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The Comprehensive Test Ban Treaty: An Assessment of the Benefits, Costs, and Risks

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Foreword

In 1999, President Clinton submitted the Comprehensive Test Ban Treaty (CTBT) to the U.S. Senate for advice and consent, and it was soundly rejected. The Obama administration announced early in its tenure that it would resubmit the same treaty to the Senate for advice and consent.

In anticipation of this renewed effort to secure Senate ratification of CTBT, the bipartisan Congressional Commission on the Strategic Posture of the United States in its May 2009 report called for a "net assessment" of CTBT prior to the Senate's renewed consideration of the treaty. The question of U.S. ratification of the CTBT was the *only* significant pertinent subject on which the Congressional Commission could not reach a consensus position. In fact, the Commission was about evenly divided between those who support and those who oppose CTBT ratification—hence the call for a net assessment prior to the resubmission of the treaty.

The origins of this report stem from the Commission's call. Several members of the Commission and its Expert Working Groups joined together to take up the challenge of assessing the arguments advanced by the proponents of CTBT. This report ultimately expands on and elaborates further the case made by those members of the Congressional Commission who oppose ratification.[1] It is a powerful and convincing case.

CTBT proponents argue that U.S. CTBT ratification would inspire the international community to rally with the United States in support of nuclear nonproliferation and strengthen the Nuclear Non-Proliferation Treaty (NPT). This cooperation, it is said, would reduce the potential availability of nuclear weapons to terrorists. In this fashion, CTBT proponents link ratification directly to nonproliferation success and countering the threat of nuclear terrorism. Given the high priority of nonproliferation and countering terrorism, CTBT proponents believe the United States has a moral responsibility to ratify the treaty. Indeed, some argue that even if U.S. CTBT ratification cannot in fact contribute to nonproliferation and countering terrorism in this fashion, the U.S. must at least be seen as "leaving no stone unturned" in its efforts to advance these goals, including by ratifying CTBT.

In advancing these arguments for CTBT ratification, proponents have demonstrated well the hope that the gesture of U.S. ratification would have this profound symbolic, diplomatic and psychological effect. There are, however, notable challenges to the realization of this hope.

Russia, for example, views nuclear weapons in part as a means of overcoming U.S. and Chinese conventional force advantages. A fundamental Russian rationale for nuclear

[1] See, *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, D.C.: U.S. Institute of Peace, 2009), pp. 83-84.

weapons is not only to counter nuclear weapons per se, but to have the nuclear capability necessary to trump potentially *superior non-nuclear forces*. Many in Russia have no desire to see the United States as the leader of an effective global movement that challenges the validity of the nuclear capabilities they deem essential to their security. Indeed, many in Moscow and also Beijing see proliferation as largely an American problem that usefully distracts U.S. attention and resources; in critical cases Russia and China show an obvious lack of enthusiasm for helping to relieve us of this problem.

This assessment of CTBT helps to demonstrate why the basic argument in favor of U.S. CTBT ratification involves unrealistic hopes. It details why ratification is unlikely to rally international cooperation against nuclear proliferation and why the prospective negative consequences of ratification are not trivial, particularly with regard to future U.S. capabilities to deter war and to extend deterrent protection to allies.

This report also explains that under international law, U.S. CTBT ratification would legally bind the United States to its restrictions; but it would be unlikely to bring the treaty into effect globally. To do so would necessitate that numerous additional countries also sign and ratify the treaty, including North Korea and Iran. In such cases, U.S. ratification would not likely inspire similar action. Unfortunately, it could give North Korea an additional opportunity to play its favored game of extorting the international community—how much might we have to pay for North Korea's favor in this regard, if such favor is possible?

Even if by an unexpected stroke U.S. CTBT ratification were to inspire the rest of the world to bring the treaty into force, the treaty could not then prevent further nuclear proliferation. Nuclear testing is not necessary for the development of primitive nuclear weapons. It never has been. The United States did not test the "Little Boy" atomic bomb before dropping it on Hiroshima in 1945.[2] What's more, the argument that U.S. agreement to forgo nuclear testing would now rally the world against nuclear proliferation is contrary to some available evidence in this regard. The United States stopped nuclear testing in 1992. Since then, China, France, India, Pakistan, North Korea, and apparently Russia have conducted nuclear tests,[3] and nuclear weapon states (e.g., Russia, China, and France) have modernized their nuclear arsenals, while other states (e.g., India, Pakistan, North Korea, Iran) have demonstrated or developed nuclear weapon technologies. If the end of U.S. nuclear testing actually is the key to rallying international opposition against proliferation, we have little evidence of it after almost two decades of no U.S. testing.

In addition, the CTBT has questionable verification provisions and lacks any serious enforcement mechanisms. The history of arms control from the 1930s until today demonstrates that, absent strong verification and enforcement measures, some states will cheat. CTBT proponents too often dismiss this problem. In doing so, they undermine the enterprise and promote the mistaken notion that CTBT verification and enforcement problems have been solved.

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[2] The United States tested the type of atomic bomb dropped on Nagasaki, but not the uranium, gun-assembled type of atomic bomb dropped on Hiroshima.

[3] That Russia "apparently" has engaged in nuclear testing is reported in, *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*, p. 83.

This assessment also explains why the problem attending CTBT ratification is not simply that the hoped-for benefits are unlikely ever to be realized, there also are prospectively large risks for the United States and its allies. The CTBT cannot prevent opponents from developing or taking steps to modernize nuclear weapons, but conversely, U.S. ratification could hinder our capability to modernize nuclear weapons as necessary for deterrence purposes.

If we ratify the CTBT, we will adhere to the U.S. "zero-yield" criterion while other countries would be free to interpret the CTBT restriction on nuclear testing—undefined in the treaty—in a less rigorous fashion. The U.S. "zero yield" criterion could undercut our capability to develop new capabilities critical to deter future threats, while opponents choosing a less rigorous testing restriction could conduct nuclear experiments that produce yield and potentially provide important military advantages. CTBT ratification would have the effect of closing off a deterrence safety route that we may need to take without providing a barrier to the range of threat developments that may drive us to seek that safety route. In this sense, it is worse than a "feel good" gesture without substance; it could threaten our capability to deter threats to us and our allies. Erecting such a solid legal barrier to testing could be incompatible with future needs that cannot now be known with certainty, but may require timely U.S. action.

International relations are unpredictable; this is particularly true with regard to the potential for the rapid development of severe security threats. Increasingly, technology spread, global communications, and cultural developments abroad have joined to make the United States the object of animosities and to shrink the security value of the great distances that separate us from most centers of serious threat. Technology spread, including biological and nuclear weapons, has also increased the potential lethality of otherwise second- and third-rate military powers.

What does this have to do with CTBT? We can no longer afford to believe that we have the luxury of waiting for serious new threats to be manifest before we consider the possibilities and prepare for them. Codifying a commitment not to test nuclear weapons reflects a pre-21st century American way of thinking about threats, i.e., that we can rest in our knowledge (or our ability to confirm what we think is knowledge) and capabilities because we can count on seeing threats far enough in advance to change course and respond as necessary. No one knows what types of nuclear weapons may be needed in the future to deter new threats, but they may not be the nuclear weapons we designed and built during the Cold War. That much is likely to be the case simply because conditions and foes can change rapidly and because the character of our enemies' nuclear and other highly lethal forces are *not* locked in and would not necessarily be so under CTBT.

It is unclear whether we will be able to design and produce reliably the future new types of capabilities we might need for deterrence based solely on our past testing experience. The option of testing could be very important for some types of new capabilities important to our future ability to deter attacks. If so, precluding our ability to test with an enduring legal instrument like the CTBT is to curry the risk that we will not have the deterrent capabilities necessary to prevent war in a timely fashion. Ratification would ensure that any future testing we might be compelled to undertake to help deter newly-emerging threats would be burdened by delay and an extended prior period of intense internal review and argument. That delay and burden may have been survivable in the 18th-20th centuries. It now would be a risk unless the CTBT also can preclude the developments that might compel us to test in the future—if only to have specific new types of nuclear deterrence capabilities. Those capabilities could include some weapon characteristics about which we may now be largely unaware or uninterested. The CTBT, however, cannot prevent the development of new threats which may demand new U.S. capabilities because it does little or nothing to make current and future enemies less hostile toward us, less able to reach us, and less able to attack us and our allies with nuclear weapons or other weapons of mass destruction.

CTBT is analogous to the 1972 ABM Treaty which restricted the U.S. development and deployment of any serious defenses against long-range missiles and effectively constrained U.S. defenses against shorter-range missile threats, but did nothing to reduce missile threats to us or our allies. It was based explicitly on a benign expectation of how the future would unfold, but precluded the development of defensive capabilities that would facilitate timely recovery if international relations proceeded in a different direction. As history actually unfolded, the need to withdraw from that treaty became blatantly obvious—but withdrawal continued to face enormous political challenges. And, if not for the shock of 9/11, it is doubtful that we would have withdrawn from the ABM treaty as quickly as we did and our capability to defend against offensive missiles would be far behind the need.

The moral here is useful when thinking about CTBT. The arguments in favor of CTBT are based on hope that the future will unfold in benign directions—to note that there is evidence contrary to this hope is an understatement. CTBT cannot stop the pace of lethal change and surprise in the development of the threats that we face, but its ratification would create a significant legal obstacle in front of our ability to adjust as may be necessary to deter new threats.

In short, herein is a policy and technical critique of the CTBT. It explains why U.S. ratification is unlikely to yield an effective rally against proliferation as is argued by CTBT proponents, and why the prospective regrets attending U.S. ratification could be serious indeed. This, of course, is the reverse of the image presented by CTBT proponents. It is our hope that all concerned citizens—and particularly all members of the U.S. Senate—will review this study as they seek a wise and prudent position on CTBT. They are unlikely to find anywhere else such an unflinchingly honest and substantive critique.

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Executive Summary

In 1999, when the U.S. Senate considered whether to give its advice and consent to the Comprehensive Test Ban Treaty, the Department of State issued a Fact Sheet outlining five key reasons for ratification. They were: the CTBT strengthens U.S. national security; advances U.S. nonproliferation and arms control objectives, as well as U.S. international leadership; provides an International Monitoring System (IMS) of which the United States should not be deprived; is verifiable; and requires no U.S. testing—now or in the future—to preserve its current nuclear deterrent capabilities.[1] With the exception of the argument about the IMS, the reasons offered in 1999 remain central to proponents' arguments today. (The IMS argument is no longer stressed because the IMS has proceeded to near completion despite non-ratification by the United States.)

On the other side of the issue, critics of the CTBT in 1999 argued that a zero-yield test ban treaty could neither be verified nor enforced, expressed skepticism over the long-term reliability of the U.S. nuclear stockpile without testing, found little evidence of tangible benefits to nonproliferation, and viewed the indefinite duration of the treaty to be unacceptable.

The Senate evaluated these matters in 1999 and found the treaty irredeemably flawed and consequently rejected it on a 51 to 48 vote (with one Senator voting present). This assessment closely examines issues related to the key arguments for and against the CTBT in 1999, as well as issues that have emerged since that time. It concludes that, on balance, CTBT ratification would achieve neither its stated goals nor the additional benefits attributed to it by CTBT proponents. Further, the treaty would actually be detrimental over the long term to the national security of the United States and its allies.

Purported Benefits of the CTBT

The argument that U.S. CTBT ratification would reduce the danger of foreign nuclear programs appears compelling. The hope is that if states are prohibited from conducting nuclear tests, then current non-nuclear powers will be unable to develop new nuclear capabilities and nuclear powers will be unable to improve their existing nuclear arsenals. Unfortunately, those hopes are demonstrably false.

Non-nuclear countries do not need nuclear testing to develop simple nuclear weapons or to produce nuclear weapons using designs and materials obtained from the black market. And, despite their pledge over many years not to test nuclear weapons, Russia and China have significantly improved their nuclear weapon capabilities and added new warheads without full-scale nuclear testing; they have maintained fully operational production facilities, and, in the case of Russia, broadened the set of circumstances in which it would consider using nuclear weapons.

Another argument expressed in favor of U.S. CTBT ratification is that it would establish U.S. international moral leadership in support of nuclear non-proliferation, i.e., the international community would be inspired by U.S. agreement of forgo nuclear testing and cooperate effectively to prevent nuclear proliferation. This argument also is demonstrably false. The United States has not tested nuclear weapons since 1992; that fact has neither prevented other nuclear-weapon states (e.g., Russia and China) from making qualitative and quantitative improvements to their nuclear weapons during that time nor inspired international support to prevent non-nuclear-weapon states (e.g., North Korea, Iran, India and Pakistan) from developing nuclear weapons or making progress toward nuclear weapons status.

Finally, CTBT proponents claim that U.S. CTBT ratification would help foster international support for President Obama's vision of total nuclear disarmament. Yet, the feasibility of nuclear disarmament is dependent on a transformation of the world order that is wholly independent of the fate of the CTBT.

Potential Costs of Non-Ratification

In 1999, some senators claimed that the Senate decision against ratification of the CTBT would have far-reaching negative effects on arms control and nuclear proliferation, but those dire predictions went unfulfilled. More recently, several commentators have postulated a range of negative reactions to another U.S. rejection of the CTBT. They warn that arms control advocates would publicly criticize the U.S. administration for not showing enough leadership on arms control and that it could lead to the unraveling of the Nuclear Non-Proliferation Treaty regime itself.

International reaction to another U.S. rejection of the CTBT will depend on how effectively the United States explains its decision. Some nations that have called for U.S. ratification of the CTBT would likely express disappointment, but the nature and sincerity of the reaction would vary with each individual nation's perspectives. If the U.S. Senate again evaluates the CTBT carefully, finds its supposed benefits to have been oversold and its potential risks substantial, and has concluded that a test ban is not in the security interests of the United States and its allies, then the president and other top officials will need to explain this reasoning to other countries. Key governments worldwide may be disappointed, but they are likely to understand and be reconciled to the decision.

Lessons from the Past

The past now provides instructive lessons to inform the debate about CTBT ratification. Lessons from the 1958-1961 U.S.-Soviet nuclear test moratorium indicate that a false sense of security in the reliability of the stockpile can result from the inability to test and confirm that weapons will work as intended. Not only did serious problems exist in the nuclear stockpile that went undetected until the United States returned to testing, but the absence of U.S. testing over four years led to serious deterioration of personnel skills and infrastructure.

The Chemical Weapons Convention and the Biological and Toxin Weapons Convention provide ample evidence that some countries have the motive and ability to violate bans on these weapons of mass destruction. Both agreements contain verification provisions;

these have not been sufficient to deter states from cheating or to inspire the international community to confront those suspected of noncompliance.

In the aftermath of the 1991 war to expel Iraq from Kuwait, the United Nations established the United Nations Special Commission (UNSCOM) and gave it sweeping authority to verify Iraqi WMD disarmament to ensure that Iraq would not rebuild its WMD. Yet, Iraq was able to hinder inspections for years and largely without consequence, while skillfully promoting the decay of sanctions. This experience demonstrates the pitfalls of enforcement and verification-related measures that are subject to the conflicting interests of an international consortium of states. This event has direct relevance to the CTBT's executive council of 51 member states, a mini-United Nations that would have to be convened to consider evidence of potential CTBT violations and vote to determine if on-site inspections were warranted. Securing the necessary 30 votes in favor from member states to enable on-site inspections is unlikely to be reliably practicable given the many competing interests that would be involved. This process would be particularly problematic if the suspected violator were a powerful state such as China or Russia.

Inherent Deficiencies of the CTBT

The CTBT has serious inherent deficiencies. First, it actually fails to define a "nuclear test," the very action the treaty is supposed to prohibit. Consequently, parties to the treaty must decide for themselves precisely what constitutes a test. As a result, varying definitions of what is prohibited by the treaty are possible. The United States interprets the treaty as prohibiting tests that produce any nuclear yield, i.e., a "zero-yield" standard. Others apparently have different standards. Russia, for example, reportedly conducts hydronuclear tests that produce a nuclear yield; such tests can be highly useful in assuring the safety and reliability of nuclear weapons, and in their modernization.

Second, the treaty is not verifiable. States can cheat in a variety of ways, with very low risk of detection. For example, a nuclear explosion can be decoupled by conducting it in an underground cavity and/or in a special container. This can reduce the seismic signal below the threshold of detectability. Other cheating scenarios are also possible.

Some CTBT proponents argue that any such undetected low-yield or masked cheating would be militarily insignificant. However, nuclear testing at a sub-kiloton level and up to a kiloton or more—a range that would be exceedingly difficult to detect—can be used to develop new nuclear weapons as well as to ensure the safety and reliability of existing nuclear warheads. Additionally, such testing can enable a state to develop and maintain the skills and facilities that support nuclear weapons research, development, and maintenance.

