



UNIDIR

**Lock them Up:
Zero-deployed Non-strategic
Nuclear Weapons in Europe**

Pavel Podvig and Javier Serrat

About UNIDIR

The United Nations Institute for Disarmament Research (UNIDIR)—an autonomous institute within the United Nations—conducts research on disarmament and security. UNIDIR is based in Geneva, Switzerland, the centre for bilateral and multilateral disarmament and non-proliferation negotiations, and home of the Conference on Disarmament. The Institute explores current issues pertaining to the variety of existing and future armaments, as well as global diplomacy and local tensions and conflicts. Working with researchers, diplomats, government officials, NGOs and other institutions since 1980, UNIDIR acts as a bridge between the research community and governments. UNIDIR's activities are funded by contributions from governments and donor foundations.

Note

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. The views expressed in this publication are the sole responsibility of the individual authors. They do not necessarily reflect the views or opinions of the United Nations, UNIDIR, its staff members or sponsors.

www.unidir.org

© UNIDIR 2017

Table of Contents

Acknowledgements	2
Acronyms	2
Executive summary	3
Non-strategic nuclear weapons in Europe and the need for arms control	5
Non-strategic nuclear weapons: A brief overview	8
Terminology and types of weapons	8
Unilateral initiatives	9
Current status of non-strategic nuclear forces	10
Recent ideas about reducing tactical nuclear weapons	11
The zero-deployed-weapons proposal	13
Practical implementation	14
Current status of nuclear-weapon storage in Russia	14
Current status of non-strategic weapon management in the United States/NATO	19
Practical implementation	22
Verification measures to implement the zero-deployment of non-strategic nuclear weapons	23
Potential additional measures	26
A roadmap for addressing tactical nuclear weapons	29
APPENDIX A. Nuclear weapon storage sites in Russia	31
APPENDIX B. Nuclear weapon storage in NATO	41

Acknowledgements

This project has been made possible by generous funding from the Government of Finland.

In February 2017, UNIDIR hosted a two-day workshop with experts from relevant countries to discuss the proposal and examine potential challenges. We are grateful for their comments and feedback, and would like to thank Alicia Dressman, Marc Finaud, Edward Ifft, Hans Kristensen, Łukasz Kulesa, Oliver Meier, Konrad Muzyka, and others who participated. Workshop participants do not necessarily endorse the proposal and any errors or omissions are solely the authors' responsibility.

We would also like to thank the staff at UNIDIR for their support in carrying out this project.

Acronyms

ALCM	Air-launched cruise missile
DDPR	Deterrence and defence posture review
ICBM	Intercontinental ballistic missile
INF	Intermediate Range Nuclear Forces (Treaty)
NATO	North Atlantic Treaty Organization
PNI	Presidential nuclear initiatives
SLBM	Submarine-launched ballistic missile
SLCM	Sea-launched cruise missile
START	Strategic Arms Reduction Treaty
WSA	Warhead storage area
WSV	Warhead storage vault
WS3	Weapon storage and security system
12th GUMO	12th Main Directorate of the (Russian) Ministry of Defence

Executive summary

The United States and the Russian Federation (and before it the Soviet Union) have long acknowledged the immense security benefits of nuclear arms control. Through the Intermediate Range Nuclear Forces Treaty, both States eliminated an entire class of weapons. In addition, thousands of warheads have been removed from service under the START and New START accords. Yet, despite significant reductions in their strategic nuclear arsenals, both countries have been reluctant to include non-strategic nuclear weapons in the arms control process.

Today, it is difficult to imagine a scenario in which “non-strategic” or “tactical” nuclear weapons would be deliberately used in a conflict in Europe. However, these weapons are still present on the continent and complicate efforts to strengthen the European security architecture. Moreover, these weapons pose potential risks of miscalculation, inadvertent escalation, or accidental use in a time of crisis. Yet, today there is no mechanism to reduce or eliminate arsenals of these weapons or to exclude the catastrophic scenarios of inadvertent use. This reality raises the imperative to develop a practical proposal that would make sure that nuclear weapons are not introduced into any potential conflict in Europe and that would lay the groundwork for eventual reductions in non-strategic nuclear arsenals.

In current operational practice, neither US nor Russian non-strategic nuclear weapons are operationally deployed on a day-to-day basis. This paper presents a proposal to ensure that all such weapons remain non-deployed during peacetime, codifying current practices into a legally-binding, verifiable arrangement. If adopted, this proposal would reduce the risks of nuclear war breaking out in times of peace and place safeguards against nuclear escalation in times of crisis.

The core of the “zero-deployed arrangement” we propose would be to transfer nuclear warheads associated with non-strategic delivery systems to a small number of storage facilities. Once warheads are removed from bases near units that operate nuclear-capable delivery systems, it should be possible to develop verification procedures that would confirm the absence of deployed warheads at those bases.

This arrangement is different from most of the proposals for control of non-strategic nuclear weapons that have been discussed so far. Most importantly, the proposal discussed in this paper does not require the parties to disclose the number of warheads in their possession, a serious stumbling block in all past attempts to reach an agreement on non-strategic weapons. Also, it does not require access to sensitive facilities that store or service nuclear weapons.

Since all verification activities are conducted to confirm the *absence* of nuclear weapons, they can employ a range of tools and techniques that would be unavailable in situations where nuclear weapons can be present. Hence, the verification regime for the zero-deployed arrangement can draw on the procedures that were developed to implement arms control agreements such as START and New START.

The zero-deployed proposal does not ignore that US–Russia relations do not at present appear conducive to further bilateral engagement in arms control. In fact, the proposal’s implementation does not initially require both sides to sit at a negotiating table and work through all the complex issues involved in crafting an arms control regime. Instead, the proposal foresees a gradual approach to implementation. Such an approach would be both politically feasible and rewarding, demonstrating the parties’ commitment to greater stability and security, and showing concrete progress towards addressing the risks posed by these weapons.

Both parties could start by making coordinated political declarations reaffirming their commitment to non-deployment and their intent to work towards a lasting and legally-binding framework codifying this commitment. The Russian Federation would confirm that all its nuclear weapons have been consolidated at central storage facilities. The United States would recognize that increasing the deployment threshold for weapons assigned to NATO air bases will require changes to current storage practices.

Second, both sides could then operationalize the political declarations via voluntary visits to sites where weapons are no longer stored but that are in good enough condition to provide an accurate picture of the type of facilities that would be verified if an agreement were to be reached. These invitations would give Russia and the United States an opportunity to test the verification procedures proposed in this paper and to work out any additional measures. This collaboration would strengthen confidence in the verification regime as well as foster a more fruitful working relationship among the parties.

Finally, when the political conditions are favourable, both sides would formally negotiate and adopt a legally-binding agreement with detailed verification procedures. Such an arrangement could serve as a stepping stone for a more comprehensive arms control process aimed at further reductions of nuclear weapons in general and non-strategic weapons in particular.

Non-strategic nuclear weapons in Europe and the need for arms control

In November 2015, five Russian strategic bombers took off from the Engels airfield in Russia on a mission to strike targets in Syria. The missiles they carried were conventional Kh-101s, but the bombers—two Tu-160 Blackjacks and three Tu-95MS Bears—are capable of delivering nuclear weapons. Just days later, Russia launched several Kalibr long-range cruise missiles from surface ships deployed in the Caspian Sea and a non-nuclear submarine in the Mediterranean. Both episodes highlight a trend towards a blurring of the line between nuclear weapons and their delivery systems, on the one hand, and their conventional counterparts, on the other.¹

When the United Kingdom decided not to pursue a new sea-launched nuclear cruise missile, its defence secretary stressed that the system “would carry significant risk of miscalculation and unintended escalation. At the point of firing, other states could have no way of knowing whether we had launched a conventional cruise missile or one with a nuclear warhead. Such uncertainty could risk triggering a nuclear war at a time of tension.”² This argument was recently echoed by former US Secretary of Defense William Perry, who, along with former Assistant Secretary of Defense Andy Weber, counselled against the procurement of a new air-launched cruise missiles, calling such weapons “uniquely destabilizing”.³ These dangers are not limited to cruise missiles. Indeed, similar risks are associated with most categories of non-strategic weapons, for example with short-range ballistic missiles. Unlike long-range ALCMs, however, non-strategic weapons are not covered by any arms control treaty.

Uncertainty about whether the weapons employed in a conflict are nuclear or conventional dramatically increases the risks of miscalculation and escalation. In fact, NATO officials have expressed concern that a number of Russian military exercises have reportedly involved the simulated use of tactical nuclear weapons.⁴ The dangers of accidental use or inadvertent escalation, with potential catastrophic consequences, raise the need for a framework that, first, reduces the risks of nuclear war breaking out in times of peace and, second, places safeguards against nuclear escalation in times of crisis.

¹ Pavel Podvig, “Blurring the line between nuclear and nonnuclear weapons: Increasing the risk of accidental nuclear war?”, *Bulletin of the Atomic Scientists*, 3 May 2016, <http://thebulletin.org/2016/may/blurring-line-between-nuclear-and-nonnuclear-weapons-increasing-risk-accidental-nuclear-war9397>.

² Philip Hammond, “The alternatives to Trident carry an enormous risk”, *The Telegraph*, 2 February 2013, <http://www.telegraph.co.uk/news/uknews/defence/9843848/The-alternatives-to-Trident-carry-an-enormous-risk.html>.

³ William J. Perry and Andy Weber, “Mr. President, kill the new cruise missile”, *The Washington Post*, 15 October 2015, https://www.washingtonpost.com/opinions/mr-president-kill-the-new-cruise-missile/2015/10/15/e3e2807c-6ecd-11e5-9bfe-e59f5e244f92_story.html.

⁴ Matthew Day, “Russia ‘simulates’ nuclear attack on Poland”, *The Telegraph*, 1 November 2009, <http://www.telegraph.co.uk/news/worldnews/europe/poland/6480227/Russia-simulates-nuclear-attack-on-Poland.html>; Adrian Croft, “Insight - Russia’s nuclear strategy raises concerns in NATO”, *Reuters*, 4 February 2015, <http://uk.reuters.com/article/uk-ukraine-crisis-russia-nuclear-insight-idUKKBNOL825A20150204>.

There is another reason to engage in meaningful steps to address non-strategic nuclear weapons in a formal arms control process. Following the entry-into-force of New START in February 2011, there has been consensus among arms control experts and government officials that the next round of nuclear arms reductions must address the non-strategic (also known as tactical) nuclear weapons of Russia and the United States/NATO stationed in Europe. In fact, in its New START ratification resolution, the US Congress requested that the president committed to initiate “negotiations with the Russian Federation on an agreement to [...] secure and reduce tactical nuclear weapons in a verifiable manner.”⁵ Without progress towards greater control of non-strategic nuclear weapons, further cuts to the strategic arsenals of Russia and the United States—and, consequently, multilateral reductions involving other nuclear weapon states as well—will likely not be possible. This reality raises the imperative to develop a proposal that can be implemented in a verifiable manner.

In February 2010, then-foreign ministers of Poland and Sweden, Radosław Sikorski and Carl Bildt, called for the negotiation of an arms control regime to cover non-strategic nuclear weapons.⁶ Similarly, then-foreign minister of Finland, Alexander Stubb, stressed in April 2010 that “no treaty arrangements limit tactical nuclear weapons, even though the threshold for their use is lower and the danger for their proliferation and falling into the hands of terrorists is greater than in the case of strategic weapons.” Stubb added that “Finland has long called for the inclusion of tactical nuclear weapons in a legally binding, verifiable and transparent international treaty system” and posited that the first steps towards achieving this aim “should be transparency and information exchange as well as other confidence-building measures, such as the withdrawal of weapons from forward emplacements”.⁷

We propose to address the risks associated with tactical nuclear weapons on the European continent and reduce the risks of escalation in the NATO-Russia context through a verifiable arrangement that would ensure the continued and verifiable non-deployment of US and Russian non-strategic nuclear weapons. A clear commitment to the continuation of the non-deployment practice, and its subsequent formalization through a legally-binding agreement, could become an important element of security and stability in Europe. Furthermore, the data exchange and confidence-building and verification arrangements that would accompany the non-deployment commitment would provide important building blocks for a more comprehensive arms control framework aimed at reducing non-strategic nuclear arsenals to be pursued further down the line.

To be sure, the prospect of further arms control negotiations between the United States and Russia depends in great measure on an improvement in the relations between the

⁵ US Senate, “New START Treaty: Resolution of Advice and Consent to Ratification”, 22 December 2010.

⁶ Carl Bildt and Radek Sikorski, “Next, the Tactical Nukes”, *The New York Times*, 1 February 2010, <http://www.nytimes.com/2010/02/02/opinion/02iht-edbildt.html>.

