclear-warhead history, posture, and policy in their respective chapters of this volume.

In the future, however, the United States will seek direct limits on warheads, which means they must be accounted for and tracked in different portions of their life cycle. This will be a difficult undertaking—again, because of the sensitivity of the warheads themselves (especially their design) and all of their related facilities and dedicated storage, moving, maintenance, and training equipment. Both the United States and Russia will want to ensure that the other party receives only the information necessary to verify that the limits of the treaty are being respected and that no sensitive information that could advantage the other side is revealed. An innovative approach to achieving these objectives is outlined by William Moon and colleagues in our technical chapter and related appendices.

NATO allies will have to be involved in this effort because verification of holdings likely will require access to US warheads stored in Europe. While most inspections of US stockpiles probably will take place in the United States, some will take place at the bases where warheads are stored for the NATO nuclear mission. Some other locations where warheads can be handled or transferred likely also will be subject to inspections.

Therefore, NATO allies should begin to think ahead about how a new treaty's requirements might affect them. It will be important for each ally to be prepared on a national basis for negotiations prior to their initiation, and it will be important for the allies to help shape any resulting treaty as it is negotiated. Many of the requirements could be similar to the responsibilities that allies carried out under the Intermediate-Range Nuclear Forces (INF) Treaty Basing Countries Agreement, which allowed INF inspections on their territory. William Alberque and his team conducted interviews of relevant NATO stakeholders on their views of the policy issues related to negotiations, and, in a separate chapter, William also outlines what those relevant policy issues are. The INF precedents are further described in Marshall Brown's chapter on legal issues.

Achieving a follow-on to New START will not be easy, in the first instance because the US-Russian bilateral relationship is in deep crisis, and horrendous Russian behavior in Ukraine is steadily exacerbating it. Into this difficult overall environment will come an agenda with some of the most difficult tasks ever attempted between Russia and the United States at the negotiating table. Creating direct limits on all warheads, with effective means to verify them, is near, if not at, the top of the list. Compounding this complexity is the rapid expansion in Chinese strategic nuclear capabilities, which is causing a good deal of anxiety in the United States and among US allies. And the growing number and complexity of Russian nuclear-warhead delivery vehicles, alongside growing missile-defense capabilities and contestation of outer space, increase the difficulty of reaching agreement.

Thus, although Presidents Biden and Putin extended New START for five years, the United States and its allies must get started *now* outlining NATO parameters for a new treaty, identifying Russian priorities, and beginning to look for common ground. Although negotiations have historically been shielded from negative bilateral environments, both capitals will find it difficult to do so now. For that reason, momentum is bound to flag and five years—now less than four years—will not turn out to be such a long period after all.

Engaging the NATO allies early, as was done during the negotiations on the INF Treaty, is important to ensure that their interests are represented from the outset and that even as the alliance grapples with Ukraine and its aftermath, it keeps its eye on arms control. Allies should not be surprised by anything that comes out of the eventual negotiating process. To the contrary, anything Washington can do to work in advance with the allies to build the system of warhead limits and verification measures will provide the United States with extra ammunition in eventual talks with the Russians. It will also lead to confidence among the allies in the process, and in turn lend momentum to the US-Russia negotiations.

# US Nonstrategic Nuclear Weapons in NATO Europe: Background, Posture, and Declaratory Policy

*Miles A. Pomper*

No nuclear arms control agreement has ever covered nonstrategic nuclear warheads (NSNW). Indeed, the easiest way to define these short-range “theater” weapons is nuclear warheads that have been excluded from prior strategic arms control limitations—the 1972 treaty that resulted from the Strategic Arms Limitation Talks (SALT I), the 1991 Strategic Arms Reduction Treaty (START I), the 2002 Strategic Offensive Reductions Treaty (SORT), and the 2010 New Strategic Arms Reduction Treaty (New START)—as well as the 1987 Intermediate-Range Nuclear Forces (INF) Treaty. During the Cold War, both sides possessed thousands of “tactical” weapons, which were seen as both less significant than strategic nuclear weapons and far harder to define, count, and verify. While the United States and NATO began work on NSNW after completing INF Treaty negotiations, it was only in the waning days of the Cold War that both US President George H. W. Bush and Soviet President Mikhail Gorbachev (and later Russian President Boris Yeltsin) took unilateral steps, known as the Presidential Nuclear Initiatives (PNIs) to remove most of the weapons from deployment and eliminate many of them.

Today, however, nonstrategic nuclear weapons are among the key issues expected to be tackled in a follow-on agreement to New START, as the Biden administration has made an agreement covering these weapons a priority. They have taken on greater prominence in the three decades since the end of the Cold War as the two countries have reduced their stockpiles of strategic arms and Russia has reintroduced systems previously eliminated under the PNIs. Today, thousands of such weapons are believed to remain in the Russian arsenal, and the United States continues to deploy an estimated 100 B61 gravity bombs in Europe as nonstrategic nuclear weapons.<sup>1</sup>

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<sup>1</sup> Another 130 weapons are believed to be in storage in the United States. Hans Kristensen and Matt Korda, “Nuclear Notebook: United States nuclear weapons, 2021,” *Bulletin of the Atomic Scientists*, January 12, 2021, <https://www.tandfonline.com/doi/pdf/10.1080/00963402.2020.1859865?needAccess=true>.

## BACKGROUND

### Cold War Highs

During the Cold War, US conventional forces alone were not viewed as sufficient to repel a Soviet invasion of Europe. As a result, nuclear weapons were seen as key to the alliance’s “flexible response,” providing various levels of conventional and nuclear escalation. As the 1988 National Security Strategy of the United States put it, “The United States retains substantial nuclear capabilities in Europe to counter Warsaw Pact conventional superiority and to serve as a link to US strategic forces.”<sup>2</sup> As a result, during the Cold War, the United States deployed a wide variety of nonstrategic systems in Europe that could deliver nuclear warheads. These included nuclear mines, artillery, short-range ballistic and cruise missiles, and gravity bombs deployed on land, sea, and air. The United Kingdom also forward-deployed hundreds of gravity bombs in West Germany.

The number of European-based nuclear weapons assigned to NATO reached a high of approximately 7,000 in the late 1960s, but the number of operational weapons declined from then until the end of the Cold War as US and NATO officials believed they could maintain deterrence with fewer, but more modern, weapons.<sup>3</sup> In 1991, the United States held about 5,000 nonstrategic nuclear weapons, of which several hundred remained in Europe.<sup>4</sup>

### Presidential Nuclear Initiatives

As the Cold War ground to a close and treaties were finalized on intermediate-range and strategic nuclear forces, the United States and Soviet Union planned to enter into negotiations on a treaty covering short-range nuclear forces.<sup>5</sup> Intensive NATO consultations were already underway when an attempted coup d’état in Russia in 1991 raised concerns about

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<sup>2</sup> White House, National Security Strategy of the United States, January 1988, p. 16, <https://nssarchive.us/wp-content/uploads/2020/04/1988.pdf>.

<sup>3</sup> Amy F. Woolf, “Nonstrategic Nuclear Weapons,” CRS Report RL32572, Congressional Research Service, updated July 15, 2021, p. 11, <https://crsreports.congress.gov/product/pdf/RL/RL32572/44>.

<sup>4</sup> Arms Control Association, “The Presidential Nuclear Initiatives on Tactical Nuclear Weapons at a Glance,” last reviewed July 2017, <https://www.armscontrol.org/factsheets/pniglance>.

<sup>5</sup> North Atlantic Treaty Organization (NATO), “Final Communiqué, North Atlantic Council, Turnberry, United Kingdom,” June 8, 1990, paragraph 12, <https://www.nato.int/docu/comm/49-95/c900608a.htm>; NATO, “Declaration on a Transformed North Atlantic Alliance Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council (“London Declaration”), July 6, 1990, paragraphs 16-17, <https://www.nato.int/docu/basicxt/b900706a.htm>; David A. Cooper, *Arms Control for the Third Nuclear Age: Between Disarmament and Armageddon* (Washington, DC: Georgetown University Press, 2021), p. 123.

control of the Soviet arsenal, particularly nonstrategic nuclear weapons.<sup>6</sup> Unwilling to take the risk that Soviet weapons could fall into the wrong hands as negotiations proceeded, President Bush announced that he would withdraw from deployment most US nonstrategic nuclear weapons and eliminate many of them in a bid to encourage the Soviets to take similar steps. Indeed, Soviet President Mikhail Gorbachev made a similar pledge several months later, which was reiterated by Russian President Boris Yeltsin early the next year after the USSR collapsed. The matched unilateral pledges are known as the Presidential Nuclear Initiatives.

Bush announced that the United States would withdraw all land-based tactical nuclear weapons (those that could travel less than 300 miles from overseas bases) and all sea-based nonstrategic nuclear weapons from US surface ships, submarines, and naval aircraft.<sup>7</sup> Furthermore, in late 1991, NATO decided to reduce by about half the number of weapons for nuclear-capable aircraft based in Europe, which led to the withdrawal of an additional 700 US air-delivered nuclear weapons. The United States implemented these measures very quickly, and by mid-1992, the United States had begun dismantling more than 3,000 land- and sea-based weapons and had withdrawn more than 1,000 additional air- and sea-based weapons.<sup>8</sup>

Following the collapse of the Soviet Union and the Warsaw Pact, NATO enlarged eastward in several steps, first to Central Europe and then to Eastern European states such as Romania, Bulgaria, and the Baltic states. As a result, much of the military logic for non-strategic nuclear weapons disappeared as Russian forces were beyond the normal short range of the weapons still deployed on the territory of the older NATO members. Indeed, some experts went so far as to say that it would require “seven consecutive miracles” for the weapons to have military utility.<sup>9</sup>

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<sup>6</sup> See Susan J. Koch, “The Presidential Nuclear Initiatives of 1991-1992,” Case Study Series, No. 5 (Washington, DC: National Defense University, 2012), [https://ndupress.ndu.edu/Portals/68/Documents/casestudies/CSWMD\\_CaseStudy-5.pdf](https://ndupress.ndu.edu/Portals/68/Documents/casestudies/CSWMD_CaseStudy-5.pdf); Nikolai Sokov, “Controlling Soviet/Russian Nuclear Weapons in Times of Instability,” in Henry D. Sokolski and Bruno Tertrais, eds., *Nuclear Weapons Security Crises: What Does History Teach?* (Carlisle, PA: Strategic Studies Institute, US Army War College, 2013), pp. 98-101, [http://www.npolicy.org/books/Security\\_Crises/Full\\_Book.pdf](http://www.npolicy.org/books/Security_Crises/Full_Book.pdf); and Graham Allison, “Sounding an Alarm: Soviet Disunion and Threats to American National Security,” September 6, 1991, reprinted as “Appendix: Graham Allison’s Memo to Colin Powell” in Graham Allison, *What Happened to the Soviet Superpower’s Nuclear Arsenal? Clues for the Nuclear Security Summit*, HKS Faculty Research Working Paper Series RWP12-038, Belfer Center for Science and International Affairs, Harvard Kennedy School, March 2012, [https://dash.harvard.edu/bitstream/handle/1/9403176/RWP12-038\\_Allison.pdf?sequence=1&isAllowed=y](https://dash.harvard.edu/bitstream/handle/1/9403176/RWP12-038_Allison.pdf?sequence=1&isAllowed=y).

<sup>7</sup> Arms Control Association, “The Presidential Nuclear Initiatives.”

<sup>8</sup> Woolf, “Nonstrategic Nuclear Weapons,” p. 13.

<sup>9</sup> Karl-Heinz Kamp and Robertus C. N. Remkes, “Options for NATO Nuclear Sharing Arrangements,” in Steve Andreasen and Isabelle Williams, eds., *Reducing Nuclear Risks in Europe: A Framework for Action* (Washington, DC: Nuclear Threat Initiative, 2011). These “miracles” were said to lie primarily in the complicated decision-making procedures for using nuclear weapons and the visibility of the many actions required to prepare the aircraft, weapons, and crews for such an attack—all of which undercut their survivability and plausible use.

Moreover, to reassure Russia that military stability in Europe and its security would not be harmed by the expansion, the alliance and Moscow signed the 1997 Founding Act on Mutual Relations, Cooperation and Security between NATO and the Russian Federation (commonly known as the NATO-Russia Founding Act). In negotiating the agreement, the North Atlantic Council, NATO's main political decision-making body, made several pledges to reinforce the moves toward stability on the continent. One involved a policy on nuclear forces,<sup>10</sup> often referred to as "the three nos," which was subsequently included in the final language of the Founding Act:

The member States of NATO reiterate that they have no intention, no plan and no reason to deploy nuclear weapons on the territory of new members, nor any need to change any aspect of NATO's nuclear posture or nuclear policy—and do not foresee any future need to do so.<sup>11</sup>

However, at a time of Russian military weakness, the continued presence of some weapons was seen as a means of alliance burden sharing and political reassurance. While NATO continued to argue for an "appropriate mix" of conventional and nuclear forces, the emphasis was on the strategic deterrent of the United States and to a lesser extent, France and the United Kingdom. Indeed, as NATO allies have often reiterated, "the *strategic* forces of the Alliance, particularly those of the United States, are the supreme guarantee of the security of Allies."<sup>12</sup>

The number of overseas storage sites for US nuclear weapons fell from more than 125 (including sites in Asia) in the mid-1980s to 10 sites for nonstrategic weapons in seven European countries, by 2000.<sup>13</sup> A decade later, only a few hundred weapons were stored in five countries—Germany, the Netherlands, Belgium, Turkey, and Italy, and the number is estimated

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<sup>10</sup> NATO, "Final Communiqué Issued at the Ministerial Meeting of the North Atlantic Council," Press Communiqué M-NAC-2 (96)165, Brussels, Belgium, December 10, 1996, paragraph 21, [https://www.nato.int/cps/en/natohq/official\\_texts\\_25056.htm?selectedLocale=en](https://www.nato.int/cps/en/natohq/official_texts_25056.htm?selectedLocale=en).

<sup>11</sup> NATO, "Founding Act on Mutual Relations, Cooperation and Security between NATO and the Russian Federation," May 27, 1997, [www.nato.int/cps/en/natolive/official\\_texts\\_25468.htm](http://www.nato.int/cps/en/natolive/official_texts_25468.htm).

<sup>12</sup> NATO, "Brussels Summit Communiqué Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Brussels 14 June 2021," June 14, 2021, [https://www.nato.int/cps/en/natohq/news\\_185000.htm](https://www.nato.int/cps/en/natohq/news_185000.htm) (emphasis added).

<sup>13</sup> Joshua Handler, "The 1991-1992 PNIs and the Elimination, Storage and Security of Tactical Nuclear Weapons," in Brian Alexander and Alistair Millar, eds., *Tactical Nuclear Weapons: Emergent Threats in an Evolving Security Environment* (Washington, DC: Brassey's Inc., 2003), pp. 23-25.

to have fallen to approximately 100 B61-12 gravity bombs today.<sup>14</sup> If NATO were to decide to use the weapons in a conflict today, Belgium, the Netherlands, and Italy would use US aircraft to deliver the weapons, while Germany would rely on the nuclear-certified version of German-built Tornado jets. Turkey hosts nuclear weapons and dual-capable aircraft—that is, aircraft that can carry out either nuclear or conventional missions—but it is not clear that Ankara has maintained the ability to conduct the nuclear mission and appears to have sharply reduced the number of weapons stored on its territory.<sup>15</sup>

In all hosting arrangements, the United States maintains responsibility for the production, transport, and storage of the weapons, as well as the personnel assigned to safeguard them, while the host country is responsible for providing the land and infrastructure necessary to sustain these military installations.<sup>16</sup> Non-basing countries, in addition, provide support to the nuclear mission—for example, by escorting the nuclear-capable aircraft. Meanwhile, Russia is estimated to possess several thousand NSNW, many on its Western edge, raising concerns in the current Ukraine war and more generally as NATO’s borders approach Russia’s. (See the following chapter for a discussion of Russia’s NSNW.)

## The Prague Speech and the 2010 NATO Strategic Concept

President Barack Obama’s 2009 speech in Prague calling for a “world free of nuclear weapons” prompted some NATO governments—including those of Germany, Belgium, Luxembourg, the Netherlands, and Norway—to have a more open debate on the options and considerations for the United States to remove its remaining stocks of nonstrategic nuclear weapons from Europe. They argued that these weapons served no

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<sup>14</sup> The weapons were apparently removed from Greece, the United Kingdom, and one base in Germany (Ramstein) in the interim. Miles A. Pomper, “The United States,” in Paolo Foradori, ed., *Tactical Nuclear Weapons and Euro-Atlantic Security: The Future of NATO* (New York: Routledge, 2013), p. 127; and Hans M. Kristensen and Matt Korda, “United States nuclear weapons, 2021,” *Bulletin of the Atomic Scientists*, Vol. 77, No. 1 (2021), pp. 63 <https://doi.org/10.1080/00963402.2020.1859865>. However, fiscal year 2023 budget documents from the US Defense Department’s comptroller—which regularly detail funding to upgrade infrastructure for “special weapons” in “secure sites and facilities” in Belgium, Germany, Italy, the Netherlands, and Turkey—included funding at Lakenheath Air Base in the United Kingdom. [https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2023/budget\\_justification/pdfs/11\\_NATO\\_Security\\_Investment\\_Program/FY23\\_NATO\\_Security\\_Investment\\_Program.pdf](https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2023/budget_justification/pdfs/11_NATO_Security_Investment_Program/FY23_NATO_Security_Investment_Program.pdf). The purpose of the upgrades at Lakenheath was unclear at the time of publication. Hans Kristensen, “Lakenheath Air Base Added to Nuclear Weapons Storage Sites Upgrades,” *Strategic Security* (blog), April 11, 2022, <https://fas.org/blogs/security/2022/04/lakenheath-air-base-added-to-nuclear-weapons-storage-site-upgrades/>.

<sup>15</sup> Hans Kristensen and Matt Korda, “Nuclear Notebook: United States nuclear weapons, 2021,” *Bulletin of the Atomic Scientists*, January 12, 2021, <https://www.tandfonline.com/doi/pdf/10.1080/00963402.2020.1859865?needAccess=true>.

<sup>16</sup> Hans Kristensen, “Non-Strategic Nuclear Weapons,” Special Report No. 3, Federation of American Scientists, May 2012, p. 24, [https://fas.org/\\_docs/Non\\_Strategic\\_Nuclear\\_Weapons.pdf](https://fas.org/_docs/Non_Strategic_Nuclear_Weapons.pdf).

military purpose in Europe and that their removal would demonstrate NATO's commitment to Obama's vision.

Others, particularly officials in NATO nations in closer proximity to Russia, such as Poland and the Baltic states, argued that US NSNW in Europe remained relevant militarily, as a deterrent and as compensation for the fact that NATO had not stationed any troops on their territory. In a conflict, these states could face a severe short-term strategic imbalance vis-à-vis their much larger Russian neighbor in both the conventional and nuclear domains until NATO reinforcements arrived.<sup>17</sup> Therefore, they saw the potential removal of the weapons as lessening the North Atlantic Treaty's treasured Article V commitment.<sup>18</sup>

At an informal meeting of NATO foreign ministers in Tallinn in April 2010, US Secretary of State Hillary Clinton put forward a compromise that was subsequently endorsed by the alliance in its 2010 Strategic Concept and again in its 2012 Deterrence and Defence Posture Review. NATO did not call for the removal of these weapons in the Strategic Concept but did indicate there that "[i]n any future reductions, our aim should be to seek Russian agreement to increase transparency on its nuclear weapons in Europe and relocate these weapons away from the territory of NATO members. Any further steps must take into account the disparity with the greater Russian stockpiles of short-range nuclear weapons."<sup>19</sup>

## **The 2010 Nuclear Posture Review and New START Ratification**

Meanwhile in the United States, the Obama administration in its 2010 Nuclear Posture Review announced that it would be retiring one type of NSNW, nuclear-armed sea-launched cruise missiles. These missiles had been used primarily to reassure Japan and South Korea of US protection in Northeast Asia, but they also provided a nuclear option to defend NATO.

However, when the Senate considered New START, negotiated by the Obama administration, many senators, particularly Republicans, complained that the treaty did not impose any limits on nonstrategic nuclear weapons. They expressed concern about the disparity in

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<sup>17</sup> For an extended version of this argument, see David A. Shlapak and Michael Johnson, "Reinforcing Deterrence on NATO's Eastern Flank: Wargaming the Defense of the Baltics," RAND Corporation, 2016, [https://www.rand.org/pubs/research\\_reports/RR1253.html](https://www.rand.org/pubs/research_reports/RR1253.html).

<sup>18</sup> Article V of NATO's founding 1949 treaty is the bedrock of the alliance. Under it, member states "agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all" and that they will come to each other's assistance, including with military force. NATO, "The North Atlantic Treaty," April 4, 1949, [www.nato.int/cps/en/natolive/official\\_texts\\_17120.htm](http://www.nato.int/cps/en/natolive/official_texts_17120.htm); NATO, "The Consultation Process and Article 4," July 28, 2015, [www.nato.int/cps/en/natolive/topics\\_49187.htm](http://www.nato.int/cps/en/natolive/topics_49187.htm).

<sup>19</sup> For more information, see Pomper, "The United States."

numbers between Russia's far larger NSNW arsenal and that of the United States, viewing the Russian weapons as a threat to US allies and at risk of theft by terrorists or hostile countries.<sup>20</sup>

The Senate, in its resolution of ratification for New START, stated that the United States should seek to initiate, within one year, "negotiations with the Russian Federation on an agreement to address the disparity between the nonstrategic (tactical) nuclear weapons stockpiles of the Russian Federation and of the United States and to secure and reduce tactical nuclear weapons in a verifiable manner." If such talks were not initiated, the resolution called for the administration to explain the failure. The resolution also urged the president to establish cooperative measures with Russia to give each party greater confidence regarding the accounting and security of NSNW.<sup>21</sup> In addition, in the fiscal year 2013 National Defense Authorization Act, Congress indicated that "the United States should pursue negotiations with the Russian Federation aimed at the reduction of Russian deployed and nondeployed nonstrategic nuclear weapons."<sup>22</sup>

That effort faced as many challenges from NATO allies as from Russia. Lead US New Start negotiator Rose Gottemoeller wrote that after New START was ratified,

I headed off to try and convince our NATO Allies that it was time to limit warheads at the negotiating table, which meant that the allies would have to countenance Russian inspectors at NATO nuclear facilities on their territories. This proved to be a tough and eventually insurmountable task, as the NATO countries at the time showed little interest in joining such an effort. It was politically difficult for many of them, given public opposition to the NATO nuclear mission, and raised too many uncomfortable questions.<sup>23</sup>

Moreover, once Vladimir Putin returned to Russia's presidency in 2012, replacing Dmitry Medvedev, it was clear that further arms control efforts and the "restart" in US-Russia relations launched by Secretary Clinton and Medvedev to repair strained bilateral ties were in danger. Moscow rebuffed President Obama's 2013 Berlin offer to make further strategic cuts. The Russian position at the time was that no more strategic nuclear reductions should be negotiated until after the central limits of New START were reached in February 2018. Putin was clearly

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<sup>20</sup> See Nikolai Sokov and Miles A. Pomper, "New START Ratification: A Bittersweet Success," James Martin Center for Nonproliferation Studies (CNS), December 22, 2010, <https://nonproliferation.org/new-start-ratification-a-bittersweet-success/>; and Woolf, "Nonstrategic Nuclear Weapons," p.1.

<sup>21</sup> The Resolution of Ratification for the New START Treaty (Treaty 111-5) can be found on page S10982 of the Congressional Record of December 22, 2010, <https://www.govinfo.gov/content/pkg/CREC-2010-12-22/pdf/CREC-2010-12-22-pt1-PgS10982.pdf>.

<sup>22</sup> National Defense Authorization Act for Fiscal Year 2013, Pub. L. 112-239, <https://www.govinfo.gov/content/pkg/PLAW-112publ239/html/PLAW-112publ239.htm>.

<sup>23</sup> Rose Gottemoeller, *Negotiating the New START Treaty* (Amherst, NY: Cambria Press, 2021), p. 191.

signaling that he had no interest in further negotiations with Obama, given that Obama would certainly be gone from office by that time.

Moreover, Russia's invasion of Crimea and ongoing meddling in eastern Ukraine dampened Western interest in further negotiations while also raising fears of a conventional conflict in the Baltics and Poland. In addition, Russia's violation of the INF Treaty through the production and deployment of the 9M719/SSC-8 missile, which brought the pact to an end, further hardened sentiment against Russia in the alliance.<sup>24</sup> Since then, NATO has taken steps to bolster its conventional and nuclear forces rather than reducing or withdrawing them.

As former NATO Deputy Secretary General Alexander "Sandy" Vershbow recently wrote,

Although nuclear weapons remained a delicate political subject in many NATO countries, allies agreed that the renewed threat of Russian conventional aggression made it necessary to retain nuclear deterrence as an insurance policy in the event conventional deterrence failed. Although they decided at the 2016 Warsaw Summit that the reduced post-Cold War NATO nuclear force posture was sufficient, they took steps to enhance the readiness and security of allied dual-capable aircraft that formed the backbone of NATO's in-theater deterrent.

At Warsaw, allies also sharpened NATO's nuclear declaratory policy to counter Russia's so-called "escalate to deescalate" strategy, under which Moscow maintained the option of first nuclear use to settle a conventional conflict on Russia's terms. Allies made clear that "any employment of nuclear weapons against NATO would fundamentally alter the nature of a conflict," and they warned Moscow that "NATO has the capabilities and resolve to impose costs on an adversary that would be unacceptable and far outweigh the benefits that any adversary could hope to achieve."<sup>25</sup>

Rhetorically, in the communiqué from the 2016 Warsaw summit, the allies vowed that "the circumstances in which NATO might have to use nuclear weapons are extremely remote." However, at the same time, they added the new assertion that "NATO's nuclear deterrence posture also relies on United States' nuclear weapons forward-deployed in Europe

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<sup>24</sup> Drawn from Miles A. Pomper with Egle Murauskaite, Nikolai N. Sokov, and Jessica C. Varnum, "Ensuring Deterrence against Russia: The View from NATO States," CNS/Heinrich Boll Foundation, 2015, <https://www.nonproliferation.org/wp-content/uploads/2015/12/Ensuring-Deterrence-against-Russia.pdf>.

<sup>25</sup> Alexander Vershbow, "Reflections on NATO Deterrence in the 21st Century" in "Policy Roundtable: The Future of Trans-Atlantic Nuclear Deterrence," *Texas National Security Review*, August 23, 2021, <https://tnsr.org/roundtable/policy-roundtable-the-future-of-trans-atlantic-nuclear-deterrence/>.

and the capabilities and infrastructure provided by Allies concerned.”<sup>26</sup> This language is considerably stronger than in the 2014 Wales summit communiqué, and this language has continued to strengthen in subsequent NATO summit statements. The Trump administration further increased the role of nuclear weapons in US defense by indicating in its 2018 Nuclear Posture Review that it planned to reintroduce the nuclear sea-launched cruise missile, as well as a variable-yield nuclear warhead.<sup>27</sup>

At the same time, prior to Russia’s invasion of Ukraine, many allies had been facing public pressure in favor of the Treaty on the Prohibition of Nuclear Weapons, which bans countries from possessing or hosting nuclear weapons. That pressure had grown with the treaty’s entry into force in 2021; there is considerable mainstream support among German, Dutch, and Belgian center-left parties and publics to either sign on to the treaty or become official observers. The Norwegian government said recently that it would become an observer, and the new German governing coalition has endorsed such a stance in the coalition agreement among the Social Democratic, Green, and Free Democratic parties.<sup>28</sup>

In the waning days of the Trump administration and with New START about to expire, the Trump team began to explore the possibility of extending the agreement with an eye to including nonstrategic nuclear weapons. Trump tasked staff with developing an arms control approach that would capture all nuclear weapons and called for a freeze. Russia agreed in principle but rejected Trump’s verification approach, which would have involved portal monitoring at nuclear production and dismantlement facilities. Moreover, US national laboratories also raised concerns about Russian preferences to extend verification beyond the PANTEX dismantlement facility in Texas to some of their facilities.<sup>29</sup>

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<sup>26</sup> NATO, “Warsaw Summit Communiqué: Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Warsaw 8-9 July 2016,” July 9, 2016, [https://www.nato.int/cps/en/natohq/official\\_texts\\_133169.htm](https://www.nato.int/cps/en/natohq/official_texts_133169.htm).

<sup>27</sup> US Department of Defense, 2018 Nuclear Posture Review (Washington, DC: US Department of Defense, 2018), <https://dod.defense.gov/News/SpecialReports/2018NuclearPostureReview.aspx>. According to press reports, the Biden administration’s 2022 Nuclear Posture Review does not recommend moving forward with either of these efforts. Michael R. Gordon, “Biden Sticks with Longstanding U.S. Policy on Use of Nuclear Weapons Amid Pressure From Allies: The president stepped back from a campaign promise that the sole purpose of nuclear weapons should be to deter nuclear attacks,” *Wall Street Journal*, March 25, 2022.

<sup>28</sup> Miles A. Pomper, “The New Nuclear Weapons Ban Treaty Will Be an Early Trial for Biden,” *World Politics Review*, November 18, 2020, <https://www.worldpoliticsreview.com/articles/29225/the-new-nuclear-weapons-ban-treaty-will-be-an-early-trial-for-biden>); Michal Onderco and Miles A. Pomper, “NATO’s Nuclear Deterrent Gets a Reprieve—For Now,” *World Politics Review*, December 8, 2021. <https://www.worldpoliticsreview.com/articles/30171/on-nuclear-sharing-nato-isn-t-out-of-the-woods-yet>.

<sup>29</sup> Senior Trump administration and other senior US government officials, video and in-person interviews with author April 2021.

## MOVING FORWARD

The Biden administration had made clear that it would seek to address NSNW through the US-Russian Strategic Stability Dialogue, with the intention to use the subgroup on future arms control to evolve the talks into full-fledged arms control negotiations with Moscow. As Bonnie Jenkins, undersecretary of state for arms control and international security, told the November 2021 NATO Nuclear Policy Symposium, “[W]e will seek to address all nuclear warheads, including non-strategic nuclear weapons and non-deployed warheads.”<sup>30</sup>

Given how the war in Ukraine has further exacerbated the deep bitterness between Washington and Moscow, it remains to be seen if and when the arms control talks, frozen after Russia’s February 2022 invasion, will resume and how the US delegation might approach them. Negotiating limits on nonstrategic nuclear weapon was destined to be difficult even before the Russian invasion; doing so in the near future may now be impossible. But given consistent bipartisan support for such limitations and widespread and bipartisan congressional distrust of Moscow, it is hard to imagine any New START follow-on—whether a treaty (which would require the two-thirds approval of the US Senate) or a less formal agreement—receiving congressional support without them.

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<sup>30</sup> Ambassador Bonnie Jenkins, “Remarks to the 2021 NATO Nuclear Policy Symposium,” Department of State, Washington, DC, November 3, 2021, <https://www.state.gov/remarks-to-the-2021-nato-nuclear-policy-symposium/>.

# The Russian Nonstrategic Nuclear Posture: History, Missions, and Prospects

*Nikolai Sokov*

Russian nonstrategic nuclear warheads (NSNW) remain a hot issue in US-Russian relations, in NATO-Russian relations, and in transatlantic and intra-European relations. The reason is simple: Russia has many more of these NSNW than the United States does. Since the United Kingdom and France no longer have non-strategic nuclear weapons, the European balance in that category of nuclear weapons is massively skewed—an estimated 100 US B61 bombs in Europe versus an estimated total of 1,900 Russian NSNW.<sup>1</sup>

Russia's publicly declared nuclear policy treats nuclear weapons, and non-strategic ones in particular, as deterrents vis-à-vis a hypothetical US and NATO attack. More specifically, the longer-range variety of non-strategic nuclear weapons have been assigned a key role in offsetting US and NATO conventional superiority (particularly in long-range precision-guided conventional weapons) under what is popularly known as the “escalate-to-deescalate” strategy. Russia's official documents do not use this term but their doctrine posits only a defensive nuclear doctrine that would involve Russia crossing the nuclear threshold if NATO appears to be winning a conventional war that it has initiated, what one might call “defensive de-escalation.”

The West, however, has been primarily concerned about a contingency that could be characterized as “offensive de-escalation”: the possibility that Russia might attack neighboring states (experts often cited the Baltic states as an example) and would threaten to use nuclear weapons to prevent NATO from intervening and to solidify gains achieved by its conventional forces. Although this mode was not part of Russia's declaratory policy, this is precisely what happened when Russia attacked Ukraine in February 2022.

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<sup>1</sup> Hans Kristensen and Matt Korda, “United States nuclear weapons, 2021,” *Bulletin of the Atomic Scientists*, January 12, 2021, <https://thebulletin.org/premium/2021-01/nuclear-notebook-united-states-nuclear-weapons-2021/>; Hans Kristensen and Matt Korda, “Russian Nuclear Weapons, 2021,” *Bulletin of the Atomic Scientists*, March 18, 2021, <https://www.tandfonline.com/doi/full/10.1080/00963402.2021.1885869>. It should be noted that the actual number of Russian weapons intended for the European theater is lower than this total estimate, as a significant share of Russian weapons are deployed in the Asian part of Russia.

NATO will now have to consider that threats to proactively use nuclear weapons will constitute part of Russia's national-security toolbox. Even worse, the degradation of Russian conventional forces in the war with Ukraine (heavy losses in both personnel and equipment) and their suboptimal performance will make the Russian leadership less inclined to rely on conventional forces and may result in a new increase in the role of nuclear weapons.

These trends are certain to apply to the role of non-strategic nuclear weapons. As NATO plans its deterrence strategy, it will be important to determine which Russian non-strategic weapons will feature most prominently within this broad and poorly defined category and whether arms control can play a role in bolstering deterrence.

This section will review the evolution of the Soviet/Russian NSNW posture and its role in Russian nuclear strategy. The main conclusion is that the emphasis in the last two decades has been and will most likely remain on long-range (that is, theater-range)<sup>2</sup> dual-capable assets, whereas short-range (tactical) non-strategic weapons will play a secondary role and perhaps will be eventually phased out.

Even though any interaction with Russia will remain difficult, arms control can nonetheless help stabilize and improve the focus of NATO's deterrence strategy—the same role it played during the Cold War. A highly confrontational, tense environment dictates a return to a Cold War strategy of limiting the first-strike capability of both sides (whether nuclear or conventional). Getting arms control off the ground will be difficult, however. The launch of the new US-Russian Strategic Stability Dialogue in the summer of 2021 offered some—albeit uncertain and tentative—promise that the old recipe might work again, but that dialogue was discontinued as a result of the Russian aggression against Ukraine. The prospects of an “INF 2.0” agreement to replace the 1987 Intermediate-Range Nuclear Forces (INF) Treaty seemed promising as recently as January 2022, but now it seems unlikely, at least in the near future. Restarting arms control efforts may require a political impetus from the highest level, but a summit meeting, whether in-person or virtual, between US President Joe Biden and Russian President Vladimir Putin is now next to impossible. Resistance within

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<sup>2</sup> For the purposes of this paper, the terms “long-range” and “theater-range” are used interchangeably to refer to strike assets capable of reaching targets within the possible theater of conflict (up to the entirety of Europe). The notion is intentionally vague because it emphasizes missions rather than ranges. It thus includes a broad range of systems—those classified by Russia as “operational-tactical” with ranges below 500 km (Iskander missiles), sea-launched missiles with ranges in excess of 1,000 km whose official categorization is uncertain, and air-launched cruise missiles that US-Soviet/Russian treaties classify as strategic. SLCMs and ALCMs can be used both in support of strategic missions (that is, against targets on US national territory) and in the theater, whereas Iskander can be employed in support of tactical missions at relatively short ranges (below 300 km). It remains a fact, however, that Russia clearly emphasizes weapons with ranges of about 500 km for ground-launched (range could increase in the future) and more than double that for other basing modes.

NATO to any arms control dialogue with Russia will be very strong. Yet, the benefits of “classic” (that is, Cold War-style) arms control are potentially too significant to discard them.

## ANALYSTS’ DILEMMAS AND RUSSIAN NSNW

Many analysts assume that any military posture, including any nuclear posture, results from conscious, rational decisions; is developed in support of a specific strategy; and employs weapons designed to support specific missions. This assumption is not entirely incorrect because every state does strive for such a posture; even if they fail, states still pretend that their posture is rational. Furthermore, even though any class of weapons can support a variety of missions, analysts tend to favor interpretations that emphasize possible aggressive intentions—an assumption that is only prudent.