Even proponents of the CTBT concede that useful nuclear tests can be conducted with little chance of detection. For example, the 2002 study by the National Academy of Sciences on CTBT verification reported:

> At the lower end of the very-low-yield category, Russia could develop and test new very-low-yield tactical weapons in the range of 10 to 100 tons. With respect to seismic detection, the 10-ton weapon could confidently be adequately tested

> under decoupling conditions even at Novaya Zemlya [Russia's nuclear test site], and might even be tested in a steel or composite containment so that it would give no ground shock at all. Indeed, with its experience in testing and weapons design, Russia could develop a 10-ton nuclear weapon using only hydronuclear tests in the kilogram-yield range, and be reasonably confident of its performance.[2]

The third inherent weakness is the blatant inadequacy of CTBT verification and enforcement measures. For example, provisions regarding the key question of on-site inspections would ensure their lack of reliability. Under the CTBT, an Executive Council of state members would govern on-site inspections. This will essentially be a mini-U.N.—except that there is no guaranteed seat on this critical Executive Council for the United States. And, even if the United States is a member of the Council, the authorization to conduct an on-site inspection would require an affirmative vote of 30 of the 51 votes on the Council. As noted above, securing such a super-majority in favor of on-site inspections would be difficult if not impossible given the many competing interests that would likely be involved. The track record of such international fora, such as the efforts to enact tough sanctions on Iran for its nuclear program, does not suggest success. Even if politics somehow could be excluded from this CTBT process, and the on-site inspection authorization proceeded smoothly, getting a team to the suspect site before any telltale emissions dissipate will be exceedingly difficult. Any cheater could focus on delaying tactics that could defeat the value of authorized inspections. This certainly was the U.N.'s experience in Iraq.

Finally, if the United States ratifies the CTBT, under international law it will be bound by its prohibitions. Yet, even with U.S. ratification, the treaty is unlikely to enter into force. For entry-into-force to occur, CTBT ratification by China, India, Pakistan, North Korea, Iran, Egypt, Israel, and Indonesia would also be required. This is very unlikely as several of these states have indicated no interest or continuing opposition. And, it is not hard to imagine that North Korea would follow its standard practice of extorting extreme concessions from the international community if its cooperation became key.

The problems described above reflect flaws that cannot be "fixed" within the terms of the CTBT. Yet, proponents are adamant that the existing treaty terms cannot be renegotiated. The Senate will not have the opportunity to consider a treaty in which these problems have been addressed; it will be asked to provide advice and consent to a treaty embedded with these many obvious and known significant flaws.

Nuclear Modernization and Doctrine in Russia and China

Ongoing modernization of nuclear forces in Russia and China is of special concern. In the decade since the U.S. Senate voted against ratification of the CTBT, there have been significant upgrades in the nuclear arsenals of both Russia and China along with significant troubling changes in their nuclear doctrines.

In 2009, the report of the bipartisan Congressional Strategic Posture Commission summarized:

> Russia is at work on a new intercontinental ballistic missile (initially deployed with a new single warhead but capable of carrying multiple warheads), a new ballistic missile submarine and the associated new missile and warhead, a new short-range ballistic missile, and low-yield tactical nuclear weapons including an earth penetrator.

That Commission also expressed concerns about nuclear developments in China:

> China is diversifying its nuclear missile force by fielding a new set of road-mobile missiles and a small force of strategic missile submarines. Its ICBM force could more than double in the next 15 years. Its lack of transparency about its capabilities and intentions is a source of significant concern, for the United States and for its allies and friends in Asia.

At the same time, U.S. self-imposed policy constraints, including its zero-yield test moratorium in effect since 1992, have inhibited U.S. nuclear weapons research and modernization, including the principle of no "new" nuclear capabilities. It is important to consider the effect of these trends over the long term, their potential impact on the overall security environment, and future requirements for the U.S. nuclear deterrent.

Risks of Ratification for the United States and Allies

Ratification of the CTBT would commit the United States to forgo nuclear testing indefinitely. Should a need to conduct a nuclear test arise, a U.S. president would face a difficult decision involving intense domestic debate and international pressure. That decision would be complicated and delayed further by the formal steps required to withdraw from the treaty. In effect, CTBT ratification would create legal and practical reasons for delay in the U.S. ability to test should the need arise in the future. In many plausible contingencies, that delay could harm U.S. and allied security. The CTBT could not prevent the many possible reasons that the United States could need to return to testing, but it would likely make such a return exceedingly difficult.

A new concern that was not pertinent in 1999 is whether an unbiased technical assessment over the health of the nuclear stockpile would be transmitted from nuclear weapon laboratory directors to the president. Since 1999, when the laboratory directors presented testimony to the Senate on CTBT-related matters, a contract clause has been added to the management and operating contracts for all three of the nuclear weapons laboratories. This new clause provides the Secretary of Energy with the authority to terminate at will and without justification any laboratory director. This clause is quite dangerous: laboratory directors are in positions of "national trust" but this new contract arrangement entails the obvious potential for new political pressures and apparent conflicts of interest.

With ratification, the United States undoubtedly would observe CTBT obligations based on its *zero-yield* interpretation as a requirement of international law. Other countries, however, could use a variety of means to conduct low-yield tests that would evade detection. Low-yield tests can be used not only to certify the reliability and safety of existing nuclear weapons, but also to develop new, more advanced weapons. The risks to U.S. security inherent in this situation would be unavoidable because, as noted above, nuclear testing, even at very low yields, can provide invaluable training and experience to technical personnel—those responsible for maintaining a nation's stockpile in safe, reliable condition. Tests can confirm the integration of processes, validity of computer models, and expert skills. At a minimum, for a country that cheats, its next generation of nuclear designers will have the advantage of this experience. U.S. designers would not. This would be an intolerable and unavoidable potential asymmetry introduced by U.S. CTBT ratification.

As stated previously, U.S. self-imposed policy constraints, including its strict interpretation of a zero-yield test moratorium, have prevented modernization of the nuclear arsenal. Such modernization could include advanced safety and security features and weapon characteristics that strengthen deterrence of adversaries and assurance of allies. At some point, the security needs of the United States and its allies may require nuclear weapons with characteristics that differ from those developed during the Cold War. Since different types of U.S. nuclear weapons may be needed to support the deterrence of war in the future, the prerogative of nuclear testing should not be forever forsworn as under the CTBT.

For more than a half century, U.S. extended nuclear deterrence commitments to allies have been critical to U.S. strategy, alliances, and nonproliferation goals. Even allies such as Japan, that support the general concept of a CTBT and steps toward global nuclear disarmament, have conditioned that support on maintenance of U.S. nuclear forces they deem critical to the continued deterrence of war. If allies perceive that the U.S. nuclear deterrent is not keeping pace with the requirements imposed by new threats they face and their confidence in the U.S. nuclear umbrella erodes, they may seek their own nuclear weapons. In contrast to the expressed hopes of CTBT proponents, U.S. CTBT ratification actually has the potential to inspire proliferation.

Safeguards

Safeguards are unilateral promises made by U.S. presidents to hedge against the potential risks in an arms control treaty. A series of safeguards has been associated with U.S. CTBT ratification; proponents suggest that these help ensure its integrity. It must be recalled, however, that safeguards are policy statements of intention; they do not carry the force of law. In addition, the funding necessary to implement safeguards is at the discretion of Congress and subject to the annual appropriations process. In the case of the CTBT, six safeguards were proposed by the president in 1997 when the treaty was forwarded to the Senate for advice and consent. Among other things, these safeguards called for a Science-Based Stockpile Stewardship Program, maintenance of modern nuclear laboratories, facilities and programs, and a nuclear test readiness program.

In 2009, the Congressional Strategic Posture Commission reported that the funding to support these safeguards has been inadequate. Although the Stockpile Stewardship Program (SSP) has had some noteworthy successes, appropriated funding has fallen well short of the levels earlier promised and needed. Important programs, such as stockpile surveillance, have been scaled back. The Commission reported that SSP programs have suffered from both underfunding and overregulation. As a result, the SSP has not been successful in key areas such as developing the tools to certify U.S.

warheads without nuclear testing and maintenance of skilled personnel needed to support the nuclear deterrent. In 2010, the Obama Administration promised significant budget increases for the SSP. However, whether the necessary funding is attained and can be sustained over successive administrations remains an unknown.

Another CTBT safeguard, the test readiness program has also suffered from inadequate funding and intermittent congressional support. The budget for the National Nuclear Security Administration (NNSA) allocates no dedicated funding for test readiness. NNSA officials report that test readiness capabilities are currently supported through programs and activities at the Nevada Test Site and that in fiscal year 2010 about $5M was allocated. This is considerably less than the funding needed to sustain a viable test readiness capability.

Historically, safeguards have been supported by arms control proponents in Congress when treaties are submitted for Senate ratification. Over time, however, the enthusiasm and budgets necessary for safeguards wanes. This has clearly been the case with those safeguards proposed for the CTBT.

Overall Assessment

Overall, the proponents' case for CTBT ratification reflects hope over available evidence and experience—hope without reason that the future will be more predictable and benign than the past. Evidence and experience suggest strongly instead that U.S. ratification of the CTBT would bring few if any tangible benefits while introducing significant new risks for U.S. and allied security.

The United States will require safe, secure, and effective nuclear weapons to deter war and assure allies for the foreseeable future. Uncertainties in the decades ahead, changes in opponents, threats and circumstances are likely to compel weapon modifications or nuclear modernization initiatives not envisioned at present. Ratification of the CTBT, a treaty of indefinite duration and with numerous deficiencies, would pose unacceptable and entirely avoidable risks to the U.S. capability to adjust as necessary to such changes.

The real risks posed by the CTBT are inherent in its basic terms, which apparently are beyond revision at this point. The proposed set of safeguards are inadequate to offset those risks and can only be judged as questionable themselves given the dubious history of such safeguards in general and CTBT safeguards in particular.

Introduction

In April 2009, President Obama said, "I state clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons" and pledged to pursue Comprehensive Test Ban Treaty (CTBT) ratification "immediately and aggressively."[3] Therefore, it is likely that the U.S. Senate will again address whether it should give its advice and consent to the treaty. When and if the U.S. Senate takes up the CTBT, it will reexamine the issues of concern in 1999 when the treaty was last considered and rejected. It will wish to know if those problems persist, as well as whether there are any new issues that are relevant to ratification.

The CTBT remains highly contentious. The 2009 report of the Congressional Commission on the Strategic Posture of the United States had but one issue upon which its members could not reach agreement—the CTBT. The Commission report cited doubts about the putative benefits of CTBT along with several concerns about the treaty, including differing interpretations of CTBT restrictions that could disadvantage the United States, inadequate verification provisions, and concern over follow-through on safeguards. However, the Commission did reach agreement on some recommendations related to the CTBT, including the need for a net assessment of benefits, costs, and risks.

This assessment of the CTBT includes the issues that arose in 1999 as well as some relevant information that has emerged in the intervening decade. It is organized into six sections.

The first section analyzes the CTBT's potential and purported benefits, as well as the possible political costs if the U.S. Senate chooses again to reject CTBT. This section reviews the goals of the CTBT outlined in the treaty's text, as well as the benefits CTBT proponents argue that the treaty will provide. It addresses three questions: Can the CTBT achieve its goals? What is likely to result if the United States does not ratify the CTBT? And, how serious are these consequences?

Section two assesses inherent deficiencies of the CTBT. Specifically, substantive deficiencies include the lack of a precise definition of what is prohibited, the difficulties in verifying treaty compliance, and unworkable procedures for the inspection of suspected violations.

Section three analyzes the nuclear weapons doctrines of and modernization in Russia and China, with particular emphasis on developments since the 1999 U.S. Senate vote against CTBT. The key question addressed is: What is the significance of apparent Russian and possible Chinese nuclear testing and nuclear weapons-related experiments?

Section four assesses the risks of CTBT ratification. The principal questions are: What are the bottom-line costs to the United States of adhering to a zero-yield nuclear test ban? What is the potential long-term impact on the U.S. nuclear deterrent and extended nuclear deterrence?

Section five examines the notion of using safeguards to help guarantee the safety and reliability of the U.S. nuclear arsenal in the absence of nuclear testing. A key question is: What have we learned about the effectiveness of safeguards since the 1999 U.S. consideration of the CTBT?

The final section is a summary critique of CTBT in light of the purported benefits, costs and risks.

Section 1:
The Purported Benefits of the Comprehensive Test Ban Treaty

The anticipated benefits of the CTBT vary, depending on whom you ask. A few treaty proponents claim that it will achieve a wide array of advantages for the United States. Assistant Secretary of State Rose Gottemoeller observed that ratifying the CTBT was important to "effectively restore our moral leadership."[4] Perhaps one of the more lengthy lists of expected CTBT benefits was authored by Brent Scowcroft et al., who state:

> [CTBT] ratification by the U.S. and eight other holdout countries will considerably strengthen the global nonproliferation regime in numerous ways. By actively seeking ratification, the U.S. will be more able to persuade Nuclear Non-Proliferation Treaty member states to erect stronger barriers against the acquisition of nuclear weapons. When ratified, the CTBT will expedite agreement on more rigorous export controls, measures to protect against the theft of dangerous materials and know-how and measures to discourage the spread of enrichment and reprocessing facilities. Implementation of the CTBT's international monitoring system will add significantly to U.S. national capabilities to detect covert nuclear testing worldwide. It will also impede the ability of countries with nuclear weapons to develop and deploy more advanced nuclear systems, including taking steps to miniaturize and otherwise make more usable their offensive nuclear capabilities.[5]

As with most proponents who confidently ascribe treaty benefits such as those listed above, these authors do not explain how or why the CTBT would have these positive results. There is no tangible evidence available that parties to the Nuclear Non-Proliferation Treaty (NPT) would support stronger nonproliferation measures as a result of U.S. ratification or CTBT entry-into-force. Nor is there tangible evidence that the CTBT would lead to stronger export controls, protection against theft of dangerous materials, or to discouraging the spread of enrichment and reprocessing facilities. And, the International Monitoring System has been developed despite the fact that the treaty would not enter into force for a long time, at best, and is already operating, in part. It will not be scrapped if the CTBT does not enter into force.

CTBT proponents express hope that, once the CTBT enters into force, the United States will be able to muster greater international support for nonproliferation than has been the case in the past. Yet, a laundry list of additional nonproliferation and counter-weapons of mass destruction (WMD) measures has been sought for years. The obstacle has not been the status of CTBT; it has been that countries understandably tend to take actions they judge to be in their own net interests and some have not supported these measures strongly or at all.

Some CTBT proponents do not ascribe a long list of benefits to the CTBT. They focus on the final item in the quotation above—the national security benefit of constraining nuclear weapons development worldwide. One such proponent, Daryl Kimball, wrote:

> ...by ratifying the CTBT, the United States stands to gain important national security benefits by constraining the ability of other states to build new and more deadly nuclear weapons that could pose a threat to U.S. security.[6]

This is the crux of the matter and the most important purported benefit to be assessed.

Preventing Further Nuclear Proliferation

The Preamble of the CTBT identifies three objectives expected of the nuclear testing ban:

- Constrain development and qualitative improvement of existing nuclear weapons,
- End the development of advanced new types of nuclear weapons, and
- Help prevent the proliferation of nuclear weapons to additional states.

The first two objectives (preventing qualitative improvements in existing arsenals and ending development of advanced warheads) are generally characterized as halting vertical proliferation. The third, preventing proliferation to others, is referred to as preventing horizontal proliferation.

Vertical Proliferation

How effective can the CTBT be in constraining vertical proliferation? Some insight can be obtained by examining developments in the United States and Russia during the period from 1992 to the present in which both states claim to have observed a moratorium on nuclear testing.

In the case of the United States, nuclear weapons development has been significantly curtailed. During the U.S.-Soviet nuclear testing moratorium of 1958-1962, the United States designed and deployed a new type of nuclear warhead. Following that moratorium, the United States discovered through testing that the warhead did not work as intended. Thereafter, it became U.S. practice that any new-design warhead introduced to its nuclear arsenal would be tested to assure reliability and performance as intended.[7]

The United States has not developed and certified a new nuclear warhead since it stopped testing in 1992. Therefore, in the specific case of the United States, the current moratorium—and by extension, the CTBT—along with U.S. policy constraints on nuclear weapon modernization, has had the effect of accomplishing the treaty's first two goals, preventing vertical proliferation.

In contrast, during its test moratorium Russia has modernized and expanded the types of nuclear warheads and weapons in its arsenal despite claims of not testing. Russia has revised its nuclear doctrine to include use of nuclear weapons in regional and general war and to offset its declining conventional forces. Secretary of Defense Robert Gates, in his October 2008 speech on the U.S. nuclear deterrent, called attention to Russia's "increased reliance on its nuclear force."[8] In support of further nuclear weapons development, it has enhanced nuclear weapons research, development, and production facilities, including modernization of its nuclear test site at Novaya Zemlya where, in the past, Russia conducted full-scale nuclear tests.

In stark contrast to the United States, Russian leaders have made nuclear modernization their highest priority.[9] In 2008, about 16 percent of the Russian Ministry of Defense budget was spent on strategic nuclear forces[10] and, in 2009, 25 percent of the 1.3 trillion ruble defense budget was allocated to upgrading nuclear forces.[11] (Note: for comparison, the U.S. Defense Department budget allocates about 2 percent of its total funding to strategic nuclear forces. If the weapons-related budget of the National Nuclear Security Administration is added, the total would only reach 3.5 to 4 percent.)