⁷ Alexander Stubb, “We Should Strive for a World without Nuclear Weapons”, Foreign Ministry of Finland, 21 April 2010, <http://formin.finland.fi/public/default.aspx?contentid=190581&contentlan=2&culture=en-US>. The column originally appeared as an op-ed in Finland’s *Helsingin Sanomat* newspaper.

superpowers. Furthermore, there are a number of political issues that could complicate negotiations related to non-strategic nuclear weapons. On the one hand, Russia has insisted that the discussion of tactical nuclear weapons should be part of a broader arms control agenda that includes missile defence, prompt global strike capabilities, and weapons in space—issues that the Russian Federation considers of paramount importance to the broader strategic landscape. On the other hand, the United States must consider the political implications of reducing its nuclear footprint in Europe at a time when the alliance has emphasized the importance of nuclear weapons in its deterrence strategy.⁸

There are also challenges at a practical level. The Russian Federation would prefer to negotiate bilaterally with the United States rather than with NATO. However, US non-strategic weapons are stationed in Europe under bilateral agreements between the United States and the respective host states. Hence, any verification arrangements that involve site visits would require the approval and cooperation of the host states as well as the United States, potentially raising the need for legally-binding inspection agreements, as was done in the context of the Intermediate Nuclear Forces Treaty. It is therefore clear that any meaningful steps to prevent the use of and reduce non-strategic nuclear weapons will entail a degree of compromise and concessions from all the parties involved.

To date, both NATO and Russia have laid out conditions for future discussions. While Russia demands that the United States withdraws the nuclear weapons it has stationed at NATO bases in Europe, NATO's focus is on numerical parity with Moscow. The alliance has expressed willingness to engage in further reductions of its nuclear arsenal should Russia take reciprocal steps. Despite these pronouncements, neither side has put forward an official proposal, so both seem to be open to new ideas to address the non-strategic weapons issue. We suggest here one possible approach to non-strategic nuclear weapons in Europe that would codify existing operational practices, maintain stability, and establish a framework for future verifiable reductions of weapons.

Today, neither Russian nor US non-strategic nuclear weapons are operationally deployed, i.e. mated to delivery systems, on a day-to-day basis. This reality is the result of a series of unilateral measures adopted by both sides over the course of decades. Although both sides' warheads could still be loaded unto delivery systems for potential use, the current non-deployment practice means that a longer timeframe, and a conscious decision, would be needed to achieve operational readiness.

By codifying these practices into a legally-binding arrangement, and introducing other measures that reassure the parties that weapons are not clandestinely deployed, this initiative would reduce the risks of nuclear war breaking out in peacetime and strengthen safeguards against nuclear weapons being introduced into a conflict in Europe. In practice, this means that warheads would neither be mated to delivery systems nor stored near

⁸ North-Atlantic Treaty Organization, Warsaw Summit Communiqué, 9 July 2016, http://www.nato.int/cps/en/natohq/official_texts_133169.htm, U.S House of Representatives, Armed Services Committee, Hearing on Military Assessment of Nuclear Deterrence Requirements, 8 March 2017, <https://armedservices.house.gov/legislation/hearings/military-assessment-nuclear-deterrence-requirements>.

them. Both sides would instead consolidate their nuclear warheads in central storage facilities. Inspections and other verification measures would provide the necessary assurances that no nuclear warheads are deployed or stored near delivery systems.

Non-strategic nuclear weapons: a brief overview

Terminology and types of weapons

There is considerable debate in the expert community about what makes a nuclear weapon “non-strategic”. A plethora of terminology has long been used, including “tactical”, “battlefield”, “theatre”, and “short-range”. Each of those terms highlights different system attributes, drawing on sometimes overlapping, sometimes divergent criteria for their categorization.⁹ This problem is compounded by variations in meaning even within the usage of a single government. For example, Russian experts have noted that the term “tactical nuclear weapons” has been used in official and non-official Russian literature to categorize all non-strategic nuclear weapons, including intermediate- and shorter-range missiles, “battlefield” nuclear weapons (i.e. a subset of nonstrategic weapons), and all types of weapons covered in the presidential nuclear initiatives of the early 1990s.¹⁰ Other categories, such as “operational-tactical nuclear weapons” have been used as well.¹¹ NATO documents have also employed the term “sub-strategic nuclear weapons”, defined as “air-delivered weapons for NATO’s dual-capable aircraft and to a small number of United Kingdom Trident warheads in a sub-strategic role (other sub-strategic nuclear weapons having been withdrawn from Europe and subsequently eliminated)”.¹²

This paper employs both “non-strategic nuclear weapons” and “tactical nuclear weapons” interchangeably to describe the US and Russian nuclear weapons that are not covered by the existing arms control agreements that limit strategic forces and intermediate-range nuclear forces (the New START and the Intermediate-Range Nuclear Forces Treaty).

The US non-strategic weapons in question are both variants of the B61 gravity bomb, namely the B61-3 and the B61-4. Under ongoing modernization plans, these will eventually be converted into the single B61-12 model. The US Department of Energy confirmed as recently as August 2016 that the first production unit of this weapon will be completed in

⁹ For a discussion of terminology, see Anatoli Diakov, Eugene Miasnikov, and Timur Kadyshev, “Non-Strategic Nuclear Weapons Problems of Control and Reduction”, Center for Arms Control, Energy and Environmental Studies, Moscow Institute of Physics and Technology, 2004, https://www.armscontrol.ru/pubs/en/NSNW_en_v1b.pdf, pp. 7–10.

¹⁰ Ivan Safranchuk, “Tactical Nuclear Weapons in the Modern World” in Brian Alexander and Alistair Miller (eds), *Tactical Nuclear Weapons: Emerging Threats in an Evolving Security System*, Washington DC, Brassey’s, 2003, p. 51.

¹¹ Boris Yeltsin, Presidential address on national security to the Russian Federal Assembly, 13 June 1996, <http://freebooks.site/uchebnik-mejdunarodnie-otnosheniya/poslaniya-natsionalnoy-bezopasnosti-prezidenta.html>.

¹² NATO, “NATO Handbook”, <http://www.nato.int/docu/handbook/2006/hb-en-2006.pdf>, p. 65, footnote.

fiscal year 2020 and will be followed by full-scale production.¹³ US tactical nuclear weapons stationed in Europe are delivered solely by nuclear-capable aircraft.

By contrast, Russian non-strategic weapons can be categorized according to their type of basing—land, air, or sea—and include a wide variety of weapons such as land-based surface-to-surface short-range missiles and warheads for surface-to-air missiles; torpedoes and depth bombs for airborne and sea-based delivery systems; cruise missiles for coastal and air defence; and gravity bombs and air-to-surface missiles. Russia's tactical aircraft systems include a variety of short-range bombers and multipurpose aircraft.

The proposal discussed in this paper only covers US and Russian nuclear weapons. It does not include France's short-range cruise missiles (operationally outside NATO) or the United Kingdom's nuclear weapons. These would have to be addressed in a multilateral format. Nevertheless, from a technical standpoint, the model proposed could also be applicable in a scenario that included French and British weapons.

Unilateral initiatives

Concrete efforts aimed at curbing and eliminating tactical nuclear weapons took off in the early 1990s. Although the Soviet Union had begun withdrawing non-strategic nuclear weapons from Central Europe in early 1990, the watershed moment arguably came with a statement by President George H.W. Bush the following year. In September 1991, Bush announced that the United States would destroy all ground-launched short-range weapons, including those deployed overseas, and cease the deployment of tactical nuclear weapons on ships, submarines, and naval aircraft "under normal circumstances".¹⁴

A month later, Soviet President Mikhail Gorbachev responded with a unilateral commitment to eliminate nuclear artillery munitions and mines, as well as nuclear warheads for tactical missiles, and to remove tactical nuclear weapons from multi-purpose submarines and surface ships. The Soviet Union pledged to eliminate a portion of those weapons as well as nuclear weapons on land-based naval aviation, placing the remainder in central storage sites. In addition, Gorbachev pledged to eliminate a portion of warheads for air-defence missiles and concentrate the remainder in central air bases. The following year, when the Soviet Union had broken apart, Russian President Boris Yeltsin pledged to also eliminate a third of the country's sea-based tactical nuclear weapons and to cut its stockpile of air-launched tactical nuclear munitions by half. Additionally, pending reciprocity from the United States, Moscow expressed its willingness to place the remaining half of the stockpile of air-launched nuclear munitions in central storage bases.

¹³ NNSA, "NNSA Reaches Important Milestone with B61-12 Life Extension Program", 1 August 2016, <https://nnsa.energy.gov/mediaroom/pressreleases/nnsa-reaches-important-milestone-b61-12-life-extension-program>.

¹⁴ For more on the withdrawal of Soviet weapons, see Joshua Handler, "Russian Nuclear Warhead Dismantlement Rates and Storage Site Capacity: Implications for the Implementation of START II and De-alerting Initiatives", Woodrow Wilson School, Princeton University, CEES Report No. AC-99-01, February 1999, pp. 39–41. The texts of the Presidential Nuclear Initiatives can be found at http://ndupress.ndu.edu/Portals/68/Documents/casestudies/CSWMD_CaseStudy-5.pdf, pp. 23–39.

This series of pledges by Soviet/Russian and US leaders became known as the Presidential Nuclear Initiatives (PNIs).

The United States reportedly completed the reductions it had promised by 1994, and the Clinton administration took a further step in denuclearizing its surface fleet. In 2004, under President George W. Bush, half of the US stockpile in Europe was cut, leading to the withdrawal of the remaining weapons on UK soil. Most recently, the Obama administration retired the TLAM/N sea-launched cruise missile.

Tracking Russia's progress in implementing its pledges has proven more difficult due to uncertainty about the size and composition of its forces as well as unclear statements by government officials. Nevertheless, at the 2015 NPT Review Conference, Russian ambassador Mikhail I. Uliyanov declared that Russia's tactical arsenal had been cut "fourfold" and that the remaining weapons had been moved to the non-deployed category and concentrated at central storage bases within the national territory.¹⁵

Current status of non-strategic nuclear forces

The weapons considered in this study include an estimated 180 US warheads stationed at bases in Belgium, Germany, Italy, the Netherlands, and Turkey, as well as an estimated 2,000 Russian non-strategic warheads that according to official statements are currently retained in central storage facilities.¹⁶ It should be noted that neither Russia nor the United States have formally disclosed information about the number or location of the non-strategic weapons in their possession. The United States, however, has published the total number of active nuclear warheads in its arsenal, and experts generally have high confidence in the estimate of the number of US weapons deployed in Europe.¹⁷ The Russian figures, however, are less certain.

As mentioned earlier, Russian officials have stated, as recently as 2015, that the decrease in Russia's non-strategic arsenal has been "fourfold". This statement is consistent with the 2,000-weapon estimate made by non-governmental experts. Nevertheless, the lack of official figures has prompted some debate on the estimates. Also, US officials have expressed unspecified concerns about Russia's implementation of the PNIs (which Russia has rebutted) and have communicated worry about the potential nuclear capability of

¹⁵ Statement by Mikhail I. Uliyanov, Acting Head of the Delegation of the Russian Federation at the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Cluster 1: Nuclear Disarmament, 1 May 2015, http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/npt/revcon2015/statements/1May_Russia.pdf.

¹⁶ The United States also maintains a stockpile of an estimated 300 warheads "for possible overseas deployment in support of extended deterrence to allies and partners worldwide." See US Department of Defense, "Nuclear Posture Review Report", April 2010, https://www.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf, p. xiii.

¹⁷ The number of weapons deployed in Europe seems to have been confirmed by a leaked cable seen by Hans Kristensen. See Hans Kristensen, "Tac Nuke Numbers Confirmed?", FAS Blog, 7 December 2010, <https://fas.org/blogs/security/2010/12/tacnukes/>.

Russian short-range missiles.¹⁸ The lack of official data on both numbers and reduction activities prevents outside experts from drawing definitive conclusions on which weapons have been eliminated, the extent to which Russia has fulfilled its pledges under the PNIs, and what the current size and composition of Russia's non-strategic forces is.

Despite the divergent estimates, one inescapable observation is the disparity between the US/NATO and Russian arsenals. This asymmetry has been widely seen as a challenge to pursuing arms control negotiations on tactical nuclear weapons. Indeed, cognizant of this reality, the US Congress has stressed the need for an agreement to not only achieve reductions but also "address the disparity between the non-strategic (tactical) nuclear weapons stockpiles of the Russian Federation and of the United States".¹⁹ The history of attempts to address the issue of non-strategic nuclear weapons, however, suggests that achieving parity would be extremely difficult.

