Part IV: Arms Control

Since 1969, the United States and first the Soviet Union and now Russia have engaged—and are still engaging—in bilateral negotiations to limit and reduce their strategic nuclear forces in an effort to strengthen their own security and make the world a safer, more stable place. Probably the centerpiece of this nuclear arms control process is the Strategic Arms Reduction Treaty (START) I, which is set to expire at the end of 2009. With this deadline approaching and a new U.S. administration in office, there has been renewed focus on negotiating a successor treaty that would maintain START I's verification procedures while resuming further reductions of Russian and U.S. nuclear stockpiles. Aside from START, strategic arms control encompasses other nuclear and related issues, including nuclear testing and the Comprehensive Test Ban Treaty, the Fissile Material Cut-Off Treaty, the Intermediate-range Nuclear Forces Treaty, national missile defense, non-strategic nuclear forces, de-alerting, and space arms control.

The expiration of START is perhaps the most urgent unresolved arms control issue at the moment: on December 5, 2009, the treaty expires, and this threatens to allow the reductions and verification procedures that both sides have so far achieved to expire with it. As a member of the Commission's Arms Control Tiger Team, Linton Brooks begins the chapter with a paper that provides follow-on START I treaty options. In a contextual analysis of the bilateral agreements between Russia/Soviet Union and the United States in years past, Brooks offers ten conclusions to guide the commission's final recommendations for a successor agreement to START.

In his paper, Brooks raises several START-related subjects that may make negotiations between the United States and Russia more difficult, including the issue of missile defenses in eastern Europe, the inclusion of tactical nuclear weapons in bilateral reductions, and the de-alerting of weapons. Experts took up these tangential issues in turn and crafted guidance for the Commission. On missile defense and its relationship to arms control, Bruce MacDonald addresses the relationship between strategic defense and offense and discusses options for addressing U.S. missile defense plans for a "third site" in Europe in the context of U.S.-Russian negotiations on START. On tactical nuclear weapons, Barry Blechman—like Brooks—argues that they should be the subject of further follow-on, but separate, negotiations, given that they are not covered under START I. Blechman notes that Russia has developed and possesses thousands of tactical nuclear weapons, explained at least in part by the erosion

of its conventional military capabilities, while the United States maintains a much smaller number of such weapons. Blechman recommends that in an effort to reduce this large numerical gap, the United States should seek to include numerical limits on tactical nuclear weapons in a formal, separate arms control agreement with Russia. In a more broadly framed paper, Victor Utgoff asserts that non-strategic nuclear forces (NSNF), including nuclear-armed tactical aircraft, the TLAM/N, short-range nuclear-armed ballistic missiles, and an assortment of other nuclear-related weapons, are outside the purview of START and the Intermediate Nuclear Forces Treaty (INF). Utgoff presents observations to the Commission on how to count NSNF, how to engage Russia on NSNF reductions, and how to reconcile U.S. extended deterrence obligations to NATO with possible NSNF future reductions.

On the issue of de-alerting (removing nuclear weapons from high alert where they can be launched on short notice), Brooks suggests in a second paper that while de-alerting is an outlier issue for a START I follow-on treaty, it could prove to be a "poison pill" if it is included in formal arms control negotiations with the Russians: if Russia considers de-alerting as a proposal that would put them at a disadvantage, as they have on missile defenses in Eastern Europe, it could further complicate such negotiations. In his paper on the subject, Frank Miller addresses some of the arguments made on behalf of de-alerting, or the "hair trigger alert" issue, explaining what the term actually refers to, and how de-alerting would affect nuclear planning, and argues that the real need is to give national leaders more decision-making time.

The success or failure of negotiations on the START follow-on treaty and missile defense issues addressed earlier may also affect other treaties and negotiations that are tied to strategic arms control. In one such case, Brad Roberts argues that the INF treaty, agreed to in 1987, is causing Russian some dissatisfaction because of "INF-derived imbalances" between itself and China, which deploys such weapons near Russia; Roberts also notes that a U.S. decision to place missile defenses in Eastern Europe could provoke Russian withdrawal from the INF. As strategic force numbers are reduced, Roberts points out that Russia may seek to correct imbalances with China by abandoning the INF and reconstituting its intermediate-range nuclear forces. Roberts concludes that the long-term viability of the INF treaty should not be taken for granted.

Several experts provided papers to the Commission to illuminate the issues on the Comprehensive Test Ban Treaty, which President Obama has pledged to resubmit for Senate ratification. In his extensive paper on the subject, Burgess Laird presents the arguments in favor of the CTBT ratification while also addressing the criticisms of the CTBT opponents and the political dimensions of the treaty. In his narrative, Laird explores the technical concerns and possible military advances associated with low-yield

testing, verification and enforcement difficulties, and the Stockpile Stewardship Program (SSP) that has maintained our nuclear stockpile without testing for over a decade now. In two shorter papers, Kathleen Bailey, followed by Linton Brooks and Dan Poneman, address specific issues that might thwart CTBT ratification in the future. Bailey assesses why the Senate rejected the CTBT in 1999 and provides options for recommendations in the run-up to a future CTBT ratification review. Linton Brooks and Dan Poneman focus on the definitional criticism of what is and is not considered banned activity and the safeguards that would need to accompany ratification. Safeguards, as the authors point out, are intended to act as a hedge should the United States need to withdraw from the treaty. In order to allay the fears of those who may worry about stockpile safety and reliability, the authors present six safeguards previously proposed by the Clinton administration and offer modifications to strengthen two of them. In a related paper on CTBT, James Goodby examines how explosive testing of nuclear weapons fits into broader U.S. policies concerned with keeping the U.S. nuclear stockpile reliable, safe, and secure. Goodby also provides a list of policy options, including the advantages and disadvantages of each, to illustrate how future choices about CTBT could play out.

An emerging arms control conundrum is fast developing over the proliferation of space weapons capability and technology and the implications for future negotiations. Bruce MacDonald notes that in 2006, the Bush administration declared that space assets were "a vital national interest"; indeed, he points out that the United States heavily depends upon its space assets, including satellites, so that their damage or destruction could have a profound military and economic impact on the country. MacDonald identifies China as a particular concern for anti-satellite (ASAT) capabilities in view of its 2007 ASAT test and argues that the United States should consider seeking a ban on kinetic energy ASAT testing, not least because of the dangerous and long-lived debris such tests produce. He concludes that more attention and study should be focused on this growing threat to U.S. security. In a supporting piece on the subject, Alicia Godsberg briefly summarizes past space arms control negotiations and treaties to provide a context for the Commission to consider space arms control.

There is increasing interest in an international treaty to halt fissile material production, and the United States has long argued for a fissile material cut-off treaty (FMCT) as a way to hinder nuclear proliferation. Susan Koch examines the basic structure of a potential treaty, including an examination of the definitional variations of fissile material, adherence options, verification concerns, and the appropriate forum for future discussion. She concludes her paper—and the chapter—by suggesting four possible treaty provisions while noting the inevitable roadblocks that the FMCT will likely encounter.

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START Follow-on

Linton F. Brooks

Summary. This paper provides options for the Strategic Posture Commission concerning the START Treaty and potential follow-on bilateral nuclear agreements with the Russian Federation. It is based on two important presumptions:

- Just as the Commission has elected not to prescribe a particular force posture, it should also not specify negotiating details. Rather it should focus on broad principles.
- Although there is a plausible future in which the United States and Russia will seek to engage other nuclear powers in multilateral arms control, such an outcome is well in the future and it is not possible to make any meaningful judgments about such negotiations. Thus, this paper is limited to bilateral issues.

Current status. The bilateral nuclear relationship between Russia and the United States has four components:

- The 1987 Intermediate Nuclear Forces (INF) Treaty, requiring the elimination of ground-launched cruise and ballistic missiles with ranges between 500 and 5500 kilometers. All reductions under this treaty are complete; the Russians have recently suggested it either be expanded to cover all states or scrapped.
- The 1991 Strategic Arms Reduction Treaty (START), which limits strategic delivery vehicles, warheads (both overall and on ballistic missiles),[1] and ballistic missile throw-weight and contains a number of subsidiary limits to preclude circumvention and aid verification. START, which is exceptionally complex (primarily to ensure effective verification), will expire in December 2009 unless extended.

- A series of 1991–2 reciprocal, unilateral steps, referred to in the United States as the Presidential Nuclear Initiatives, removing nuclear weapons from Navy ships and attack submarines, eliminating nuclear artillery and short-range nuclear missiles, and withdrawing many so-called tactical, or non-strategic nuclear weapons to central storage.[2] The United States has officially stated that Russia is no longer in compliance with these commitments.
- The 2002 Treaty of Moscow (also called the Strategic Offensive Reduction Treaty or SORT), reducing operationally deployed strategic warheads to between 1700 and 2200 by 2012. Because the Treaty of Moscow lacks verification provisions and allows an immediate increase in deployed forces after 2012, it is widely regarded as little more than a joint declaration of intent expressed in treaty form.

The immediate question facing the United States and the Russian Federation is what, if anything, should replace the START Treaty when it expires in December 2009. Neither the Bush administration nor Russia wished to extend the Treaty in its present form.[3] Both saw advantages to a replacement regime that would preserve the benefits of START while reducing burdensome and expensive verification requirements. Russia sought (and presumably still seeks) a formal follow-on treaty that would include legal limits on forces. The Bush administration, convinced that the era of large-scale East-West arms control has ended and that it must retain flexibility to adjust future force structures, preferred to focus on transparency and confidence building.

The lack of Bush administration interest in formal bilateral arms control arose in part from an attempt to move beyond the adversarial relationship of the Cold War and develop more "normal" bilateral relationship between the two countries. It also reflected doubts as to arms control's relevance. Virtually all analysts and administrations of both parties accept the principle that arms control is not an end in itself but a means to ensure national security and international stability. It is thus useful to consider traditional benefits of U.S. Soviet or U.S.–Russian arms control to see if they are still relevant.

While each analyst and policy maker will have a slightly different list, the following are commonly considered benefits of formal bilateral arms control:

- *Provide predictability and avoid an action-reaction cycle where each side builds new systems in anticipation of similar moves by the other.* Called arms race stability, this was a major motivator during the Cold War. Today, however, with no new strategic systems in development in the United States and with Russian modernization proceeding at a very slow rate, it is irrelevant.

- *Reduce incentives to preempt in time of crisis (provide crisis stability).* Much of the Cold War arms control effort was aimed at encouraging a shift away from ICBMs with multiple warheads that were seen as "use or lose" systems during a crisis. While this concern is still theoretically valid, economic conditions in Russia preclude massive restructuring no matter what arms control agreements say. Further, the dangers from the antiquated Russian warning system outweigh any pressures caused by force structure.
- *Save money by capping expenditures on new systems.* This advantage has vanished due to the very slow rate of strategic spending on both sides.
- *Reduce suspicion and avoid misunderstanding through increased transparency and predictability.* This benefit remains important and argues for retention of data exchanges and other transparency measures regardless of the whether or not there are any numerical limits on force structure.
- *Improve the overall political relationship between the two sides.* This is probably the strongest argument for extending or replacing the START Treaty and was a major reason for concluding the Treaty of Moscow. It has been given increased urgency by the deterioration in political relations between Russia and the United States incident to Russia's turn away from democracy and transformation into a security state.

In addition to these traditional reasons, there are three new reasons for continuing some form of strategic arms agreement with Russia. First, continuing formal arms control (especially in parallel with ratification of the CTBT) will put the United States in a stronger position during the NPT Review Conference, slated to open April 26, 2010. Second, the United States has long maintained a *de facto* policy of maintaining nuclear forces "second to none," in part because of the importance of assuring allies of our ability to maintain extended deterrence.[4] If this policy is retained, the United States can only implement the President's desire to reduce U.S. nuclear forces in parallel with Russia. Formal arms control is the easiest way—though not the only way—to ensure such equality. Finally, some NATO allies see continuation of arms control as important both for predictability and for limiting the threat from Russia.

> Conclusion #1: *The Commission should call for United States to seek a new START treaty to halt the deterioration of relations with Russia, maintain transparency and predictability, and prepare for the 2010 Review conference. The Commission should make it clear that there are limited "traditional" military/strategic benefits to be expected from such a treaty and that it is not necessary for such a treaty to drive Russian force structure in a stabilizing direction.*

Timing. START expires in December 2009. Based on history, appropriate senior U.S. sub-cabinet officials may not be in place until late spring. Although in theory, a replacement treaty could be negotiated quickly (especially using the approach set forth below) it is probably desirable to await the completion of a Nuclear Posture Review before determining the final warhead and launcher levels to accept. Therefore, the United States should move immediately to negotiate an extension to the existing START treaty in order to (a) preserve the transparency regime and (b) make it clear that the United States and Russia intend to move forward with strategic arms negotiations. Such an extension could be done without waiting for any additional nominations or confirmations of American officials.

START can be automatically extended for five years if all five parties (including Ukraine, Belarus and Kazakhstan) agree. This is not likely to be acceptable to Russia and should be unattractive to the United States because it holds open the specter of retaining unnecessarily complex verification provisions. The easiest course would be to exchange diplomatic notes agreeing to continue to observe the provisions of the treaty pending negotiation of the replacement. An alternate would be a simple amendment extending the treaty unaltered for at least 6 months and probably a year, either between the United States and Russia or among all five parties. An amendment would require Senate advice and consent, but could be provisionally applied pending ratification. The Commission need not select among specific extension options.

In her opening statement at her confirmation, the Secretary of State said, "We will work with Russia to secure their agreement to extend essential monitoring and verification provisions of the START Treaty before it expires in December 2009, and we will work toward agreements for further reductions in nuclear weapons." To the extent that this suggests extending monitoring and verification provisions without extending the limitations of START, it is a mistake. The Bush administration tried this approach and failed. Appearing to call for extending those provisions we like (verification) but not the provisions of concern to Russia (numerical limits) will probably fail and will certainly establish a poor attitude for subsequent negotiations.

> Conclusion #2: *The Commission should propose an immediate 12-month extension of the entire START treaty without waiting for additional officials to be confirmed but should not specify the mechanism for this extension.*

One plausible approach. The United States and Russia could replace both START and the 2002 Treaty of Moscow (SORT) with a new treaty that:

- Limited operationally deployed strategic warheads to a number significantly less than the current limits of 1700–2200.[5]

- Limited launchers to slightly above the current levels (perhaps 1300). This number could be lower if systems withdrawn from strategic nuclear service—like the U.S. B-1 bomber or the four ballistic missile submarines converted to carry conventionally armed cruise missiles—were excluded. On balance, it seems easier to simply count everything that is being counted now.
- Mandated that both deployed warhead and launcher limits be reached no later than the end of 2011.
- Preserved the START inspection regime (except for portal monitoring), most of the data exchange provisions, the ban on telemetry encryption,[6] and the provision for a Joint Compliance and Inspection Commission. Simplification is possible.
- Eliminated all auxiliary limits, launcher restrictions, throw weight restrictions, limitations on deployment of mobile ICBMs, and destruction provisions (other than for launchers).

The Commission need not—and probably should not—specify the details of the follow-on approach. What is crucial is to specify that the follow-on treaty provide numerical limits on both launchers and warheads (or their surrogates under counting rules similar but not identical to those used in START).[7] In particular, the Commission should not propose a specific force structure or number of warheads for the new treaty, consistent with its decision not to prescribe a particular force posture for U.S. strategic forces. It should, however, note that this initial phase of negotiations should lead to levels on both the Russian and U.S. side sufficiently high that the forces of other states need not be considered and that there be no incentive for a Chinese "sprint to parity."[8] Virtually all analysts would agree that deployed strategic warhead numbers of 1000 or above would meet this condition.

> Conclusion #3: *The Commission should stress that the new treaty must provide numerical limits on both launchers and warheads (or their surrogates under counting rules similar to those used in START), should not offer incentives to China to seek parity or require consideration of the forces of other states, should replace both START and the Treaty of Moscow (SORT), and that the new limits should be reached as rapidly as possible.*

Risks in negotiating the replacement treaty. The greatest danger will be the temptation to expand the scope of the agreement to cover ballistic missile defenses, nonstrategic nuclear weapons, nondeployed warheads, so-called "hair-trigger alert" or other areas. These areas may well be suitable for separate parallel or follow-on discussions. The priority, however, should be given to replacing START and the Treaty of Moscow. Doing so will maintain continuity in the strategic nuclear relationship.

A second danger will be for one side or the other to seek to "improve" the existing text on peripheral issues (such as definitions or the Annex of Agreed Statements). In general, the parties should base negotiations on the premise that if either side wishes to retain existing language, it should be retained. At the same time, the sides should include "viability and effectiveness" language to permit later adjustment.

A final danger will be that the sides will be unable to agree on handling so-called conventional strategic weapons (also referred to as weapons for Prompt Global Strike) such as the proposed (and thus far rejected by Congress) Conventional Trident Modification. Some Americans, hopeful that such a program will play an important anti-terrorism role in the future, will resist any constraints, while Russians will fear an unrestrained ability for the United States to have strategic impact outside the new treaty. Because this system makes strategic sense only as a niche capability deployed in small numbers, the best solution would be to count such systems against the limits of the treaty if they are launched from existing ICBM silos, ballistic missile submarines or heavy bombers. A slight adjustment in launcher limits may be appropriate.

> Conclusion #4: *The Commission should strongly urge that the new treaty not seek to capture ballistic missile defenses or non-strategic nuclear weapons. Discussions on both could occur in parallel (the Russians will probably insist on this in the case of missile defenses) but should not be allowed to delay the START replacement.*

> Conclusion #5: *The Commission should strongly urge that any Prompt Global Strike systems launched from existing ICBM or SLBM launchers should be counted under the new treaty.*

Future flexibility. One reason some analysts oppose additional permanent reductions is the fear that geopolitical conditions will change and that it will be difficult to modify the treaty to take account of such changes.[9] They can accept reductions well below 2200, but only if there is flexibility to alter those limits in the future. To the extent that the Commission shares this concern, it could be alleviated if the new treaty allowed either side to increase warhead and launcher numbers (as in the Treaty of Moscow) but only with five years' notice. This approach would meet U.S. concerns with preserving the option to react to unforeseen international developments. Because geopolitical changes develop slowly, five years' notice for increasing operationally deployed strategic warheads would not pose any significant risk to national security. At the same time, such an approach will significantly lessen the value of the new treaty in building international support for the 2010 NPT Review Conference. It should be noted that START (and presumably its

replacement) has the common provision allowing withdrawal in cases where supreme national interests are threatened.

> Conclusion #6: *The Commission should explicitly consider whether the United States requires any additional flexibility beyond the standard ability to withdraw from a treaty. If so, it should consider recommending the provision described above.*

An alternate approach. The discussion thus far presumes a single treaty that would replace both START and the Treaty of Moscow (SORT). There is another plausible option. The United States and Russia could amend SORT to reduce the number of operationally deployed strategic warheads dramatically below the current level of 1700–2200, retaining the 2012 date for accomplishing these reductions. The amended SORT Treaty should expire far enough in the future (perhaps four years from entry into force) so that a successor START treaty with all the necessary details could reasonably be negotiated and brought into force within that time. Verification would be provided by an extension to the current START Treaty. This option could prove attractive if negotiations for the ultimate follow-on START Treaty take longer than expected. In such a case, it could make it clear to the international community that the two sides were serious about moving forward with the reductions process.

Next steps after negotiating a replacement treaty. The approach set forth in this paper will result in a simplified version of START at lower levels. The United States will probably wish to continue the arms control process further (indeed, promises to do so may become necessary during the initial negotiations). Two obvious areas for follow-on negotiations are missile defenses (covered in a separate Tiger Team paper) and non-strategic nuclear weapons. In addition, Secretary Clinton promised in her opening statement at her confirmation hearing to "work with Russia to take U.S. and Russian missiles off hair-trigger alert."

