U.S. - Russia Nuclear Arms Reductions

The Next Round

— BY JAMES E. DOYLE

INTRODUCTION

The signing and implementation of the New Strategic Arms Reduction Treaty (START) reflects the commitment of the United States and the Russian Federation to strengthen their strategic partnership and to seek even greater future reductions in nuclear arms. New START, which entered into force in early February 2011, requires the United States and the Russian Federation to reduce their arsenals of deployed strategic nuclear weapons to 1,550 or fewer warheads by early February 2018.[1]

In the next round of nuclear arms negotiations with Russia, the United States will seek lower limits on non-deployed and non-strategic nuclear weapons in addition to limits on deployed strategic weapons.[2] Limits on non-strategic (also referred to as "tactical") nuclear weapons would be intended to address the numerical disparity between the United States and the Russian Federation's tactical nuclear weapons stockpiles.[3] Continued reduction in overall nuclear weapons inventories and the role they play in U.S. national security strategy are also seen as an important demonstration of the U.S. commitment to its obligations under Article VI of the Nonproliferation Treaty to pursue nuclear disarmament.

For their part, Russian government officials have indicated interest in limiting non-deployed strategic warheads and have called for the relocation of all non-strategic nuclear weapons to centralized storage depots on national territory.[4] Russia's desire for all non-strategic weapons to be located on national territory would require the withdrawal of U.S. nuclear weapons deployed with North Atlantic Treaty Organization (NATO) allies in Europe. Russia may also have an interest in further limits on deployed strategic nuclear delivery vehicles below those imposed by New START, combined with new limits on non-deployed strategic warheads. Such limits would clearly constrain the ability of the United States to rapidly increase the number of deliverable strategic warheads should it break out of New START and any future treaty.

UNCERTAIN TIMELINE FOR NEGOTIATIONS

Despite some areas of mutual interest in convening another round of nuclear arms reduction talks there are also significant issues that cause Russia's enthusiasm for a treaty following New START to be less than that of the United States.[5] Several Russian officials have stated that it is necessary to see how New START is implemented before new talks begin. During the seven-year period for implementation, Russia may view other strategic issues as a higher priority on its U.S. and European agenda. These include the possible continued expansion of NATO,

[1] The formal name of New START is "Measures for the Further Reduction and Limitation of Strategic Offensive Arms." It was signed on April 8, 2010 in Prague and, after ratification, entered into force on February 5, 2011. The New START Treaty: Signed, Posted February 02, 2011, The White House Blog: http://www.whitehouse.gov/blog/2011/02/02/new-start-treaty-signed

[2] These objectives have been articulated in the April 2010 U.S. Nuclear Posture Review and in the Senate Foreign Relations Committee Report providing advice and consent on the New START treaty. See Committee on Foreign Relations, United States Senate, Report on the Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms (The New START Treaty), 111th Congress, 2d Session, Oct. 1, 2010 and The Nuclear Posture Review Report, April 2010 at http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf

[3] Russian inventories of tactical nuclear weapons are estimated to be roughly ten times larger than estimates of U.S. inventories. See Miles Pomper, William Potter, and Nikolai Sokov, "Reducing and Regulating Tactical (Nonstrategic) Nuclear Weapons in Europe," The James Martin Center For Nonproliferation Studies, Monterey Institute of International Studies, Monterey, CA, December 2009, and Robert S. Norris and Hans M. Kristensen, "U.S. Tactical Nuclear Weapons in Europe, 2011," *Bulletin of the Atomic Scientists*, January 2011, http://bos.sagepub.com/content/67/1/64.full

[4] See Madeleine Albright, Strobe Talbott, Igor Ivankin, and Aleksander Dynkin, Next Steps on U.S.-Russian Nuclear Negotiations and Nuclear Non-Proliferation: Recommendations from the June 23, 2010 Meeting, the Brookings Institution, Oct. 2010.

[5] An excellent summary of these is provided by Steven Pifer in "The Next Round: The United States and Nuclear Arms After New START," Brookings Arms Control Series, paper 4, December 2010.

NATO nuclear weapons, ballistic missile defense, and the conventional force balance in Europe.[6] Finally, if the next bilateral treaty limits completely new items such as non-strategic and non-deployed nuclear weapons in addition to lower limits on deployed strategic arms, it may take at least two to three years to negotiate, and possibly longer.

While the duration and outcome of future negotiations is uncertain, there appears to be sufficient interest on both sides to initiate them within the next 12-24 months. Many technical and administrative obstacles to reaching a new agreement have already been identified. The months and years before the talks begin and before potential agreements are reached can be used by both sides to refine their objectives, explore how agreements covering a broader range of nuclear armaments could be implemented and verified, and jointly address obstacles to successful negotiations. While additional bilateral numerical reductions are important, equal emphasis should be placed on seeking opportunities for improving the U.S.-Russian strategic partnership and for providing a model for eventual multilateral efforts at nuclear arms limitations and reductions.

NEW OPPORTUNITIES AMID TOUGH CHALLENGES

One of the greatest challenges and opportunities of the next phase of negotiations is whether the bilateral arms control enterprise can be transformed by both sides into a mechanism that helps achieve a broader range of political and strategic objectives. It is important to continue to adjust the objectives of arms control negotiations to be consistent with changes in the security environment since the end of the Cold War. Objectives should be much less focused on issues of arms race stability, crisis stability or managing a hostile relationship.[7] While these remain important concepts, their salience has been reduced by changes in the nature of the U.S.-Russian relationship and in the global threat environment.