Recent ideas about reducing tactical nuclear weapons

Despite the steps that both the Russian Federation and the United States have taken to reduce the number of tactical nuclear weapons in their arsenals, the countries have so far not been successful in negotiating a legally-binding instrument. The conclusion of New START renewed interest in the topic, and a number of proposals for reductions and confidence-building measures have been put forward.²⁰

One idea was advanced in 2011 by Russia's foreign minister Sergey Lavrov, who, in discussing prospects for cuts of tactical nuclear weapons, advocated for the "withdrawal of these weapons to the territory of the State to which they belong as well as removal of the infrastructure for their deployment abroad should be regarded as a first step towards the resolution of this problem."²¹

Meanwhile, NATO's Deterrence and Defence Posture Review (DDPR), adopted at the 2012 summit in Chicago, opens the door to reductions given "reciprocal steps by Russia." No further details or criteria were spelled out in the DDPR, although alliance members reportedly agreed to task appropriate committees to study what the reciprocal steps by Russia could be.²²

¹⁸ Stephen G. Rademaker, Assistant Secretary of State for Arms Control, US Department of State, Press Roundtable at Interfax, 6 October 2004, <https://2001-2009.state.gov/t/isn/rls/rm/37275.htm>.

¹⁹ US Senate, "New START Treaty: Resolution Of Advice And Consent To Ratification", 22 December 2010.

²⁰ A comprehensive list of ideas since 2000 was compiled and discussed by Anne Finger and Oliver Meier in "Confidence-building on tactical nuclear weapons: What's on the table?", *Hamburger Beiträge zur Friedensforschung und Sicherheitspolitik*, No. 160, May 2013, <https://ifsh.de/file-IFSH/IFSH/pdf/Publikationen/hb%20160.pdf>.

²¹ Statement by H.E. Mr. Sergey Lavrov, Minister of Foreign Affairs of the Russian Federation, at the Plenary Meeting of the Conference on Disarmament, 1 March 2011, [http://www.unog.ch/80256EDD006B8954/\(httpAssets\)/F2C753C466AD602DC1257846005C3761/\\$file/1211RussianFederation.pdf](http://www.unog.ch/80256EDD006B8954/(httpAssets)/F2C753C466AD602DC1257846005C3761/$file/1211RussianFederation.pdf).

²² NATO, "Deterrence and Defence Posture Review", 20 May 2012, http://www.nato.int/cps/en/natohq/official_texts_87597.htm.

Additionally, a year earlier, a group of NATO members advocated for gradual information sharing between the NATO and Russia of numbers, locations, operational status, command arrangements, and security of non-strategic weapons, suggesting that both sides consider an exchange of visits by military officials.²³

A number of ideas have also been floated by non-governmental experts in Europe, Russia, and the United States. A common thread through many of them is an emphasis on confidence-building measures and data exchanges as main pillars. But some of the data exchanges proposed are quite detailed, such as locations of component parts of dismantled warheads.²⁴ Some of these proposals include a verification component with a degree of intrusiveness, others rely primarily on national technical means, and still others do not include a verification component at all. There are even proposals would codify the PNIs into legally-binding commitments, or at least seek to operationalize the initiatives by providing for the verification of data exchanges resulting from PNI implementation activities.²⁵

Another approach that has garnered some attention and support is the adoption of a single limit, or common ceiling, for all nuclear weapons, including both strategic and tactical.²⁶ Under this approach, each party would be free to determine the relative mix of strategic and non-strategic weapons in its arsenal. Implementation of this proposal, however, would require accounting for active strategic and non-strategic warheads, data exchange, and probably access to warhead storage facilities. This, of course, has been a serious obstacle in the past.

In a 2007 study on the possible elimination of tactical nuclear weapons, Rose Gottemoeller—now deputy secretary-general of NATO—articulated a number of potential approaches to control of non-strategic nuclear weapons. These included further unilateral steps by Russia and NATO countries in the mould of the PNIs, with NATO withdrawing all weapons back to the United States and Russia having the opportunity to visit the bases to check that the nuclear activities at those sites had ceased. Gottemoeller also advanced the idea of a ban on operational deployment of tactical nuclear weapons and withdrawal of warheads to central storage facilities.²⁷ This paper builds on the approach articulated by

²³ “Non-paper submitted by Poland, Norway, Germany and the Netherlands on increasing transparency and confidence with regard to tactical nuclear weapons in Europe.” Also supported by Belgium, the Czech Republic, Hungary, Iceland, Luxembourg, and Slovenia”, Berlin, 14 April 2011.
<http://www.fas.org/programs/ssp/nukes/nuclearweapons/nato-nonpaper041411.pdf>.

²⁴ Alexei Arbatov, “A Russian Perspective on the Challenge of US, NATO, and Russian Non-Strategic Nuclear Weapons” in Steve Andreasen and Isabelle Williams (eds), *Reducing Nuclear Risks in Europe: A Framework for Action*, Nuclear Threat Initiative,
http://www.nti.org/media/pdfs/NTI_Framework_full_report.pdf?_id=1322694001, p. 169.

²⁵ See Anne Finger and Oliver Meier, “Confidence-building on tactical nuclear weapons: What’s on the table?”

²⁶ “Beyond New START. Advancing U.S. National Security through Arms Control with Russia”, James M. Acton and Michael S. Gerson (eds), September 2011, https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/110824_Acton_BeyondNewSTART_WEB.pdf, pp. 15–6.

²⁷ Rose Gottemoeller, “Eliminating Short-Range Nuclear Weapons Designed To Be Forward Deployed” in *Reykjavik Revisited: Steps Toward a World Free of Nuclear Weapons*, Complete Report of the 2007

Gottemoeller and others to propose a framework under which tactical nuclear weapons would remain non-deployed during peacetime in a verifiable way.²⁸ If adopted, this measure would pave the way towards eventual reductions and the elimination of tactical nuclear weapons in Europe.

The zero-deployed-weapons proposal

In current operational practice, neither US nor Russian non-strategic nuclear weapons are operationally deployed in the sense this term is understood in the context of New START. Unlike earlier arms control treaties, New START accounts for warheads that are mated to delivery systems and provides procedures for verifying each party's number of deployed warheads.²⁹ Since non-strategic nuclear weapons are not mated to their delivery systems, it should be possible to create an arrangement that would allow to maintain the non-deployed status of non-strategic weapons in a transparent and verifiable way. In effect, this proposal would codify the existing operational reality.

The core of the zero-deployed arrangement would be a transfer of nuclear warheads associated with non-strategic delivery systems to a small number of storage facilities. Once the warheads are removed from the bases near operational units, it should be possible to develop verification procedures that would confirm the absence of deployed warheads at those bases.

This arrangement proposed here is different from most arrangements that have been discussed in the past. First, the arrangement we propose does not require disclosure of data on the number of warheads, a serious stumbling block for all past attempts to reach an agreement on non-strategic weapons. Second, because all warheads would remain in storage, the number of deployed warheads for both sides would be zero. This is similar to the practice under New START, which, while accounting for deployed weapons, does not place limits on the number of warheads in reserve. In fact, as a matter of policy, the United States maintains a reserve capability known as "hedge" or, informally, "upload potential". Russia has a much smaller upload potential, but it has taken steps to increase it. The existence of upload potential has been known for decades, but it did not prevent the United States and Russia from concluding New START. At least initially, a similar approach can be taken for non-strategic weapons. Third and finally, implementation of this proposal

Hoover Institution Conference, pp. 107–54,

http://media.hoover.org/sites/default/files/documents/9780817949211_ch3.pdf.

²⁸ APS–CSIS, "U.S.-Russian Nuclear Reductions After New START: Summary of a Workshop Exploring Next Steps", June 2013, <https://www.aps.org/policy/reports/popa-reports/us-russia.cfm>; Pavel Podvig, "What to Do about Tactical Nuclear Weapons", *Bulletin of the Atomic Scientists*, 25 February 2010, <http://thebulletin.org/what-do-about-tactical-nuclear-weapons>.

²⁹ Earlier treaties, such as START, relied on counting rules, which assumed that each launcher carries a certain number of warheads regardless of the actual warhead load. New START maintained that practice for strategic bombers—each bomber accounts for one warhead against the limit of 1550 operationally deployed warheads. ICBMs and SLBMs are accounted according to the actual number of warheads they carry.

does not require access to sensitive facilities that store or service nuclear weapons. Since all verification activities are conducted to confirm the *absence* of nuclear weapons, this arrangement includes a range of tools and procedures that would otherwise not be accepted by either party if the inspections required access to facilities with nuclear weapons.

The zero-deployed arrangement would be compatible with a number of other proposed measures. Indeed, the zero-deployed arrangement is in line with Russia's call for a consolidation of weapons at central storage facilities and would help verify such an agreement. Russia suggested that the storage facilities should be located on national territories, but this is a political issue that should be resolved through negotiations and compromise. From the point of view of practical implementation of the zero-deployed arrangement, the location of storage sites is not particularly important. Similarly, a transfer of weapons to central storage would be functionally equivalent to their withdrawal from the NATO–Russia border, which was an element of a number of proposals originating from NATO. The verification procedures of the zero-deployed arrangement can draw on the set of procedures that were developed for START and New START.

It should also be emphasized that although the zero-deployed arrangement does not address the numerical parity and does not include provisions for the elimination of non-strategic weapons, the proposal would not preclude any efforts to address these issues further down the road. In fact, the zero-deployment proposal provides verifiable assurances of the absence of deployed non-strategic nuclear weapons, which will both improve security and stability and facilitate nuclear disarmament.

The following sections describe the current practices of non-strategic nuclear weapons storage and management in Russia and at NATO bases hosting US nuclear weapons. The description, based on open source research, serves as the basis to outline practical steps toward consolidation of non-strategic weapons, possible verification provisions, and potential steps to further strengthen the zero-deployed regime.

Practical implementation

Current status of nuclear-weapon storage in Russia

The Russian Federation has a variety of non-strategic delivery systems that are believed to be nuclear capable. These include bombers, short-range ballistic and cruise missiles used by ground forces, air-defence systems, cruise missiles and torpedoes used by the navy, and weapons of the naval aviation and coastal defence. Nuclear-capable delivery systems can be found in all services of the Russian armed forces. The custody of nuclear weapons, however, is currently consolidated under the 12th Main Directorate of the Ministry of Defence (also known as 12th GUMO). Units of the 12th Main Directorate receive nuclear weapons from an assembly plant and are responsible for storage, service, maintenance, and delivery of those weapons to combat units. The only time the custody of a nuclear

weapon is transferred to another agency is when it is mounted on the delivery system that assumes combat duty.³⁰

In practice, the only weapon systems that are on combat duty with nuclear weapons are the intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs). Strategic bombers that are counted as nuclear launchers in New START do not patrol with nuclear weapons on board, so the warheads that are assigned to them do not leave the custody of the 12th GUMO.

Weapons assigned to non-strategic systems are also consolidated in storage facilities managed by the 12th Directorate. In 2007, the head of the 12th Directorate confirmed that the only deployed weapons are those on ICBMs and SLBMs. He also stated that no nuclear weapons are deployed on non-strategic submarines or surface ships.³¹ Since then, Russia has repeatedly stated that all its non-strategic weapons have been consolidated in central storage facilities. According to recent official statements, this deployment practice has not changed since 2007 (with the possible exception of long-range sea-launched cruise missiles, which Russia never formally considered non-strategic).³²

The storage facilities that are operated by the 12th Main Directorate fall into two categories. In the top category are twelve central or national-level sites, also known as “Object S” sites. These are believed to be the central facilities referred to in the official statements regarding consolidation of non-strategic weapons. If so, these sites hold all non-strategic nuclear weapons.

Figure 1 shows the locations of the currently operational national-level storage facilities. Additional information about the sites and the military units associated with them is listed in Appendix A.³³ In addition to the unit that services the storage, most national-level sites have a mobile unit that can support delivery of weapons to combat units.

³⁰ The description of the weapon storage and deployment procedures is partially based on information in the semi-official history of the 12th Main Directorate. See *Рожденные атомной эрой. История создания и развития 12 Главного Управления Министерства Обороны Российской Федерации. т. 1*. Москва: Наука, 2007.

³¹ “Дежурство у ядерной кнопки. Военные гарантируют безопасность на российских атомных объектах,” *Российская газета*, 4 September 2007, <https://rg.ru/2007/09/04/orujie.html>.

³² See, for example, Statement by Mikhail I. Uliyanov, Acting Head of the Delegation of the Russian Federation at the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Cluster 1: nuclear disarmament, 1 May 2015, http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/npt/revcon2015/statements/1May_Russia.pdf; *Рожденные атомной эрой*, p. 289.

³³ Appendix A also contains a description of the methodology used to identify the active nuclear storage facilities.

Figure 1. National-level nuclear weapon storage facilities in Russia



In addition to the national-level sites, the Russian Federation is believed to maintain 34 base-level storage facilities, some of which are affiliated with operational bases.³⁴ In the past, most of the units at operational bases were assigned to individual services, such as the Air Force or the Strategic Rocket Forces, but since 2009 they have all been subordinated to the 12th GUMO.³⁵ Each base-level facility is affiliated with a national-level facility, which is probably responsible for providing nuclear weapons when deemed necessary. This affiliation is territorial, but base-level facilities are in some cases located as far as several hundred kilometres away from its parent site.