The United States might also seek further reductions in strategic offensive arms. Such additional reductions may require direct constraints on warheads (including non-deployed warheads), especially if the United States reaches the limits of the treaty through downloading of systems rather than the elimination of launchers.[10] Some Russian experts have asserted that the Russian military has become concerned with U.S. non-deployed weapons. They see the disparity in the potential for uploading of ballistic missiles as putting Russia at a significant disadvantage.

Verification of numbers and locations of non-deployed weapons (whether strategic or non-strategic) is difficult and we lack a good conceptual approach. Some work was being done at the end of the Clinton administration on warhead verification; it should be resumed. Compared to the 1990s, however,

Russia has become much less willing to allow intrusive verification. In 2002 the United States proposed inspections of all USAF bomber weapons storage areas, an approach the Russians rejected it because it was "too intrusive."[11] Almost certainly, they would take the same attitude today. The ideal approach would be for the United States and Russia to work jointly (at the technical rather than the political level) to consider approaches and technology that might allow for verification without unacceptable intrusiveness.

Quite apart from verification considerations, any proposal on non-strategic nuclear weapons needs to take the attitude of our NATO allies into account.[12] Given the vast disparity in non-strategic stockpiles, the only thing the United States has to offer in negotiations on non-strategic nuclear weapons is removal of the limited number of weapons deployed in Europe.[13] If mismanaged, such a step could damage the alliance and even induce some states to consider their own weapons programs.[14] No benefit from any Russian action on non-strategic nuclear weapons is worth fragmenting the NATO alliance.[15]

> Conclusion #7: *The Commission should recommend that the United States and Russia begin technical discussions separate from any formal arms control negotiations on verification of non-deployed weapons. These discussions should include representatives of the weapons laboratories and uniformed military from both countries.*

> Conclusion #8: *The Commission should strongly urge that the United States should conduct intensive and extensive consultations with NATO before entering into any discussions with Russia on non-strategic nuclear weapons and that it should not agree to removal of weapons from Europe without the concurrence of our NATO allies.*

Longer term multilateral discussions. As noted earlier, it is premature to bring other countries into any formal arms control negotiations and it is difficult or impossible to make any meaningful judgments about such negotiations. But it is possible that within the eight years that this administration hopes to be in office there will be a desire to move toward a multilateral regime. The challenges of doing so are daunting. They include fundamental issues such as whether all involved states will have rights to the same level of strategic forces (probably important to China and India), treatment of non-strategic weapons (a term with little meaning to such states as India and Pakistan), multilateral verification (made more complex by attitudes in China that transparency is a weapon the strong use to disadvantage the weak), and the role of defenses, especially against ballistic missiles.

Preparing for such an uncertain future should not be allowed to distract the United States from near-term negotiations. There may be merit, however,

in some discussions on transparency and confidence-building measures for nuclear forces. Initially these discussions should occur among the United States, United Kingdom and France. Later they could be expanded to include all five nuclear powers recognized under the Nonproliferation Treaty.

> Conclusion #9: *If the Commission considers it necessary to comment on longer term negotiations, it should advocate limited discussions as outlined above. In doing so, it should stress that the primary focus should remain on overall discussions with Russia on nearer-term issues.*

The outlier issue: So-called "hair trigger alert." It is important to be clear on the actual problem with current alert postures. Provisions against accidental or unauthorized launch are extremely robust in both states. Further, the current de-targeting agreements between Russia and the United States reduce the consequences of the launch of a single missile. But the ICBMs of both sides depend for survivability in part on the ability to launch them quickly in the face of an attack. The issue therefore is that one side might assume it was under attack and respond quickly (but erroneously) to avoid a "use or lose" situation. Were one side to attack, the other would have only about thirty minutes to detect and characterize the attack, make a decision to launch, communicate appropriate orders, and execute the launch before ICBMs were destroyed. This time could be even shorter for attacks involving submarine-launched ballistic missiles; the Russians often express concern about the ability of Trident to destroy their ICBM force.

In theory, lengthening decision time could give more time for verification that an actual attack was in progress and could therefore reduce the risk of a side launching a "retaliatory" strike in the mistaken belief that it was under attack. Proposals for lengthening decision time typically fail on one of two grounds. First, in time of great tension (which is when a side might be predisposed to believe it was under attack) prudent planners would restore launch readiness. Second, if one constructed a regime where it took a very long time to restore launch readiness, the chances that ICBMs would be destroyed would be increased. It is not in U.S. interest to have a situation in which the forces of either side are only useful in a first strike.

In addition to these technical problems, the Russians have shown no interest in changing the alert status of their forces. Because Russia depends more heavily on ICBMs than does the United States, the Russians will assume that such a proposal is aimed at putting them at a disadvantage, just as they assume that ballistic missile defense in Europe is actually aimed at them. It would appear much more fruitful to focus on avoiding the mistaken belief that an attack was in progress by improving Russian warning systems, building on the Joint Data Exchange Center.[16]

Separate papers will provide a more complete analysis of de-alerting. From the standpoint of arms control negotiations, however, it is important to keep this issue from becoming a poison pill. Thus, it should be raised with the Russians separately from any formal negotiations and only after we have begun to repair the overall relationship and have a better understanding of exactly what we hope to accomplish. Even then, it appears more suitable for discussion in a broad strategic stability dialogue than for formal arms control.

> Conclusion #10: *Whatever attitude the Commission adopts toward the issue of "hair trigger alert," it should recommend that the issue be kept separate from any other arms control negotiations (especially the initial follow-on to START) and should be raised only after a productive arms control dialogue has been restored.*

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1. More precisely, the Treaty limits the ability to deliver warheads by limiting delivery vehicles (missiles and bombers) and using a system of attributing a number of warheads to each delivery vehicle.
2. The United States deployed non-strategic nuclear weapons (also called tactical or battle field weapons) extensively during the Cold War to serve as a counterweight to Soviet conventional superiority and a means to link the defense of Europe to the U.S. nuclear arsenal. The term "non-strategic" is a misnomer; in political terms, all nuclear weapons are strategic.
3. Ukraine, Belarus and Kazakhstan are also parties to START but play no meaningful role in decisions on its future.
4. It is important to understand that this policy deals with perception. Arguments for maintaining it are not evaluations of military sufficiency or of the size of U.S. forces necessary to deter a Russian strike.
5. The practice of expressing a binding limit as a range (e.g. 1700–2200 operationally deployed strategic warheads) is intellectually illogical and should be discontinued.
6. Some analysts would object to this provision. They note that the encryption requirements pose a concern both for some U.S. development activities related to ballistic missile defense (in particular use of C4 SLBMs as target missiles) and for prompt conventional global strike (from delivery vehicles limited under START). Others would give primacy to the ability to continue to monitor Russian developments. The Commission need not take a position on this issue.
7. Existing START counting rules are probably unworkable and certainly unattractive at the lower levels envisioned for a follow on treaty.
8. There is no evidence that the Chinese are interested in such a sprint and they have repeatedly said they are not. Still, getting in a realm where such a sprint is feasible is an unnecessary complication.
9. Those who make this argument often cite the difficulties of modifying or withdrawing from the ABM Treaty as an example.
10. This will be a particular issue for submarine-launched ballistic missiles where there are operational reasons to maintain a certain number of ships and where elimination of launch tubes on individual SSBNs is prohibitively expensive (although tubes could easily be disabled).
11. Private communication with a senior NSC official.
12. Particular attention will need to be given to the very different views expressed by officials in private discussions versus in public as well as the different views expressed by officials of the ten Eastern European member states that have joined the alliance since 1999 and the Western European states and Turkey that constituted most of NATO member states prior

to 1999. These "new" NATO allies generally feel (a) both a stronger distrust of Russia than the Western European states and (b) a stronger need for U.S. security reassurances. Russia's actions against Georgia late last year only strengthened their distrust of Moscow and their need for security reassurances from Washington. In addition, any proposal on forward deployed nuclear systems in Europe would also need to take the attitudes of Japan and South Korea into consideration. Both Tokyo and Seoul look at U.S. commitments within NATO as a reflection of the strength of their commitments in the Asia-Pacific. The common thread among all of these actors—Western European officials "behind closed doors," Eastern European capitals, and Tokyo and Seoul is that they see the United States' forward-deployed systems as of immense symbolic/political importance. They realize that these weapons were designed for a different (Cold War) context and that they are greatly outnumbered by Russian weapons—and thus that they possess marginal operational utility—but nevertheless see them as outward and visible signs of a U.S. commitment to extended deterrence and to Article V of the NATO Treaty. Their removal could well be interpreted, in Eastern European nations especially, as a willingness of the United States to make their territories safe for conventional war.

13. In principal, one could trade Russian action on non-strategic weapons for U.S. actions in a totally different area (for example, with respect to the CFE Treaty). There are few if any examples of such an approach working in the arms control area.
14. Turkey is often cited in this regard, especially if the Iranian nuclear program continues.
15. The costs to the United States of not considering the views of the new members could be quite concrete. On a per capita basis, the new members are making significant contributions in military personnel and other capabilities to both Iraq and Afghanistan In addition, several have offered basing rights to the U.S. military, and Poland and the Czech Republic appear eager to host U.S. missile defense installations. The point is not that the new members would renege on these commitments, but that they could attempt to exact a high cost in other ways. At the very least, U.S. moves regarding non-strategic nuclear weapons that did not come as a result of extensive consultations with our NATO allies might well sound the death knell for U.S. requests that NATO members increase their contributions to Afghanistan.
16. The problem would effectively vanish if forces were restructured to eliminate ICBMs or even reduce them to a small fraction of the strategic forces of the two sides. Much of the twenty-year history of Soviet-U.S. arms control was a (largely unsuccessful) attempt to drive the Soviets away from their dependence on ICBMs.

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Missile Defense and Arms Control

Bruce W. MacDonald

Introduction and Background

While the U.S. withdrew from the ABM Treaty on June 13, 2002, Russia has expressed in several fora its interest in re-establishing some limits on strategic defensive weapons as a precondition to agreeing to substantial reductions in strategic offensive weapons. A particular matter of concern to Russia is the "third site" U.S. missile defense deployments currently planned for Poland and the Czech Republic. While the U.S. is probably unlikely to offer, and may not accept, limits on strategic defenses in its forthcoming strategic dialogue with Russia, Russia almost certainly will press the U.S. for some restrictions, which means that the U.S. will need to evaluate the conditions under which it may want to consider strategic defensive limitations, what its options are, and what it should seek in return. Accordingly, the Commission may wish to address the issue of restrictions on missile defenses.

In its interim report, the Commission found that

> "Missile defenses appropriate to defend against a rogue nuclear nation could serve a damage-limiting and stabilizing role in the U.S. strategic posture, assuming such defenses are perceived as being effective enough to at least sow doubts in the minds of potential attackers that such an attack would succeed. On the other hand, levels of defenses sizable enough to sow such doubts in the minds of Russia or China could lead them to take actions that increase the threat to the U.S. and its allies and friends." [Finding 16]

Following this logic, there is in theory a negotiating "trade space" in which the U.S. could accept limitations on national missile defenses that did not seriously affect its ability to defend against rogue nuclear threats as long as the "price" for accepting such restrictions was deemed acceptable. The

possibility of cooperation with Russia in addressing rogue threats that challenge both nations adds an important negotiating dimension to this issue.

In thinking about limits on missile defenses, there are larger issues that affect the missile defense issue. For Russia, the Third Site touches the sore spot of NATO expansion, and U.S./NATO "encroachment" closer to Russia. China has for some time been quite concerned about the viability of its nuclear deterrent, and advocacy by some in the U.S. for defenses against Chinese missiles, and seeks U.S. acceptance of mutual vulnerability. China already worries about the challenge that just current U.S. plans and deployments pose to its strategic forces and suspects that the U.S. has plans for space-based missile defenses, which causes them particular angst. China's ongoing strategic modernization may in part reflect a hedging strategy against their worst-case projections of U.S. defenses.

Options

There are a number of missile defense options, not all mutually exclusive, that could be considered, including:

A. No restrictions on strategic defenses, which would give the U.S. maximum flexibility in addressing rogue threats and preserve a mid-term option to pursue a damage-limiting strategy against China and even Russia. On the other hand, neither Russia nor China would be likely to acquiesce in such a strategy and presumably would take important steps to offset such U.S. defenses. Even absent a concerted U.S. attempt at damage limitation, such a posture could be an important disincentive to Russian agreement to reductions below what they would reduce to even in the absence of a START agreement, and both Russia and China could take additional hedging steps to preserve the credibility of their respective nuclear deterrents.
B. Confidence-Building Measures (CBMs) that would seek to reassure chiefly Russia and China but also the U.S., UK, and France that missile defense deployments and activities were not aimed at blunting others' nuclear deterrents while still providing credible defenses against rogue states. The Bush Administration was pursuing this approach with Russia, particularly on the European Third Site, which was initially welcomed by Russia but apparently fell out of favor. This option could be combined with any of the others presented here. Such CBMs could include permanent exchanges of observers at production and deployment sites, a commitment not to deploy interceptors until Iran takes some objective step, agreements for consultation before increasing interceptor numbers, and many others. U.S. pursuit of credible boost-phase missile defense, much

more relevant to the North Korea-Iran threats than to Russia or China, could with appropriate consultations help build confidence as well. If successful, such CBMs could head off Russian and Chinese responses to U.S. defenses that would be adverse to U.S. security interests and reassure them that the U.S. was not planning to pursue "worst case" defenses that Russia and China might otherwise hedge against. On the other hand, given the stakes involved, Russia and China may be reluctant to rely just on CBMs, seeing them at best as useful but insufficient to address their security concerns. This would be especially relevant to China, whose much smaller deterrent is potentially much less resilient against a sizable and effective U.S. missile defense. At a minimum, Russia would probably want such CBMs codified in a treaty and not made voluntary. Renewing the Bush Administration offer, at least as an initial step, could allow the U.S. to better determine if it was the offer or the U.S. administration that Russia was rejecting.

C. *Limitations on numbers of sites and numbers of interceptors.* Under this option, the U.S. would presumably preserve its ability to defend against rogue nuclear threats while agreeing not to deploy current technology defenses sufficient to call into question the credibility of China's or Russia's strategic deterrents. The U.S. could maintain R&D on more advanced systems as a hedge against Russian breakout and also preserve its options in the event of an unexpected technological breakthrough in missile defense. The right of both the U.S. and Russia to pursue such limited national protection could be explicitly recognized in the agreement. This option would prevent the U.S. from pursuing, for the life of the agreement, a damage-limiting strategy against Russia and China, although the U.S. would retain the option of withdrawal for supreme national interests. One potential problem is that, depending on the size of defenses permitted, defenses sufficiently modest to keep China from feeling threatened could affect U.S. capabilities to defend against rogue threats. This would depend upon the projected size of the Chinese strategic arsenal and the number of interceptors and sites permitted, among other factors. Indeed, the current U.S. plans for 40 interceptors in Alaska and four at Vandenburg AFB already cause concern to China.[1]

D. *Resurrection of the ABM Treaty.* The U.S. and Russia could resurrect the ABM Treaty and operate again under its terms. At a minimum, it would need to be adjusted to permit nationwide ABM defenses, and adjustments could be sought in its numerical limits to accommodate U.S. missile defense plans. Such an option would likely be reassuring to Russia and could enable them to agree to deeper reductions in offensive forces, as well as providing reassurance to the UK, France and China, who in the past were major Treaty supporters because

of the limited sizes of their deterrents. On the other hand, making adjustments in the ABM Treaty may be problematic: it would need to be updated in a number of ways and could well be as challenging and time-consuming as starting over. Furthermore, such a step could be politically difficult in the U.S. Were the U.S. to agree to limits on defenses, it may want to draw on portions of the ABM Treaty.

E. *A ban on strategic defenses.* While theoretically possible, such a restriction would force both Russia and the U.S. to dismantle existing strategic defenses that serve important national interests and thus would likely be unacceptable to both sides.

F. *Third Site.* Under both A and B above, there are several options for how the U.S. can choose to address the third site issue, not all mutually exclusive:
   a. *Proceed with current plans.* This would support our commitments to NATO and provide some protection against a projected Iranian ICBM threat, though it could pose a stumbling block to a larger START agreement. It would not foreclose, and could facilitate, U.S.-Russian collaboration on defense against an Iranian threat.
   b *Delayed third site IOC, with prior NATO consultations, based either on interceptor deployment or radar completion, awaiting outcome of U.S.-Russian discussions.* This provides almost all the benefits of "a," although it would delay protection against an Iranian ICBM threat, which is not projected for a few years at least. Deployment of some U.S. troops at the locations could provide some of the political reassurance that Poland and the Czech Republic are seeking.
   c. *Cancel plans to activate the third site.* Unless the U.S. could extract a sufficient "price" from Russia, this option would cleanly remove a stumbling block to START and could save modest funds, although it provides no protection for Europe or the U.S. and could hinder missile defense cooperation with Russia.
   d *Use the third site for missile defense cooperation with Russia.* Consistent with both options "a" and "b" above, this option envisions active engagement with Russia to win their agreement to cooperate in the development and operation of this third site and would likely produce additional benefits, both military and diplomatic, in joint efforts to address the Iranian threat.

Observations

1. The likelihood that Russia will press this issue at some point in the reductions process makes it unnecessary for the United States to initiate

discussions, but regardless of what outcome it is willing to agree to, the U.S. should be prepared to address Russian proposals. The growing relevance of China in U.S. missile defense thinking suggests that even if not a party to negotiations on missile defenses, ongoing consultations with China should be considered.

2. Fiscal and technological considerations make substantial increases in U.S. spending for national missile defense unlikely, at least in the near term, though simply maintaining current spending levels would allow the U.S. to deploy a sizable number of interceptors over an extended period of time.
3. While Russia may agree to modest START reductions without any limits on missile defenses, it appears likely that they would need to make substantial changes to their national security strategy before they would agree to more substantial offensive reductions without at least some limits on strategic defenses. Such changes do not appear likely in the near- to mid-term.
4. Willingness to agree to some restrictions on strategic defenses could be an important lever to win Russian concessions on issues of interest to the United States without significantly compromising U.S. ability to defend against rogue threats. Such restrictions could even facilitate collaboration between the two countries on rogue state defenses in general and the Iranian threat in particular.
5. CBMs appear unlikely by themselves to be sufficient to resolve Russian and Chinese anxieties about U.S. missile defense efforts but can be helpful as an adjunct to other restrictions.
6. There is room for compromise on the third site issue that would advance U.S. security interests.
7. As discussed in the separate START paper, discussions with Russia on this subject can occur in parallel with START follow-on discussions but should be kept formally separate because the solutions are likely to be very different in legal form. The parallel negotiating approach of the 1980's provides one model.

1. The Obama Administration have proposed reducing this deployment to 30 interceptors since this paper was written.

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Future Role of Tactical Nuclear Weapons

Barry Blechman

The term "tactical" nuclear weapons, typically used to designate shorter range weapons that would be used for war-fighting purposes, is misleading as weapons of any range can be used for either strategic or tactical purposes, depending upon the situation.[1] Still, we'll adhere to the convention for the purposes of this paper.

The U.S. has a relatively small number of tactical nuclear weapons, mainly nuclear gravity bombs that can be delivered by tactical aircraft. The U.S. also has a small number of nuclear-armed Tomahawk cruise missiles that were taken off deployment in the early 1990s but are held in a reserve status. Of U.S. allies, the UK no longer deploys tactical weapons. France retains a small number of nuclear-armed short-range missiles that would be delivered by tactical aircraft, but recently announced plans to halve this inventory.