Yet in real life, a state’s military posture can be influenced by a great many other variables—for example, the nature of the decision-making system, the impact of interest groups, delays or failures of research and development (R&D) programs, historical-cultural traits, or mirroring. These analytical challenges directly affect the analysis of Russian NSNW. A close look suggests the following:

- **The Soviet NSNW posture was not necessarily rational;** it emerged in an ad hoc fashion and began to take a more rational shape only in the 1970s (much like its strategic posture).
- **The initial post-Cold War NSNW posture reflected the Soviet legacy,** modified only by arms control measures, the need to eliminate weapons under the Presidential Nuclear Initiatives, and the process of transferring Soviet nuclear weapons from Belarus, Kazakhstan, and Ukraine to the territory of Russia.
- **The legacy posture began to change only within the last decade,** roughly coinciding with the adoption of the 2014 Military Doctrine.

**Most of the Russian NSNW arsenal today is designed to support a specific mission (a backup for its emerging long-range conventional capability)** and, from the perspective of at least the Russian military, cannot be bargained away. But elements of that legacy arsenal are not assigned a specific mission and thus can be reduced; slow-paced reductions continue even today but could be accelerated within the framework of arms control regimes.

## THE EMERGENCE AND EVOLUTION OF THE SOVIET NSNW POSTURE

As a class, NSNW did not emerge in support of a specific military mission. Rather, in the early years of the nuclear era, technology allowed only for short-range missiles and theater-range bombers. Countries deployed the systems that could deliver nuclear weapons, and until the late 1950s, battlefield- and theater-range weapons were the only option available. The Soviet Union was not any different from everyone else (including the United States) in this regard.<sup>3</sup> Until the first intercontinental ballistic missiles (ICBMs), the Soviet military had to rely on nonstrategic weapons for serious contingencies.

Furthermore, these weapons were initially seen as an enhancement of traditional warfighting capabilities, missions, and strategies. The view that nuclear weapons fundamentally changed the nature of warfighting, as Bernard Brodie suggested,<sup>4</sup> did not quite penetrate Soviet military thinking until considerably later.

Contrary to common perception, the Soviet Union initially did not display much interest in deploying large numbers of short-range nuclear weapons or integrating them into the military infrastructure. Nor did it see them as an offensive tool.<sup>5</sup> An in-depth study of early Soviet nuclear policy based on declassified archival documents<sup>6</sup> arrived at rather counterintuitive conclusions: during the 1940s and 1950s, not only the United States and NATO but also the Soviet Union proceeded from scenarios of the opponent launching a surprise “bolt from the blue” attack. Further, the Soviet Union was reluctant to integrate tactical nuclear weapons into its conventional forces and instead tried to keep the nuclear and the conventional components separate and did not foresee a major role for tactical nuclear weapons in a possible large-scale war in Europe. Finally, it appeared ready to put them on the negotiating table with the view that reductions were possible.

A distinctive feature of Soviet NSNW programs (and later Soviet nuclear weapons as a whole) was their emphasis on ground-launched assets with special attention to missiles. This preference reflected the peculiarities

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<sup>3</sup> Although the first flight of the Tu-95 bomber took place in 1952, there were few of these bombers in the 1950s, and they were able to carry only small payloads for intercontinental distances.

<sup>4</sup> Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New York: Yale Institute of International Studies: 1946).

<sup>5</sup> The establishment of the 12th GUMO, the special branch of the Soviet military for handling of nuclear weapons, in 1947 indirectly attests to the reluctance of Soviet leadership to integrate nuclear weapons into the Armed Forces; nuclear weapons were kept separate from delivery vehicles and released to troops only following a special directive.

<sup>6</sup> Vojtech Mastny, “NATO in the Beholder’s Eye: Soviet Perceptions and Policies, 1949-56,” Cold War International History Project, Working Paper No. 35, Washington, DC, March 2002, <https://www.wilsoncenter.org/sites/default/files/media/documents/publication/ACFB01.pdf>.

of Soviet and Russian engineering history: work on rockets and their military applications began in the mid-19th century and never fully ceased. Research continued into the 1920s, and both aircraft and missile industries saw their beginnings almost simultaneously in the 1930s. Enough missile designers survived the purges of the late 1930s to produce rapid progress, which benefited from the legacy of Nazi Germany's missile programs. The establishment of the Strategic Rocket Forces as a dedicated branch of the military in the late 1950s ensured that the missile industry would have strong and consistent institutional support.

By the early 1960s the role of nonstrategic nuclear weapons in Soviet military planning increased when Premier Nikita Khrushchev led a sharp reduction in the Soviet Armed Forces. After the Soviet Union's conventional superiority over NATO shrank, it was inevitable that nuclear weapons would be given a greater role. This change was also motivated by the continued massive inferiority of the Soviet Union in strategic weapons,<sup>7</sup> which continued until the late 1960s. That meant that in case of a large-scale war, Europe was destined to remain the main theater for both conventional and nuclear forces. Particularly significant was the development of nuclear artillery in the mid-1960s,<sup>8</sup> which helped increase the degree of integration of nuclear weapons with Ground Forces. (Nuclear artillery, nonetheless, never enjoyed the same status and role as it did in the United States and remained a distant second to missiles.) Also, during that time the Soviet military developed procedures to quickly release nuclear weapons to troops in case of an enemy surprise attack for massive use at a very early stage of conflict.

The number of nonstrategic nuclear missiles in the Soviet Ground Forces, especially those deployed outside Soviet territory, continued to increase, and their missions were more closely integrated into the general missions of Soviet Armed Forces. Nevertheless, these weapons did not enjoy the same status and role as they did in the United States and NATO. In typical Soviet scenarios that foresaw aggression by NATO—in which Soviet forces stopped it and then launched a massive counteroffensive—nuclear weapons were expected only to make the standard phases of

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<sup>7</sup> Estimates vary but there is no doubt that the United States held massive superiority. John T. Correll estimated US superiority to be 7.5 to 1. See John T. Correll, "Airpower and the Cuban Missile Crisis," *Air Force Magazine*, August 1, 2005, <https://www.airforcemag.com/article/0805u2/>. Soviet and Russian calculations suggest that US nuclear superiority over the Soviet Union was 11-12 to 1. See Fedor Ladygin and Vladimir Lota, "U Kraya Karibskoi Propasti" [At the Brink of the Caribbean Precipice], [https://function.mil.ru/news\\_page/country/more.htm?id=11415875@cmsArticle](https://function.mil.ru/news_page/country/more.htm?id=11415875@cmsArticle). Rajesh Rajagopalan estimated it at 17 to 1. See also Rajesh Rajagopalan, "Deterrence and Nuclear Confrontations: The Cuban Missile Crisis and the Sino-Soviet Border War," *Strategic Analysis*, June 2000, [https://ciaotest.cc.columbia.edu/olj/sa/sa\\_jun00rar01.html#note\\*](https://ciaotest.cc.columbia.edu/olj/sa/sa_jun00rar01.html#note*).

<sup>8</sup> The first nuclear artillery systems were developed, and a small number even deployed, in the late 1950s, but they were completely removed from service by 1960. Introduction of nuclear artillery into the Armed Forces began in 1965, when the Soviet nuclear industry was able to develop a 152mm munition.

warfighting shorter.<sup>9</sup> Moreover, use of nonstrategic nuclear weapons was contemplated exclusively in the context of a global war: Soviet military and political leaders insisted that nuclear war could never be limited to the European theater. If the United States tried to do that, Moscow would immediately expand the war to the US homeland.<sup>10</sup> In contrast, American plans from the same period allowed for limited nuclear use to de-escalate and quickly end limited military conflicts.<sup>11</sup> A rather unusual feature of Soviet policy toward nonstrategic nuclear weapons in the 1960s was the virtual absence of modernization. Nonstrategic missiles represented essentially 1950s technology with marginal modifications: until the mid-1970s, the only intermediate-range missiles were the liquid-fueled and relatively inaccurate SS-3 (R-5, according to Soviet designation), introduced in 1956), SS-4 (R-12, introduced in 1959), and SS-5 (R-14, introduced in 1962), which represented, by Soviet classification, the first generation of missiles. Right after them came the SS-20 (RSD-10, introduced in 1976), which belonged to the third generation, meaning that a whole generation of missiles was skipped for that category.

There are two explanations for this phenomenon, and they are not mutually exclusive. First, modernization and deployment efforts during that period were primarily concentrated on strategic missiles, an area in which the Soviet Union sought to quickly close the gap with the United States and create a reasonably survivable deterrent. Second, the Soviet missile industry and designers during that time concentrated almost exclusively on liquid-fueled missiles, which were not the best fit for the battlefield due to significant weight, sensitivity to even small accidents and bad roads, vulnerability due to the need for defueling and refueling (procedures that required considerable time) to maintain them on alert during deployments, and other features. In contrast, Soviet designers quickly arrived at acceptable technical solutions, such as ampulization of liquid fuel,<sup>12</sup> for silo-based ICBMs.

Significant modernization of land-based missiles began only in the 1970s, thanks to Dmitry Ustinov, first as the secretary of the Central Committee

<sup>9</sup> Petr Lúnák, "Planning for Nuclear War: The Czechoslovak War Plan of 1964," *Cold War International History Project Bulletin*, No. 12/13 (Fall/Winter 2001), pp. 289-290, [https://www.wilsoncenter.org/sites/default/files/media/documents/publication/CWIHP\\_Bulletin\\_12-13.pdf](https://www.wilsoncenter.org/sites/default/files/media/documents/publication/CWIHP_Bulletin_12-13.pdf).

<sup>10</sup> Petr Ivashutin to Mikhail Zakharov, "Material on the Development of Military Art under Conditions of Conducting a Missile-Nuclear War According to Contemporary Views," August 28, 1964, No. 1689c, Top Secret, available from the Center for Security Studies and Conflict Research, Zurich, [https://www.php.isn.ethz.ch/kms2.isn.ethz.ch/serviceengine/Files/PHP/16248/publicationdocument\\_singledocument/9b1ac8c6-310d-47bf-ad54-ad66c4ac1bbd/ru/640828\\_ivashutin\\_Ru\\_fulltxt.pdf](https://www.php.isn.ethz.ch/kms2.isn.ethz.ch/serviceengine/Files/PHP/16248/publicationdocument_singledocument/9b1ac8c6-310d-47bf-ad54-ad66c4ac1bbd/ru/640828_ivashutin_Ru_fulltxt.pdf).

<sup>11</sup> "A Study of the Management and Termination of War with the Soviet Union, prepared by the Staff of the Net Evaluation Subcommittee of the National Security Council," November 15, 1963, Top Secret (declassified in 1997), National Archives, Record Group 59, Department of State Records, Records of Policy Planning Council, 1963-64, Box 280, File "War Aims".

<sup>12</sup> "Ampulization" refers to sealing liquid fuel in launch canisters. This allows the fuel to be stored for years and eliminates the need to conduct fueling before launch, reducing preparation time needed before firing.

of the Communist Party of the Soviet Union in charge of the defense industry and later as minister of defense. Ustinov had been a long-time proponent of solid-fueled missiles and committed significant political and monetary resources toward their development. The rise of the Moscow Institute of Thermal Technology to prominence—and eventually to the role of the leading design bureau that currently holds a near-monopoly in the field—dates to that time, as does the rise of KB (Design Bureau) Mashinostroyeniya, which now plays a leading role in the development of tactical missiles.

As a result of these efforts, the Soviet Armed Forces by the end of the 1970s began to deploy a new generation of theater-range (SS-20 Pioneer) and tactical (SS-21 Tochka) missiles; the latter were later scheduled for replacement with the longer-range SS-23 Oka. It can be even said that only in the 1970s did Soviet nonstrategic forces acquire true warfighting capabilities. In typical fashion, however, the Soviet military did not *replace* old missiles with new ones but instead chose to *add* new weapons to the existing force, following the time-honored tradition of hoarding military assets and also increasing the number of targets the United States and NATO would need to destroy in case of conflict. The rapid growth in the number of Soviet theater-range missiles contributed to the crisis that triggered the dual-track decision by NATO in 1979 to deploy new intermediate-range weapons while seeking an agreement that would limit such US and Soviet systems.

The Soviet increase in sea- and air-launched nonstrategic nuclear assets during the 1960s and afterwards attracted less attention in the West. But it was perhaps more consequential, especially the rapid nuclearization of the Soviet Navy, which quickly concluded that it stood no chance in a hypothetical confrontation with the US Navy without an almost exclusive reliance on nuclear weapons. Consequently, it strongly emphasized the development of assets capable of destroying US aircraft-carrier groups, which were considered the priority target, at an early stage of conflict. These included nuclear-armed anti-ship cruise missiles and coastal-defense cruise missiles. It is worth keeping in mind that early work on cruise missiles was primarily supported by the Navy, which turned into the biggest proponent of nonstrategic nuclear weapons, the role it continues to play to the present day.

The Soviet Air Force accounted for a significant number of nuclear weapons, but its role in military planning began to truly increase only with the development of short-range missiles that replaced gravity bombs. Like other branches of the Soviet military, it gave priority to the ability to strike the opponent from a distance, preferably with high accuracy. Since Soviet strategic bombers were not able to carry large payloads for intercontinental distances, the emphasis was on shorter-range aircraft and theater-level

missions (especially after the introduction of the Tu-22M3 in the late 1970s). The introduction of air-launched cruise missiles (ALCMs) in 1984 further enhanced the theater role of the Air Force: a special version of the strategic Tu-95MS equipped for 16 ALCMs could not reach the United States and was intended for theater use. The Air Force was supposed to acquire a greater role in strategic missions with planned production of a large number of Tu-160 strategic bombers, but the breakup of the Soviet Union put an end to these plans.

Starting in the 1960s, the Soviet Union also actively introduced nuclear weapons into its air-defense and missile-defense forces. The decision with regard to air defenses was primarily driven by the perceived inferiority of the Soviet Air Force, which was believed unable to resist a massive attack by the superior US Air Force using only conventional weapons. Missile defense had to rely on nuclear weapons because the capability to perform kinetic intercept was not reliable during that time. The United States adhered to the same views but decided to refrain from deployment of an operational nuclear-armed missile-defense system, whereas the Soviet Union deployed an active system around Moscow.

## **THE INF TREATY, THE PNIS, AND THE BREAKUP OF THE SOVIET UNION**

By the early 1990s, the Soviet nonstrategic nuclear force had undergone major changes. These resulted from three almost simultaneous developments: the conclusion of the 1987 Intermediate-Range Nuclear Forces (INF) Treaty, the Presidential Nuclear Initiatives (PNIs) initiated by the United States in 1991, and the breakup of the Soviet Union.

As referenced above, the Soviet Union's deployment in the 1970s of SS-20 intermediate-range missiles in addition to existing 1950s-generation intermediate-range missiles triggered a major crisis in the country's relations with NATO. The 1979 dual-track decision by NATO gave Moscow a choice between eliminating the intermediate-range missiles or accepting the deployment of American ground-launched ballistic and cruise intermediate-range missiles in Europe. Negotiations on the INF Treaty began in the fall of 1981, but an agreement could not be reached by November 1983, when American deployments began. At that point, the Soviet Union walked out of negotiations or, in official lingo, "discontinued" them by refusing to set the date for the next round. Negotiations resumed in the spring of 1985 and successfully concluded with the signing of the INF Treaty on December 8, 1987.

The INF Treaty banned all US and Soviet ground-launched ballistic and cruise missiles with a range between 500 and 5,500 kilometers (km) regardless of the warhead (nuclear, conventional, chemical, or any

other). This created a major dent in the Soviet nonstrategic nuclear force. Although the treaty had an overwhelmingly positive effect on European and global security, it also left a legacy of issues that affected subsequent developments:

- The INF Treaty did not address sea- and air-launched nuclear weapons that had similar missions to the land-based missiles banned under the treaty—two categories in which the Soviet Union claimed the United States enjoyed considerable superiority. This issue was mostly addressed by the PNIs (through mutual renunciation of the development of future missiles of this type), but the conventional variants of these weapons remain a serious Russian concern and recently, after the introduction of modern cruise missiles into the Russian inventory, have become a US concern.
- The INF Treaty covered the SS-23 Oka short-range missile in a personal concession made by Mikhail Gorbachev. (Instructions approved by the Politburo did not allow that, and although his position as the general secretary of the Communist Party gave him plenty of authority, he was far from all-powerful.) This remained a sore point for the Soviet military and the cause of many attacks on the INF Treaty, as well as a stimulus for the development of a more advanced replacement, the Iskander.
- The treaty was bilateral, which was acceptable in the 1980s, but subsequent progress in intermediate-range missiles by many countries—China, India, Pakistan, Israel, Iran, South Korea, and North Korea, all of which are within reach of Russian territory—made the ban much less tolerable. Within a decade of the 1988 entry into force of the INF Treaty, the Strategic Rocket Forces began to publicly complain that the ban prevented Russia from having *conventional* missiles, which were sorely needed.

The next major step in the reduction of nonstrategic nuclear weapons was the PNIs in the fall of 1991. The United States was concerned that the breakup of the Soviet Union would increase the chances that nuclear weapons would fall into unauthorized hands—those of the governments of newly independent states (which would have meant unprecedented proliferation of nuclear weapons, undermining the Treaty on the Non-Proliferation of Nuclear Weapons) or even non-state actors, including terrorists. President George H.W. Bush announced unilateral measures to reduce tactical nuclear weapons and invited the Soviet Union to join. Gorbachev responded in only 10 days, announcing a similar package of initiatives; the latter were confirmed

and somewhat expanded by Russian president Boris Yeltsin in January 1992 after the breakup of the Soviet Union.<sup>13</sup>

To summarize, Russian commitments under the two stages of PNIs included the following:

- All nuclear warheads for ground-launched tactical systems would be stored at central storage facilities or dismantled. (All nuclear mines and artillery shells were subject to dismantlement.)
- All nuclear weapons for sea-launched tactical missiles would be withdrawn from ships and submarines and either stored at central storage facilities or dismantled, leaving both navies with strategic submarine-launched ballistic missiles (SLBMs) as their only nuclear weapons.
- About two-thirds of the nuclear warheads for air-launched weapons, air-defense missiles, and missile-defense missiles would be withdrawn from troops and either stored at central storage facilities or eliminated. The rest remained in the category of “deployed,” which for that category meant warheads were kept in storage facilities co-located with Air Force bases.

In 2004, Russia announced that it no longer considered itself bound by the PNIs,<sup>14</sup> arguing that these had been just a goodwill gesture and the security environment had fundamentally changed since their adoption. This announcement came rather unexpectedly; only half a year earlier, a Russian official had confirmed adherence to the PNIs and even said

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<sup>13</sup> For review and analysis of the PNIs and their implementation, see William Potter and Nikolai Sokov, “The Presidential Nuclear Initiatives, 1991-1992: An Assessment of Past Performance and Future Relevance,” Toda Peace Institute Brief No. 21, October 2018, [https://toda.org/assets/files/resources/policy-briefs/T-PB-21\\_Nikolai%20Sokov%20and%20William%20Potter\\_The%20Presidential%20Nuclear%20Initiatives%201991-92.pdf](https://toda.org/assets/files/resources/policy-briefs/T-PB-21_Nikolai%20Sokov%20and%20William%20Potter_The%20Presidential%20Nuclear%20Initiatives%201991-92.pdf); Nikolai Sokov, “Strengthening the 1991 Declarations: Verification and Transparency Components,” in Taina Susiluoto, ed., *Tactical Nuclear Weapons: Time for Control* (Geneva: UNIDIR, 2002, publication No. UNIDIR/2002/11); Susan J. Koch, “The Presidential Nuclear Initiatives of 1991-1992,” Case Study Series, No. 5 (Washington, DC: National Defense University, 2012), [https://ndupress.ndu.edu/Portals/68/Documents/casestudies/CSWMD\\_CaseStudy-5.pdf](https://ndupress.ndu.edu/Portals/68/Documents/casestudies/CSWMD_CaseStudy-5.pdf); Nikolai Sokov, “Controlling Soviet/Russian Nuclear Weapons in Times of Instability,” in Henry D. Sokolski and Bruno Tertrais, eds., *Nuclear Weapons Security Crises: What Does History Teach?* (Carlisle, PA: Strategic Studies Institute, US Army War College, 2013), pp. 98-101, [http://www.npolicy.org/books/Security\\_Crises/Full\\_Book.pdf](http://www.npolicy.org/books/Security_Crises/Full_Book.pdf)

<sup>14</sup> Otvét Ofitsialnogo Predstavatelya MID Rossii A.V. Yakovenko na Vopros Rossiiskikh SMI na Press-Konferentsii f RIA-Novosti Otnositelno Initsiativ Rossii po Sokrashcheniyu Takticheskogo Yadernogo Oruzhiya [Response of the Official Representative of the Foreign Ministry of Russia A.V. Yakovenko to a Question from Russian Media at a Press Conference at RIA-Novosti about Russian Initiatives on the Reduction of Tactical Nuclear Weapons], October 7, 2004, [http://www.mid.ru/web/guest/voenno-strategiceskie-problemy/-/asset\\_publisher/hpkjeev1aY0p/content/id/458482](http://www.mid.ru/web/guest/voenno-strategiceskie-problemy/-/asset_publisher/hpkjeev1aY0p/content/id/458482).

that reductions could be accelerated were the West to provide funding.<sup>15</sup> It is difficult to gauge what exactly happened in between to cause such a fundamental change. One might suspect that the Russian military, following the adoption of a new Military Doctrine in 2000 and its further development in 2003 (see the next section), wanted to expand available options, but this is not likely. There was no indication that Russia in fact violated any of its 1991-92 commitments. Rather, it apparently implemented the NSNW reductions promised in 1991-92 and even went beyond them. The refusal to recognize the PNIs, therefore, was primarily a political step.

Obviously, the PNIs fundamentally changed the entire Soviet—later Russian—nonstrategic nuclear posture. Launch-ready nuclear capability in this category no longer existed; implementing nuclear missions now required that warheads first be released to troops, ships, submarines, or aircraft. For some categories of delivery vehicles (such as nuclear artillery) warheads would no longer exist.

These reductions hurt the Navy particularly: without nuclear weapons, it could no longer even remotely hope to face the US Navy, and this prompted it to look for ways to preserve the nuclear mission, even if in an abridged form. To achieve that, it took advantage of differences between the US and Soviet systems of handling nuclear weapons and the absence of the definition of “central” in the PNIs with regard to “central storage” facilities. In the United States, that term meant storage facilities that were located at a considerable distance from delivery vehicles at military bases, which made it impossible to quickly transfer nuclear warheads to troops. In the Soviet system, however, a nuclear-weapons storage facility could be classified as “central” as long as it was subordinate to and controlled by the 12th GUMO, the department of the Ministry of Defense in charge of handling nuclear warheads. Accordingly, warheads for naval nonstrategic missiles were placed at storage sites located at naval bases, literally a stone’s throw from ships and submarines. Moreover, no later than the second half of the 1990s (and probably even earlier) the Navy began training for fast transfer of warheads to ships and submarines so that in a prewar situation, the Navy could deploy its nonstrategic nuclear weapons within hours. American protests against that definition of “central” remained unanswered.

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<sup>15</sup> Vystuplenie Glavy Rossiiskoi Delegatsii A.I. Antonova na 3 Sessii Podgotovitel'nogo Komiteta Konferentsii po Rassmotreniyu Deistviya DNYaO [Statement by the Head of the Russian Delegation, A.I. Antonov, to the 3rd Session of the Preparatory Committee of the NPT Review Conference], April 28, 2004, Document 927-28-04-2004, <http://www.mid.ru/Nsdvbr.nsf/10aa6ac6e80702fc432569ea003612f0/432569d800226387c3256e840046adc4?OpenDocument>; “Rossiya Perevypolnila Plany po Sokrashcheniyu Yadernogo Oruzhiya” [Russia Has Exceeded the Plan for Reduction of Nuclear Weapons], RIA-Novosti, June 22, 2005, <http://www.rian.ru/politics/20050622/40566772.html>.

In effect, the Navy replicated the situation at the Air Force, where nuclear weapons are readily available for deployment on aircraft. That is the standard arrangement for both the US and the Russian Air Forces. Storage of weapons for Soviet Ground Forces—if warheads for ground-launched NSNW are still available for deployment—is typically “central” in a geographic as well as administrative sense, and movement of warheads to mate with delivery vehicles is usually done well in advance.

As the Soviet Union was falling apart, the issue of controlling nonstrategic nuclear weapons acquired ever-greater urgency. As noted above, the US PNIs were motivated, to no small extent, by the desire to facilitate the transfer of nuclear weapons to the territory of Russia; this concern was all the more serious because nonstrategic nuclear weapons were stored or deployed in nearly all Soviet republics. Although this remained largely unnoticed outside the Soviet Union, the military became concerned about that problem in the early 1990s, when an attempt by the Popular Front of Azerbaijan to seize nuclear warheads for interceptor aircraft was narrowly avoided. Tu-22M3 bombers, which were sent to collect the warheads, managed to take off at the last moment as a local armed militia was approaching the base.<sup>16</sup> After that, the military began to quietly withdraw nonstrategic nuclear weapons from all republics of the Soviet Union that did not have strategic weapons on their territories.

By the time of PNIs, the process was nearing completion, but the impact of the US initiative was nonetheless significant. When assessing the role of PNIs, one needs to keep in mind that in the fall of 1991, the central government had almost completely lost the ability to control events in the Soviet republics. For example, the PNIs (which addressed not only nonstrategic but also strategic weapons) provided a justification to withdraw ICBMs with multiple independently targetable reentry vehicles from Ukraine and Kazakhstan, but interagency correspondence within the Soviet government admitted that its officials were powerless to utilize that opportunity because governments in these two republics objected to the withdrawal.<sup>17</sup>

When the Soviet Union collapsed in December 1991, nonstrategic nuclear weapons remained in the territories of only two former republics: Kazakhstan and Ukraine. Agreements concluded as part of the package on the dissolution of the Soviet Union included provisions for the transfer of these weapons to Russia by the summer of 1992. In the case of Kazakhstan, this process proceeded smoothly and quickly. In Ukraine, however, it faced difficulties. The Ukrainian government stopped the withdrawal on February 23, 1992 (it announced that decision only two

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<sup>16</sup> The story, surprisingly, remained almost unknown even in Russia, much less outside it. A detailed description can be found in Sokov, “Controlling Soviet/Russian Nuclear Weapons.”

<sup>17</sup> For details and references to the interagency correspondence, see Nikolai Sokov, *Russian Strategic Modernization: Past and Future* (Boulder, CO: Rowman and Littlefield, 2000).

weeks later) as the country began the process of painful reassessment of the conditions under which it would agree to part with nuclear weapons and their delivery vehicles. Many in Ukraine believed that the country should retain nuclear weapons.<sup>18</sup> For nonstrategic nuclear weapons, the issue was solved when Russia agreed to ensure that all these weapons removed from Ukraine would be dismantled. To ensure the verifiability of the agreement, the two countries concluded a special protocol on the accounting of nonstrategic nuclear weapons. After that, the withdrawal resumed in April 1992 and was completed in May. The protocol that regulated the accounting had an unanticipated benefit of dispelling rumors, which appeared a decade later, that Ukraine had secretly kept up to 200 nuclear weapons.

There were many stories about the loss of nonstrategic nuclear weapons in the 1990s, but none of them has ever been confirmed. The best known one is that of a loss of more than 100 atomic demolition munitions (ADMs)—portable nuclear mines also known as “suitcase nukes”—which had been subject to dismantlement under PNIs. These rumors emerged after General Alexander Lebed, following his retirement from the position of secretary of the Security Council of Russia (a position roughly similar to national security adviser in the United States) disclosed that a significant number of ADMs could not be located during his tenure in the Kremlin. A thorough accounting and tracking of all nuclear weapons—a process General Lebed had initiated himself—succeeded in matching records to physical weapons and concluded that none had been lost.<sup>19</sup>

## CURRENT NUMBERS

The Russian NSNW stockpile is notoriously difficult to assess. US Undersecretary of State for Arms Control and International Security Bonnie Jenkins recently estimated that it comprises between 1,000 and 2,000 warheads, basing her estimate on public reports.<sup>20</sup>

The estimate that has become the public “gold standard” is provided and periodically updated by Hans Kristensen and Matt Korda’s “Nuclear Notebook” column for the *Bulletin of the Atomic Scientists* and now stands

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<sup>18</sup> For details see Sokov, *Russian Strategic Modernization*.

<sup>19</sup> See “Suitcase Nukes: A Reassessment,” James Martin Center for Nonproliferation Studies (CNS), September 23, 2002, <https://nonproliferation.org/suitcase-nukes-a-reassessment/>; and its follow-on, Nikolai Sokov, “‘Suitcase Nukes’: Permanently Lost Luggage,” CNS, February 13, 2004, <https://nonproliferation.org/suitcase-nukes-permanently-lost-luggage/>.

<sup>20</sup> US Department of State, “Under Secretary Bonnie Jenkins’ Remarks: Nuclear Arms Control: A New Era” (remarks to the 17th Annual NATO Conference on WMD Arms Control, Disarmament, and Nonproliferation, Copenhagen, Denmark, September 6, 2021), <https://www.state.gov/under-secretary-bonnie-jenkins-remarks-nuclear-arms-control-a-new-era/>.

at about 1,900 weapons.<sup>21</sup> That figure has not changed much in more than a decade. It slowly declined from slightly over 2,000 to about 1,800 and then increased to the current level. While the Kristensen-Korda estimate is widely accepted, it has one well-known drawback: the assessment of the NSNW stockpile is based on the number of nuclear-capable nonstrategic delivery vehicles although their main mission is conventional. Therefore, an increase in the number of Kalibr sea-launched cruise missiles (SLCMs) or Iskander ground-launched missiles does not necessarily reflect changes in the NSNW stockpile. Similarly, at a conference in February 2022, Maj. Gen. Ferdinand Stoss, US Strategic Command's director of plans and policy, shared an assessment that Russia has up to 2,000 nonstrategic nuclear weapons today and that the number could grow to 4,000 by the end of the decade.<sup>22</sup> It remained unclear whether that statement referenced the stockpile of nuclear warheads or the number of nuclear-capable nonstrategic delivery vehicles. In the latter case this may overstate the number of NSNW given that the missiles are primarily used for conventional missions.

Other estimates using different methodology have been close to that of Kristensen and Korda. William Potter, Miles Pomper, and Nikolai Sokov, writing in 2009, believed that the Russian active stockpile of NSNW was around 2,000 warheads with perhaps as many as double that number slated for elimination.<sup>23</sup> There are also lower figures: in 2012, Igor Sutyagin estimated the Russian NSNW stockpile at around 1,000 weapons.<sup>24</sup>

Russia has rather stubbornly refused to provide official numbers. It disclosed in 2005 that the NSNW force had been reduced by 75 percent since 1991.<sup>25</sup> That figure has not changed in two decades and is hardly very credible. If one accepts Alexei Arbatov's estimate of 21,700 weapons as the size of the Soviet NSNW arsenal in 1991,<sup>26</sup> one-quarter would be about 5,000 warheads. An interesting perspective on the 75 percent figure was offered by the chief of the 12th GUMO, General

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<sup>21</sup> Hans M. Kristensen and Matt Korda, "Nuclear Notebook: How Many Nuclear Weapons Does Russia Have in 2021?," *Bulletin of the Atomic Scientists*, March 15, 2021, <https://thebulletin.org/premium/2021-03/nuclear-notebook-russian-nuclear-weapons-2021/>.

<sup>22</sup> Hans M. Kristensen, <https://twitter.com/nukestrat/status/1490775556471861262>.

<sup>23</sup> Jonas Bergenas, Miles Pomper, William Potter, and Nikolai Sokov, "Reducing and Regulating Tactical (Non-Strategic) Nuclear Weapons in Europe," CNS Occasional Paper, December 2009, [https://nonproliferation.org/wp-content/uploads/2014/02/reducing\\_tnw\\_april\\_2010.pdf](https://nonproliferation.org/wp-content/uploads/2014/02/reducing_tnw_april_2010.pdf).

<sup>24</sup> Igor Sutyagin, "Atomic Accounting: A New Estimate of Russia's Non-Strategic Nuclear Forces," RUSI Occasional Paper, November 2021, [https://www.europeanleadershipnetwork.org/wp-content/uploads/2013/02/1211\\_OP\\_Atomic\\_Accounting\\_Web\\_updated.pdf](https://www.europeanleadershipnetwork.org/wp-content/uploads/2013/02/1211_OP_Atomic_Accounting_Web_updated.pdf).

<sup>25</sup> The 75 percent figure was publicly declared in "Prakticheskie Shagi Rossiiskoi Federatsii v Oblasti Yadernogo Razoruzheniya" [Practical Actions of the Russian Federation in the Area of Nuclear Disarmament], Report presented at the 7th NPT Review Conference (2005), slide 13, [https://mid.ru/ru/foreign\\_policy/international\\_safety/disarmament/1697692/](https://mid.ru/ru/foreign_policy/international_safety/disarmament/1697692/); "Rossiya Perevpolnila Planu po Sokrashcheniyu Yadernogo Oruzhiya" [Russia Has Overfulfilled the Plan for Reduction of Nuclear Weapons], RIA-Novosti, June 22, 2005, <http://www.rian.ru/politics/20050622/40566772.html>. The same data has been repeated since then, year after year.

<sup>26</sup> Alexei Arbatov, "Deep Cuts and de-Alerting: A Russian Perspective," in Harold A. Feiveson, ed., *The Nuclear Turning Point* (Washington, DC: The Brookings Institution Press, 1999), p. 320.

Vladimir Verkhovtsev, who disclosed in 2007<sup>27</sup> that reductions had been deeper than what Russia promised under the PNIs. These promises, he claimed, would have amounted to 64 percent of the Russian NSNW force, but in fact the reduction reached 75 percent. In particular, he said that elimination of warheads assigned to the Ground Forces had been completed while remaining warheads for the Navy were stored on shore. But “if necessary [Russia] could deploy them [and] no one should doubt that,” Verkhovtsev said. Since dismantlement has continued beyond 2005, the current stockpile (including retired warheads) should be much smaller. The 75 percent figure, however, provides little guidance on the size of the operational stockpile and there is little choice but to use the 1,000-2,000 range.

## THE EVOLVING ROLE OF NSNW IN RUSSIAN NUCLEAR STRATEGY

Russian non-strategic weapons attracted international attention in the mid-1990s, when Russian government, military, and nongovernmental experts were discussing options for a response to the increased level of perceived threat following NATO enlargement.<sup>28</sup> At that time, some regarded enhanced reliance on short-range assets as an attractive way to balance this threat. The advantages of that option were, on the surface, convincing: the arsenal was already in hand, the military could rely on existing manuals and doctrines, and the availability of the NSNW option appeared more credible than the threat of using strategic weapons and triggering World War III. Moreover, the conceptual foundations were readily available—NATO reliance on short-range nuclear weapons to deter superior Soviet conventional forces during the Cold War.

This discussion did not translate into policy, however. Instead, the Yeltsin government opted for a political solution, the NATO-Russia Charter. In December 1997 the Russian government adopted the “National Security Concept,” and in July and August of 1998, Boris Yeltsin signed several

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<sup>27</sup> Nikolai Poroskov, “Takticheskii Yadernyi Kozyr” [A Tactical Nuclear Ace], *Vremya Novostei*, September 7, 2007.

<sup>28</sup> For details of the debates on the role of NSNW in Russia in the mid-1990s, see Nikolai Sokov, “Tactical Nuclear Weapons Elimination: Next Step for Arms Control,” *Nonproliferation Review*, Vol. 4, No. 2 (Winter 1997), pp. 17-27.

decrees<sup>29</sup> that continued the Soviet policy of a single mission for nuclear weapons, that of strategic deterrence (that is, nuclear weapons were to be used only in a global war). The only tangible result of that discussion was greater attention paid to NSNW in the West.

The game changer was the war in Kosovo in 1999, which particularly shocked Russia because it was launched without the authorization of the UN Security Council. Russia had regarded its right of veto as an efficient tool to deter the use of force against itself. A new round of the war in Chechnya appeared inevitable and Moscow saw that situation as almost identical to the conflict in Kosovo and worried that the United States and NATO would intervene.

For military officials, the shocking takeaway from the war in Kosovo was the fact that there had been no fighting on the battlefield: the Serbian army remained on the receiving end of US/NATO strikes and was unable to respond. They knew that the Russian army was not much different from Serbia's and understood that in case of US/NATO intervention in Chechnya, Russian troops stood little chance of resisting. The simple fact that there would be no battlefield in the traditional sense of the word required a near-term response, and nuclear weapons were the only asset that distinguished Russia from Serbia.