By 2020, Moscow plans to have modernized its nuclear forces.[12] Planned additions include a new nuclear cruise missile, a modernized SLBM, a MIRVed version of the SS-27, and submarines to carry the new Bulava-30 ballistic missile. Moscow also recently initiated plans to develop and produce a new long-range bomber and a new heavy intercontinental ballistic missile. The fact that this significant Russian vertical proliferation is occurring while Russia simultaneously claims that it is not conducting nuclear tests demonstrates well that the CTBT's restraint on vertical proliferation would be meager indeed.

Some of the new Russian missiles are reported to carry newly developed warheads or older warheads with new components and capabilities. For example, the warhead for the TOPOL-M (SS-27, both silo-based and mobile) is reportedly a new design with greater yield.[13] Russian officials claim the Bulava-30 also has a newly developed warhead. Other new weapons reportedly include such warhead innovations as lower-yield, "clean" warheads, and warheads with enhanced electromagnetic pulse to attack and destroy electronics.[14] Others, including former Russian Minister of Atomic Energy Mikhaylov, have reported that Russian scientists were "developing a 'nuclear Scalpel' [with a] low-yield warhead … surrounded with a superhardened casing which makes it possible to penetrate 30-40 meters into rock and destroy a buried target … with virtually no radiation contamination …"[15]

It is very likely that Russia would not deploy modernized or new warheads without some level of testing that would give it confidence that the weapons would work as intended. It is likely that Russia either has used previously tested designs as the basis for its new warheads, or has, in fact, undertaken nuclear testing at a level of yield sufficient for extensive modernization of its nuclear weapons. Thus, whether or not Russia has adhered to nuclear testing restrictions contained in the CTBT, the treaty has not succeeded in halting vertical proliferation. Russia's nuclear weapon modernization is discussed further in Section 3.

Horizontal Proliferation

How effective can the CTBT be in halting horizontal proliferation? Certainly from a technical standpoint, a test ban—even one scrupulously adhered to—would not prevent a nation from developing and deploying fission-type weapons. As Harold Agnew, former director of Los Alamos National Laboratory wrote in 1996, "…with a supply of plutonium… and/or enriched uranium, any nation with a munitions industry can develop a multi-kiloton device. It may be large and unsophisticated, but the designers can be assured it will work without testing."[16] South Africa proved this when it clandestinely built nuclear weapons without testing. "Little Boy," the U.S. gun-assembly type weapon used against Japan, had not been tested prior to its use. Pakistan and India[17] developed nuclear weapons without testing prior to demonstrating their nuclear weapon capability in May 1998. In short, there is ample evidence that demonstrates beyond doubt that CTBT could not prevent proliferant countries from developing nuclear weapons.

It is the case that more advanced types of warheads are likely to require testing unless a nation were to obtain very detailed design information along with the technological skills to construct the nuclear warhead. Again, however, we know that CTBT could not provide the needed constraints because history demonstrates that proliferant countries can obtain advanced designs, or even assistance with simpler designs, as well as help with components and special nuclear materials. The A. Q. Khan nuclear technology supply network and Libya's former nuclear weapons program demonstrate that sensitive nuclear technologies and detailed plans for nuclear weapon designs have been bought and sold on the black market, including by Iran.[18] Another example of selling nuclear weapons technology is described in a recent book by a former Secretary of the Air Force and a former Director of Intelligence at Los Alamos National Laboratory. The book notes that a design for one of China's nuclear bombs was "provided to Pakistan, Libya, and Iran."[19] This warhead design has been reported to have been tested by China and weaponized to be carried on a ballistic missile. This history demonstrates the fallacy of the claim that CTBT would prevent horizontal proliferation.

In recognition of these technical realities and history, some CTBT proponents retreat to the argument that, even if the treaty will not technologically constrain a proliferant nation, it will help establish an effective norm against nuclear weapons acquisition. Here again, however, there is persuasive evidence that this is not the case. First, the NPT, which banned additional states from acquisition of nuclear weapons, already established such a norm. The problem is that the norm, which has existed since the NPT went into force in 1970, is ignored by some and violated. Nations may be party to the NPT and violate it (e.g., Iran), violate and withdraw from the treaty (e.g., North Korea), or simply refuse to join (e.g., India, Pakistan, and Israel).

Some treaty proponents also argue that a nuclear test ban would bolster U.S. moral leadership and other nations would follow the U.S. example. Yet again, the evidence is to the contrary. Since 1992, when the current U.S. nuclear testing moratorium began, there have been the following known nuclear tests by nations other than the five nuclear-weapons-states recognized by the NPT:

India	May 11 and 13, 1998
Pakistan	May 28 (five tests claimed) and 30 (one test), 1998
North Korea	October 16, 2006 and May 25, 2009

Today, many states have the capability to create a functioning nuclear explosive. The limitation is not technology;[20] it is a matter of resources and intent. Some states may view nuclear weapons as a means to gain international clout and as vital to their security. When fundamental national security interests are at risk, security concerns typically trump international political norms. All three nations listed above chose to tolerate international condemnation for the sake of improving or demonstrating their nuclear weapons capabilities. France, too, was willing to endure similar condemnation when it conducted its most recent series of nuclear tests in 1995-1996.

Combating nuclear proliferation continues to be an important national goal. A number of potentially helpful actions are underway and others have been proposed.[21] However, U.S. ratification of the CTBT would contribute little toward this goal.

Conclusion

The CTBT will not prevent further nuclear proliferation. Since the United States suspended nuclear testing in 1992, some nuclear weapons states (e.g., Russia, China, France) have modernized their nuclear arsenals; some states (e.g., China, India, Pakistan) have expanded their nuclear arsenals; and other states (e.g., North Korea, Iran) have developed and demonstrated technologies in pursuit of nuclear weapons.

Contributing to Nuclear Disarmament

The stated ultimate purpose of the CTBT—nuclear disarmament—is contained in the treaty preamble:

> Recognizing that the cessation of all nuclear weapon test explosions and all other nuclear explosions, by constraining the development and qualitative improvement of nuclear weapons and ending the development of advanced new types of nuclear weapons, constitutes an effective measure of nuclear disarmament and non-proliferation in all its aspects.

When the CTBT was signed by the United States in 1996, administration officials were careful to clarify that the intent was to "ban the boom and not the bomb." However, the Obama administration has gone beyond that premise and stated that the CTBT is a step toward total nuclear disarmament. In August 2009, Assistant Secretary of State Gottemoeller outlined the administration's agenda for arms control and disarmament. She said that the START Follow-on Treaty was the first step, and CTBT ratification the second on the "long road to a nuclear free world."[22] And a White House press release on September 15, 2009 stated, "… the CTBT is part of the President's comprehensive agenda to prevent nuclear proliferation, and to pursue the ultimate goal of a world without nuclear weapons."[23] But, would the CTBT help accomplish the goal of facilitating total nuclear disarmament? If so, how?

Serious analyses of conditions needed for complete nuclear disarmament reveal that roadblocks to nuclear disarmament have little or no connection with a CTBT. The most important condition for nuclear disarmament is for states to no longer need nuclear weapons for their security. As the bipartisan Commission on the Strategic Posture of the United States stated, "The conditions [for elimination] … are not present today and establishing such conditions would require a fundamental transformation of the world political order."[24]

Indeed, the need for a transformed world as a precondition to nuclear disarmament is evident in the current situation in the mid-East. Even if disputes between Israel and its neighbors could be resolved peacefully, Iran's quest for a nuclear weapons capability sufficiently threatens both the security of Israel and Arab states that incentives for nuclear proliferation in the region would abound. The status of CTBT is irrelevant to this roadblock to nuclear disarmament.

In addition, it appears that the conventional superiority of the United States must be eliminated for nuclear disarmament to be plausible. Russian leaders have made this a precondition to any interest they might have in exploring nuclear disarmament.[25] The rationale here is that U.S. conventional capabilities are so overwhelming that the only deterrent currently available to less capable states is a weapon of mass destruction. The conundrum is that advanced conventional capabilities are fundamental to the United States being able to reduce its reliance on nuclear weapons and to reduce its nuclear arsenal. But, these same U.S. advanced conventional capabilities also preclude serious interest by others in steps toward nuclear disarmament. A CTBT would do nothing to resolve this roadblock.

Nuclear disarmament would also require the creation of a reliable global collective security system capable of protecting all states. This was the unmet goal of the League of Nations and continues to be the unmet goal of the United Nations. Yet, the fundamental reason why this goal remains unmet endures: individual states follow their own security interests and their interests often conflict. The continuing inability of the international community to set aside national differences to cooperatively solve common security problems is demonstrated daily as North Korea and Iran continue to flout the international community with their nuclear programs.

It is essential to note that, even if all nations have agreed to a nuclear test ban and total nuclear disarmament, cheating could still occur—perhaps without detection. In an environment where all others have given up nuclear weaponry, the advantage conferred by possession of even a few nuclear weapons would be great. Nuclear weapons are too small and the world is too large for there to be reasonable confidence that they have all been eliminated. At present, there are no technologies that would enable us to know how much special nuclear material (e.g., plutonium or enriched uranium) has been produced and where it is, how many nuclear weapons have been built and where they are, or what facilities to produce special nuclear materials exist and where they are. Again, the CTBT would do nothing to change this.

Some proponents of the CTBT state that the treaty would contribute to total nuclear disarmament by freezing nuclear arsenals worldwide at their current levels, thereby easing future arms control efforts to work on bringing those frozen capabilities downward in quantitative and qualitative terms. However, as discussed above and will be shown in greater detail in Section 3, both Russian and Chinese nuclear modernization have proven the opposite. Although both assert that they abide by the testing limitations of the CTBT, they continue their nuclear weapons modernization apace. As noted above, it is a proven point that nuclear testing is not a prerequisite to development and deployment of some types of nuclear weapons designs. In short, CTBT could not freeze nuclear arsenals worldwide.

Given these hard facts, CTBT proponents sometimes fall back on the claim that U.S. ratification of the CTBT would provide a moral example and thereby lead other states to follow the U.S. example. Yet again, actual evidence supports a contrary conclusion. For example, an April 2008 report on proliferation and civil nuclear power cited the following case of the United States attempting to "lead by example" without first addressing the motivations for other states to choose alternative courses of action:

> [In 1977] The [Carter] administration argued then that even though the possibility for stealing separated plutonium and uranium was not very likely within the United States, the risk for theft of such materials would be substantially greater within foreign nations. The United States ultimately fell back to a posture of attempting to set *an example* for the rest of the world by abolishing all reprocessing of our nuclear spent-fuel wastes. At the time, the United States believed that by making such a pronouncement against separation and reuse of fuels on proliferation grounds, both the European nations and Japan would abandon their reprocessing plans—a notion that history has proven to be naïve. Now, after nearly 30 years since those U.S. decisions, the fact is that *no* other nation has chosen to follow the U.S. lead in this regard. Instead, the other industrial powers around the world have elected to reprocess their fuel.[26] (Emphasis as in the original.)

The claimed linkage of CTBT to the potential for total nuclear disarmament is based on unwarranted hope. Despite continuing expressions of this hope, there is no evidence or reason to expect that a CTBT would, in any way, address the many real roadblocks to nuclear disarmament.

Conclusion

While the CTBT is widely presented as an important stepping stone toward global nuclear zero, it cannot contribute substantively to eliminating or even reducing the fundamental motivations for states to acquire or retain nuclear weapons, or their ability to do so.

Political Costs of Non-Ratification

> "A vote by the Senate rejecting the Comprehensive Test-Ban Treaty would cause a tidal wave of astonishment. It might set off a chain reaction around the world, which would be even more serious than the chain reaction of the atomic bombs in Nagasaki and Hiroshima."[27]
>
> —Senator Arlen Specter, October 1999

Another way to look at the possible benefits that might be associated with the CTBT is to examine what negative events might be forestalled if the treaty were to be ratified by the United States. CTBT proponents argue that a second Senate rejection of CTBT would be disastrous for arms control in general, and for the Nuclear Non-Proliferation Treaty in particular. The actual evidence from history can again provide some useful lessons here.

In the 1999 Senate debate over CTBT ratification, several senators argued that it would be calamitous and tragic if the Senate were to reject the treaty and that it would set back arms control and nonproliferation. Despite these dire predictions, there were no disasters resulting from the 1999 U.S. Senate rejection. In fact, since that vote there have been numerous nonproliferation and arms control successes—many led by the United States—that belie the predictions (see Table 1).

Even though the disaster predicted by CTBT supporters did not occur after 1999, another Senate vote to reject ratification undoubtedly could have political ramifications. Condemnation would be expected from advocates (who perceive the ban as integral to their goals of non-proliferation and nuclear zero) and from nations that made CTBT a central element of their nonproliferation and arms control policy. But would the disappointment of these treaty proponents have practical effects? The answer is that there may be three consequences.

First, some CTBT advocates would publicly and vocally chastise the Senate vote, and would criticize the U.S. administration for not doing enough to show leadership on arms control. It should be noted, however, that even if the Senate did vote to ratify the treaty, many of these same individuals and groups would continue to criticize the United States for not doing enough in the arms control arena, just as they have continued to do following previous major arms control treaties and the 75 percent reduction in the number of U.S. strategic nuclear weapons since the end of the Cold War.

Table 1: Nonproliferation and Arms Control Successes Post-1999	
2002	U.S.-Russian Treaty on Strategic Offensive Reductions.
2002	G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction.
2003	Libya admitted secret chemical and nuclear weapons programs, which were subsequently dismantled.
2003	U.S. launched Proliferation Security Initiative, now supported by more than 90 nations.
2004	A.Q. Khan secret nuclear network discovered and broken up.
2004	United Nations Security Council Resolution 1540 established standards for all states to prevent WMD proliferation.
2004	U.S. launched Global Threat Reduction Initiative, helping secure nuclear reactors worldwide.
2006	Global Initiative to Combat Nuclear Terrorism launched jointly by the United States and Russia and is now supported by over 75 countries.
2007	Syria's secret nuclear program discovered; reactor destroyed.
2007	U.S. and Russia established the Nuclear Energy Initiative.
2008	U.S. nuclear weapons at lowest number since Eisenhower Administration.
2010	New START Treaty signed.

Based on Jayson Roehl, "The United States Senate and the Politics of Ratifying the Comprehensive Nuclear Test Ban Treaty," *Comparative Strategy*, Vol. 28, No. 4, pp. 313-314.

Second, some nations that have called upon the United States to ratify the CTBT would likely express disappointment; the nature and sincerity of their reactions would vary with individual nations' perspectives. Some observers have claimed that European nations, in particular, would be less willing to join the United States in further nonproliferation initiatives if the U.S. Senate does not consent to the treaty. However, this would seem unlikely or at worst short-lived given that nonproliferation is as much in the interests of Europe as it is of the United States.

In this context, we should recognize that Allies' views on the CTBT issue are nuanced. Japan and Germany, for example, both call for CTBT ratification and entry-into-force. Yet, both countries have defense policies that rely on the United States nuclear deterrent, and both have called upon the United States to keep that deterrent strong. As one Japanese official said, Japan wants the CTBT to enter into force, but only if the United States can keep its nuclear deterrent strong without testing.[28] Tokyo is comfortable with these seemingly contradictory policies because it expects the United States to do whatever is in the U.S. national security interest and necessary to maintain a credible "nuclear umbrella." Extended deterrence and U.S. commitments to allies are discussed further in Section 4.

Third, and perhaps most importantly, some commentators question whether another Senate rejection of CTBT would contribute to unraveling of the NPT regime. The NPT, which entered into force in 1970, is viewed by many as a bargain between the then-declared five nuclear weapon states—which agreed to pursue nuclear disarmament—and the non-nuclear weapon states—which agreed to forgo nuclear weapons while benefiting from access to nuclear energy. The bargain is contained in Article VI, which states:

> Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.

The non-nuclear weapon states have repeatedly and specifically cited the CTBT as a critical step toward fulfilling Article VI obligations. However, they typically emphasize only the responsibilities of the nuclear weapon states while ignoring those of all states to work toward this goal concurrently with general and complete disarmament. Indeed, as noted above, nuclear disarmament is plausible only in the context of a reliable global collective security system that could enforce “strict and effective international control” over a general disarmament process. Yet, any progress by these states towards the creation of such a collective security system and general disarmament is noticeably absent. The salience of their complaints against the United States regarding CTBT should be understood in this context.

Is it possible that some nations would leave the NPT in protest if the U.S. Senate were to vote again against consent and ratification? It typically is a mistake to say any such future event is “impossible.” However, there are several mitigating factors that will likely influence developments.