In addition, several other U.S. allies in NATO, who have no nuclear weapons of their own, deploy tactical aircraft squadrons equipped and trained to deliver nuclear bombs. Such weapons are maintained on bases on their territory—in some cases at U.S. bases, in others at the ally's base. In all cases, release of these weapons requires approval of both the U.S. and the host nation. During the Cold War, these weapons were intended to be one means of implementing NATO's threat to initiate nuclear warfare in the event NATO's forces were in danger of being overrun by quantitatively superior Soviet conventional forces. Today, some U.S. allies, or at least their national security officials, place importance on retention of these weapons in support of maintaining a special role in the alliance. The special arrangements concerning these weapons and the need to plan for their possible use are also believed to support closer relations among the allies. In addition, the possibility of an Iranian nuclear weapons capability

and deteriorating relations with Russia have been reinvigorating support for maintaining tactical weapons in some countries.

All U.S. tactical nuclear weapons in the Pacific are retained only on U.S. territory. Japan, however, or at least some Japanese officials, is said to place importance on retention of the Tomahawk missiles, even if in a reserve status, as evidence of the credibility of U.S. security guarantees.

Since the end of the Cold War, with the erosion of its conventional military capabilities, Russia has placed increasing emphasis on nuclear weapons generally, and on tactical weapons in particular. As NATO has expanded, Soviet military writers have envisioned the possibility of warfare on its borders or in what they call "the near-abroad," and have stated that Russia would not hesitate to use tactical nuclear weapons in such circumstances. Russia is believed to have thousands of such weapons, both air-delivered munitions and ground-launched missiles, and there have been press reports that Russia has continued to modernize these weapons throughout the post–Cold War period.[2]

China also has nuclear weapons that could be delivered by short-range aircraft, as well as a growing inventory of short- to medium-range missiles that could be armed with nuclear warheads.[3] China probably envisions these weapons in a strategic context, however, either with regard to a confrontation with the U.S. over Taiwan or Korea, or in a future conflict with Russia or Japan.

Tactical nuclear weapons of the types addressed in this paper have never been discussed in any formal arms control negotiation and are not subject to any negotiated constraints.[4]

In considering its future nuclear posture, the U.S. needs to decide whether or not it wishes to retain its tactical weapons and, if so, which ones and where they should be deployed. These questions should be considered along with decisions on strategic nuclear forces as, for example, a decision to make deep cuts in strategic forces might cause one to place greater emphasis on tactical weapons, or vice versa. Decisions on tactical weapons may be particularly important in the near future as, if they are to be retained in the force, steps have to be taken with respect to modernizing the aircraft that would deliver them, the facilities in which they are stored, particularly in Europe, and even with regard to some of the weapons themselves. Also, NATO is reconsidering the role of dual-key weapons in the post–Cold War environment and the U.S. needs to lead that process. Complicating all these issues is the likelihood that any public debate on nuclear modernization in Europe could have significant political repercussions. None of these decisions can be discussed in any detail in an unclassified paper.

The future of the Tomahawk missiles also poses an important question. The Navy has sought to retire these weapons for many years as maintaining

their reserve status requires special training of some submarine crews and special certification of some submarines—an allocation of manpower time and financial resources the Navy would prefer to forego. The question is whether or not Japan could be reassured about the U.S. nuclear guarantee through some other means, such as an action to draw attention to the presence of U.S. strategic submarines in the Pacific.[5]

Regardless of its near-term decisions about tactical nuclear weapons, the U.S. clearly should attempt to include these weapons in future arms control negotiations so as to attempt to place some controls on Russian forces. While the two nations seem to have similar numbers of strategic warheads, the Russians clearly have a huge advantage in tactical warheads. Moreover, it is these weapons which perhaps are most vulnerable to being acquired by a terrorist organization, either because of laxity in Russian security precautions or because of corrupt Russian officials. Perhaps not the next agreement with Russia on nuclear issues, but certainly the agreement after that should seek to define limits on both nations' (and other nations') total warheads, both strategic and tactical.

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1. For example, the nuclear forces of Israel, India, and Pakistan would all be considered "tactical" in that they are of relatively short-range, but are obviously intended for strategic purposes.
2. Of course, use of numerous nuclear weapons on its border could have very negative unintended consequences for Russia itself; still, Russian military officials appear to believe the threat has deterrent value.
3. Most of China's short- to medium-range missiles appear to be conventionally armed.
4. The U.S.-Soviet Treaty on Intermediate-range Nuclear Forces in 1985, which eliminated the two nations' ground-launched ballistic and cruise missiles with ranges between 500 and 5,500 km, might be considered an exception to this statement, but the U.S., at least, considered the missiles it was giving up in a strategic context.
5. When the U.S. withdrew its intermediate-range missiles from Turkey in the 1960s as a consequence of the Cuban missile crisis, a Polaris strategic submarine, then deployed in the Mediterranean, made a port call to Izmir to demonstrate the continuing U.S. nuclear presence in the region.

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Potential U.S.-Russian Nuclear Arms Control/Non-proliferation Initiatives on Non-strategic Nuclear Forces

Victor A. Utgoff

What Does the Term Non-Strategic Nuclear Forces Encompass?

By definition, non-strategic nuclear forces (NSNF) do not include the kinds of nuclear forces that have been captured in the strategic arms control agreements concluded between the U.S. and Russia or the former Soviet Union. Further, this paper will not consider intermediate-range nuclear forces as the INF Treaty eliminated these forces for the U.S. and Russia. NSNF does include forces such as nuclear-armed tactical aircraft, the TLAM-N, short-range nuclear-armed ballistic missiles, artillery-fired atomic projectiles, nuclear warheads for air and ballistic missile defense, nuclear depth charges, nuclear torpedoes, and atomic demolition munitions. This collection of weapons with its wide spectrum of yields, delivery ranges, sizes, uses, etc., defies any simple and useful characterization in terms of physical properties, except that they are all nuclear weapons.

In this short paper, we will consider NSNF as belonging to one or the other of two classes. The first will be battlefield weapons broadly defined as those having relatively small nuclear yields and planned for use against opposing forces at ranges of at most a few hundred miles. The second will be referred to as theater nuclear weapons—which are capable of larger yields and could be planned for use against forces or other targets at ranges of perhaps 500 to 1000 miles.

Note that many nuclear-armed states other than Russia and the U.S. own weapons that would fall into the second of these two classes. As it seems unlikely those forces will become subject to arms control limitations in the foreseeable future, this paper restricts its attention to NSNF owned by the U.S. and Russia.

Primary Values of NSNF as Seen by Russia and the U.S.

During the darkest periods of the Cold War, the U.S. and the Soviet Union deployed many thousands of NSNF. Their primary value for the U.S. and its allies was to offset the large numerical superiority in conventional forces fielded by the Soviet Union and its allies. The Soviet Union built NSNF in order to be able to hold its own if not win the nuclear combat the U.S. and its allies might escalate to, and to avoid being seen as inferior in this category of military capabilities.

As the Cold War ended, substantial reductions were made in NSNF. In 1987, the U.S. and the Soviet Union agreed to the Intermediate Nuclear Forces Treaty which eliminated all land-based ballistic and cruise missile with ranges between 500 and 5500 km. In 1991–92 further reductions in NSNF were promised by both sides in sequential "Presidential Nuclear Initiatives." President George H.W. Bush first promised to unilaterally withdraw all land-based tactical nuclear weapons (those that could travel less than 300 miles) from overseas bases and all sea-based tactical nuclear weapons from U.S. surface ships, submarines, and naval aircraft. In late 1991, NATO further agreed to reduce by "about half the number of nuclear weapons for nuclear-capable aircraft based in Europe." NSNF were also removed from bases in South Korea by 1991.[1]

In October 1991, "Russia's President responded by stating that…the Soviet Union would destroy all nuclear artillery ammunition and warheads for tactical missiles; remove warheads for nuclear anti-aircraft missiles, and destroy some of them, destroy all nuclear land-mines; and remove all naval [NSNF] from submarines and surface ships and ground-based naval aviation, destroying some of them." "President Yeltsin [amplified these promises by] stating that Russia would destroy all warheads from short-range missile, artillery, and atomic demolition devices; one third of the warheads from sea-based [NSNF]; half the warheads from air-defense interceptors; and half the warheads from the Air Force's [NSNF]."[2]

These reductions and redeployments reflected recognition on both sides that the prospects of war between them had essentially disappeared for the foreseeable future. The reductions were especially welcome for NATO front line allies as the possibility that they would have to mount a nuclear defense on their territory had always been viewed with great skepticism. Many

experts believed that such a defense could not be implemented effectively, and in any case would lead to enormous destruction for both sides.

Shifts in Perceived Values of NSNF

The values of NSNF now seen as most valuable have shifted for both sides. Russia's conventional forces have suffered a serious decline and it no longer sees itself capable of defending its vast territory with conventional forces. Consistent with this view, in 1993, Russia "rejected the Soviet Union's no-first use pledge, indicating that it viewed nuclear weapons as a central feature in its military and security strategies." During a meeting of the Kremlin Security Council in 1999, President Yeltsin and his security chiefs reportedly agreed "that Moscow should develop and deploy tactical, as well as, strategic nuclear weapons." Vladimir Putin, then chair of the Council, stated that Yeltsin had endorsed "a blueprint for the development and use of non-strategic nuclear forces." In military doctrine published in 2000, Russia stated that it could use nuclear weapons "in response to large-scale aggression utilizing conventional weapons in situations critical to the national security of the Russian Federation.[3] In 2003, President Putin went so far as to refer to nuclear deterrence forces as "the main foundation of Russia's national security."[4]

These statements indicating a change in Russian policy toward NSNF are consistent with rebuffs of NATO's requests for information about the status of Russia's NSNF. In 1997, NATO expressed its concerns about "the large number of tactical nuclear weapons of all types" and called on Russia "to bring to completion" the reductions called for in the 1991 and 1992 presidential nuclear initiatives. In a December 2000 report NATO also "proposed a set of transparency measures… including an exchange [of] data on U.S. and Russian sub-strategic nuclear forces." As of May 2002, these proposals "had not achieved many tangible results."[5] More recently Rose Gottemoeller noted that "differences over how to exchange data under the Presidential Nuclear Initiatives [have] been a persistent irritant between Russia and NATO practically since [they] were agreed to the early 1990s."[6,7]

For the U.S., the value of its nuclear umbrella as a tool for dissuading nuclear proliferation primarily by allies has increased substantially since the end of the Cold War. Nuclear proliferation by North Korea and especially its test of a nuclear device in 2006 have led both Japan and South Korea to seek reassurance from the U.S. that they can continue to rely on its nuclear umbrella. NATO members, especially those nearest to Russia, also appear to value greatly the extended nuclear guarantees provided through the Alliance. Iran's pursuit of capabilities to build nuclear weapons has raised concerns among some Middle East states about their possible need for the deterrent protection provided by nuclear forces.

U.S. allies see NSNF specifically as an important if not essential component of extended nuclear deterrence. Japan especially values U.S. capabilities to deliver nuclear strikes from forward locations within Northeast Asia, especially those that can be provided by deploying the U.S. TLAM-N on attack submarines. South Korea raised the question of redeployment of U.S. NSNF onto its territory in consultations with the U.S. immediately after North Korea's nuclear test in 2006. NATO has been a strong supporter of nuclear programs of cooperation with the U.S. that store nuclear bombs on the territories of some NATO states that would be released to and flown to their targets by the allies.

NATO's 1999 Strategic Concept states that "a credible Alliance nuclear posture and the demonstration of Alliance solidarity and common commitment to war prevention continue to require widespread participation by European Allies involved in collective defence planning, in nuclear roles, in peacetime basing of nuclear forces on their territory and in command, control and consultation arrangements. Nuclear forces based in Europe and committed to NATO provide an essential political and military link between the European and the North American members of the Alliance."[8] NATO's Strategic Concept is being revised this year. While it is possible that the new concept may not take so strong a position on retention of U.S. NSNF in Europe, European concerns about Iran's pursuit of a capability to build nuclear weapons and Russia's invasion of Georgia point in the other direction.

Primary Concerns with U.S. and Russian Deployed NSNF

The primary concerns with Russian battlefield nuclear forces are the large uncertainties in their numbers, the possibility that they have not been relocated at central storage facilities but are instead deployed at a large number of bases across Russia, and that those bases are not adequately secure against the possibility of theft, capture, or misuse of such weapons. CTR support has apparently been focused on assistance in moving nuclear weapons from Ukraine and Kazakhstan back to Russia after the Cold War and on improving the security of only its central storage locations.[9]

The technical features of some Russian NSNF are also a source of worry. Some of these weapons, such as atomic demolition munitions, are light enough to be man portable and small enough to easily hide. It is also possible that Russia has had some success in developing weapons with specialized features for "battlefield" use. For example, an air-air defense weapon producing directed high-intensity neutrons or directed EMP effects might greatly increase the effectiveness of Russian fighter-interceptors.

More generally, NATO was never satisfied that it had a practical doctrine for employing nuclear weapons against maneuvering ground forces in a

way that would be effective but would be unlikely to produce large amounts of blast, radiation, and fire damage to non-military targets. But effective battlefield nuclear doctrines that produce low collateral damage are possible, especially using relatively clean low-yield weapons.[10]

Finally, some argue that a "nuke is a nuke" and that Russia should not be allowed to retain a substantial advantage in numbers of NSNF, especially new types for fighting on the battlefield. Perhaps so, but NATO's European Allies have always preferred that any nuclear warfare not be restricted to their territories but quickly escalate to the adversary's homeland. It seems likely that NATO would not act on the opportunity to build nuclear forces specialized for battlefield use, though a modest number of some types of specialized low-yield weapons might be useful from a strictly military point of view.

Among the primary concerns expressed about U.S. forward deployed NSNF are that they too might not be adequately secure against the possibility of theft, capture, or misuse. As part of an Air Force effort to upgrade the handling and security of its nuclear weapons, it inspected nuclear storage sites in NATO Europe and reported that most of those sites "do not meet U.S. security requirements." This report stirred up some anti-nuclear sentiment in Europe. At the same time, officials from NATO states and NATO HQ rejected the review's findings and methodology. They argued that the review added nothing new to the reports on the security of these sites that are provided quarterly to the NATO Nuclear Planning Group, and added that security enhancements are being implemented.[11] Another concern expressed by some is that forward deployment of NSNF in Europe is simply not needed in the current security environment.[12]

Possible Commission Recommendations

Unless and until Russia finds a way to build conventional forces sufficient to give it reasonable confidence that it can defend its territory from conventional attack, it seems most unlikely to consider eliminating all its NSNF. Similarly, the various means for implementing U.S. extended nuclear deterrence guarantees to NATO for more than 40 years, especially forward deployment of NSNF for potential release and use by Allies if necessary, have become a powerful symbol of Alliance solidarity.

In the current international security environment, with its fractious U.S.-NATO relations with Russia, and with some NATO Allies becoming increasingly concerned with Iran's pursuit of capabilities to build nuclear weapons, unilaterally withdrawing forward deployed U.S. NSNF seems likely to shake the confidence of NATO in U.S. nuclear security guarantees. And, all other things being equal, their concerns would be widely shared by non-NATO allies who also depend upon U.S. extended deterrence guarantees.

Possible Recommendation 1: The commission could recommend that the U.S. not consider withdrawing all U.S. NSNF from Europe without comprehensive consultations with all the NATO states and the organization as a whole.[13] Further, all U.S. allies depending upon the U.S. nuclear umbrella should be assured and satisfied that such redeployments do not imply any weakening of their extended nuclear deterrence guarantees.[14] Arrangements for quick redeployment should the need arise would be maintained, as would all the other planning, training, exercise, and command and communication capabilities required to maintain overall NATO capabilities to support nuclear deterrence. Sufficient conditions for redeployment could be agreed in advance.[15]

NATO seems less likely to support redeploying U.S. NSNF in Europe back to the U.S. unless they see substantial gains from doing so. This suggests that such redeployments be paired with a valuable change in Russia's NSNF deployments.

Possible Recommendation 2: The commission could recommend that the U.S. seek an understanding with Russia that all NSNF would normally by held in storage facilities centrally located within each state's territory.[16]

As mentioned above, since only a few years after the Presidential Nuclear Initiatives, NATO bids to get Russia to discuss the disposition and nature of remaining Russian NSNF or to consider NSNF arms control have gotten at best minimal responses. Pending a substantial improvement in NATO-Russian relations, movement toward any negotiated limits on NSNF may simply not be possible. In this event, small but useful steps might still be possible, especially in concert with the broader and more important diplomatic efforts the new administration appears to be interested in making.

Possible Recommendation 3: The commission could recommend that the U.S. and NATO seek an agreement with Russia to begin to exchange information on the nature and disposition of the NSNF capabilities that both sides have maintained. Additionally, the sides might consider joint efforts to re-explore technical means for verifying the elimination of such weapons.[17]

U.S.-Russian negotiations to reduce both sides' nuclear weapons seem likely to eventually require taking formal account of Russian NSNF either by counting them with strategic nuclear weapons according to some agreed formula, or counting them in a separate agreement that limits NSNF. It is not too early to attack this problem. A failure to consider NSNF could even prove a "poison pill" when the executive branch seeks acceptance of a START follow-

on agreement.[18] It is important to understand that nuclear weapons are not all equal and incorporate this fact into thinking about arms control.

Possible Recommendation 4: The commission could recommend that DOD and DOS explore alternative approaches to counting rules for NSNF.

1. Amy Woolf, "Report for Congress, Nonstrategic Nuclear Weapons," Congressional Research Service, updated July 29, 2008, pp. 9-10.
2. Ibid, p. 11.
3. Ibid, pp. 15-16.
4. Dmitri Trenin, "Russia's Nuclear Policy in the 21st Century Environment," IFRI, Autumn 2005, p. 8.
5. "The Pressing Need for Tactical Nuclear Weapons Control," Arms Control Today, May 2002.
6. 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 2007," Hoover Institution Conference, December 2008.
7. Note that this shift in Russian attitudes toward NSNF is consistent with the possibility of continued Russian development of nuclear weapons. Use of nuclear weapons against conventional forces operating on or over Russian territory or that of an opponent would place a premium on very small nuclear weapons and on weapons that produce minimal residual radiation or provide special effects such as directed EMP or enhanced neutron radiation.
8. "The Alliance's Strategic Concept," approved by Heads of State and Government participating in the meeting of the North Atlantic Council in Washington, D.C., April 23-24, 1999, paragraph 64.
9. Woolf, op. cit., pp 25-26.
10. Victor Utgoff and Willard Christenson, "Battlefield Nuclear Forces: An Undervalued Option for Improved Deterrence in Europe" (U), Institute for Defense Analyses, Paper P-2076, May 1988, unclassified Executive Summary.
11. Hans M. Kristensen, "USAF Report: Most Nuclear Weapons Sites in Europe do not meet U.S. Security Standards," FAS Strategic Security Blog, June 19, 2008.
12. See Oliver Meier, "NATO Mulls Nuke Modernization, Security," Arms Control Today, September 2008.
13. See "Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II, review of the DoD Nuclear Mission, December 2008, p. v.
14. This potential recommendation parallels a conclusion in Linton F. Brooks, "START Follow-on," February 15, 2009.
15. For example, redeployment in the event that Iran tests a nuclear device or is otherwise discovered to be building nuclear weapons could be guaranteed.
16. See recommendations in "Toward a Nuclear-Free World," George P. Schultz, William J. Perry, Henry A. Kissinger and Sam Nunn, Wall Street Journal, January 15, 2008.
17. Gottemoeller, op. cit.
18. Burgess Laird made such an observation in his comments on Linton Brooks' START Follow-on.