The current security environment warrants greater emphasis on:

- Deepening the strategic partnership
- Increasing transparency regarding nuclear arsenals and infrastructure
- Jointly developing technologies for improved verification and monitoring
- Improving security for nuclear weapons and materials

- Crafting arms reductions to support nonproliferation and counterterrorism objectives
- Establishing models and examples that other states may draw upon if and when they undertake negotiated nuclear arms reductions

To contribute to this set of objectives nuclear arms negotiations may need to become more cooperative and innovative. Formal "rounds" of meetings between negotiating teams will need to be coordinated with ongoing joint technology development, verification experiments, familiarization visits and other transparency activities. Any new agreements on future reductions should still take the form of legally binding treaties. The advantages of this approach include winning political support and commitment to implement the agreement from across a broad base of governments that are party to the agreement. Formal treaties also maintain the precedent that arms reductions agreements and related measures should be matters of domestic and international law and fully enforceable under those laws.

Nevertheless, there is room in the next round of U.S.-RF negotiations for new and innovative means of reaching and verifying agreements. Some existing tools such as on-site inspections and data exchanges through the Nuclear Risk Reduction Centers (NRRC) can be enhanced and used in new ways.[8] Other tools such as intensified military-to-military activities, classified data exchanges and verification measures using trusted third parties could come into play in future agreements.

REDUCING NUCLEAR WARHEADS

As has been clear for decades, one of the greatest technical challenges of the next round of bilateral negotiation will be establishing and reducing actual inventories of nuclear warheads of various categories. Directly accounting for individual nuclear warheads has never been accomplished by previous nuclear arms reduction treaties. Warhead limits, such as the 1,550 deployed strategic warhead limit set by New START are met by counting the number of warheads declared by each side to be carried by strategic nuclear delivery vehicles such as intercontinental ballistic missiles (ICBMs) and strategic bombers.

This does not provide an accurate accounting of nuclear warheads actually possessed by the United States and Russia. For example, New START attributes only one nuclear warhead to each

[6] Other reasons for Russian preference to move slowly with respect to additional nuclear arms negotiation relates to the pace of retirement and modernization occurring within its strategic nuclear forces. Over the next ten years Russia will deploy a new class of ballistic missile submarine with a new class of missiles, retire another class of submarine and upgrade missiles on a third existing class of submarines. Its land-based strategic missile force will also change significantly with new deployments of road-mobile missiles, retirement of most Soviet era SS-18 and SS-19 intercontinental ballistic missiles (ICBMs) and the possible development of a new silo-based, multiple warhead missile. Russia likely wants to delay any new treaty obligations that could impact its strategic modernization programs given a high degree of uncertainty over their successful implementation.

[7] *Arms race stability* is a condition where neither side feels it is at a significant numerical or operational disadvantage in terms of nuclear force structure. Because such disadvantages were seen to be so threatening in the hostile political environment of the Cold War, a real or perceived disadvantage could cause one side to launch a rapid buildup of forces. This, in turn, could be perceived by the other side as displaying hostile intent or seeking a counter-advantage. Without proper communication both sides could get caught in a buildup spiral (arms race) with negative consequences in terms of cost, misperception and distrust.

Crisis stability is a condition where neither side feels compelled to launch its nuclear forces first in a political crisis due to the belief that they are about to be struck by the opponent and will not have sufficient forces to retaliate, or because the residual forces they will retain after absorbing a strike will be insufficient to inflict the necessary level of damage on the opponent to avoid military defeat in the conflict. Maintaining crisis stability requires both sides to retain invulnerable second-strike capabilities.

In both types of stability the assumption during the Cold War was that due to the hostile nature of the U.S.-Soviet relationship both sides would inevitably act to seek and exploit military advantage, and were likely to take decisions motivated by such advantages or perceptions of advantage or disadvantage during crises.

[8] For information on the U.S. NRRC see: http://www.state.gov/t/avc/nrrc/c26278.htm

strategic bomber when in fact they are designed to carry many warheads. Similarly, a large set of nuclear warheads possessed by both sides are kept in storage to supplement the warheads that are mounted atop ICBMs that are kept on alert. Finally, there are the inventories of non-strategic nuclear warheads and retired warheads awaiting dismantlement. In summary, current U.S.-Russian nuclear arms agreements cover only a small fraction of total warheads maintained by both sides. This is illustrated by the fact that as of September 30, 2009, the United States possessed 5,113 nuclear warheads in its militarystockpile, of which only 1,550 will be accounted for under New START.[9]

It is difficult to see how the stated objectives of negotiating reductions in non-deployed or non-strategic nuclear weapons could be reached without establishing nuclear warheads as specific items of account. These categories of nuclear warheads are stored separately from their delivery vehicles and, in most cases, can be delivered by a range of different delivery vehicles. A practical approach to accounting for them would be for both sides to periodically exchange data on the number and location of all non-deployed and non-strategic nuclear warheads and allow periodic inspections to confirm the accuracy of the declarations.[10] Data update notifications would be provided when warheads were retired, replaced or temporarily removed for maintenance or training purposes. A similar approach could be followed for retired warheads awaiting dismantlement.