National-level facilities apparently store both strategic and non-strategic weapons. Most of them handle weapons from different services. For example, the Vologda-20 national-level storage site has five base-level sites affiliated with it (see Figure 2). Two of these are Rocket Forces divisions with Topol/SS-25 missiles, two facilities are affiliated with air bases (and maybe with air defence units), and one is the storage site in Kaliningrad region that is apparently responsible for servicing all units that are deployed there. The example of the Kaliningrad site suggests that at least some base-level facilities have the capability to support operations across different services (in this case, naval aviation, coastal defence, and short-range ballistic missiles). However, the base-level facilities of the Strategic Rocket Forces are an exception, as each of them only services the missile division it is assigned to.

Almost all base-level 12th GUMO units have storage facilities to which they are assigned. Although these are normally much smaller than national-level storage facilities, they seem to be capable of storing nuclear weapons for a considerable period of time and of providing them with adequate security and maintenance.

The role of base-level facilities can be illustrated by the way in which they are believed to handle the deployment of strategic weapons. When a missile division of the Strategic Rocket Forces is prepared for deployment of a new ICBM, the base-level unit receives the warheads from its “parent” national-level facility. When the missile is loaded into a silo or on a mobile launcher, the 12th GUMO crew installs the warheads and then turns the missile over to the Rocket Forces. It is likely that when a missile is taken off duty for maintenance, its warheads are stored at the base-level facility for the period of the maintenance. The 12th GUMO unit is also responsible for regular maintenance and check-ups of the warheads deployed to the missile division. The procedure for SLBMs would be similar in that the base-level unit would receive the warheads from the national-level facility and then install them on a missile before it is loaded onto a submarine.

The weapons assigned to strategic long-range bombers are probably stored at the base-level facility affiliated with the bomber base. This would correspond to the highest degree of readiness for the bombers that do not go on patrol with nuclear weapons. Even in this case, nuclear warheads of air-launched cruise missiles (ALCMs) would be stored separately

³⁴ More accurately, there are 34 military units of the 12th GUMO that have duties related to handling nuclear weapons. The Russian term for base-level storage facilities is “voyskovaya basa khraneniya”. See “Гаранты ядерного щита,” Красная звезда, 3 September 2012, <http://www.redstar.ru/index.php/component/k2/item/4428-garantyi-yadernogo-schita>.

³⁵ Ibid.

from the missiles. The 12th GUMO unit would be responsible for attaching warheads to missiles and delivering them to the aircraft. It should be noted that the warhead storage site can be located at a distance of several kilometres from the air base, so it is likely that the 12th GUMO crews bring the warheads to the airbase, where ALCMs are stored, and warheads mated to missiles. Gravity bombs, however, would not require assembly.

Figure 2. Vologda-20 national-level storage site and associated base-level storage facilities



The sequence for non-strategic weapons is likely somewhat different. Nuclear weapons that are assigned to a certain operational unit would normally be stored at the national-level facility. During a so-called “threatening period” these weapons would be transferred to the base-level facility, which could store the weapons in anticipation of further

instructions.³⁶ It appears that, during a “threatening period”, nuclear weapons could also be delivered from a central storage site directly to the operational units and immediately mated to delivery vehicles. The latter, however, would be an option reserved for a genuine crisis. Transfer to a base-level storage would likely take place in circumstances short of an open crisis, for example as a way of signalling. Russia is known to test these deployment procedures. One exercise of this kind, which reportedly involved the transfer of nuclear weapons from national-level to base-level facilities, was conducted in February 2013.³⁷

During a “threatening period”, mobile units, which are affiliated with all but two national-level storage sites, can transport nuclear weapons by trucks (and maybe by rail or air) to the destination, arm the delivery systems “in the field”, and provide the necessary service and maintenance. This kind of arrangement, however, almost certainly would not be viable in situations requiring sustained deployment.

Current status of non-strategic weapon management in the United States/NATO

In contrast to the wide variety of warheads and delivery systems employed by the Russian Federation, US tactical nuclear weapons at NATO air bases are limited to two variants of the same air-delivered gravity bomb, the B61. Weapons at NATO air bases are stored in underground vaults, known as Weapons Storage Vaults (WSV), under aircraft bays. The vaults are located inside individual Protective Aircraft Shelters (PAS) or Hardened Aircraft Shelters (HAS) as they were called in early documents.³⁸ Each WSV can store up to four nuclear weapons. According to the US Air Force, dispersing the weapons and co-locating them with the aircraft “enhances survivability, safety, security, and operational availability while reducing the overall intelligence signature.”³⁹

Figure 3 shows the locations of bases across NATO member states that are believed to host nuclear weapons. The remaining US non-strategic warheads (an estimated 300) are believed to be stored at the Kirtland Underground Munitions Storage Complex in New Mexico.⁴⁰ This facility could be considered analogous to a national-level central storage site in Russia.

³⁶ See, for example, *Рожденные атомной эрой*, pp. 204-205.

³⁷ Bill Gertz, “Russians Conduct Huge Nuke Drill”, *Washington Free Beacon*, 5 March 2013, <http://freebeacon.com/national-security/russians-conduct-huge-uke-drill/>.

³⁸ US Department of Defense, “Nuclear Matters: A Practical Guide”, [Appendix C: Nuclear Weapons Effects Survivability and Testing](#), 2008. See also Otfried Nassauer, Oliver Meier, Nicola Butler, and Stephen Young, “US nuclear NATO arsenals 1996–97”, Basic Notes, British American Security Information Council, <http://www.basicint.org/sites/default/files/PUB010297.pdf>.

³⁹ US Air Force, Force Protection C2 Systems Program Office, “Weapons Storage & Security (WS3) Program” as quoted in Hans Kristensen, “U.S. Nuclear Weapons in Europe. A Review of Post-Cold War Policy, Force Levels, and War Planning”, Natural Resources Defense Council, February 2005, <http://www.nukestrat.com/pubs/EuroBombs.pdf>, p. 16.

⁴⁰ Hans M. Kristensen and Robert S. Norris, “Worldwide Deployments of Nuclear Weapons, 2014”, *Bulletin of the Atomic Scientists*, 26 August 2014, <http://www.tandfonline.com/doi/full/10.1177/0096340214547619>, p. 102.

Figure 3. Location of U.S. non-strategic nuclear weapons in NATO



Custody and control of the tactical nuclear weapons at air bases in Europe is reportedly handled by US Munitions Support Squadrons (MUNSS) at each given base.⁴¹ The MUNSS mission includes receiving, storing, maintaining, and accounting for the weapons, as well as handing over the weapons to the national NATO strike wing commander if ordered to do so by the US National Command Authority. There are four MUNSS units—one each in Belgium, Germany, Italy, and the Netherlands. Each MUNSS comprises approximately 110 personnel and all four units fall under the command of the 38th Munitions Maintenance

⁴¹ Hans M. Kristensen, “U.S. Nuclear Weapons in Europe. A Review of Post-Cold War Policy, Force Levels, and War Planning”, *Natural Resources Defense Council*, February 2005, <http://www.nukestrat.com/pubs/EuroBombs.pdf>.

Group (MMG) at Spangdahlem Air Base in Germany.⁴² There is no MUNSS unit at the Aviano Air Base in Italy, where, instead, nuclear weapons are under the custody of a US Air Force fighter wing. No MUNSS unit and no US fighter wing is currently assigned to Turkey's Incirlik Air Base, where Turkish pilots are reportedly no longer certified to carry out nuclear strike missions.⁴³ Instead, US aircraft from other bases would reportedly first need to fly into the base to load the weapons. Turkish aircraft have, however, been participating in recent exercises as non-nuclear escort aircraft.⁴⁴ The arrangement at Incirlik is probably closest to the scenario envisioned under the zero-deployment proposal.

According to open sources, a series of bilateral and multilateral agreements between the United States and the respective host countries spell out the command and procedures for handling nuclear weapons. Bilateral stockpile agreements establish provisions for the introduction, storage, custody, security, safety, and release of nuclear weapons, as well as cost sharing. These provisions are implemented through technical agreements between the air forces of the United States and the host country, defining joint and individual responsibilities. An additional cooperation agreement provides for exchanges of sensitive information. Finally, the use by NATO forces of the territory of a third-nation is regulated through so-called third party stockpile agreements.⁴⁵

The United States has agreements in place with the Belgian, Dutch, German, and Italian forces to conduct nuclear strike missions with US weapons. US Air Force personnel maintains control of the weapons until their use is authorized by the US president and approved by NATO in case of war.⁴⁶

Since 1991, on-site maintenance and repair of the warheads on European soil has been carried out aboard "weapons maintenance trucks" (WMTs) by US teams. A WMT performs the maintenance and repair activities inside the aircraft shelters and the warheads are disassembled either aboard the truck or next to it, inside the protective shelter. In 2011, the US Air Force launched a programme that will replace the WMT with the Sandia

⁴² *Reykjavik Revisited: Steps Toward a World Free of Nuclear Weapons*, Complete Report of the 2007 Hoover Institution Conference. See also, 38th Munitions Maintenance Group, USAF Orders of Battle, <http://usafunithistory.com/PDF/30-49/38%20MUNITIONS%20MAINT%20GP.pdf>.

⁴³ Aaron Stein, "Turkey's Airplane-less Nuclear Weapons: A Classic Crisis Stability Problem? (Updated)", *Turkey Wonk: Nuclear and Political Musings in Turkey and Beyond*, 15 April 2014, <https://turkeywonk.wordpress.com/2014/04/15/turkeys-airplane-less-nuclear-weapons-a-classic-crisis-stability-problem/>.

⁴⁴ Robert S. Norris and Hans M. Kristensen, "US tactical nuclear weapons in Europe, 2011", *Bulletin of the Atomic Scientists*, 1 January 2011, <http://www.tandfonline.com/doi/pdf/10.1177/0096340210393931?needAccess=true>; Mustafa Kibaroglu, "Turkey, NATO & Nuclear Sharing: Prospects after NATO's Lisbon Summit," BASIC, Nuclear Policy Paper No. 5, April 2011, http://www.basicint.org/sites/default/files/Nuclear_Policy_Paper_No5.pdf, p. 2.

⁴⁵ Hans M. Kristensen, "U.S. Nuclear Weapons in Europe. A Review of Post-Cold War Policy, Force Levels, and War Planning", *Natural Resources Defense Council*, February 2005, <http://www.nukestrat.com/pubs/EuroBombs.pdf>.

⁴⁶ Hans M. Kristensen and Robert S. Norris, "United States Nuclear Forces, 2017", *Bulletin of the Atomic Scientists*, vol. 73, no. 1, 2016, <http://www.tandfonline.com/doi/full/10.1080/00963402.2016.1264213>, pp. 48–57.

National Laboratory-developed “Secure Transportable Maintenance System” (STMS). STMS will consist of a 36-foot trailer with weapon-handling gear and a host of other security and safety features.⁴⁷

Practical implementation

The zero-deployed non-strategic weapons proposal aims to make sure that no non-strategic nuclear weapons are deployed on a day-to-day basis. To achieve this, the United States and the Russian Federation should agree to withdraw all their weapons into central storage facilities. They would also agree on verification measures that would allow inspectors or others to confirm that no non-strategic nuclear weapons are located at bases outside the agreed central storage sites. On the proposal, the verification arrangements would initially apply to the European continent, i.e. all NATO bases as well as Russian facilities located west of the Urals. While it would be possible to extend the arrangement to bases in Russia’s Far East, such an extension would likely raise political and verification hurdles.

We suggest that Russia withdraws all its non-strategic nuclear weapons to the twelve national-level storage facilities that were described earlier. For US non-strategic weapons in Europe, the choice would be more difficult since NATO does not maintain a similar central storage system. From a technical standpoint, transferring the weapons to the Kirtland Storage Complex in the United States could be a viable option. However, such a move may be politically controversial within NATO and probably in the United States as well.

An alternative would be to make modifications at one or more bases in Europe that already have the necessary support infrastructure to service and store nuclear warheads long term. The weapons could be stored in bunkers away from airfields, as opposed to the current practice of storage under aircraft bays. While the vault system was introduced in the late 1980s for the purpose of, among other things, increasing the safety and security of the warheads, it can be argued that moving weapons to a central storage site (or sites) would not negatively impact this goal. In fact, Aviano and Incirlik bases have reportedly been undergoing security upgrades, indicating that the current system requires improvement.⁴⁸ Security incidents at bases in Belgium and the Netherlands in 2010 and

⁴⁷ The trailer will accommodate 11–13 individuals, with teams composed of 5–9 US Air Force maintainers and an additional 4–6 observers and evaluators. See US Air Force, “Briefing for Industry Solicitation #: FA9422-12-R-0001 Secure Transportable Maintenance System (STMS)”, 20 September 2011, <http://www.defenseinnovationmarketplace.mil/resources/USAF%202011%209%2020%20STMS%20Industry%20Day.pdf>. STMS was scheduled to be rolled out in 2014, but a Department of Defense task force documented delays in the project. See US Department of Defense, “Defense Science Board Permanent Task Force on Nuclear Weapons Surety”, Air Force Nuclear Enterprise Follow-On Review, April 2013, http://www.acq.osd.mil/dsb/reports/AFNucEnt_FollowOnRvw.pdf, p. 17.