Even before the war in Kosovo ended, the Security Council of Russia (the first meeting chaired by Vladimir Putin in the capacity of its secretary) commissioned a new Military Doctrine, and it is not surprising that nuclear weapons featured prominently in it. The doctrine,<sup>30</sup> approved in 2000, introduced a new mission for nuclear

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<sup>29</sup> Kontsepsiya Natsionalnoi Bezopasnosti Rossiiskoi Federatsii [Concept of National Security of the Russian Federation], December 17, 1997, <https://www.armscontrol.ru/start/rus/docs/snconold.htm>. The 1998 decisions included a decree of Boris Yeltsin, "On urgent measures toward reforming the Armed Forces of the Russian Federation" (July 1997) and two Security Council documents, "The Concept of Development of Nuclear Forces until 2010" and "The Foundations (Concept) of State Policy in the Area of Defense Development until 2005" (July-August 1998). The texts of these documents are classified, but their general thrust can be gleaned from accounts in the Russian press. See "Sovet Bezopasnosti RF Reshil Sokhranit Trekhkomponentnyi Sostav Strategicheskikh Yadernykh Sil" [RF Security Council Decided to Keep the Three-Component Composition of Strategic Nuclear Forces], *Interfax*, No. 4, July 3, 1998; "Russia to be Major Nuclear Power in 3d Millennium—Official," *ITAR-TASS*, July 3, 1998; Ivan Safronov and Ilya Bulavinov, "Boris Yeltsin Podnyal Yadernyi Shchit" [Boris Yeltsin Raised the Nuclear Shield], *Kommersant Daily*, July 4, 1998; Yuri Golotuyk, "Yadernoe Razoruzhenie Neizbezhno" [Nuclear Disarmament is Unavoidable], *Russkii Telegraph*, July 11, 1998; Yuri Golotuyk, "Moskva Skorrektirovala Svoi Yadernye Argumenty" [Moscow Has Adjusted Its Nuclear Arguments], *Russkii Telegraph*, July 4, 1998; Anatoli Yurkin, "Perspektivy Voennogo Stroitelstva" [The Prospects of Nuclear Posture], *Krasnaya Zvezda*, August 5, 1998, pp. 1, 3; Oleg Falichev, "Vpervye So Vremeni Miluykovskikh Reform" [For the First Time Since Miluykov's Reforms], *Krasnaya Zvezda*, August 18, 1998, pp. 1, 2.

<sup>30</sup> For an analysis of nuclear-policy-related elements of the 2000 National Security Concept and Military Doctrine, see Nikolai Sokov, "Russia's New National Security Concept: The Nuclear Angle, January 2000," <https://nonproliferation.org/russias-new-national-security-concept-the-nuclear-angle/> and "Russia's 2000 Nuclear Doctrine," <https://www.nti.org/analysis/articles/russias-2000-military-doctrine/>.

weapons—the less-than-global, “regional” conflict<sup>31</sup>—and a new criterion for the scale of their use—“tailored damage,” which was defined in 2003 as “damage, subjectively unacceptable to the enemy, which exceeds the benefits the aggressor expects to gain as a result of the use of military force.”<sup>32</sup> (The criterion for global conflict remained the same, “unacceptable damage.”)

The Zapad-99 exercise held in May 1999 (the first in the “Zapad” series) played an important role in the development of the new doctrine. This exercise simulated the use of force by the United States and NATO against Kaliningrad Oblast with the US/NATO force replicating the one employed against Serbia a few months earlier. The exercise demonstrated that Russian troops would be able to resist a similar onslaught for no longer than a few days and then added a new element—limited use of nuclear weapons which, according to the scenario, would make the cost of conflict unacceptably high for the United States and NATO and force them to retreat.

Although that term has never been used in the Russian official discourse, this amounted to the mission of “de-escalation” of a conventional conflict through limited use of nuclear weapons. The concept and the term were developed in an article published in the leading Russian military journal, *Voyennaya Mysl*,<sup>33</sup> in 1999 during the time when the military was working on the new doctrine. Indeed, the doctrine was about de-escalation in all but name.

The 2003 document “Aktualnye Zadachi Razvitiya Vooruzhennykh Sil RF”<sup>34</sup> provided important clues to the role of various elements of the Russian nuclear forces. It emphasized that the United States and its allies had demonstrated the pattern of using long-range strike weapons, including airborne delivery systems and SLCMs, at an early stage of conflict. Accordingly, the document postulated “the utmost necessity of having the

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<sup>31</sup> For an analysis of nuclear-policy-related elements of the 2000 National Security Concept and Military Doctrine, see Nikolai Sokov, “Russia’s New National Security Concept: The Nuclear Angle, January 2000,” <https://nonproliferation.org/russias-new-national-security-concept-the-nuclear-angle/> and “Russia’s 2000 Nuclear Doctrine,” <https://www.nti.org/analysis/articles/russias-2000-military-doctrine/>. The notion of global war is self-explanatory; the category of regional wars pertains to a situation in which Russia faces a coalition of states, with some among of them not adjacent to Russia and/or some of them possessing nuclear weapons. The example the drafters of the 2000 Military Doctrine had in mind was escalation of the war in Chechnya through direct military involvement of the United States and its allies. The doctrine also included two other categories—one “local war” (in which Russia faced one or more neighboring states that had limited goals) and “military conflict,” which meant fighting with non-state actors (as in the war in Chechnya).

<sup>32</sup> “Aktualnye Zadachi Razvitiya Vooruzhennykh Sil RF,” [Urgent Tasks of the Development of the Armed Forces of the Russian Federation], *Krasnaya Zvezda*, October 11, 2003, [http://old.redstar.ru/2003/10/11\\_10/3\\_01.html](http://old.redstar.ru/2003/10/11_10/3_01.html).

<sup>33</sup> V. I. Levshin, A.V. Nedelin, and M.E. Sosnovsky, “O Primenenii Yadernogo Oruzhiya dlya Deeskalatsii Voyennykh Deistvii” [On the Use of Nuclear Weapons for the De-escalation of Hostilities], *Voennaia Mysl*, No. 3 (1999), pp 34-37, <http://militaryarticle.ru/zarubezhnoe-voennoe-obozrenie/1999-zvo/8995-o-primenenii-jadernogo-oruzhija-dlja-dejeskalacii>.

<sup>34</sup> “Aktualnye Zadachi Razvitiya Vooruzhennykh Sil RF.”

capability to strike military assets of the enemy (long-range high-precision weapons, long-range Air Force) outside the immediate area of conflict. To achieve this, [we] need both our own long-range high-precision strike capability and other assets that enable [us] to transfer hostilities directly to enemy territory.”

The 2003 document, together with the accompanying speech by Minister of Defense Sergey Ivanov, clearly stated, however, that reliance on nuclear weapons for “regional” contingencies would continue until Russia was able to modernize its conventional forces—that is, acquire the same long-range precision-guided capability as the United States and its allies had.

These provisions left little role for short-range (tactical) nuclear weapons. Large-scale exercises held since the adoption of the 2000 Military Doctrine have simulated limited nuclear use that employed long-range assets. Targets that featured in these simulations included command-and-control centers, air bases, and similar facilities; they were located throughout Europe, the Pacific, Southeast Asia, the Indian Ocean, and even the continental United States. Short-range weapons (such as tactical land-based missiles or tactical aircraft) cannot reach these targets. Instead, simulations featured medium and heavy bombers carrying gravity bombs, short-range missiles, and ALCMs. The Navy continued to stick to nuclear missions as well. Vice Admiral Oleg Burtsev, deputy chief of the Navy’s Main Staff declared that the role of tactical nuclear weapons in attacking nuclear submarines would increase: “The range of tactical nuclear weapons is growing, as is their accuracy. They do not need to deliver high-yield warheads; instead it is possible to make a transition to low-yield nuclear warheads that could be installed on the existing types of cruise missiles.”<sup>35</sup>

The next version of the Military Doctrine, issued in 2010, did not change this strategy. Reduction of the role of nuclear weapons, in particular in “regional” conflicts, apparently was not even discussed. Instead, there was a proposal to further expand de-escalation to “local wars,”<sup>36</sup> effectively assigning nuclear weapons to contingencies like the war with Georgia in 2008. That proposal was rejected.<sup>37</sup>

Many experts in the West and some in Russia believe that Russian short-range (tactical) nuclear weapons have a role in deterring China.<sup>38</sup> The underlying logic is similar to the common belief about the role of tactical nuclear weapons vis-à-vis NATO: if the opponent has superior conventional

<sup>35</sup> “Rol Takticheskogo Yadernogo Oruzhiya na Mnogotselevykh APL Vozrastet – VMF” [The Role of Tactical Nuclear Weapons on Multipurpose Submarines Set to Grow – the Navy], *RIA-Novosti*, August 23, 2009, [http://www.rian.ru/defense\\_safety/20090323/165742858.html](http://www.rian.ru/defense_safety/20090323/165742858.html).

<sup>36</sup> “Menyaetsya Rossiya, Menyaetsya i ee Voennaya Doktrina” [As Russia Changes, Its Military Doctrine Changes Too], *Izvestiya*, October 14, 2009.

<sup>37</sup> The rejection was probably one of the reasons the adoption of the new doctrine was delayed from 2009.

<sup>38</sup> See, for example, Arbatov, “Deep Cuts and de-Alerting,” p. 321.

forces, Russia needs to rely on nuclear weapons. It is commonly believed that Russia simulated use of tactical nuclear weapons in at least one large-scale exercise in the Far East, although it is not clear whether simulated launches of Iskander short-range missiles implied nuclear or conventional warheads. One reason to treat such reports with caution is the simple fact that there are few valuable targets on Chinese territory that borders Russia. It may be more logical for Moscow to rely, vis-à-vis China, on the same assets that it would use against the West—long-range nuclear assets that can reach targets deep inside the opponent’s territory. Indeed, interviews conducted by the author with Russian military sources during the period between the adoption of the 2000 and the 2010 Military Doctrines indicated that Russia relied not just on intermediate-range but also strategic weapons for deterrence of China.

A serious change in Russian nuclear strategy came only in the 2014 edition of the Military Doctrine,<sup>39</sup> which introduced the notion of non-nuclear deterrence, and in 2015 Russia demonstrated initial conventional capability by firing long-range SLCMs against targets in Syria. The 2014 document, however, retained the old language about the use of nuclear weapons in “regional” contingencies. This combination of nuclear and conventional deterrence appears logical for the state of affairs in 2014: building up conventional capability was bound to take considerable time and, in any event, there was little hope of catching up with the United States. Thus, the nuclear threshold was raised but the prospect of escalation to that threshold in a theater-level conflict did not disappear.

The chief of the General Staff of the Russian Armed Forces, Valeri Gerasimov, announced in 2017 that progress in long-range conventional weapons and the prospect of acquiring hypersonic delivery vehicles would enable Russia to reduce reliance on nuclear weapons in the future.<sup>40</sup> It is notable that he talked only about reducing reliance on nuclear weapons but not about ending it. Nuclear weapons have remained the foundation of Russian military security.

This underlying principle was confirmed by Vladimir Putin’s decree, “Foundations of State Policy of the Russian Federation in the Area of Nuclear Deterrence” in 2020,<sup>41</sup> which clarified some elements of policy while making other elements more ambiguous. Unlike previous

<sup>39</sup> “Voyennaya Doktrina Rossiiskoi Federatsii” [Military Doctrine of the Russian Federation], RG.ru, December 30, 2014, <https://rg.ru/2014/12/30/doktrina-dok.html>.

<sup>40</sup> Vystuplenie Nachalnika Generalnogo Shtaba Vooruzhenykh Sil Rossiiskoi Federatsii – Pervogo Zamestitelya Ministra Oborony Rossiiskoi Federatsii Generala Armii Valeriya Gerasimova na Otkrytom Zasedanii Kollegii Minoborony Rossii, 7 noyabrya 2017, [Statement by Chief of General Staff of the Armed Forces of the Russian Federation – First Deputy Minister of Defense Army General Valeri Gerasimov at the Open Meeting of the Collegium of the Ministry of Defense], November 7, 2017, [http://function.mil.ru/news\\_page/country/more.htm?id=12149743@egNews](http://function.mil.ru/news_page/country/more.htm?id=12149743@egNews)

<sup>41</sup> Ob Osnovakh Gosudarstvennoi Politiki Rossiiskoi Federatsii v Oblasti Yadernogo Sderzhivaniya [On the Foundations of State Policy of the Russian Federation in the Area of Nuclear Deterrence], June 2, 2020, <http://static.kremlin.ru/media/events/files/ru/lluTKhAiabLzOBjlfBSvu4q3bcl7AXd7.pdf>.

documents, the new decree did not distinguish between various categories of conflicts (such as “global” or “regional”). It allowed for a nuclear response not only to a nuclear attack but also in a situation in which Russia’s conventional forces are insufficient to repel the attack or are overwhelmed— specifically, when a conventional attack against Russia “threatens the very existence of the state.”

At the same time, the decree also restated the earlier provision about non-nuclear deterrence, effectively confirming that Russia would not resort to nuclear strikes at the early stage of conflict as was the case prior to 2014. But the decree also obliquely referred to possible changes in NATO’s nuclear posture (such as the much-discussed possibility that B61 bombs might be moved eastward—for example, to the territory of Poland), suggesting that Moscow could in that case enhance the role of nuclear weapons once again.

The decree reaffirmed, in considerably stronger words than previous military doctrines, the defensive nature of Russia’s nuclear deterrence: nuclear weapons will be used only in response to an attack on Russia, whether nuclear or (initially) conventional. Thus, at the level of official documents the only scenario for nuclear use was in response to the adversary’s aggression. The threat to use nuclear weapons in case of US and NATO intervention in the war Russia launched against Ukraine was thus outside the bounds of Russian declaratory policy and undermined the relevance of that policy for understanding and predicting Russian behavior.

To summarize, Russian nuclear strategy has changed relatively little since 2000. The cornerstone is still the option of limited nuclear use in response to an attack by superior conventional forces. The addition of conventional deterrence in 2014 has made the nuclear threshold higher but the limited-use option has remained part of Russian deterrence strategy. Official pronouncements have kept opacity on two important points, however.

First, what will be the role of nonstrategic nuclear weapons in all these scenarios? The absence of even indirect hints in recent documents and public statements can be interpreted to mean that guidance offered in 2000-2003 has not changed. In other words, the emphasis in any limited-use scenarios will be on theater-range assets. This leaves little room for short-range, tactical weapons and emphasizes longer-range assets.

This potentially opens a window of opportunity for modest asymmetric reductions in those Russian nonstrategic nuclear weapons that do not have a tangible role in limited-nuclear-use contingencies. The possible scale of such reductions is difficult to assess because reliable data on the breakdown of Russian NSNW stockpile is not publicly available. As noted above, estimates of the Russian NSNW arsenal by Kristensen and Korda assume that all Russian long-range cruise missiles are nuclear, which is

hardly the case. As noted above their primary mission is conventional. As a result, as the number of long-range missiles continues to grow the gap between delivery vehicles capable of carrying NSNW and actual NSNW can be expected to grow as well. Russia will certainly seek to shield nuclear warheads for cruise missiles and other long-range assets from reductions but the bottom line for NSNW reductions is difficult to assess.

Second, what is the connection between nonstrategic and strategic nuclear weapons in limited-use scenarios? The prospect of limited nuclear use in the theater for de-escalation purposes theoretically leaves open the possibility that strikes will be limited to targets in NATO Europe, starting with NATO's long-range assets deployed in Europe that can be employed against Russian territory. This would, without a doubt, include American personnel and bases as well as surface ships (such as aircraft carriers and ships with SLCMs on board) but not necessarily US territory. On the other hand, Russian exercises in 2000-2013, which were described above, apparently included simulation of limited strikes against US territory too. The possibility that limited nuclear use could, under some scenarios, extend to US territory is consistent with Soviet insistence during the Cold War that US territory would not remain immune in case of a limited nuclear war in Europe.

Until 2014, Russian approaches to deterrence of "regional" war were dominated by limited- nuclear-use options because the United States held a near-monopoly on modern conventional weapons and could wage a large-scale conflict without resorting to nuclear weapons. This is no longer the case, with improvements to Russian long-range conventional missile forces. Nowadays, a more likely scenario of a direct conflict between Russia and the United States and NATO includes a conventional phase. In such a scenario, conventional strikes against US territory appear significantly more likely than nuclear strikes in previous, nuclear-only scenarios.

As a result of the buildup in long-range conventional weapons, the standoff (immediately usable) long-range conventional capability of Russia and NATO in Europe is roughly equal as of the end of 2021. NATO continues to enjoy a limited advantage, but it would be insufficient for a quick and decisive victory. That balance may decisively shift in favor of NATO only after the United States is able to move a large number of platforms equipped for long-range conventional weapons (aircraft, ships, submarines) to the European theater, but that may take some time.<sup>42</sup> Russia clearly remains concerned that the United States could eventually prevail in a conventional fight and for that reason, retains escalation to the nuclear level as a fallback option for any conflict with the United States and NATO. Moscow is likely to be the one to decide whether to cross the nuclear threshold; accordingly, it will also

<sup>42</sup> Vienna Center for Disarmament and Non-Proliferation, *Establishing a Transparency and Confidence Building Regime for Long-Range Conventional Weapons in Europe*, 2022 (forthcoming).

likely be a Russian decision whether a nuclear war should be expanded to the Western hemisphere. Given the regular flights of Russian ALCM-carrying strategic bombers toward and near the United States, the option remains on the table, but official clarification is absent.

The US deployment of W76-2 low-yield warheads on Trident SLBMs introduces a further element of uncertainty. These warheads were intended to deter Russia from limited use of nuclear weapons in the European theater, but employing them might actually have the opposite effect. Since, under Russian declaratory strategy, escalation to limited nuclear use is reserved for a situation in which Russia faces certain defeat from US and NATO conventional forces, a US threat of limited nuclear use will hardly force Russian leadership to accept defeat. If anything, such a threat (and even more so actual use) will all but guarantee Russian strikes against US territory. Worse, if the United States launches an SLBM equipped with a low-yield warheads, Russia will not know whether its warheads are nuclear or conventional and is very likely to perceive it as a strategic attack. In that case, the conflict will instantly escalate to the level of a “global” war under the definition used in the Military Doctrine. Much will depend on the perceived asymmetry of the stakes: if the stakes for Russia in the impending defeat will be greater than the US stakes in defeating Russia, Russian threats will likely carry more weight.

It is important to understand, of course, that all these scenarios are intended to affect an adversary’s decision making rather than lead to the use of nuclear weapons in real life. A realistic threat of nuclear use (including demonstration of resolution to cross the nuclear threshold) supported by an appropriate posture is primarily intended to prevent an attack by the other side. The same is true for the US decision to deploy low-yield warheads, whose main purpose is deterring Russia from “going nuclear” under conditions of a conventional war. In real life, any decision to use nuclear weapons would be very difficult and perhaps even driven by different motives.

## **RUSSIA’S WAR AGAINST UKRAINE: INITIAL ASSESSMENTS OF NUCLEAR STRATEGY AND THE ROLE OF NSNW**

An analysis of Russian declaratory nuclear strategy in conjunction with its posture yields a reasonably logical picture of the role non-strategic nuclear weapons have in Russian deterrence policy and the role they may play in a variety of contingencies. The war against Ukraine launched at the end of February 2022 has introduced major uncertainties into that picture. Vladimir Putin has issued several rather explicit warnings to the West that direct involvement in the war could result in nuclear war. These warnings

introduced a nuclear component into an already dangerous situation fraught with the possibility of escalation to great-power conflict. At the moment of this writing, the war still continues but it seems possible to make some initial conclusions about Russian nuclear deterrence strategy in light of recent developments.

First of all, Putin's references to nuclear weapons were unnecessary, bordering on irrational. There is no doubt that the United States and NATO are well aware of the existence of Russian nuclear weapons and would have exercised caution to avoid escalation without Putin's reminders. Clearly, these statements were intended to communicate to the West that it should stay away from the war, but if they communicated anything, it was probably the fear and emotional instability of the Russian leadership (which in itself is not a good sign).

Second, the use of nuclear weapons to protect an offensive war is outside Russian declaratory strategy, which foresaw nuclear weapons as a tool for deterring an attack on Russia itself. This casts doubt on many assumptions about Russian nuclear strategy and especially about Moscow's redlines, the crossing of which could trigger nuclear use. Even scenarios of "offensive de-escalation," which were developed in the West before the war in Ukraine, did not go beyond a statement that Russia would threaten the use of nuclear weapons in case of direct military intervention by NATO. Today, NATO governments are forced to proceed by trial and error trying to determine where the redlines might be. In other words, we are living in a world of extreme uncertainty.

Russia's declaratory policy proceeded from an assumption that war would be launched by the United States and its allies and would include, as one of its components, a massive strike with long-range conventional weapons, to which Russia would respond. If the conflict did not end at that stage, there might come a turn for nuclear weapons. Since Putin's recent statements are outside that framework, redlines are difficult to determine, so any step by the West may be fraught with the danger of escalation, including, in the extreme case, to the nuclear level. It has turned out that unprecedented economic sanctions and provision of arms to Ukraine do not cross the redline. The arrival of volunteers from the West, however, was met with a Russian conventional strike at the Yavoriv training range, where some of them assembled before going to the frontlines. A consensus of NATO governments has determined that a no-fly-zone, which would have pitted NATO pilots against Russian aircraft and air-defense systems, would be too risky and probably cross the redline. As events continue to unfold, there may be other uncertain situations; the emergence of the new Russian policy, which can be classified as "offensive deterrence," makes any decision risky. It is possible that maximum uncertainty was one of the goals of Putin's references to nuclear weapons early in the war.

Third, the acquisition of long-range precision-guided conventional capability by Russia has apparently introduced an additional and somewhat safer rung on the escalation ladder. Since 2014, Russia's Military Doctrine has allowed for a stage of non-nuclear deterrence prior to crossing the nuclear threshold. This arrangement probably holds even during the war in Ukraine, meaning that were the West to cross the unknown and undefined redline, the initial Russian response would not be nuclear; instead conventional weapons would be used first. According to the US Department of Defense, as of March 17, 2022, Russia had used more than 1,000 missiles in the Ukraine invasion,<sup>43</sup> but the breakdown into different types and ranges was not revealed. Available incomplete reports in the media suggest, however, that the share of the long-range variety of such missiles has been relatively small, which may indicate that Russia has few of such missiles or may, alternatively, suggest that it has sought to keep the bulk of these weapons in reserve to be used against NATO were the war in Ukraine to escalate. A recent analysis suggests the latter is the case.<sup>44</sup> This means that the initial Russian response to escalation would involve conventional weapons but since most—if not all—of these missiles are dual-capable, further escalation to the nuclear level may involve exactly the same weapons and it may be difficult to clearly detect when the line between conventional and nuclear is crossed.

All this means that the world has entered a new stage of uncertainty about possible use of nuclear weapons, including and especially the nonstrategic ones. The opacity of data about NSNW stockpiles in Russia as well as the lack of any degree of transparency with respect to their operations (such as the transfer of warheads for nonstrategic delivery vehicles from storage to military bases) makes the situation highly dangerous and calls for urgent measures to implement arms control and transparency measures for NSNW.

## THE FUTURE OF THE RUSSIAN NSNW POSTURE

There is little doubt that the Russian attitude toward non-strategic nuclear weapons and the prospects of arms control is defined by two considerations:

- The Russian military continues to attach considerable value to this category of nuclear weapons. They have a mission that needs to be fulfilled, and that mission is primarily in the European theater. Therefore, some number of non-strategic weapons—most likely the intermediate-range variety—will be preserved at any cost, and Moscow will not agree either to their elimination or even to equal limits with US NSNW in Europe.

<sup>43</sup> "Russia Launches Over 1,000 Missiles Since Start of Ukraine Invasion, US Official Says," *National Post*, March 17, 2022, <https://nationalpost.com/pmn/news-pmn/russia-launches-over-1000-missiles-since-start-of-ukraine-invasion-us-official-says>.

<sup>44</sup> Vienna Center for Disarmament and Non-Proliferation, *Establishing a Transparency and Confidence Building Regime*.

- The long-standing Russian condition for negotiations on NSNW, the withdrawal of American B61 bombs from Europe, is little more than a pretext to avoid negotiations. Paradoxically, the debate about the withdrawal of B61s, which took place in Germany a decade ago, was viewed in Moscow with serious, albeit well-concealed, concern because Moscow risked falling into its own trap. Had that happened, Russia would have been forced to enter negotiations on NSNW. When NATO decided to keep that component of nuclear deterrence, the Russian military sighed with relief.

Russia's NSNW posture appears to be undergoing a major transition. The military has focused on increasing the number and the capabilities of long-range conventional weapons while non-strategic nuclear weapons have taken a back seat. The scenario that still seems to dominate Russian military thinking is the US and NATO ability to wage war at long ranges without encountering the opponent's forces on the battlefield, or at least the use of long-range conventional weapons in the first stage of conflict to degrade the opponent's forces. The Russian military appears to plan to use long-range precision-guided conventional weapons primarily against command, control, and communication centers; radars and air-defense and missile-defense assets; and critical elements of civilian and transport infrastructure throughout NATO territory. The goals are to degrade the ability of the United States and NATO to strike at similar targets in Russia and also to prevent them from sending reinforcements to the NATO-Russian border. In the past, these targets were assigned to nuclear weapons. In a way, Russia is undergoing the same transition as the United States did in the 1990s – shifting missions from nuclear to conventional weapons.

An important feature of the Russian military posture is the dual capability of long-range strike assets. This is a new development, which represents a departure from Soviet traditions: the Soviet Union always kept conventional and nuclear weapons strictly separate, to the point of installing different attachment joints for nuclear and conventional ALCMs. Dual capability is cost-effective and allows for greater versatility, but it is dangerous because the opponent will not know which warhead the missile launched by Russia is carrying.

Although Russian sources are silent on that aspect, there is a widely held belief that all new strike assets that Russia has developed since the end of the Cold War are dual-capable and that nuclear warheads exist for all these systems, with the possible exception of Iskander. The new ALCM was developed, from the beginning, as dual-capable (officially, there are two versions, Kh-101 and Kh-102, but they differ only in the warhead). Work on the nuclear warhead for the Kalibr SLCM, according to an interview

by the author with a defense industry insider, began in the early 2000s, shortly after the launch of R&D on the SLCM itself. New hypersonic weapons Kinzhal and Tsirkon are also most likely dual-capable.

Whether nuclear warheads are available for Iskander short-range missiles is not clear. Russia was supposed to dismantle all nuclear warheads for ground-launched systems under the PNIs and, according to Verkhovtsev, has implemented that promise. Yet, many observers, including in Russia, believe that such warheads may be available. Although Russia has not admitted to testing a version of the Iskander cruise missile with a range exceeding 500 km, it is clear that even if it has not yet done so, it eventually will develop such a missile, especially if NATO deploys long-range conventional missiles in Europe. And when it does, there can be little doubt that the intermediate-range version of Iskander will be dual-capable.

It seems only reasonable to expect that Russia will continue to emphasize long-range dual-capable missiles. A recent analysis of the Russian army's logistical capabilities<sup>45</sup> concluded that the Russian Armed Forces are designed for "active defense" inside Russia's own territory or at very short distances outside it. Challenges Russian forces encountered in the war with Ukraine confirmed these conclusions; problems with logistics became evident only a few days after the beginning of the war and made the Russian army slow down, and even stop, its offensive. In this light, the ability to strike at the opponent's rear is a logical and valuable part of Russia's military posture; long-range conventional missiles were actively used against targets in Ukraine's rear, especially after the Russian offensive stalled. Long-range strike assets also emphasize the ability to penetrate air and missile defenses—the main impetus behind the hypersonic-weapons programs as well as some other, more exotic designs (such as the Burevestnik loitering cruise missile powered with a nuclear engine).

Advances in precision guidance have made nuclear warheads for air- and missile-defense weapons unnecessary. There is no data—or even rumors—about the dual capability of the "S" series of systems. Nuclear warheads for the A-235 missile-defense system may still be kept in storage, but even that is no longer certain.

All these trends suggest that the Russian NSNW stockpile will likely continue to decline and will primarily consist of warheads for theater-range missiles:

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<sup>45</sup> Alex Vershinin, "Feeding the Bear: A Closer Look at Russian Army Logistics and the Fait Accompli," *War on the Rocks*, November 23, 2021, <https://warontherocks.com/2021/11/feeding-the-bear-a-closer-look-at-russian-army-logistics/>.

- Nuclear ALCMs on strategic bombers, which will support both strategic and theater missions; and nuclear-armed missiles on medium Tu-22M3 and Tu-22M3M bombers, including Kinzhal and perhaps also other air-to-surface missiles (Kh-32). Nuclear weapons on other aircraft (such as the Su-34) are less likely but possible.
- Nuclear-capable missiles on ships and submarines: Kalibr and Tsirkon as well as possible future new systems. (R&D work in Russia continues, so a significant enhancement—a new generation or at least advanced versions of the current generation—is highly likely.)
- Possibly also a limited number of warheads for ground-launched missiles, especially if Russia deploys the theater-range variety.

Other categories of the existing stockpile (warheads for air and missile defense) will most likely be withdrawn from service either completely or with limited exceptions (such as warheads for the A-235 missile-defense system around Moscow). Perhaps more importantly for any arms control measures on short-range (tactical) nuclear weapons, warheads for such systems will likely be phased out completely or almost completely; the emphasis will continue to be on longer (theater)-range assets.

In other words, any reductions will be primarily of weapons with marginal military utility. The essence of this process is continued optimization of the Russian arsenal to meet the requirements of the current military missions in the theater; the legacy arsenal will become more rational. These missions will not require a large non-strategic arsenal: analysis of exercises that simulated possible conflict with NATO in 2000-2013 suggest 10-20 nuclear weapons. After all, if the main purpose is deterrence, not warfighting, the deterrent effect can be achieved by a mere threat to cross the nuclear threshold and a minimal capability. Of course, the threat needs to be credible and there should be a sufficient variety of assets with different basing modes; this could require a stockpile of several hundred.

Among these, sea-launched assets will dominate for several reasons, among them versatility (they can be used against both naval and land targets); the ability to move to other theaters (giving SLCMs the ability to support strategic missions against US territory as necessary); the availability of many types of platforms (surface ships of different sizes, nuclear submarines, and diesel submarines) which makes the force more survivable; and, last but not the least, the continuing interest of the Russian Navy in a nonstrategic nuclear capability, which has made it the main bureaucratic and political supporter of these weapons. The 2017 “Foundations of Naval Policy” emphasized that, in addition to strategic deterrence, the Russian Navy must be able to “inflict no less than critical

damage using nonstrategic nuclear weapons.” It should be noted that the Navy is also tasked with the mission of non-nuclear deterrence,<sup>46</sup> which is built around the same dual-capable systems.

Although nuclear warheads for naval theater-range assets will most likely remain stored on shore, the Navy probably has a procedure to quickly load them onto ships and submarines in case military conflict is assessed as almost certain (*ugrozhaemyi period*, or the “high threat period,” in Russian military parlance). That way, Russian vessels will have the entire range of nuclear and conventional weapons available to them literally from the first minutes of the conflict.

While the bulk of the nonstrategic nuclear stockpile will remain in the European part of Russia, a significant share will also be stored in the Far East. Nonstrategic nuclear missions in the Far East are not limited to China; indeed, China does not appear to be the main concern lately. Rather, these weapons are to be used against US aircraft carriers as well as US bases in the Pacific. (In 2003, Russian strategic bombers practiced ALCM strikes against Guam, for example.) In some contingencies, even US territory could be a target: Alaska (especially the missile-defense assets there) is within easy reach for nonstrategic strike assets, as is the state of Washington. Plans for deployment of Project 636.3 diesel submarines in Kamchatka have already been announced, and one can expect that Kalibr SLCMs will come with not only conventional but also nuclear warheads.

To summarize, in the last 10 years or so, the Russian NSNW posture has been undergoing a transition from a legacy, post-PNI Soviet arsenal to a combination of assets in support of specific missions. The process is far from complete, but the contours of the future posture can already be discerned. Greater certainty about that future posture may, in theory, enable arms control measures, but one central issue will stand in its way: the Russian military strongly believes that Russia needs a larger NSNW force than does NATO, and that belief is largely shared by the political leadership and the elites more generally. This means that Russia will not agree to equal ceilings, much less to complete elimination of that category of nuclear weapons. As long as NATO keeps emphasizing the need to achieve equal ceilings in NSNW, Russia will continue to resist application of arms control to these weapons. A more measured, phased approach that begins with transparency may be more promising.

That said, the role of NSNW in Russian security strategy has been on the decline. As the country continues to build up its long-range conventional capability, NSNW are increasingly relegated to the role of a backup. Accordingly, the NSNW arsenal will most likely shrink (although

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<sup>46</sup> Osnovy Gosydarstvennoi Politiki Rossiiskoi Federatsii v Oblasti Voenno-Morskoi Deyatelnosti na Period do 2030 goda [The Foundations of State Naval Policy of the Russian Federation until 2030], July 20, 2017, <http://www.kremlin.ru/acts/bank/42117/page/1>.

Russia will insist on keeping it equal to or greater than the US and NATO combined arsenal—that is, including France and the United Kingdom). Changes in that attitude toward NSNW can result only from fundamental changes in the global, and especially, European security landscape.

However, during the war with Ukraine, the Russian army has demonstrated that it has a limited capability to fight large-scale conflicts. Although its performance certainly has improved since its war with Georgia in 2008, it apparently has a long way to go. This may mean that the role of nuclear weapons—including, first and foremost, the theater-range variety—will once again increase, just as Moscow felt it vital to rely on nuclear weapons after 2000. Accordingly, the higher profile of nuclear weapons in the security toolbox may make the Russian military less predisposed toward reduction of its nonstrategic nuclear arsenal. So while the objective factors that favor reductions continue to hold, the political and psychological resistance to such reductions may grow. Further, it is not inconceivable that while remnants of the legacy NSNW arsenal will continue to be reduced, the number of nuclear warheads deployed on modern long-range dual-capable systems will increase. All this makes negotiations with NATO on NSNW—and, even more, the successful conclusion of such negotiations—quite problematic.

## **THE LIKELY RUSSIAN POSITION ON THE VERIFICATION OF NSNW**

The most difficult aspect of any arms control measures with respect to NSNW will be verification. Russia, especially its military, has been traditionally adamant that verification of stockpiles is not needed for arms control. That approach worked reasonably well for strategic weapons but is inapplicable to nonstrategic ones because the vast majority of these are equipped with conventional warheads. Moreover, the number of delivery vehicles is significantly greater than the number of nuclear warheads, and that gap is bound to grow as Russia continues to emphasize enhancement of its capability in long-range conventional assets.

Russia's agreement in the fall of 2020 to commit politically to a freeze on its nuclear stockpile indicates, however, that the wall is not impenetrable. Even though it refused to discuss verification even in principle, this was the first time that Moscow agreed to apply any arms control or confidence-building measures that would have affected the NSNW stockpile. The fact that the offer was taken off the table in 2021 does not alter the fact that the NSNW stockpile is no longer a sacred cow. Granting Americans access to nuclear-warhead storage facilities in the context of the Cooperative Threat Reduction (CTR) program and other similar programs also suggests that rejection of such measures is less firm than the Russian military claims publicly.

Any verification of stockpiles will probably need to satisfy the following criteria:

- There should be no “verification for the sake of verification.” To put it slightly differently, Russia will insist on a minimalistic approach, involving only the measures needed to verify the provisions of a possible arms control agreement. At least at the initial stage, Moscow will most likely reject verification for transparency and confidence building.
- Verification cannot entail any measures that could impair the safety and security of warheads and storage facilities (meaning that Russia will seek to severely limit access of inspectors to storage facilities, ban the opening of shipping containers, and seek other restrictions).
- The agreed approach should minimize the vulnerability of warheads. Such an approach could include measures to ensure that the United States cannot track each Russian warhead in real time. There should be no measures that would prevent release of warheads to troops in an emergency.
- Differentiating between strategic and nonstrategic stockpiles in an agreement that focuses on NSNW will be very difficult. At a minimum, it will be necessary to find ways to differentiate between warheads for different categories of delivery vehicles—and perhaps rearrange warheads among storage facilities so that strategic and nonstrategic warheads do not mix—while protecting information about warhead designs.
- The next stage will be an agreement on what “nonstrategic” means. For example, ALCMs on long-range aircraft have been regarded as strategic weapons in contrast to SLCMs, which have never been limited by strategic arms control treaties (but were included in the PNIs). In any event, existing categories do not fit mission sets well.
- Russia will seek to ensure that any verification regime provides comprehensive and equal coverage: the same measures should apply to all NSNW and facilities worldwide, including on the territory of the United States. Russia will certainly try hard to avoid a situation that existed in the context of the Strategic Arms Reduction Treaties, where the only missile-production facility subject to continuous monitoring was in Votkinsk, Russia.
- It is unclear how Russia will propose to address the British and French nuclear stockpiles. The United Kingdom only has SLBMs and thus does not have nuclear weapons in the NSNW category; France has SLBMs and ALCMs. Since Russia attempted to include the nuclear forces of these two countries into the INF Treaty, it

could try the same for stockpile verification, making an argument that their mission is limited to the European theater. This will probably be a relatively simple problem because the inclusion of British and French forces would necessitate application of similar measures to China, and Russia will likely avoid talking about these matters with Beijing.