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De-alerting Strategic Missile Forces

Franklin C. Miller

The so-called de-alerting debate has been with us for well over two decades. The "failure" of the U.S. and Russian governments "to solve the problem" has been attributed to bureaucratic resistance on both sides. Some authors today continue to insist "quick-use forces could exacerbate instability in a crisis and are vulnerable to inadvertent use." It is certainly correct that officials in both Moscow and Washington have resisted appeals to take their respective missile forces off alert; that this is true underscores three underlying realities: (1) the alert posture of both sides nuclear force is in fact highly stable and subject to multiple layers of controls, *i.e, neither side is on a "hair trigger alert"*; (2) there is confusion about what the ultimate goal of de-alerting is; and (3) given this uncertainty, it is far more difficult to prescribe corrective action that does not contain within it the seeds of crisis instability.

Are we on "hair trigger alert" today?

Both U.S. and Russian strategic nuclear missile forces (i.e., land-based missiles {ICBMs} and submarine launched missiles {i.e., SLBM}) can only be launched if the proper codes are provided to the launch crews by the respective national leaderships. These codes are needed to unlock electromechanical devices which otherwise would prevent missile system launch. Access to the codes is highly restricted, and the codes are not maintained at the ICBM launch sites or onboard the strategic missile submarines (SSBNs). In the United States, only the President has the authority to release the codes to the forces, thereby enabling the launch of a nuclear-armed system. It is generally believed that the Russian President holds the same

nuclear-launch authority as well. All of this said, there was concern in some quarters during the Cold War that the inherent vulnerability of ICBMs to pre-emptive attack would cause a U.S. President or the Soviet leadership to order the launch of their ICBMs if early warning information received from infra-red sensing satellites and long-range ground-based radars suggested that the other side had initiated such a pre-emptive attack. This Cold War situation has changed significantly since the early 1990s. As both sides gradually reduce the warhead loadings on their ICBMs to meet the limits of the START treaty and the Moscow Treaty, the military value of a pre-emptive strike on the other side's ICBMs is greatly reduced; attacking an ICBM armed with a single nuclear warhead is generally considered to be of no interest to nuclear planners on either side. Moreover, by fielding mobile ICBMs which can be dispersed in a crisis, Russia has taken further steps to insure the survivability of its nuclear deterrent and to reduce the pressure to make an early decision to launch its nuclear forces. And, in fact, since the end of the Cold War, Russian strategic forces have been operated in a manner which suggests the Kremlin does not fear a bolt out of the blue attack: the majority of their SSBNs have been kept in port and their mobile ICBMs have remained inside their bases.

All of this said, some believe that false indications of an attack could cause the President or the Soviet leadership to order an all-out launch by mistake. Recognizing this, U.S. national policy stressed for decades that our deterrent should not rely on such a "launch under attack" capability and, in fact, U.S. retaliatory plans were built in a manner to insure that this was so…thereby increasing stability. According to some commentators, however, the Soviet leadership created a "doomsday system" which could, under certain circumstances (total loss of communications with the Soviet leadership, confirmed detection of nuclear detonations on Russian soil, etc.) bypass the electro-mechanical interlocks and launch Russian ICBMs; these commentators believe the Russian Government has retained this doomsday system and that it could be activated accidently. The U.S. intelligence community has never verified the accuracy of these reports.

Would taking strategic missile forces off of alert increase stability?

Despite a general belief in both the U.S. and Soviet/Russian governments that maintaining missiles in an alert status did not create instabilities, for more than twenty years an element of the arms control community has worried about alert intercontinental ballistic missiles (ICBMs), and in particular Russian ICBMs standing day-to-day alert, concerned that they are particularly susceptible to accidental or inadvertent launch. An often-voiced argu-

ment is that the Russian military is concerned to the degree of paranoia about a U.S. surprise attack and that it is predisposed to call for a rapid launch of its ICBMs if indications of a U.S. attack were received; these fears are compounded by the fact that the Russian missile early warning system has deteriorated since the Cold War and that major gaps in coverage exist. They have led to calls for taking steps to disable the U.S. Minuteman force in the hope that Russia would follow suit with its ICBMs—thereby increasing strategic stability. The de-alerting proponents allow that if a crisis developed the systems could be returned to alert status in order to deter attack. In the abstract, all of this sounds reasonable. The rationale, however, begins to unravel when it confronts reality.

Russia has far more warheads on its ICBMs than the United States has in its Minuteman force (because Russian strategic culture places far more confidence in its land-based forces than it does in its submarine-based forces). As a result, even if the United States were to eliminate its entire ICBM force, Russia would probably still maintain ICBMs on alert. Put another way, if all U.S. ICBMs were disabled, Russia might arguably be willing to take a number of ICBMs carrying warheads equal to the U.S. ICBM force off alert…but this would still leave a sizable portion of the Russian ICBM force on alert. And, to the degree one worries about Russian paranoia leading to "hair-trigger" responses, the prospect of taking only a portion of the Russian ICBM force off alert should raise major worries, because the remaining alert forces would logically be placed on an even higher alert status than is the case today (because the prospect of the loss of these remaining alert missiles would be absolutely unacceptable in Russian eyes). *If, therefore, the goal of a de-alerting policy is to decrease Russian reliance on quick launch, this step would fail to meet that goal.* Nothing short of removing all Russian ICBMs from alert would do—and the prospect for this is highly unlikely.

Furthermore, the idea of disabling U.S. ICBMs is premised on the view of some Americans that the threat the Russian General Staff fears is a preemptive strike carried out by U.S. ICBMs. Various Soviet and Russian officials over the years, however, have pointed more often to the U.S. SLBM force as the source of a U.S. first strike. *From an American standpoint, however, it is difficult to conceive of a more destabilizing action than that of disabling the ability of our ballistic missile submarines to launch their missiles—and therefore to be able to deter under all possible circumstances.*

Finally, even if both sides were able to muster the political will to take the great step into the unknown by de-alerting/disabling some or all of the ICBMs and/or SLBMs, no verification scheme has yet been devised to provide confidence that a missile, land- or sea-based, either has been taken off alert or returned to alert status. Should a crisis develop, moves by each side to return disabled nuclear forces to an alert status would further heighten

tensions and raise the specter of one side launching first in the belief that the other side had not completed its re-alerting activities.

If we disable our missile forces, can we return them to alert status safely?

If there is one lesson to be learned from the recent December 2008 report by the Secretary of Defense Task Force on Nuclear Weapons Management (also known as the Schlesinger Task Force), it is that once crews stop believing their mission is real they cease to pay attention to their responsibilities and lose competency; de-alerting would create such attitudes (as an example, examine the challenges of maintaining morale of the Minuteman II launch crews who continued to carry out their functions once their systems were deactivated in the fall of 1991). We should be quick, therefore, to note the dangers which would arise from using badly motivated and incompetent forces to return systems to alert status in a crisis.

If we are concerned that false warning information could create pressures for a launch decision, are there other steps we can take?

To the degree that one worries about launch based on faulty information, the best answer has always been to improve Russian warning systems to make an accidental launch impossible; the moribund U.S. effort to establish a Joint Warning Center with Russia attempted to help fill this need.

1. The term "de-alerting" has many interpretations. A de minimis approach to de-alerting would be to remove target coordinates from a missile's guidance computer; if somehow launched by accident, the missile would head for the open ocean rather than any land mass. **This action was taken by the U.S., Russia, UK, France and China in the mid-1990s.** Another approach would call for removing a component necessary to launch the system from the launch control complex; in the U.S. this might be removing the firing keys and storing them off-site. In a building crisis, the keys, it is argued by proponents, always could be returned to the launch complexes. (Obviously, it is much more difficult to do something similar with SSBNs.) Verifying that a second set of launch-critical components had not been hidden on-site would be a daunting task, however. A less reversible and more dramatic approach would call for the removal of warheads from the missiles; this could be verified with higher confidence, but re-arming the missiles could take a year or more; in a crisis, the side that re-armed first would have an obvious advantage. The conundrum here is that the more dramatic and verifiable steps make it impossible to fire a missile in peacetime (when there is no need to deter another state) but create circumstances where, in a crisis, when a deterrent is necessary to help manage and de-escalate the situation, there could be both a rush to re-arm and a premium for pre-emption. I have used the term"disable" in this paragraph to indicate that the steps being recommended would not be reversible in a matter of minutes.

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The Future of INF

Bradley H. Roberts

Background

For most of the U.S. arms control community, the Treaty on Intermediate-range Nuclear Forces is little more than an historical footnote. Agreed in 1987, the treaty led to the elimination of all U.S. and Soviet ground-launched cruise and ballistic missiles with ranges between 500 and 5500 kilometers. The elimination of these weapons was completed years ago. The INF treaty is far more prominent in Russia's arms control debate. Russian concerns about the treaty crested in 2007 with a series of high-level statements threatening to withdraw. The Bush administration was able to persuade Russia to agree to a renewed effort to globalize the treaty. The Obama administration has signaled its commitment to this globalization effort. Diplomatic efforts have been made to expand INF membership to all countries with missiles of the specified ranges. But this seems highly unpromising, as it would require states as varied as Israel, Iran, Pakistan, India, and China to relinquish such capabilities. The fate of the treaty is a matter of considerable importance to U.S. allies in both Europe and Asia, among many others.

Key Issues

The INF treaty may resurface as an issue for U.S. arms control strategy in one of two ways. The first would be through failure to re-start START. At this time of renewed high-level commitment to renewed strategic dialogue with Russia, such a failure seems unlikely. But dialogue may yet not result in a return to the START process envisioned by many. From a top-level political perspective, the United States is renewing its interest in arms control at a time when Russian leaders talk increasingly about the need for strategic flexibility in order

to meet the different requirements of a new security environment around Russia's periphery. They talk explicitly about the need to escape "cold war relics" in the arms control realm. These explicitly include CFE and INF. Their complaint about the treaty on Conventional Forces in Europe is that it locks them into a cold war force posture that is ill-suited to Russia's current and emerging security environment. Their complaint about the INF treaty is that it prevents their deployment of counters to the medium- and intermediate-range nuclear weapons deployments on-going around their periphery. Some Russian experts have argued that being freed from these restraints might actually enable the Russian military to reduce its reliance on tactical nuclear weapons as a cover for weakness in other dimensions of Russian military power. In dealing specifically with the INF-derived "imbalances," Russian experts argue that neither ICBMs nor tactical weapons are useful for re-establishing the desired nuclear balances with these states. Russian leaders have explicitly threatened to withdraw from INF in response to U.S. missile defense plans in Central Europe. If ultimately Russia cannot accept what the U.S. and NATO deem necessary in this regard, there may be many repercussions, including INF withdrawal. This would lead, presumably, to Russian redeployment of intermediate-range nuclear forces to counter-balance comparable systems in countries oft-mentioned of specific concern: Iran, India, and China. A quick means of doing so has also been touted by some Russian military leaders: enhancements to the new Iskander SRBM.

The second way in which INF may resurface would be if re-starting START succeeds. As is widely recognized, reductions in the number of operationally deployed strategic nuclear weapons would raise a host of new arms control challenges. One of the most complicated relates to how to bring China into the equation. So far at least, the U.S. side has conceived this problem as largely a challenge of dissuasion (i.e., how many U.S. weapons are enough to ensure that China is not tempted to make a "sprint to parity"). Russia shares this concern about a possible Chinese sprint, but it also sees China as already well ahead in the local nuclear balance of power, as it fields medium- and intermediate-range forces against Russia for which Russia has no counter-balancing force. The large Russian advantage in tactical nuclear weapons seems useless to Russians for this purpose, as there is no Russian conventional force structure along the border with China whose presence these weapons might support. China is highly unlikely to relinquish these weapons in order to globalize the INF treaty. This imbalance of forces will become even more pronounced in Russian eyes as the strategic reductions accelerate, and it may seek escape from the restraints of the INF treaty as part of the process of reducing strategic forces. Some Russians have spoken privately about altering the INF Treaty so that it permits Russia a fixed number of deployments in a limited number of geographic regions. This might prove

tolerable to the United States and its allies under certain conditions. But U.S. allies, especially those in East Asia, keenly remember an initial U.S.-Soviet INF deal two decades ago that would have shifted SS-20 deployments from west of the Urals to East Asia, a deal that Japan in particular saw as a sell-out of its interests. These sensitivities are certain to re-erupt if and as the INF treaty reemerges as a topic of political interest.

Suggested action by the SPC: final report might include a finding on this topic but no specific recommendation seems necessary at this time.

Notional finding: The long-term viability of the INF treaty should not be taken for granted. Russian complaints that it is a "cold war relic" that locks Russia into an increasingly disadvantageous military position as medium-range nuclear-tipped missiles proliferate around its periphery have led to renewed efforts to "globalize" the treaty. This seems highly unpromising, as countries like Israel, Iran, India, and China seem highly unlikely to relinquish capabilities they see as essential to their regional military postures. Collapse of the treaty would undermine the U.S.-Russian arms control process more generally, while also negatively affecting the security interests of U.S. friends and allies in both Europe and Asia. Success in renewing strategic arms control with Russia (and more generally, in renewing a genuine strategic dialogue) could assuage some Russian concerns about INF, but may also raise new questions about how to stabilize strategic competition in Eurasia.

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Assessing Technical Concerns with the Comprehensive Test Ban Treaty

Burgess Laird

Introduction

Following a short floor debate in October 1999, the Senate rejected ratification of the Comprehensive Test Ban Treaty (CTBT) by a vote of 51–48, falling far short of the 67 votes necessary for ratification. Over the past few years, there has been growing support across the U.S. political spectrum for reconsideration and ratification of the CTBT, which prohibits conducting any nuclear weapons test explosion or any other nuclear explosion anywhere. In both of their frequently cited op-ed pieces in *The Wall Street Journal*, four senior U.S. statesmen (former Secretary of State Henry Kissinger, former Secretary of State George Shultz, former Secretary of Defense William J. Perry and retired Senator Sam Nunn) have urged the U.S. Senate to reconsider and ratify the CTBT. President Obama has made ratification of the CTBT one of the major pillars of his arms control and disarmament policy.

Many experts see ratification of the CTBT as essential to restoring confidence in the nonproliferation regime. Indeed, the CTBT has long been seen as a litmus test of the Nuclear Weapons States' commitment to their obligation under Article VI of the Non-Proliferation Treaty (NPT) to pursue measures leading to nuclear disarmament. Moreover, a key part of the bargain that secured the indefinite extension of the NPT in 1995 and at the 2000 NPT Review Conference was commitment on the part of the Nuclear Weapons States to achieve the CTBT. U.S. failure to ratify the CTBT has come at a cost. It has repeatedly put the United States on the defensive at different international nonproliferation meetings, including the NPT Review Conferences. It has complicated the U.S.'s ability to persuade other states to address the

challenges posed to the NPT regime by countries such as North Korea and Iran. Finally, it has served as a convenient rationale for other states to avoid embracing important new non-proliferation measures such as the International Atomic Energy Agency's (IAEA's) Additional Protocol, which requires the IAEA to assess the entire nuclear fuel cycle through intrusive verification measures such as short-notice inspections of suspected facilities.

CTBT proponents argue that the global norm against nuclear testing remains strong, as the international condemnation of the 1998 tests by India and Pakistan and the 2006 test by North Korea reflected, and that Treaty ratification can only strengthen that global norm and with it the NPT regime. Norms matter, it is asserted, because they help in pressuring violators.[1]

Noting that the United States enjoys significant advantages over China, Pakistan, and India in the sophistication of its nuclear arsenal and the depth of its knowledge related to nuclear weapons technology, some CTBT proponents maintain that a test ban would place technical constraints on these states that would greatly restrict any further qualitative improvements in their weapons.[2] Finally, CTBT proponents note that, though Russia and the United States possess the most advanced nuclear weapons and nuclear weapons expertise, a test ban would provide insurance against a renewal of the nuclear arms race by impeding the development of so-called "fourth generation" nuclear designs.[3]

Finally, some Treaty proponents argue that, because the United States has a voluntary moratorium on testing that enjoys overwhelming political support and for which it is already paying the technical price for a CTBT, it only makes sense that the United States gain the political benefits to be had from the CTBT.

To be clear, U.S. ratification of the CTBT does not ensure its entry into force; for that Washington would need to mount an extensive and adept diplomatic strategy. To date, 180 countries have signed the CTBT and 145 countries have ratified it, including all U.S. NATO allies. Nine countries must still ratify the CTBT for it to achieve entry into force; the United States and China are the two key holdouts. China has indicated on numerous occasions that it will ratify the CTBT as soon as it is confident that the United States will do so. Many Indian scholars and former policy makers argue that if the United States ratifies the CTBT, India will also do so. The major diplomatic efforts will likely focus on encouraging Egypt and Pakistan to ratify the Treaty.

But while U.S. ratification would appear to be the key to breaking the international logjam preventing the CTBT's entry into force, the Obama Administration's success in securing ratification is by no means assured. Indeed, the Administration's efforts to win Senate approval of the Treaty will face major political challenges in securing the 67 votes necessary for the Treaty's passage. Leading Senate critics of the Treaty include Senators John Kyl of

Arizona and Jeff Sessions of Alabama, who oppose the CTBT based on the claims that adherence to its terms cannot be effectively verified and that in the long term the United States cannot maintain confidence in the reliability of the U.S. nuclear deterrent force in the absence of testing. Treaty opponents also cite related concerns over the possible military advances that states like Russia and China might make through clandestine testing at very low yield levels and the Treaty's lack of teeth for enforcing compliance.

The technical concerns cited by CTBT opponents today are in essence the same as the arguments cited in the 1999 Senate debate to help defeat ratification. An appreciation of those concerns, therefore, appears imperative. This paper reviews and assesses the key features of those concerns and offers the Commission options for their consideration in light of them.

Persistent Technical Concerns with the CTBT

In 1999, three major technical concerns and one political-legal concern played a large role in the defeat of the CTBT.[4] Each persists today. One concern is that adherence to the terms of the CTBT could not be effectively verified despite the Treaty's extensive verification provisions, including an International Monitoring System (IMS), consisting of remote sensors; confidence building measures; provisions for consultation and classification; and once the treaty enters into force, the possibility of short-notice, on-site inspections. Since 1999, this concern has been the focus of three different in-depth technical studies, each of which has concluded that adherence to the terms of the CTBT can be effectively verified.[5]

A second technical concern is that even if testing of nuclear weapons at traditional yields of several kilotons and above could be detected, countries could still make significant advancements in their nuclear weapon capabilities through nuclear testing at yield levels that might escape detection. This concern was a principal focus of a 2002 National Academy of Sciences (NAS) study, which concluded that militarily significant improvements in nuclear weapons capabilities cannot be achieved via low-yield tests by states with little testing experience or states, like Russia and China, with extensive testing and design expertise. Nonetheless, some U.S. nuclear analysts and experts assert that Russia and China can achieve militarily significant gains to their weapons capabilities through very-low-yield tests that might go undetected.[6]

A third technical concern involves the capacity of the United States, in the absence of nuclear testing, to maintain confidence in the safety, security, and reliability of the U.S. nuclear deterrent force. This argument rests on the proposition that the Department of Energy's Stockpile Stewardship Program (SSP)[7] will prove unable to live up to its stated goal. This concern has been the

source of continuing controversy, and the terms of the argument itself have evolved significantly to form the basis of the case for the Reliable Replacement Warhead (RRW)—itself, a source of on-going debate.

A fourth concern that is not so much technical as it is political-legal is that the CTBT has no teeth to enforce compliance among States Parties. Lacking enforcement teeth, the Treaty provides little reason for countries to forego nuclear testing. The issue of CTBT enforcement is a political-legal issue, not strictly a technical issue. The Treaty is neither more enforceable nor less enforceable than other non-proliferation accords.