⁴⁸ Hans M. Kristensen, “Upgrades At US Nuclear Bases In Europe Acknowledge Security Risk”, *FAS Blog*, 10 September 2015, <https://fas.org/blogs/security/2015/09/nuclear-insecurity/>.

2014 also suggest that security at these facilities can be improved.⁴⁹ Furthermore, the bunker storage system is reportedly still in use at all bases within the United States.

Because the zero-deployment proposal does not impose a ban on non-strategic nuclear weapons per se, parties would retain the right to occasionally deploy their weapons, for example, for exercises or, indeed, in a crisis. The aim of the proposal is to create confidence that the weapons are not deployed on a day-to-day basis. In this vein, the agreement would include provisions that establish notification procedures for the deployment of weapons for exercises. Also, each party would retain the right and capability to suspend this arrangement and deploy weapons during a crisis. These procedures would be analogous to the ones described in START, allowing exercises and operational dispersals after an appropriate notification.

Verification measures to implement the zero-deployment of non-strategic nuclear weapons

It is important to emphasize that since the objective of verification activities under this agreement is to confirm the absence of nuclear weapons rather than to verify the number of deployed weapons or weapons in storage, or to certify reductions of nuclear arsenals, the verification procedures would be relatively simple. These would include an initial data exchange, routine inspections, and non-routine or special inspections.

Initial data exchange and establishing the baseline

The goal of the initial data exchange is to come to an understanding about which facilities may store nuclear weapons and which may not. “Category 1 facilities” would cover central storage facilities cleared to store nuclear weapons. These sites could be used to store nuclear weapons and would therefore not be available for inspection activities. Information about these sites would be limited to the coordinates and outlines of the perimeter of the site. Category 1 could also include other sites in addition to central storage facilities. For example, in Russia it might include base-level storage facilities that service missile divisions of the Strategic Rocket Forces. Category 1 may also include storage sites at the strategic aviation bases and the facilities that provide support to the ballistic missile submarines.

“Category 2 facilities” would be sites that the parties have agreed may not be used to store nuclear weapons under normal circumstances. Because the agreement would be implemented on the European continent, Category 2 facilities would likely include Russian base-level facilities operated by the 12th Main Directorate west of the Urals. In NATO, Category 2 would have to include air bases that have Protective Aircraft Shelters and that can be used for weapons storage. Category 2 facilities would be open to inspections and,

⁴⁹ For more on the incident at the Kleine Brogel base in Belgium, see Hans M. Kristensen, “US Nuclear Weapons Site in Europe Breached”, *FAS Blog*, 24 February 2010, <https://fas.org/blogs/security/2010/02/kleinebrogel/>. On the incident at Volkel air base in the Netherlands, see Jeffrey Lewis, “Security Lapse at Volkel”, *Arms Control Wonk*, 24 March 2014, <http://www.armscontrolwonk.com/archive/20120/volkel/>.

therefore, the data exchange would have to include, in addition to the name of the facility and its coordinates, a site diagram indicating the site's boundaries and any bunkers that have the capability to store warheads for an extended period of time (i.e. facilities that have the capability to service warheads and provide other technical maintenance).

The initial data exchange would have to be verified through baseline inspections certifying the completeness of the declarations. These inspections would give the parties an opportunity to ascertain the absence of facilities capable of storing nuclear weapons outside of the declared list. Over the course of an inspection, parties might request access to additional bases in order to establish that they do not have the ability to store nuclear weapons (such as vaults inside aircraft shelters, additional bunker areas, or equipment required to safely maintain the weapons).

Routine inspections

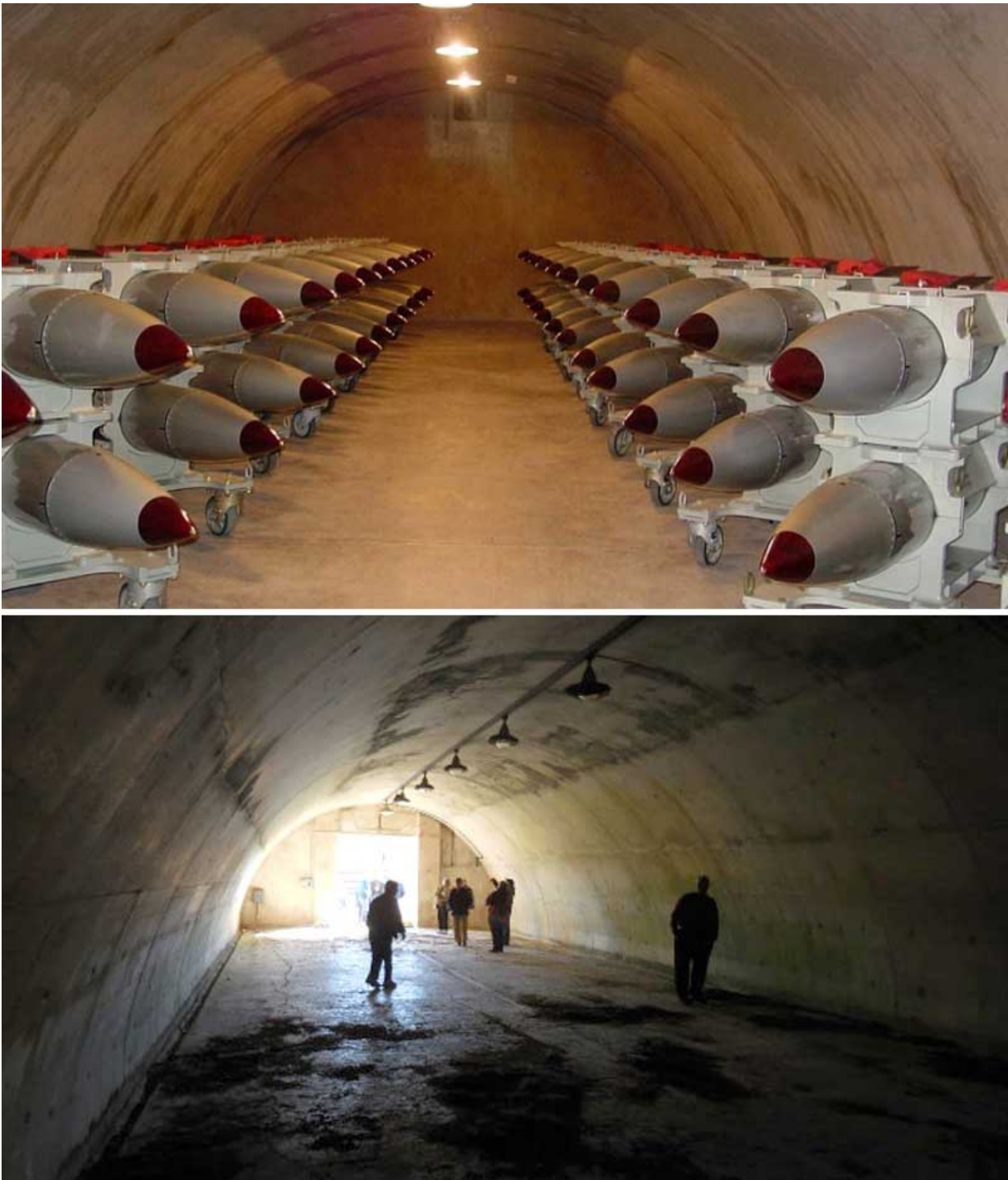
Random routine inspections would take place at Category 2 (base-level storage) facilities to verify the absence of nuclear weapons or containers that can hold nuclear weapons. The inspected party would probably implement managed access measures to protect sensitive information about the facility, but since the storage halls are supposed to be empty, the amount of sensitive information would be small (see Figure 4).

If the inspectors discover an object that they believe could potentially contain a nuclear warhead, the inspected party would be asked to certify that the object is non-nuclear. The procedure for conducting this kind of certification was included in START and New START. For example, the New START Annex on Inspections states that “the inspected Party shall have the right to use radiation detection equipment in order to demonstrate to inspectors that an object located on the front section of a deployed ICBM or deployed SLBM [or on a designated heavy bomber] and declared by a member of the in-country escort to be a non-nuclear object, is, in fact, non-nuclear.”⁵⁰

Since the zero-deployed arrangement assumes that no nuclear objects can be located at the Category 2 facilities, any object found inside the facility should be available for a demonstration of this kind.

⁵⁰ New START. Annex on Inspections, Part Five, Section VI, 1(a)-1(b).

Figure 4. An igloo-type storage facility with B-61 bombs and an empty igloo.⁵¹



⁵¹ Hans Kristensen. "Estimated Nuclear Weapons Locations 2009," November 25, 2009. <https://fas.org/blogs/security/2009/11/locations/>; Olmstead, Kathryn. "Have You Seen the Nuclear Weapons Storage Igloos in Limestone?" *The Bangor Daily News*. Accessed February 1, 2017. <http://bangordailynews.com/2015/11/05/living/tour-recalls-storage-of-nuclear-weapons-at-secret-site-in-limestone/>..

Non-routine inspections

The zero-deployed arrangement would be strengthened if it includes a procedure for requesting and conducting a certain number of non-routine (also called special or challenge) inspections outside declared facilities. Yet the bar for requesting such inspections should probably be set quite high. Non-routine inspections should only be requested in exceptional circumstances. These inspections would be similar to those conducted at the stage of initial declarations. Their purpose would be to establish the absence of facilities capable of storing nuclear weapons.

Closeout inspections

At some stage in the implementation of the agreement, parties could opt to eliminate base-level facilities altogether. Indeed, Russia has mentioned the elimination of forward-deployment infrastructure as a [first] step towards addressing tactical nuclear weapons.⁵² It should be noted, however, that dismantlement of the base-level infrastructure would not eliminate the parties' capability to deploy weapons at these bases for a short period of time. For example, weapons could be loaded on an aircraft at a location close to the central storage and the aircraft could then be deployed at virtually any airbase. However, this procedure would not work for long-term deployment, since it is likely that nuclear warheads require protection and maintenance service that cannot be provided when the warheads are aboard a plane.

The parties could disable the facilities in a number of ways, for example by removing the ventilation and maintenance equipment that service bunkers and removing other features that allow the long-term storage of warheads. The parties would notify each other that such measures have been taken. An on-site inspection would verify and certify the new status of the facilities. These procedures mirror the closeout inspections developed in prior US–Russia arms control agreements.

Potential additional measures

Because the long-term deployment of tactical nuclear weapons needs a support infrastructure for extended storage, servicing, and maintenance of warheads, verifying the absence of warheads at potential storage sites is an adequate means of reassuring both parties that tactical nuclear weapons are not operationally deployed on a day-to-day basis. Aside from inspections, national technical means would provide adequate ways to detect activities related to operational deployment, such as movements of warheads or refurbishments to storage facilities consistent with the infrastructure needs for extended storage and weapons security. Despite these adequate assurances, there are a number of additional measures the parties to the treaty could explore, either to address specific challenges such as verification of sea-launched cruise missiles, or as a means to implement

⁵² Statement by H.E. Mr. Sergey Lavrov, Minister of Foreign Affairs of the Russian Federation, at the Plenary Meeting of the Conference on Disarmament, 1 March 2011, [http://www.unog.ch/80256EDD006B8954/\(httpAssets\)/F2C753C466AD602DC1257846005C3761/\\$file/1211RussianFederation.pdf](http://www.unog.ch/80256EDD006B8954/(httpAssets)/F2C753C466AD602DC1257846005C3761/$file/1211RussianFederation.pdf).

a more ambitious arms control approach that, not only maintains the non-deployment status of the weapons, but also begins to verifiably reduce their numbers.

Inspecting launchers at nearby bases

In addition to routine inspections inside the base-level storage sites, the verification arrangement could also include the possibility of inspections of nuclear capable delivery systems located near the inspected base, such as aircraft or short-range ballistic or cruise missiles, to verify that they are not deployed with nuclear weapons. These additional measures could further increase confidence that weapons are not being brought in directly from central storage facilities to be mated to delivery vehicles, bypassing traditional deployment procedures. The inspection procedure that would be followed in this case could be modelled on the New START Type One inspection procedures that seek to verify the number of deployed warheads.⁵³ The key difference is that under New START all warheads installed on ICBMs or SLBMs are counted against the treaty limit, regardless of whether they are nuclear or not. For the zero-deployed non-strategic weapons arrangement it would be important to confirm the non-nuclear nature of the warheads that are installed on any inspected delivery system. This would be also be done through procedures based on New START measures.