In any event, Russia almost certainly will begin by flatly rejecting the idea that verification should be applied to nonstrategic stockpiles. To get the Russian military to discuss this topic, an agreement to begin negotiations on verification must come from the top (first and foremost Vladimir Putin himself), and it will be necessary to find ways to make top Russian leadership interested. If and when such negotiations begin, Russian negotiators will present a position that may be unacceptable, or at least difficult, for the United States—insisting on conditions that will limit access and intrusiveness for inspections in Russia while ensuring that inspections in the United States and allied countries are as inconvenient and intrusive as possible. Among other features, it is likely that Russia will insist on inspections on ships and submarines, which the US Navy has traditionally rejected.

Ultimately, Russia will seek measures that are as limited, nonintrusive, and nonrestrictive as possible to ensure that operations with its NSNW stockpile are as unaffected as possible. For the success of the negotiations, it would be advisable to keep in mind the following principles:

- A step-by-step approach to verification—measures that initially have minimal operational effect but subsequently are expanded and made more intrusive—has a greater chance of succeeding. After successful implementation of modest measures for a period of time, concerns of the Russian military will likely subside. This dynamic closely follows the pattern of US-Russian interaction in the context of the CTR program; the same dynamic will have to be repeated because military and civilian officials who have experience in CTR implementation have already retired, and institutional as well as personal memory has been lost.
- The US position should include from the very beginning a degree of verification on US territory. An attempt to exclude it from such a regime would breed suspicion that the United States is interested only in targeting Russia NSNW and would make any progress difficult.
- A proposal that could enhance chances for an agreement could include measures such as suspect-site inspections that would serve as a quasi-verification measure for the NATO obligation contained in the NATO-Russia Founding Act to refrain from deploying nuclear weapons on the territories of the former Soviet Union and other Warsaw Pact members.

- The process should include continuous dedicated dialogue between high-level military leaders, such as regular meetings between the chairman of the US Joint Chiefs of Staff and the Russian chief of General Staff with a broader agenda. It also would be advisable to hold informal seminar-style Track 1.5 events to better educate the Russian military about the value of transparency and confidence building in parallel with negotiations on verification.
- It will be vital to clearly explain the motives behind the US position and display readiness to compromise on specific proposals as long as the end goals are achieved. That formula worked well during START I and New START negotiations, and there is no reason why it cannot be repeated with respect to the highly sensitive topic of NSNW verification. Joint work of this kind helps build the trust that is essential for successful outcome of negotiations.

Verification of NSNW stockpiles is perhaps the most challenging task of the entire arms control agenda. It is achievable, but one has to prepare for a long haul, multiple challenges, and deadlocks. Persistence and efforts to build personal relationships among negotiators at all levels will be needed for success. Getting a handle on the least regulated element of nuclear arsenals, however, is worth the effort.

# Allied Views: Interviews with Key Stakeholders

## *William P. Alberque and Political Team Contributors<sup>1</sup>*

This first stage of the CNS project included interviews with key stakeholders from NATO countries to gain a better understanding of their thinking on US-Russian arms control for nonstrategic nuclear weapons. To this end, the CNS project team interviewed experts from foreign-affairs and defense ministries, parliaments, think tanks and academia, as well as NATO officials involved in deterrence and arms control.<sup>2</sup> The intention was to identify which political, legal, and technical issues are likely to emerge among the allies in the run-up to, negotiation of, and implementation of any such agreement, as well as the options available for dealing with any such issues. Starting in early June, the team began interviewing stakeholders in allied capitals based on a detailed questionnaire, in most cases tailored for the specific audience. (See Appendix B for an example of the questionnaire for a country publicly identified as hosting dual-capable aircraft able to carry out NATO nuclear missions.)

The questionnaire broke the problem down into five main topics, asking interview subjects:

- The potential purpose and scope of the treaty;
- Their country's perception of the threat from Russian NSNW;
- Their perception of the potential effect of such negotiations on NATO's nuclear-sharing arrangements and force posture;
- Who should participate in such negotiation and in what capacities; and
- Their thoughts on implementation and verification, particularly regarding Russian access to NATO European military infrastructure.

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<sup>1</sup> The other members of the CNS political project team—Lukasz Kulesa, Egle Murauskaite, Hanna Notte, and Michal Onderco—conducted many of the interviews and contributed additional research for this section.

<sup>2</sup> The CNS project team conducted interviews with government and nongovernment experts from Belgium, the Czech Republic, Estonia, France, Germany, Latvia, Lithuania, the Netherlands, Poland, the Slovak Republic, the United Kingdom, and several different offices at NATO headquarters. The interviews were conducted by phone or videoconference or in person at NATO headquarters and some other facilities in the spring and summer of 2021. Note that no nation is cited individually in the answers below to protect the anonymity of the interviewees and that none of the answers were considered official government positions, but rather the views of the interviewees, informed by their personal experience, expertise, and viewpoints.

The interviews revealed broad support for addressing Russian NSNW in some way—with some interviewees supporting strengthening US and NATO deterrence capabilities before engaging in dialogue with a Russia seen as untrustworthy by many. All interviewees agreed that such talks can be bilateral between the United States and Russia, but with extensive NATO consultations before and after each round of negotiations. Interviewees agreed that consultations should include the United States seeking and gaining allied consensus before engaging with Russia. All agreed further that Russia will use talks to seek to divide allies, alienate NATO partners, and ultimately eliminate NATO’s forward-deployed nuclear forces. All interviewees also appeared to be sensitive to the complexity of the task before the United States in designing and negotiating a treaty that would increase security and protect allied interests while ensuring the enduring mission toward collective defense. One interviewee suggested that this questionnaire should serve as the basis for further dialogue at NATO headquarters in a classified environment.

Most interviewees seemed unaware of the full implications of the lessons identified from the most applicable precedent for such a treaty, namely the Intermediate-Range Nuclear Forces (INF) Treaty, including their own potential obligations to host Russian inspections on their territory to verify the presence or absence of US NSNW. Once this topic was raised, the NATO allies with certified dual-capable aircraft (known as the “DCA nations”) immediately highlighted the need to maintain the long-standing policy of “neither confirm nor deny” (NCND) regarding the presence or absence of US nuclear weapons on their territory. At the same time, most interviewees appeared to be aware of the need for new and innovative approaches to verify such an agreement.

The most significant and urgent takeaway from these interviews is that it would be immediately useful to conduct outreach and education efforts to better inform allies of the potential implications of a US-Russian deal and to help prepare them to contribute usefully to the consultation process required to support US-Russian negotiations.

## **PURPOSE AND SCOPE**

Most NATO allies are aware of the need for further negotiations to address nuclear weapons that currently are not a part of existing arms control arrangements. Perceptions of the overall need for further arms control varied, as one would expect, depending on the proximity of the country to Russia. In general, the further west a country is, the greater the perceived need for arms control (including more expansive eventual efforts to include hypersonic missiles and cyber capabilities); the further east, the more the interviewees focused on deterrent options, and worried about Russia’s ability to extract gains at NATO’s expense. Several eastern

interviewees specifically cited Russia's appalling record on arms control compliance as an insuperable barrier to future agreements. Among the allied states toward the west (but not only there), there was a marked divide between representatives of think tanks—at the extreme in support for arms control—and defense-ministry officials who voiced skepticism about the value of arms control and Russia's intentions in agreeing to any talks. As one interviewee stated, they prefer “no deal to any bad deal.” One interviewee, from a famously arms control-friendly state, explicitly stated that France's embrace of Russia's offer of an INF moratorium was foolish and counterproductive, calling it a “game.”

That said, interviewees broadly supported greater transparency and limiting Russian nuclear warheads not currently constrained by the New Strategic Arms Reduction Treaty (New START), specifically its stock of NSNW. While several interviewees maintained the goal of the eventual elimination of nuclear weapons, they also said the first step must include Russian willingness to limit the currently unconstrained parts of its arsenal. All interviewees said that intrusive verification was a necessary condition for any limitations or reductions, especially due to Russian untrustworthiness. Several interviewees said that limits were good, but reductions should be the explicit intention of any such negotiations, with one interviewee highlighting the need to reduce the number of Russian central storage facilities and forward storage facilities. Another cited past arms control lessons and said that the duration of the treaty also would be important—not so long that it slips into irrelevance, and not so short that it puts the parties under pressure to negotiate again too soon.

Several interviewees retained a focus on delivery systems rather than warheads, with a strong desire to separate conventional and nuclear systems (without any appreciation for dual capabilities). As one interviewee put it, “think big but start small,” citing the lack of trust between the sides and the potential for the Strategic Stability Dialogue to build necessary confidence. Nearly all interviewees agreed that there should be no territorial sublimits to any agreement (that is, for example, limitations on Europe and Russia west of the Ural Mountains). One interviewee did advocate for a Europe-only approach to NSNW elimination, and two others indicated such an approach might be valuable—if it is a first step. Most others cited the portability and concealability of warheads as reasons not to consider a Europe-only approach. One interviewee (from a further western ally) stated flatly that advocating for Europe-only solutions would “solve nothing, is reversible, and increases the risk of conflict,” and another said that it “would be the end to all NATO trustworthiness” in its dialogue with Asian partners.

## THREAT PERCEPTION

All interviewees expressed concerns about Russia, although some posited that China, terrorism, and cyber war are all topics that are of more immediate concern to them and their publics. Several interviewees also pointed out that public perceptions varied depending on proximity to Russia, with a few stating that some of their political parties and publics saw no threat from Russia at all. Some allies further west even questioned whether nuclear weapons were the real threat, naming cyber and advanced conventional weapons, especially new dual-capable cruise missiles, as more pressing concerns than Russian NSNW. However, almost all respondents who did name dangerous systems pointed to Iskander (a short-range nuclear-capable ground-launched ballistic and cruise missiles system) and its ability to target NATO allies and partners from Kaliningrad and Crimea, as well as the destabilizing effects of the INF-Treaty-violating 9M729 as a direct threat to NATO.

The divide based on geography was notable in this regard. Allies closer to Russia were more mindful of Russia's extensive arsenal of short-range dual-capable and nuclear-only delivery systems and the risk that Russia could use its intermediate-range dual-capable air-, land-, and sea-launched missiles to "decouple" European security from the US nuclear umbrella by confining a nuclear attack to Europe. Interviewees from countries further away from Russia were still concerned, but about all Russian capabilities, not just short- and theater-range systems. Those that mentioned Russian capabilities as a threat regardless of geography stated that the new Russian systems announced by Russian President Vladimir Putin in his speech on March 1, 2018, were mostly strategic in nature and therefore should be addressed within a strategic-nuclear-weapons dialogue (for example, a New START follow-on). The most sophisticated analysis by interviewees ranked the threat of short- and medium-range ground-launched missiles as the highest threat to NATO, due to their mobility, availability, and difficulty to detect, followed by air-launched and sea-based systems, due to US and NATO capabilities to track and interdict them, with special concerns about what role the Kinzhal air-launched ballistic missile and advanced supersonic cruise missiles will play in Russian military doctrine.

## POTENTIAL IMPACT ON NATO

All interviewees seemed clear-eyed that Russia would seek to end NATO's forward basing of nuclear weapons as the price for any agreement to address the NSNW imbalance between the United States and Russia. There was unanimity among interviewees (including nongovernmental organizations, surprisingly) that NATO's nuclear-sharing arrangements

cannot be up for negotiation and that NATO should make no unilateral conciliatory gestures to induce Russia to come to the table. Such a step was widely seen as damaging NATO unity and defense posture, even among the interviewees most likely to support arms control. As one said, NATO already has little leverage considering its lack of nonstrategic nuclear capabilities compared to Russia, while previous efforts to engage Russia in discussions about controlling these weapons have failed. This line of thinking stressed the points that the United States should avoid seeming desperate to engage Russia and that the United States and the other NATO allies have shown considerable restraint to date. These views can be summed up as “What more can we give?” One interviewee, from a country not known for its support for arms control, stated that NATO can play a supportive role in offering transparency and confidence-building measures (CBMs) related to NSNW exercises and nuclear doctrine.

There was a divergence of views as to whether NATO should modernize, or increase its deterrent capabilities, especially its nuclear capabilities, beyond the current deployment of air-delivered B61-LEP12 gravity bombs as an inducement for Russia to engage in negotiations. There was not a clear East-West divide among interviewees on this account, with a significant (and somewhat surprising, considering the tenor of some of the public debates around the issue) number of interviewees supporting new NATO and US deterrent options, including new sea-based options and conventional deep strike. However, there was broad support for what one interviewee called “the appropriate mix” of conventional, nuclear, and missile-defense capabilities comprising the NATO deterrent. One interviewee said no new NATO or US deployments could induce Russia to negotiate, but this was a distinctly minority view, with most agreeing that improved deterrence options were conducive to collective defense and negotiations. Another interviewee stated that Russia likely would most likely not deploy additional assets if NATO strengthened its conventional or nuclear force posture, as Moscow likely knew its own optimal posture and is pursuing that, regardless of allied capabilities or deployments.

Several interviewees saw modernization as a potential “bargaining chip” for negotiations (while maintaining the current DCA mission of granting these allies access to US nuclear weapons in wartime), while one said it was “absolutely crucial to maintain credibility” and not something to be negotiated at all. Several interviewees maintained that NSNW will not be negotiated by the United States and Russia in isolation, but with explicit or implicit “linkages to conventional and strategic systems,” as well as missile defense and space. One interviewee from a nation not noted for its hawkishness stated that the new US nuclear options—sea-based cruise missiles and low-yield warheads—were important to assure allies. This answer came in the context of the view that introducing new US land-

based nuclear-capable missiles in Europe would be both publicly divisive and politically impossible, as well as contradicting the long-standing NATO policies of the “three nos”<sup>3</sup> and agreement not to mirror Russian behavior.<sup>4</sup> Unsurprisingly, several interviewees called specifically for the termination of the NATO-Russia Founding Act and the overturning of the three nos to allow and facilitate new nuclear basing options.

## PARTICIPATION IN NEGOTIATIONS

Interestingly, almost all interviewees said that China should not be part of the negotiations at an early stage. (As several said, “Keep it simple.”) The interviewees believed there should be only two full treaty parties: the United States and Russia. China was seen as a “bridge too far” for now, with the clearest statement being, “[W]e want a stronger commitment and role by China in arms control...[W]e want Chinese confidence building measures (CBMs) and more transparency as a first step.” This statement was echoed by several other interviewees, particularly further east, who saw China’s eventual participation in arms control with the United States and Russia as necessary, and eventual “P5” negotiations to include the United Kingdom and France. All interviewees except one agreed that the NATO policy of keeping the United Kingdom and France out of this phase of bilateral US-Russian nuclear arms control negotiations remains necessary. However, many interviewees stated that those two European nuclear-weapon states must remain supportive of the US-Russian negotiations and not impede or detract from progress in bilateral arms control. One interviewee pointed out the hypocrisy of the position of the previous US administration in insisting upon Chinese participation but excluding the United Kingdom and France.

No interviewee believed that the Organization for Security and Cooperation in Europe (OSCE) was an appropriate platform for NATO dialogue on NSNW, though a few said that the United States and Russia could brief the OSCE’s Forum for Security Cooperation (or a dedicated session of the

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<sup>3</sup> The three nos were declared as part of a Communiqué of the NATO Foreign Ministerial in Brussels on December 10, 1996: “NATO countries have no intention, no plan, and no reason to deploy nuclear weapons on the territory of new members.” For further analysis of the three nos, see William Alberque, “‘Substantial Combat Forces’ in the Context of NATO-Russia Relations,” NATO Defense College, Research Paper No. 131, June 2016, p. 6, <https://www.ndc.nato.int/news/news.php?icode=962>.

<sup>4</sup> NATO, “Press conference by NATO Secretary General Jens Stoltenberg ahead of the meetings of NATO Defence Ministers, June 16, 2020, [https://www.nato.int/cps/en/natohq/opinions\\_176480.htm](https://www.nato.int/cps/en/natohq/opinions_176480.htm).

OSCE Structured Dialogue<sup>5</sup>) and the European Union on progress. Several interviewees agreed that the closest NATO partners, Sweden and Finland, should be consulted and briefed at NATO, along with Georgia and Ukraine given the recent Russian invasions of those countries (but separately from the two Nordic countries). Other key partners, such as Japan, South Korea, and Australia, should be briefed by the United States and not NATO, as should the United Nations, these interviewees said.

Most interviewees also agreed that NATO consultations—true consultations, and not just briefing after the fact—would be necessary to safeguard allied interests. One interviewee highlighted that any such consultations must be true dialogue, rather than the US presenting *faits accomplis* to the allies, as occurred during New START negotiations, and in the final US decision to withdraw from the INF and Open Skies Treaties. Another interviewee cited the US effort to educate allies about Russia’s INF Treaty violation as a specific example of the need for improvement in US sharing of intelligence with allies if it wants them to fully support its future bilateral negotiations. However, several interviewees (from both DCA and non-DCA countries) supported two tracks of consultations, with a small group comprised of the United States and the DCA allies prioritized, and the rest included on an “as needed” basis. One interviewee stated clearly that any US-Russian NSNW treaty cannot provide access to missile-defense facilities based in NATO Europe.

## IMPLEMENTATION

Few interlocutors had considered the lessons for their countries from the INF Treaty experience of thorough Russian inspections in NATO Europe. Several interviewees (in former INF basing countries—that is, countries in which missiles covered by the INF Treaty were based) were unaware of the existence of INF Basing Countries Agreements<sup>6</sup> at all, and several others pointed out their lack of resources to engage in expanded arms control measures. However, one interviewee criticized INF Treaty verification as being “defective or insufficient,” without elaboration. A few were concerned about additional Russian access to sensitive facilities, including their own bases that will house dual-capable F-35s. Several interviewees said that they had experience, both practical and technical, that they would gladly provide to the United States to assist in negotiation and stated that

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<sup>5</sup> The OSCE Structured Dialogue on current and future challenges and risks to security in the OSCE area brings together senior officials from capitals and ambassadors of the organization’s 57 participating states in the format of an informal working group to discuss the challenges and seek ways to reverse the negative developments that have marked European security in recent years. It was launched by foreign ministers in their Declaration on the Twentieth Anniversary of the OSCE Framework for Arms Control at the OSCE Ministerial Council in Hamburg in December 2016, <https://www.osce.org/structured-dialogue>.

<sup>6</sup> See the “Legal Issues” chapter for a further description of these agreements and their implications.

they certainly would not impede any required access to their bases. One interviewee stated that all allies should be inspectable under the treaty, as it would both preserve NCND policy and provide NATO the opportunity to inspect potential future Russian bases in Belarus.<sup>7</sup> Several interviewees said that the dispute-resolution mechanism in the treaty would need to be robust, as an NSNW treaty likely would have many disputes, ambiguities, and other implementation issues to resolve. The mechanism also could play an important role in de-escalating tensions regarding nuclear-weapon deployments, training, and exercises. Several interviewees agreed that Belarus should be as inspectable as any NATO ally, although one doubted that inspections in Belarus would ever be applicable, as Belarus was unlikely to host Russian NSNW.

A few interviewees pointed out that their national experience with Russian verification of conventional arms control and other treaties was positive and offered to use these relationships to help the United States to facilitate better inspections on their territory. However, one interviewee diverged from this view, stating that Russian inspectors aggressively sought to go beyond what treaties allowed and cautioned that with nuclear weapons, this attitude would pose increased risks. One interviewee stated that the most difficult issue will be privileges and immunities; such issues are often a problem in implementing agreements. For instance, would an ally be able to wield a veto over potential problematic inspectors prior to receiving an inspection team?

Most interviewees agreed that more work needs to be done on verification and supported work in various forums—such as the International Partnership for Nuclear Disarmament Verification (IPNDV) and NATO itself—to carry out this work. Several interviewees cited the need to engage with and involve the IPNDV and the Swedish-led Stepping Stone approach in developing innovative verification techniques and technologies.

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<sup>7</sup> Vladimir Isachenkov, “Belarus president offers to host Russian nuclear weapons,” *Associated Press*, November 30, 2021; William Alberque, “Belarus seeks to amend its constitution to host Russian nuclear weapons,” International Institute for Strategic Studies, February 4, 2022, <https://www.iiss.org/blogs/analysis/2022/02/belarus-seeks-to-amend-its-constitution-to-host-russian-nuclear-weapons>

# Policy Issues Related to **Verification of Nonstrategic** Nuclear Warheads

## *William P. Alberque and Political Team Contributors*

The previous sections described the overall context of US-Russian arms control negotiations, the two countries' likely positions on future strategic arms control, the importance of addressing warheads currently outside of any arms control framework, and the roles of nonstrategic nuclear weapons in the US and Russian nuclear doctrines and force postures. They also discussed NATO allies' positions, concerns, and potential contributions to future US-Russian negotiations on, agreement on, and implementation of confidence-building measures (CBMs) and arms control to address non-strategic nuclear threats. This section describes the policy obstacles to NSNW arms control and proposes potential solutions.

The biggest political obstacle related to the work defined herein is Russia's behavior over the past two decades, especially its systemic violations of its arms control obligations, its violation of the charters of the United Nations and the Organization for Security and Cooperation in Europe, and its threats of and use of force against its neighbors, including its ongoing war on Ukraine. In fact, its threat of the use of nuclear weapons in the current conflict has forced the United States to suspend the Strategic Stability Dialogue with Russia. However, and perhaps paradoxically, its threats have highlighted the need to limit Russian non-strategic nuclear warheads (NSNW) in future arms control.

There has never been a clearly articulated set of proposals for how to design an arms control treaty between the United States and Russia to address nuclear weapons outside the strategic arsenals. This fact comes as a surprise to most people, even to specialists in international relations. It is not unreasonable, considering the language used by the governments involved, to assume that warhead accounting and limitations exist in arms control. Instead, all nuclear arms control agreements that have ever been agreed and implemented have limited *delivery systems*, that is, the rockets, missiles, aircraft, and naval vessels that deliver nuclear warheads to the targets. This was true for the INF treaty as well as well as all strategic arms control agreements, including the two treaties that resulted from the

Strategic Arms Limitation Talks, signed in 1972 and 1979, respectively;<sup>1</sup> the Strategic Arms Reduction Treaties, known as START I (1991) and START II (1993);<sup>2</sup> the Strategic Offensive Reductions Treaty (2002); and New START (2010).

In fact, as stated above, bilateral nuclear arms control to date has focused on delivery systems rather than warheads because monitoring such systems using national technical means of verification (particularly satellites) has been easier. By contrast, addressing NSNW requires overcoming verification challenges as well as three other types of issues: security of information, definitions, and stockpile disparities. The locations, movements, and designs of nuclear warheads are among the most closely held secrets of the nuclear-weapon states. The definitions of terms in nuclear matters vary widely among nations, and within nations. This variance can be seen in discussions of the difference between strategic and nonstrategic weapons; the point at which active weapons become inactive; the point in dismantlement (or assembly) a warhead stops (or starts) being a warhead; and the difficulty of identifying individual warheads as so many of the constituent parts of warheads are regularly replaced. US and Russian NSNW stockpiles also differ significantly in types and numbers. And finally, verification will require a degree of assurance in a way that satisfies both political and intelligence requirements and gives each side confidence that the other is not gaining a decisive advantage.

The entire sequence of negotiation would most likely be preceded by a declaration from the US and Russian governments of their intention to negotiate, including the scope of the intended eventual agreement and some idea of the timeline for negotiations. However, it also is possible that bilateral discussions would result in transparency and confidence-building measures (T/CBMs) preceding and facilitating such an announcement, as Russia continues to reject the offer to negotiate solely on NSNW.

## SCOPING THE TREATY

What might be the scope of such negotiations? The optimal result would be a treaty between the United States and Russia that accounts for all NSNW and limits the number of such weapons—with or without reductions. This section outlines the parties and scope of such a treaty, its relevant terms, and its operation and identifies potential obstacles to negotiating and implementing such a treaty in the political, legal, and technical realms. At the same time, the report identifies potential T/CBMs that could form the basis of less ambitious agreements or act as stepping-stones to an eventual legally binding treaty.

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<sup>1</sup> The Interim Agreement on Certain Measures with Respect to the Limitation of Offensive Arms (1972) and the Treaty on the Limitation of Strategic Offensive Arms, Together with Agreed Statements and Common Understandings Regarding the Treaty (1979).

<sup>2</sup> START II never entered into force.

## Parties

Beneficiaries of US extended deterrence, such as NATO allies, are not envisioned as parties to the treaty. However, verification to include on-site inspections of facilities that currently or potentially store NSNW would require an agreement between the United States and the allies to facilitate access. If this is the case, the United States likely would insist on inspections at Russian permanent facilities in other countries that also could store nuclear weapons, such as Belarus, Armenia, Syria, and occupied Ukraine.

## Structure

A full-fledged treaty would be expected to be structured along lines similar to its predecessors—that is, with a preamble and sections covering scope, parties, definitions, and the operation and implementation of the treaty. At a minimum, the treaty would include a data exchange, including a baseline (initial) exchange between the parties and then likely an annual exchange of accountable items and infrastructure. As noted in the technical chapter, a treaty focused on warheads, especially NSNW, is likely to require a more ambitious exchange of information and data. This exchange likely would include the requirement to send notifications of significant changes in accountable items and infrastructure, as well as notifications of inspections and queries related to anomalies. There certainly would be verification of the information exchanged under the agreement, through a combination of national technical means, on-site inspection, and remote monitoring. A treaty of this complexity will require a consultative body between the parties to resolve perceived discrepancies over entry-into-force and withdrawal clauses and potentially to consider accession clauses. The purpose of this last point is to accommodate expansion of membership to include, for instance, China, although adding parties could be quite complicated because of the differing nuclear forces, posture, and doctrine of the other nuclear-weapon states. While T/CBMs that could precede a treaty would be politically binding, a treaty, by definition, will be legally binding, requiring legislative review and approval. A treaty also will require extensive protocols or supplementary and side agreements for effective implementation.

A US-Russian treaty on NSNW would be expected to contain the following elements:

- Preamble, scope, parties
- Definitions, to include those for accountable/limited items and actions (for example, individual nuclear devices, or secure data representing individual nuclear devices)

- Information exchange—baseline, periodic (for example, annual), and ongoing updates to provide a total picture of limited items
- Notifications (of, for instance, additions, movements, or eliminations)
- Verification, to include quotas for inspections/observations (requiring additional notifications on intent to inspect, acceptance, and results), which could include routine and short-notice challenge inspections, and monitoring (on-site/portal and/or remote monitoring)
- Consultation mechanism and body
- Entry-into-force clause
- Amendment clause
- Withdrawal/termination clause
- Additional protocols, pre- and post-treaty agreements
- Legal status—whether the final agreement is politically binding (like the Vienna Document)

## Accountable Units: Warheads

As a first step, any treaty would have to give a precise definition of “nonstrategic nuclear warheads.” There are three possible approaches—one focusing on delivery vehicles, one focusing on yield, and one defining the weapons by exclusion. Exclusion appears to be the fastest route in this case. The definition by exclusion of NSNW would be that all nuclear warheads that are part of the active nuclear-weapon stockpile of a state that are not associated with strategic delivery systems, especially but not only those accounted for under strategic arms control agreements. Such a definition of NSNW immediately excludes warheads that are awaiting or scheduled for dismantlement, in the armament process, in repair or refurbishment, or in the “hedge.” It also leaves aside questions on how much modification would be required to repurpose a warhead designed and built for strategic delivery systems to be mounted on a nonstrategic delivery system. (For more detail on definitions, see Appendix B.)

### *Counting*

Another challenge in designing a treaty on US and Russian NSNW lies in counting and accounting for warheads. Even with the simplest of definitions of scope—all warheads in the active stockpile not associated with strategic forces—defining and accounting for all such warheads poses significant challenges. The first such challenge is that there is no official

agreed method of accounting for warheads even within the United States and Russia, much less between the two sides.<sup>3</sup>

Under New START and its predecessors, the two sides could have an unlimited number of actual nuclear warheads. Only the delivery vehicles and launchers (that is, missiles, submarines, and heavy bombers) that deliver those warheads from the United States to Russia and vice versa were reduced and eliminated or converted to nonstrategic missions. The warheads associated with those systems were not dismantled or otherwise eliminated, but rather put back into storage. So, even if a treaty seeks to define NSNW as warheads not assigned to strategic delivery systems, it requires going far beyond New START in accounting for individual nuclear warheads in order to achieve limits on them. The process begins with the two sides agreeing to the definition of this category of weapon system and to exchange the numbers of these systems. The two sides will need to structure this initial exchange with an eye toward the contents of an annual exchange, as well as what would constitute a change that requires notification.

The next level of complexity comes with associating any numbers with locations for permanent and temporary storage, which is considered highly sensitive by both sides. A potential method of avoiding security issues related to geolocation and numbers of warheads is described in the technical section of this report, as well as how the two sides would support on-site inspections and other verification techniques. Still, agreement to exchange total numbers alone would constitute a significant T/CBM and could serve as an interim step on the way toward agreement on an eventual treaty. Locations and numbers would constitute another level of T/CBM. The two sides could, of course, skip T/CBMs entirely and instead agree to the scope of a treaty that limits or reduces warheads, but that scenario suggests a more difficult genesis based on the current and radically differing positions of the sides described in the previous sections.

### *Warhead-Total Disparities and US-Russian Arms Control*

One common objection to NSNW arms control is the disparity in numbers between the United States and Russia. Using figures from the Federation of American Scientists (FAS), the United States has a total of 1,800 deployed strategic nuclear warheads (with approximately 2,000 strategic warheads in reserve/hedge) and 1,750 retired warheads awaiting dismantlement; the Russians have 1,600 (with 985 strategic warheads in the reserve/

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<sup>3</sup> The complexities of definitions are explored in many places in the open literature. For example, see Amy Woolf, "Nonstrategic Nuclear Weapons," CRS Report RL32572, Congressional Research Service, Washington, DC, updated March 7, 2022, <https://sgp.fas.org/crs/nuke/RL32572.pdf>; and Gunnar Arbman and Charles Thornton, "Russia's Tactical Nuclear Weapons: Background and Policy Issues," Swedish Defence Research Agency, FOI-R-1057-SE, November 2003.

hedge), and 1,760 retired warheads awaiting dismantlement.<sup>4</sup> FAS further estimates that the United States has 230 NSNW, while Russia has 1,912. Note that Russia has never publicly declared its stockpile totals, unlike the United States, and there are many questions on the operational status of its NSNW warheads. Russia has stated, for instance, that all its NSNW warheads are in “central storage” locations and not mounted on delivery systems. It must be noted that these statements are at least misleading and may be untrue, as many Russian “central storage” facilities are near the associated bases housing the delivery systems. Regardless, Russia is estimated to have a 10:1 advantage in operationally deployed NSNW warheads compared to the United States.

Operationally, a treaty, even without limits, can force a state party to rethink and simplify its arrangements, if for no other reason, than to clarify its submission. Restrictions on numbers and/or locations also can create incentives for parties to make trade-offs and reduce excess or crossover capabilities. Thus, a treaty on NSNW could encourage the Russians to better separate their active and inactive stockpiles and their strategic and NSNW stockpiles and to eliminate redundancy and dual capability in some warheads and related equipment. These all are desirable outcomes.

### *Issues Related to Warhead Storage and Basing Locations*

In addition to the complexities of definitions, delivery systems, and warhead totals, there is the additional question of how to tackle the issue of defining the locations for declarations and inspections related to a potential NSNW treaty. These locations would include permanent and temporary storage and deployment sites and key transfer or transportation nodes. The challenges in addressing locations stem from definitions, geography, and the differing policies regarding warhead storage in the US and Russian nuclear complexes. For instance, the US government stores nuclear warheads in central locations in the United States and at forward-deployed locations in the United States and in Europe. It could, in theory, transit warheads through other appropriately equipped US or allied air bases on its way to or from permanent storage sites. There also is the neither-confirm-nor-deny policy in effect among US allies, which means that they must do nothing to confirm or deny the presence of nuclear weapons on their territory at any given moment. If the United States listed the current NATO nuclear storage sites in the treaty, it would be tantamount to violating its long-standing policy. The allies that host these facilities remain adamant that this policy must remain in place. Therefore, one way to avoid this problem entirely

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<sup>4</sup> Hans M. Kristensen and Matt Korda, “Russian nuclear weapons, 2021,” *Bulletin of the Atomic Scientists*, Vol. 77, No. 2 (2021), pp. 90-108, <https://www.tandfonline.com/doi/full/10.1080/00963402.2021.1885869>; Hans M. Kristensen and Matt Korda, “United States nuclear weapons,” *Bulletin of the Atomic Scientists*, Vol. 77, No. 1 (2021), pp. 43-63, <https://www.tandfonline.com/doi/full/10.1080/00963402.2020.1859865>.

in a future treaty is to declare all NATO air bases that are capable of permanently or temporarily hosting US nuclear weapons, including all NATO air bases. However, there still would be the problem of protesters seeking to highlight the presence of US nuclear weapons in Europe who may disrupt inspection activities. Open-source analysts frequently take note of and publicize unusual Russian military air movements, and the approach of a Russian military transport to a NATO air base would likely signal an incoming inspection team, thus tipping off protesters.

Russia, on the other hand, has large central warhead-storage facilities, with no real corresponding sites on the US side. In addition, Russia uses these large storage facilities to store both strategic and nonstrategic warheads, as the United States defines those categories. The other complexity is the huge difference in the number and types of movements there are on the Russian side versus the US side. That said, these complexities can be reduced through further analysis. The United Nations Institute for Disarmament Research (UNIDIR) in 2017 published a report that used geolocation to provide the first publicly disclosed listing of all sites managed by the 12th GUMO, the organization responsible for Russian nuclear-weapons storage.<sup>5</sup> Based on this, one can begin to model the Russian storage complex. It includes 12 of the large-scale central storage sites mentioned above, as well as 34 forward storage sites in western, central, and eastern Russia. (See Appendix A for a nominal list of Russian facilities represented in Figure 4.1.)

Designing a system that declares these facilities, their active NSNW holdings, and movements among the facilities is, in theory, not only possible, but relatively simple. Indeed, some of these facilities could be associated only with strategic systems, and an agreement could define the storage facilities in a way that could clearly distinguish between strategic, nonstrategic, or commingled sites. There is a great precedent in arms control, the Conventional Armed Forces in Europe (CFE) Treaty, for limited access to facilities, with parts of the facility off-limits because they do not contain treaty-limited items. The following is a list of 10 types of locations likely to be a part of a NSNW agreement:

1. National storage sites
2. Operational unit storage sites
3. Training sites (complexity: naval weapons)
4. Deployment areas (complexity: naval weapons)
5. Maintenance and repair sites

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<sup>5</sup> Pavel Podvig and Javier Serrat, "Lock them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe," UNIDIR, 2017, <https://unidir.org/publication/lock-them-zero-deployed-non-strategic-nuclear-weapons-europe>.

6. Production/assembly facilities
7. Dismantlement facilities
8. Material production facilities
9. Testing sites
10. Rail transfer points

For example, it is possible that an agreement would include training and deployment areas, as well as all associated maintenance and repair facilities. Recall that the Intermediate-Range Nuclear Forces (INF) Treaty includes declarations on geographically defined areas for such activities and allows inspectors to go into those areas if declared missiles are not present in storage. The CFE Treaty has a similar provision for accountable items such as battle tanks not present at the object of verification. The 2017 UNIDIR report provides a useful illustration of the complexity of Russian warhead movement from storage: “[D]uring transit, warheads may be temporarily stored in warship and submarine docking areas, maintenance facilities, delivery system mating/de-mating areas, rail transshipment areas and railheads, and weapon transportation vehicles. These are not storage facilities per se, but rather infrastructure with the capability of handling weapons for a limited period of time.” Such locations could be used to hide nuclear weapons and thus could be considered for snap or challenge inspections. Finally, it also is possible, if there is an overall freeze on warhead numbers, that all production and dismantlement facilities would need to be declared and inspectable. However, the further definition of reportable and inspectable facilities in this regard, while worthy of study, would require considerable additional work and is therefore considered outside the scope of this report.