First, the NPT regime is at risk today for reasons wholly unrelated to actions the United States may or may not take regarding the CTBT. North Korea violated, then abrogated the NPT. Iran, a member, is almost certainly pursuing nuclear weapons despite its treaty obligations. Syria was discovered to be covertly constructing a nuclear facility. North Korea and Pakistan have been engaged in selling nuclear weapons-related technology to others, perhaps to an extent as yet unrevealed. In the future, states party to the NPT may view the treaty as ineffective in protecting them against new proliferants, particularly in the Middle East. Thus, if states party to the treaty view the NPT as ineffective and even a liability rather than an asset to their security, the NPT regime would continue to be at risk regardless of what transpires with the CTBT.

Second, countries that are dissatisfied with the progress toward nuclear disarmament will not be mollified by U.S. ratification of the CTBT. Once this step is accomplished, they will renew demands for further deep cuts in U.S. and other nuclear weapons arsenals and capabilities. They may again employ their most useful political tool—the threat of unraveling the NPT—to achieve their aims.

Third, the response by NPT parties to Senate rejection of the CTBT depends to a large extent on how the United States explains itself to other NPT parties. The President and other top officials would need to convey to others that the U.S. Senate has evaluated the CTBT carefully, found its supposed benefits to have been oversold and its potential risks substantial, and has concluded that CTBT ratification is not in the security interests of the United States and its allies. Some responsible governments would be disappointed, but could understand the decision. It would be of great importance to communicate widely the reasons for that decision. In the current global security environment, the deficiencies in the treaty—discussed next in Section 2—appear to impose unacceptable risks at this time for the United States and its allies.

Conclusions

- **International reaction to another U.S. rejection of the CTBT would be varied and largely rhetorical.**
- **Another rejection is unlikely to contribute materially to the unraveling of the NPT. The NPT regime is troubled and could unravel for reasons wholly unrelated to the U.S. action regarding CTBT.**

Section 2:
Deficiencies of the CTBT

Arms control treaties are negotiated by parties with varying interests and often competing concerns. It is, therefore, logical that compromises are made and that language may be nuanced and subject to varying interpretations. Even recognizing this, the CTBT is extraordinarily flawed in policy, technical elements, and its provisions for verification.[29] Four problems, detailed below, stand out.

The CTBT Does Not Define "Nuclear Test"

> "Some Russian weapons scientists believe that they are compliant with the CTBT if the nuclear yield of an experiment is less than the energy released by the high explosive in the device. Thus, if an experiment contained fifty pounds of conventional high explosive, they are permitted to release up to fifty pounds of nuclear yield."[30]
>
> —Stephen Younger, August 2009
> Former Director of Nuclear Weapons Technology
> Los Alamos National Laboratory

One of the most serious policy flaws of the CTBT is its failure to define in technical terms what constitutes a nuclear test. The irony here is that the treaty fails to define what it purports to prohibit. Thus, one treaty party may conclude that experiments producing some measurable level of nuclear yield are allowable, whereas another may view those same experiments as treaty violations.

When members of the Strategic Posture Commission testified before the Senate Armed Services Committee on their findings, including the inability to reach a consensus on CTBT ratification, former Senator John Glenn expressed his concern over this issue:

> I'd want to know what we're agreeing to. I don't think it's adequately defined yet. The Soviets, or the Russians now, define it … in a different way than we do.[31]

Some CTBT advocates say that the CTBT negotiating record reflects a consensus on what is allowable, i.e., no nuclear yield in a test is permitted. A former U.S. CTBT negotiator testified to Congress that Russia agreed to the U.S. decision that the CTBT bans any test having nuclear yield,[32] and various claims have been made that a common "understanding" exists of what constitutes a nuclear test. However, no official document codifying such an agreement has been made public. The U.S. Department of State stated in a 2007 letter to Senator Jon Kyl that there was no negotiated definition of what constitutes a nuclear test and that "…it is left to the individual State Party to decide for itself whether a test that produced more than a zero yield would violate the Treaty."[33]

Russian public statements on what tests or nuclear experiments are allowable under the CTBT are often confusing or conflicting. For example, Russian Ambassador Grigory Berdennikov said in May 1996 at the Conference on Disarmament, "The Russian delegation has always argued that this treaty [the CTBT] should contain no threshold restrictions whatsoever." CTBT advocates contend that the ambassador meant that the treaty bans tests of any yield. Treaty opponents contend that this wording should be interpreted only as "the treaty shouldn't contain a definition of what is meant by *test*." An analysis by the CIA notes that the term "zero yield" never appears "in the CTBT text or in any other document approved by the Russian side."[34]

The CTBT does not define what constitutes a nuclear test. Since signing the CTBT, Russia apparently has conducted tests that produce nuclear yield; the United States has not. President Yeltsin, according to the Russian press, issued a decree in April 1999 which approved hydronuclear testing.[35] Subsequently, Russian officials have admitted that Russia conducts so-called hydronuclear tests. While this term does not have an internationally agreed definition, it is generally defined by U.S. weapons scientists to be tests which produce yields of hundreds of pounds or less.[36] In November 2003, during an event at Lawrence Livermore National Laboratory Georgly Rykovanov, the Director of the Russian nuclear weapons laboratory at Chelyabinsk, explained to his hosts that hydronuclear experiments were being conducted in Russia, but at a yield sufficiently low to make them undetectable.[37] It is noteworthy that the Soviet Union conducted almost 90 hydronuclear tests, both above and below ground, but did not consider them nuclear tests. According to a Russian accounting of nuclear tests, "Experiments with nuclear energy release less than one metric ton of chemical explosive are not included in the list of nuclear tests."[38]

Hydronuclear tests involve a combination of high explosive, usually in a nuclear weapon configuration, and fissile material whose quantity is reduced far below the amount required for a nuclear weapon. Interestingly, hydronuclear experiments were historically referred to by U.S. scientists as "zero-yield tests," even though the fission energy release, although small, was not necessarily zero.[39]

At present, it is unclear to what level of yield the Russians test. They probably could test at up to one kiloton (kt) without detection, and higher with an increasing, although still low, probability of detection. (See following section.) Neither the United States nor the International Monitoring System (IMS) has technologies capable of detecting low-yield nuclear tests in Russia and China, particularly when efforts are made to conceal those tests.

Conclusions

- **Because the CTBT does not define "nuclear test," states can decide for themselves what level of nuclear yield is allowable.**
- **The United States abides by its self-imposed strict definition of "zero yield," while apparently Russia—and perhaps China—continue testing at some level of nuclear yield.**

The CTBT Is Not Verifiable

> "As long as the treaty is not verifiable, and thus not enforceable, ratification would not be prudent."[40]
>
> —Robert Gates, Secretary of Defense, December 9, 2008

The CTBT establishes an IMS to collect hydroacoustic, infrasound, radionuclide, and seismic data to detect open or clandestine nuclear testing. Treaty supporters argue that the IMS makes it hard for an evader to conduct undetected tests and that the treaty is "effectively verifiable."[41] Indeed, the IMS has progressed significantly over the past decade; yet, it still cannot detect militarily significant tests of hundreds of kilograms or tens of tons—perhaps several kilotons—of nuclear yield. This is a significant technical deficiency of the CTBT. Specifically, the IMS is highly unlikely to be effective in two important types of cheating scenarios.

The first type of evasive nuclear testing would be to decouple the blast—that is, conduct the nuclear test in an underground cavity to reduce the seismic signal. The effects of decoupling are well-documented. For example, the United States conducted a nuclear test in the Tatum salt dome located at Chilton, Mississippi as part of a program to evaluate the peaceful uses of nuclear explosions. *Sterling*, the test conducted on December 3, 1966, had a yield of 380 tons. The apparent seismic yield was only 5.3 tons, a reduction by a factor of 71.7. Thus, decoupling can cause a blast of one kiloton to look to seismic detectors to be as low as a 14-ton explosion (1/70th as small). Theoretical simulations indicate that even greater reductions in decoupling—possibly up to a factor of 100—may be possible in some cases.[42]

For nuclear tests of one kt or less, a CTBT evader can decrease the seismic signal below detectability by detonating it in a deep, moderate-size, elongated cavity mined in high-strength, low porosity rock or in salt. With careful attention to the selection of geologic environment and to assurance of adequate depth and stemming of the tunnel complex, the evader could have high confidence that there would be no detection by radionuclide monitoring technologies.[43] For example, despite the IMS being alerted to North Korea's impending nuclear test in May 2009—and with no attempt by North Korea to hide the test—no radionuclides were detected by the IMS following the test.[44]

There is some disagreement about how many kilotons can be decoupled with little or no risk of detection. One expert on the subject, William Leith of the U.S. Geological Survey, has concluded that clandestine nuclear tests of a few kilotons, up to a limit of approximately 10 kt, also can be decoupled in salt domes with very low risk of detection. In hard rock, tests up to 10 kt are harder to conceal primarily because the cavity is more difficult to construct. Yet, it is technically feasible if elongated cavities with aspect ratios (e.g., 20:1) are used,[45] or if the lower seismic signal is masked with accompanying chemical explosions.[46]

Although much more technically challenging, it is feasible to decouple nuclear explosions of greater than 10 kt.[47] Doing so is easier in thick salt deposits or domes than in hard rock. Extensive, suitable salt deposits are present in several countries of concern, including Iran, Syria, China, and Russia. Additionally, these countries have significant natural seismic activity which could mask testing activity. The large number of seismic signals from mining blasts, rock bursts, and earthquakes make detection and identification of nuclear explosions more difficult.

The capability of IMS seismic stations to detect decoupled tests is further reduced when the stations are located at some distance from a given nuclear test site. China and Russia did not permit IMS stations to be located at Lop Nor and Novaya Zemlya, Chinese and Russian test sites respectively. The closest IMS station to Lop Nor is 783 kilometers away and the closest to Novaya Zemlya is 1,112 kilometers away. The remote locations of the IMS stations in China and Russia have reduced the IMS ability to detect smaller testing events, to identify the nature of the event, to determine the site of the event more precisely, and to establish the time of the event more exactly.[48] In 2008, a U.S. State Department official wrote the following in a response to the Congressional Research Service:

> There is no doubt that we would be better off if we had close-in seismographs around Lop Nor and Novaya Zemlya. If IMS were allowed to install three seismographs surrounding Lop Nor at the distances similar to those surrounding NTS [the Nevada Test Site], it would be much easier not only to detect smaller events, but also to identify the nature of smaller events and to determine a better location as well as the origin time.[49]

When members of the Strategic Posture Commission testified to Congress and stated that they could not reach consensus on ratification of the CTBT, former Secretary of Defense James Schlesinger addressed his skepticism over the technical adequacy of the IMS:

> On the testing issue, I think it's quite correct that the International Monitoring System has improved greatly since the days that the Senate had their vote. Nevertheless, I think it would still be desirable to have some on-site monitoring systems. … to get further confidence in that area.[50]

Some CTBT proponents have argued that construction of a cavity for a decoupled test is not only difficult, but an observable activity. This is erroneous. Creating a cavity of adequate size and depth is not a significant technical hurdle and numerous technical descriptions on decoupling and containment are publicly available. Many nations have significant mining experience and capabilities. Also, as the CIA has stated, "There is ample evidence that the engineering technology required to excavate underground cavities in hard rock that are large enough to decouple [nuclear] tests of several kilotons yield is commercially available worldwide."[51]

Also, there need not be observable indicators of mining activity, such as removal of spoil. A smart, evasive cheater can simply mask such activities. For example, India removed massive amounts of spoil for its 1998 nuclear test without detection—despite regular pre-test observation of the site by U.S. intelligence assets.

Treaty proponents have also argued that radioactive venting would enable detection of decoupled tests. As General John Shalikashvili wrote in 2001, "...cavity-decoupled explosions can reduce seismic signals but increase the probability of radioactive venting."[52] However, venting can be contained. The CIA has stated that there is:

> ...ample evidence that US technical publications on radioactive debris containment, as well as the openly published methods used by US experts to test cavities for containment before a test is conducted, have been closely studied by foreign experts. Therefore, we estimate that an evader could successfully contain a decoupled test in hard rock, using a cautious experimental approach, and thereby avoid detection by sensors external to its country. As documented by the US Geologic Survey, using data from past nuclear tests conducted by several countries in hard rock geologies, prompt venting of gases does not occur when cautious containment measures are used. It is possible that localized seepage of small quantities of gases may occur, but it would only be detected and identified by locally placed sensors.[53]

A variation of the decoupling scenario that can be used for very low-yield nuclear tests of, say, one kiloton or less, is to use one or more containment vessels. Containment vessels have been used for decades by nuclear weapon development laboratories, including in the United States and other countries. These vessels have been used for a variety of purposes. For example, in the United States above-ground hydrodynamic experiments are conducted routinely to examine the implosion process of a warhead primary. For these experiments, the fissile material (weapons grade plutonium or uranium) is removed and a substitute material is used for the experiment. In some situations, the laboratories have placed a mock warhead primary in a large, steel reinforced vessel to keep various materials from being scattered over the local environment when the warhead high explosive is initiated.

In addition, multiple, nested containment vessels have been used by the United States to contain both the warhead materials and radioactive gases—by-products of a nuclear explosion—for special purpose, very low-yield nuclear tests. In 1989, the Office of Technology Assessment produced a report on nuclear testing and containment. The report described in detail several nuclear tests conducted in horizontal tunnels at the Nevada Test Site. The report included the following description:

> …three redundant containment "vessels" that nest inside each other and are separated by plugs …Each vessel is designed to independently contain the nuclear explosion, even if the other vessels fail. If, for example, gas leaks from vessel I into vessel II, vessel II has a volume large enough so that the resulting gas temperatures and pressures would be well within the limits that the plugs are designed to withstand.[54]

When pressed, CTBT proponents concede that the treaty has serious technical deficiencies. A 2002 National Academy of Sciences report briefly addressed the issue of containment vessels and speculated on the potential value of such vessels for low-yield testing:

> At the lower end of the very-low-yield category, Russia could develop and test new very-low-yield tactical weapons in the range of 10 to 100 tons. With respect to seismic detection, the 10-ton weapon could confidently be adequately tested

> under decoupling conditions even at Novaya Zemlya, and might even be tested in a steel or composite containment so that it would give no ground shock at all. Indeed, with its experience in testing and weapons design, Russia could develop a 10-ton nuclear weapon using only hydronuclear tests in the kilogram-yield range, and be reasonably confident of its performance. Russia might even aim for a 10-ton weapon as a modification of an existing weapon…[55]

Russian nuclear design laboratories are known to have conducted weapon-related experiments using large containment vessels. Senior officials from one of the Russian nuclear design laboratories (VNIIEF) published a technical paper describing explosive-resistant containment vessels in detail. The paper described a need by the design laboratory in the late 1970s and early 1980s to develop explosive–resistant chambers “capable of hermetically holding inside its volume an explosive release of energy equivalent to” 150 to 200 kilograms of TNT. According to the paper, the key was fiberglass-like material that allowed the vessel to expand and absorb energy without fracturing. Development of these vessels—called Kolba in Russian—was completed by 1983. At a technical symposium at Sandia National Laboratories in 1993, Russian scientists proposed using the Kolba concept for creating explosion-resistant containers capable of fully containing up to 10-25 kt of TNT.[56] When the United States assisted in the closure of the Soviet-era nuclear test site in Semipalatinsk, Kazakhstan, Kolba explosive containment vessels were found in some of the tunnels.[57]

Whether or not this practice of conducting explosions in containers continues, and for what purposes, remains speculative. A 1999 report by the CIA addressed whether Russia was conducting nuclear tests at Novaya Zemlya (NZ) to develop new nuclear warheads. The heavily redacted release of a previously classified report quoted public statements by Russian officials that “one of several probable objectives of this testing effort is the development of low-yield warheads.” Specifically, then-First Deputy Minister of Atomic Energy Ryabev was quoted as stating that tests at NZ the previous year were “conducted in special containers cemented into the rock.”[58]

A second type of cheating scenario is simply to test without attribution. For example, a cheater could conduct a test of any desired yield under or on the ocean surface by using a submarine or surface vessel to place the nuclear device. It can then be detonated hours or days later, escaping not detection, but attribution. The IMS would detect, identify, and probably measure the yield for the testing nation (which, if a treaty party, would have access to all IMS data). Even if it could pinpoint a very precise location of the test after the fact, there probably would be no debris left at the detonation site.

An example of this second type of cheating may have taken place in 1979 in the south Indian Ocean. A U.S. Vela satellite detected a double flash of light characteristic of a nuclear explosion. Although scientists at the U.S. nuclear weapons laboratories and analysts at the Defense Intelligence Agency were convinced that the signal was an unattributed nuclear test, a Presidential Panel subsequently concluded this event was probably due to a small meteoroid striking the satellite and reflecting sunlight into the Vela’s sensors. However, many scientists and intelligence experts find more plausible the explanation offered in a recent book by former Secretary of the Air Force Thomas Reed and former Director of Intelligence at Los Alamos, Danny Stillman. These authors claim that this event was a nuclear test and a joint undertaking between Israel and South Africa.[59]

Alternatively, an unattributable test could be conducted in space. Space launches by an increasing number of nations will have "failures" and, among those classified as failures, a lost payload could detonate weeks or months later. Attribution would be difficult, if not impossible, no matter how strong the suspicions.