Accounting for nuclear-capable launchers

One option for constraining the number of non-strategic weapons that can be deployed, would be to use the approach of START and New START in limiting the number of launchers or delivery systems that can carry nuclear warheads. These procedures could be applied in this context to put a cap on the number of nuclear-capable delivery systems and initiate reductions in the overall number of warheads. With non-strategic delivery systems, this task would be more difficult than for strategic ones, primarily because of the large number of potentially nuclear capable launchers and the fact that almost all of them can be used with conventional payloads. It is reasonable to assume that neither side would want to limit its conventional capabilities.

The experience of START and New START suggests that it may be possible to establish a procedure for distinguishing nuclear and non-nuclear delivery systems. Specifically, the treaties include procedures for converting heavy bombers to conventional-only capability. After conversion, the bombers would no longer be counted against the treaty limit. The United States took advantage of this provision and converted its entire fleet of B-1B heavy bombers. The two-step conversion process, which was completed in March 2011, involved the removal of the aircraft's arming and fusing equipment. According to the US Air Force, a metal sleeve was first welded into the aft attachment points of the aircraft's pylon attachments to prevent the installation of cruise missile pylons. In the second phase, capable connectors for nuclear weapons were removed from the weapons bays to prevent the pre-arm signal from reaching the weapons.⁵⁴ Also, the United States had a plan to

⁵³ New START, Annex on Inspections, Part Six.

⁵⁴ United States Air Force, Fact Sheets: B-1B Lancer, 16 December 2015, <http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104500/b-1b-lancer.aspx>.

convert some of its B-52H bombers to non-nuclear configuration. After conversion, these bombers would not be counted against the New START limit of strategic launchers. Similarly, the United States and Russia could certify that some of their aircraft or short-range ballistic or cruise missiles are not capable of carrying nuclear payloads.⁵⁵

Addressing submarine-launched cruise missiles

The United States has retired its nuclear sea-launched cruise missile (SLCM), the TLAM/N.⁵⁶ This unilateral move implemented one of the policies articulated by President Obama's administration in the 2010 Nuclear Posture Review.⁵⁷ Furthermore, a 2012 report by the US Department of Energy indicates that the entire stockpile of W80-0 warheads belonging to the TLAM/N has been dismantled.⁵⁸

For its part, under the PNIs, Moscow pledged to remove all tactical nuclear weapons from its surface ships and multipurpose submarines and to eliminate a third of its sea-based non-strategic arsenal.⁵⁹ Russia, however, has not formally confirmed that this pledge covers long-range submarine-based cruise missiles. According to a long-standing Soviet and Russian position, these weapons should be classified as strategic. In practice, evidence suggests that Russia did remove nuclear SLCMs from its submarines.⁶⁰ Nevertheless, some Russian submarines and surface ships appear to have the capability to carry nuclear SLCMs.

For decades, experts and government officials have discussed the challenges of verifying reductions of submarine-launched cruise missiles. These obstacles arise from a number of unique factors, namely the inherent difficulties of differentiating nuclear and non-nuclear SLCMs, counting deployed SLCMs, and detecting conversion of non-nuclear to nuclear status.⁶¹ Today, all of these challenges remain, especially as many states, including Russia and the United States, deploy SLCMs in large numbers. The zero-deployed arrangement

⁵⁵ Pavel Podvig, "New START and non-strategic nuclear weapons," in *U.S.-Russian Nuclear Reductions After New START: Summary of a Workshop Exploring Next Steps*, APS-CSIS, June 2013, <http://www.aps.org/policy/reports/popa-reports/upload/nuclear-reductions.pdf>.

⁵⁶ Hans Kristensen, "US Navy Instruction Confirms Retirement of Nuclear Tomahawk Cruise Missile", *FAS Blog*, 18 March 2013, <https://fas.org/blogs/security/2013/03/tomahawk/>.

⁵⁷ US Department of Defense, "Nuclear Posture Review Report", April 2010, https://www.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf, p. 28.

⁵⁸ B&W Pantex, "Pantex FY 2012 Performance Review", available at https://nukewatch.org/importantdocs/resources/Pantex_Final_FY12_PER.PDF, p. 24

⁵⁹ The text of the PNIs is available at http://ndupress.ndu.edu/Portals/68/Documents/casestudies/CSWMD_CaseStudy-5.pdf.

⁶⁰ For a discussion, see Pavel Podvig, "No, Russian submarines do not carry tactical nuclear weapons", *Russian Strategic Nuclear Forces*, 25 September 2006, http://russianforces.org/blog/2006/09/no_russian_submarines_do_not_c.shtml; Pavel Podvig, "Do Russian attack submarines carry nuclear weapons?", *Russian Strategic Nuclear Forces*, 15 September 2006, http://russianforces.org/blog/2006/09/do_russian_attack_submarines_c.shtml.

⁶¹ S. Drell et al., "Verification Technology: Unclassified Version, The MITRE Corporation, 15 October 1990, <https://fas.org/irp/agency/dod/jason/verif.pdf>, p.37.

would have to provide a mechanism that would ensure that no nuclear SLCMs are deployed on submarines or surface ships at any given time.

One step in that direction would be a resumption of the formal data exchange on nuclear SLCMs that was included in START but not in New START.⁶² Under a politically-binding declaration in conjunction with (but outside) START, the United States and Russia pledged to deploy no more than 880 nuclear SLCMs and to declare the number of deployed nuclear SLCM in an annual data exchange.⁶³ Although this agreement never included verification provisions, it is believed that the United States and Russia did not deploy nuclear SLCMs on their submarines when START was in force. Under the zero-deployment arrangement, the number of nuclear SLCMs that the parties would be allowed to deploy would be zero and the data exchange would reflect that status.

Verifying the absence of warheads at base-level storage facilities could provide further assurances of non-deployment of nuclear SLCMs. These assurances would be even stronger if in addition to a visit to a storage facility at a base, the arrangements could allow inspections of submarines and surface ships present at a base when the inspecting team arrives. Procedures similar to those in New START could be employed, through which the inspecting party would select the base for inspection and designate the submarine (or surface ship) and the individual launcher to be inspected. In this case, the inspection would certify that no nuclear warhead is installed on the SLCM selected for an inspection.⁶⁴ Radiation detection equipment could be employed to detect the absence of nuclear material.

A roadmap for addressing tactical nuclear weapons

For decades, the United States and the Russian Federation (and before it the Soviet Union) have acknowledged the immense security benefits of nuclear arms control. With the Intermediate Range Nuclear Forces Treaty, both countries eliminated an entire class of weapons. Thousands of warheads have been removed from service under the START and New START accords. Despite these significant reductions in their strategic nuclear arsenals, however, both countries have been slow to include non-strategic nuclear weapons in the arms control process. Rather than negotiating, Moscow and Washington have carried out unilateral reductions and adopted an informal policy of non-deployment.

⁶² Jeffrey Lewis, "Russia and the United States should resume data exchanges on nuclear armed sea-launched cruise missiles" in James M. Acton (ed.), *Beyond Treaties: Immediate Steps to Reduce Nuclear Dangers*, Carnegie Endowment for International Peace, October 2012, http://carnegieendowment.org/files/beyond_treaties.pdf, pp. 4–5.

⁶³ Declaration of the United States of America Concerning its Policy Regarding Nuclear Sea-Launched Cruise Missiles and Declaration of the Union of Soviet Socialist Republics Concerning its Policy Regarding Nuclear Sea-Launched Cruise Missiles, 31 July 1991, <https://www.state.gov/www/global/arms/starhtml/start/declsts.html#sealaunchedALCMs>.

⁶⁴ New Strategic Arms Reduction Treaty (New START), Article XI, <https://www.state.gov/documents/organization/140035.pdf>. Detailed procedures are explained in Part Five, Section VI, as well as Part Nine, Second Agreed Statement, of the Protocol to the treaty, <https://www.state.gov/documents/organization/140047.pdf>.

This paper has presented a blueprint to codify current operational practices, lower the risks of uncertainty and miscalculation, improve crisis stability and overall security, and establish a framework for future verifiable reductions of non-strategic nuclear weapons based on the tools developed over five decades of arms control between Russia and the United States. If adopted, this proposal would provide reasonable assurances that both US and Russian non-strategic nuclear weapons remain non-deployed during peacetime. As both countries move towards deeper reductions in their nuclear arsenals, the consolidation of tactical nuclear weapons into central storage sites lays important groundwork for their elimination at a future stage.

The zero-deployed proposal does not ignore that the current state of US–Russia relations may prevent further bilateral engagement in arms control. At the same time, the proposal’s implementation does not require the parties to sit at a negotiating table and work through all the complex issues involved in crafting an arms control regime initially. Instead, a gradual approach would be both politically feasible and rewarding, demonstrating the parties’ commitment to greater stability and security while, and showing concrete progress towards addressing the risks posed by these weapons.

First, both sides could make political declarations reaffirming their commitment to the current status of non-deployment and their intent to work towards a lasting and legally-binding framework. The Russian Federation would confirm that all of its nuclear weapons have been consolidated at central storage facilities. The United States would recognize that increasing the deployment threshold for weapons assigned to NATO air bases will require changes to current storage practices.

Second, both sides could then operationalize the political declarations via voluntary visits to sites where weapons are no longer stored but that are in good enough condition to provide an accurate picture of the type of facilities that would be verified if an agreement were to be reached. These invitations would give Russia and the United States an opportunity to test the verification procedures proposed in this paper and to work out any necessary additional measures. This collaboration would strengthen confidence in the verification regime and foster a more fruitful working relationship among the parties.

Finally, when the political conditions for negotiations are in place, both sides would formally negotiate and adopt a legally-binding agreement with detailed verification procedures. Such an arrangement could serve as a stepping stone for a more comprehensive arms control process aimed at further reductions.

While non-strategic nuclear weapons have not been used on the battlefield, such weapons continue to pose severe risks of accidental use, miscalculation, and inadvertent escalation. In peacetime, these risks undermine the security and stability of the Euro–Atlantic area. In a time of crisis, these dangers could lead to a catastrophic scenario. Ensuring that these weapons are not deployed would mitigate these risks and pave the way towards their elimination.

APPENDIX A. Nuclear weapon storage sites in Russia

At present, the Russian Federation has different types of facilities that could store or handle nuclear weapons. These are national-level, central storage facilities under the direct control of the Ministry of Defense's 12th Main Directorate (also known as 12th GUMO) and storage facilities at military bases of the various services and branches of the Russian Armed Forces. The military units that operate these base-level facilities are also subordinated to the 12th Main Directorate. Table A1 and Table A2 detail the location and military units assigned to these two storage types according to information found in open sources. Open source research also shows which bases of the various armed forces services would receive nuclear weapons from the various central storage depots (Figure A1).¹

The map on Figure A2 illustrates the geographical distribution of all of these storage facilities throughout the Russian Federation.

Additionally, during transit, warheads may be temporarily stored in warship and submarine docking areas, maintenance facilities, delivery system mating/demating 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.

¹ Our research relied on openly available information about a series of orders issued in 2009 by the Chief of General Staff of the Russian Armed Forces. These orders assigned distinct insignias to a number of military units that have been otherwise identified as being part of the 12th Main Directorate. Additional research of various open sources, such as social media accounts, online fora, and collaborative mapping platforms, corroborated this information and allowed to identify the links between units and the organizational structure shown in Figure A1. Publicly available commercial satellite imagery helped identify the locations of potential storage sites exhibiting the distinct physical features described in this appendix.