### *Restrictions or Limitations*

In addition, a treaty could include any of the following restrictions or limitations:

- Limitations on deployment locations
- Limitations on use of the warheads in exercises (to include potential banning of use of live warheads in peacetime training, exercises, or deployments)
- Warhead reductions to a level of “proportionate balance” (that is, each side reducing its weapons stockpile by the same proportion even if the absolute numbers of warheads removed are different; this would be the case, for example, under an agreement in which each side reduces its NSNW total by an agreed percentage)

- Warhead reductions to absolute balance (numerical equivalence)
- “Freeze” of the total number of warheads, or of some defined subset of warheads—NSNW versus strategic, active versus inactive, forward deployed versus central storage
- Regional limitations (such as from the Atlantic to the Urals)
- “Safer storage” (to include de-mated warheads, separating either the fissile material from the conventional explosive, or any limited-lifetime components such as tritium boosters, under normal peacetime operations)
- Bilateral elimination of all NSNW

It is likely that the treaty that will be discussed will include the concept of an accounting for a declared total, with the possibility for a cap/freeze, and some reductions either to a proportionate balance or to an absolute balance. It is unlikely that any US-Russian treaty in the near to mid-term will include limitations on exercises, regional limitations (due to portability), storage modalities (due to sensitivity), or bilateral elimination.

*Reasons for Not Using Delivery Systems as the Unit of Accountability*

This project focuses on nuclear warheads rather than delivery systems for myriad reasons, principally due to the increasing use of dual-capable systems and the concomitant problem of differentiation. It may be possible to differentiate between a nuclear and conventionally armed version of

**FIGURE 4.1. RUSSIAN NUCLEAR-WEAPONS STORAGE SITES**



Source: “Where the weapons are - Nuclear weapon storage facilities in Russia,” Russian Strategic Nuclear Forces, [https://russianforces.org/blog/2017/08/where\\_the\\_weapons\\_are.shtml](https://russianforces.org/blog/2017/08/where_the_weapons_are.shtml)

the same cruise missile using advanced assay methods. However, it is extremely unlikely that in the near term the United States and Russia would both agree to the implementing technology for such assays and have high confidence in these methods in the context of an arms control agreement. It is a principle in military affairs in general, and arms control specifically, that only older, well-understood technologies should be used, as each new technology increases the fears of cheating or otherwise spoofing the results of analyses provided by the advanced technology.

The complexities of differentiation between conventional and nuclear-capable systems increase when one considers verification of missiles that may be deployed in the air, on land, or at sea. For instance, if a future NSNW treaty focused on ground-launched missiles only, and not air- or sea-launched missiles, the question of how one would differentiate between a ground-, air-, or sea-launched Kalibr cruise missile in a storage facility, apart from its delivery system, is difficult.<sup>6</sup> How difficult is it to change the launch mode of a cruise missile from air- or sea-launch to ground-launch status? What physical barriers exist to arming a nominally conventional cruise missile with a nuclear warhead? How would one differentiate between such systems during an inspection, especially if no warhead is loaded? If there are impediments to switching payloads, how easy is it for users to defeat such impediments? What are the “functionally-related observable differences,” and are they spoofable or removable? Table 4.1 lists current Russian dual-capable systems outside strategic arms control, further illustrating the complexity of accounting for delivery systems versus warheads.

Then there is the problem of dual-capable aircraft (DCA) and naval vessels. The issue of DCA was specifically eliminated from INF Treaty negotiations for many reasons, not least because of their mobility and their ability to switch between conventional and nuclear missions with minimal outwardly observable differences (such as reinforced hard points on the aircraft wings used to carry external loads). The idea of tracing and counting various DCA-certified airframes on either side<sup>7</sup> is likely impossible in geographically limited areas (for example, in Europe) due to their mobility. Naval vessels, including surface ships and undersea vehicles (manned submarines and unmanned underwater vehicles) pose a similar problem, due to their mobility, as well as their longer deployment times. Other issues include potentially nuclear-armed missiles assigned to anti-aircraft and anti-space-vehicle missions, as well as nuclear devices that do not require delivery vehicles, such as man-portable warheads, nuclear charges, and nuclear landmines. While these systems were declared eliminated by the United States and Russia in the 1990s, no verification took place.

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<sup>6</sup> The Soviet Union produced fewer types of intermediate-range cruise missiles, all of which were more easily distinguishable from each other (for example, Kh-20 and Kh-55) than is currently the case with Russian cruise missiles.

<sup>7</sup> These include US F-15s, F-16s, and F-18s, Russian Su-24s, Su-34s, Tu-22M3Ms and Tu-160s and European Tornados, Rafals, and Eurofighters.

**TABLE 4.1. RUSSIAN NUCLEAR AND DUAL-CAPABLE NONSTRATEGIC MISSILES**

NATO Name	Russian Name	Type	Range
SS-N-15 STARFISH	RPK-2 Vyuga 81R	SLBM (ASBM)	37-45 km
SS-N-16 STALLION	RPK-6/7 Vodopad/Veter	SLBM (ASBM)	100 km
SS-N-19 SHIPWRECK	3M45 Granit	SLCM (AS/LACM)	550 km
SS-N-21 SAMPSON	3M10 Granat	SLCM (LACM)	3,000 km
SS-N-22 SUNBURN	ASM-MSS Kh-41	ALCM (ASCM)	120 km
SS-N-22 SUNBURN	P-270 Moskit-M 3M82	SLCM (ASCM)	120 km
SS-N-26A STROBILE	3M55 Oniks	SLCM (AS/LACM)	300-600 km
SS-N-27 A/B SIZZLER	3M54 Kalibr	SLCM (ASCM)	530 km
SS-N-30 SAGARIS	3M14 Kalibr PL/T	SLCM (LACM)	2,500 km
SS-N-33	3M22 Tsirkon	SLCM (AS/LACM)	>500 km
AS-4B/C KITCHEN	Kh-22	ALCM (ASCM)	360-600 km
AS-15A KENT	Kh-55 RKV-500	ALCM (LACM-N)	2,400 km
AS-16 KICKBACK	Kh-15 RKV-15	ALCM (LACM)	150 km
AS-22 KLUGE	KH-555 Raduga	ALCM (LACM-N)	3,000 km
AS-23A	Kh-101 Kalibr	ALCM (LACM)	4,000 km
AS-23B KODIAK	Kh-102 Kalibr	ALCM (LACM-N)	5,000 km
AS-X-24 KILLJOY	Kh-47M2 Kinzhal	ALBM (LABM)	1,000 km
AS-X-4 Mod 2	Kh-32	ALCM (LACM-N)	1,000 km
SS-21 SCARAB	9K79-1 Tochka-U	GLBM (LABM)	120 km
SS-26 STONE	9M723 Iskander-M	GLBM (LA/ASBM)	480 km
SSC-1 SEPAL	S-35/P-35	CDCM (ASCM)	300 km
SSC-7 SOUTHPAW	9M728 Iskander-K	GLCM (LACM/ASCM)	480 km
SSC-8 SCREWDRIVER	9M279 Novator	GLCM (LACM)	>2,000 km
SSC-X-9 SKYFALL	Burevestnik	GLCM (LACM-N)	Unlimited
SS-N-30A SAGARIS	3M14A Kalibr-A	ALCM (LACM)	2,500 km
KR-BD	Kh-BD	ALCM (LACM)	3-5,000 km

Note: The abbreviations used in this table are included in the List of Acronyms and Other Key Terms on p. iv.

Even basic questions on categorization of missile types and ranges are not in any way settled within the missile community itself. For instance, US-Soviet negotiations established definitions that included short range (0-500 km), shorter-range intermediate (500-1,000 km), longer-range intermediate (1,000-5,500 km), and intercontinental-range (more than 5,500 km) missiles. The exceptions included a shorter range for air-launched missiles when launched from long-range bombers, and sea-launched missiles when launched from long-range naval vessels (in START I and New START). This contrasts with the range definitions used by the US Defense Intelligence Agency in its annual analysis of missile threats, which quantifies range as follows: close range (0-300 km); short range (300-1,000 km); medium range (1,000-3,000 km); intermediate range (3,000-5,000 km); intercontinental range (more than 5,500 km); all air-launched ballistic missiles; and all sea-launched ballistic missiles.

Such differences in definitions and terminology will pose significant challenges to negotiators on both sides. Getting the answer to this question right—as with all the political issues identified in this section—will help immeasurably in scoping a potential agreement, or taking steps toward an agreement, that will address NSNW threats.

# Legal Issues Related to the Implementation of a Treaty on Nonstrategic Nuclear Warheads

*Marshall L. Brown Jr.*<sup>1</sup>

NATO allies may need to assume certain legal obligations to ensure the effective implementation of a US-Russian treaty on nonstrategic nuclear warheads (NSNW). The scope of that treaty has not yet been determined. It is not clear, for instance, whether the treaty will seek to limit, reduce, or eliminate NSNW; which types of NSNW will be covered by the treaty; or how the treaty will define and count warheads. Nevertheless, it is already possible to identify some legal issues that may emerge during negotiations, particularly related to verification. Fortunately, many of these issues have been addressed in the negotiation and implementation of other arms control treaties and confidence- and security-building measures, such as the Chemical Weapons Convention (CWC), the Conventional Armed Forces in Europe (CFE) Treaty, Article IV of the Dayton Peace Agreement, the Open Skies Treaty, the Vienna Document, the New Strategic Arms Reduction Treaty (New START), and, perhaps most relevant to this discussion, the Intermediate-Range Nuclear Forces (INF) Treaty and the Basing Countries Agreement that accompanied it.<sup>2</sup>

The successful negotiation of the INF Treaty showed the importance of the involvement of NATO allies, at the earliest stages, in the development and refinement of positions to be taken by the United States with the Soviet Union. That involvement consisted of discussion of, and agreement on, matters related to the deployment of the INF missiles and launchers, as well as on the verification of treaty provisions that addressed such systems.

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<sup>1</sup> The author thanks CNS Scientist-in-Residence George Moore, who contributed his legal expertise and extensive knowledge of nuclear-warhead characteristics to the development of this chapter.

<sup>2</sup> All 30 NATO members have hosted inspections of some type under confidence-building arrangements and arms control treaties: All NATO members are members of the CWC. Twenty-two NATO members are parties to the CFE Treaty (not Albania, Croatia, Estonia, Latvia, Lithuania, Montenegro, North Macedonia, and Slovenia); the United States and Canada host inspections only on European territory under the CFE Treaty. Article IV of the Dayton Peace Agreement mandates CFE Treaty/Vienna Document hybrid inspections in Croatia and Montenegro. All NATO members have the International Atomic Energy's Additional Protocol. Germany, Italy, the Netherlands, Belgium, the United Kingdom, and the United States were parties to the Intermediate-Range Nuclear Forces Treaty's Basing Countries Agreement. Twenty-six NATO members are parties to the Open Skies Treaty (not Albania, North Macedonia, Montenegro, and the United States). All NATO members are Vienna Document members (although the United States and Canada receive inspections only on European territory).

The discussions at NATO occurred at the North Atlantic Council (NAC) and at the Nuclear Planning Group (NPG) and its complementary body, the High-Level Group (HLG) of the NPG. Discussions also took place in an entity that was tasked specifically with developing an agreed NATO arms control approach to the INF crisis. This entity, which originally was called the Special Group and then renamed as the Special Consultative Group (SCG), was tasked to follow the negotiations on a continuous basis and provide a platform to gather allied reactions to those negotiations. As Ambassador Maynard Glitman, the chief US negotiator of the INF Treaty, described it, “We knew at the outset that the SCG and the HLG would have to proceed, and be seen as proceeding, in a manner that went well beyond traditional consultations. Thus, the exchanges of views and papers, in a collegial, seminar-like process led to the development of a common, jointly arrived at position. It was a NATO position, not only an American one, and one which all the Allies could defend as their own.”<sup>3</sup>

Following the development of a NATO common position and beginning of the US-Soviet negotiations, the US INF negotiators provided extensive debriefing of the results of each negotiating round to NATO allies, in consultations at NATO headquarters in Brussels and in capitals.<sup>4</sup> It is highly likely that this practice would be followed by the United States with respect to an NSNW treaty.

A 2012 Brookings Institution report on lessons learned from the INF Treaty negotiations also makes this point about allied involvement with respect to a future agreement on nuclear weapons in Europe:

“If negotiations do begin, a close consultative process in which allied concerns and ideas may be fully aired and discussed is the *sine qua non* for allied support.”<sup>5</sup> Further, the authors view the consultations as “pivotal steps in the negotiations.”<sup>6</sup> Steven Pifer, one of the authors of the 2012

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<sup>3</sup> Maynard W. Glitman, *The Last Battle of the Cold War: An Inside Account of Negotiating the Intermediate Range Nuclear Forces Treaty* (New York: Palgrave Macmillan, 2006), p. 34.

<sup>4</sup> Glitman describes the consultation process as essentially collaborative: “The United States was negotiating not only for itself but also for its Allies. I believed it was essential that we, as their agents, had a responsibility to keep the Allies fully and promptly informed about our activities in Geneva. Other U.S. negotiators and I were frequent visitors to NATO headquarters; in my case at least once a month, and on one occasion twice in a week. All of these consultations were fundamental in resolving differences and developing and maintaining a common NATO position.” Glitman, *The Last Battle*, p. 35.

<sup>5</sup> Steven Pifer, Avis T. Bohlen, William F. Burns, and John Woodworth, “The Treaty on Intermediate-Range Nuclear Forces: History and Lessons Learned,” Brookings Institution, 2012, p. 4, <https://www.brookings.edu/wp-content/uploads/2016/06/30-arms-control-pifer-paper.pdf>.

<sup>6</sup> Pifer et al., “The Treaty,” p. 16.

report, more recently recommended an SCG-like mechanism for NATO involvement in future US-Russian nuclear-arms talks.<sup>7</sup>

With respect to verification of an NSNW treaty, it is highly probable that the NATO allies, at a minimum, will insist on the standard set down in the communiqué issued at the special meeting of NATO's foreign and defense ministers on December 12, 1979: "[A]ny agreed limitations must be adequately verifiable."<sup>8</sup> Since some of the verification measures that were eventually agreed within the context of the INF Treaty directly involved at least of some of the NATO allies, agreement within NATO was essential. As Ambassador Glitman recalled, "Owing to the complexity of the issue and the need to obtain Allied agreement to a regime that would involve Soviet inspectors visiting US bases on Allied territory, we would not table specific verification provisions until [several days after tabling the rest of the draft treaty text]."<sup>9</sup>

The legal issues that would have the most direct effect on NATO allies are related to the obligation to host inspections on their territories if an inspection regime were incorporated into the treaty. Such an obligation could be contained in an agreement among all the allies, based in part on the INF Treaty-related Basing Countries Agreement.<sup>10</sup> An inspection regime for NSNW in Europe would require access by Russian inspectors to military facilities on the territories of allies, almost certainly requiring memoranda of understanding, exchanges of letters, signed agreements, or even legislation by allies. Even absent an inspection regime, there may be other obligations to be assumed by allies, such as those related to coordination of US-Russian confidence-building measures toward a possible treaty and any negotiated bilateral commitments on noninterference with national technical means of verification (NTM). With respect to US obligations vis-à-vis allies, the latter would likely want to ensure that their own rights are being protected during the implementation of any US-Russian treaty on

<sup>7</sup> Pifer wrote, "The Biden administration will be open to consultations with NATO allies on its approach to these varied questions. As to the structure, German officials might consider suggesting something along the lines of the Special Consultative Group (SCG), the mechanism used by NATO in the 1980s to consult on the negotiation that produced the Intermediate-range Nuclear Forces (INF) Treaty. Regular meetings at NATO headquarters, reinforced by senior arms control experts traveling from capitals, ensured that allies understood US positions and the state of play in the negotiations, and allowed them an opportunity to voice concerns and ideas to US policymakers. Among other things, the SCG consultations helped allies to stay in sync, particularly in 1983 when the Soviets engaged in wedge-driving attempts." Steven Pifer, "Germany's Role in US-Russian Nuclear Arms Control," *Internationale Politik Quarterly*, May 31, 2021, <https://ip-quarterly.com/en/germanys-role-us-russian-nuclear-arms-control>.

<sup>8</sup> NATO, "Special Meeting of Foreign and Defence Ministers," Brussels, December 12, 1979, <https://www.nato.int/docu/comm/49-95/c791212a.htm>.

<sup>9</sup> Glitman, *The Last Battle*, p. 247.

<sup>10</sup> "Agreement among the United States of America and the Kingdom of Belgium, the Federal Republic of Germany, the Republic of Italy, the Kingdom of the Netherlands, and the United Kingdom of Great Britain and Northern Ireland, regarding inspections relating to the Treaty between the United States of America and the Union of Soviet Socialist Republics on the elimination of their intermediate-range and short-range missiles" (Basing Countries Agreement), December 11, 1987 (*Department of State Bulletin*, Vol. 88, No. 2130, January 1988, pp. 78-81).

their territory. An ally subject to hosting inspections may want to consider obtaining clarification from the United States on questions such as liability for any acts carried out on its territory during an inspection. An ally may also want Washington to protect information considered sensitive by the ally from public disclosure.

## **PARTIES TO A NATO NSNW INSPECTION AGREEMENT**

An eventual US-Russia treaty may include procedures for the conduct of inspections on the territories of any or all allies. Therefore, it would be prudent for all 30 NATO member states to conclude a related comprehensive agreement. Such an agreement could also include obligations to coordinate cooperative and confidence-building measures and a commitment not to interfere with NTM. With respect to inspections, not all NATO allies are likely to be subject to the same type of inspection, and indeed some may not be inspected at all during the implementation of the treaty. There may be differences in inspection procedures, depending upon the status of the site to be inspected (for example, active storage sites, former storage sites, and sites suspected or capable of hosting NSNW). In any case, it is prudent to assume that all allies would require some type of agreement or understanding, prior to US-Russia negotiations, on how the United States plans to implement on-site inspections. Such a process took place in the context of the INF Treaty through the SCG, which met from 1979 until 1993, before and during negotiations, as well as during the negotiation of US-Russia implementation agreements and protocols.

It is likely that provisions akin to what was agreed among the United States and the five INF Treaty “basing countries” would be required if an inspection regime were included in the US-Russian treaty. However, due to the desire to preserve NATO unity and cohesion and the policy of “neither confirm nor deny” (regarding the presence of nuclear weapons), it would be prudent for all allies to have the same basic obligations. For instance, it is likely that inspection-related provisions would cover European allies on whose territories such items are located<sup>11</sup> or were once located but have been removed,<sup>12</sup> allies with the capability of storing such items, and allies with airfields that could support dual-capable aircraft. This latter category would include all allies and thus provide the best conformity with NATO policies. However, this all would depend upon what is agreed between the United States and Russia.

For the allies on whose territory NSNW are presently located, there already exist bilateral hosting agreements with the United States that may have

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<sup>11</sup> Belgium, Germany, Italy, the Netherlands, and Turkey.

<sup>12</sup> Greece, the United Kingdom Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, and Poland.

to be modified to deal with technical issues raised in a new US-Russian treaty, including foreign access (by inspectors), pre- and post-inspection procedures, liability concerns, and reimbursement for related costs. For other allies with territory that could be subject to inspections, relevant arrangements may need to be negotiated directly with the United States or incorporated as part of the NATO agreement.

## LEGAL ISSUES RELATED TO VERIFICATION

While the US-Russian negotiations may give rise to a verification regime that does not raise significant legal issues or obligations for allies (such as remote monitoring of NSNW storage bunkers, perimeter and portal monitoring, and mutual exchanges of inventory-management data between the United States and Russia<sup>13</sup>), the verification regime with the greatest impact on the allies, and the concomitant need to enact implementing legislation, would include on-site inspections. There are certain common elements in arms control agreements involving such inspections that would likely be part of a NATO agreement. These include provisions for identification of inspectable sites; granting privileges and immunities for inspectors; naming and approving/rejecting lists of proposed inspectors; establishing liability during inspections; receiving inspectors upon arrival at the point of entry, including procedures relating to passport checks and disease-related protocols; and providing in-country escorts.

### Identification of Inspectable Sites

Inspectable sites under a US-Russian treaty conceivably could be limited to active NSNW storage sites in Europe. However, it likely would be more advantageous to include former NSNW storage sites on the territory of the European allies, including former Warsaw Pact members, as well as any NATO air base or any facility anywhere capable of storing NSNW. Allies would need to agree in advance of any decision to be taken during the US-Russian negotiations with respect to identifying sites subject to inspection (again, through an SCG-like mechanism).

With respect to suspect-site or challenge inspections, issues related to inspections conducted at facilities owned or controlled by the host government are less difficult, from a legal perspective, than those not so owned or controlled, precisely because of the government nexus. Government-owned or -controlled facilities potentially subject to suspect-site or challenge inspections should be identified with sufficient specificity to permit the individual ally to prepare for that possibility, and the relevant procedures should be included in the NATO NSNW agreement, as well as in any necessary bilateral implementation agreements. While the precise

<sup>13</sup> See Chapter 6: Technical Issues and Considerations for Verifying Limits on Nonstrategic Nuclear Warheads for further discussion of that type of verification regime.

form of a bilateral implementation agreement between the United States and another NATO ally would depend upon the diplomatic practice of the two sides, that agreement should be legally binding and should specify that the US-Russia treaty and the NATO NSNW agreement are considered to be authoritative in case of any discrepancy with the bilateral agreement. These bilateral implementation agreements could be concluded between the inspection authorities of the two sides, between the US Department of Defense and the corresponding defense ministry, and/or between the two foreign ministries as an exchange of diplomatic notes. In any event, the most important element in such bilateral agreements is that they should facilitate the effective implementation of the US-Russian treaty, taking into consideration the specific situation of the NATO ally, identifying the responsible authorities, and providing for channels of communication to resolve any issues that might arise.

The more difficult legal issue arises with respect to suspect-site/challenge inspections of facilities no longer owned or operated by the host government, particularly if they are not active sites (for example, former facilities turned to commercial development). Inspections of such facilities are possible, for instance, under a mechanism analogous to the CWC Article IX challenge-inspection regime. But if the right to conduct inspections is part of an agreement that is binding under international law, as the CWC is, then rather complicated legal issues emerge. For the United States, the concern has been with the Fourth Amendment of the US Constitution<sup>14</sup> and the possibility of a warrantless search, and it is not inconceivable that NATO members might have similar legal constraints. Thus, establishing such a right to inspect any facility anywhere will probably be avoided during the US-Russian negotiations, particularly as NSNW are unlikely to be stored or otherwise located outside of declared, government-owned or operated facilities, except for movement between such facilities. However, it is possible that an option that preserves the concept of “challenge,” but without the potential domestic legal concerns, could be modeled on the CFE challenge inspection, which is subject to denial but with “reasonable assurances” that the item under limitation is not present, or Vienna Document “specified area” inspections, where there is no expectation of intrusion on private property, homes, or businesses.<sup>15</sup>

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<sup>14</sup> “The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.”

<sup>15</sup> Conventional Armed Forces in Europe Treaty, November 19, 1990, Protocol on Inspection, Section VIII, para 9: “If access to a specified area is denied: (A) the inspected State Party or the State Party exercising the rights and obligations of the inspected State Party shall provide all reasonable assurance that the specified area does not contain conventional armaments and equipment limited by the Treaty”; Vienna Document 2011, paragraph 80.

## LEGAL ISSUES RELATED TO INSPECTIONS

### Privileges and Immunities

Each ally would be obligated to provide legal protections to Russian inspectors on its territory while conducting an inspection. Generally referred to as “privileges and immunities,” these protections are accorded to foreign inspectors and associated personnel during their presence on the territory of a state that is subject to verification measures. A standard method in arms control and disarmament agreements<sup>16</sup> has been to address this issue by referring to specific provisions of the Vienna Convention on Diplomatic Relations of 1961, extending to the inspectors certain provisions of that convention relating to diplomatic agents and then implementing the relevant protections in domestic legislation.

Whether a NATO NSNW agreement related to a US-Russia NSNW treaty directly becomes part of the domestic law of an individual ally—that is, whether it “self-executes”—or whether it requires separate implementing legislation depends to a great extent on the constitutional procedures and practices of the state. The character of the agreement may also be relevant—that is, whether it is binding under international law or is a political commitment that is not binding under international law but still has political consequences if not honored. In the latter case, it would not normally become part of the domestic law absent legislative action.

Under Article 27 of the Vienna Convention on the Law of Treaties, “A party may not invoke the provisions of its internal law as justification for its failure to perform a treaty” (subject to a very narrow exception). Thus, national law needs to be consistent, or made consistent, with the obligations assumed under a binding agreement, in this case the NATO NSNW agreement. Several international agreements make such an obligation explicit under the title of national implementation measures.<sup>17</sup> In any case, the allies may need to consider what legal or legislative action, if any, would be necessary to provide privileges and immunities in accordance with their respective constitutional systems.

The Open Skies and CFE Treaties are good precedents in this regard. The former is binding under international law<sup>18</sup> and provides for privileges and immunities for “designated personnel who will carry out all duties relating to the conduct of observation flights.”<sup>19</sup> The treaty was subject to ratification

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<sup>16</sup> For examples, see the INF Treaty and its Basing Countries Agreement(s), START I, the CWC, the Comprehensive Nuclear-Test-Ban Treaty, the CFE Treaty, and New START, as well as the Open Skies Treaty and the Vienna Document (although, with respect to the Vienna Document, without a reference to specific provisions).

<sup>17</sup> Chemical Weapons Convention, January 13, 1993, Article VII.

<sup>18</sup> Open Skies Treaty, March 24, 1992, Article XIII, Section II.

<sup>19</sup> Open Skies Treaty, Article XIII.

by each state party in accordance with its constitutional procedures.<sup>20</sup> Instruments of ratification are provided to the depositary governments once those constitutional procedures are completed. For the allies who have ratified the Open Skies Treaty, the constitutional procedures that were used for its ratification, which thereby established the requisite privileges and immunities in their internal law, should be readily identifiable. The CFE Treaty is similarly binding under international law and contains privileges and immunities for inspectors, and allies that are parties to that treaty should have implemented those privileges and immunities.<sup>21</sup>

Privileges and immunities were established in the legally binding agreement among the United States and the basing countries negotiated in the context of the INF Treaty.<sup>22</sup> In the INF Basing Countries Agreement, the privileges and immunities listed are identical to those contained in the INF Treaty (except those related to inspection activity that would not occur on the territory of the basing countries), and the basing countries assumed the obligation to provide those privileges and immunities to the inspectors.<sup>23</sup>

The Vienna Document 2011 contains some privileges-and-immunities provisions,<sup>24</sup> and all NATO members are participating states, but, since it is a political commitment<sup>25</sup> rather than an agreement subject to international law, there is no uniform standard on how allies should enact provisions on privileges and immunities in their respective national legislation. The political commitment to implement the measures in the Vienna Document<sup>26</sup> is silent about how this would be accomplished.

The NATO Status of Forces Agreement (SOFA) would arguably provide privileges and immunities to personnel from NATO allies accompanying a Russian inspection team (such as escorts during an inspection), but it would not provide those same protections to Russian inspectors or other

<sup>20</sup> Open Skies Treaty, Article XVII, para 1.

<sup>21</sup> CFE Treaty, Protocol on Inspection, Section XIII.

<sup>22</sup> Basing Countries Agreement, Article 1, para 2: "The Kingdom of Belgium, the Federal Republic of Germany, the Republic of Italy, the Kingdom of the Netherlands and the United Kingdom of Great Britain and Northern Ireland, hereinafter the Basing Countries, hereby agree to facilitate the implementation by the United States of America of its obligations under the Treaty, including the Inspection Protocol thereto, on their territories in accordance with the requirements, procedures and arrangements set forth in this Agreement."

<sup>23</sup> Basing Countries Agreement, Article IV, para 4: "Each Basing Country shall accord inspectors and aircrew members of the Inspecting Party entering into its territory for the purpose of conducting inspection activities pursuant to the Treaty, including the Inspection Protocol, the privileges and immunities set forth in the Privileges and Immunities Annex to this Agreement."

<sup>24</sup> For inspections, see paragraph 92 of the Vienna Document 2011, December 22, 2011: "The inspectors and, if applicable, auxiliary personnel will be granted during their mission the privileges and immunities in accordance with the Vienna Convention on Diplomatic Relations." For visits, see paragraph 125 of the Vienna Document: "The members of the team and, if applicable, auxiliary personnel will be granted during their mission the privileges and immunities in accordance with the Vienna Convention on Diplomatic Relations."

<sup>25</sup> Vienna Document, paragraph 160: "The measures adopted in this document are politically binding."

<sup>26</sup> Vienna Document, paragraph 158: "The participating States will implement this set of mutually complementary confidence- and security-building measures in order to promote security co-operation and to reduce the risk of military conflict."

personnel from Russia, such as aircrew members. Escort teams would most likely consist of military personnel, and, in accordance with Article I, paragraph 1 of the SOFA, the term “force” as used in the SOFA means personnel belonging to the armed forces of a NATO member state.<sup>27</sup> Whether civilian personnel serving as escorts to Russian inspection teams would also enjoy privileges and immunities under the NATO SOFA would depend upon their status as a “civilian component.”<sup>28</sup> Thus, escorts from a NATO member state, both civilian and military, would likely be covered under the NATO SOFA, and there should be no need to include an obligation to accord privileges and immunities within the framework of the NATO NSNW agreement to personnel from NATO allies who serve as escorts to Russian inspection teams.

An additional legal issue with respect to privileges and immunities could emerge if there were a need to conduct inspections, visits, or exhibitions on the territory of any of the European allies prior to entry into force of the NATO NSNW agreement. Some exhibitions and inspections related to START I were conducted by the parties prior to entry into force.<sup>29</sup> The conduct of those activities was the subject of a separate US-USSR agreement that, under US constitutional procedures, was not legally sufficient on its own to establish privileges and immunities for the inspectors, although some protections were provided as a political commitment.<sup>30</sup> It is possible that, for some of the allies on whose territory such activities might be conducted prior to entry into force, there might be similar legal constraints with respect to providing legally binding privileges and immunities to individuals from Russia. However, the practice followed by the Vienna Document—that is, to provide privileges and immunities as a politically binding commitment—could be deemed sufficient for such limited purposes.

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<sup>27</sup> NATO Status of Forces Agreement, June 19, 1951, Article I, 1.a.: “[F]orce’ means the personnel belonging to the land, sea or air armed services of one Contracting Party when in the territory of another Contracting Party in the North Atlantic Treaty area in connection with their official duties, provided that the two Contracting Parties concerned may agree that certain individuals, units or formations shall not be regarded as constituting or included in a “force” for the purpose of the present Agreement.”

<sup>28</sup> NATO SOFA, Article I, 1.b.: “[C]ivilian component’ means the civilian personnel accompanying a force of a Contracting Party who are in the employ of an armed service of that Contracting Party, and who are not stateless persons, nor nationals of any State which is not a Party to the North Atlantic Treaty, nor nationals of, nor ordinarily resident in, the State in which the force is located.”

<sup>29</sup> Agreement on Early Exhibitions of Strategic Offensive Arms of July 31, 1991. This agreement established the procedures by which the parties would arrange and conduct exhibitions and inspections prior to entry into force of START I, in order to ensure the ability to begin accurate and reliable inspections in a timely manner after entry into force.

<sup>30</sup> Agreement on Early Exhibitions of Strategic Offensive Arms of July 31, 1991, Article V: “The exhibiting Party shall treat with due respect the inspectors and aircrew members of the inspecting Party in its territory in connection with the conduct of these exhibitions and inspections, and shall take all appropriate steps to prevent any attack on the person, freedom, and dignity of such persons.”

## Naming and Rejecting Inspectors

Individuals who are to take part in inspection teams must be identified in advance. That would permit the relevant agencies in the host country to conduct a review of those individuals' records to determine whether there is any information available that might prejudice their inclusion in an inspection team. Most arms control agreements that include inspections give the receiving state the right to object to a proposed inspector. With respect to the Open Skies Treaty, the Vienna Document, and the CFE Treaty, there is an absolute right to reject an inspector, without having to provide any explanation.<sup>31</sup> Under the INF Basing Countries Agreement, START I, and New START, the right to object is available under certain circumstances.<sup>32</sup> It is likely that the US-Russian negotiations would choose the latter precedent, as it is based on previous US-Russian treaties, including the most recent. It should be noted that while this appears to limit the ability of an ally to contest the presence of a Russian inspector on its territory, it is likely in practice that the United States would have similar prejudicial information and would thus reject that proposed inspector on its own.

## In-Country Escorts

The appointment of in-country escorts and their responsibilities toward inspectors are well documented in arms control and confidence-building agreements,<sup>33</sup> and it is almost certain that similar provisions would be adopted in a NATO NSNW agreement. The role of the in-country escort is to accompany the inspection team throughout the period that the inspection team is within the territory of the individual ally and to provide assistance to the inspection team. The specific type of assistance to be provided, as well as the authority of the in-country escort vis-à-vis the inspection team, would be stipulated in the NATO NSNW agreement, as well as in the US-Russian treaty. The in-country escort would consist of both US personnel and individuals nominated by the ally.<sup>34</sup> Because certain aspects of the

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<sup>31</sup> CFE Treaty, Protocol on Inspection, Section III; Open Skies Treaty, Article XIII, Section I; also see the CWC Verification Annex, Part II.A.

<sup>32</sup> Protocol to the New Strategic Arms Reduction Treaty, April 8, 2010, Part V, Section II.6: "An individual included on the list of inspectors may be objected to only if that individual is under indictment for a criminal offense on the territory of the inspected Party, if that individual has been convicted in a criminal prosecution or expelled by the Party reviewing the list, or if that individual has been previously deleted from the list at the request of the inspected Party for having violated the conditions governing inspection activities."

<sup>33</sup> CFE Treaty, Protocol on Inspection, Section II; CWC Verification Annex, Part II; Open Skies Treaty, Article II and Annex F; Vienna Document. (The functions of the in-country escort are performed by "representatives of the receiving state": see paragraphs 84, 93, 95, 98, 129, 131, and 133.)

<sup>34</sup> The concept of an escort team consisting of representatives of the host as well as the stationing (basing) country is contained in the CFE Treaty; see Protocol on Inspection, Section I, para 1(H). The involvement of two different states to assist the inspection team is also contemplated in the Vienna Document; see paragraphs 82 and 98.

in-country escort's role involve movement and travel, including processing through customs and immigration, it is likely that the US escorts would defer to the escorts provided by the receiving state for such matters.

However, it is almost certain that the escorts provided by the ally would not accompany the US escorts and Russian inspectors into the storage site to participate in or observe the actual inspection. The restrictions on the presence of non-US personnel in the storage sites are already established by relevant bilateral agreements between the United States and the respective allies, and it is NATO policy that the United States retains absolute control and custody of its nuclear weapons forward-deployed in Europe. In addition, all the allies potentially subject to such inspections are non-nuclear-weapon states and thus, under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT),<sup>35</sup> are not to seek or receive any assistance in the manufacture of nuclear weapons. While the warhead-inspection procedures under a US-Russian NSNW treaty are not yet known, sensitive technology relevant to the manufacture of nuclear weapons might be revealed during the inspection of US warheads by Russian inspectors, and the presence of officials from a non-nuclear-weapon state under such circumstances could raise NPT compliance issues.

## **POSSIBLE ADDITIONAL OBLIGATIONS OF NATO MEMBERS**

### **Coordination of Cooperative and Confidence-Building Measures**

Several arms control agreements provide for the possibility of cooperative measures to enhance the effectiveness of NTM or to deal with ambiguities that may arise in the implementation of the agreement.<sup>36</sup> In a potential US-Russian NSNW treaty, this might include special inspections, visits, or moving items out of structures into the open to facilitate viewing (as in START I). Such measures could have practical implications for allies, and

<sup>35</sup> Treaty on the Non-Proliferation of Nuclear Weapons, July 1, 1968, Article II: "Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices."