Establishing an agreed method for accounting for all nuclear warheads is an essential tool for moving towards the long-term goal of a world without nuclear weapons. This approach has several benefits. It could establish a legal structure for defining and counting all nuclear warheads. It is more accurate than the arcane counting rules employed in START and New START that obfuscate actual warhead inventories and leave several categories of warheads unaccounted for. A true accounting of all nuclear warheads would provide a greater degree of transparency regarding the size and capabilities of U.S. and Russian nuclear arsenals. The exchange of data on storage locations and periodic maintenance activities would provide more information on nuclear warhead production infrastructures as well.

While the logic and potential benefits of moving to warheads as the primary unit of account in the next treaty are clear, the difficulties of doing so should not be underestimated. Russia has not made a declaration similar to the United States regarding the total number of nuclear weapons in its stockpile. Neither country has disclosed the specific number of non-deployed, non-strategic or retired warheads in its possession. The inventories and locations of these categories of warheads remain classified national security information. Due to the need for dynamic operations such as warhead maintenance, training, and reliability inspections it will be a complex challenge to create treaty protocols and procedures that provide confidence that numbers of stored warheads are being reduced. Moreover, whatever verification and inspection procedures might be proposed for a new treaty limiting warheads, both sides must be confident that they will not compromise classified information or decrease the physical security of the warheads and storage facilities.

A Three-Pronged Approach

To prepare for challenging and potentially long-term negotiations and to create a positive environment for overcoming technical and administrative obstacles to a new agreement the United States and Russia should consider a three-pronged strategy of cooperative activities:

One – Confidence-Building and Transparency Measures

This track could include a sustained set of confidence-building and transparency measures that address enduring concerns and misperceptions in the U.S.-Russian strategic relationship and build cooperation and partnership. The recommendations for activities under this track will concentrate on those most related to nuclear stockpiles, operations and infrastructure but, to be effective, they should be conducted in parallel with similar activities in the areas of missile defense, conventional forces and NATO-Russia relations. Some of the following activities will take several years to plan and implement while others build on previous U.S.-Russian interactions and could be initiated more quickly.

[9] The active stockpile does not include several thousand retired U.S. warheads awaiting dismantlement. See U.S. Department of Defense Fact Sheet, http://www.defense.gov/news/d20100503stockpile.pdf

[10] See Fetter, Steven and Ivan Oelrich, Verifying a Prohibition on Nuclear Weapons, *Elements of a Nuclear Disarmament Treaty: Unblocking the Road to Zero*, edited by Barry Blechman and Alex Bollfrass, pp. 27-56. Washington, DC: Henry L. Stimson Center, 2010.

1) Exchange Current Data and 10-20 Year Plans for Nuclear Forces and Stockpiles

In order to increase trust and reduce the possibility of misperception regarding military capabilities, both sides could periodically exchange 10-20 year plans for their nuclear delivery systems and nuclear stockpiles. From Russia's perspective such data exchanges should include descriptions of planned deployments of ballistic missile defenses and any strategic conventional weapons that could be used in a first strike on its nuclear arsenal. Eventually, Russia is likely to acquire some prompt global strike and improved missile defense capabilities of its own and advance notice of such deployments will be useful to U.S. planners.

Exchanging nuclear weapons information could reduce uncertainties on both sides regarding the future security environment for which they must plan, while simultaneously increasing confidence that neither side was seeking military advantage over the other. For example, official information regarding Russia's general nuclear warhead manufacturing, disassembly, and refurbishment capabilities is not openly available. If the United States knew more about Russia's warhead manufacturing and retirement capabilities over the next decade, it could be less concerned about the need to hedge against the possibility of a Russian "breakout" from a future treaty by retaining large numbers of reserve warheads. Similarly, Russia may be willing to reduce its active warhead stockpile and manufacturing infrastructure if its concerns are eased regarding U.S. capabilities to rapidly upload non-deployed warheads onto strategic missiles or deploy robust missile defenses.

Perhaps the most critical information to exchange in the near term would be total warhead inventories in the following categories:

- Deployed strategic
- Non-deployed strategic
- Non-strategic
- Retired and awaiting dismantlement

These data would facilitate negotiations aimed at further reducing any or all categories of nuclear warheads. It will be essential to first discuss and develop a common method of categorizing nuclear warheads.[11] It may be desirable, but not essential, to declare distinct warhead types within these categories. The same is true for declaring accurate storage or deployment locations. However, if a future treaty required the permanent monitoring or removal from military stocks of an exact number of warheads, their location and life-cycle pathway to elimination will eventually need to be declared and monitored.

There are several advantages to exchanging stockpile data early in what will likely be a long-term effort to reach new agreements. Once information is exchanged, both sides can begin to independently assess their level of confidence in the accuracy of the data. During periodic meetings and exchanges, each side can seek clarification of factual uncertainties or inconsistency. The objective over time is for confidence and transparency to increase, perhaps allowing simplification of verification procedures for future agreements or expanding the range of treaty options that negotiators could consider. For example, if high confidence were established in baseline inventories of total warheads in the deployed, non-deployed, and non-strategic categories, perhaps a future agreement setting a lower limit for a combination of these categories would become more feasible. Such an approach would allow both sides to choose their own mix of warheads under a lower ceiling than has been proposed in the past.[12] Early stockpile data exchanges covering these warhead categories would be a prerequisite to this option.

One development that potentially eases the future exchange of classified or sensitive information is the entry into force on January 12, 2011, of the U.S.-Russian Nuclear Energy Cooperation Agreement. One of the stated objectives of this agreement is to create the conditions for improved cooperation on joint technology development to support arms control and nonproliferation activities.[13] Despite the precedents and potential mechanisms for exchanging classified data, both sides must determine that it is in their interest to share details of their nuclear stockpile.