The Issue of Effective Verification of the CTBT

One of the principal objections to the CTBT in the October 1999 Senate floor debate was that the Treaty's verification measures were inadequate to detect, locate, and demonstrate potential cheating. Treaty proponents counter that the CTBT has extensive verification provisions, including an IMS, consisting of remote sensors; confidence building measures; provisions for consultation and classification; and once the treaty enters into force, the possibility of short-notice, on-site inspections. As of the fall of 2008, 233 of the 337 IMS facilities were certified.[8] The IMS will include monitoring stations inside Russia, China, and other sensitive locations, including locales where the United States cannot otherwise gain access.

Treaty proponents note that the IMS technologies, which actually met the standards of effective verification in 1999, have only improved since the Senate's defeat of ratification. Today, because of the continued global expansion of the IMS facilities as well as improvements in, *inter alia,* the algorithms, sensors, seismic models and new detection techniques that comprise IMS technologies,[9] there are virtually no conceivable scenarios in which potential violators could conduct militarily significant explosive tests and escape detection by the IMS.

The 2002 NAS study, mentioned above, concluded that underground nuclear tests "can be identified as explosions using IMS data down to a yield of 0.1 kilotons (kt) in hard rock if conducted anywhere in Europe, Asia, North Africa and North America."[10] The NAS panel also found that improvements in regional seismology provide additional confidence, lowering the threshold below 0.01 kt. Moreover, as David Hafemeister points out, North Korea's 0.6 kt test was promptly detected and identified from signals recorded at 31 seismic stations in Asia, Australia, Europe, and North America, including 22 IMS stations established by the Preparatory Commission for the CTBT Organization.

Out of 10 evasion scenarios examined by the NAS panel, the only scenarios identified as needing to "be taken seriously" are those involving cavity

decoupling and mine masking, but it also determined that an explosion in a cavity cannot be confidently hidden if its yield is larger than 1 or 2 kt. A number of major technical hurdles exist that would greatly complicate the ability of even the most advanced nuclear weapons states to test and avoid detection.[11] Together, they would appear to constitute a nearly foolproof barrier to clandestine testing by new and aspiring nuclear weapons states.

Issue of Improvements That Can Be Achieved via Low-Yield Testing

The second technical concern in the 1999 Senate debate was that other countries could improve their nuclear-weapon capabilities through nuclear testing at low yields that might escape detection. The 2002 NAS report tackled this issue directly, addressing the advances that could plausibly be made under a CTBT by clandestine testing in various yield ranges, both by countries with greater prior nuclear test experience and/or design sophistication and by those with lesser experience and/or sophistication.

The NAS concluded that in no case could any country have high confidence of successfully concealing a test with a yield over 1–2 kt from seismic detection. Two key findings emerged. First, in the "very-low-yield" range from 10 tons to 1 kt, countries of lesser prior nuclear test experience might be able to improve the efficiency and yield-to-weight of unboosted fission weapons compared to the performance of the first-generation weapons that could be developed and deployed with some confidence without any testing at all. For experienced nuclear weapons states, tests in this range might serve to help partially develop primaries for thermonuclear weapons. But, the report noted that "deployment of such an untested component by one of the five NWS, which have available fully tested primaries of adequate yield, would not increase the state's capability and would reduce its confidence in its stockpile. A state that has not yet fully tested primaries could not rely on a primary test of less than full yield."[12] Second, in the "low-yield" range of 1 kt to 20 kt, states with lesser test experience or experienced states could develop and fully test primary nuclear explosives and low-yield thermonuclear weapons, but concealment would be highly unlikely.

The NAS panel drew two key conclusions from its evaluation of plausible achievements by testing at various yields: First, "Countries of lesser nuclear test experience and design sophistication would be unable to conceal tests in the numbers and yields required to master nuclear weapons more advanced than the ones they could develop and deploy without any testing at all." Second, "Those countries that are best able to successfully conduct such clandestine testing already possess advanced nuclear weapons of a

number of types and could add little, with additional testing, to the threats they already pose or can pose to the United States."[13]

Nonetheless, as mentioned above, some authorities claim that militarily significant gains can be achieved by advanced nations like Russia and China through very-low-yield tests that might go undetected. The author does not have information which would enable him to assess this argument. Thus, while it appears that low-yield testing will not enable states with little testing experience to achieve militarily significant improvement to their nuclear weapons capabilities, it is not yet clear whether very-low-yield testing that might escape detection will enable states with greater testing and design experience from achieving militarily significant improvements to their capabilities.

The Ability of the SSP to Ensure the Reliability of the U.S. Nuclear Arsenal

The third principal objection to the CTBT is that, in the face of complex and unforeseen threats of the future, the United States may need to conduct nuclear tests to assure the safety, security, and reliability of its nuclear deterrent force. At the time of the Senate debate in 1999, the SSP was seven years underway and its technical ability to provide confidence in the stockpile was still in question, in the view of some experts.

Over the course of the next three years, both the 2001 report of the Special Adviser to the President and Secretary of State, Gen. John Shalikashvili (USA, Ret.), and the NAS report concluded that the SSP was succeeding in meeting its aim of providing confidence in the safety, security, and reliability of the stockpile in the absence of testing, and that there were no problems on the horizon that should cause the SSP to fail.[14] But the question has become more nuanced. Almost no one denies that the SSP (to include its Life Extension Program) has been extremely successful[15] to date and that it is expected to continue to fulfill its original aim for the next decade. The real issue concerns the ability of the SSP to ensure the stockpile's reliability into the future, some 20 or 30 years hence. As Thomas D'Agostino explains:

> With every life extension program we do on a weapon, we slowly move further and further away from the designs that were certified with underground nuclear tests. These inevitable accumulations of small changes over the extended lives of these highly-optimized and complicated systems, has give rise to concerns about the reliability of the weapons over time. While we are confident that today's stockpile is safe and reliable, it is only prudent to explore alternative means to ensure stockpile reliability over the long term.[16]

A 2007 American Academy for the Advancement of Science (AAAS) study elaborates upon the concerns to which D'Agostino refers. These concerns are documented as "findings" and while most of the findings to date are age-related findings associated with the more numerous non-nuclear parts of the warhead system,

> [S]ome significant findings involving nuclear and non-nuclear parts are potentially more serious, because they raise questions about whether the findings can be assessed without nuclear testing and because remediation may require cycling through the full production complex….For example, recent plutonium aging data show that the properties of plutonium metal change very slowly because of radioactive decay with minimum plutonium lifetimes approaching a century. Consequently, chemical processes (e.g., corrosion of pit materials) rather than radioactive properties will determine the lifetime of pits in most systems. In any case, pits probably will need to be replaced at some point, and it is unclear whether the projected capability will be adequate. Changes have been observed in other parts of the physics package that may eventually require repair. Furthermore, as one looks to the future, it is possible that, even with a functioning production complex, changes introduced by aging and frequent repairs will, in the absence of nuclear testing, gradually undermine confidence in the reliable performance of the weapon (although progress in the SSP could offset this trend)."[17]

It is this concern over the ability to maintain confidence in the stockpile over time—a concern shared by the Laboratory Directors—that served as one impetus for the RRW program.[18] It is critical to note, D'Agostino's and the AAAS Report's concerns notwithstanding, that the SSP has already made significant contributions to shedding light on one of the central concerns in an era of no-testing: the ability to understand the effects of aging on the plutonium that comprises the nuclear weapon pit. To be more precise, the SSP has enabled a much greater understanding of self-irradiation damage on the structure and properties of plutonium alloys. This enhanced understanding of aging effects in plutonium was integral to a 2006 JASON assessment which came to the conclusion that "there is no degradation in performance of primaries of stockpile systems due to plutonium aging that would be cause for concern regarding their safety and reliability. Most primary types have credible minimum lifetimes in excess of 100 years as regards aging of plutonium; those with assessed minimum lifetimes of 100 years or less have clear mitigation paths that are proposed and/or being implemented."[19]

This paper will not evaluate the many arguments made on behalf of or against the RRW as those arguments (like the RRW itself) are inextricably bound up with the issue of nuclear weapons infrastructure "Complex Transformation"—a subject area addressed by the Nuclear Infrastructure Experts Working Group.[20]

The technical questions surrounding the narrower issue of whether the SSP, as currently conceived, will be sufficient to maintain confidence in the stockpile into the future, or whether it is necessary to create a transformed complex (to include an RRW, or something very much like it) have reached an impasse. Politically, the RRW would seem to be dead or at least dormant,[21] for the next few years; the broader issue of Complex Transformation, exclusive of the RRW, continues to be hotly debated on Capitol Hill.

In the face of this impasse, some have proposed the idea of a "grand bargain" that would entail support for CTBT ratification in exchange for support of the RRW. While the idea is proposed as a compromise designed to gain domestic political support, it is unlikely to secure the hoped-for political support on the Hill and it would almost certainly meet with strong protest from most NPT member states (with the possible exceptions of the United Kingdom and France). It is important to note that others argue that the RRW should be seen as a safeguard for the CTBT. In this understanding, the CTBT and the RRW should be cast as a package, not for reasons of political expediency, but out of the conviction that the RRW is a key element in ensuring the reliability of the stockpile over the long term. Importantly, the argument that the RRW will enable the United States to undertake deep reductions (to include ridding itself of its sizeable reserve of non-deployed warheads) because we will have greater confidence in each remaining warhead, is a compelling argument that just might be able to attract political traction abroad.

And therein may lie the ingredients for a proposal that *might* stand a good chance of gaining both domestic political support on the Hill and meeting with support (or at least a lack of vocal opposition) from most other NPT member states. The proposal would entail (1) encouragement of U.S. ratification of the CTBT together with (2) a commitment to proceed with the R&D on, but not production of, a surety warhead that would entail many of the features of the RRW, and (3) a U.S. commitment to deep, negotiated reductions in its nuclear arsenal. The commitment to deep reductions would neutralize most Article VI-related concerns (both at home and abroad) over the U.S. commitment to pursue R&D on a warhead with relaxed margins.

But there is another option. Rather than retreating into the corners of making the best possible case for the SSP on the one hand or the RRW on the other, two highly regarded scientists—Bruce Goodwin of Lawrence Livermore National Laboratory and Glenn Mara of Los Alamos National Laboratory—have proposed a novel alternative for ensuring stockpile reliability over the long term.[22]

Goodwin and Mara contrast the current set of "polar possibilities"—the *status quo*, which they characterize as Cold War weapons maintained indefinitely through incremental Life Extension Programs (iLEPs) and the RRW approach—and argue that "both approaches carry baggage." The RRW cur-

rently has no political traction and successive iLEPs carry an increasing risk. This risk increases because, as the overall stockpile size is reduced (and importantly weapons types are reduced) through arms control agreements, the issue of the reliability of each remaining weapon (and weapon type) becomes that much more important. Hedging against this risk means preserving a large reserve stockpile—in itself a politically unpopular, costly and strategically improbable option. Instead, they advance a novel alternative that they call "extensive reuse LEP" or "erLEP" that might mitigate the above dilemma.

Goodwin and Mara characterize the erLEP as sitting "in a continuum between the iLEP and the high-margin, high-surety RRW." As they see it, the erLEP concept could be applied not only to plutonium pits but to other tested weapon components. It would make use of embedded microsensors to monitor each and every weapon's health—a necessity in a future of vastly reduced stockpiles. They maintain that erLEP would enable a smaller production complex and eliminate the costly production of many secondary components because it could utilize more than two decades of such components that currently sit in storage.

Whether the SSP is sufficient to ensure the reliability of the nuclear arsenal into a future without testing is unclear. What is clear is that the RRW—the proposed solution for the postulated future shortcomings of the SSP—is currently a political non-starter—at least as a stand-alone item. At the same time, the SSP brings its own risks, such as long-term affordability problems and, according to many experts, the possibility of increasing technical problems that could well require the maintenance of a large reserve stockpile with its own cost and political downsides. The "grand bargain" idea is unlikely to secure the hoped-for political support on the Hill and is likely to be met with strong protest from most NPT member states. But a package that combines U.S. ratification of the CTBT, R&D on a surety warhead, and a commitment to deep reductions might well win support on the Hill and meet with some degree of support from abroad. Finally, an in-depth study of the erLEP concept might be added to such a package as an additional safeguard.

The Issue of Enforcement

During the 1999 floor debate, Senator Lugar was particularly concerned that the Treaty did not contain measures sufficient to respond to States Parties in non-compliance. Citing the ineffectiveness of international sanctions and norms in the face of North Korean, Iranian, Iraqi, Indian, and Pakistani actions, the Senator argued that he did not find the CTBT's range of responses to non-compliance to be especially compelling. These responses include (i)

suspending the rights and privileges of a State Party that fails to cooperate fully with requests from the Conference or the Executive Council, (ii) recommending collective action by States Parties and (iii) bringing violations to the attention of the United Nations. This concern still exists and is cited as a reason to oppose the Treaty.

In his report, General Shalikashvili responded to such criticism, arguing that "Making the Treaty's enforcement mechanisms more explicit or more automatic would have gone against the long-standing U.S. position that States Parties, not international organizations, should have the authority to decide whether other Parties are in compliance, and what to do if they are not. And while it is possible to imagine times when more draconian enforcement provisions might be a stronger deterrent against cheating, it is equally easy to imagine ways in which the United States or its friends could become the victim of unwisely crafted enforcement provisions."

General Shalikashvili further noted that that the CTBT is not an isolated effort, but part of what he called "an intricate web of bilateral, regional, and global arrangements," which together help to hold proliferation in check. The lack of the CTBT's entry into force is part of what today weakens the overall system of proliferation constraints. In other words, the CTBT is a necessary, but not sufficient, condition for non-proliferation. The Treaty alone may not be able to ensure that every State Party remains in compliance, but its lack of entry into force provides cover to those states intent on testing nuclear weapons. CTBT proponents maintain that the Treaty's entry into force would make it easier to mobilize the international community against the violation both of a norm and of a legally binding prohibition against nuclear explosions. It should be expected that this new reality would also exert a greater deterrent effect than an international norm alone. Finally, the Treaty does not foreclose any options that the United States currently has for responding, unilaterally or multilaterally, should another state conduct a nuclear explosion. Specifically, if the United States discovered that a particularly grave incidence of non-compliance occurred for which sanctions were deemed an insufficient response, then under the "supreme interests" clause of the Treaty, the United States would be able to withdraw. If the United States implements certain long-discussed safeguards—about which more below—then the six months' notice to withdraw from the Treaty would be somewhat less than the time it would take to prepare for a test.

The CTBT is neither more enforceable nor less enforceable than other non-proliferation accords. To demand that the Treaty contain enforcement mechanisms that will guarantee punishment and with the guarantee of that punishment succeed in deterring non-compliance actions by States Parties is to ask too much of the Treaty. It is, in short, setting an unrealisti-

cally high bar. While the CTBT does not guarantee a world in which states do not test nuclear weapons, it is a major addition to the web of arrangements that help hold proliferation in check.

Safeguards

A discussion of the principal technical concerns with the CTBT would not be complete absent a discussion of safeguards entertained in order to guard against a collapse of the Treaty, or in the event of some event jeopardizing the supreme interests of a State Party.

Elements of the SSP itself were advanced as safeguards by the Clinton Administration.[23] These include maintaining a readiness to test; maintaining the safety and reliability of the existing nuclear weapon stockpile; maintaining a cadre of scientists and engineers with expertise in nuclear weapons; and maintaining an intelligence capability to provide assurance that other states are not carrying out nuclear explosions. The Shalikashvili Report urged additional safeguards, including enhanced surveillance and monitoring activities within the SSP; a dedicated infrastructure revitalization fund; strict discipline over changes to existing nuclear weapon designs to ensure that neither an individual change nor the cumulative effect of small modifications would make it difficult to certify weapon reliability or safety without a nuclear explosion; establishment of a high-level external advisory mechanism, and an intensive review of the Treaty's net value for U.S. national security at ten-year intervals, together with a willingness to withdraw under the "supreme national interests" clause, if there are deep doubts on this score.

More recently, the RRW has been argued to be a critical safeguard for ensuring the reliability of the stockpile on into a future absent of testing (whether the United States ratifies the CTBT or not, it is already adhering to its self-imposed moratorium). Because it has relaxed performance margins relative to the current stockpile of warheads which were designed with extremely stringent performance margins, the RRW will be a more reliable warhead. As a result, the argument proceeds, the United States will be able to undertake deeper reductions (and rid itself of its substantial non-deployed warhead reserve that brings its own dollar, security, and political costs) than it might otherwise have been able to without raising risk. As noted previously, a package that combines CTBT ratification, R&D on a surety warhead, and deep strategic arms reductions might gain domestic political support and meet with approval from other signatory states.

Options

In light of the above discussion, the following options are proposed for the Commission's consideration:

Option 1

Recommend U.S. ratification of the CTBT, together with the safeguards outlined above in Section IV except for the RRW, arguing that the benefits of ratification outlined in Section II are paramount and that, because of the success of the SSP, the United States is well positioned to sustain its nuclear deterrent on into the future under the CTBT. This position would essentially take its cue from the findings of the Shalikashvili and NAS reports. At the same time, the view that the SSP positions the United States well to sustain its deterrent on into the future would be at odds with the misgivings of such experts as Tom D'Agostino, and other technical experts such as Goodwin and Mara.

Option 2

Recommend U.S. ratification of the CTBT, but only as part of a package deal in which the United States simultaneously proceeds with the RRW as an essential safeguard in addition to the other safeguards outlined above. In this instance, the Commission would cite the benefits of ratification outlined above in Section II, but note that technical concerns over the ability of the SSP to ensure the reliability of the stockpile into the future make the RRW a necessity. This position would seek to strike a compromise, but it would have uncertain prospects on Capitol Hill and would be certain to meet with loud protests from other NPT member states who would cast RRW support as contrary to Article VI obligations.

Option 3

Recommend a package deal that combines U.S. ratification of the CTBT, a commitment to support for R&D on a surety warhead as a safeguard, and a commitment to negotiated, deep nuclear reductions. This position might succeed on Capitol Hill and meet with some degree of support from important signatory states abroad. The commitment to deep reductions would neutralize concerns over the U.S. commitment to pursue R&D on a warhead with relaxed margins. Again, an in-depth study of the erLEP concept might be added to such a package as an additional safeguard.

Option 4

Recommend neither support for nor opposition to ratification of the CTBT, but that the Commission note its concern over the technical ability of the SSP to ensure the reliability of the future nuclear arsenal. This recommenda-

tion would take its cue from the argument advanced by Tom D'Agostino and other experts.

Option 5

Recommend against U.S. ratification of the CTBT, arguing that the technical risks of being unable to ensure the reliability of the future stockpile mandate that the United States retain its ability to conduct tests when significant problems arise. This recommendation would take its cue from the arguments that prevailed in the 1999 debate and still hold sway with Treaty opponents today.