In his 2001 report on the CTBT, General (ret.) Shalikashvili, in the section on verification, speculated that "…in this interconnected world, states that violate their legal obligations risk having their citizens reveal what remote monitoring might not uncover."[60] The Russian press actually did this in 2000, but without the predicted notice or alarm by national security officials. A book written by Russian nuclear weapons designers, including V.A. Logachev, revealed that, "Since 1994, numerous additional hydrodynamic and hydronuclear experiments have been successfully carried out at NZTS [Novaya Zemlya Test Site]." The significance of this admission was largely overlooked until discovered by a team of technical researchers.[61]

Conclusions

- **The CTBT verification and monitoring system, and supplemental U.S. national technical means, cannot detect decoupled nuclear explosions of one-to-two kilotons, and perhaps of several kilotons.**

- **Cheaters may simply choose to test openly, but without attribution.**

CTBT On-Site Inspection Provisions Are Likely Unworkable

> "Already the U.S. and Russia are operating from very different premises as to what constitutes allowed experiments versus disallowed ones. Think about that for a minute. How could one ever write a *demarche* charging that some nation has violated the CTBT? ...How can you possibly convince [other] nations (two-thirds of the 51 members of the CTBT Executive Council) that some nation has violated the treaty, if you haven't defined what is a violation, or even defined any of the constitutive terms used?"[62]
>
> —C. Paul Robinson, September 2009
> Former Director, Sandia National Laboratories

The CTBT provides procedures for determining whether mandatory on-site inspections (OSIs) are warranted in the event of a suspected nuclear test. Treaty proponents argue that this verification tool can be a powerful deterrent and could provide definitive evidence of a violation. However, timely OSI under the CTBT's provisions would be very difficult, if not impossible, in practice and would be unlikely to produce definitive evidence even if cheating had taken place.

One policy-related problem is that the decision to conduct an OSI would have to be made by an Executive Council that is, in essence, a mini-United Nations. Thirty of the 51 Council members must vote affirmatively for an OSI request before it can proceed. Seats on the Executive Council are allocated on the basis of regional groupings and there is no guaranteed seat for the United States. (The United States obtained a “side agreement” among the Western group that it would always be allowed a seat on the Executive Council, but this is not a formal part of the treaty and thus could be ignored.) Even if the United States has a seat on the Council, it would be only one of 51 members. If the United States were to seek an OSI in Russia or China, and those countries opposed inspection, they could probably muster sufficient nay votes in the Council to block the OSI. CTBT OSI provisions hardly provide confidence that a timely OSI would be available.

A second problem is that determining the precise location to be inspected is extremely difficult. If gases have vented, finding their point of origin may not be possible. Even if a radioactive detection station should pick up a radioactive cloud moving over the station, the current state of the art for atmospheric transport calculations is not adequate to locate the origin of the cloud. Seismic stations may not be very helpful. The often-cited “fact” that seismic monitors can detect one kiloton explosions is based on the criteria that the explosion is carried out in hard rock, at an optimum depth of burial, and is fully coupled. If these criteria are not present, the range of detectability falls significantly. Any seepage of gases can be critical in further pinpointing the exact test site coordinates; however, even this can be insufficient. As the CIA noted:

> From U.S. experience at the Nevada Test Site, seeping gas—if the gas does seep—is most likely to appear within a distance of about a few kilometers of the shot point. Unless some form of NTM provides a good estimate of the precise location, the initial search area for the OSI will, at a minimum, cover several hundred square kilometers.[63]

A third problem is the difficulty of reaching the suspect area in a timely manner. A number of events must transpire before an OSI can occur, including: the Executive Council must be convened to meet; evidence must be presented to the Council, the Council must deliberate and decide for inspection; and, the inspection team must be assembled and transported. Realistically, if successful, this process is likely to require 11 to 12 days, perhaps more. Meanwhile, evidence would be eroding. Approximately two weeks after a nuclear test, the observables which would help in precisely locating the event (small aftershocks around the explosion cavity and the persistence of any escaping radioactive gases) would have significantly dissipated, making the tasks of locating and positively identifying the event increasingly difficult with each passing day.[64]

A fourth problem concerns the OSI managed-access provision which allows an inspected State Party to restrict access to sites of up to four square kilometers each and totaling up to 50 square kilometers. This provision was designed to help protect against abuse, but it also dims the prospects for a conclusive inspection in cases where the precise location of the suspected test is unknown.

A fifth problem with OSI is common to most, if not all, arms control agreements: the reluctance of states to request an inspection lest nothing is found. If an inspection occurs, but reveals no evidence of violation, then the inspected nation is perceived as having a clean bill of health. In the case of the CTBT, this effect would be particularly strong, given the low likelihood of telltale venting or other observables that would enable inspectors to locate the test site precisely.

Finally, the suspect state may simply refuse to be inspected or further delay it. In the end, a state suspected of testing will retain control over whether or not an inspection is actually conducted. Even if everything works perfectly—a CTBT party initiates a request for an OSI, international politics are put aside in the Executive Council, the correct area of the violation is identified, and transportation and other logistics work in a timely fashion—the state can refuse to allow an inspection to proceed in a timely fashion or at all. The OSI regime may function only to make a guilty party refuse or delay a request for an OSI.

Conclusions

On-site inspections under the CTBT would be highly problematic for five key reasons:

- **The decision to undertake such an inspection must be made by an Executive Council that is akin to a "mini-UN";**
- **Precisely locating the suspect site would be extremely difficult;**
- **The probability of the inspection team reaching the site in a timely manner is low;**
- **Managed-access provisions may severely restrict the inspectors' abilities to reach the precise test site; and,**
- **States can refuse to be inspected.**

Entry-Into-Force Is Unlikely Even With U.S. Ratification

The CTBT shall enter into force 180 days after 44 specific states have deposited instruments of ratification. The 44 states are those with nuclear reactors that participated in the work of the Conference on Disarmament's 1996 session and were Conference members as of June 18, 1996. Of the 44, India, North Korea, and Pakistan have not signed the treaty; China, Egypt, Indonesia, Iran, Israel, and the United States have not ratified it.

Treaty supporters argue that once the United States has ratified the CTBT, diplomacy can convince the remaining eight to ratify. This again is solely an expression of hope. For some states, it is highly unlikely. The past decade of unsuccessful diplomatic interactions with Iran and North Korea to persuade them to forgo nuclear weapons indicates that they are not particularly amenable to such diplomacy and that North Korea would likely use the occasion to extort favors from the international community.

Even if the United States were to ratify the treaty, it would not enter into force until the remainder of the 44 have signed and ratified it. Thus, if the United States ratified the CTBT, the U.S. "...would be bound by restrictions that other key countries could ignore."[65]

Conclusion

Even if the United States ratifies the CTBT, others would not be bound by its restrictions because some of the 44 states required for its entry-into-force are unlikely to ratify the treaty.

Arms Control History Demonstrates Need for Caution

What can history tell us about the risks of ratifying the CTBT? First, perhaps the greatest lesson is that if breaking arms control commitments can confer military or political advantage, some states will do so. Second, if verification and enforcement provisions are questionable, some states will cheat. These points are demonstrated by the history of the 1958-1961 nuclear test moratorium, the Chemical Weapons Convention, the Biological and Toxin Weapons Convention and the United Nations Special Commission in Iraq.[66]

The Testing Moratorium, 1958-1961

In May 1955, the Subcommittee of Five of the U.N. Disarmament Commission (the United States, United Kingdom, Canada, France, and the Soviet Union) began negotiations on a nuclear test ban. The verification problems were intractable; the USSR opposed any verification mechanisms that would allow on-site observation of their test sites. Soviet Premier Bulganin wrote to President Eisenhower in October 1956 that there should be a test ban without provision for verification. Eisenhower rejected this approach.

As negotiations remained at an impasse, the USSR, in March 1958, announced that it was discontinuing all tests and appealed for other nuclear powers to do so as well. The United States remained adamant that verification was a prerequisite, but proposed a year-to-year test suspension. The USSR responded by resuming testing, which continued until November 1958. That month, the United States and USSR each began a self-imposed suspension of nuclear testing. The moratorium held until August 1961, when Moscow broke out and conducted 31 nuclear tests within three months. President Kennedy urged Moscow to return to the moratorium; when diplomatic efforts failed, U.S. nuclear testing resumed in April 1962.

During nearly three years of the test moratorium, the United States dismantled most of the infrastructure required for its nuclear test program. According to the official account of the moratorium and its aftermath,

> …when President Kennedy found it essential to United States interests to resume testing in response to the Soviet testing, the experience for America's testing community was technically agonizing, operationally painful, and economically very costly. The atmospheric component of test resumption had especially high political obstacles and costs.[67]

During the test moratorium, the U.S. technical community responsible for the reliability of the nuclear stockpile believed that the arsenal remained healthy since there was no compelling evidence of impending problems. That changed quickly once testing was resumed. Then-Director of Development, Research and Engineering, Dr. John Foster, testified,

> The first surprise in the moratorium came when the Russians resumed testing with a major effort of wide scope. That was the first and only surprise in the moratorium. When we resumed testing, surprises came with almost every test.[68]

After testing was resumed, serious problems were identified in four nuclear warhead designs. During the three-year test moratorium, the nuclear weapon design laboratories lost numerous experienced design personnel and would have lost more had the moratorium continued. The laboratories reported difficulty in hiring qualified people to fill the openings and replace the lost design talent.

Today's moratorium has been in place for over 18 years. The problems associated with a lack of experienced designers are now far worse than during the 1958-1961 moratorium. As the Director of Lawrence Livermore National Laboratory (LLNL) recently stated, "Currently there are 18 individuals employed at LLNL with underground testing history relevant to today's stockpile. All but one is eligible for retirement. Additionally the average age of our current weapons design workforce is approximately 52."[69]

The Chemical Weapons Convention (CWC)

Like the CTBT, the CWC was touted as a key step toward disarmament of all weapons of mass destruction. The CWC, which entered into force in 1997, requires each State Party not to develop, produce or otherwise acquire chemical weapons (CW); not to use them; not to transfer them; and, to destroy all existing stockpiles.

Despite the fact that they signed and ratified the CWC, there are a number of nations suspected of non-compliance. In 2005, the U.S. Department of State issued a report stating that there were continuing concerns regarding China, Iran, Russia, and Sudan.[70] North Korea and Syria were also mentioned, but they are not party to the CWC—a point which demonstrates that non-universality presents its own risks. The concerns about the non-compliance of these states were reaffirmed by U.S. Ambassador Donald Mahley in 2008.[71]

The CWC provides for challenge inspections, but neither the United States nor any other country has sought to use this option to resolve the non-compliance problems. The reason is simple: CW can be rapidly moved from one storage place to another in the event of a challenge inspection. Moreover, if a challenge inspection was to be undertaken and nothing was found, the State Party in question would be exonerated by the international community.

The CWC offers a clear example of how an arms control treaty can be adhered to by the United States, while other States Party may continue to cheat.

The Biological and Toxin Weapons Convention (BTWC)

The BTWC also was envisioned as a key step toward disarmament of all weapons of mass destruction. This treaty, which entered into force in 1975, requires all States Party to refrain from developing, producing, or stockpiling biological and toxin weapons.

Although several states have suspected BW programs, the United States has publicly identified two states with biological weapons in violation of the BTWC—Iran and North Korea—as well as one non-party, Syria.[72] Due to political considerations, the United States has not singled out Russia, despite definitive violations of the treaty in the past and possible continuing non-compliance.[73]

UN WMD Inspections in Iraq, 1991-1998

In the aftermath of the 1991 war to expel Iraq from Kuwait, the United Nations chartered the United Nations Special Commission (UNSCOM) and gave it sweeping authority to verify Iraqi WMD disarmament and to ensure Iraq did not later rebuild its WMD. Lessons from this experience demonstrate the potential pitfalls of verification-related inspections that are subject to the diverse interests of multiple states.

Charles Duefler, deputy executive chairman of the UN Special Commission on Iraq from 1993 to 2000, cited the inability of the UN Security Council to work in a unified manner to verify and enforce the stated goals of WMD disarmament by Iraq. For France and Russia, lucrative oil contracts trumped intrusive inspections. As a result, they often successfully obstructed UNSCOM inspections. Duefler said this disunity "was the ultimate wrench in the weapons inspections' works."

> …Baghdad was able to manipulate the system. …[through] economic incentives Iraq was offering to those who aided its case for ending sanctions. Russia and France were being given preferential treatment in the allocation of lucrative Iraqi oil contracts under the UN oil-for-food program.[74]

As individual members of the UN Security Council expressed different degrees of enthusiasm and hesitancy for the inspection regime, the chairman of UNSCOM had to constantly adjust the intrusive inspection activities. Duefler lamented, "Imagine working for a boss with multiple personality disorder—and one with worsening symptoms. Once there was discord among the inspections' enforcers, …united action became impossible."[75]

In this historical example, Duefler reports, "Iraq was thus able to willfully (and largely without consequences) hinder inspections for years while skillfully promoting the decay of sanctions." Duefler cautions, "States can find any number of ways to circumvent inspectors. Inspectors will merely be pawns used in a political chess match where each player has a different (and often divergent) goal."[76]

Conclusions

- **The 1958-1961 test moratorium provides important lessons: without testing, we can develop a false sense of security in the reliability of nuclear warheads when, in fact, serious problems exist; and, lack of testing leads to deterioration of personnel skills and infrastructure.**

- **The United States suspects that there are several countries that are not in compliance with the CWC and the BTWC. If states are willing to cheat on these arms control treaties for military advantage, there is significant risk that some would be willing to cheat on the CTBT if they perceived it to be in their interests—particularly given the inadequacy of CTBT verification provisions.**

- **When large organizations, composed of representatives from individual states, are entrusted with responsibility to determine compliance with international agreements, states' interests often conflict with impartial investigation and enforcement of compliance.**

Section 3: Russian and Chinese Nuclear Weapon Modernization and Doctrines

> "China and Russia have embarked on an ambitious path to design and field new [nuclear] weapons."[77]
>
> —Robert Gates, Secretary of Defense, October 28, 2008

In the decade since the U.S. Senate voted not to ratify the CTBT, there have been significant upgrades in the nuclear arsenals of both Russia and China along with significant changes in their nuclear doctrines. Because ratification of the CTBT surely would inhibit future nuclear weapons modernization by the United States, it is important to consider these upgrades and changes, their impact over the long term on the security environment, and potential implications for deterrence and U.S. nuclear forces.

Russia

Following the end of the Cold War, Russia was no longer capable of sustaining large numbers of conventional forces. At the same time, it observed advances in U.S. conventional capabilities that would allow, in some cases, reduced U.S. reliance on nuclear weapons in favor of conventional weaponry. Additionally, Russia has become concerned about potential conflicts along its extensive border, a looming struggle over energy resources, and NATO enlargement. Moscow's response was to revise Russian nuclear doctrine and to expand the circumstances in which Russian leaders would consider use of nuclear weapons.

In 1993, Russia made its first post-Soviet change to its nuclear doctrine. The new doctrine departed from the decades-old pledge never to be the first to use nuclear weapons and adopted a broadened concept of nuclear deterrence to cover large-scale non-nuclear threats to Russia.[78] In 1996, the Russian Defense Council again reviewed its military doctrine and issued a revision that was more explicit about the circumstances under which Russia might initiate use of nuclear weapons. In 2000, Russian President Putin approved a new National Security Concept which further expanded the range of situations in which Moscow might use nuclear weapons. It read:

> The main task of the Russian Federation is to deter aggressions of *any* scale against it and its allies, including with the use of nuclear weapons. The Russian Federation must have nuclear forces capable of delivering specified damage to *any* aggressor state or a coalition of states in *any* situation.
>
> The Russian Federation reserves the right to use nuclear weapons in response to the use of nuclear or other weapons of mass destruction against it and (or) its allies, as well as in response to large-scale aggression utilizing conventional

> weapons in situations critical to the national security of the Russian Federation.[79] (Emphasis added.)