2) Reciprocal Visits to Nuclear Weapon Storage Facilities

Such visits could serve three purposes. First, they reinforce the idea that neither side is the object of the other's nuclear forces and that both sides have mutual security interests of the highest order. Second, they provide a foundation that can facilitate the joint design of transparency or verification measures and serve as potential models for formal inspections. Third, visits can provide another opportunity to exchange best practices or review the progress of U.S. supported security upgrades because improved security of nuclear weapons is an objective of future agreements. In fact, such reciprocal visits could be integrated with ongoing U.S. Department of Defense (DoD) and National Nuclear Security Administration (NNSA) nuclear weapons security cooperation with Russia. Cooperation could include joint research and development of improved security and accounting technologies, and other activities that become a permanent component of the strategic relationship, providing continued confidence and insight into how each country is managing nuclear security. In this context, the additional possible benefit is potential development of integrated security, accounting and verification technologies.

Any inspections to confirm reductions of non-strategic and non-deployed nuclear warheads will entail declarations of the numbers to be reduced and some method to verify their removal from active stockpiles. Reciprocal visits to the storage facilities for these weapons could take place in the United States and/or NATO nations, and Russia. U.S. and Russian officials have exchanged visits to nuclear storage sites in the past as part of confidence building measures and during joint efforts to improve security of nuclear weapons.[14]

Such visits allow observation of the facilities where on-site inspections or remote warhead storage monitoring might take place, thus facilitating the design of verification instruments or approaches. Factors such as the remoteness of the facility, access procedures, the availability of electric power, and communications infrastructure may affect the feasibility of some verification approaches. Such visits also help establish and exercise administrative procedures for allowing foreign national access to sensitive and classified areas.

[11] Steven Pifer, "The Next Round: The United States and Nuclear Arms Reductions after New START," Brookings Arms Control Series, Paper 4, December 2010.

[12] For example, see Joseph F. Pilat, "Controlling Nonstrategic Nuclear Forces," in Larson, Jeffrey A. and Kurt J. Klingenberger, editors, *Controlling Non-Strategic Nuclear Weapons: Obstacles and Opportunities, United States Air Force, Institute for National Security Studies*, July 2001, p. 243

[13] Fact Sheet: U.S.-Russia 123 Agreement on Nuclear Energy, U.S. Department of States, January 12, 2011: http://www.america.gov/st/texttrans-english/2011/January/20110112112648su0.9979931.html

[14] For example, in June 1998, General Eugene Habiger, then commander of the US Strategic Command visited a Russian SS-19 base at Kozelsk; a national nuclear weapons storage depot in Saratov oblast, the strategic bomber base at Engels; the SS-25 base in Irkutsk; and a naval nuclear weapons storage site near Severomorsk. Habiger previously visited another SS-25 base at Tejkovo and the SS-24 base at Kostroma in October 1997, and a group of senior Russian officers, including Lieutenant General Igor Valynkin, then head of the 12th Main Directorate of the Russian Defense Ministry, which is responsible for the storage of nuclear weapons removed from active service, had toured several American strategic nuclear weapons facilities in March 1998. See Nuclear Threat Initiative (NTI) research library database:

3) Reciprocal Visits to Warhead Assembly/ Disassembly Sites

This activity was proposed as a confidence building measure in the mid-1990s. But an exploratory U.S. proposal for reciprocal visits to dismantlement facilities was not accepted by Russian officials in 1994.[15] However, much has changed in Russia's nuclear warhead production complex since then, and this initiative could be revived.

Reciprocal visits could facilitate the development of monitoring and verification approaches for nuclear warhead reductions. Both sides could exchange basic flow diagrams of how and where the warhead dismantlement process takes place within the facilities. During reciprocal visits each delegation could be given familiarization briefings and tour the storage areas and dismantlement bays and cells. These visits could give both sides a better understanding of all the safety, security, and operational factors that would need to be considered during inspections to confirm warhead elimination.

Because these facilities and their operations deal directly with disassembly and maintenance of nuclear warheads, it will be very difficult to create inspection procedures that do not threaten to compromise classified stockpile information. Reciprocal visits may help both sides identify specific storage areas and certain aspects of the dismantlement process that can be isolated and monitored to help build confidence that reductions have taken place as declared without threatening security. In fact, one of the activities that could be undertaken in relation to the proposed reciprocal visits is for U.S. and Russian specialists to conduct a joint study of managed access at assembly-disassembly plants.

4) Joint Demonstrations of Verification Technologies

Another set of beneficial activities would be periodic, perhaps annual, joint expositions of verification and monitoring technologies under development by U.S. and Russian scientists. The location of these demonstrations could alternate between the countries. One purpose for this collaboration would be for decision makers on both sides to become familiar with current approaches to monitoring and verification for warheads, and to determine the remaining challenges that must be overcome. This activity would be integrated with a program of actual joint technology development and operational field trials that would become the central part of the second prong of bilateral preparations for new negotiations.