Table A1. National-level storage facilities

Name	Other names	Military unit	Mobile unit	Coordinates
Saratov-63	Object 1050, Krasnoarmeyskoye	25623	04197	51°25'28"N 46°15'35"E
Bryansk-18	Object 365, Rzhanitsa	42685	54056	53°33'39"N 33°58'17"E
Komsomolsk-na-Amure-31	Object 1201, Selikhino	52015	57381	50°17'43"N 137°28'6"E
Trekhgorny-1	Object 936, Trekhgorny	41013	24562	54°47'16"N 58°37'54"E
Lesnoy-4	Object 917, Nizhnyaya Tura	40274	-	58°36'57"N 59°38'8"E
Khabarovsk-47	Object 1200, Korfovskiy	25625	81385	48°10'58"N 135°1'35"E
Voronezh-45	Object 387, Borisoglebsk	14254	24552	51°21'47"N 41°55'38"E
Irkutsk-45	Object 644, Zalari	39995	25007	53°27'23"N 102°35'50"E
Belgorod-22	Object 1150, Golovchino	25624	-	50°33'47"N 35°44'9"E
Vologda-20	Object 957, Chebsara	25594	00494	59°5'59"N 38°36'41"E
Mozhaysk-10	Object 714	52025	06031	55°25'35"N 35°46'8"E
Olenegorsk-2	Object 956, Ramozero	62834	-	68°14'56"N 33°51'39"E

Table A2. Base-level 12th Main Directorate units and storage facilities

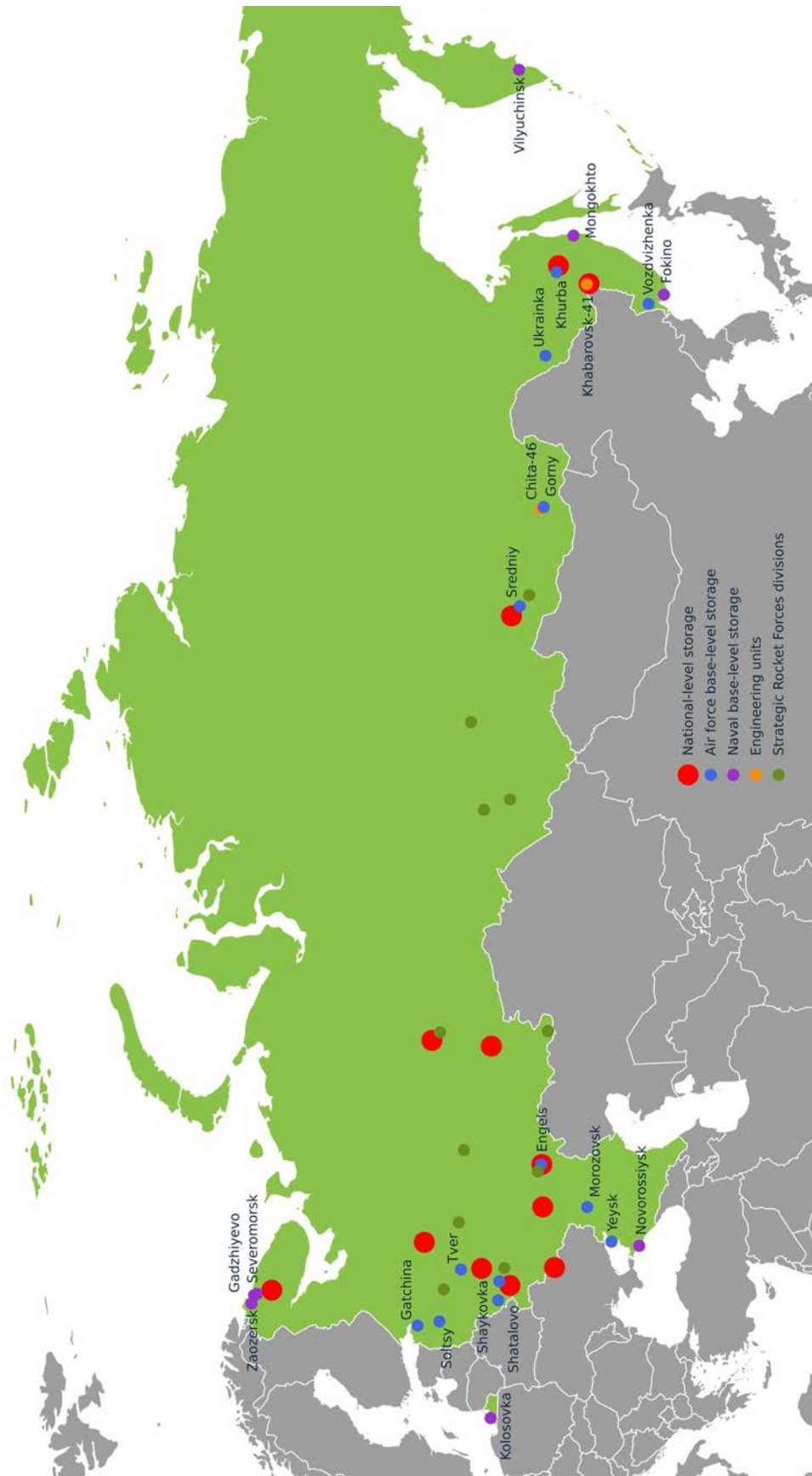
Branch	Name of base	Unit	HQ or Potential Storage Location	Comments
<i>Air Force</i>	Ukrainka	27835	51°10'36"N 128°34'37"E	Long-range aviation, Tu-95MS strategic bombers
	Gatchina	44086	59°31'20"N 29°55'6"E	Tactical aviation, possibly air defence
	Vozdvizhenka	23477	44°00'13"N 131°54'52"E	Tactical aviation
	Morozovsk	55796	48°19'11"N 41°47'35"E	Tactical aviation
	Tver	19089	56°45'40"N 35°42'18"E	Airfield not located
	Engels	77910	51°25'23"N 46°15'39"E	Long-range aviation, Tu-160, Tu-95MS strategic bombers
	Shatalovo	23476	54°19'57"N 32°27'31"E	Tactical aviation
	Sredniy	26221	52°54'11"N 103°28'39"E	Long-range aviation, Tu-22M3
	Khurba	77944	50°25'35"N 136°51'3"E	Tactical aviation
	Soltsy	75365	58°8'50"N 30°19'53"E	Long-range aviation, Tu-22M3
	Yeysk	32161	46°37'43"N 38°15'2"E	Naval aviation training centre
	Gornyy	54160	51°31'0"N 113° 1'60"E	Tactical aviation
<i>Navy</i>	Novorossiysk	52522	44°39'56"N 37°46'34"E	Black Sea Fleet
	Gadzhievo	69273	69°15'13"N 33°21'33"E	Northern Fleet, naval weapons, SLBMs
	Kolosovka	20336	54°50'12"N 20°21'11"E	Kaliningrad region
	Fokino	36199	42°53'41"N 132°33'46"E	Pacific Fleet
	Mongokhto	40689	49°15'39"N 140°12'23"E	Naval aviation, Tu-142
	Vilyuchinsk	31268	52°57'20"N 158°22'24"E	Pacific Fleet, naval weapons, SLBMs
	Zaozersk	22931	69°23'51"N 32°27'5"E	Northern Fleet, naval weapons, SLBMs
	Severomorsk	81265	69° 5'39"N 33°28'48"E	Naval aviation
<i>Strategic Rocket Forces</i>	Solnechny	25996	56° 7'0"N 92°14'60"E	R-36M2/SS-18 silo ICBMs
	Yushkar-Ola	54200	56°34'0"N 48° 4'0"E	Topol/SS-25 mobile ICBMs
	Bologoye	33787	57°52'0"N 33°40'0"E	Topol/SS-25 mobile ICBMs
	Novosibirsk	54245	55°16'0"N 83° 1'60"E	RS-24 Yars mobile ICBMs
	Sibirskiy	08326	43°54'20"N 44°41'10"E	Topol/SS-25 mobile ICBMs
	Teykovo	54175	56°53'60"N 40°35'0"E	Topol/SS-25, RS-24 Yars mobile ICBMs
	Yasny	93766	51°1'0"N 59°49'0"E	R-36M2/SS-18 silo ICBMs
	Kozelsk	44240	53°56'5.60"N 35°46'19"E	UR-100NUTTH/SS-19 and RS-24 Yars silo ICBMs

Branch	Name of base	Unit	HQ or Potential Storage Location	Comments
	Svobodny	54203	58°5'59"N 60°25' 43"E	RS-24 Yars mobile ICBMs
	Tatischchevo	68886	51°41'60"N 45°32'60"E	Topol-M/SS-27 silo ICBMs
	Irkutsk	73752	52°16'60"N 104°27'0"E	Topol/SS-25 mobile ICBMs
	Shaykovka	26219	54°15'53"N 34°25'15"E	Long-range aviation, Tu-22M3
<i>Engineering units</i>	Khabarovsk-41	23227	48°21'15"N 135°01'31"E	
	Chita-46	23233	51°31'5"N 113°2'28"E	

Figure A1. Organization of 12th Main Directorate units

	Engineering units	Air Force	Navy	Rocket Forces
Belgorod-22		Morozovsk	Novorossiysk	
Bryansk-18		Shatalovo		Kozelsk Shaykovka
Irkutsk-45		Sredniy		Solnechny Novosibirsk Sibirskiy Irkutsk
Khabarovsk-47	Khabarovsk-41 Chita-46	Gorny Vozdvizhenka		
Komsomolsk-na-Amure-31		Seryshevo Khurba	Fokino Mongokhto Vilyuchinsk	
Lesnoy-4				Svobodny
Mozhaisk-10		Tver		
Olenegorsk-2			Gadzhiyevo Severomorsk Zaozersk	
Saratov-63		Engels		Tatishchevo
Vologda-20		Gatchina Soltsy	Kolosovka	Bologoye Teykovo
Voronezh-45		Yeysk		
Zlatoust-30				Yoshkar-Ola Yasny

Figure A2. 12th Main Directorate national storage sites and base-level storage facilities



Examples of storage facilities

Once the location of 12th Directorate units has been established, satellite imagery of the various storage facilities across Russia's territory allows the identification of the potential storage facilities, national-level and base-level. Because these facilities would be expected to host nuclear weapons, a heightened level of security around them can be expected. In identifying potential storage facilities, several observables can be useful. These include:

- Overall size of the site
- Presence of covered bunkers
- Size and number of structures and bunkers within the site
- Presence of ventilators for the bunkers
- Presence of heightened security features
- Proximity of 12th Directorate military unit

National-level facilities

The image below shows the Bryansk-18 national-level storage site of the 12th Main Directorate (Figure A3). It gives a clear example of some of the indicators of nuclear weapons storage facilities in Russia. The perimeter of the site is about 9500m, which falls within the normal range for national-level sites identified in this study. Within the site, we can distinguish six areas for weapons storage, further suggested by the presence of ventilation outlets. This type of configuration is similar across sites surveyed through satellite imagery.

Base-level facilities

Base-level facilities identified through satellite imagery and open sources typically share some of the basic features identified at national-level storage sites like Bryansk-18. These features include distinct bunker areas, ventilation outlets, and heavy security with a fortified outer perimeter. This type of facility can be smaller than the national-level sites.

In many cases, a base-level site would include a bunker with two entrances, as illustrated on Figure A4, which shows the base-level facility at the Engels air force base. The drawing on Figure A5, which is based on one of the former Soviet storage facilities in Eastern Europe, shows the internal layout of such a bunker.

In most cases, the base-level storage site is located some distance away from the operational base it is assigned to. In Engels, the nuclear weapon storage is about 7 km away from the airfield (Figure A6). However, in some cases, a unit that services a base-level facility can deploy weapons at an operational base (such as airfield) as far as 100 km away from the storage site. In other cases, the storage facility can be located in the immediate vicinity of the airfield. One example is the Soltsy air base, where the storage area is connected to the airfield (Figure A7).

Although most sites were constructed during the Soviet period, satellite imagery shows that Russia has recently upgraded a number of suspected base-level storage facilities or built new ones. One example is the possible bunker at Morozovsk air base. As shown on Figure A8, the bunker that appears to be used as weapon storage was built after 2005.

Figure A3. National-level storage site at Bryansk-18



Figure A4. Base-level storage facility at Engels air base



Figure A5. Schematic of the inside of a Soviet-era base-level storage site.
Copyright: Robert Jurga. Reprinted with permission.