The revised nuclear doctrine includes limited use of nuclear weapons, including preventative use. As then-head of Russian General Staff, Gen. Yuriy Baluyevskiy said in January 2008, "For the defense of the sovereignty and territorial integrity of the Russian Federation and its allies, armed force, including nuclear weapons, will be used, including preventatively, in cases envisaged by the doctrinal documents of the Russian Federation."[80] Indeed in 2009, the debate within Russia over preemptive nuclear strike was reported closely by the Russian news media. Revising nuclear doctrine to include preemptive nuclear use comes at a time when the Russian military has begun a program of down-sizing and military reform. This military reform included President Medvedev's approval in November 2009 of legislation expanding the missions for Russian Armed Forces outside of Russia.[81]

Russia's new doctrine has become manifest in its behavior. Russia has used explicit nuclear threats to attempt to coerce some of its neighbors, including U.S. allies,[82] and it has conducted several military exercises against NATO-like opponents that include the simulated use of Russian nuclear weapons for purposes of deescalation and termination of conflict. Over the past decade, nuclear threats against the West by senior officials have become commonplace. President Medvedev has called this pattern "not muscle-flexing, but an expression of honor …"[83]

In support of the new doctrine, Russia's emphasis on tactical nuclear weapons—also referred to as non-strategic nuclear forces (NSNF)—has greatly increased. Whereas the United States reportedly has fewer than 500 operational NSNF warheads, Russia has about 3,800 and a large number in reserve. And, Russia has been modernizing its NSNF warheads to include very low-yield nuclear weapons (from tens of tons to 100 tons of TNT equivalent). The CIA reported that in the early 1990s, Russian officials stated they had designed a nuclear device with "enhanced output of high-energy X-rays with a total yield of only 300 tons."[84] The Moscow press claimed that a presidential edict from then-President Yeltsin called for "development of a new generation of nuclear weapons."[85] Russia now deploys some of these NSNF in violation of its 1991/1992 commitments under the Presidential Nuclear Initiatives to limit these weapons.[86]

Russia's nuclear test site at Novaya Zemlya declined during the 1990s, in part due to lack of funding. However, in 2000, Vladimir Putin personally chaired a meeting at which the decision was made to modernize the test site so that it would again be capable of conducting full-scale nuclear tests. This was followed by a decision in 2002 to upgrade the site to conduct experiments related to Russia's stockpile stewardship. In July 2006, Defense Minister Sergei Ivanov and Rosatom head Sergei Kirienko inspected the improvements made at Novaya Zemlya and concluded that the proposed upgrades had been completed successfully and that the site was now "ready to conduct full-scale nuclear tests."[87]

Russia's nuclear weapons modernization picked up in pace and extent following the issuance of its 2000 nuclear doctrine. Modernization programs include new warheads and delivery systems, upgraded and functional nuclear weapons design and production infrastructure, and nuclear weapons testing facilities. Advanced nuclear weapons capabilities reportedly include a low-yield nuclear warhead (about 50-ton yield) and precision accuracy on Sineva submarine-launched ballistic missiles,[88] multiple independently targetable reentry vehicles on its Topol-M mobile intercontinental ballistic missiles (ICBMs),[89] nuclear warheads for new shorter range weapons such as the Iskander,[90] and development of a new heavy ICBM to replace the SS-18,[91] as well as a precision, low-yield nuclear earth penetrator referred to as a "nuclear scalpel."[92]

In October 2008, Secretary of Defense Gates noted that Russia has "increased reliance on its nuclear force" and pointed out that Russia currently "has a fully-functional infrastructure that can manufacture a significant number of warheads each year."[93] As the Congressional Commission's report on America's strategic posture summarized:

> Russia is at work on a new intercontinental ballistic missile (initially deployed with a new single warhead but capable of carrying multiple warheads), a new ballistic missile submarine and the associated new missile and warhead, a new short-range ballistic missile, and low-yield tactical nuclear weapons including an earth penetrator. It is also engaged in continued research and development on a hypersonic intercontinental glide missile.[94]

Additionally, as the Congressional EMP Commission reported in 2004, Russia may have developed weapons that employ electromagnetic pulse (to destroy electronics) as the primary or sole means of attack.[95]

In 2003, Viktor Mikhaylov, the former Russian Minister of Atomic Energy, stated during an interview that Russia "can take several more steps forward [in nuclear weapon design] without even testing any nuclear devices." Mikhaylov, who had previously argued that very-low-yield hydronuclear explosions were needed and not prohibited by the CTBT, commented further, "sooner or later we will have to do a test, but I am not convinced that it will definitely have to be a powerful nuclear explosion."[96]

Russia has been able to advance and modernize its nuclear weapons and nuclear-weapons-testing infrastructure despite a declared moratorium on nuclear testing beginning in 1990 and its ratification of the CTBT in 2000.

China

Less is known about China's official nuclear doctrine due to its intentional lack of transparency.[97] China's December 2006 Defense White Paper discusses the fact that the Navy, Air Force and Second Artillery Force are modernizing forces to have both nuclear and conventional counterattack capabilities. This indicates that all three services have a nuclear mission. Because so little is known about China's nuclear employment doctrine, there are often contradictory assumptions and conclusions by Western analysts. For example, although China is often cited as having a "no first use" doctrine, some experts have reported that the formulation is cleverly worded in a way that is non-restrictive,[98] and which allows use of nuclear weapons in conventional conflicts. The December 2006 Defense White Paper, as well as the Defense White Paper of 2008,[99] linked nuclear weapons to the concept of "active defense in local wars."[100]

China's nuclear weapons modernization continues apace, with new warheads and delivery systems. China is developing multiple independently targeted re-entry vehicles (MIRVs) and maneuvering re-entry vehicles for its ballistic missiles. It may also be developing air- and ground-launched nuclear-armed cruise missiles.[101] Various reports from the *National Intelligence Daily* stated that Chinese nuclear testing in the 1990s related to a nuclear artillery shell design, designs for new SLBM and ICBM warheads, as well as nuclear weapons that may use more advanced concepts such as aspherical primaries.[102] A 1997 report by the Congressional Research Service reported that the Chinese nuclear testing series from 1992 to 1996 was probably "to develop small, lightweight warheads for its new nuclear forces."[103] In 1999, China claimed that it had successfully developed an enhanced radiation weapon.[104]

As the Commission on America's Strategic Posture summed up:

> China is diversifying its nuclear missile force by fielding a new set of road-mobile missiles and a small force of strategic missile submarines. Its ICBM force could more than double in the next 15 years. Its lack of transparency about its capabilities and intentions is a source of significant concern, for the United States and for its allies and friends in Asia.[105]

In addition to strategic and non-strategic nuclear weapons, China is developing military capabilities for asymmetrical warfare against the United States. It is hardening its own communications infrastructure, while developing weapons to gain dominance in the electromagnetic spectrum. There have been reports that China is developing electromagnetic pulse weapons.[106] And, as the DOD 2009 *Report on Military Power of the People's Republic of China* noted:

> The January 2007 test of a direct ascent anti-satellite (ASAT) weapon demonstrates that the PLA's interest in counterspace systems is more than theoretical. In addition to the "kinetic kill" capability demonstrated by the ASAT test, the PLA is developing the ability to jam, blind, or otherwise disable satellites and their terrestrial support infrastructure.[107]

In October 2009, the commander of the U.S. Pacific Command called the Chinese arms build-up "unprecedented" and announced "in the past decade or so China has exceeded most of our intelligence estimates of their military capability and capacity every year."[108]

In the early 1990s, before announcing a moratorium on nuclear testing in July, 1996, China conducted several nuclear tests. Moreover, there have been reports that China continued low-yield nuclear testing after 1996. A Congressionally mandated study on China concluded that "nuclear tests related to development of the PRC's next generation of thermonuclear warheads may be continuing at the PRC test site at Lop Nor."[109] China, like Russia, may have defined the CTBT restrictions so as to allow such tests. Additionally, it is possible that higher-yield testing may be conducted using decoupling or other masking means.

Conclusions

- **Both Russia and China have made significant upgrades in their nuclear weapons capabilities in the past decade, to include modernized warheads, new delivery systems, and nuclear weaponry with expanded military missions. These upgrades have progressed simultaneously with Russia's and China's claimed adherence to a nuclear test ban.**

- **Russia has changed its nuclear doctrine in the past decade to expand the types of circumstances in which it would consider using nuclear weapons. China's nuclear doctrine is less clear on circumstances in which Chinese leaders might consider using nuclear weapons, but it may also be prepared to use nuclear weapons preventatively and in conventional conflicts.**

- **China and Russia maintain a fully functional nuclear weapons infrastructure and test readiness posture; the United States does not.**

Section 4:
Risks Associated With U.S. Ratification of the CTBT

> "To be blunt, there is absolutely no way we can maintain a credible deterrent and reduce the number of weapons in our stockpile without either resorting to testing our stockpile or pursuing a modernization program. In short, in the absence of a program to produce modern, safe, secure, and reliable nuclear weapons, we may well be faced in the future with the need to resume nuclear testing."

—Robert Gates, Secretary of Defense, December 9, 2008[110]

In any debate over whether to forgo U.S. nuclear testing permanently, it is prudent to examine carefully the risks that might be involved. In the post-Cold War environment, the nature of threats to U.S. and allies' security has changed dramatically and continues to evolve. The U.S. shift from reliance on the nuclear deterrent to greater reliance on advanced conventional capabilities may have changed other countries' perceptions of the value of nuclear weapons—but not in the direction hoped for by CTBT proponents. Indeed Russia appears to have placed greater emphasis on and is modernizing its nuclear arsenal, in large part, to offset U.S. conventional superiority. Similarly, other nations have concluded that the only counter to U.S. conventional superiority is development of weapons of mass destruction. We cannot reliably predict what adversaries may do in the future, just as we cannot know what weaponry they will wield. In this unsettled time, we must evaluate what additional risks we may face if the CTBT were to be ratified.

Others Can Conduct Militarily Significant Nuclear Testing

> "Supporters of the treaty argue that [low-yield tests] cannot be significant and that the treaty would therefore ''lock in'' our [nuclear] advantages vis-à-vis other nuclear powers and aspirants. I do not know how they can be so sure of this in an age of rapidly exploding technology and whether, on the contrary, this may not work to the advantage of nations seeking to close this gap. After all, victory in the Cold War was achieved in part because we kept increasing, and not freezing, our technological edge."[111]

—Henry Kissinger, 1999

One risk that the United States faces if it ratifies the CTBT is that others may continue militarily significant nuclear testing without detection. In the past, CTBT proponents have argued that "...U.S. adversaries could not significantly advance their nuclear weapons capabilities through tests below the threshold of detection..." [112] and that any such tests would be too small to affect the strategic balance.[113] In 2001, retired General John Shalikashvili speculated, "Tests that are small and infrequent enough to avoid detection, however, would not enable Russia or any other advanced nuclear weapon state to develop new weapon systems that would undermine the U.S. nuclear deterrent."[114]

Is it possible that the continued low-yield nuclear testing by others would not be of significant military value? To answer this, we must examine two issues: what advantage can be gained by low-yield testing, and what advances have been made by others over the past decade despite a testing moratorium.

Nuclear testing, even at very low yields, provides invaluable training and experience to technical personnel—those responsible for maintaining a nation's stockpile in safe, reliable condition. Tests can confirm the integration of processes and skills ranging from design to deployment. In the absence of testing, scientists can draw conclusions without the risk of being proven wrong short of nuclear war. In Russia's case, its next generation of nuclear designers will have the advantage of experience. In the United States, they will not. This directly limits the ability of U.S. scientists to capably certify the safety and reliability of the nuclear stockpile.

Low-yield nuclear tests—those with explosive test yields of only one to two kilotons—may be sufficient to ensure that warhead designs, which were originally tested at higher yields, are still capable of performing their intended military missions. Thus, by carrying out previously benchmarked tests, performed at quite low yields, one can ensure that no major changes have occurred in a previously stockpiled weapon, and thereby address critical issues of great military significance about the suitability of the devices to remain in the stockpile.

Low-yield tests can be used not only to certify the reliability and safety of existing nuclear weapons, but also to develop new, more modern weapons. When asked by Senator Jon Kyl, "What yield of testing would be the lowest possible to accomplish new designs as well as safety and reliability?", then-Director of Los Alamos National Laboratory, Siegfried Hecker, responded:

> The nuclear yield required would depend upon warhead requirements. I believe most designs could be adequately tested at yields between one and 10 kilotons.[115]

Testing within this range of low yields, 1-10 kilotons, as noted previously, is likely to be undetectable in plausible circumstances.

There is a tendency to mirror-image—to assume that other nations would have to test their weapons also at a range of 1-10 kilotons. This may not be true. Russia, for example, appears to have based its nuclear warhead designs on a different approach and concept than that used by the United States. If so, such warheads could be tested for safety and reliability at very low yields. Low-yield tests could also be used to develop some types of more modern weapons. This point was confirmed when U.S. nuclear testing personnel monitored the closing of the Soviet nuclear test site in Kazakhstan. They discovered that in the 1970s and 1980s the USSR had conducted 26 tests with reported yields of less than 1 kiloton that had not been detected by U.S. or international monitoring. Don Linger, former Director of U.S. underground testing at the Defense Nuclear Agency (now part of the Defense Threat Reduction Agency), wrote:

> These tests were being conducted to assess the weapon development and military effects assessment of a new type of very low yield nuclear weapon which would be by now in the Russian inventory. To the amazement of the US nuclear test personnel who were on-site and inspected the test tunnels at the Degelen Mountain complex, the testing done for weapon development and then to conduct the military effects diagnostics tests necessary to use these weapons effectively in military situations had been done with tests which were very low in yield and mostly without international detection.[116]

The capability to derive militarily significant data from low-yield nuclear tests is not restricted to established nuclear weapons states such as Russia and China. For less advanced states, tests of very low yield can be sufficient to develop and prove new nuclear weapons designs, depending on the design objective. For example, North Korea conducted a nuclear test on October 9, 2006. Although a Russian official estimated the yield of the North Korean test at 5-15 kilotons, most other countries' technical analyses, including that of the United States, placed the yield at less than a kiloton.[117] Some analysts argued that the low yield of the test indicated a failure or, at best, partial success. Others argued the opposite. For example, the former Director of Los Alamos National Laboratory, Siegfried Hecker, observed that the North Korean device tested in 2006 could be a smaller and more advanced design and that the North Koreans likely learned much from the test.[118]

Over the long term, low-yield nuclear weapons testing can provide even broader advantages for those countries that conduct tests compared to those countries that do not test. The very process of conducting nuclear tests:

- Produces and qualifies highly trained, experienced nuclear weapons designers, engineers, and support personnel;
- Assures the infrastructure to design and test nuclear weapons;
- Enables validation for the tools and calculations—such as computer models used in the U.S. stockpile stewardship program—that can be used in the absence of nuclear tests;
- Enables and promotes development of new, more modern weapons safety features, and qualifies them for use;
- Allows experiments to develop innovative techniques that can disable nuclear weapons; and
- Conveys to the nuclear weapons establishment and military that the national leadership places value on the role of nuclear weapons for deterrence.

Conclusions

- **Nuclear tests of less than a kiloton can be of significant military value to countries with nuclear stockpiles.**
- **Nuclear tests of a kiloton or more can serve not only to assure the safety and reliability of current stockpiles, but also can enable development of new, modernized nuclear weapons. Tests of less than a kiloton may be useful in developing low-yield warheads.**
- **Testing at low yields also has a profound impact on the development and maintenance of capable, experienced nuclear weapons designers, engineers, and supporting personnel and infrastructure.**

Extended Deterrence Could Be Adversely Affected

For more than a half century the United States has assured allies of their security by providing them extended nuclear deterrence guarantees. Assuring allies via extended deterrence has been critical to U.S. alliance strategy, diplomacy, nonproliferation goals, and nuclear force sizing and deployments. Nuclear guarantees are pledges that communicate the readiness of the United States to deter or defend against attacks on allies. These guarantees have been a principal pillar of U.S. nonproliferation policy.

Today some 30 countries are covered by the U.S. nuclear umbrella. These include NATO allies, Japan, South Korea, and Australia. Though most nuclear guarantees originated during the Cold War, they remain important in the current era. The report of the Strategic Posture Commission stated that the assurance of allies remains a top U.S. priority in the current security environment and identified important new challenges to extended deterrence associated with Russia, China, and proliferation:

> …there is a challenge associated with adapting extended U.S. deterrence policies and programs. The requirements of extended deterrence in Europe are evolving, given the changing relationship with Russia, the perception of some allies that they are keenly vulnerable to Russian military coercion, and the perception of others of a rising nuclear threat from the Middle East. The requirements of extended deterrence in Asia are also evolving, as North Korea has crossed the nuclear threshold and China modernizes its strategic forces. In the Middle East, various states depend on the United States as a security guarantor and question whether or how it might stand up to a nuclear-armed regional power. These concerns require a clear and credible response from the United States. Failure to meet their security needs could have significant repercussions.[119]

The Strategic Posture Commission report addressed the challenge of adapting U.S. extended deterrence policies to provide assurance to allies as the threat environment evolves. Regarding U.S. nuclear weapons for assurance, the commission report stated:

> Some U.S. allies believe that extended deterrence requires little more than stability in the central balances of nuclear power among the major powers. But other allies believe that their needs can only be met with very specific U.S. nuclear capabilities. This point was brought home vividly in our work as a Commission.[120]

The Commission identified a linkage between U.S. test readiness and extended deterrence: it reported "evidence that some allies interpret the apparent lack of test readiness as a symptom of reduced U.S. commitment to extended deterrence" and called test readiness "an essential safeguard of the no-test policy." [121] The Commission also noted the chronic unwillingness of the Congress to support the nuclear test readiness program and recommended increased support for test readiness. For fiscal year 2010 and beyond, the dedicated test readiness budget has been eliminated. Currently, programs at the Nevada Test Site support approximately $5 million toward maintaining test readiness capabilities—an amount that is wholly inadequate for a viable test readiness program.