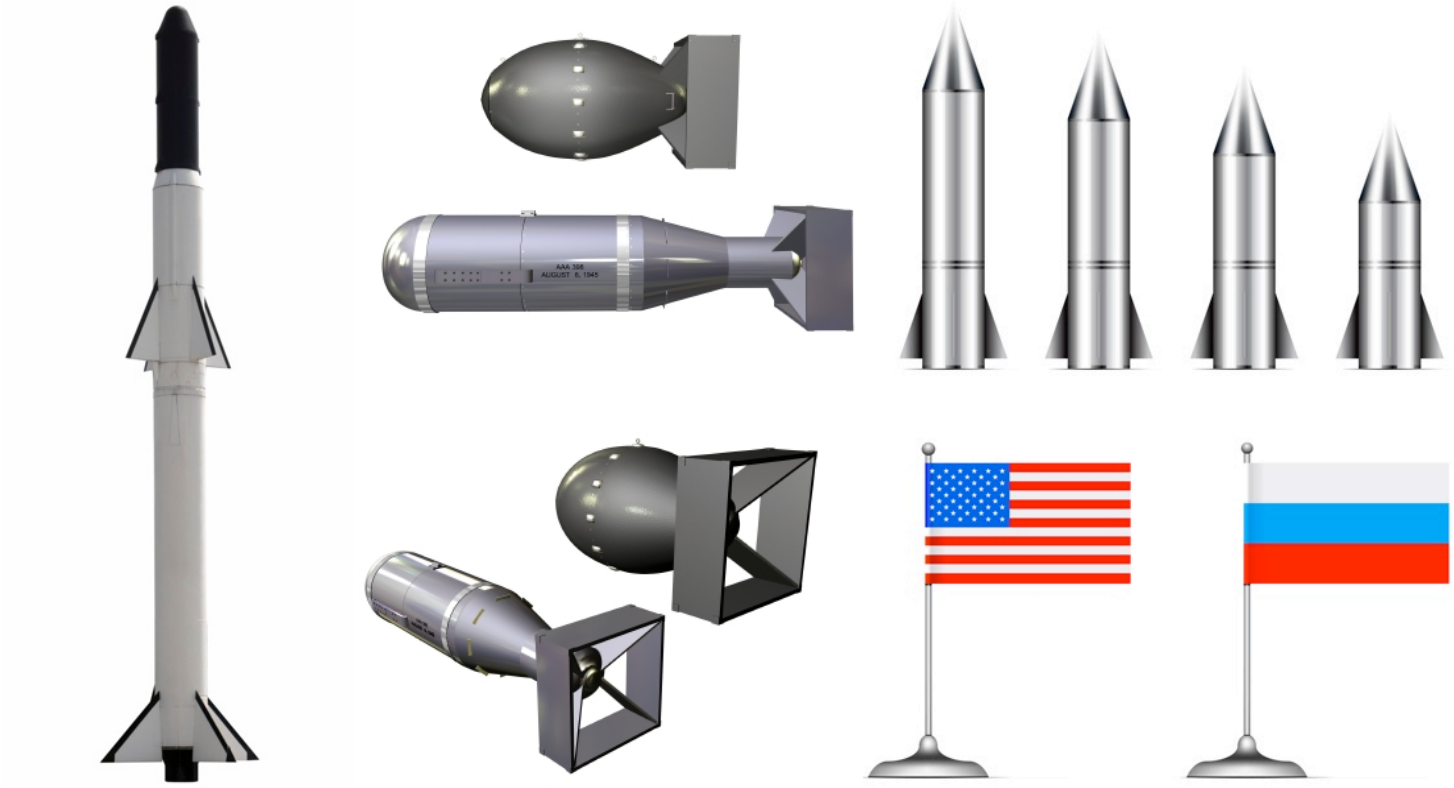
Two - Joint Development and Field Trials of Verification Technology and Procedures

Cooperative development and joint field trials of verification technology and procedures are central to the success of future verified nuclear warhead agreements. These are the most technical and labor-intensive activities, requiring the most financial and administrative resources. Whenever possible, tests and field trials of verification approaches should be conducted in realistic settings at nuclear facilities and use actual nuclear weapons and their storage and transportation containers. The purpose is to investigate how technology can support potential treaty verification activities. Therefore, a series of joint verification experiments could be designed around hypothetical treaty objectives.

Significant precedents exist for this type of joint technical experimentation in the U.S.-Russian relationship, and those experiences provide a foundation for building new cooperation. One precedent was the series of Joint Verification Experiments (JVEs) conducted by U.S. and Russian specialists in 1988 to demonstrate technologies and procedures that were useful for verifying the Threshold Test-Ban Treaty.[16]

[15] See Oleg Bukharin, "The changing Russian and US nuclear weapon complexes: challenges for Transparency," In Zarimpas, Nicholas, ed. *Transparency in Nuclear Warheads and Materials: the Political and Technical Dimensions*, Oxford: Oxford University Press, 2003, pp.203-204.