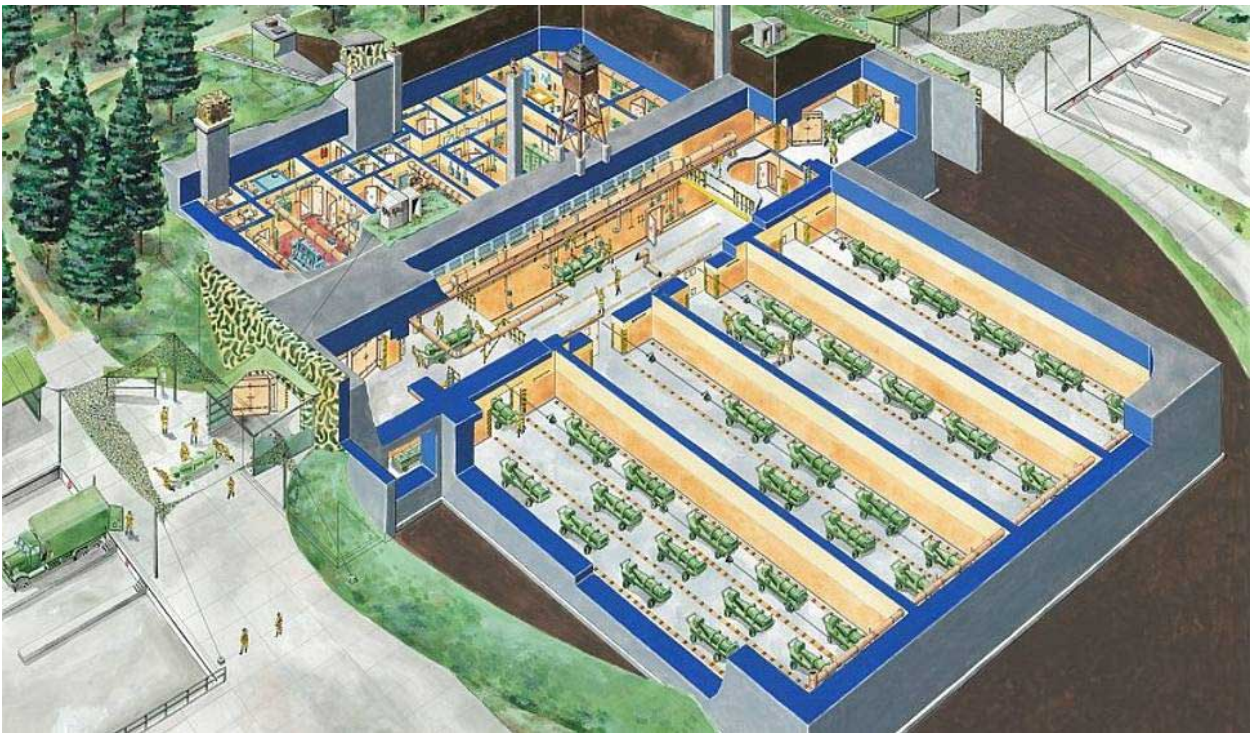


Figure A6. Engels airbase and the nuclear weapon storage site



Figure A7. Soltsy airfield and the nearby storage site



Figure A8. Comparison of 2005 and 2014 satellite images of storage area at Morozovsk Air Force Base, which shows new storage facility



APPENDIX B. Nuclear weapon storage in NATO

There are six operational bases throughout Europe believed to store nuclear weapons. These bases are located in Belgium, Germany, Italy, the Netherlands, and Turkey. In recent years, nuclear weapons have been removed from a number of bases in Germany, Greece, Turkey, and the United Kingdom. The weapons have either been flown back to the United States or added to the stockpiles of the six operational bases. However, it is possible that at least some of the closed storage facilities may be brought back into operational status if needed.¹ Table B1 lists the suspected locations and custodial arrangements for active weapons storage facilities of US tactical nuclear weapons at bases in Europe.²

Table B1. Active WS3 Storage at Air Bases in Europe

Country	Air Base	WS3 Location	Custody
Belgium	Kleine Brogel	51°10'30.59"N 5°28'24.55"E	701 MUNSS
Germany	Büchel	50°10'55"N 7°3'47"E	702 MUNSS
Italy	Aviano	46° 1'42.43"N 12°35'57.13"E	31st Fighter Wing
	Ghedi-Torre	45°26'52"N 10°17'0"E	704 MUNSS
Netherlands	Volkel	51°39'27.65"N 5°41'33.17"E	703 MUNSS
Turkey	Incirlik	37° 0'15.15"N 35°25'10.59"E	39th Air Base Wing*

*There is no permanent fighter wing at Incirlik. Delivery would be carried out by aircraft from other US bases.

Weapons at NATO air bases are stored in underground vaults under delivery aircraft and inside aircraft shelters (Figure B1). The storage system, known as Weapon Storage and Security System or WS3 (NATO calls it the Weapon Security and Survivability System), has

¹ According to Harold Smith, former US Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, the WS3 at some closed bases were "mothballed in such a way that if we chose to go back into those bases we can do it". See "Harold Smith's Goodbye: NATO Weapons-Protection Chairman Lauds Sandia-Designed Vaults, Technology", *Sandia Lab News*, 20 December 1996, p. 9.

² Hans Kristensen, "U.S. Nuclear Weapons in Europe. A Review of Post-Cold War Policy, Force Levels, and War Planning", Natural Resources Defense Council, February 2005, <http://www.nukestrat.com/pubs/EuroBombs.pdf>.

been in use since 1988, when it replaced the Weapon Storage Area (WSA) centralized storage in igloos.³

Figure B1. Protective Aircraft Shelter at Volkel Air Base in the Netherlands.
(Source: US Air Force)



Inside the protective aircraft shelters (PAS), the weapon storage vaults have a reinforced concrete foundation and a steel structure recessed into the floor of the individual shelter. The vault barrier, barrier support, mid-level deck, and platform assembly are elevated out of the concrete foundation by an elevator, providing access to the weapons in two levels. Each level can hold two weapons, for a total of four weapons per vault (Figure B2). The floor slab is reportedly approximately 16 inches thick and the concrete vault body is equipped with sensors to detect intrusion attempts.⁴

³ The WSA system has been described as consisting of several bunkers with hardened vault doors. The storage area was surrounded by several fences, barriers, motion sensors, and host country security personnel. See, John W. Hurst, "Balikesir, Turkey 1979-1980", American Military in Turkey, <http://www.merhaba-usmilitary.com/1hurstjindex.html>.

⁴ Hans Kristensen, "U.S. Nuclear Weapons in Europe. A Review of Post-Cold War Policy, Force Levels, and War Planning", Natural Resources Defense Council, February 2005, <http://www.nukestrat.com/pubs/EuroBombs.pdf>.

Figure B2. Nuclear Weapons Storage Vault with elevated bays. (Source U.S. Air Force)

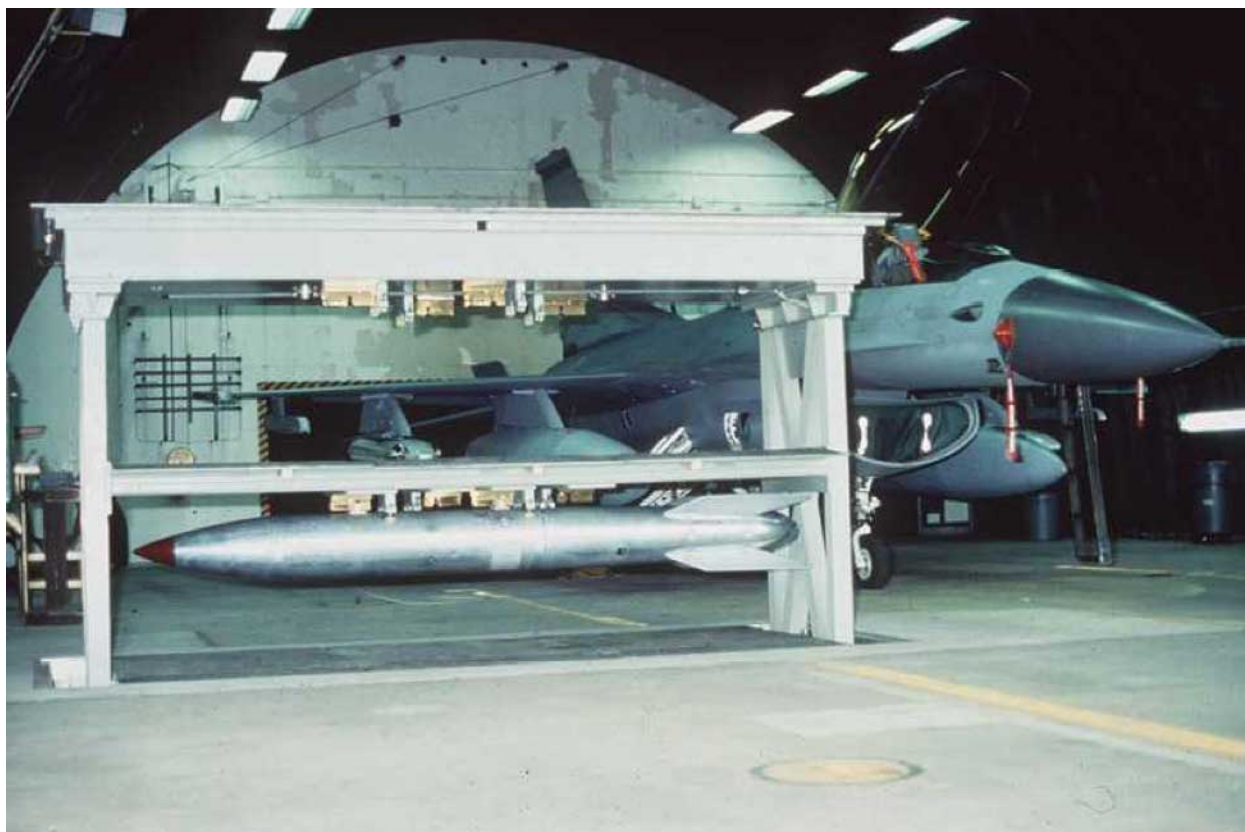
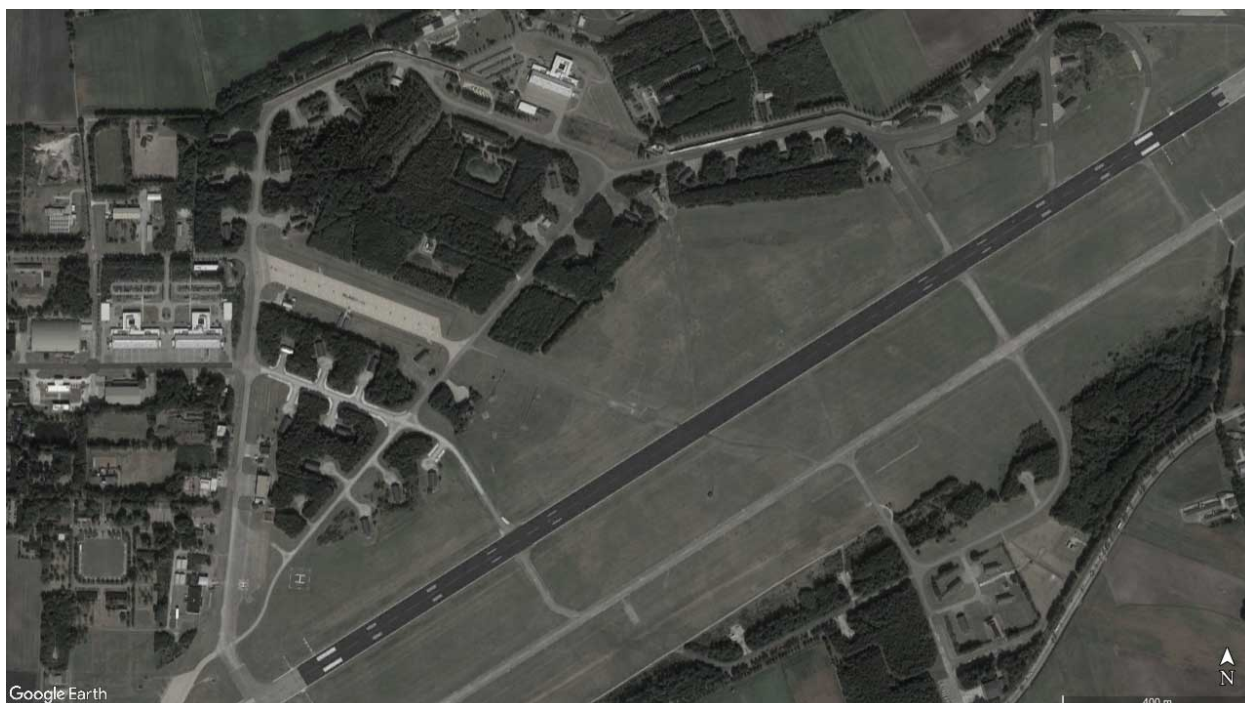


Figure B3. Satellite image of Volk Air Base shelters



Satellite images show the PAS in a typical base such as Volkel Air Base in the Netherlands (Figure B3). The open source map below confirms the location of the shelters which house the weapon storage vaults.

Notably, some bases may contain additional storage areas, either not in use or perhaps repurposed after the transition to the current WS3 approach. For example, at Kleine Brogel in Belgium, in addition to the WS3 units, satellite imagery shows two additional areas: one is a former Quick Reaction Alert site, the other an old WSA with igloos, now used to store conventional munitions (Figure B4).

Figure B4. Former Quick Reaction Alert site (upper right) and igloo-type storage area (left side) at Kleine Brogel





UNIDIR

Lock them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe

Pavel Podvig and Javier Serrat

It is difficult to imagine a scenario in which “non-strategic” or “tactical” nuclear weapons would be deliberately used in a conflict in Europe. However, these weapons are still present on the continent and complicate efforts to strengthen the European security architecture. Moreover, these weapons pose potential risks of miscalculation, inadvertent escalation, or accidental use in a time of crisis. Yet, today there is no mechanism to reduce or eliminate arsenals of these weapons or to exclude the catastrophic scenarios of inadvertent use. This reality raises the imperative to develop a practical proposal that would make sure that nuclear weapons are not introduced into any potential conflict in Europe and that would lay the groundwork for eventual reductions in non-strategic nuclear arsenals.

This paper presents a proposal to ensure that all such weapons remain non-deployed during peacetime, codifying current practices into a legally-binding, verifiable arrangement—thereby reducing the risks of nuclear war breaking out in times of peace and placing safeguards against nuclear escalation in times of crisis.