<sup>36</sup> Strategic Arms Reduction Treaty (July 31, 1991), Article XII (display in the open of treaty-limited items); New START, Article VIII: "In those cases in which one of the Parties determines that its actions may lead to ambiguous situations, that Party shall take measures to ensure the viability and effectiveness of this Treaty and to enhance confidence, openness, and predictability concerning the reduction and limitation of strategic offensive arms." Vienna Document, paragraph 18: "In order to help to dispel concerns about military activities in the zone of application for [confidence- and security-building measures], participating States are encouraged to invite other participating States to take part in visits to areas on the territory of the host State in which there may be cause for such concerns."

therefore coordination between the United States and the ally concerned would be necessary and included in the NATO NSNW agreement, possibly in the same way CFE Treaty and Vienna Document inspections are coordinated by NATO in the Verification Coordinating Committee.<sup>37</sup>

### *Noninterference with National Technical Means of Verification, and Concealment*

Provisions dealing with noninterference with NTM and concealment that impedes NTM have been standard in several arms control agreements,<sup>38</sup> normally with little change in wording.<sup>39</sup> The prohibition on noninterference with NTM is in respect to NTM used “in a manner consistent with generally recognized principles of international law.” Given the state of current technology and the reluctance of states to discuss such matters openly, it is unlikely that this provision will be elaborated in detail or lead to a compliance issue.

The United States has provided some examples of what it believes would constitute interference with NTM, and, although this view is not binding on the Russians, these examples were provided to the US Senate as representing the official position of the US government: “[A] Party cannot destroy, blind, jam, or otherwise interfere with the national technical means of verification of the other Party that are used in a manner consistent with generally recognized principles of international law.”<sup>40</sup> Because items subject to limitation are located or could be located on the territories of NATO allies, it will be important to identify possible security-related activities at bases and facilities that might be relevant to the obligations assumed by the United States on noninterference with NTM. Such activities could relate to, for example, movements in and out of a NSNW facility that are to be monitored by NTM, although such activities are more likely to be concealment measures that impede NTM rather than interfere with it.

An obligation not to use concealment measures that impede verification by NTM can be formulated in a way that allows for certain exceptions, such as environmental covers, but those exceptions must be spelled out.<sup>41</sup> This constraint should be manageable insofar as the practices of the allies in this connection are identified in advance in consultation with

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<sup>37</sup> See NATO, “Verification Coordinating Committee (VCC),” last updated April 20, 2011, [https://www.nato.int/cps/en/natohq/topics\\_69341.htm](https://www.nato.int/cps/en/natohq/topics_69341.htm).

<sup>38</sup> INF Treaty, Article XII; START I, Article IX; CFE Treaty, Article XV; New START, Article X.

<sup>39</sup> With respect to the Vienna Document, the reference to NTM, in paragraph 73, does not explicitly prohibit interference: “The participating States recognize that national technical means can play a role in monitoring compliance with agreed confidence- and security-building measures.”

<sup>40</sup> START Article by Article Analysis, Article IX; New START Article by Article Analysis, Article X.

<sup>41</sup> New START, Article X, para 2: “The obligation not to use concealment measures shall not apply to cover or concealment practices at ICBM bases or to the use of environmental shelters for strategic offensive arms”; CFE Treaty, Article XV, para 3: “This obligation does not apply to cover or concealment practices associated with normal personnel training, maintenance or operations involving conventional armaments and equipment limited by the Treaty.”

the United States and agreed to during negotiations with Russia. In any case, neither the prohibition on interference with NTM nor the prohibition on concealment should come as a surprise to parties to the CFE Treaty<sup>42</sup> or to the allies who were party to the INF Basing Countries Agreement, but there may be specific concerns that need to be addressed based on the sensitivity of NSNW and the possible presence of non-NSNW-related items at these facilities.

In addition, certain cooperative measures, for example those established for the INF Treaty, START I, and New START may be useful in a US-Russia NSNW agreement in order to improve the effectiveness of NTM, avoid issues related to concealment and cover practices, and generally enhance confidence, openness, and predictability. It should be noted that in New START, the parties provisionally applied NTM and concealment obligations for the period between signature and entry into force.<sup>43</sup> The NATO allies should keep this possibility in mind in considering whether they need to adopt any domestic legislative or administrative measures.

Another issue is the “two-meter rule,”<sup>44</sup> a procedure stipulated in both the CFE Treaty and the Vienna Document to allow inspectors access to locations and structures where items subject to the treaty could be located but to limit the inspectors from visiting sensitive areas unrelated to the treaty or agreement. There are lessons in balancing these requirements that can be applied, but there always will remain a concern that limiting inspector access could be used to prevent full accountability and facilitate noncompliance.

## **OBLIGATIONS TO BE ASSUMED BY THE UNITED STATES**

### **Preservation of Rights of NATO Members**

It is likely that the NATO allies will want assurance from the United States that their rights will be preserved during the implementation of the US-Russia NSNW treaty. Such an assurance was provided explicitly in the INF Basing Countries Agreement.<sup>45</sup> The rights to be preserved are not specified in that agreement, so such an assurance can be interpreted quite broadly. Where certain rights need particular protection—for example, the right of a NATO member to keep certain information from being disclosed to the public—it would be advisable to include it in the NATO NSNW agreement (see below).

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<sup>42</sup> CFE Treaty, Article XV.

<sup>43</sup> New START, Protocol, Part Eight, Section II, para 12.

<sup>44</sup> CFE Treaty, Protocol on Inspection Section VI, para 24 and the declaration of “restricted locations, installations or defense sites” (see, for example, Vienna Document, paragraph 56).

<sup>45</sup> Basing Countries Agreement, Article I, para 5(2): The United States “undertakes on request at any time to take such action, in exercise of its rights under the Treaty, including the Inspection Protocol, as may be required to protect and preserve the rights of the basing Countries under this agreement.”

An important aspect of this assurance is the need for the NATO allies to be aware of changes that may be made to the NSNW treaty during its implementation that relate to their respective obligations. Procedures for making such changes are contained in several bilateral and multilateral treaties, and they provide for the modification of provisions that were agreed (and were subject to ratification) without going through the established amendment procedure.<sup>46</sup> These changes (sometimes known as “viability and effectiveness” changes) are limited to modifications that do not affect substantive rights or obligations, and they normally relate to technical details concerning inspections and notifications. Such changes are proposed and agreed within the framework of a consultative body established by the underlying treaty. Because changes may affect the conduct of inspections on their territories, it may be necessary for NATO allies to review relevant proposals with the United States before it concludes an agreement with Russia. That would also permit the allies to ascertain whether there are any necessary measures for them to take, in accordance with their own constitutional procedures, for such measures to be implemented on their territories (through an SCG-type mechanism).

## Liability

There may be relevant provisions on liability in the separate bilateral agreements between the United States and each of the NATO allies on whose territory US NSNW are located. Allies also may be able to rely on the NATO SOFA<sup>47</sup> with respect to the claims for damages that result from the presence of inspectors on their territory. Concerning damage beyond that covered by the SOFA, a separate undertaking by the United States was made in the 2008 US-Poland agreement on ballistic-missile defense,<sup>48</sup> although the concerns that led to that provision went well beyond damage that might be caused by Russian inspectors on the territory of a NATO member during an inspection. There are also relevant provisions in the Open Skies Treaty dealing with liability that could be adapted, if necessary, in any NATO NSNW agreement.<sup>49</sup>

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<sup>46</sup> See, for example, New START, Article XV, and Protocol, Part VI; CFE Treaty, Article XVI; and CWC, Article XV.

<sup>47</sup> NATO SOFA, Article VIII.

<sup>48</sup> Agreement Between the Government of the United States of America and the Government of the Republic of Poland Concerning the Deployment of Ground-Based Ballistic Missile Defense Interceptors in the Territory of the Republic of Poland, August 20, 2008, Article XIV, para 4: “The Parties shall consult on the most appropriate way to handle any other claim, including a claim by a third party, that is not covered by the NATO SOFA. In the event of such a claim against the Republic of Poland for loss or damage ... the United States shall provide appropriate assistance and legal support to the Republic of Poland with respect to any such claim, including any litigation arising therefrom. The United States will give sympathetic consideration to a request from the Republic of Poland for reimbursement of a final judgment from a claim based on damage or loss ...”

<sup>49</sup> Open Skies Treaty, Article XII: “A State Party shall, in accordance with international law and practice, be liable to pay compensation for damage to other States Parties, or to their natural or juridical persons or their property, caused by it in the course of the implementation of this Treaty.”

## Nondisclosure of Sensitive Data

The disclosure of information related to US NSNW to Russia, either directly by the United States in a data exchange or obtained by Russian inspectors during an inspection, could consist of information held by NATO allies that is normally classified and handled in strict conformity with security regulations. This information most likely is subject to bilateral agreements with the United States, as well as to NATO requirements. While it would be the obligation of the United States to provide such information to Russia, and not the obligation of an ally, the information would likely include numbers and specific locations of NSNW, including detailed site diagrams of facilities subject to inspection. If items belonging to the receiving ally were co-located with US NSNW at such facilities, those items might be subject to observation by Russian inspectors, and the United States would be expected to take measures to protect the rights of the ally in keeping such items protected from both Russian observation and from public disclosure.

In addition, there may be some information about the presence of nuclear weapons on the territory of certain allies that the ally considers sensitive, including the location of NSNW storage facilities and other information that could be used by anti-nuclear groups, and therefore should be protected from public disclosure by the United States. Allies should be familiar with the handling of sensitive military information in CFE Treaty Articles XIII and XVII and in its Protocol on Notifications and the Exchange of Information,<sup>50</sup> and it is likely that this practice would be followed in the NATO NSNW agreement. It is also worth noting that most information obtained in the course of New START implementation, including inspections and information exchanges, is treated as non-releasable to the public or to countries that are not parties to the treaty, unless otherwise agreed by the parties.<sup>51</sup>

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<sup>50</sup> CFE Treaty, Article XVI, para 2(G) requires the states parties to “consider and work out appropriate measures to ensure that information obtained through exchanges of information among the States Parties or as a result of inspections pursuant to this Treaty is used solely for the purposes of this Treaty, taking into account the particular requirements of each State Party in respect of safeguarding information which that State Party specifies as being sensitive.”

<sup>51</sup> New START, Article VII, paras 5-7.



# Technical Issues and Considerations for Verifying Limits on Nonstrategic Nuclear Warheads

*William Moon and Technical Team Contributors<sup>1</sup>*

Uncertainty about the number and locations of Russia's stockpile of short-range systems and warheads remains a significant challenge for NATO. The United States has long insisted that the nuclear-arms-reduction process with Russia address nonstrategic nuclear warheads (NSNW). Doing so, however, may require a major shift in accounting methodologies, from a focus on delivery vehicles to a focus on warheads. This shift is required because a wide variety of delivery vehicles can be used for NSNW; such systems are also often used for conventional and mobile systems. In addition, they can be stored in multiple locations. As a result, they are difficult to identify and track using national technical means (NTM) such as satellites. Moreover, in peacetime, NSNW are typically not mated to delivery systems, so the old accounting method used by the Intermediate-Range Nuclear Forces (INF) Treaty and the Strategic Arms Reduction Treaty (START I) to limit warheads, which attributes a certain number of warheads to each deployed delivery system, is inapplicable.

The idea of developing a new approach to accounting was raised during the negotiation of START II and III, and further put into law by Congress in the resolution of ratification for the New Strategic Arms Reduction Treaty (New START). The resolution called for the disparity between US and Russian NSNW to be addressed and for the two countries to “reduce tactical nuclear weapons in a verifiable manner.”<sup>2</sup> New START procedures to verify the number of re-entry vehicles loaded on missiles may provide precedent for inspection of deployed systems, but there are no arms control precedents for inspecting warheads in storage, which account for the lion's share of NSNW stockpiles.

The Biden administration has declared that it will seek to address all nuclear weapons in negotiations on a successor to New START. While New START, which was extended until February 2026, limits specific strategic

<sup>1</sup> Dan Zhukov, Bill Delaney, Marshall Brown, Ferenc Dalnoki-Veress, George Moore, Neil Perry, and Sami Shihadeh.

<sup>2</sup> Treaty between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, with Protocol, April 8, 2010, <https://www.congress.gov/111/cdoc/tdoc5/CDOC-111tdoc5.pdf>.

nuclear weapons, NSNW are unconstrained. Technical challenges to warhead verification must be overcome to pursue a negotiation toward any political agreement or treaty addressing NSNW.

## TECHNICAL AND OPERATIONAL CHALLENGES FOR NSNW WARHEAD VERIFICATION

NSNW warhead monitoring and tracking—in fact, all warhead monitoring—can be conducted without gathering the most sensitive data associated with warhead composition, performance, configuration, or design by focusing on logistics data associated with warheads, such as shipments, movements, and other transactions. This approach, however, will require careful consideration of the technical and operational challenges required to minimize concerns about nuclear safety and security and avoid disruption of nuclear operations.

### Technical Challenges

A potential agreement limiting nuclear warheads faces a number of monitoring challenges. Specifically, the technical characteristics of nuclear warheads—small signatures, ease and frequency of movements, multiple layers of protection, and safety and sensitivity concerns with inspecting warheads within containers—present extreme challenges for NTM and on-site inspections to verify warhead inventories. Open-source data on nuclear warheads is also quite limited. Public statements by the Biden administration, for example, have estimated the number of Russian NSNW warheads at between 1,000 and 2,000 and growing.<sup>3</sup> That is such a wide range that any warhead limitation agreement would require strong verification measures to engender confidence in any declaration. New methodologies to identify, monitor, and track nuclear warheads will be needed to support warhead verification. Nuclear warheads are small and relatively easily and quickly transported by road, rail, and air. While they must be handled with care and securely placed within a transport conveyance, the external appearance of trucks, railcars, and aircraft used for warhead movements may not differ from the appearance of other such vehicles. The warheads can also be moved around quickly within facilities and loaded for transport by overhead cranes, forklifts, and trolleys operated by small numbers of individuals. The ease of transporting nuclear warheads means that the verification of an arms control treaty must focus on monitoring and tracking movements rather than relying on annual or semiannual declarations of warhead locations. Frequent and unobservable movements would quickly make

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<sup>3</sup> US Department of State, “Under Secretary Bonnie Jenkins’ Remarks: Nuclear Arms Control: A New Era” (remarks to the 17th Annual NATO Conference on WMD Arms Control, Disarmament, and Nonproliferation, Copenhagen, Denmark, September 6, 2021), <https://www.state.gov/under-secretary-bonnie-jenkins-remarks-nuclear-arms-control-a-new-era/>.

any declaration obsolete, and real-time notifications or those for planned movements would almost certainly raise nuclear-security concerns.

In addition to their small size, nuclear warheads include several key components that can produce different size and design configurations when they are assembled, making it difficult to develop a precise definition of a warhead. Different warheads may contain a variety of components, and those components may be replaced and/or removed during the warhead's service life. Since the components can be removed, the sides could alter a warhead's configuration to circumvent the definition of a warhead that is based on specific components, configuration, or even based on size or shape. Previous arms control treaties used procedures to define the size of treaty-limited items such as containers, means of transport, and rooms/facilities subject to inspection. The combination of the small size of warhead components and the large variety of configurations in which they can be arranged means that a warhead-verification system cannot rely on size or configuration to define inspectable items, locations, or facilities since the size limitations would be too small and too numerous to monitor.

Further, for important safety and security reasons, nuclear warheads are stored and transported in specialized containers and sometimes in containers within containers. Depending on the location of the warhead and the equipment near the warhead, it may not be possible to open a container within certain storage areas. In order to enhance nuclear security and guard against insider threats, the infrastructure of warhead storage sites is designed to limit and prevent direct access to warheads—even by site personnel. Warheads may often be stored in containers for extended periods at locations where the containers cannot be opened. Under these circumstances, it would not be possible to enable arms control inspectors to access warheads within containers while they are in storage or during transportation operations without raising nuclear-security concerns.

There are greater safety concerns related to the use of technologies to verify the contents of warhead containers than those commonly used to examine missiles. Previous arms control agreements that limited delivery systems—START I and the INF Treaty—used x-ray technologies at portal monitoring facilities to observe missiles when they were transported out of manufacturing facilities in containers loaded on railcars. This worked well for missiles because both sides were familiar with the practice of using x-rays to inspect missiles during their research-and-development (R&D) process and to inspect missile motors for potential deformities. However, the countries have not designed their fully assembled warheads to be subject to active or invasive interrogation. The electronics within warheads are precisely designed to initiate a nuclear explosion and may surround the primary and secondary explosives; an intrusive examination therefore could set off or damage the explosives. For these safety reasons, technologies to examine

warhead containers would have to be passive, measuring emanations from the warheads. In addition, such measurements could reveal sensitive nuclear-weapons-design information, unique for each warhead (including shape, configuration, and isotopics), so remote sensing equipment would need to be designed to protect that information from the inspecting party. Further, any equipment used for a remote inspection of warheads would have to be jointly developed. Safety testing would have to be performed and an extensive certification process would be required for each type of warhead before it could be considered for approval by all parties to any agreement. To simplify this process, extensive R&D efforts on verification have been conducted to develop warhead-specific templates that could be used for verification, but more work is required to overcome sensitivities related to warhead design (see Appendix E).

In addition, personnel in or around nuclear weapons typically are not permitted to carry any sort of electronics or magnets or any type of device that could cause interference. These safety concerns pose difficult challenges to applying any sort of physical tag to nuclear warheads or their containers.

## Operational Challenges

Nuclear warheads, and Russian nuclear warheads in particular, are located at many different facilities, and they are often moved within and between facilities, making it extremely challenging to view the entire inventory in real time and obtain a comprehensive inventory picture and therefore determine compliance with relevant treaty limitations.

Even if on-site access were permitted, nuclear-warhead storage facilities are often located in remote locations that can be logistically difficult to reach, and some large storage sites in Russia cover extensive territory, including numerous facilities that would be difficult to monitor in a single visit. While inspectors conducting NSNW verification visits could count declared assets using procedures like those used for inspections under the INF Treaty, START I, New START, the Conventional Armed Forces in Europe (CFE) Treaty, and Vienna Document 2011, the large, remote facilities will be more difficult to reach to be inspected for undeclared warheads within a reasonable amount of time.<sup>4</sup>

NATO facilities may be easier logistically to inspect due to their smaller number across a smaller geographic footprint, but they could have many of the other constraints. In addition, warheads can be moved within a facility relatively easily, making it difficult for on-site personnel to count and track warheads. The combination of these operational and technical challenges with the difficulties of monitoring nuclear warheads using

<sup>4</sup> Site visits to Russian nuclear-warhead storage sites conducted under the CTR program sometimes required three-hour van rides from the closest city and the closest commercial airport, and visits to large storage sites took four hours to make four stops within the facilities. See William M. Moon, "What it's like to visit a Russian Nuclear Warhead Storage Site," Stimson Center, April 1, 2021, <https://www.stimson.org/2021/what-its-like-to-visit-a-russian-nuclear-warhead-storage-site/>.

NTM would make it extremely difficult to use traditional approaches to verify declarations of a large and dispersed warhead inventory.

The current disparities in NSNW stockpile operations and practices between Russia and NATO host states pose additional challenges. Russian NSNW, for example, may be co-located with strategic warheads at most, if not all, large Russian nuclear-warhead storage, maintenance, and logistics facilities. In addition, many of the Russians' large central storage facilities are located within a relatively short distance from storage sites that are purely for tactical warheads and from deployment sites for tactical-weapons delivery systems, so any agreement on tactical or short-range warheads would have to include the central storage sites as well. This means that approaches to warhead verification cannot focus exclusively on either NSNW or strategic warheads but must be able to track and monitor warheads across a broad range of potential facilities and storage sites.

Activities that would need to be monitored under a warhead-verification regime are also driven by the operational status of the nuclear warheads in the stockpile. Previous arms control treaties have focused on deployed weapons, but any agreement addressing nuclear warheads, and particularly NSNW, would need to account for non-deployed warheads as well. At any one time in their life cycle, nuclear warheads may be considered to be deployed, operational, reserve, scheduled for maintenance or refurbishment, or destined for disassembly/dismantlement. The status of nuclear warheads, however, cannot be determined by observation, activity, or location, making it much more difficult to verify such necessary distinctions in an agreement limiting warheads.

The frequency and types of operational movements involving the Russian NSNW inventory also differ from US warhead movements in a number of ways. Russian warhead shipments are conducted primarily by rail and road, while US movements in Europe are primarily by air. The differences mean that a greater proportion of Russian warheads will be in the process of transportation at any one time and that they will be tied up in transportation operations for longer periods at a time. If on-site inspections were to be required before, after, or during transportation, arms control inspectors would have to spend considerable time in Russia while Russian inspections in NATO Europe could be conducted much more quickly for the same function.

Monitoring Russian rail shipments of individual warheads by visual inspection or NTM is also challenging. Russian cargo railcars for warheads are deliberately designed to look just like any other cargo car. Russian rail-transportation convoys dedicated to shipments of warhead components are conducted over routes similar to those for complete warheads, creating the need to distinguish among types of shipments. At the same time, for security reasons, the Russians do not use consistent routes for warhead movements—even between known sites—especially when it comes to the final

road movements between the points at which the warheads are transferred from rail to trucks and the sites, making it very difficult to monitor individual movements through NTM alone. In addition, Russian warhead shipments via rail are often not point-to-point. Warhead transport trains may follow circuitous routes in which they drop off and pick up warheads at multiple locations over a long journey. This makes it difficult to track warhead movements, especially since each stop could include off-loading, uploading, or both.<sup>5</sup>

Another operational challenge with warhead verification is that on-site visits to warhead-storage sites would involve many different organizations and countries. The Russian deployment bases for NSNW fall under the full gamut of services, including the 12th GUMO and the Russian Navy, Strategic Rocket Forces, and Air Force. NATO's nuclear-deterrence posture relies on nuclear weapons forward-deployed by the United States in Europe involving several air bases in host countries. If on-site challenge inspections are included in an agreement, then potentially any NATO country in Europe with or near a NATO air base could be subject to challenge inspections. The coordination, logistics, and legal frameworks for such visits present significant challenges, especially considering the need to avoid significant disruption of nuclear security and other operational requirements (see the "Legal Issues" chapter).

Perhaps the biggest operational concern regarding warhead verification is nuclear security. It will be critically important that any agreement on warheads be implemented without interfering with nuclear-security requirements. That means minimizing physical access to warheads in terms of time and personnel. Warheads are considered to be highly vulnerable to theft during transport—whether by air, by sea, or over land by railcars or transport trucks. So physical access during transportation operations must be minimized and data on transportation schedules and routes must not be revealed before or during warhead movements. The United States and Russia would both strongly resist the notion of examining or inspecting warheads during transport or providing advance notification of transport, due to security concerns and operational disruptions.

One further operational consideration when developing a warhead-verification agreement involves the large disparities in size, composition, logistics, and locations of US and Russian NSNW inventories. Not only does Russia possess more NSNW, but they are moved more frequently and involve many more locations. This would create a significant imbalance in reciprocal inspections and exchanges. Russia would be required to provide more data and more updates, and more of its facilities and bases would be impacted by any warhead-verification methodology. Therefore, the United States and other

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<sup>5</sup> US intelligence agencies can use NTM to determine that some shipments have taken place by monitoring known rail transfer points, since only railcars associated with warheads and components will go in or out of those points. However, satellites cannot detect whether trains are dropping off and/or picking up warheads.

NATO countries need to understand that any NSNW agreement would need to ensure that it carries equal costs and provides equivalent benefits to both sides by acknowledging that the Russians would receive a higher percentage of total inventory data under an equal number of exchanges.

The technical and operational challenges associated with warhead verification demonstrate that an agreement or treaty limiting NSNW warheads will require some new and additional arms control approaches. Verification measures used in previous treaties limiting delivery systems will not work as well for warheads. The dynamic nature of warhead inventories, with their frequent movements that are difficult to observe by NTM, will need an approach that seeks to monitor and track total US and Russian NSNW inventories, along with both nonintrusive and more intrusive verification measures, such as on-site inspections.

## **INSIGHTS ON NUCLEAR-WARHEAD VERIFICATION BASED ON PREVIOUS COOPERATIVE THREAT REDUCTION EXPERIENCE**

The technical and operational challenges to warhead verification may seem insurmountable unless one examines previous US-Russia cooperation on nuclear-warhead security. Following the dissolution of the USSR in 1991, US Senators Sam Nunn and Richard Lugar established the Cooperative Threat Reduction (CTR) program to work with Russia and the other former Soviet Union states to reduce and secure their inherited arsenal of weapons of mass destruction. Under the CTR program, the US Department of Defense (DoD) worked closely with the Russian Ministry of Defense (MoD) from 1995 to 2013 to enhance the safety and security of the latter's nuclear-warhead inventory, while the US Department of Energy worked to secure Russian weapons-usable nuclear material.

One of the important features of the CTR nuclear-security program was the joint development of the Russian MoD's Automated Inventory Control and Management System (AICMS), established to track and monitor Russia's nuclear-warhead inventory.<sup>6</sup> Close technical exchanges were conducted on the inventory management of nuclear warheads over the duration of the CTR agreement to provide common understandings on how nuclear warheads are tracked, what data is used, and how that data is authenticated. Based on these exchanges, we know that the US and Russian inventory-management systems are similar in their design and operation.

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<sup>6</sup> For more details, see: William M. Moon, "Inventory Management Cooperation: A Core Function of Nuclear Security," Stimson Center, August 6, 2021, <https://www.stimson.org/2021/inventory-management-cooperation-a-core-function-of-nuclear-security/>.

At first glance, it may seem that developing an inventory-management system for warheads would be a fairly straightforward task, simply involving a serial number for the warhead and a system to track its location. In fact, as discussed in the previous section, the effort becomes enormously complex due to the many components (including shipping and storage containers), the numerous locations, the operational status of the warheads, the requirements for regular security checks, the age and condition of all components, the personnel with access to the warheads and with access to the inventory-management system, the security and reliability checks within the systems, and the frequent movements and operations and maintenance required for continued warhead safety and security.

Before developing the AICMS, the MoD technical experts described a process that used paper “passports” that accompanied the warhead everywhere it went throughout its life cycle. These warhead passports contained records of every transaction, every component, and every action that impacted the warhead. From the first transfer of custody from Rosatom—the Russian Atomic Energy Ministry (now the State Atomic Energy Corporation)—to the 12th GUMO to the final return to Rosatom, every action taken with regard to that warhead was recorded on the paper passport. AICMS automated this function and provided a real-time capability to gather and manage all of this data for the entire stockpile within the inventory-management system. In many ways, the AICMS was modeled on the DoD inventory-management system, DIAMONDS (Defense Integration and Management of Nuclear Data Services), which captures similar data.

To define the requirements for the AICMS program, DoD and MoD engaged in detailed technical discussions that addressed the hardware, software, communications, facilities, and data required for the system. Although no current or actual warhead data was exchanged, the sides shared their processes and procedures used to monitor and track warheads, including the typical types of transactions that are recorded and procedures on how shipments are tracked to and from facilities, how transfer-of-custody documents are handled, how locations are tracked, how data is exchanged between field sites and central control facilities, how the system tracks personnel involved in transactions, how system reliability is maintained, and how total inventory audits are conducted. The total program included designing and producing the modular facilities installed at nuclear-weapons storage sites across Russia, along with a Central Control Point facility in Moscow and a backup central facility in Sergiev Posad.

In addition to cooperation on inventory management, the CTR nuclear-security program provided comprehensive nuclear-security upgrades at nearly all Russian nuclear-weapons storage sites and rail transfer points (RTPs) and conducted three visits to each of the sites. During those visits, the CTR teams used unique identifiers to verify that the equipment at the

security monitoring center was installed and functioning properly. The program also established site designators that were used to track progress in construction and installation at each storage site and RTP and to plan for site visits. The CTR cooperation also included bringing Russian personnel for on-site visits to two DoD nuclear-weapons storage bases in the United States on a reciprocal basis, though there were far fewer Russian visits to US sites.<sup>7</sup>

Another CTR program dealt with transportation security for nuclear warheads; it supported shipments of nuclear warheads from storage bunkers at weapons-deployment sites to central storage sites and dismantlement facilities. The Russian MoD provided data on warhead shipments, including the date and exact distance of each shipment conducted. It also provided this data for up to two separate shipments of limited-lifetime component shipments to disassembly facilities per year. The shipment data was exchanged 30 days after each shipment so that no nuclear-security concerns would be raised. Twenty to 70 shipments were conducted per year, totaling over 500 shipments over the duration of the agreement.

The CTR program, as well as similar but smaller-scale programs conducted by the United Kingdom and France, also provided supercontainers for the safe and secure transportation and storage of nuclear warheads. In addition, the CTR program provided secure cargo and guard railcars used for nuclear-warhead transportation, and trucks and other escort vehicles used for road convoys. These efforts involved detailed technical discussions on tie-downs—the straps and chains used to secure the warheads inside the railcars and vehicles—and other internal design requirements that provided data on the processes and procedures involved in loading, transporting, and unloading warheads.

These cooperative programs provided significant insights into US-Russian nuclear-warhead inventory-management operations, procedures, and data that may be useful in developing potential verification measures for an agreement limiting NSNW and/or strategic warheads.

## **A STEP-BY-STEP APPROACH TO ADDRESS WARHEAD VERIFICATION TECHNICAL AND OPERATIONAL CHALLENGES BY BUILDING ON PREVIOUS COOPERATION EFFORTS**

The technical and operational challenges involved in warhead verification will require a new approach to ensure that all concerns are addressed by

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<sup>7</sup> Under the CTR program, Russian nuclear-security personnel visited US nuclear-warhead storage facilities at Francis E. Warren Air Force Base in Wyoming and Naval Submarine Base Kings Bay in Georgia. See, for example, William M. Moon, “2000 Russian Ministry of Defense Visit to Francis E. Warren Air Force Base,” October 5, 2020, <https://www.stimson.org/2020/2000-russian-ministry-of-defense-visit-to-francis-e-warren-air-force-base/>.

any agreement to limit NSNW or the total inventory of warheads. Previous CTR experience in nuclear security will help provide examples of the data and site-access procedures that the sides have exchanged previously and that the sides might agree to exchange under a warhead-verification regime. It is also worth noting that the data and mutual understandings reached between the United States and Russia on nuclear security and warhead handling and logistics under the CTR program were not negotiated up front in the original agreement. These programs evolved during long-term, detailed, technical discussions conducted over the 18-year duration of the program. The trust required to exchange information and negotiate site access and data sharing was achieved on a step-by-step basis. The sensitivities and safety and security issues involving nuclear warheads suggest that such an approach may be required to build and implement a warhead-verification regime as well.

A step-by-step approach does not mean defining the exact sequence of progression to achieve a warhead-verification agreement. Instead, such a process encourages the sides to engage in technical discussions to explore mutual interests and develop common understandings with regard to warhead verification as they can be negotiated. The agreements and data exchanges can be achieved concurrently. For warhead verification, this approach would enable the two countries to develop confidence-building measures, conduct limited data exchanges, and identify potential joint verification demonstrations and experiments before or during negotiations on specific processes and procedures. In this way, technical discussions on warhead verification could precede, or could be conducted in parallel with, negotiations on warhead limits. This approach would allow the sides to demonstrate and test various methods to validate warhead data and gain confidence in those procedures as they were being developed. Findings from the technical discussions on warhead verification could be used to inform negotiations on limiting the numbers of NSNW or total warheads.

This approach differs significantly from many previous arms control efforts, which tended to start with negotiations limiting nuclear weapons and then shift to more intensive negotiations on verification methods developed separately and unilaterally to verify those limits. Verification provisions in the earlier US-Russian treaties focused on establishing and verifying a baseline declaration, sending notifications of any significant changes to the baseline, conducting annual exchanges to re-establish the baseline, and then seeking to detect violations through a combination of NTM and on-site inspection. In contrast, this proposed approach would focus first on validating the content of warhead-data exchanges to establish an accountability process to support negotiations on limits.

As the sides develop warhead verification capabilities, such as mature data-exchange methodologies and cooperative measures to help validate notifications and data exchanges, this information could offer negotiators a wider variety of options to limit warhead stockpiles. For example, if verification procedures can be developed to address specific warhead locations, operations, or status, then negotiators may be able to design specific limits tailored for such exchanges that would better serve the interests of both sides. A step-by-step approach to developing a process for warhead verification may help identify new and different ways to implement verification measures that would apply to a freeze or moratorium on warheads; limits on different types and deployment statuses of warheads; rules for or restrictions on warhead locations; or trade-offs on stockpile size, composition, and limits.

## **Developing a Data Exchange Methodology to Support a Step-by-Step Approach**

The technical and operational challenges posed by warheads require that a data-exchange methodology for warhead verification must be able to track the lifetime of operations and transactions conducted for all warheads in the inventory. Warheads cannot be tracked by using a simple number or designator; they aren't easily distinguishable; and their composition and dynamic life cycle make them difficult to track. However, based on previous CTR cooperation on Russian and US inventory-management systems, we already know how each country addresses this complex problem, and we can use that knowledge to design a methodology for exchanging warhead-verification data based on the data and procedures used by the US and Russian inventory-management systems, DIAMONDS and AICMS. By using existing inventory-management systems as a source of data and as a model for how to process warhead-inventory data, the methodology will minimize operational impacts while reducing errors and increasing confidence in the data that is processed from these systems. This approach will not require creating new data or revealing sensitive data, such as warhead composition, shape, or performance. Instead, the data will consist of less sensitive historical, logistical data on warhead locations, movements, and transactions.

### *Creating Nuclear Warhead “Passports” to Track Warheads for Verification Using Previously Exchanged Data*

AICMS and DIAMONDS both use the concept of warhead passports to monitor and track all nuclear-warhead movements and operations. Warhead passports include all data and information required to track the respective warhead inventories. Using this concept of warhead passports,

the proposed data-exchange concept would create a unique, virtual identifier for each warhead, derived from actual warhead data provided by the respective inventory-management systems. There are several key questions that must be answered in order to develop a warhead-verification data-exchange methodology:

- What data from warhead passports can be exchanged between the parties and used to derive virtual identifiers for warheads?
- When can the data be exchanged?
- How should the data be exchanged?

Previous nuclear-warhead data exchanges provide precedents for compiling warhead data in a way that can be used to identify, monitor, and track individual warheads from each side's warhead stockpile. Using data on location, transportation operations, components, escort personnel, and, potentially, warhead status, nuclear-warhead passports can be created by combining the data into a virtual record that can serve to identify individual warheads. Every warhead will have a unique set of historical logistics and handling data associated with it that can be used to distinguish warheads so that they can be tracked under a warhead-verification agreement. The sides will first need to agree on a sufficient exchange of data to confidently identify individual warheads under a warhead-limitation agreement (using data that has been shared previously); then the sides can work to develop processes and procedures to confirm the data and potentially to identify additional warhead information and data that can be exchanged. (For more details on potential data elements, see Appendix C.)

When compiled together, warhead locations, transaction dates, components, personnel, and status provide a rich assortment of data elements within warhead-passport data that can be used to develop unique identifiers to monitor and track warheads over their life cycle in support of a verification methodology. For each warhead, transactions and data elements are updated frequently creating a large quantity of data. Even if the United States and Russia do not agree on sharing all the data, there would still be a significant quantity of data that has been exchanged under the CTR program that can be used to create a unique identifier to monitor and track the warhead inventory. In this way, it may be possible to develop a warhead-verification data-exchange methodology without requiring either side to release data it would consider too sensitive for an exchange.

In pursuing this approach, it will be critical to engage directly with the key organizations that are responsible for nuclear-warhead security and maintenance to conduct a deeper analysis of these data sets to support negotiations and develop agreements on the precise data that may be exchanged. This will require direct talks between the 12th

GUMO and the US DoD Office of Nuclear Matters and its supporting organizations, including the Defense Threat Reduction Agency.

## Using Cryptography to Manage the Release of Warhead-Passport Data

The data contained in each nuclear-warhead passport can be used to represent and create a unique digital virtual identifier to track warheads under a verification agreement. A critical point, however, is that even though the individual, historical transactions may not be too sensitive to exchange, if the United States and Russia were to exchange complete data for every warhead, the cumulative information would still reveal too much about individual warhead life cycles and would be too sensitive to share all at once. So the challenge is to capture the data without revealing it all at once. Cryptography offers a technology that can perform that function.

The key technique that protects sensitive data until it is no longer an operational concern is called a “cryptographic commitment.” The process is based on a “hash function”—an algorithm that derives a unique, inviolable digital fingerprint from any set of data. Because a hash is tamper-evident and cannot be reversed to reveal the original data, any slight change in the original data will result in a different hash. This method can be used to derive a unique digital virtual warhead identifier. The parties can then “commit” these identifiers and associated warhead transactions to each other while protecting the warhead passports’ operational sensitivity and ensuring that they are tamper-evident. Later, each side can share the actual data and verifiably prove that it was the data originally committed via the hash. (See Appendix D for a detailed analysis of the cryptographic technologies that could be used to produce passport IDs.)