[16] On August 17, 1988 at the U.S. nuclear test site in Nevada, the United States and the Soviet Union conducted the first phase of the Joint Verification Experiment (JVE). This was the result of a U.S.-Soviet agreement that provides for one underground nuclear explosion experiment at the U.S. test site and for another such experiment at the Soviet test site near Semipalatinsk in September. During the December 1987 Washington summit, the U.S. and Soviet Union agreed to design and conduct the JVE to facilitate an agreement on effective verification measures for the Threshold Test Ban Treaty (TTBT) of 1974 and the Peaceful Nuclear Explosions Treaty (PNET) of 1976. Results of the JVE permitted these two treaties to be ratified. The JVE provided the opportunity to measure the yield of nuclear explosions using techniques proposed by each side. The United States used CORRTEX, a direct hydrodynamic yield measurement system for verification of the TTBT and PNET. Through the JVE, the United States hoped to provide the Soviet Union with the information it needed to accept the routine U.S. use of CORRTEX in the verification of these two treaties. See White House Statement 8/17/1988: http://www.reagan.utexas.edu/archives/speeches/1988/081788a.htm



Another was the series of Mutual Reciprocal Inspections (MRI), involving joint experimental verification measurements of nuclear weapons components that took place in 1994-2000.[17] Both the JVE and MRI activities took place at U.S. and Russian nuclear weapons facilities and involved scientists from the respective national nuclear weapons laboratories. Another objective of these joint activities was to identify verification technologies that would accomplish the intended task and be acceptable to both sides. This remains the challenge for developing technologies and procedures for verifying nuclear warhead reductions in a future treaty.

1) Begin the Preparatory Work Now for Joint R&D on Warhead Verification.

While there are clear benefits to working jointly in the area of verifying nuclear warhead storage or elimination, the sensitivity of this activity will require that each side revive unilateral efforts to identify specific projects they are willing to undertake and prepare for any agreed joint development or experiments. Both sides will have to assess and mitigate the security risks involved with joint R&D and experimentation at their nuclear weapons facilities. The evaluation of candidate verification technologies and procedures that can be proposed to the other side for joint experimentation will also require some unilateral effort. This preparatory work can possibly be conducted by both sides in parallel with bilateral discussions to plan a future set of joint experiments.

2) Propose to Russia the Creation of a Joint Multiyear Warhead Monitoring Experimentation Plan

This plan should include joint experiments to test verification and monitoring approaches that cover a range of possible treaty requirements. Despite the fact that it is unknown at this time what specific new data exchanges, sublimits (for example, limits on the numbers of certain types of deployed warheads) and reductions might be called for under a new treaty, the range of possibilities clearly include the following:

- Reduce deployed strategic warheads, strategic delivery vehicles and launchers below the limits required by New START.[18]
- Reduce non-strategic nuclear warheads.
- Reduce non-deployed strategic warheads.
- Establish a single limit covering all nuclear warheads—providing freedom to mix strategic and non-strategic, deployed and non-deployed—perhaps with one or two sublimits, e.g., a sublimit on deployed strategic warheads.
- Require that some specified number of warheads remain in permanently monitored storage.

All but the first of these five potential treaty objectives would require some exchange of warhead

[17] Andrew Bieniawski "Historical Review," briefing materials, Fissile Material Transparency Technology Demonstration, August 14, 2000, Los Alamos, LA-UR-00-2239.

[18] Because New START already includes inspection procedures for verifying the elimination of nuclear delivery vehicles and launchers, there is no need to conduct joint verification R&D for this purpose. Lower deployed strategic warhead limits could be achieved simply by requiring the elimination of more strategic delivery vehicles and forbidding any increases to the number of warheads carried on remaining vehicles. Under such an agreement the warheads from eliminated delivery vehicles could be stored by either side, requiring no new verification technologies or procedures. However, if the removed warheads were required to remain in permanently monitored storage or be dismantled then new inspection technology and protocols are needed.

stockpile data in one or more of the following categories:

- Non-deployed strategic warheads
- Non-strategic warheads
- Retired warheads in storage awaiting dismantlement

This means that some method for developing confidence in the accuracy of declared stockpile data will have to be agreed to as well. Any future agreed approach is likely to include periodic on-site inspection to confirm declared inventories but may or may not include new inspection technology or instrumentation. Some potentially useful tools in maintaining confidence in stockpile declarations would be systems for the unattended monitoring of warheads in storage and the ability to exchange encrypted stockpile data through the U.S. and Russian Nuclear Risk Reduction Centers.

Any agreed approach is likely to include periodic on-site inspection to confirm declared inventories but may or may not include new inspection technology or instrumentation.

3) Develop Verification Experiment Scenarios

A series of joint experiments could be designed around several treaty monitoring scenarios. Two important challenges that scenarios are likely to include are first, authenticating that a sealed container declared to contain a nuclear warhead or warhead component actually does contain such an item and second, maintaining Chain of Custody (COC) regarding the integrity of authenticated nuclear warheads as they move through various stages of the retirement, storage, and dismantlement life cycle.

The scenarios provided below are illustrations chosen from a wide range of possibilities for joint exercises demonstrating verification technologies and procedures. These exercises can provide valuable feedback both to longer-term R&D efforts for verifying future nuclear arms reductions and to formal treaty negotiations.

Scenario 1: Mock Inspection to Verify Baseline Declaration

A mock inspection could include identification of a nuclear warhead deployment or storage facility, declaration of the type and number of items at the facility and some procedure for confirming the declaration.[19]

An additional step could require unique identifiers or "tags" be placed on individual stored nuclear warheads for later confirmation.

Scenario 2: Removal of Warheads from Operational Strategic Missiles

This scenario could simulate the removal of warheads from any type of strategic ICBM or SLBM, for example, the U.S. Minuteman III ICBM or the Russian SS-18, SS-19, and SS-24 ICBMs. Established treaty procedures already exist in New START for the initial portion of this scenario. Monitoring of the transportation of the missile front section containing warheads on a special truck to a weapon service area will be needed as well as a radiation measurement and final tagging and sealing of the warhead storage or transportation container. [20]

Scenario 3: Continuous Monitoring of Stored Nuclear Warheads

Several approaches to storage monitoring have been tested and/or employed in the past, including manned perimeter-portal monitoring systems, periodic inspections of tagged items, and unattended systems with continuous monitoring of the exterior and interior of storage facilities.[21] Nevertheless, additional testing of prototype systems is necessary. Remote monitoring systems include a variety of sensors including video, motion detection, monitored seals and other technologies that would detect in real time any attempt to enter or remove the contents of a sealed storage weapons magazine.