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1. As O'Hanlon points out, until North Korea's October 2006 nuclear test, Beijing and Seoul had largely protected Pyongyang from severe sanctions, even after it broke out of the NPT in 2003. But following North Korea's test, China, South Korea and Russia agreed to a significant tightening of economic sanctions against Pyongyang, an action which appears to have contributed to North Korea's return to the negotiating table and the subsequent 13 February 2007 accord that, imperfectly and far from completely, has begun to restrain the North's nuclear efforts. See Michael O'Hanlon, "Resurrecting the Test-Ban Treaty," Survival, Vol. 50, No. 1, February-March 2008, pp. 125-126.
2. Specifically, while it would not completely foreclose all of Pakistan's and India's nuclear options (see the subsequent discussion of what can be achieved by clandestine testing at low yields), a CTBT that includes those states would impede their ability to perfect boosted fission weapons and thermonuclear weapons, thus hampering their ability to engage in an otherwise destabilizing nuclear arms race. In the absence of a test ban, China would be able to reduce the size and weight of its nuclear warheads in an effort to produce multiple independently targeted warheads for its nuclear force. (It is important to note that data from Chinese tests indicate that China may already be capable of "MIRV-ing" (Multiple Independently Targeted Reentry Vehicles), but that it has simply chosen not to do so. On this point, see Thomas C. Reed, "A Tabulation of Chinese Nuclear Device Tests," Physics Today, September 2008, accessed at <http://ptonline.aip.org/journals/doc/PHTOAD-ft/vol_61/iss_9/47_1s.shtml>). With a test ban, this would be next to impossible as China would have very little confidence that any radically new weapons would work as desired.
3. See National Academy of Sciences, Technical Issues Related to the Comprehensive Test Ban Treaty, National Academy Press, Washington, D.C., 2002. Also see General John M. Shalikashvili (USA, Ret.), Special Advisor to the President and Secretary of State, Findings and Recommendations Concerning the Comprehensive Nuclear Test Ban Treaty, January 2001; Thomas Graham, "The Comprehensive Nuclear Test Ban Treaty," 2009 National Security and Nonproliferation Briefing Book, Peace and Security Initiative, November 2008, pp. 21-24.
4. See, for example, Senator Richard G. Lugar, "Statement in Opposition of the CTBT," October 7, 1999, accessed at <www.fas.org/nuke/control/ctbt/text/100799lugar.htm>.
5. See the NAS and Shalikashvili reports (referenced in footnote 1). Also see The Verification Research, Training and Information Centre, Final Report of the Independent Commission on the Verifiability of the CTBT, October 2000, (often referred to as the VERTIC report), accessed at <www.ctbtcommission.org/> and International Group on Global Security, A New Look at the Comprehensive Test Ban Treaty, Netherlands Institute of International Relations Clingendael, September 2008, accessed at <www.ctbto.org/fileadmin/user_upload/pdf/External_Reports/A_New_Look_at_the_Comprehensive_Nuclear-Test-Ban_Treaty.pdf>.
6. The author has been told that the concerns about the ability of Russia and China to learn from very-low-yield tests are shared by some technical experts in the U.S. nuclear complex. The author has been unable to independently verify those concerns.
7. The SSP was launched following the suspension of U.S. nuclear testing in 1992 expressly as the means to ensure confidence in the nuclear weapons stockpile in the absence of nuclear

testing. The SSP includes a set of very advanced and very costly tools and initiatives to include the Dual Axis Radiographic Hydro Test facility, the National Ignition Facility, the Advanced Simulation and Computing program, and others that have raised concerns about the long-term cost and opportunity cost implications of the SSP.

8. See David Hafemeister, "The Comprehensive Test Ban Treaty: Effectively Verifiable," Arms Control Today, October 2008, accessed at <http://armscontrol.org/act/2008_10/Hafemeister>.
9. See Hafemeister's discussion of interferometric synthetic aperture radar and improvements in waveform comparison.
10. NAS Report, p. 5.
11. See Hafemeister, who identifies six technical hurdles.
12. NAS Report, p. 69.
13. Ibid, pp. 10–11.
14. The NAS panel argued (pp. 3-4) that the SSP "can already point to significant successes in [problem solving in the nuclear weapons program], as seen, for example, in the implementation of numerous new, relatively small-scale, measurement and analysis techniques ranging from new bench-top inspection instruments to larger-scale laboratory facilities (including, e.g., accelerated aging tests, novel applications of diamond-anvil cells and ultrasonic resonance, synchrotron-based spectroscopy and diffraction, and subcritical and hydrodynamic tests). All of these provide additional assurance that defects due to design flaws, manufacturing problems, or aging effects will be detected in time to enable evaluation and corrective action if such is deemed necessary."
15. See, for example, Nuclear Weapons Complex Assessment Committee, The United States Nuclear Weapons Program: The Role of the Reliable Replacement Warhead, AAAS, April 2007. Also, the Directors of the National Weapons Laboratories and the Administrator of the National Nuclear Security Agency readily acknowledge the SSP's success to date.
16. See Thomas D'Agostino, "The Reliable Replacement Warhead Program," Presentation at the Woodrow Wilson International Center for Scholars, June 15, 2007, accessed at http://nnsa.energy.gov/news/print/905.htm.
17. See Nuclear Weapons Complex Assessment Committee, pp. 15 and 22.
18. To be clear, this concern has existed for some time; the plans for and discussion over the RRW have simply brought it greater prominence. For two different perspectives, see the NAS report, page 5, and the Secretary of Energy Advisory Board, Recommendations for the Nuclear Weapons Complex of the Future: Report of the Nuclear Weapons Complex Infrastructure Task Force, July 13, 2005, esp. pp. 6-13.
19. See Pit Lifetime, JASON Report JSR-06-335, November 20, 2006. Dr. Siegfried S. Hecker, former Director of Los Alamos National Laboratory and a world-renowned plutonium metallurgist, challenged the conclusions of the JASON report regarding plutonium aging as too optimistic; his views inform and indeed are reflected in the concerns outlined by D'Agostino and addressed in the AAAS Report. See S.S. Hecker, "Comments on the JASON Report on 'Pit Lifetime'," March 29, 2007 and AAAS Report, p. 22.
20. As the Infrastructure Working Group's papers reflect, Complex Transformation is intended to meet the goal of making the complex smaller, safer, more secure, and more cost effective while restoring its ability to make nuclear weapons in a responsive manner—a goal that includes but goes well beyond the goals of the RRW.
21. Secretary Gates' recent statements asserting the imperative of the RRW are very important because they indicate that the debate for RRW may be more latent than dead and that there may well be attempts to raise the issue anew in the near future. See Robert M. Gates, "A Balanced Strategy," Foreign Affairs, January/February 2009, Vol. 88, No. 1, pp. 28–40.
22. See B.T. Goodwin and G. Mara, "Stewarding a Reduced Stockpile," (LLNL-CONF-403041), AAAS Technical Issues Workshop, Washington, D.C., April 21, 2008.
23. See *A New Look at the Comprehensive Test Ban Treaty*, p. 47.

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The Comprehensive Test Ban Treaty: Options and Analysis for the Strategic Posture Review Commission

Kathleen C. Bailey

The paper examines the key reasons why the Comprehensive Test Ban Treaty (CTBT) was rejected by the U.S. Senate in 1999 and presents some options for consideration by the Commission.

Major Issues Regarding the CTBT

Issue: Certification of safety and reliability of the U.S. nuclear arsenal

Proponents say that the stockpile stewardship program has demonstrated that the current nuclear arsenal can be effectively and reliably maintained under a permanent CTBT.

Opponents say that the ability to certify absent some level of testing is becoming increasingly difficult. The nuclear weapons laboratories have continued to find problems with each of the warheads in the stockpile every year since the current moratorium began. Some of the problems are associated with the manufacturing process and some are due to aging. As then-Director of LANL, John Browne, testified in 1999,

> We also continue to find problems that were introduced during the original manufacturing of some specific weapons. We have identified several issues

> that, if they had occurred when testing was active, most likely would have been resolved by nuclear testing.

Issue: Testing enables safety upgrades

The weapons in the current U.S. stockpile do not have all of the most modern safety and security features, the so-called surety features, currently available. Of the 9 warhead types in the U.S. stockpile only 6 have the surety features. For example, they do not all have insensitive high explosive, which would minimize the chances of the explosive detonating if it were accidentally struck or dropped. Nor do all of the stockpiled weapons have a feature that would protect against plutonium release in case the weapon is accidentally engulfed in fire. Because introduction of different materials or protective features could affect warhead performance, it would be necessary to conduct a nuclear test to determine the effects of adding any of the safety measures now available.

In the future, there may be discoveries that would improve weapons surety, such as the invention of materials that might make accidental detonation even less likely or mechanisms to prevent terrorist use and access. As the former Director of Sandia National Laboratories, Dr. Paul Robinson, noted,

> While improvements to safety and security systems for nuclear weapons can be developed and implemented without nuclear explosive testing, several attractive technical concepts for enhancement of these features will be foreclosed by the inability to test.

The inability to test has another adverse impact on the development of new safety measures: it reduces the motivation of technologists. As former Assistant to the Secretary of Defense for Atomic Energy, Dr. Robert Barker, stated,

> The absence of nuclear testing also removes any incentive for designers to invent further enhancements to inherent nuclear weapon safety. Even if such features are invented they will sit unused as long as we deny ourselves the ability to conduct nuclear tests.

Issue: The CTBT is not verifiable.

Proponents frequently quote a 2002 National Academy of Sciences study that determined "underground nuclear explosions can be reliably detected and can be identified as explosions, using IMS data down to a yield of 0.1 kilotons (100 tons) in hard rock if conducted anywhere in Europe, Asia, North Africa and North America." They claim that advances in regional seismology have provided additional confidence.

Opponents counter that de-coupling and masking can readily be used to dramatically reduce seismic signals, making it difficult or impossible to detect clandestine nuclear tests. As the NAS study referenced in the above paragraph states, "Accepting the possibility of a cavity decoupled test, we conclude that such an underground nuclear explosion cannot be reliably hidden if its yield is larger than 1 or 2 kilotons."

Even if a signal is detected, identifying it as a nuclear test and pinpointing the location of the event may be impossible. Thus, neither the treaty's verification measures nor U.S. national technical means can detect all militarily significant tests. Furthermore, there are no sure technical means to attribute tests conducted over the open ocean.

Issue: A test ban forecloses modernization

Proponents say the CTBT forecloses U.S. nuclear weapons modernization, which is good because it helps devalue nuclear weapons and makes them less usable.

Opponents think that this is a negative effect. They think the U.S. should have the ability to develop nuclear weapons in response to technological advances, whether they are advances to accomplish new goals, or advances that could make the weapons safer and more secure.

Issue: CTBT doesn't define "nuclear test"

The CTBT bans "any nuclear weapon test explosion or any other nuclear explosion," but it does not define what constitutes a nuclear test. This is because no agreement could be reached.

At present, the U.S. interprets the CTBT as banning nuclear tests with any yield. Russia does not accept this "zero-yield" definition. It is likely that Russia continues to adhere to a definition consistent with the older TTBT (i.e. tests that can be contained are not nuclear explosions). It is possible that China, India, North Korea, or others may also interpret the CTBT as allowing tests with some level of nuclear yield.

Some proponents of the CTBT argue that it doesn't matter that the treaty doesn't define "test," because very-low-yield testing cannot be used to develop new weapons. Furthermore, they argue, reopening the treaty to achieve a definition would be politically impossible.

Opponents say that we should not mirror image: although very-low-yield tests might not be useful to U.S. nuclear weapons designers, such tests may be useful to others. More importantly, nuclear tests of any yield may actually be made difficult or impossible to detect due to masking or de-coupling.

Issue: Will the CTBT contribute meaningfully to nonproliferation?

Proponents argue that the CTBT is essential to nonproliferation because it makes it harder for nations with nuclear arsenals to develop and deploy new nuclear warheads, and it helps prevent those without nuclear arsenals from developing them.

Opponents argue that all NWS other than the United States have already modernized their nuclear arsenals, despite the test ban since 1992, and the inability to test does not foreclose nuclear proliferation (e.g. South Africa, Israel). Nations that pursue nuclear weapons do so because they perceive them to be in their security interests. Whether other nations test or not is not a factor.

Issue: The CTBT is essential to maintaining the NPT

Proponents believe that the CTBT is a necessary political step to fulfilling our obligations under NPT Article VI. They further point out that allies strongly urge us to ratify.

Opponents believe that the CTBT is an effective disarmament measure only for those who have not yet modernized and who will abide by the zero-yield definition of what constitutes a nuclear test (e.g. the U.S. only). As for allied pressures, it depends upon whom you talk to. As one German MOD representative stated in November 2008, "It is our position publicly that the U.S. should ratify the CTBT. More quietly, it is also our position that the U.S. nuclear deterrent is essential to Europe and you must do whatever required to keep it safe, secure and reliable."

Options for Consideration

In addition to the obvious options of either recommending or not recommending ratification of the CTBT are some intermediate actions that could be considered.

Option 1: Recommend a study and report be undertaken on the issue of verification. The study should specifically examine the extent to which cheating could take place without detection and identification, and the military significance that such cheating could have.

Option 2: Recommend a study and report on the effectiveness of the U.S. certification process. The study should address questions of what problems have been discovered with stockpiled weapons, how they have been dealt with, and the difference that nuclear testing (and at what level of yield) would make to the certainty of certification.

Option 3: Recommend an assessment of the types and numbers of nuclear weapons that will be required for the foreseeable future to fulfill

U.S. extended-deterrence obligations. This should be undertaken in close consultation with allies. The impact of a CTBT on the ability to fulfill the needs should be assessed.

Option 4: Recommend a reassessment of the safety and security technologies associated with stockpiled weapons, to include a close look at what new technologies might make our weapons even safer and more secure, and whether such measures would require testing. And, if so, what level of yield and number of tests would be required. The objective should be to identify what level of additional safety and security we would forego if we were to ratify the CTBT.

Option 5: Recommend a protocol be negotiated to achieve a definition, acceptable to all nations now in possession of nuclear weapons, of what constitutes a "nuclear test" under the CTBT.

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1. The George H.W. Bush Administration determined that it would be more cost-effective to develop new, safer warheads instead of adding safety features to older warheads, and so recommended. Subsequent administrations did not follow up on that recommendation.

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Issues Concerning CTBT Ratification

Linton F. Brooks and Daniel Poneman

What Is Limited?

Issue. The CTBT obligates states parties "not to carry out any nuclear weapons test explosion or any other nuclear explosion." Neither "nuclear weapons test explosion" nor "nuclear explosion" are defined. U.S. practice is to ban any test that results in a self-sustaining nuclear reaction. Russia is widely believed to use a different, less constraining definition, although details are unclear. Different Russians (none speaking officially) have suggested different formulations. Russia has acknowledged that it understands the U.S. definition.

Some believe that if Russia and China interpret the CTBT in a fashion that permits sub-kiloton testing they could gain military benefits through such testing, benefits that would be denied to the United States under the definition we are using. Further, some believe that under some scenarios the United States might be unaware that such testing is in progress.

Regardless of one's position on the likelihood of such testing, it is a sound principle of international agreements that the obligations on the parties should be equal. Many (including the CTBT negotiator) believe that all five recognized nuclear states had an identical, common understanding of what was permitted during the negotiations and that current U.S. practice is consistent with that understanding. The State Department advises, however, that there is no documentation that such an understanding was reached. The lack of a clear understanding could complicate—or even prevent—CTBT ratification.

A possible approach. The United States should approach the other recognized nuclear states (Russia, China, the United Kingdom and France) and seek an

agreed joint statement on how the five of them will interpret the prohibition. The United States should push for a definition consistent with U.S. practice and should portray the effort as simply documenting an understanding that existed at the time negotiations were complete. Involving all of the recognized nuclear states is logical, both in terms of international politics and as a practical matter. Only these more sophisticated programs are likely to be capable of benefiting from an interpretation that would allow testing at sub-kiloton levels.

It is possible that Russia will agree to a joint statement but will suggest a different definition. While it would be preferable to reach agreement on the U.S. definition, what is most important is to have an agreed definition of what is permitted. The United States can decide later whether to take advantage of any additional flexibility.

Once the five recognized nuclear states have agreed on a joint statement, that statement would be submitted to the Senate as part of the common understanding between the Executive Branch and the Senate on the meaning of the Treaty. The Senate would then rely on this submission in providing its advice and consent to ratification.

What Safeguards Are Required?

Issue. Some may fear that it will prove impossible to maintain the safety, security, and reliability of the U.S. nuclear arsenal once the CTBT is ratified. The Senate normally deals with these concerns through safeguards. Safeguards are proposed by the Administration and—often after significant discussion—are included in the Senate resolution providing advice and consent to ratification. In essence, the Senate makes its approval contingent on continued implementation of safeguards.

In submitting the CTBT for Senate consideration, the Clinton Administration proposed the following six safeguards, which are similar to those agreed upon for other arms control treaties:

- Safeguard A: "conduct of a Science Based Stockpile Stewardship program to insure a high level of confidence in the safety and reliability of nuclear weapons in the active stockpile";
- Safeguard B: "maintenance of modern nuclear laboratory facilities and programs";
- Safeguard C: "maintenance of the basic capability to resume nuclear test activities prohibited by the CTBT";
- Safeguard D: "a comprehensive research and development program to improve our treaty monitoring";
- Safeguard E: intelligence programs for "information on worldwide nuclear arsenals, nuclear weapons development programs, and related nuclear programs";

- Safeguard F: the understanding that if the Secretaries of Defense and Energy inform the President "that a high level of confidence in the safety or reliability of a nuclear weapon type which the two Secretaries consider to be critical to our nuclear deterrent could no longer be certified, the President, in consultation with Congress, would be prepared to withdraw from the CTBT under the standard 'supreme national interests' clause in order to conduct whatever testing might be required."

To meet the concern of those who worry about the future of the stockpile, Safeguards A and/or B could be strengthened as follows:

- Modify Safeguard A: "conduct of a Science Based Stockpile Stewardship program to insure a high level of confidence in the safety and reliability of nuclear weapons in the active stockpile, including the ability to resolve any problems identified by implementing traditional life extension programs, by the development of modified warheads, or by options in between."
- Modify Safeguard B to read "maintenance of modern nuclear laboratory facilities and programs and an effective production complex, including the ability to design and produce modified warheads if required."

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1. Some U.S. experts assert that the statements made by the Russian government in submitting the CTBT to the Russian Duma for approval during the 1990s suggested a definition very close to that used by the United States. If this is true—and if the Russian government reaffirms it—that should partially alleviate the concerns.
2. This is a common practice in arms control treaties.
3. Based on history, safeguards are somewhat perishable. While in theory they bind the Executive, in practice there is no mechanism for reconsideration of a treaty if safeguards are not observed. Further, if funding is involved, the involvement of the House of Representatives (which plays no role in ratification) is required.
4. White House, Office of the Press Secretary, "Fact Sheet: Comprehensive Test Ban Treaty Safeguards," August 11, 1995.
5. This concern is not shared by the Directors of the national laboratories; from their perspective, a test ban has already been in effect for the past 15 years.

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Assuring the Reliability, Safety and Security of U.S. Nuclear Weapons: Policy Options

James E. Goodby

Purpose. The purpose of this essay is to describe the array of issues that U.S. decision-makers must take into account in assuring the reliability, safety, and security of U.S. nuclear weapons. During the Cold War, explosive testing of nuclear weapons was conducted almost exclusively for the purpose of confirming the validity of new weapons designs. Today, the question of whether to conduct explosive nuclear testing is linked almost exclusively to the reliability, safety, and security of existing U. S. nuclear weapons. Explosive nuclear testing, however, is only one of several factors that bear on this problem. In fact, the absence of explosive nuclear testing has proved to be less of a challenge to maintaining the U.S. nuclear arsenal in good condition than other constraints, such as inadequate funding for the Stockpile Stewardship Program (SSP) and for maintaining a strong scientific and technical base at the nation's national laboratories. Ironically, these self-imposed constraints inflict wounds on public and congressional support for U.S. international commitments designed to roll back the gravest danger the nation faces: nuclear proliferation and nuclear terrorism.