Once all the existing warhead data is represented by the shared passport IDs at the start of a US-Russia agreement, newly recorded data elements can be similarly represented and exchanged as hashed notifications. These notifications can then be used to prove the authenticity of the original data elements once the host side reveals them at a later point. Crucially, the accumulation of cryptographic commitments together with passport IDs will comprise an immutable historical record: if any actual data elements are changed after the corresponding IDs or notification hashes are exchanged, they will not pass the data-validation procedure because the fact of the change (although not *what* has changed) will be apparent. A notional warhead passport (see Figure 6.1) and the visualization of the resulting data commitment structure (see Figure 6.2) are pictured below.

Both Russia and the United States track all actions and movements affecting each warhead with data-management techniques akin to giving

each warhead its own passport. The notional warhead passport depicted in Figure 6.1 shows columns of typical data compiled by the United States and Russia in their inventory-management systems that could be used to create a warhead ID. Figure 6.2 illustrates how additional data would be collected and used to provide notifications that the data for the warhead passport has been updated.

**FIGURE 6.1. NOTIONAL WARHEAD PASSPORT**

Date/Time	Location	Status	Components	Operation	Personnel	ID Hash
11-11-2001 14:00	Departure from Assembly-1	Inactive	Primary (P), Secondary (S), Limited-lifetime component (LLC), Permissive action link (PAL)	Transfer of custody (TOC): from Rosatom to MOD	Escort-1	8df91ks83v0
11-13-2001 06:15	Arrival RTP-1	Inactive	P, S, LLC, PAL	Rail-to-road transfer	Escort-1	
01-02-2023 13:15	Central Storage Site-1	Active	P, S, LLC, PAL	Audit	Escort-4	
01-08-2023 02:06	Central Storage Site-1	Scheduled for dismantlement	P, S, LLC, PAL	Designated for dismantlement	Escort-11	b1s5oe25am
02-03-2023 12:40	RTP-5	Scheduled for dismantlement	P, S, PAL	Transportation	Escort-11	a832j3msy1s
02-05-2023 18:57	Disassembly-3	Dismantled	P, S, PAL	TOC, Disassembly	Escort-11	x98y1h3ni0l

Note: The thick line divides the entries recorded before and after the commencement of the data-exchange process. Baseline passport (above the line) is used in its entirety to derive and share a single commitment identifying the passport, while entries recorded during the process (below the line) are hashed and committed as individual status updates.

**FIGURE 6.2. DATA COMMITMENT STRUCTURE**

Passport ID Hash: 8df91ks83v0

Date/Time	Location	Status	Components	Operation	Personnel
11-11-2001 14:00	Departure from Assembly-1	Inactive	Primary (P) Secondary (S) Limited-lifetime component (LLC) Permissive action link (PAL)	Transfer of custody (TOC): Rosatom-MOD	Escort-1
11-13-2001 06:15	Arrival RTP-1	Inactive	P, S, LLC, PAL	Rail-to-road transfer	Escort-1
...	...	...	...	...	...
01-02-2023 13:15	Central Storage Site-1	Active	P, S, LLC, PAL	Audit	Escort-4



Update 1 Hash: b1s5oe25am

Date/Time	Location	Status	Components	Operation	Personnel	Previous Hash
01-08-2023 02:06	Central Storage Site-1	Scheduled for dismantlement	P, S, LLC, PAL	Designated for dismantlement	Escort-11	8df91ks83v0



Update 2 Hash: a832j3msy1s

Date/Time	Location	Status	Components	Operation	Personnel	Previous Hash
02-03-2 12:40	RTP-5	Scheduled for dismantlement	P, S, PAL	Transportation	Escort-11	b1s5oe25am



Update 3 Hash: x98y1h3ni0

Date/Time	Location	Status	Components	Operation	Personnel	Previous Hash
02-05-2023 18:57	Disassembly-3	Dismantled	P, S, PAL	TOC: MOD-Rosatom disassembly	Escort-11	a832j3msy1s

Note: All hashes at the top of each block are “committed,” or shared, between the treaty parties, while the underlying data entries are subject to being revealed later under negotiated challenge procedures.

Another information-technology tool that can be used to verify that the data contained in warhead passports includes valid data is called a SNARK. The acronym zk-SNARK stands for “zero-knowledge succinct non-interactive argument of knowledge.” It is a mathematical proof construction in which one can prove that the data elements committed through the warhead passport hashes are all valid without revealing the actual information. Both parties can use SNARKs to interrogate the warhead passport data to confirm that all fields are filled out correctly, that each field contains the right kind of data, and that the data follows a logical sequence. SNARKs can be used by each party without any interaction between the prover and verifier and do not require the host party to reveal any of the specific data points contained in the warhead passports. Running SNARKs to examine the data sets will not affect the integrity of cryptographic commitments for each warhead.<sup>8</sup>

Although the individual data elements may not be too sensitive to exchange under a warhead-verification agreement, it would still be unreasonable to expect that the sides would agree to exchange all of this data at once. If complete data were exchanged for all warheads, it would reveal sensitive information on warhead life cycles that neither side would wish to share. Instead, a step-by-step approach to data exchanges on warhead verification should be developed that would include an exchange of unique passport IDs representing each warhead but would reveal only less sensitive individual data elements one at a time. This would enable the sides to allow limited exchanges while testing the data-exchange process by seeking to verify small amounts of data as they are released. The frequency of initial data exchanges could be controlled through negotiations as both sides gained confidence in the accuracy of the data under a gradual exchange process.

Since the data on individual warheads is committed and cryptographically linked through its hashes, verification of any single data point for a warhead increases confidence in the authenticity of individual warhead commitments within the overall stockpile. As each data element is revealed and verified, confidence in the data exchange grows incrementally.

## **Developing a Challenge Process to Validate and Verify Warhead Data in a Step-by-Step Approach**

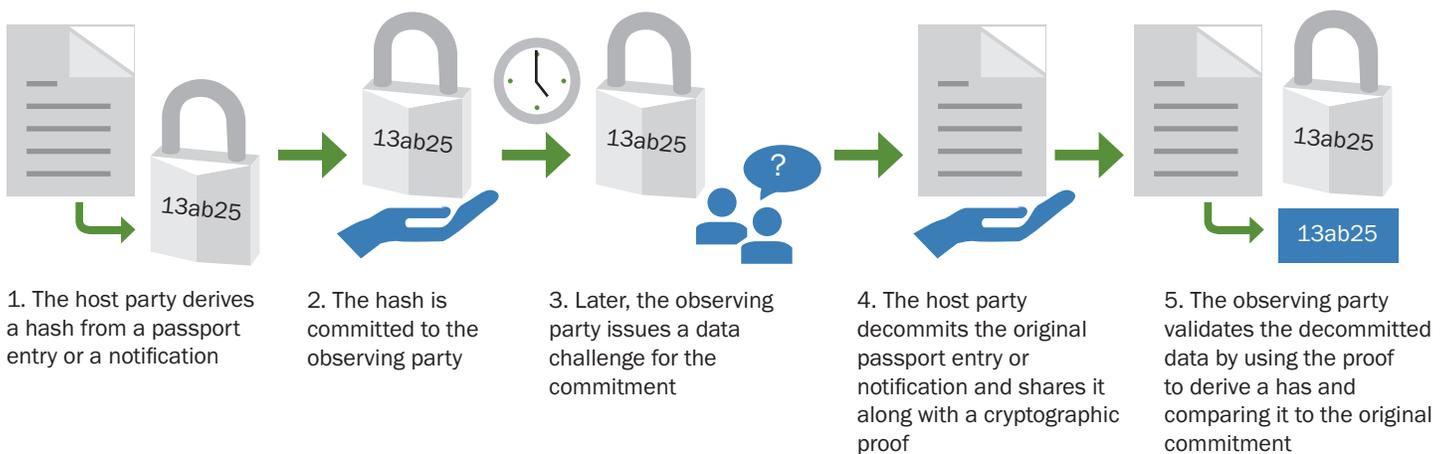
Arms control treaties typically include a challenge function that is intended to detect or reveal anomalies or violations of the agreement, which can be in the form of a short-notice or suspect-site inspection. Under this warhead-data-exchange methodology, however, challenges would be designed to reveal and validate data points secured by the cryptographic commitments of individual warheads. Over time, challenges will authenticate the warhead passport ID.

<sup>8</sup> “What are zk-SNARKs?” Zcash, n.d., <https://z.cash/technology/zksnarks/>.

The parties issue challenges by identifying a specific data element that the challenged party would reveal upon request. Figure 6.3 below provides a graphical representation of the data-challenge process that would be used for the notional warhead passport shown above in Figure 6.1. For this example, Russia would provide the United States with the committed hash for warhead 8df91ks83v0. Then the United States could challenge Russia to disclose the date and time that this warhead was transferred to MoD. Russia would provide the data—for example, “11-11-2001, 14:00.” Through NTM, the United States would likely have data on certain dates on which warhead shipments from specified assembly sites occurred. If NTM had previously identified a shipment from an assembly site on 11-11-2001, for example, then the data release would identify one of the warheads that was included in that shipment. The revealed data would then be validated by processing it through the same hash function used to produce the original commitment. If the data had not been changed, it would produce the same hash code that was originally committed. By validating each data element through a cryptographic proof under such a challenge process, the sides would gain confidence in the credibility of all the data committed by the passport ID hash code. This could all be accomplished without revealing the rest of the data contained in each passport. Over time, the United States could challenge Russia to release data on other warheads included in that shipment.

Each of the parties to an agreement involving exchanges of warhead data would be able to design its challenges to enhance its confidence even further by using NTM, open-source information, and intelligence to issue challenges to confirm information it might have gathered on its own. In the example of a challenge involving the transfer of custody of a warhead, confidence in the data would be enhanced even further if the initial shipment of warheads had been previously captured by NTM. For example,

### FIGURE 6.3. DATA CHALLENGE PROCESS



if the United States had information on a rail transfer operation conducted on a specific date, it could challenge Russia to reveal data on one or more warheads that were involved in that operation. Such data would no longer be sensitive and, since a valid passport would have used that same data to produce the passport ID code, this data-exchange process would validate that the passport ID code was produced with real, authentic data.

The sides would need to negotiate the rules governing the parameters of issuing and responding to challenges. Given nuclear-security concerns regarding current operational data, the sides would likely need to agree that challenges would target historical data. They would need to agree on how current the data could be before it was eligible to be revealed. Since warhead-shipment data has previously been shared after 30 days under CTR cooperation, the sides would need to agree on whether that is enough time or too much. The frequency of the challenges would also need to be negotiated. By taking a step-by-step approach to a warhead-verification agreement, however, the frequency could be adjusted over time as the sides gain confidence in the data exchange methodology and challenge process.

The concept behind this step-by-step data-exchange process is that the data used to produce the passport ID codes and notifications would be revealed one element at a time after a negotiated time delay, thus generating increased confidence over time while protecting other data until the sides agree on when to reveal it. As a result, by preserving operational sensitivity and creating an immutable historical record, this data-exchange methodology would increase transparency and build confidence as it was implemented. It would minimize operational impacts by committing data that had already been compiled by the respective inventory-management systems while preserving nuclear security. The data would enable the sides to monitor and track warheads over their entire life cycle without requiring teams of inspectors to scour numerous sites and locations in an attempt to verify a baseline database up front.

## **Operational Impacts, Risk Mitigation, and Negotiability of the New Data-Exchange Methodology**

This data-exchange methodology is designed to minimize impacts on ongoing operations, mitigate risks, and maximize negotiability. By relying on data that already has been collected by each country's inventory-management system and by using cryptographic concepts to reduce the number of data points that need to be verified to gain confidence in the passport data represented by the unique virtual hash codes, the data exchange would not impose significant additional work burdens on the host countries. Nuclear-security concerns would also be mitigated by relying primarily on historic data and not requiring contemporaneous or

advance notice of movements. In addition, such an approach would not require more on-site inspections than desired by the two sides.

Knowledge of Russia's scientific capabilities gained from previous US work with Russia on warhead security suggests that Russia may be willing to engage in such an approach once the Ukraine war is over and the sides are ready and willing to resume discussions on a follow-on to New START. Although the use of cryptography on fairly large data sets may be complex, the Russians are familiar with the technologies and are among the world leaders in such capabilities. Data-exchange discussions, in fact, could offer an opportunity to discuss advanced data concepts outside the tense environment of cybersecurity concerns. Finally, since the CTR data exchanges were not always reciprocal, the Russians would likely gain more data than they previously received on US warheads.

The most important risk associated with this methodology is the possibility that the host country would exclude some warheads from the overall data base when it was committed. This methodology is designed to validate declared warhead stockpiles, but by providing a challenge process to reveal data points throughout a warhead's total historical life cycle, data challenges will also be helpful in detecting non-declared warheads and thus deterring countries from maintaining stockpiles of such warheads. Thus, the challenging party will have numerous opportunities to detect non-declared warheads through challenges issued as long as the warhead exists. Withholding small numbers of warheads may be possible, but at current stockpile levels small differences from the declared stockpile would not pose significant risks to the other party. Such efforts would become harder and harder to hide if the inventory were reduced.

If either side were to withhold significant numbers of warheads, the host country would create nuclear-security concerns for itself by complicating efforts to centrally track the entire inventory and its ability to conduct system-wide audits. Otherwise, it would have to recreate a separate inventory-management system that could be costly and complex to manage. Nevertheless, the parties would need to develop additional or supplemental verification measures, addressed in the discussion of additional verification measures in Appendix E, to detect undeclared warheads, and they would need to use the data-exchange methodology to validate any findings.

## **Potential Nonintrusive Procedures and Technologies to Support and Supplement Data Confirmation**

Using this step-by-step data-exchange methodology, additional warhead-verification steps may be developed to provide complementary measures that can be used to validate and authenticate the data as it is revealed.

These additional steps or measures could be used in conjunction with the data-exchange methodology to confirm data that is revealed under data-exchange challenges. They are relatively simple and nonintrusive techniques used in previous treaties and agreements that would not pose any nuclear-safety or nuclear-security concerns and would not disrupt ongoing operations.

### *National Technical Means*

The United States and Russia have used NTM for many years to identify and track each other's warhead shipments. Central storage sites and transportation transfer locations have been monitored, and each side has collected extensive data on the movements of the other's warheads and the procedures related to these movements. Although this data does not provide a complete picture of the warhead inventory, it does include a significant trove of information that could be used to support development of numerous challenges to confirm data as it is revealed. The use of previously collected data by the challenging party makes it difficult for the challenged party to anticipate what data the other side might hold, thus incentivizing the sides to use valid data when deriving the warhead passport IDs. Each party can use its historical data to design challenges that will validate the data exchanges as they are revealed. However, the sides would not share all such historical data gained through NTM, as the other side would be able to glean important information about warhead life-cycle patterns and could develop techniques to evade NTM.

Certain additional provisions could be considered to utilize NTM further. Under previous treaties, the sides agreed to display missiles in the open and to open missile shelters for specified periods of time to allow the monitoring party to confirm numbers and types of such missiles. There were also procedures whereby items subject to elimination would remain visible to NTM for a specified time without requiring on-site inspection. For nuclear-security reasons, open displays of warheads would not likely be supported by either side under a future agreement, but displays of open containers, open railcars with the transport trays pulled out, or open transport vehicles could be considered after a transport operation is conducted. If the parties to a warhead-verification accord agree to such displays, this additional data would be entered into the warhead passports by each side's inventory-management system, and updated notifications with relevant cryptographic commitments would be exchanged. Future challenges then could include the release of this agreed information along with any other data requested in the challenge. This action would provide additional assurances of the validity of the data being released and credibly demonstrate which warheads specifically were associated with the open display of containers, railcars,

or other transportation elements used during the warhead-transportation operation. Escort and convoy vehicles associated with a transportation operation could be included in an open display and could be inspected later to confirm the specific escort vehicle used.

### *Tags and Seals*

A typical verification tool is affixing tags or seals that can be tracked. If tags and seals were used to help verify data revealed under a secure data-exchange methodology, they could provide additional assurances to help confirm data associated with a warhead passport. However, safety and security concerns make the use of such techniques for tracking nuclear warheads problematic. Metal and electronics are strictly prohibited around warhead-storage facilities and in close proximity to the warheads. However, if each warhead were assigned a unique identifier—for example, a hash code that could be etched on a specialized warhead container, like the etchings used by the International Atomic Energy Agency (IAEA) on fissile-material containers—then the associated tags and seals could be displayed during operations in such a way that they would identify the warhead(s) involved in the operation. The tags could be attached to a container if they do not violate safety protocols, or they could simply be carried by designated host-country escorts, like “Buddy Tags,” and kept with the warheads wherever they might be. Images or views of the tags could provide an additional layer of verification as other warhead data are released under data-challenge procedures. Another technique that could provide further confirmation of warhead data might be the application of a nonelectronic cellulose nitrate film that can be assessed before and after application to validate the identity of a specific warhead.

Considerable verification R&D has been conducted to develop tags and seals that could be used to track warheads. Using physical tags and seals to provide additional information to the data exchanges described above would provide greater confidence than relying on the physical or virtual tags alone. Such R&D efforts could be conducted jointly in a test environment using notional data before being added to supplement the data-exchange methodology.

### *Remote Monitoring and Surveillance Cameras*

For most warhead operations, including long-term storage, remote video monitoring and surveillance could pose nuclear-security concerns that would preclude their use for warhead verification. It may be possible, however, to identify specific locations or situations in which cameras or video monitoring may be safely used to help confirm data exchanges

without creating nuclear-security vulnerabilities. One example might be the use of sealed cameras at rail transfer points. Sealed cameras could be used by designated personnel to record buddy tags or even to track components after being removed from an assembled warhead. Such data would not have to be released in real time, but under a secure data-exchange methodology, the challenging party might be allowed access to such cameras at a later date to examine pictures or video taken during a previous operation. Since this camera/picture retrieval would occur after an operation was conducted, it would not pose security concerns. On its own, such information might not be particularly useful in verifying warhead movements, but when combined with the release of other data associated with the same warheads over their lifetime, such evidence would provide additional assurances of the validity of the overall data-exchange process and the specific data points revealed under later challenges.

One big advantage to pursuing a step-by-step approach to warhead verification using a secure data-exchange methodology along with these simple, nonintrusive supplemental verification measures is that the sides could agree to implement such steps before or during negotiations to address potential limits on NSNW and/or strategic nuclear warheads. In fact, this methodology could be demonstrated to the sides in a confidence-building exercise by running theoretical challenges and updates conducted between the parties using notional data. As the sides became comfortable with the data-exchange methodology and approach, they could consider expanding the exercise to include real data associated with a subset of the total warhead stockpile, such as between two sites or locations.

Data collected during New START procedures examining re-entry vehicles may provide additional corroborating data to support this methodology on warheads. This could be expanded to focus on NSNW warheads next, or go immediately to include the entire warhead stockpiles. Feedback from such exchanges and exercises may even help build confidence to support specific limitations or outcomes to address the security concerns for each party. Knowing how data can be exchanged and validated could allow the sides to consider limitations or restrictions focused on particular warhead types or locations, or even warhead status focused on deployed warheads or warheads scheduled for dismantlement.

## **Development and Implementation of Additional Verification Measures to Detect and Deter Cheating**

Additional verification measures, such as visits to suspect sites, would be required to ensure that neither side possessed a significant number of unreported warheads. Under a step-by-step approach, a secure data-exchange methodology with supplemental measures to help confirm

and validate data released under challenges could provide a foundation upon which additional verification measures could be developed and implemented to detect and deter cheating. Depending on the agreement reached or treaty negotiated, such additional verification measures could even be negotiated and added during implementation. Since all historical logistics data is securely captured through cryptographic commitments, the sides could work on validation of previous data exchanges to build confidence before seeking limitations that may require more intrusive verification measures. The sides could work together to research and develop additional verification measures on a step-by-step basis. Instead of launching into immediate negotiations on verification measures that might include remote or on-site activities, this approach would be to develop more stringent and intrusive measures as the sides consider more extensive limitations, allowing the sides to conduct joint R&D and experimental warhead-verification exercises that each side could evaluate for their value as negotiations continue.

### *Portal Monitoring*

The sheer number of storage sites makes manned portal monitoring of such facilities impractical in the short term given the cost, the number of personnel required for inspections, and the extensive equipment involved. Remote portal monitoring could be considered to overcome some of these problems. Portal monitoring of rail transfer points could be considered, but it would still involve a significant number of facilities in Russia with no equivalent in the United States or Europe. Portal monitoring of warhead-production facilities proved to be too sensitive for the two sides during the most recent effort to address warhead limits. The Trump administration, as part of its proposal for a freeze encompassing all nuclear warheads, proposed a system that would use portal monitoring alone to measure the number of warheads departing production facilities and returning to disassembly facilities to ensure that the total numbers of warheads remained constant.

The two sides could consider such measures once they reached an agreement that severely limited the number of warheads in the stockpile. In that case, portal monitoring could be limited to a smaller number of production/assembly/disassembly facilities or rail transfer points. It should be noted, however, that these facilities likely process both nonstrategic and strategic warheads, thus creating additional complications if an agreement were to limit one or the other type of warhead. Another challenge associated with portal monitoring of nonstrategic warheads in Europe involves the location of and limited space surrounding the warhead-storage facilities, factors that would make it difficult for inspectors to conduct monitoring activities. Portal monitoring of warhead-storage facilities could also significantly impact

operations for both sides,<sup>9</sup> making this verification tool difficult to use unless the sides were to agree to more extensive warhead limits.

### *Remote Video Monitoring*

A key element of nuclear safeguards for fissile materials includes video monitoring of the material in storage facilities. Video surveillance within nuclear-warhead storage facilities, however, poses significant obstacles before it can be considered as a measure to support a warhead-limitation agreement. During nuclear-security cooperation under the CTR program between the United States and Russia, there were extensive technical discussions on whether to use video surveillance within the storage bunkers to enhance nuclear security at the storage sites. The sides agreed that using remote video within the bunkers should not be included in the comprehensive security upgrades because of concerns about the ability to verify the authenticity of the video feeds, the vulnerability of such video to potential insider threats, and the emphasis on monitoring the access points using a combination of video and on-site guards.

Given that the DoD and MoD experts agreed to exclude video surveillance within the bunkers from the nuclear-security operating systems, it seems unlikely that the sides would agree to such measures for warhead verification—at least in the near term. The large number of locations, bunkers, and warheads that would be involved in such video surveillance would create an extremely complex task if it were to address entire national stockpiles, and making such a system “spoof proof” would require the use of highly classified means and methods. The nuclear-security concerns with allowing access to such video would likely be at least as challenging as allowing on-site inspection.

While remote monitoring inside warhead storage bunkers may not be likely in the near term, other remote video may be helpful to corroborate other data exchanged for a warhead-verification regime. Video or pictures of empty railcars or trucks taken with a time stamp shortly after a transfer operation would help support a future data challenge inspection that revealed certain warheads that were involved in that operation. On their own, video and pictures with time stamps may not be particularly useful for verification purposes, but under a secure data-exchange methodology involving warhead passports, such evidence can help build confidence and complicate attempts to conceal or evade verification methods.

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<sup>9</sup> For the INF Treaty, the portal monitoring delayed shipments of rocket motors for three to four hours or more. The Cargoscan system was rather slow and required precise measurements to distinguish between treaty-limited and non-treaty-limited rocket motors. For warheads, depending on the technologies used, making this distinction could be much more difficult. There could also be additional safety concerns involved in screening nuclear warheads and components.

### *Potential Robotics Applications*

In the context of developing verification methodologies to confirm data exchanges, robotics may also provide a capability to conduct operations such as collecting video or pictures with minimal disruption to operations and would not require logistics and support measures as extensive as those that on-site inspection would. Robotic devices controlled by the host country under direction of the inspecting party could gather additional data to provide additional layers of assurance and validation for data revealed by a challenge. Robotic technology could prove especially useful during dismantlement operations to verify the removal of components showing unique identifiers with pictures and video that could be further verified through electronic validation.

### *Site Diagrams for Inspections*

On-site baseline, challenge, and close-out inspections would be useful to evaluate and verify the capacity of certain storage areas, the presence or absence of NSNW, or other notified and exchanged data. To facilitate such inspections, the sides would need to exchange site diagrams of the relevant inspectable sites within bases, including the NSNW storage or transfer areas. This data is sensitive, but less so if the sides were to discuss their national assessment of each other's nuclear infrastructure as part of an agreement on warhead-stockpile limits. Such data has been exchanged under many previous agreements, including the CFE Treaty and the Vienna Document, and diagrams of the nuclear-security systems installed at Russian storage and transfer sites were developed during cooperation under the CTR program. These diagrams never went so far as to address storage capacity or configuration of storage bunkers. A future agreement should consider to what extent site diagrams should be shared and determine whether such diagrams should reveal detailed information regarding total storage capacity and other infrastructure for handling nuclear weapons.

### *Inspection and Verification of Closed Facilities*

If an agreement were to include the task of verifying that previous storage sites have been closed, or if it were to address closing current storage sites or include inspections of “caretaker”<sup>10</sup> facilities, on-site inspection of such facilities could be conducted without presenting nuclear-security concerns or disrupting operations. Such inspections would need to verify the absence of warheads, and for closed sites, the removal of heating and air-conditioning systems, security systems, and especially handling equipment, including overhead and mobile cranes, trolleys, tracks, or any other kind of equipment that could be used to move or handle warheads.

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<sup>10</sup> Caretaker facilities are sites that have been deactivated but may be returned to operational use if needed for a future contingency operation.

Inspections at closed storage facilities, such as those that might be conducted under an agreement to consolidate warheads at fewer storage facilities, could provide assurances precluding long-term storage of nuclear warheads, but short-term storage within containers and/or railcars or vehicles would still be possible for weeks, months, or more depending on weather conditions and other factors. If the sides were to greatly increase their capacity for short-term storage by building significant additional quantities of containers, railcars, and transport trucks, such activity could be detected by the other side. In addition, since the data-exchange process includes such short-term storage transactions, any transaction detected that was not substantiated by a data challenge would indicate potential activity associated with undeclared warheads. For this reason, inspection and verification of the elimination of excess short-term storage capacity should also be considered when developing a comprehensive verification approach to limits on nuclear warheads.

### *On-Site Visits to Suspect Facilities*

Based on previous experience and history involving arms control treaties, on-site inspections and challenge inspections are often two of the first verification methodologies that policy makers and arms control experts consider when developing new concepts for arms control verification. Such challenge inspections have been included in previous agreements for the challenging party to conduct visits to facilities to ensure there are no non-declared treaty-limited items located at those sites. For a potential future comprehensive verification regime for any agreement on warheads, NATO countries should be prepared to support similar visits to former weapons-storage areas or other potential dispersal sites for dual-capable aircraft.

Using the proposed data-exchange methodology, the United States and Russia would pre-identify both long-term and short-term storage locations required to track declared warheads. Using challenge inspections to search for undeclared individual warheads would not be a productive verification tool, given the warheads' small size, frequent movements, and other characteristics as described in the section above, "Technical and Operational Challenges for NSNW Warhead Verification." On-site visits to suspect facilities, however, would likely be part of a future agreement in some form, perhaps as confidence-building measures to reassure the other party that such facilities are no longer in use and are incapable of storing nuclear warheads. Such confidence-building measures would not be designed to search for suspect items but would focus on infrastructure capabilities previously associated with warhead-storage sites.

Given that the former sites have likely been repurposed after many years since being closed down, confidence-building visits would involve less scrutiny than an inspection of a newly closed site. The absence of

overhead cranes, trolleys, tracks, nuclear-security systems, and other infrastructure such as temperature and humidity control systems that meet strict nuclear-weapons requirements that would be required to handle and secure multiple warheads for significant periods would be relatively simple to observe during a confidence-building visit at a repurposed site. These visits would be designed to focus on the handling infrastructure of the site rather than on a search for warheads at the site. Such inspections would concentrate on the site's capacity to rehouse warheads for significant periods without detection. Once a single visit took place, the inspecting party could relatively easily monitor the site via NTM to ensure there are no activities that would be associated with a nuclear warhead storage site.

Confidence-building visits would be preferable to on-site challenge inspections because specific inspection procedures require more extensive and difficult negotiations. On-site challenge inspections also significantly disrupt operations at the facilities before, during, and immediately after the inspections. The host party to a challenge inspection, or any on-site visit, must conduct an intensive review and analysis of the site prior to inspection to identify any sensitive information and then develop and implement appropriate shrouding to protect that information from disclosure. The small size and mobility of warheads greatly reduces the ability of suspect-site challenge inspections to detect non-declared warheads. Without a data-exchange process to track all declared warheads as they move between all long-term and short-term locations during their entire life cycle, suspect-site challenges would not be able to identify any individual warheads that might be detected. Instead, confidence-building visits conducted to support a specially designed warhead data-exchange methodology would provide greater confidence while confirming the absence of warheads at non-declared locations and accounting for individual warheads that may be located within restricted areas.

If Russia were to agree to inspections at or visits to suspected storage sites, the sides could begin developing confidence in inspection techniques by visiting former Soviet nuclear-weapon-storage sites. NATO countries that formerly hosted such sites, such as the Czech Republic, might offer to host confidence-building visits to former sites to prepare for a potential future agreement. These site visits would help gather information to establish a baseline on the shape and configuration of sites that were previously used as nuclear warhead storage sites and conduct an assessment of their current condition, custody, and ownership. Dozens of additional former NATO NSNW storage sites, including closed and fully remediated facilities in Germany, Greece, and the United Kingdom, may also be sites that Russia would be interested in examining under an agreement limiting warheads in storage. The condition and legal status of all sites that may have previously housed nuclear warheads in Europe may be difficult to identify, so efforts to

gather information on such sites would be useful in preparing for a potential future warhead-limitation agreement.

### *Joint Verification Research and Development*

Following a step-by-step approach, the United States and Russia could also engage in supplemental verification measures to support this data-exchange methodology. Instead of launching into immediate negotiations on verification measures that might include remote or on-site activities, this approach would be to conduct joint exercises that each side could evaluate for their value. Such exercises could start with notional or theoretical data at neutral sites and then move to using actual data at actual sites over time. In this way, the sides would work together to develop verification measures to assist in data validation and to develop additional measures for a comprehensive verification regime that would include procedures to detect undeclared warhead stockpiles. (See Appendix E for more information on previous joint verification R&D conducted by the United States and Russia.)

### **Additional Considerations for a Warhead-Passport Data-Exchange Methodology to Support an Agreement or Treaty Limiting NSNW**

During the Obama administration, the White House began studying the different layers of data and subsets of the warhead stockpile that might be exchanged between the parties under a warhead verification agreement. The five layers were as follows:

- the total number of warheads in the active stockpile;
- the total number of warheads awaiting dismantlement;
- the number of deployed and non-deployed warheads;
- the number of warheads by type corresponding to geographic location (country, region, or specific bases); and
- the number of warheads identified by type (strategic and nonstrategic) and individual warhead designator and/or association with delivery-vehicle types (missile, bomber, or submarine).

When considering potential future negotiations that may address warheads, the United States and its NATO allies should engage in discussions on which layer or layers it will seek to address in discussions of warhead verification. The Biden administration has made clear its intention to seek limitations on all warheads, including NSNW. A warhead-passport data-exchange process would be the same for any set of warheads, so preparations should consider whether NSNW should be included in an

overall-stockpile approach and what the advantages and disadvantages might be if NSNW were viewed as a separate layer within that stockpile. In addition, the United States and NATO partner countries should begin considering the type and quantity of data they would be willing to release and the frequency of data releases in a step-by-step methodology.

Within this context, then, a key question for the NATO allies to consider is whether and when it would be in their interest to focus on NSNW in terms of potential data exchanges leading to an agreement or treaty that would reduce nonstrategic-warhead inventories. They should seek to answer questions such as what data would be of highest interest to acquire from Russia and what data should be withheld.

The key issues include:

- whether to include non-deployed as well as deployed warheads;
- whether to include inactive warheads (including warheads in repair or those scheduled for dismantlement) as well as active warheads;
- how to share and exchange location data;
- whether and how to limit data exchanges based on countries, sites, or regions of storage and transit sites; and
- how to identify storage locations in Europe and whether to acknowledge the country or use site designators.

As these questions are addressed, a data-exchange methodology can be tailored to meet appropriate needs and requirements.

### **Confidence-Building Applications of a Step-by-Step Technical Approach Relating to Data Exchanges on NSNW Warheads**

A warhead data-exchange methodology using cryptography could provide the United States and NATO with a transparency, verification, and confidence-building tool to support potential discussions with Russia. By proposing a new data-exchange methodology for warhead verification that is secure and relies on data elements that have been exchanged in the past, it may be possible to establish technical exchanges on nuclear-weapons challenges in the European region within the context of ongoing strategic-stability talks. In addition, the United States and NATO could propose working together with Russia to help build the system through US-Russian joint exercises and/or demonstrations using notional data to further develop the concept in support of potential diplomatic discussions or agreements. This approach would enable the sides to build confidence in the data-exchange process over time, thus creating a foundation for future verification negotiations.

In that way, this concept could be applied to the entire stockpile inventory, or any agreed subset of data such as nonstrategic or strategic warheads, deployed or non-deployed warheads, warheads destined for dismantlement, or warheads at specific storage sites.

This approach could be considered part of the concept that Russia had been promoting before its invasion of Ukraine—a “security equation” framework that could include different arrangements and agreements designed to strengthen transparency and strategic stability. Such an approach might also address the Russian complaints that previous US proposals required excessively intrusive verification. Although the officially stated Russian position on the security equation focuses on delivery vehicles and the associated platforms, it seeks to limit deployed warheads “which pose a direct operational threat.”<sup>11</sup> Russia’s position includes explicit claims that all of its warheads associated with short- and intermediate-range delivery systems in Europe are currently located in central storage facilities.<sup>12</sup> Although Russia has consistently demanded that the United States withdraw all of its nuclear weapons from Europe before beginning negotiations over NSNW, Deputy Foreign Minister Sergei Ryabkov has expressed potential interest in developing confidence-building measures focused on intermediate-range systems. A proposal to develop a new methodology for a data exchange on nuclear warheads could help validate Russian claims that its NSNW are all located in central storage.

By using site designators for warhead-storage locations, the United States and Russia could begin the process of exchanging stockpile data under this step-by-step approach without requiring either side to publicly acknowledge or identify individual storage sites up front. Over time, however, data challenges would require the sides to identify all warhead-storage locations for the entire service life of all declared warheads. Thus, the data-exchange process could be used to determine whether any warheads in the declared inventory are currently stored or have ever been located in suspect storage facilities in the European enclave of Kaliningrad, bordered by NATO members Poland and Lithuania. This data-exchange process could authenticate Russian claims that there are no nuclear warheads in the region and determine if there were any declared warheads stored there during the service lives of any warheads in the current stockpile. In order to hide such a location, the Russians would either have to falsify warhead-passport data or maintain a non-declared stockpile. Additional data challenges and verification measures could focus on detecting any such Russian deception efforts.

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<sup>11</sup> Carnegie Endowment for International Peace, “Keynote Address: Sergey Ryabkov” (address to the Carnegie International Nuclear Policy Conference, Washington, DC, June 22, 2021), p. 6, [https://ceipfiles.s3.amazonaws.com/pdf/Sergey+Ryabkov+Keynote\\_Transcript.pdf](https://ceipfiles.s3.amazonaws.com/pdf/Sergey+Ryabkov+Keynote_Transcript.pdf).

<sup>12</sup> Ministry of Foreign Affairs of the Russian Federation, “Вопросы ядерного разоружения” [Nuclear Proliferation Issues], April 28, 2021, [https://www.mid.ru/web/guest/adernoe-nerasprostranenie/-/asset\\_publisher/JrcRGi5UdnBO/content/id/2612366](https://www.mid.ru/web/guest/adernoe-nerasprostranenie/-/asset_publisher/JrcRGi5UdnBO/content/id/2612366).