Scenario 4: Monitored Warhead Dismantlement

Another series of experiments could be aimed at methods and technologies for building confidence that nuclear warheads had been dismantled. For example, the joint development of inspection systems using passive and active radiation measurements to determine the presence or absence of weapons-grade fissile material and high explosives in a sealed container offers one possible element of a procedure for authenticating declared items as nuclear warheads. Other systems that combine tags, seals, and live video could be developed to provide remote monitoring of the actual warhead dismantlement process.[22] Used in combination with observations at warhead deployment sites and methods for monitoring transportation, these measures may provide adequate confidence that warheads had been dismantled in a manner consistent with declarations

Scenario 5: Verification of Weapons Transportation

Current approaches to monitoring items during transportation include the application of tags and seals that are inspected prior to and following transportation. Because, given sufficient time and resources, most tags and seals are vulnerable to defeat, new and more robust approaches are needed to developing confidence that sealed warhead containers have not been tampered with during the significant periods of transportation. One approach could be to provide the inspecting party with live sensor data on the status and integrity of the containers without revealing the precise location of the shipment. (For safeguards and security purposes, the precise location of a warhead transport is kept secret both in the United States and in Russia.)

Scenario 6: Verified Conversion of Weapons-Grade Fissile materials

Key technology challenges for monitoring the conversion of weapons-usable materials into

[19] For more on monitoring declarations see "Verifying a Prohibition on Nuclear Weapons," by Steven Fetter and Ivan Oelrich in *Elements of a Nuclear Disarmament Treaty*, Edited by Barry Blechman and Alex Bollfrass, The Henry L. Stimson Center, 2009.
[20] For a detailed description of this activity at an operation base see Oleg Bukharin and James Doyle, "Transparency and Predictability Measures for U.S. and Russian Strategic Arms Reductions," *The Nonproliferation Review*, vol. 9, no. 2, Summer, 2002, pp. 82-100.
[21] Committee on International Security and Arms Control, U.S. National Academy of Sciences, "Monitoring Nuclear Weapons and Nuclear-Explosive Materials," Washington, DC: National Academy Press, 2005.
[22] For a summary of existing approaches at the time see Office of Nonproliferation Research and Engineering, Arms Control & Nonproliferation Technologies Project. *Technology R&D for Arms Control*, Washington, DC: U.S. Department of Energy, 2001.

non-weapons-usable forms include demonstrating continuity of knowledge during the transition from item accountability to bulk processing and back to item accountability. A joint experiment demonstrating technologies to monitor the conversion of excess warhead components to non-weapon forms could involve the International Atomic Energy Agency (IAEA), which could eventually assume responsibility for monitoring former weapons materials. This scenario matches the objective of the U.S.-Russian–IAEA Trilateral Initiative and joint experiments in this area could be part of an effort to finalize that initiative.[23]

Three - International Outreach Regarding Verification and Transparency Activities

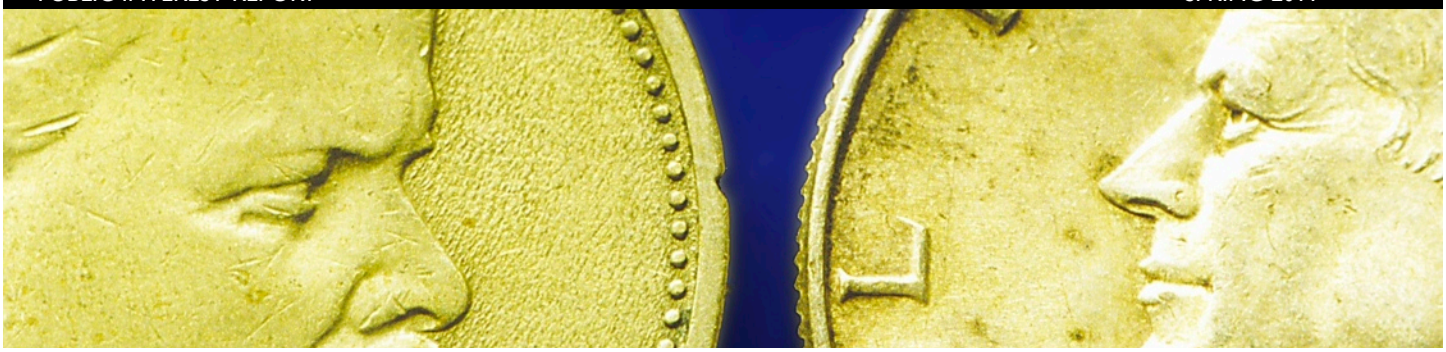
This third effort is the most forward-looking and its objective is to share experiences and approaches to verification developed between the United States and Russia. In essence, it supports the long-term vision of eliminating all nuclear weapons and begins preparing for the phase of nuclear arms reductions that will require the participation of all countries possessing nuclear weapons.