Even allies who support the general concept of a CTBT and steps toward global nuclear disarmament have conditioned that support on maintenance of nuclear deterrence to support their national security. For example, in November 2009 the United States and Japan jointly released a statement outlining their commitment to achieving a world without nuclear weapons. The joint statement qualified support for proposed actions on the condition that they promote "international stability and security while ensuring that those steps do not in any way diminish the national security of Japan or the United States and its allies."[122]

Conclusions

- **U.S. extended nuclear deterrence has been a principal and successful element of U.S. nuclear nonproliferation policy.**
- **To assure allies, the U.S. nuclear arsenal may need to include specific types of nuclear capabilities that are deemed essential by allies.**
- **Beneficiaries of U.S. extended deterrence guarantees closely observe debates in the United States over nuclear issues such as test readiness and sustaining confidence in the nuclear stockpile without testing.**
- **U.S. ratification of the CTBT could undermine U.S. efforts to assure allies. Indeed, it could undermine the U.S. ability to provide future capabilities deemed essential by allies for extended deterrence and their assurance. If allies perceive that the United States nuclear deterrent is not keeping pace with new challenges, they could seek their own nuclear weapons.**

U.S. Nuclear Weapons Modernization Would Be Restricted

> "We can't just continue to sustain the Cold War era weapons that we have in our [nuclear weapons] inventory. They were designed for Cold War purposes; they were designed with Cold War specifications; it's a new world in the 21st Century. We need weapons that are designed for and support the needs of the warfighter in the 21st Century."[123]
>
> —General Kevin Chilton, November 2009

> "A nuclear arsenal which is unable to keep pace with a changing security environment is unlikely, in the long run, to prove much of a deterrent."[124]
>
> —Roger Batzel
> Former Director, Lawrence Livermore National Laboratory

The United States is likely to need a safe, secure, effective nuclear arsenal for the foreseeable future.[125] This arsenal must be capable of performing specific missions—missions that derive from today's security environment. Those missions, in part, result from the weapons capabilities and employment doctrines of potential adversaries. In the past decade, the security environment for the United States and its allies has changed dramatically. Some of the changes include:

- North Korea demonstrated its nuclear weapons capability with two low-yield tests that it did not try to hide. And, North Korea has apparently transferred nuclear technology to others.

- Iran is proceeding rapidly toward a nuclear weapons capability and has a vigorous offensive missile program. Years of intense negotiations with Tehran, sanctions, and multiple UN Security Council Resolutions have not dissuaded Iran from the pursuit of nuclear weapons.

- Russia appears to have revised its nuclear doctrine to lower the threshold for its use of nuclear weapons.

- Russia and China have well-developed, fully functional, operating nuclear weapons infrastructures. Both are modernizing their delivery systems while also modernizing and increasing the versatility and war-fighting characteristics of their nuclear weapons. China is also increasing the size and diversity of its nuclear forces.

"Every president from Truman to George W. Bush has held that the United States could not allow another country to gain an advantage in overall nuclear capability."[126] Traditionally, the United States balanced nuclear reductions and limitations with modernization programs deemed necessary for deterrence and parity. Yet, while the above-listed developments have unfolded, the United States has imposed a variety of unprecedented policy, budgetary, and legislative constraints on its own nuclear weapon research and development efforts. The United States has no new or modernized warheads or delivery systems designed for the new security environment. U.S. self-imposed constraints, including its strict interpretation of a zero-yield test moratorium, have hobbled modernization of the U.S. nuclear arsenal.

As a consequence, today the U.S. strategic force infrastructure is moribund. Russia has more nuclear weapons than the United States (it retains thousands of tactical weapons) and has modern weaponry designed for a more diverse set of missions. By these measures, it is questionable whether the U.S. nuclear arsenal can still be considered "second to none."

Modernization refers to the upgrading of nuclear warheads to make them not only more reliable, survivable, secure and safe, but also to tailor them to support contemporary U.S. strategic goals such as deterrence, extended deterrence and assurance. All remaining U.S. warheads, however, were designed during the Cold War and were intended to destroy Soviet hardened targets such as missile silos and to threaten Soviet national survival. As such, the warheads are mostly high-yield—which may not suit contemporary deterrence needs—and their strategic delivery systems don't measure up to today's standards for precision accuracy.

U.S. nuclear modernization could incorporate advanced safety and security features and other characteristics that could help strengthen deterrence of adversaries and assurance of allies. At some point, the security needs of the United States and its allies may call for nuclear weapons with characteristics other than those developed during the Cold War.

As noted above, today's threat environment is dramatically changed from the Cold War. The number of nuclear-armed states continues to climb and the risk of limited nuclear use against the United States and/or its allies may actually be increasing. In this new environment, Russia has developed low-yield, reduced-fission nuclear weapons that can be employed in situations where post-conflict reconstruction and minimization of damage to civilians and neighboring states are priority goals. As a Defense Science Board report noted in September 2009,

> ...many prominent leaders in the United States still hold fast to the belief that no one would dare to use nuclear weapons against our nation—believing that no one would run the risk of U.S. nuclear retaliation. They hold to this belief despite the possibility that new generation weapons can create militarily useful human and electronic effects with less physical destruction, which can lower the barrier to use by others, especially on their own territory. They hold to this belief despite the potential for being drawn into regional conflicts after limited use of nuclear weapons against U.S. allies.[127]

To counter threats such as those posed by low-yield nuclear weapons, chemical and biological weapons, or large-scale conventional aggression it may be necessary in the future for the United States to replace its high-yield warheads with less destructive ones because "... the credibility of the U.S. deterrent may rest *not on how much damage can be threatened* à la the Cold War's 'assured destruction' standard, but rather *on how controlled is that threatened damage*. In such cases, advanced strategic non-nuclear weapons and low-yield, accurate nuclear weapons may contribute to a U.S. deterrent threat that is more believable than otherwise would be the case."[128]

Some commentators assert that nuclear weapons are now useless. Yet, as former Secretary of Defense James Schlesinger recently said, "Nuclear weapons are used every day to deter our potential foes and provide reassurance to allies to whom we offer protection."[129] U.S. nuclear weapons are used not only to deter nuclear and overwhelming conventional threats from other states, but also threats involving other weapons of mass destruction. As noted in Section 2, several states continue to possess chemical and biological weapons, despite their pledge to eliminate them. In the future, it is possible that some as-yet-unknown type of weapon, or even more potent types of chemical or biological weapons, will be developed. It is essential that the United States maintain its capability to modernize its nuclear arsenal to respond to such evolving threats. Retaining the option to test may be key to this important capability.

Adhering indefinitely to a zero-yield CTBT would freeze the qualitative aspects of U.S. nuclear weapons. The nuclear weapons capabilities of other nations, however, would not be locked in—due to their possibly different interpretations of CTBT restrictions, cheating without detection, testing at low yields, or different approaches to nuclear warhead design.

Recently, the United States did consider developing, without nuclear testing, a reliable replacement warhead (RRW) for some stockpiled weapons. During a feasibility study of the RRW proposal, U.S. officials chose a design based on tested devices in order to assure reliability. Although the RRW program was cancelled and that warhead was not developed, the example highlights the U.S. practice that nuclear testing is necessary for modernization that varies significantly from already-tested designs. Thus, without nuclear testing, the United States cannot, with high confidence in their reliability, add new designs, substantially modernized concepts, or advanced, invasive surety features to its nuclear arsenal.

Depending on how international relations evolve, and how new threats to the United States and its allies develop, the United States will need to adapt its nuclear weapons arsenal to meet the security challenges of the future. The nature of future challenges cannot be known. In his October 2008 speech on the nuclear deterrent, Secretary of Defense Gates recalled his years in the intelligence business and cautioned, "Who can tell what the world will look like in 10 to 20 years? As someone who has spent most of his career in the intelligence business, I can assure you that our track record for long-term guesswork hasn't been all that great." Responding effectively to plausible future challenges almost certainly would require some level of nuclear testing to understand the nature of the adversary's new weapons, develop the capabilities critical for deterrence, or to assure that U.S. weapons work as intended.

Winston Churchill warned in his final speech: "Be careful above all things not to let go of the atomic weapons until you are sure and more than sure that other means of preserving peace are in your hands!" The CTBT threatens to undermine the deterrence and assurance effects of the U.S. nuclear arsenal by freezing it to Cold War standards in the absence of other known means of preserving the peace.

Conclusion

The security environment ahead is unpredictable. There may be new challenges in the future that could necessitate U.S. nuclear testing for development of more modern, flexible nuclear warheads.

U.S. Weapons' Safety and Security Would Not Be Maximized

> "Without nuclear tests, confidence in reliability would be substantially reduced by the introduction of some safety technologies."[130]
>
> —John Nuckolls, September 1999
> Former Director, Lawrence Livermore National Laboratory

There are known safety and security (surety) features that could be added to U.S. nuclear weapons. Examples include replacing conventional high explosives with insensitive high explosives to decrease the risk of inadvertent detonation, adding fire resistance, and incorporating technologies to prevent detonation if the weapon were stolen or captured. Additionally, it is probable that research and development could produce new surety technologies in the future, if this were a priority.

It is possible to add some surety features to currently stockpiled U.S. weapons with no loss in weapons reliability. However, adding extensive surety features to some U.S. nuclear weapons, particularly those in ballistic and cruise missiles, would require difficult design work and weight and volume tradeoffs that could affect weapons reliability. The only way to be certain that some surety upgrades do not affect weapons performance in some weapons is to conduct a nuclear test.

Conclusion

The CTBT would make it difficult, and for some features perhaps impossible, to add existing or new technologies for safety and security upgrades to current U.S. nuclear weapons.

Warhead Certification Is Increasingly Less Certain

> "[A]s our current generation of experienced scientists and engineers retire from the workforce and turn over the responsibility for stockpile assessment to the next team, there is legitimate concern that the new generation will be sufficiently trained and experienced to technically certify the stockpile."[131]
>
> —Admiral Henry G. Chiles, October 1999
> Former Commander, STRATCOM

In the past, U.S. nuclear weapons were certified as safe, secure, and reliable only after appropriate experiments, calculations, and testing had demonstrated that they were so. With the cessation of U.S. nuclear testing, the certification process became one that is based on best estimates of weapons reliability. Certification today is based on calculations and experiments, but without the results of underground nuclear testing directly relevant to the device being certified. Certification is actually an assertion, not a demonstration.[132] With reliance on the stockpile stewardship program and the absence of nuclear testing, the burden of proof for the national laboratories has been shifted from demonstrating that nuclear weapons will perform as intended to asserting that the available evidence does not indicate that they will not operate properly.

Warhead surveillance and non-nuclear testing always have been part of the certification process. Since U.S. nuclear testing ceased in 1992, the surveillance program has been enhanced to try to provide greater assurance of weapons reliability. As STRATCOM Commander General Kevin Chilton said, "If it was not for this [surveillance] program, I think we could argue successfully that some weapons in the inventory today would have been removed from deployment in the active inventory, or we may have had to go back to the President and asked for testing."[133]

Unfortunately, the surveillance program is troubled; it has been cut back in scope for budgetary reasons, and even this scaled-back program is behind schedule. In January 2010, the Director of Los Alamos National Laboratory wrote, "I have repeatedly raised my concern about the inadequacy of the surveillance program in my annual assessment letters ..."[134] The Director of Lawrence Livermore National Laboratory, George Miller, explained:

> Since nuclear weapons are not static devices, and their chemical and physical compositions change over time, an active surveillance program is necessary to look for and identify unexpected changes in our stockpile warheads and to confirm and validate our material aging and compatibility simulations. *Funding*

> *constraints have impacted the rate and throughput of the surveillance of stockpile warheads and the implementation of modern advanced surveillance diagnostic instruments and techniques.*[135] (Emphasis added.)

Problems due to warhead aging *are* being found and fixes must be made. These fixes can introduce further problems because often the materials or components differ from those in the original designs. Yet, nuclear testing to determine the effects of fixes has not been allowed. As the Director of Los Alamos National Laboratory stated, "This [inability to test] has required some exceptions to military requirements for yield, radiation hardness, and more frequent component replacement to address technical issues for which stockpile stewardship tools are not adequate."[136] Thus, despite the surveillance program, the new certification process has an inherent weakness: without nuclear testing, the level of certainty declines. Stephen Younger, former Director of the Weapons Program at Los Alamos National Laboratory, stated in 2009:

> I no longer believe that the current nuclear arsenal can be maintained indefinitely without nuclear testing. Our weapons were designed with a limited lifetime and we have already conducted several refurbishment programs to extend their lives. Small changes—some purposefully introduced to fix known problems and some naturally occurring as a result of age—are accumulating to take the weapons further and further from their original configuration. At some point, so many small changes will have occurred that our test pedigree will fade as the principal argument for confidence. We will then face one of three options: conduct a nuclear test to verify the performance of our much-refurbished weapons, design new weapons that are more robust, or accept decreased confidence in our nuclear deterrent.[137]

Recently, the Director of Lawrence Livermore National Laboratory wrote, "Funding reductions over the past five years have impacted the scientific and technological foundation of the SSP. The current LEP [life extension program] approach exercises only that portion of the intellectual base required to make the LEP repair. It does not fully exercise the overall intellectual base required to maintain the nuclear force." Furthermore, he concluded, "It will become increasingly more difficult to preserve this base of human capital if their skills are not exercised routinely."[138]

Even though the number and seriousness of problems with the stockpile are increasing, directors of the national laboratories may be under substantial political pressure to certify nuclear weapons despite any reservations they may have, or to give Congressional testimony that has been vetted for political correctness. A key reason is that since 1999, when some laboratory directors gave testimony that appeared unsupportive of the CTBT, a contract clause has been added to the Management and Operating contracts for all three nuclear weapons laboratories. It provides the Secretary of Energy with the power to remove any laboratory director at his/her discretion for "contract performance deficiencies." This is extremely dangerous because it could impinge on directors' willingness to provide information freely and without political pressure.[139] This is not an idle concern. After one laboratory director's 1999 testimony expressing concerns about the CTBT, the Department of Energy sought to fire the director as a reprisal for that testimony. The historical lesson of this incident will not be lost on directors asked to testify in the future.

The decline in U.S. certainty about warhead certification might be more acceptable if other countries faced the same limitations, but they do not. As noted before, apparently Russia and possibly China continue to test at low yields or, depending on technologies used and the testing environment, may be testing at higher yields. Such tests can provide extremely high confidence in warhead performance. They have also allowed development and production of new warheads to adapt to new military requirements. Moreover, the new Russian pit production facility at Mayak may allow large-scale replacement of aging warheads with newly produced warheads. At a minimum, the apparent nuclear tests give their scientists and engineers the advantage of experience; they have the opportunity to develop and test their skills in the design, manufacture, and testing of nuclear weapons and demonstrate the results to their military customers.

Conclusion

U.S. confidence that its warheads will perform as intended has eroded in the absence of nuclear testing and the bounds of uncertainty have expanded; further declines in confidence are inescapable as U.S. warheads age beyond their design lifetimes. National security risks posed by this disadvantage are heightened by the fact that other states have apparently continued to test and thus have much higher confidence in their stockpiles and the experts who maintain them.

Section 5:
The Value and Effectiveness of Safeguards

Safeguards are unilateral promises made by U.S. presidents to maintain U.S. nuclear weapons capabilities, consistent with arms control treaty limitations. They are policy statements and do not have the force of law, domestic or international. Any funding necessary to implement safeguards is at the discretion of Congress annually and is in no way guaranteed.

Safeguards were first used when President Kennedy sought U.S. Senate consent and ratification of the Limited Test Ban Treaty of 1963. To convince the Joint Chiefs of Staff to support that treaty, safeguards included: being prepared to resume nuclear testing, strengthening weapons laboratories, and conducting low-yield nuclear experiments. Most recently, safeguards were proposed by President Clinton in 1995 when he announced the U.S. position of making the CTBT a zero-yield treaty (see Table 2).

Table 2: Safeguards

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: Conduct of a comprehensive research and development program to improve our treaty monitoring;

Safeguard E: Conduct of 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 deterrence 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."

Proponents of the CTBT argued in 1999 that Safeguard A (the Stockpile Stewardship Program (SSP)) was already successful because it had allowed for three certifications of the U.S. stockpile without nuclear testing. Now, certification of the stockpile without nuclear testing has been maintained for eleven more years; it would seem, therefore, that there is even more evidence that Safeguard A has been effective. Yet, a closer look at SSP suggests some important questions.