Understandings Concerning the Comprehensive Test Ban Treaty (CTBT). Constraints on the explosive testing of U.S. nuclear warheads involve only the "physics package," i.e., the fissile materials and related materials that together, under particular conditions, produce a self-sustaining explosive chain reaction. It is this process that marks the boundary between what is permitted and what is banned under the terms of the CTBT. The nuclear weapons states that participated in the negotiation of the CTBT in Geneva in

the mid-1990s agreed that all nuclear explosions (i.e., self-sustaining explosive chain reactions) were to be banned. The record is quite clear on this. This is the position that the CTBT Office in Vienna has adopted in its approach to monitoring: "zero means zero." This means that hydronuclear experiments, which can produce up to four pounds of fission yield (i.e., an explosion equivalent to four pounds of TNT) are banned, while hydrodynamic experiments and underground sub-critical nuclear explosive tests (i.e., tests that do not produce self-sustaining chain reactions) are permitted.

U.S. Policy. Since a self-sustaining chain reaction is not the anticipated result of a hydrodynamic, or subcritical experiment, such tests are permitted under the regime that would exist were the CTBT in effect. Accordingly, U.S. policy is to conduct subcritical experiments as necessary. During the U.S. self-imposed unilateral moratorium on nuclear test explosions (self-sustaining explosive chain reactions) that began in 1992, the United States has conducted subcritical experiments. It has refrained from conducting test explosions that would be banned, were the CTBT ever to enter into force. This policy also has been pursued by the Bush Administration, which declared at the outset that it had no intention of allowing the CTBT to enter into force.

The Unilateral Moratoriums. It is not clear what other nuclear weapons states, such as China and Russia, who have signed or ratified the CTBT regard as permissible under the current moratorium. The CTBT is not in force but the law of treaties says that "a State is obligated to refrain from acts which would defeat the object and purpose of a treaty…until it shall have made its intention clear not to become a party to the treaty." If putative parties to a treaty expect that the treaty will never enter into force, they should so state, as the Bush Administration did. Since this has not occurred in the case of other signators, one would expect that other nuclear weapons states would abide by agreed understandings regarding the scope of the CTBT. But the nature of unilateral moratoriums is such that decisions about what is permitted and what is not permitted, are by definition unilateral. No formal or informal multilateral understanding about the scope of the several unilateral moratoriums exists.

Context. As noted above, each nuclear testing constraint needs to be considered in the context of other activities affecting the reliability, safety, and security of U.S. nuclear weapons. Three generic categories of constraints are 1) those that are self-imposed because of budgetary constraints; 2) those that are imposed by international law, i.e., treaties ratified by and with the advice and consent of the Senate; and 3) those imposed as a matter of policy or as the result of domestic laws by the U.S. Government, usually by the U.S. Administration but also frequently by Congress. An example of the first are budgetary shortfalls in funding the nuclear weapons program. An example of the second is the Limited Test Ban Treaty(LTBT), which requires

that nuclear explosive testing be conducted underground (there is no definition of a nuclear explosive test in that treaty). An example of the third is the unilateral moratorium on all nuclear explosive testing that was declared by President George H.W. Bush in 1992 at the urging of Congress, and which continues today.

Each of these three categories of constraints presents policy options that, in their totality, will determine U.S. policies and actions regarding the reliability, safety, and security of the U.S. nuclear weapons arsenal. Only a comprehensive review of policies regarding the reliability, safety, and security of the U.S. nuclear arsenal will provide an adequate basis for national policy. Determining a policy regarding nuclear explosive testing, for example, in isolation from related policy options would lead to a flawed policy. Some combination of the several policy options will be required to produce a coherent policy; hypothetical combinations will be described in very general terms at the end of this paper to illustrate the point. The following disaggregated list of options describes the types of issues that the Administration and Congress should address together over the next year or two.

I. Future Stockpile Stewardship Program (SSP) Spending Options

SSP is the best example of potentially unconstrained warhead-related activities. It has a direct impact on warhead reliability, safety, and security and also on the U.S. capability to maintain a responsive nuclear infrastructure. U.S. Government witnesses have testified that under the constraint of no nuclear explosive testing, SSP thus far has been a success. The issue will be how to fund it, in relation to other national objectives.

Option A. *Expand*. Robust funding for the Stockpile Stewardship Program and a responsive nuclear infrastructure. If necessary, reduce funding for other DOE and DOD programs.

Option B. *Static*. Prioritize within the SSP and infrastructure projects to allow for more funds for other DOE and DOD programs.

Option C. *Reduce*. Continue with SSP projects already approved but suspend funding for new projects.

II. CTBT and Alternative Treaty Constraints on Testing

Option A. Proceed with ratification of the Comprehensive Test Ban Treaty.

Pro: Puts pressure on other countries to refrain from testing; important for success of 2010 NPT Review Conference; preserves U.S. relative advantages; the ability to detect attempts of countries to evasively perform

nuclear tests will be strengthened when the treaty enters into force and the international monitoring system (IMS) becomes fully effective.
Con: Risk that the Senate might not consent to ratification; unclear whether CTBT would enter into force because of failure to ratify by other required parties.

Option B. Seek to amend the treaty to clarify definitions or reach side agreements, e.g., transparency at test sites, concerning the treaty's implementation.

Pro: Would place U.S. concerns on record; side understandings might be possible with some parties.
Con: Amendments almost certainly would be rejected, leading to abandonment of the treaty; understandings regarding the scope of the treaty already are clear.

Option C. Abandon efforts to have the CTBT enter into force.

Pro: The resulting furor might lead to a more comprehensive arms control package that would include several nuclear restraint measures such as mandatory Additional Protocol (AP) for IAEA inspections or strengthened Proliferation Security Initiative (PSI).
Con: The likely result would be a resumption of underground nuclear testing; other nations that would be freed from testing constraints might benefit more from testing than would the United States.

Option D. Initiate efforts to negotiate a new treaty affecting nuclear explosive testing.

Pro: An effort undertaken in parallel with continued support for the CTBT or a strengthened moratorium (see III. B.), perhaps negotiated only among those states that already have tested, might produce additional measures of transparency.
Con: The effort almost certainly would not succeed in raising the permissible yield to some agreed number or limiting the treaty to some specified period of time; the likely result would be resumption of testing.

III. The Explosive Testing Moratorium

A. Continue the current moratorium.

Pro: If linked to continued support for the CTBT, the moratorium places some pressure on other countries not to test; this course avoids a Senate fight over consenting to ratification; avoids confrontation with states, like India, that have not signed the CTBT.

Con: Failure to bring CTBT into force deprives us of the full benefits of the International Monitoring System, including on-site challenge inspections provided for by the treaty; a moratorium will not be regarded by non-nuclear weapons states as fulfillment by nuclear weapons states of obligations in connection with the NPT; unilateral moratoriums inevitably lead to differences regarding what is permitted and what is not.

B. Seek agreements that would give the moratorium more international approval or legal standing.

Pro: Provisions such as not being the first to resume explosive nuclear testing might make the moratorium regime more stable; UN Security Council Resolutions, endorsed by the P5, condemning all nuclear explosive testing also would give the moratorium more credibility; it might be possible to reach an agreement regarding what testing is permitted during a moratorium and to agree on greater transparency.
Con: Measures that make the moratorium more permanent and irrevocable have few advantages, if any, over entry into force of the CTBT; this approach also would put the CTBT and the CTBT Office in Vienna into a state of limbo where the central, enduring regime would be expected to be the moratorium, not the treaty, and the full potential of the IMS will not be realized.

C. Modify the United States management of the moratorium to permit explosive testing below a given yield, with or without limits on numbers.

Pro: The United States would be able to test at low yields if it chose to do so; if successfully managed, a threshold-moratorium regime could be arranged.
Con: The most likely outcome would be the collapse of the CTBT effort and open season on testing; any limits on yield or numbers would be applied in a way that permitted whatever experimentation any testing country thought necessary; it is not clear that any security benefits the United States would gain from tests at low levels, particularly if the yields are restricted to levels significantly below 100 tons of TNT equivalent, would exceed the net losses resulting from testing conducted by other countries.

D. Give warning that the moratorium will be abandoned unless certain conditions (e.g., signature of the CTBT by all those necessary for the treaty to enter into force, definitive agreement by Iranian and North Korea governments to cease nuclear weapons programs) are met within some reasonable time period (e.g., one year, or conclusion of the 2010 NPT Review Conference).

Pro: This would apply pressure on other countries to strengthen their support for nonproliferation.
Con: For some countries, an ultimatum of this type would be taken as a signal that they could conduct underground tests at the end of the period.

E. Drop the moratorium and prepare to resume nuclear explosive testing

Pro: If there were violations of the moratorium by other nuclear weapons states, this might be an appropriate response.
Con: A resumption of nuclear testing by the United States would spell an end to nuclear constraint, and not only in the testing area; the nonproliferation regime would inevitably collapse.

IV. Coherent U.S. Policies as Regards Salience of Nuclear Weapons

A. A policy of leading, in an effort to reduce the salience of nuclear weapons, would 1) ratify the CTBT and 2) adequately fund a robust SSP and nuclear infrastructure programs.

B. A policy of hedging, in order to maintain the option of a higher profile for nuclear weapons in the U.S. defense posture, would 1) maintain the moratorium but 2) fund projects that would support the development of new nuclear weapons.

C. A policy aimed at enhancing near-term nuclear superiority as a means of dissuading would-be peer competitors would 1) seek to expand the scope for U.S. nuclear weapons testing while otherwise seeking to maintain the system of unilateral moratoriums and 2) concentrate SSP spending on near-term operational needs like, for example, shortening the lead-time for testing at the Nevada Test Site.

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Space Arms Control and Diplomacy

Bruce W. MacDonald

Introduction and Background

The U.S. is highly dependent on its space assets for strategic intelligence, surveillance, force-enabling conventional military superiority, and economic well-being, and grows ever more dependent on them. With the proliferation of space and other technologies, and specifically with the anti-satellite (ASAT) capability that China demonstrated in early 2007, there is a risk that an adversary could exploit this fast-growing U.S. dependence on space assets in a conflict to greatly weaken U.S. military and economic power. Apart from potential hostile actions, the growth of peacetime space operations by multiple countries has created a "space traffic" problem that in the future could impede or threaten the functioning of U.S. space assets. In addition, the growing cloud of orbiting space debris poses a threat to all space assets, as the recent collision between a working U.S. communications satellite and a lifeless Cosmos satellite dramatically illustrated.

Each administration since the Eisenhower years has recognized the importance of space to national security and established a space policy. In 2006, the Bush Administration issued a space policy that made two major changes in U.S. space policy. First, it declared for the first time that U.S. space assets are a "vital national interest," in recognition of the extraordinary and growing dependence of U.S. military forces on space for their effectiveness, as well as the growing dependence of the U.S. and world economy on them. The phrase "vital national interest" carries much heavier national security implications than has ever been attributed to space. The second major change was to reject any further role for arms control in addressing U.S. space secu-

rity challenges, making explicit a policy that had been informally in place since early in that administration. The Obama Administration has spoken more favorably about arms control and space, but has to date only made a short statement on the White House website that it seeks to ban weapons that interfere with commercial and military satellites. The statement was silent on whether interference involved kinetic effects alone or covered electronic or information warfare.

The Strategic Problem

The U.S. has an overriding interest in maintaining the safety, survival, and functioning of its space assets and those of its allies so that the profound military, civilian, and commercial benefits they enable can continue to be provided to the U.S. and its allies.

These space assets face three forms of challenges and threats, all of them worrisome and growing:

1. China's 2007 ASAT test, which destroyed an old weather satellite, illustrated that the deployment of a significant number of these and/or other weapons could pose a serious threat to U.S. space assets within a decade if China chose to do so. China is also pursuing other programs that have important ASAT implications, and other nations are reportedly interested in ASAT capabilities as well. The U.S. shootdown of an errant NRO satellite in early 2008 demonstrated the inherent ASAT capability of many missile defense systems.
2. Space "traffic" is heavier than it has ever been and getting worse, both in terms of physical vehicles and also communications. Yet there is no "FAA for space," and even just the monitoring, much less the management, of objects in space is widely agreed to be far less than what is needed. The U.S. Air Force does freely provide data on about 17,000 orbiting objects, including almost all objects greater than 10 cm. in diameter. There is a substantial need for greater space traffic management capabilities, including enforceable rules of the road, codes of conduct, and space situational awareness that would inform a "space FAA" management capability.
3. Space debris poses an insidious and growing threat to all space assets. Debris in space does not quickly fall to the ground, as on earth; at orbits of 500 miles and more above the earth debris can stay aloft for centuries and more. In addition to the 17,000 orbiting objects cited above, there are perhaps hundreds of thousands of potentially lethal objects larger than one centimeter in orbit, and millions of smaller objects that pose at least some risk. The recent Iridium-Cosmos 2251

> collision in space generated still more debris: over 600 detectable pieces, an almost 4% debris increase from one incident, while the one Chinese ASAT test was estimated to have increased orbital debris by 10%. Orbital debris specialists believe there is a debris level at which such collisions could initiate a self-sustaining chain reaction. A space war in the next 10–20 years, involving kinetic energy weapons between the U.S. and China where many tens of satellites were destroyed, could render key orbital bands extremely hazardous to space assets.

Despite its stated opposition to space arms control, the Bush Administration took steps to begin addressing the larger space traffic management issue with other countries, and it had continued and expanded previous efforts to encourage international cooperation on mitigating civilian debris-producing activities. Ironically, as a growing satellite and space power, China had been an active participant in these discussions, and the ASAT test was reportedly a matter of great embarrassment to the civilian Chinese officials involved in them. There have been talks proposed on space weapons at the UN Conference on Disarmament, with China and Russia joining to call for a ban on space weapons. The U.S. opposed both the specific proposal and the whole idea of such discussions. The China-Russia space weapons ban proposal suffered from serious verification shortcomings in any event.

Space Arms Control Options

Arms control should be seen as one approach in a strategic toolkit of options to address important U.S. security concerns. The 1996 Clinton space policy laid down two criteria for space arms control measures: they should be in the U.S.'s security interests, and they should be verifiable. These criteria are used here.

Current space arms control regime. At present, the main agreement covering space is the Outer Space Treaty, which prohibits the placing of nuclear weapons in orbit or elsewhere in space and prohibits their testing in space as well. It does not prohibit the placement of conventional weapons in orbit. The OST is the chief agreement addressing space and entered into force in 1967. Reflecting an era when the U.S. and U.S.S.R. were the only real space powers, ASAT capabilities existed but were limited, and space offensive actions subject to a threshold for use, it does not address some key issues present in the strategic landscape of space today. The Bush Administration considered it sufficient, and that no further formal agreements were necessary, though it supported voluntary space management agreements.

Space Traffic Management

There is a slate of measures that fall under the rubric of "space codes of conduct," "space rules of the road," and others, that fall somewhere between informal agreements and formal arms control. The EU has proposals in this area, and various policy groups in the U.S. and elsewhere have similar proposals. The U.S. was working on similar ideas late in the Bush Administration, and military, civilian, and commercial operators within the U.S. have championed similar ideas. Rather than dive into a discussion that could consume volumes, the Commission may want to consider a general endorsement of international discussions that would facilitate the development of such space rules of the road, codes of conduct, space best practices, and an international system of management to ensure the smooth functioning of assets in space. There is the question of whether such codes should be optional or mandatory, as informal or formal agreements, but the Commission need not address that issue, though in the maritime arena there are formal agreements. Former Senator John Warner is reported to have stated that the "Incidents at Sea" agreement with the Soviet Union, which was negotiated while he was Secretary of the Navy in the mid-'70s, was valuable not just for the agreement itself, but also for the new channel of communication with the Soviet Navy it opened up, which proved useful on several occasions. He reportedly is supportive of a comparable agreement on space. The UK's recent paper, "Lifting the Nuclear Shadow: Creating the Conditions for Abolishing Nuclear Weapons" notes that "[a]n alternative way forward in the medium term [on space arms control] may be an International Code of Conduct on Outer Space Activities aimed at enhancing transparency and confidence-building measures."

Debris

There have been ongoing international discussions on space debris mitigation for a number of years. The restrictions to date have been voluntary, which may reduce incentives to comply. There are at least three options directly addressing debris:

1. Continue current voluntary compliance efforts, which have met with some limited success but have not prevented significant growth in the debris problem.
2. Substantially step up U.S. and international priority on debris mitigation issues, with consideration of space trade penalties where nations choose not to comply with "best practices" for debris mitigation. Such efforts would likely reduce the rate of growth of space debris by an

uncertain amount, and penalties imposed would not be cost-free for the imposers.

3. Further raise the ante on the space debris problem by negotiating a treaty on space debris. This would emphasize the importance of the issue but could face resistance from some less developed countries that would complain of a double standard and ask for exceptions. It will also place a greater onus on the U.S. to increase its space surveillance capabilities to enhance monitoring. It would take longer to implement and could be overkill in addressing this problem.

Ban on Kinetic-Energy ASAT Testing

A logical extension of the concerns over space debris, this option would seek to discourage the development of KE-ASAT weapons by banning their testing against orbiting objects and would make no judgments about space weapons overall. Careful language crafting need not impose any constraints on missile defense testing. Such a ban would put the parties on record as recognizing that this form of warfare has too much disproportionate collateral damage to be allowed. There is an inherent break-out capability through missile defense systems, but parties could be deterred by both the inherent capabilities of the other side and the indiscriminant nature of the collateral damage, which such tests or space sorties would pose a threat to their own satellite operations. Verification of such a ban would be much easier than a ban on the weapons themselves.

There is a useful analogy for such a testing ban in the Limited Test Ban Treaty of 1963, which banned atmospheric nuclear testing. While generally considered an arms control treaty, the LTBT actually had its political roots in tangible worldwide environmental fears when strontium-90, cesium-137, and other nuclear testing byproducts began showing up in milk and food supplies across the globe. As a result, the LTBT was negotiated in just eight weeks in the summer of 1963 (probably an arms control record), and atmospheric nuclear testing ceased, with resultant environmental gains. In the same way, steps to discourage KE-ASAT testing or employment would serve both important security and space environment purposes. The existence of other means for offensive counterspace operations makes this option more palatable as well to those who might otherwise oppose space arms control.

Other Arms Control Options

There are other potential options that frankly need much more study before they could be seriously considered. The Russian-Chinese proposed ban on

all weapons in space has serious verification issues, which China privately admits. Furthermore, it appears not to cover ground-based space weapons. Some have proposed a ban on interference with the regular operation of other countries' space assets. This has the advantage of banning behavior, not existence, and so would be potentially more verifiable. Yet it has more substantial definitional problems as to what constitutes interference, and would not ban testing against one's own space assets. Other options include a peacetime "keep-out zone" for satellites, which could build confidence. A no-first use pledge could be in the interests of the U.S., though such pledges could not be counted upon to stand up in a crisis environment.

Clearly more study of space arms control options is needed, but there appears to be room to move forward, with broad civilian and commercial backing in the areas of space traffic management and space debris. Consideration in principle of a KE-ASAT testing ban may also merit priority consideration, especially in view of the potential near-term Chinese KE-ASAT capability based on its 2007 ASAT test. Furthermore, by making a proposal on space arms control and being willing to at least discuss the subject, the U.S. would be removing one of the arguments that China has used to deflect action on the fissile materials cut-off issue. Such removal may not lead to Chinese movement on FMCT, but it would make their current position less tenable.

Acquisition and Policy Postscript

All the options described above have certain acquisition implications. Improved space situational awareness is a sine qua non for every option, and much better space intelligence is needed to enable us to distinguish potentially hostile from benign space vehicles. To help us better determine our broad space security objectives, U.S. space policy needs, in the words of Gen. Moorman, former Vice Chief of Staff of the Air Force, the kind of "intellectual ferment" that we had in the early days of nuclear weapons, which so far is sorely lacking. In addition, space needs international cooperation if it is to continue to provide our military forces with the data that enables our conventional superiority and does so much to support our strategic nuclear forces.