# Appendix A: Nuclear-Weapons Storage Locations in Russia

## NATIONAL STORAGE SITES, ASSOCIATED 12TH GUMO UNIT STORAGE SITES<sup>1</sup>

### Western Russia

- Vologda-20, Object 957 (Chebsara), units 25594, 00494
  - Gatchina, Unit 44086  
(AF: Tactical aviation, possibly air defense)
  - Soltsy, Unit 75365 (AF: Long-range aviation, Tu-22M3)
  - Kolosovka, Unit 20336 (N: Kaliningrad)
  - Bologoye, Unit 33787 (RF: SS-25 mobile ICBMs)
  - Teykovo, Unit 54175 (RF: SS-25, RS-24 Yars mobile ICBMs)
- Olenegorsk-2, Object 956 (Ramozero), unit 62834
  - Gadzhiyev, Unit 69273  
(N: Northern Fleet, naval weapons, SLBMs)
  - Severomorsk, Unit 81265 (N: Naval aviation)
  - Zaozersk, Unit 22931  
(N: Northern Fleet, naval weapons, SLBMs)
- Mozhaysk-10, Object 714, units 52025, 06031
  - Tver, Unit 19089 (RF)
- Bryansk-18, Object 365 (Rzhanitsa), units 42685, 54056
  - Shatalovo, Unit 23476 (AF: Tactical aviation)
  - Kozelsk, Unit 44240 (RF: SS-19 and RS-24 Yars silo ICBMs)
  - Shaykovka, Unit 26219 (AF: Long-range aviation, Tu-22M3)
- Belgorod-22, Object 1150 (Golovchino), unit 25624
  - Morozovsk, Unit 55796 (AF: tactical aviation)
  - Novorossiysk, Unit 52522 (N: Black Sea Fleet)

<sup>1</sup> The information in this section is from Pavel Podvig and Javier Serrat, “Lock them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe,” United Nations Institute for Disarmament Research, 2017, <https://unidir.org/publication/lock-them-zero-deployed-non-strategic-nuclear-weapons-europe>.

- Voronezh-45, Object 387 (Borisoglebsk), units 14254, 24552
  - Yeysk, Unit 32161 (N: Naval aviation training center)
- Saratov-63, Object 1050 (Krasnoarmeyskoye), units 25623, 04197
  - Engels, Unit 77910 (AF: LRA, Tu-160, Tu-95MS strategic bombers)
  - Tatischchevo, Unit 68886 (AF: SS-27 silo ICBMs)
- Lesnoy-4, Object 917 (Nizhnyaya Tura, formerly Sverdlovsk-45), unit 40274
  - Svobodny, Unit 54203 (RF: RS-24 Yars mobile ICBMs)
- Trekhgornyy-1, Object 936 (formerly Zlatoust-30), units 41013, 24562
  - Yasny, Unit 93766 (RF: SS-18 silo ICBMs)
  - Yushkar-Ola, Unit 54200 (RF: SS-25 mobile ICBMs)

## Central Russia

- Irkutsk-45, Object 644 (Zalari), units 39995, 25007
  - Sredniy, Unit 26221 (AF: Long-range aviation, Tu-22M3)
  - Novosibirsk, Unit 54245 (RF: RS-24 Yars mobile ICBMs)
  - Irkutsk, Unit 73752 (RF: SS-25 mobile ICBMs)
  - Sibirskiy, Unit 08326 (RF: SS-25 mobile ICBMs)
  - Solnechny, Unit 25996 (RF: SS-18 silo ICBMs)

## Eastern Russia

- Komsomolskna-Amure-31, Object 1201 (Selikhino), units 52015, 57381
  - Khurba 77944 50°25'35"N 136°51'3"E Tactical aviation
  - Ukrainka (Seryshevo), Unit 27835 (AF: Long-range aviation, Tu-95MS strategic bombers)
  - Fokino, Unit 36199 (N: Pacific Fleet)
  - Mongokhto, Unit 40689 (N: Naval aviation, Tu-142)
  - Vilyuchinsk, Unit 31268 (N: Pacific Fleet, naval weapons, SLBMs)

- Khabarovsk-47, Object 1200 (Korfovskiy), units 25625, 8138
  - Khabarovsk-41, Unit 23227 (Engineering)
  - Chita-46, Unit 23233 (Engineering)
  - Gorny, Unit 54160 (AF: Tactical aviation)
  - Vozdvizhenka, Unit 23477 (AF: Tactical aviation)

RF: Rocket Forces

AF: Air Forces

N: Navy

**FIGURE A.1. RUSSIAN NUCLEAR-WEAPONS STORAGE SITES**



Source: "Where the weapons are - Nuclear weapon storage facilities in Russia," Russian Strategic Nuclear Forces, [https://russianforces.org/blog/2017/08/where\\_the\\_weapons\\_are.shtml](https://russianforces.org/blog/2017/08/where_the_weapons_are.shtml)



# Appendix B: Sample Questionnaire

## Questions for a DCA Ally on Potential US-Russian Arms Control of Nonstrategic Nuclear Weapons

***The following is an anonymized version of the questionnaire that was used during the interviews of allies and NATO headquarters personnel and is summarized in the report. It is included to be indicative of the questions asked, although they were tailored to the individuals.***

In the following questionnaire, we are seeking your thoughts and opinions on the scope and scale of a potential negotiation between the US and Russia on non-strategic nuclear weapons. We then pose a series of questions on the actual and potential implementation of arms control, confidence-building, and non-proliferation inspections on your national territory.

In the broadest sense, we define NSNW here as those nuclear warheads and associated delivery systems that are NOT purpose-built by the two sides to be launched from their own territory to strike the territory of the other side. Thus, excluded systems include intercontinental ballistic missiles, sub-launched ballistic missiles, and nuclear armaments (long-range nuclear air-launched cruise missiles, nuclear air-to-surface missiles, and nuclear bombs) that are delivered only by long-range heavy bombers. In other words, NSNW are those systems that traditionally are not limited by strategic arms control.

We define NSNW here as short-range systems previously covered by the Presidential Nuclear Initiatives of 1990/1991, the intermediate and shorter-range systems covered by the INF Treaty, and in a short-range nuclear treaty discussed by NATO after completion of the elimination of INF systems. NSNW in this definition includes nuclear warheads associated with systems such as nuclear landmines, nuclear artillery, unguided rockets, and ground, sea and air-launched ballistic and cruise nuclear missiles of short range (0-500 km), shorter-range intermediate systems (500-1,000 km), and longer-range intermediate systems (1,000-5,500 km), and could also include air-dropped nuclear bombs associated with shorter-range aircraft.

### I. Agreement Scope and Goals

1. Russian nuclear weapons have posed a historic threat to the security of NATO Allies. However, Allies can have different perceptions of the nature of threat.

A. Do you judge that specific types of delivery systems pose more of a specific threat to your country than others (e.g., short-range nuclear weapons, land versus sea launched systems)?

B. Are there Russian nuclear weapons that pose a greater threat to NATO as a whole than to your territory (e.g., medium-range nuclear missiles)?

C. Are there current or declared Russian nuclear weapon systems that should be eliminated through a new arms control agreement, based on the threat these systems pose to your country or to NATO?

D. We understand the your public's general disposition for/against nuclear weapons. Does your country have any legislation that identifies any specific types of nuclear weapons systems that are prohibited (e.g., local nuclear weapon free zones, or bans on nuclear armed or -powered vehicles)?

E. If Russia agreed that NSNW weapons would be verifiably eliminated, would you support reduction or elimination of NATO nuclear forces?

2. Do you think that increasing NATO/U.S. nuclear deployments might persuade Russia to engage in NSNW negotiations? How do you assess the probability that Russia may respond with arms racing instead of negotiations?

3. Over the decades, NATO has debated retiring old systems, updating existing systems, or introducing new systems (e.g., Follow-On To Lance, B61 upgrades). What is your take on the matter? Should NATO introduce new capabilities, maintain and modernize existing systems, or withdraw them entirely from Europe?

4. If the US and Russia negotiated on the transparency, limitation, or elimination of NSNW, what would be your preference on the involvement of your country:

A. As a full party to any resulting agreement or treaty.

B. As a member of NATO, consulting with the US and Russia equally.

C. As a member of NATO, consulting with the US before and after each round of negotiations (e.g., the INF model).

a. At end of negotiations, concluding a US-NATO members agreement on implementation.

b. At end of negotiations, concluding an agreement with the US on implementation, which could be unclassified or classified.

c. No need to conclude an agreement with other NATO members or the US.

D. No involvement.

5. What role should Belarus, as a member of the Union State and a host for Russian dual-capable forces play in a future US-Russian NSNW agreement?

- A. The same as any NATO DCA state currently hosting assets
- B. The same as any NATO state not participating in DCA or hosting assets
- C. The same as any NATO state formerly hosting NSNW-related facility
- D. Equal party with the US and Russia
- E. Non-party

6. Should the following have a role in any future agreement on NSNW or involvement in process/negotiation toward such agreement? If so, please specify the role (participant, formal observer, informal observer, briefed by both parties, briefed by the US/NATO, briefed in the OSCE context, briefed in the UN context, or none):

- A. EU
- B. Sweden and Finland
- C. Ukraine and Georgia
- D. Kazakhstan
- E. Other NATO partner nations (e.g., Japan, ROK, Australia, Israel)
- F. UN
- G. OSCE
- H. China

7. What would your preferences on the goals for the US in a negotiation with Russia on NSNW (as many as apply):

- A. Total verifiable elimination of all US and Russian NSNW globally
- B. Total verifiable elimination of all US and Russian NSNW in the Euro-Atlantic region
- C. Verifiable limitations on US and Russian NSNW numbers
- D. Verifiable limitation on deployment areas of US and Russian NSNW
- E. Verifiable reductions of permanent storage locations of NSNW
- F. Verifiable limitation/elimination of equipment to support NSNW
- G. Declaration of NSNW totals
- H. Declaration of NSNW total and locations?

8. What is Russia's likely goal in a US-Russian NSNW negotiation?

- A. Political goal of sowing disunity among Allies/with partners
- B. Limiting UK and French nuclear weapons

C. Removal of US nuclear weapons from Europe

D. Ending NATO's nuclear sharing arrangements

9. Are Russian goals in NSNW negotiations linked to strategic arms control, i.e., to build leverage for missile defense discussions?

10. What role should the UK and France play in a negotiation between the US and Russia on NSNW transparency, restrictions, reductions, or elimination?

A. None – Allies must maintain long-standing policy to exclude UK and French nuclear weapons from any US-Russian negotiation

B. Observer

C. Full participant in negotiations, but with an opt-out of any final agreement

D. Full participant in negotiations and bound by any final agreement

11. How important is it to you that China be involved in NSNW negotiations?

A. Essential, as a full party

B. A positive addition, if it can be arranged

C. A negative addition, adding unnecessary complications

D. Irrelevant for this stage of arms control

12. If you could export the problem of Russian NSNW to the Asia theater, that is, convince Russia to move its NSNW east of the Urals, would you? What verification provisions such a move may entail in your view?

13. In case of failure of US-Russian negotiations, should NATO take unilateral steps towards limitation of its own NSNW, or towards strengthening its NSNW posture?

## II. Implementation and Related Legal Issues

Your country has high/low levels of experience in hosting and conducting arms control within the NATO Alliance. These include inspections under CWC, CFE, Dayton Article IV, IAEA Additional Protocol, INF Basing Countries Agreement, Open Skies, Vienna Document.

1. Are there agreements other than the ones listed above that allow for on-site inspection or on-site-inspection-like visits on your territory?

2. For any agreement to which your country is a state party, are you aware of any of the following:

A. Have there been any legal or practical issues in connection with the conduct of on-site inspections?

B. Have there been any legal or practical issues in connection with

the right to reject inspectors, or with the privileges and immunities that inspectors have while on your territory?

C. Have there been any legal or practical issues with inspections conducted on your forces when they were hosted by an inspected state (e.g., NATO Balkan operations)?

D. Have there been any legal or practical issues with facilitating inspections of hosted NATO or partner forces on your territory?

3. Can you contemplate any issues relating to the implementation of a U.S.-Russia NSNW agreement on your territory that would be problematic for your government, such as:

A. Transparency between the US and Russia about activities and facilities in your country, and facilitated access for Russian inspectors on your territory.

B. Access by such inspectors to facilities on your territory associated with dual-capable aircraft (without any acknowledgement of participation in that mission).

C. Former nuclear storage sites (including facilities that may be co-located with dual-capable aircraft or purported nuclear storage sites).

4. As one of the few NATO Allies that was party to the INF Basing Countries Agreement, are you aware of any lessons learned from your country's experience negotiating and implementing that agreement that could be useful to include in a similar agreement relating to a US- Russia NSNW agreement?

5. If your country was to be included as a potential inspectable party in a US-Russian agreement limiting NSNW, especially air bases or major exercise areas, are there any impediments to facilitating resulting inspections, in particular, are there any national restrictions on access by inspectors to such facilities? Are there special zones within such facilities that should be considered off-limits or subject to certain limitations? Are such zones clearly identifiable as not related to NSNW, or could they be reasonably explained as such?

6. Do you have any national or local legal, legislative, or executive agreements that limit or prohibit the movement of nuclear-capable aircraft or actual NSNW on your territory?

A. If so, would you recommend that your country seek to reflect that legal status in a theoretical US-Russian agreement that would provide for inspections on your territory, or would you be willing to allow inspections anywhere on your territory to verify that status?

7. Are there any practices at facilities or items that are associated with US forces in your country that might impede verification by national technical means (e.g., treaty mandated visibility by military satellites as required under START)?

8. Generally speaking, do you think your country would be supportive of US-negotiated cooperative measures that the US and Russia could use to deal with ambiguities regarding a treaty between the parties on NSNW on your territory (e.g., special inspections, declared area inspections, limited overflights)?

9. Do you think that it would be important to limit public knowledge of any special status (e.g., the INF Basing Countries Agreement) in a new US-Russian agreement, particularly if could be interpreted as acknowledging the presence of US nuclear weapons?

# Appendix C: Data Elements for a Warhead Passport

*By William Moon and William Delaney*

A key requirement for producing a conceptual warhead passport will be to identify the columns of data that would be collected to derive the hash codes and to determine what data would be subject to sharing under the data-challenge procedure. Based on previous exchanges between the United States and Russia under the CTR program and military-to-military exchanges, several categories of data are described below as potential elements of a passport.

## LOCATION DATA

US and Russian nuclear-warhead data is some of the most sensitive and secure information on each side and is guarded and protected accordingly. That does not mean, however, that none of the data can be exchanged. Location data, for example, is extremely sensitive, yet presumed warhead locations are available from open sources.<sup>1</sup> In addition, personnel from the Cooperative Threat Reduction (CTR) program visited Russian warhead-storage locations and rail transfer points that were identified by the nearby city and by a site designator. While precise latitude and longitude designations will likely remain too sensitive to exchange, it would be reasonable to expect that a data-exchange methodology could include locations by identifying sites by their city and site designator.

## TRANSACTION DATES

Nuclear-warhead transaction dates may be another data point that could be exchanged under a warhead-verification agreement. The Russians were able to share precise dates of warhead shipments with CTR personnel, though the dates were not provided until 30 days after the shipment occurred. Based on this precedent, historical data on warhead movements, and perhaps additional warhead transactions, could be included in a warhead-verification data-exchange methodology.

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<sup>1</sup> See for example, Hans M. Kristensen and Matt Korda, "United States nuclear weapons, 2021," *Bulletin of the Atomic Scientists*, Vol. 77, No. 1 (2021), pp. 43-63, <https://doi.org/10.1080/00963402.2020.1859865>; Hans M. Kristensen and Matt Korda, "Russian nuclear weapons, 2021," *Bulletin of the Atomic Scientists*, Vol. 77, No. 2, pp. 90-108, <https://doi.org/10.1080/00963402.2021.1885869>; and Pavel Podvig and Javier Serrat, "Lock them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe," United Nations Institute for Disarmament Research, 2017, <https://unidir.org/publication/lock-them-zero-deployed-non-strategic-nuclear-weapons-europe>.

## TRANSPORTATION DATA

It will be very important that, for nuclear-security reasons, a warhead-verification data-exchange process focus on historical data on warhead movements to ensure that information on current movements is never released. Under the CTR program, the United States and Russia conducted long discussions on how best to confirm warhead shipments. The two sides strongly agreed that current and future shipment plans, including locations and routes, should be closely guarded and never shared between the parties because any potential leak of such information could pose grave nuclear-security concerns. This is particularly important because warheads are considered to be highly vulnerable to theft during transport.

Data on past movements and past locations, however, has been exchanged and shared between Russia and the United States under the CTR agreement and provides examples of the sorts of data that may be exchanged under a warhead-verification agreement. The Russian Ministry of Defense also shared some data on the types of warhead-transportation operations that were conducted, including shipments from storage bunkers at deployment sites to central storage, from storage bunkers at deployment sites to disassembly facilities, and from central storage to disassembly sites. Based on this precedent, it may be possible for the sides to exchange and share data on these types of operations or transactions. Each of these types of shipments involve specific, known operations such as road-to-rail transfers and transfers of custody.

## COMPONENT DATA

US-Russian technical exchanges on nuclear-warhead safety and security have also addressed such topics as limited-lifetime components and other nuclear-warhead components that the sides have been willing to identify to each other. The existence of particular components within assembled warheads has been discussed in technical exchanges, is understood and acknowledged in open sources, and is commonly understood between US and Russian technical experts. The identification of the major components contained within a warhead at different stages in its life cycle may be another data element from a warhead passport that might be used to identify, monitor, and track warheads during their service lives. It is unlikely that either side would be willing to share detailed information on specific components contained within assembled warheads. Down the road, however, as a step-by-step process proceeds, the sides might be willing to share specific data such as serial numbers on limited-lifetime components—for example, in order to identify a specific component as it is removed from a warhead as a preliminary step for the removal of a warhead from the active stockpile or when the warhead is scheduled for final dismantlement.

If the sides were willing to share specific data such as serial numbers on primaries, for example, that could support a potential future agreement limiting critical warhead components and link to a potential methodology to verify a fissile material cutoff treaty that could address the material included in operational warheads as well. Ultimately, the warhead primary component, known as the warhead “pit,” is the item of greatest concern in limiting warheads. Thus, if the sides were willing to focus a future agreement on limiting pits, the data exchanges and corresponding verification measures could be redesigned to support such an agreement. Such data is managed within each side’s inventory-management system and could be added to the data exchanged under an agreement in the future.

## PERSONNEL DATA

There is another potential data element that is captured within warhead passports and tracked by inventory-management systems that may be helpful in designing a warhead-verification data-exchange methodology. During arms control inspections and CTR site visits, the host party always provided personnel escorts to help conduct verification work. If there were a warhead-verification agreement, all personnel given access or allowed near a warhead would be identified and tracked by warhead inventory-management systems. It may be possible for designated personnel to be assigned unique identifiers that could be tracked and captured in an exchange of warhead-verification data.

## WARHEAD-STATUS DATA

Although there is no precedent for the United States and Russia to share data on warhead status, the sides may be willing to exchange such data in order to distinguish active warheads in the stockpile from those scheduled for dismantlement. Such an exchange could be used as a confidence-building measure to show the other side that total stockpile numbers may not pose as large a threat as the other side may perceive. Warhead-status data would not be verifiable unless specific steps were identified to distinguish warheads scheduled for dismantlement, such as the removal of a limited-lifetime component or other component. CTR cooperation was focused on warheads “destined for dismantlement,” which does indicate that the sides could consider pursuing a data exchange that identifies the status of various warheads in the stockpile.

The concept of identifying individual warheads by certain data elements associated with a warhead has been employed since the very first inventory managements systems were developed. Figure C.1 shows an example of one of the earliest identification plates used for a Russian nuclear warhead.

The bronze plate shown below represents an early rendition of some of the data that are used to identify a specific nuclear warhead. In this case, it shows assembly date and personnel identified by unit as well as a serial number. Recent warheads contain more data compiled in their “passports” that accompanied the warheads and were subsequently automated in development of the AICMS inventory management system.

## FIGURE C.1. SOVIET NUCLEAR BOMB AND ITS BRONZE IDENTIFICATION PLATE WITH RELEVANT DATA



▲ The 480kg 244N bomb lay in its container which had small built-in wheels. Its transportation was difficult because its full weight with the container was 1 t. Vladimir Astalkovits



▲ The 244N bomb data table. 244N-T2SB-1 means that the bomb was assembled by the 2nd team's 1st shift. The M-3458 is its serial number. The II KB. 1973g means that it was assembled in the 2nd quarter, in the year of 1973. Vladimir Astalkovits

Source: Becz, László, Szabolcs Kizmus, and Tamás Várhegyi, OKSNAR - Fully Assembled State - Soviet Nuclear Weapons in Hungary 1961-1991, self-pub., 2019. The data table shows an example of the Soviet system of capturing a serial number and other data together, such as would be included in a warhead passport.

# Appendix D: Cryptographic Methods for Data Exchanges on Nonstrategic and Total Warhead Stockpiles

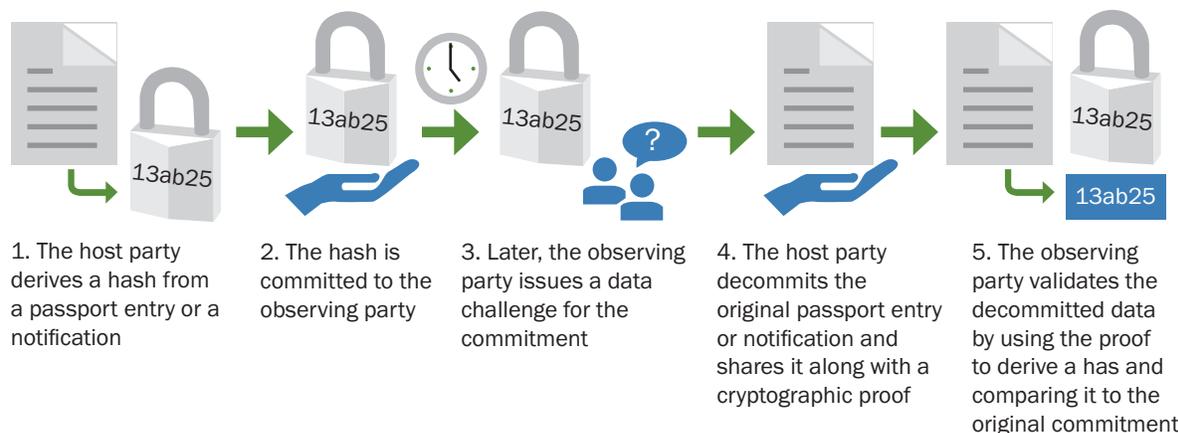
*By Dan Zhukov and William Moon*

Cryptographic techniques can be used to enable a secure and authenticable warhead data-exchange process. The most basic element of these techniques is a hash function—an algorithm that can take input data of any type and size and derive a long string of digits and characters (known as a hash) that is uniquely associated with that data. Hashes have two relevant characteristics:

1. A hash function cannot be reversed to get the original input data from a hash.
2. No two data sets will yield the same hash when run through the same function.

In other words, a hash can act as a one-way representation of a data set of any given size. That hash cannot be decrypted, as it does not contain actual data about any individual warhead, and yet it can be used as an advance commitment to a particular data set's authenticity. These aspects allow for the host party to share cryptographic commitments that represent the agreement-defined data entries, such as historical logistics and handling transactions associated with specific warhead passports. Cryptography keeps those data elements secret unless the sides agree to reveal the data in question. If required by the agreement or requested by the verifying party, the host party will reveal the original data entry and confirm that the same entry was used to derive the initially shared hash, as shown in Figure D.1.

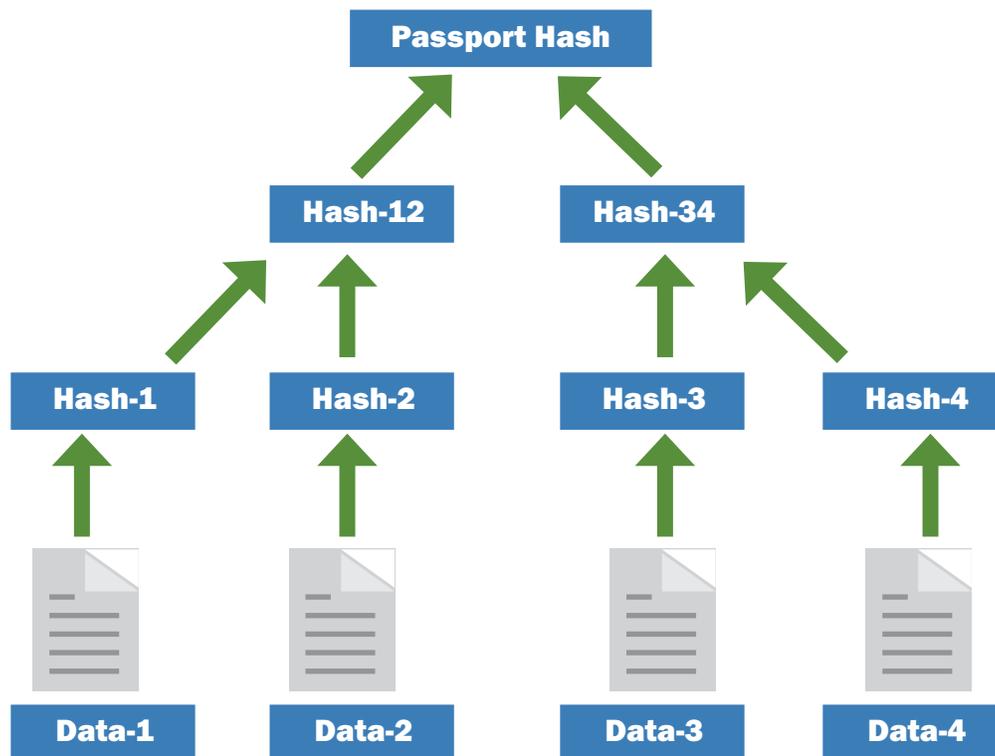
**FIGURE D.1. DATA CHALLENGE PROCESS**



Hash functions therefore allow the United States and Russia to exchange historical data about their warhead inventories while credibly committing to the validity of that data at the time of recording. Additionally, by combining hashes into bigger data structures, both sides can turn large data sets, such as entire individual warhead histories, into individual hashes, which would serve as passport IDs for our methodology. The cryptographic data structure in question is called a Merkle tree—a structure in which each data element is turned into a hash, and then pairs of hashes are recursively combined to produce additional hashes until a single hash can be used to commit the entire dataset. An example of a Merkle tree is depicted in Figure D.2.

Merkle trees enable a credible commitment that a given data element is contained in the entire data set used in the tree’s creation. Assume that after an agreement on warhead-transparency measures is reached, both parties solely commit the top-level passport ID hashes that represent entire warhead passports. Later, either party can reveal a single data element from a passport (for example, Data-1) and a specific set of hashes (Hash-12 and Hash-34) that would prove that Data-1 contributed to the derivation of the passport hash ID.

**FIGURE D.2. MERKLE TREE STRUCTURE**



The verifying party would need to conduct the following hashing operations in order to confirm the following:

1. Data-1 => Hash-1
2. Hash-1 and Hash-2 => Hash-12
3. Hash-12 and Hash-34 => Passport hash

As a result, the verifying party would be assured that Data-1 comes from the correct passport and was in that passport at the time of the baseline data exchange. At the same time, no other data entries would be revealed as part of that demonstration.

Crucially, both the United States and Russia each have their own families of government-certified hash functions, published by the National Institute of Standards and Technology<sup>1</sup> and Rosstandart<sup>2</sup> respectively. This means that each side can use its own hash functions to cryptographically commit its inventory of nonstrategic nuclear warheads (NSNW) and therefore trust that the algorithm does not have a back door through which the sensitive data can be accessed. For an extra security layer, the two function standards can be combined into a single hash function to ensure that both parties' data is cryptographically protected to the same extent, thus further incentivizing mutual trust.<sup>3</sup>

Note: Many of the cryptographic techniques and concepts described in this report are also widely used in blockchain applications that include distributed ledger technology (DLT) and various cryptocurrencies. While the methodology presented in this report relies on the same cryptographic foundation, it should nevertheless be viewed as different from DLT for several reasons. First, the proposed data-exchange methodology is bilateral and does not involve a distribution of a given ledger throughout a multilateral network. Second, contrary to DLT applications, the United States and Russia would not validate hashes as soon as they are committed; instead, the data validation process for each commitment can occur only after a negotiated time delay.

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<sup>1</sup> National Institute of Standards and Technology, "Hash Functions," updated June 22, 2020, <https://csrc.nist.gov/projects/hash-functions>.

<sup>2</sup> Rosstandart, "Information technology. Cryptographic data security. Hash function," January 1, 2013, <http://protect.gost.ru/document.aspx?control=7&baseC=6&page=1&month=6&-year=-1&search=&id=180209>.

<sup>3</sup> Dr. Dan Boneh, cryptography professor, professor of electrical engineering, and senior fellow at the Freeman Spogli Institute for International Studies, Stanford University, interview with authors, April 23, 2021.



# Appendix E: US–Russian Joint Verification R&D

*By Ferenc Dalnoki-Veress and William Moon*

The United States and Russia have a long history of joint verification experiments. The previous experience, which included some notable successes, should be leveraged in developing additional verification measures, joint experiments, and demonstrations. This experience forms a solid basis for the sides to build mutual confidence through further data exchanges and other verification procedures. Ultimately, if the United States and Russia were able to reach agreement to limit nonstrategic nuclear weapons or all nuclear warheads, a step-by-step approach to such an agreement could include joint research-and-development (R&D) efforts seeking to fill gaps or supplement the data exchange and corroborating verification measures.

One of the earliest initiatives was the 1988 US-Soviet Joint Verification Experiment, which helped bring the Threshold Test Ban Treaty into force by demonstrating the methodology used to measure the yields of nuclear-weapon tests. Then in 1989, an independent experiment by the Natural Resources Defense Council—a US nongovernmental organization—and the Soviet Academy of Sciences used very sensitive gamma-ray detectors to verify the presence of fissile materials used in nuclear weapons. This initiative was followed in the 1990s by US-Russian lab-to-lab exchanges focused on sharing knowledge related to the safety and security of nuclear weapons, as well as other projects to build mutual trust.

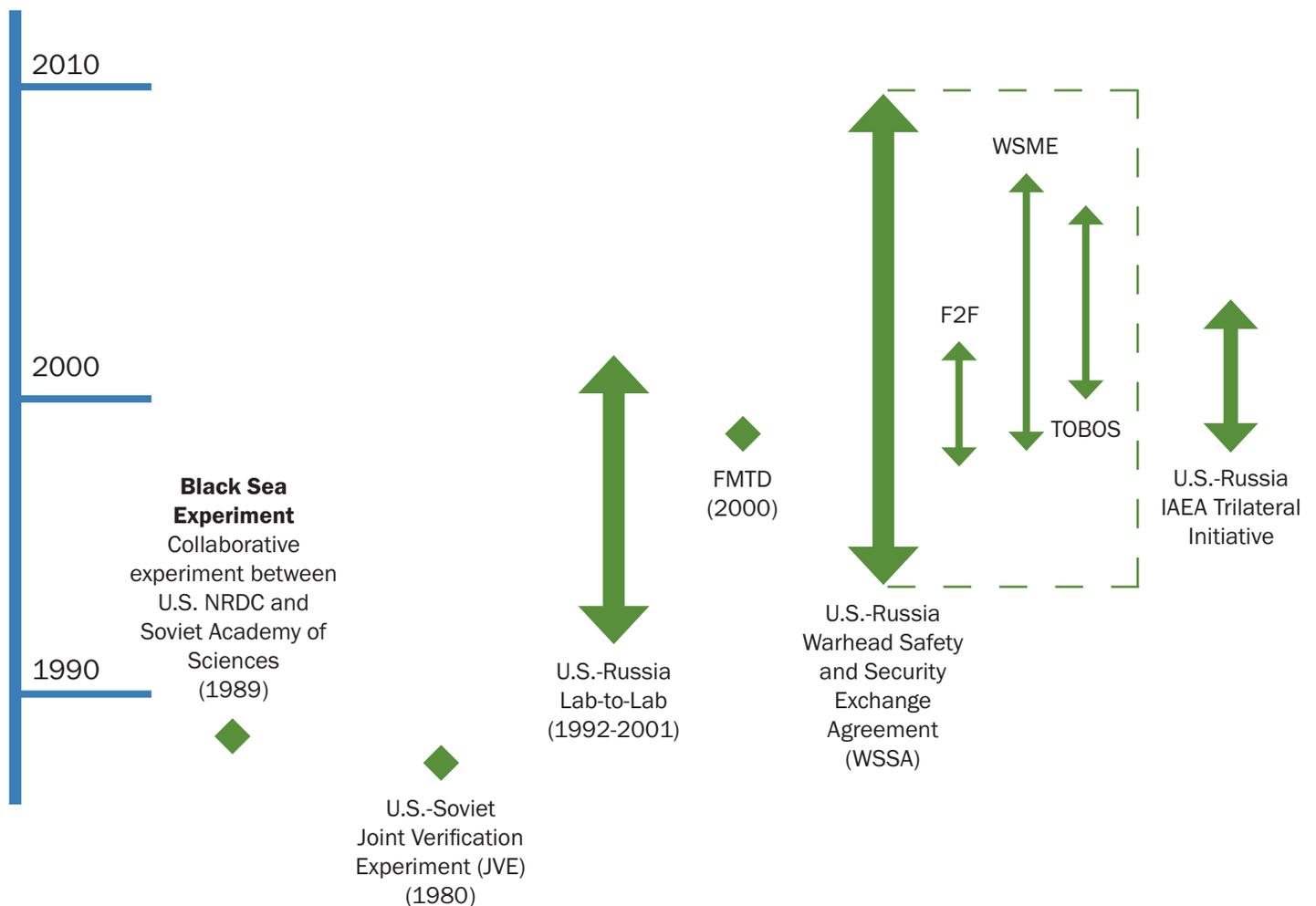
The US-Russia Warhead Safety and Security Exchange Agreement, which was in place from 1994 to 2010, provided a formal structure for lab-to-lab activities, broadened collaboration on nuclear-arms-control verification, and added cooperation to combat nuclear-related terrorism. These exchanges led to the development of warhead- and facility-monitoring technologies.

At the turn of the century, lab-to-lab cooperation yielded another joint verification exchange, called the Fissile Material Transparency Technology Demonstration. Under this program, Russian scientists visited Los Alamos National Laboratory for a demonstration of the verification of a classified plutonium pit while in a container, using an attribute-measurement system with an information barrier. The information-barrier approach is particularly significant because it demonstrated that the authenticity of a warhead can be verified without

revealing sensitive information about the isotopic composition or configuration of the nuclear explosive itself. This technology led to the Trilateral Initiative by the International Atomic Energy Agency (IAEA), the United States, and Russia to investigate the financial, legal, and technical issues arising from IAEA monitoring of weapons-origin fissile material. While support for the Trilateral Initiative ended in 2001, it demonstrated that the sides could detect the presence of weapons-grade plutonium without revealing sensitive information. Unfortunately, US-Russian exchanges and practical cooperation ceased in 2014 after the Russian invasion of Crimea.

Figure E.1 below provides a timeline of various joint verification experiments and programs conducted jointly by the United States and Russia.

## FIGURE E.1. TIMELINE OF JOINT VERIFICATION EXPERIMENTS AND PROGRAMS BY THE US AND RUSSIA



The United States and Russia conducted a joint verification R&D program in the early 2000s that may be worth further examination. The program, which was called “TOBOS” (Tekhnologii Obespecheniya Bezopasnosti Opasnykh Sistem, or Technologies for Securing the Safety of Dangerous Systems), was conducted in March 2001. The goal of the program was to develop a system that provides round-the-clock security and location information on warhead containers in Russia. The concept was developed because both countries were interested in examining ways to tag warheads in storage while overcoming the problem that no tags or metal or electronic devices could be directly attached to warheads without violating their certification and safety protocols. The system, which was demonstrated in St. Petersburg, involved winding cables around and through key points on a container. The container was then connected to the facility infrastructure in such a way that the warhead could not be moved from its storage location without setting off an alarm that could be transmitted off-site over secure communications. Such a technology could serve a function similar to that of remote video cameras used to monitor nuclear material storage under IAEA safeguards without raising nuclear-security concerns associated with warhead storage.

## **WARHEAD NONDESTRUCTIVE-ASSAY TECHNOLOGIES**

Numerous organizations and entities have conducted extensive R&D on nondestructive-assay (NDA) technologies and techniques to be able to identify individual warheads and distinguish them from one another by using templates and other means to protect sensitive information. Such efforts could be used to provide additional confirmation of warhead identification if the sides were to agree on such measures. The data-exchange concept using less sensitive warhead passport data could provide a basis for warhead verification such that NDA techniques could be considered for further joint R&D to support a long-term effort that would be necessary when total warhead stockpiles reach much smaller numbers.



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