If the United States and Russia develop effective means to verify the elimination of nuclear warheads, they will set a powerful precedent that can be assessed for use by other nations. Several nuclear weapon states and most non-nuclear weapon states have embraced the goal of a world without nuclear weapons. The United Kingdom and Norway have completed a program of mock inspections of warhead elimination. In addition, some Russian officials have stated that any additional bilateral nuclear reductions will have to take into consideration the status of nuclear arsenals in countries such as China, France, and the United Kingdom.

In order to involve these countries in the development of transparency and verification approaches, new political and administrative mechanisms will need to be created. The UK-Norway experiment is one such mechanism that could be expanded to include other states. Another possibility is to involve the IAEA in some aspect of verification and monitoring for nuclear arms elimination.

IAEA participation in nuclear warhead verification or monitoring is limited by the NPT provisions forbidding the transfer of any nuclear weapons information from nuclear weapon states to non-nuclear weapon states. Nevertheless, the IAEA does have the responsibility of verifying the absence of undeclared nuclear weapons activities in the non-nuclear weapons states. Thus, it might participate as an observer in some of the bilateral or multilateral verification experiments. Moreover, the IAEA is an institution that many nuclear security experts believe could be involved in verifying some aspects of nuclear disarmament such as a global ban on the production of fissile materials for nuclear weapons purposes.

[23] Thomas E. Shea, "The Trilateral Initiative: A Model for the Future?" *Arms Control Today*, May 2008. http://www.armscontrol.org/act/2008_05/PersboShea.asp%2523Sidebar1



Many options exist for increasing the participation of other nations in the development of technologies and approaches for verifying the elimination of nuclear warheads. These include but are not limited to the following:

- Periodically invite observers from other countries to verification technology demonstrations suggested under U.S.-Russia Track One activities or joint experiments under Track Two.

- A joint U.S.-Russia team could prepare for and provide verification technology demonstrations in the nuclear institutes or nuclear security centers of China, India, and other states.

- These international demonstrations could include verification technologies developed by the host nation or other regional participants.

- The United States could join the verification R&D efforts of other countries or groups of countries. For example, the United States and the United Kingdom already conduct joint verification R&D. This cooperation could be expanded and joined by other interested states.

- The development of verification approaches for nuclear arms reductions could be included in the agendas of international nuclear security and nonproliferation initiatives such as the Global Initiative to Combat Nuclear Terrorism, the G-8 Global Partnership, and the Nuclear Security Summits.

- Status updates and verification technology demonstrations could be provided every five years at the NPT review conference. This would provide support for implementation of the "thirteen steps" towards nuclear disarmament endorsed at the 2000 NPT Review Conference. The last of these steps is "the further development of the verification capabilities that will be required to provide assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a nuclear-weapon-free world.[24]

CONCLUSIONS

The United States and Russia have declared their intention to reduce their nuclear arsenals below the levels required by New START. The schedule and objectives of a new round of bilateral negotiations are unknown at this time. However, both countries share an interest in using the time prior to and during the next round of talks to prepare for the negotiations, determine what is desirable and possible in a future treaty, and address the challenges for reaching a new agreement.

These challenges are formidable and span the political, scientific, technical, and financial domains. They cannot be resolved unilaterally. This article has proposed a set of activities that can help address problems specifically associated with making nuclear warheads items of account in future treaties. These activities can help both nations to begin answering critical questions that lie in the way of agreements that reduce nuclear warheads. One of these is to find a mutually acceptable standard for verification of a future treaty. Efforts to jointly develop technologies and approaches can provide a range of confidence levels from transparency to strict verification resulting in a diverse "toolkit" of verification options that could be used as needed for future agreements.

Implementing a strategy similar to the three prong approach suggested above will require a significant increase in effort and resources from the U.S. interagency community as compared to the modest annual investment in arms reduction verification capabilities during the past decade. In addition, new institutional mechanisms are needed to formalize a U.S. interagency verification R&D initiative and build bilateral structures for revitalizing work with Russia's technical community.

Verifying the elimination of nuclear warheads is essential to making a world without nuclear weapons possible. Ultimately this will be a global, not bilateral effort. The international community understands the need for effective verification of nuclear warhead reductions and several states beyond the Unites States and Russia are conducting verification research. It is in the interest of America and Russia to lead this effort and to support the nuclear arms verification activities of other states. The sharing of approaches and technologies can improve the effectiveness of these efforts and increase the likelihood of developing verification methods that are internationally acceptable.

While considering the challenges of verifying warhead reductions, it is useful to keep in mind the security benefits that such reductions can provide. First, such agreements can provide confidence that nuclear warheads have been reduced as opposed to simply placed in storage. This alleviates the perceived need for "hedging" against the possibility of treaty breakout by retaining excess non-deployed warheads. Second, accounting for all categories of warheads provides transparency on the total nuclear weapon stockpiles as opposed to only operationally deployed warheads. Third, reducing and limiting nuclear warheads produces clear progress towards U.S. and Russian NPT Article VI commitments to reduce and eventually eliminate nuclear arms. Fourth, future warhead agreements could provide confidence that the large stocks of Russian non-strategic nuclear weapons have been placed in long-term storage or dismantled, thus reducing the threat of their use or theft. Finally, verified bilateral warhead reduction agreements can help clear some challenges on the path to a future verified multilateral nuclear arms reductions treaty whose goal may be the complete elimination of national nuclear arsenals. ■

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[24] Deepti Choubey, Are New Nuclear Bargains Attainable? Carnegie Endowment for International Peace Report, November 2008.