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Summary of Previous Space Arms Control Negotiations

Alicia Godsberg

U.S.-USSR

The United States and Soviet Union held three rounds of negotiations on anti-satellite weapons in 1978 and 1979, which made only limited progress. There were important definitional and other issues, and the USSR was generally resistant. In the aftermath of the Soviet invasion of Afghanistan in late 1979, these talks were never resumed.

UN

1. Committee on the Peaceful Uses of Outer Space (COPUOS)
   a. The UN General Assembly established COPUOS in 1959 to review international cooperation in space, devise UN programmes related to the peaceful use of outer space, encourage research and dissemination of information on outer space, and consider legal issues arising from the exploration of outer space. The Committee has two subcommittees—the Scientific and Technical Subcommittee and the Legal Subcommittee—and meets annually in Vienna. COPUOS decisions are implemented by the UN Office for Outer Space Affairs.
   b. In June 2007 COPUOS adopted debris mitigation guidelines. The guidelines include measures to be considered for mission planning, design, manufacture, and operational (launch, mission, and disposal) phases of spacecraft and launch vehicle orbital stages. Member states have pledged to implement these guidelines "to the greatest extent feasible."

   c. The 2007 session of COPUOS agreed on a draft resolution on the practice of states and international organizations in registering space objects to the General Assembly, and approved a workplan for the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).

2. Resolutions on the Prevention of an Arms Race in Outer Space (PAROS)
   a. Since 1982, PAROS has been introduced annually to both the General Assembly and its First Committee. Only the U.S. (first abstained, but has voted "no" since 2005) and Israel (abstains) do not vote in favor of PAROS. The Bush administration argued that the existing multilateral arms control regime is sufficient, and that there is no need to address the non-existent threat of a space arms race.
   b. The PAROS resolution reaffirms the importance of the 1967 Outer Space Treaty, but notes that the current outer space legal regime is not sufficient to prevent an arms race in outer space. PAROS calls for states, especially those with space capabilities, to refrain from actions contrary to the objective of PAROS and to "contribute actively" to that objective. It argues for consolidation and reinforcement of the outer space legal regime, and says a new treaty on PAROS should be negotiated in the Conference on Disarmament (CD).
3. Other measures
   a. 2005, 2006, and 2007—Russia introduced resolutions on transparency and confidence-building measures in outer space activities. Only the U.S. has objected, and Israel has abstained.
   b. 2007—the UN Secretary General released a report on "Transparency and confidence-building measures in outer space."
   c. 2008—Russia and China introduced a draft treaty for a ban on weapons in outer space to the CD. The U.S. maintained its opposition to such a treaty.
   d. 2009—The European Union submitted a Draft Code of Conduct on Space Objects and Space Activities to the CD. This Code is meant to strengthen existing UN treaties and principles on space security and to codify new best practices, including measures of notification and consultation.

Treaties

1. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water (1963)—also known as the Limited Test Ban Treaty (LTBT) [entered into force 1963; U.S. and USSR ratified]

   a. Each of the Parties undertakes to prohibit, prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion in the atmosphere, outer space, or under water.
2. Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967)—also known as the Outer Space Treaty [U.S. and USSR ratified]
   a. Parties undertake not to place nuclear or other WMDs in orbit and to use the moon and other celestial bodies for peaceful purposes. Military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies are forbidden.
3. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979) [entry into force—1984; neither the U.S. nor the RF are Party]
   a. Arms control aspects of the Agreement reaffirmed the main principles of the Outer Space Treaty.
4. Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects—submitted jointly by Russia and China to the CD on 12 February 2008.
   a. Terms of the draft Treaty
      i. Keep outer space free from "military confrontation" and open to peaceful uses and exploration for the "development of humankind."
      ii. Defines certain terms, such as "outer space," "outer space object," and "weapons in outer space."
      iii. States parties would undertake not to place in orbit any objects carrying any kind of weapons, not to install them on celestial bodies or other space structures, not to use or threaten to use force against outer space objects, and not to encourage any other parties to do so.
   b. The United States opposed the terms of the draft Treaty for several reasons, including that the definitions were inadequate and verification could not be assured.

PAROS Issues

1. No weapons in outer space: Because there are no weapons in outer space, the U.S. does not recognize the importance of a PAROS treaty. Many states see value in taking action, as preventing an arms race in outer space is preferable to managing one that has started.

2. Definitions: Many space assets are capable of performing both commercial and military missions; this makes the definition of what constitutes space militarization problematic. In addition, space objects and space debris are potentially harmful to spacecraft or could destroy important satellites or other devices. The U.S. argues that the inability to define space weapons is the main barrier to negotiating a PAROS treaty. Russia and China have produced a working paper in the CD that discusses definitions (i.e. Outer Space, Space Weapons, Space Objects and Peaceful Use of Outer Space) and suggested that a future PAROS treaty might not need specific definitions if agreeing on them proves too difficult (the Outer Space Treaty and the Moon Agreement do not have specific definitions).
3. Verification: Verification of a PAROS treaty would be difficult, and the issue might have to be postponed in order to move forward with negotiations in the CD. Russia suggested to the CD that *transparency and confidence building measures could, for a certain period of time, compensate for the lack of verification measures.* In 2006, Russia and China submitted a working paper on verification aspects of PAROS to the CD.

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Fissile Material Cut-Off Treaty

Susan J. Koch

Introduction

This paper presents options for consideration by the Strategic Posture Review Commission on a Fissile Material Cut-Off Treaty (FMCT). The paper assumes that the United States will and should support a legally-binding FMCT—given the near-universal support for such an agreement by U.S. officials and analysts and the fact that the new Administration has embraced such a position. Therefore, the paper does not offer options regarding support for an FMCT in principle or for a legally-binding treaty. Instead it examines the key issues of difference regarding an FMCT: its substantive coverage; adherence; verification; and negotiating forum.

The options below are not presented in the expectation that the Commission should choose among them. Instead, they are offered primarily to illustrate the range of issues involved in an FMCT. The final section of this paper recommends a Commission position on the FMCT that includes some, but not necessarily all, of those elements.

Substantive Coverage

Definition of fissile material

The first issue is the definition of the "fissile material" to be covered by the Treaty. The question here is not the nature of the material—plutonium (Pu) and highly-enriched uranium (HEU) —but its purpose. An FMCT could:

- Option One: Ban the production of fissile material for nuclear weapons or other explosive devices;

- Option Two: Ban the production of fissile material for any military purpose;
- Option Three: Ban the production of all fissile material; or
- Option Four: Ban the production of all fissile material by the P-5, and of fissile material for explosive (variant—military) purposes by all other signatories.

The initial official call for an FMCT, by the United Nations General Assembly in December 1993, proposed a "treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices." Since that time, relatively few officials or outside observers have supported a broader FMCT that would ban production of all fissile material or of fissile material for military purposes (the latter would essentially capture naval propulsion as well as nuclear weapons).

Limiting an FMCT to fissile material for nuclear weapons would have major advantages: it would clearly define the Treaty as a nuclear arms control/arms reduction measure and, above all, would not seek to constrain signatories' ability to produce Pu or HEU for other purposes (e.g., nuclear energy, research reactors, naval reactor fuel). An FMCT that sought to ban production of all Pu or HEU would be virtually impossible to negotiate, even though the P-5, at least, probably have more than ample stocks for all foreseeable explosive and non-explosive purposes (assuming that the treaty allows the retention of existing stocks, an issue discussed below). An FMCT that sought to ban production of fissile material for any military purpose would win broader support. However, and crucially, it would almost certainly be opposed by the P-5 and other states (such as Brazil) that either use or intend to use fissile material for naval propulsion.

On the other hand, the imposition of treaty constraints on the basis of the material's purpose rather than nature would create daunting verification problems and built-in breakout potential, even if effective verification were achievable. Still, even a ban on all fissile material production would not be without verification difficulties, caused in part by the continued production of low-enriched uranium. A ban on production of fissile material for any military purpose would fall between those two poles: more difficult to verify than a total production ban; potentially less difficult than a ban on production for nuclear explosive purposes.

Option 4 would seek to reduce the disadvantages of the other options, by differentiating between the large P-5 stocks and those of other signatories who might still need (or want) to produce fissile material for non-explosive purposes. Option 4 might be attractive to some potential signatories, but certainly not to the P-5: none of the P-5 would likely support differential obligations; China would undoubtedly insist on continuing production for

other purposes; France would demand continued reprocessing; and all the P-5 would likely view this approach as prematurely cutting off potential avenues for disposition of spent nuclear fuel. Finally, Option 3 would carry all of the verification problems of Option 1 in regard to the states whose potential breakout would be of greatest concern.

Definition of "cut-off"

The second issue, about which analysts differ sharply, concerns the definition of cut-off. An FMCT could:

- Option One: Ban all future production of fissile material;
- Option Two: Impose a limit on fissile material stocks that would require all signatories to reduce existing stocks;
- Option Three: Impose a limit on fissile material stocks that would not require any signatories to reduce existing stocks, allowing all to maintain current inventories or to increase them until they reach the allowed level;
- Option Four: Impose a limit on fissile material stocks that would require some signatories to reduce existing stocks, allowing the others to maintain current inventories or increase them until they reach the allowed level.

Proponents of Options Two and Four support an FMCT that would reduce the over-large stocks of fissile material in the world (and especially in the United States and Russia), better preparing the way for future weapons reductions while reducing the proliferation risk of "loose nuclear material." Option Four may be particularly attractive to non-P-5 states, who want the P-5 to reduce but do not want to cease their own fissile material production in the near future. For those states, Option Three might be the second best choice, allowing them the flexibility they feel they need. From an arms reduction perspective, however, Option Three is the worst option—a limit above current U.S. or Russian levels would be almost meaningless, politically and substantively.

Whether "fissile material" is defined as all HEU and Pu, or limited to that produced for nuclear explosive or all military purposes, would affect the political feasibility of the cap and/or reduction options. The arguments discussed above against a broad definition of "fissile material" would apply a fortiori to any proposal to reduce existing stocks, whether held by some or all signatories.

Adherence

There appear to be four basic options for adherence to an FMCT:

- Option One: Open to the P-5 and the four states that do not belong to the Nuclear Nonproliferation Treaty (India, Israel, North Korea, Pakistan). Link entry-into-force to ratification by all nine;

- Option Two: Same as Option One, but link entry-into-force to ratification by the P-5 only;
- Option Three: Open to all states, but link entry-into-force to ratification by the P-5 and the four non-NPT parties;
- Option Four: Same as Option Three, but link entry-into-force to ratification by the P-5 only. (This was the approach taken in the draft FMCT tabled by the Bush Administration in May 2006.)

Many analysts have proposed that an FMCT bind the P-5 and the four non-NPT parties, because all other states have committed in the NPT not to produce or retain fissile material for weapons purposes. However, that begs some important issues. First, what about states that in the future might withdraw from the NPT, as North Korea did in 2003? Second, might an FMCT establish stronger constraints on other states who are now pursuing, or may in the foreseeable future pursue, nuclear weapons in violation of their NPT obligations? Third, would universality help to reinforce, even if not strengthen, the existing NPT constraints? Finally, and conversely, would it be useful to accept an FMCT that bound the P-5 only, given the relatively large size of their fissile material stocks and the extreme difficulty of winning adherence by India, Israel, North Korea and Pakistan? The answers to all of those questions strongly suggest that Option Four is the best approach.

Verification

There are four basic options:

- Option One: Include multilateral verification measures in the FMCT, striving to reach the "effective verification" standard;
- Option Two: Exclude all verification measures from the FMCT;
- Option Three: Include some verification measures in the FMCT, supplemented by confidence-building measures;
- Option Four: Same as Option Three, but impose more intrusive verification measures on non-nuclear-weapon states.

The verification issue has for the last few years been the focus of most attention regarding an FMCT. The original United Nations General Assembly resolution in 1993 called for an "internationally and effectively verifiable treaty." The decision by the Bush Administration in 2004 to support a legally-binding FMCT without verification measures generated considerable opposition, although it is doubtful that it significantly affected—one way or another—the prospects for actually negotiating an FMCT. The Obama Administration has provided no public details but has endorsed a "verifiable" treaty. In her prepared remarks at her confirmation hearing, Secretary of

State Clinton stated that, "…we will work…toward…reviving negotiations on a verifiable Fissile Material Cutoff Treaty."

The Bush Administration argued that FMCT verification measures would have to be too intrusive to protect core national security interests and too costly for many states to accept. Even then, the Bush Administration claimed, an FMCT would not be effectively verifiable. Advocates of verification disagree. They assert, among other things, that the Bush Administration standard of being able to "detect noncompliance in time to convince a violator to reverse its actions, or to take such steps as may be needed to reduce the threat presented and deny the violator the benefits of its wrongdoing" is inappropriate and could not be met by many extant treaties. Detailed proposals for FMCT verification are scanty, but most propose using the measures of the International Atomic Energy Agency (IAEA) Additional Protocol, supplemented by additional challenge inspections. The IAEA would monitor the FMCT, but would require major additional personnel and financial resources to be able to do so.

No matter what one's position on the desirability or feasibility of FMCT verification, the task is a daunting one. Some of the substantive complications have been discussed above. In addition, many (if not most) of the "target states" would be loath to accept the intrusiveness required into weapons-related fissile material areas. None of the nuclear-weapons states or the non-NPT Parties has disclosed its fissile material stocks (in or out of weapons). None of the nuclear-weapons states has accepted the most intrusive measures of either IAEA Safeguards or the Additional Protocol. The United States has come closest, but the U.S. Safeguards Agreement and Additional Protocol both allow the United States to exclude from their application any locations, activities or information of direct national security significance. None of the non-NPT Parties has full-scope safeguards or an Additional Protocol in effect. Iran has failed to ratify the Additional Protocol and no longer provisionally applies it; indeed, only 90 states have brought their Protocols into force.

Negotiating Forum

Two options appear available:

- Option One: Continue to seek to negotiate the FMCT in the Conference on Disarmament (CD); and
- Option Two: Establish a new multilateral forum dedicated to negotiating an FMCT, possibly under the IAEA Board of Governors.

Option One would carry the benefits, but also the costs, of inertia. The CD has been considering whether and how to open FMCT negotiations for 15 years. Some states have from time to time linked their support for such

negotiations to other issues; China's long-standing linkage between FMCT and Outer Space Arms Control negotiations is the best example. The large CD membership further complicates the issue. Even if linkage ceased to be a problem (either because the United States accepted it or others dropped the demand), it would remain highly questionable whether the CD could be an effective negotiation forum.

Option Two would offer a new beginning and also discourage linkage to other issues. Placing negotiations under the IAEA Board of Governors would avoid the procedural and political difficulties of establishing a new international forum, engage national delegations already familiar with nuclear nonproliferation issues, and provide a forum of (barely) manageable size. Moreover, there may be a useful precedent in that the Additional Protocol was negotiated after the first Gulf War by a working group under the IAEA Board of Governors.

Nevertheless, Option Two could generate international controversy, given the long (if fruitless) history of the FMCT in the CD. Critics would argue that the change would move away from a truly multilateral negotiation to one dominated by the P-5 and other leading industrial states. Such criticism might be tempered if the negotiation took place under IAEA auspices, given the organization's substantive expertise and likely role in any FMCT implementation. Further, moving such a negotiation to the IAEA, given the past tension between the United States and that organization, would be consistent with the Commission's Interim Report finding that "Stronger financial, technical, and political support for the IAEA by the United States could enhance its ability to perform its unique and important mission." Care would need to be taken, however, to prevent FMCT negotiations from diverting scarce IAEA personnel and financial resources from more urgent safeguards tasks.

Conclusions

Consistent with the Commission's avoidance of overly detailed recommendations regarding future U.S. strategic force structure, it is recommended that any Commission position on FMCT be quite general, while highlighting major points of difference from, or commonality with, earlier U.S. positions.

The Arms Control Tiger Team and Counterproliferation Expert Working Group are in general agreement that the Commission should support:

- Negotiation on a legally-binding FMCT;
- Definition of "cut-off" as a ban on further production as of a set date;
- Treaty open to all states;
- Transfer of negotiating forum to a dedicated venue, perhaps within the IAEA.

The first three elements would reaffirm Bush Administration policy. The fourth element would be new; neither the Bush nor Clinton Administration appears to have questioned the desirability of keeping FMCT negotiations in the CD.

Tiger Team and Expert Working Group views differ on two other important FMCT elements:

- Definition of "fissile material." Most members support retaining the traditional definition of "fissile material for nuclear weapons or other explosive purposes." Others favor a ban on production of all fissile material.
- Verification. Most members support seeking measures that could effectively verify an FMCT (as that concept was defined during the Clinton Administration). Others would reaffirm Bush Administration policy—arguing that an effectively verifiable FMCT is not feasible and should not be pursued.

U.S. support for an effectively verifiable FMCT, combined with the other changes outlined here, would enhance the chances of initiating FMCT negotiations within the next few years. They would also improve the odds of successfully concluding those negotiations. However, those odds—while better—would still not be very good, for several reasons. For example: China probably would balk at any treaty that denied it the ability to increase fissile material stocks for weapons purposes; Russia and China would almost certainly oppose transparency into their weapons and weapons material stocks; the United States, France and the United Kingdom would also have difficulty with providing required information and access.

Even if an FMCT were successfully negotiated, chances are low that the four non-NPT parties would sign and ratify it. Iran and North Korea would do so if (but only if) international efforts finally succeeded in persuading them to abandon their nuclear weapons programs. It is harder to imagine circumstances that would persuade India, Pakistan and Israel to adhere to an FMCT.

Most Tiger Team and Expert Working Group members believe that the poor prospects for an actual FMCT should not deter the United States from supporting the treaty and pressing for its negotiation. In their view, that support would be politically important, not least in the run-up to the 2010 NPT Review Conference. Others argue that the near-term U.S. arms control and nonproliferation agenda is too full and too important to allow attention to be diverted to a negotiation with so little chance of success. All agree that, under any circumstances, the United States should be cautious in paying a substantial cost (regarding FMCT or other issues) to win the opening

or conclusion of FMCT negotiations, given the risk that the corresponding benefit will not be realized.

1. "Plutonium" covers all plutonium except that with 80 percent or more PU-238. "HEU" is uranium enriched to 20 percent or more.
2. "Effective verification" is a standard used through the Clinton Administration that implied the capability to detect a militarily significant violation in time to respond effectively and, in some formulations, to deny the violator the benefits of violation. As noted below, the Bush Administration used a more stringent definition.
3. The Conference on Disarmament has 65 members, currently including Algeria, Argentina, Australia, Austria, Bangladesh, Belarus, Belgium, Brazil, Bulgaria, Cameroon, Canada, Chile, China, Colombia, Cuba, North Korea, Congo, Ecuador, Egypt, Ethiopia, Finland, France, Germany, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Malaysia, Mexico, Mongolia, Morocco, Myanmar, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Poland, South Korea, Romania, Russia, Senegal, Slovakia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine, United Kingdom, United States, Venezuela, Vietnam, and Zimbabwe.
4. The IAEA Board of Governors has 35 members, always including the P-5 and with several members elected by regional groups. For 2008–2009, the Board is composed of Algeria (Chair); Afghanistan; Albania; Argentina; Australia; Brazil; Burkina Faso; Canada; China; Cuba; Ecuador; Egypt; Finland; France; Germany; Ghana; India; Iraq; Ireland; Japan; Lithuania; Malaysia; Mexico; New Zealand; Philippines; Romania; Russia; Saudi Arabia; South Africa; Spain; Switzerland; Turkey; United Kingdom, United States; and Uruguay.