The Stockpile Stewardship Program Has Had Limited Success

> "...computer simulation, experimental capabilities, and expert judgment resulting from [SSP] will allow me to provide the formal statement of stockpile confidence made through the Annual Certification Process. Without a successful [SSP] or extensive nuclear testing, however, I believe the confidence in the nuclear stockpile would decline to an unacceptable level."[140]

—Bruce Tarter, September 1999
Former Director, Lawrence Livermore National Laboratory

One of the most important questions in the U.S. debate over the CTBT is whether the Stockpile Stewardship Program (SSP) has indeed been successful. That is, have computer simulation, experimental capabilities, and expert judgment been maintained and improved to such an extent that they can provide decisive positive evidence that U.S. stockpiled weapons are safe and reliable in the absence of testing? Before answering this question, it is useful to review briefly the history of SSP, which was the result of a bargain struck between policy-makers who wanted a nuclear test ban, and those who were responsible for the safety and reliability of U.S. nuclear weapons.

In October 1992, President George H.W. Bush signed legislation passed by the U.S. Congress that contained an amendment to enact a nine-month moratorium on U.S. nuclear testing and to limit the number and purpose of nuclear tests thereafter. President Bush objected to the amendment and, in January 1993, recommended to the Congress, in writing, that nuclear testing be resumed for, among other reasons, the purpose of developing backup warheads in the event that there might be safety or reliability problems with the existing stockpile. He stated, "...as long as nuclear weapons and nuclear deterrence continue to be a critical element of U.S. national security strategy, we must be able to conduct a modest number of nuclear tests." He further said that a multilateral comprehensive test ban is not consistent with U.S. national security interests.

When President Clinton took office, he made the decision to continue the testing moratorium and struck a bargain with those responsible for maintaining the safety and reliability of the U.S. nuclear stockpile. In return for their support of a complete moratorium on U.S. nuclear testing, a promise was made to support development of alternative technologies to assure the safety and reliability of the stockpile. Thus, in 1994 the United States established the SSP to assure the continued viability of the nation's nuclear weapons stockpile,[141] as well as to maintain the science and engineering capabilities to support the nuclear deterrent in the present and the future—all without nuclear testing. Has SSP succeeded in these goals? If SSP has not succeeded, or only partly succeeded, what impact would CTBT ratification have on the likelihood of future SSP success?

One of the most alarming and important failures of the current SSP is the insufficient number of hydrodynamic experiments that would reproduce as closely as possible the operation of an actual weapon without producing nuclear yield. Not only have very few such experiments been conducted recently, only one plutonium subcritical experiment has been conducted in the past four years. Absent these experiments, U.S. weapons scientists and engineers must rely more on computer modeling and simulation that uses imprecise plutonium equation-of-state data. This is risky because the stockpiled weapons are changing; aging problems are being found, parts are being replaced, and remanufacturing is introducing materials and procedural changes. "As weapons depart further from the tested envelope, models and simulations become increasingly problematic."[142] Stephen Younger, former Director of Los Alamos National Laboratory Weapons Program, noted, "To rely on calculations alone is akin to the scholastics who refused to look through Galileo's telescope because the answers might disagree with ancient texts. If you do not look, you will not find."[143]

A second crucial failure of SSP is that sampling requirements for stockpile surveillance are not being met. Not only has the number of warheads undergoing surveillance been reduced, but also the degree of scrutiny of the components has been cut back. Despite reducing the scope of the program, it is underfunded and behind schedule. A 2009 JASON report stated, "Surveillance of stockpile weapons is essential to stockpile stewardship. Inadequate surveillance would place the stockpile at risk. We find that the surveillance program is becoming inadequate."[144]

A third serious problem is failure to maintain the science and engineering capabilities to support the nuclear deterrent in absence of testing. In 1997, then-Director of Lawrence Livermore National Laboratory, Bruce Tarter, said that "Our ability to retain and attract new top-notch scientists and engineers to the program will be another key index of the [SSP's] success."[145] In fact, the U.S. capability to design new nuclear weapons, to design new surety features, or to incorporate known surety features into weapons, has withered in the past decade. As the Director of Los Alamos National Laboratory, Michael Anastasio, stated:

> Since the moratorium on nuclear testing began in 1992, the complete portfolio of traditional skills has not been exercised. The nuclear weapons enterprise has not been given the opportunity to demonstrate the design-certify-build process since fielding the W88 in 1989. Actually performing all these steps, from initial concept through actual stockpile entry, is necessary to verifiably demonstrate that these capabilities exist. Instead, the complex has developed a generation of excellent analysts who are proficient in assessing small deviations from the tested conditions in the stockpile. This is a necessary task to sustaining the legacy stockpile, it is not sufficient to sustain the intellectual capacity and competency to implement new safety and security features in the stockpile of the future.[146]

A fourth failure of SSP is that key parts of the infrastructure have not been maintained. The Chemistry and Metallurgy Research facility at Los Alamos (which does plutonium R&D and provides support for pit production) and the 9212 facility at Y-12 (which manufactures highly enriched uranium components) are Manhattan-era facilities. They are becoming unsafe, and are hugely expensive to operate. Replacement facilities are long overdue. Construction of modern replacements is included in President Obama's promise to fund nuclear weapons modernization programs, but realization of that goal is years away.

A fifth failure of SSP is that it has made few, if any, advances in understanding the fundamental physics of nuclear explosions. As Paul Robinson, former Director of Sandia National Laboratories, stated, "The extreme complexity of these physics processes is why the nuclear weapons program has always had to be an experimentally-based program, and today it should remain so—except of course that we are prohibited from carrying out any of the necessary and crucial experiments."[147]

Congress established the National Nuclear Security Administration (NNSA) in 1999 as a semiautonomous Department of Energy agency to manage stockpile stewardship and related programs. NNSA's budget for the stockpile stewardship program has three main elements: Directed Stockpile Work (activities directly supporting weapons in the stockpile); Campaigns (technical efforts to develop and maintain capabilities to certify the stockpile for the long term); and Readiness in Technical Base and Facilities (mainly infrastructure and operations for the weapons complex).

One problem preventing the success of SSP is inadequate funding and political support from both the executive and legislative branches. In 1995, President Clinton said, "In order for this program to succeed, both the administration and the Congress must provide sustained bipartisan support for the stockpile stewardship program over the next decade and beyond."[148] Yet, funding and support have not been maintained, as can be seen by the funding and out-year projections of funding for the NNSA. (See Figure A.) The chart shows the projected growth in out-year funding and the erosion of those projections over time. SSP funding was projected to increase; instead it has decreased. Promises of future funding cannot adequately safeguard against future risks and the many deficiencies of the CTBT.

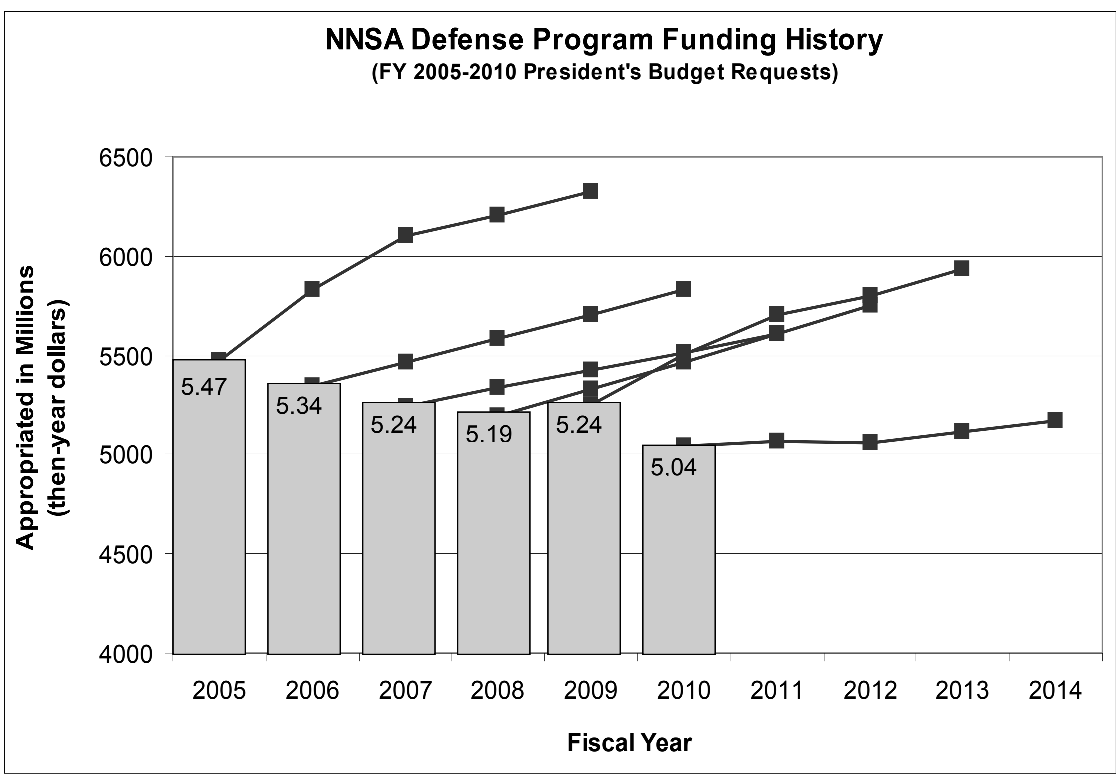

Figure A

The funding of Los Alamos National Laboratory has been particularly bleak. In September 2009, Director Michael Anastasio stated:

> Across the nuclear weapons complex, the number of warheads undergoing surveillance has been reduced, implementation of diagnostic capabilities has experienced lengthy delays, fewer experiments of a particular kind have been conducted, development of modern models and codes has been slower than desired and strategic investments in facilities, workforce sustainment, computational science and experimental science have not been made in a timely manner. If the current fiscal environment continues, the Laboratory will no longer be able to incrementally reduce programmatic scope and will be forced to terminate some essential capabilities.[149]

In April 2010, the administration released its Nuclear Posture Review which included plans to significantly increase budgets for the nuclear weapon laboratories. A few days later, the directors of those laboratories issued the following joint statement:

> We believe that the approach outlined in the NPR, which excludes further nuclear testing and includes the consideration of the full range of life extension options (refurbishment of existing warheads, reuse of nuclear components from different warheads and replacement of nuclear components based on previously tested designs), provides the necessary technical flexibility to manage the nuclear stockpile into the future with an acceptable level of risk. We are reassured that a key component of the NPR is the recognition of the importance of supporting 'a modern physical infrastructure—comprised of the national security laboratories and a complex of supporting facilities—and a highly capable workforce with the specialized skills needed to sustain the nuclear deterrent.[150]

This statement appears to place a great deal of faith in the 2010 NPR initiatives being fully implemented and sustained over time. A review of the fate of similar initiatives proposed in the 2001 NPR, funding for the nuclear weapons complex over the past two decades, and obstruction of nuclear weapon-related initiatives by some in congress would seem to compel a great deal of caution here.

In November 2010, during the contentious Senate debate on the New START Treaty, the administration sent an updated nuclear modernization plan[151] to Congress. The new plan further increased planned funding levels for the weapons activities budget for NNSA. The laboratory directors promptly responded with a joint letter to the Senate Committee on Foreign Relations which included the following endorsement: "[W]e believe that the proposed budgets provide adequate support to sustain the safety, security, and effectiveness of America's nuclear deterrent ... with adequate confidence and acceptable risk." The letter from the laboratory directors reflected their experience with budgets dependent on political follow-through. They qualified their support with the caution, "implementation of the future vision … will require sustained attention and continued refinement as requirements are defined and baseline … established." And they cited a need to "revisit these budgets every year as additional detail becomes available."[152]

In addition to the technical problems and budgetary issues, there are obstacles posed by burgeoning bureaucracy. Following the end of the Cold War, a bureaucratic expansion of breathtaking proportions was implemented at the Department of Energy and in the weapons laboratories. Los Alamos National Laboratory (LANL) is today nearly twice the size it was during the peak of the Cold War when it was conducting up to four simultaneous weapons development programs and performing a dozen or more nuclear tests per year. Today LANL conducts one or, at most, a very few non-nuclear experiments per year and has no major warhead development program. At the nuclear weapons laboratories, there are divisions devoted to safety, project management, environment, and numerous other worthy endeavors, all of which require personnel and resources formerly devoted nearly entirely to weapons research and development.

In essence, the bureaucratic culture has changed from one that seeks to manage safety and security risks to one which attempts to eliminate them completely. Michael Anastasio, Director of LANL, has stated that these increasing standards and costs from environmental and other requirements, combined with tight budgets, "[put] at risk the fundamental premise of Stockpile Stewardship."[153] Thus, periodically adding money, without reform of governance, is not the answer. However, lacking governance reform, additional funds are essential to prevent the only expendable personnel—those associated with the core nuclear weapons mission—from suffering greater losses.

Conclusion

Despite some noteworthy advances, the SSP has suffered from underfunding and overregulation. The SSP has not been a success in key areas, including technologies associated with certifying U.S. warheads without nuclear testing, warhead surveillance, laboratory experiments, and sustaining skills needed to support the nuclear deterrent. Nuclear testing may be necessary in the future to resolve important issues involving warhead reliability and operation.

Safeguards are Promises That May Not Be Kept

> "The half-life of testing safeguards, beginning with the Limited Test Ban Treaty, was about a year, and after about three half-lives they were abandoned entirely."[154]
>
> —Paul Robinson, January 2010
> Former Director, Sandia National Laboratories

The safeguards listed in Table 2 were devised as the quid pro quo for agreement by those responsible for the U.S. nuclear weapons stockpile to the cessation of U.S. nuclear testing. It is important to note that these safeguards were tied to the U.S. decision to undertake a self-imposed testing moratorium. They were to take effect regardless of whether the U.S. Senate ratified the CTBT. If implemented fully, the safeguards were expected to help assure the continuing safety and reliability of the stockpile in the absence of nuclear testing. In the event that problems developed with a stockpiled nuclear weapon, Safeguard C—maintenance of the capability to resume nuclear testing—would enable the problem to be evaluated and confirm that the designed fix would perform properly. There is perhaps no better example of the frailty of safeguards than Safeguard C.

Although a rudimentary test explosion could be conducted within a year of a decision to do so, a complex experiment would require 2-3 years, primarily because of the need to develop required diagnostics. Furthermore, the personnel and technical capabilities to support nuclear testing have not been sustained.

The Nevada Test Site has not been adequately maintained and budgets to maintain test readiness have drastically declined. As noted earlier, no funds dedicated for test readiness were requested by the Obama administration for 2010 or the out years. The political will and budgetary support from Congress have eroded to such an extent that it is fair to say that Safeguard C has not been kept.

Conclusion

Safeguards are not guaranteed; they are subject yearly to the political and economic pressures of the budget process. Safeguards do not assure the safety and reliability of U.S. nuclear warheads. Safeguards are not substitutes for well-written, verifiable treaties.

Section 6:
Summary Assessment: Benefits vs. Costs and Risks

"The fundamental question regarding the CTBT is not about the value of nuclear tests. Undeniably, they are the best way to assure ourselves of the performance of our nuclear deterrent. Rather, the question is whether the risks associated with the absence of testing outweigh the perceived benefits of banning them for all nations."

—Stephen Younger, Former Director, Nuclear Weapons Technology
Los Alamos National Laboratory

The principal objective of the CTBT is to ban all nuclear weapons explosions and thereby prevent proliferation of nuclear weapons to additional states and to forestall weapons modernization by existing nuclear weapons states. The CTBT would not prevent nuclear weapons acquisition by additional states because some types of weapons do not need testing, and because some states could cheat or simply remain outside the treaty. The CTBT will inhibit nuclear weapons modernization—but only by those states that adhere to the U.S. criterion for a zero-yield nuclear test ban. The CTBT would lock the United States into a position that would erode its capability to design new nuclear weapons as well as its ability to certify its existing stockpile. In contrast, China, Russia, and others may test below detectable levels and thus be able to modernize and assure reliability of their nuclear arsenals in ways denied the United States. This asymmetry would be directly attributable to CTBT and could prove significantly disadvantageous for U.S. and allied security.

A key lesson from the events of the decade since 1999 is that self-imposed U.S. policy constraints, including adherence to a zero-yield nuclear test moratorium, which would become legally binding if the CTBT were to be ratified, has frozen the development and upkeep of the U.S. nuclear stockpile while allowing weapons modernization and infrastructure development by Russia, China, and others. It is now clear that the argument made in 1999 that the CTBT would freeze a U.S. nuclear advantage is simply untrue. In fact, the advanced warhead designs in the U.S. arsenal, considered to be an advantage to the United States in the 1990s, may now prove to be a disadvantage because modifications that depart from tested designs—such as advanced surety features—cannot be incorporated with high confidence without testing.

Proponents of the CTBT also assert that U.S. ratification will achieve additional aims, including goodwill and moral leadership, which will translate into action on numerous nonproliferation and arms control objectives such as export controls, restrictions on technology sharing, etc. In fact, there is no tangible evidence that there will be any such follow-on progress and some contrary evidence from analogous expectations in the past that remain unmet. No promises of such actions have been made by states that want the United States to ratify the CTBT. A number of states certainly will express rhetorical approval should the U.S. Senate ratify the CTBT and disapproval if it does not. But, this approval or disapproval will likely be short-lived. The question is whether this rhetorical approval would be worth the costs and risks associated with CTBT ratification.

Proponents also point to a significant downside if the U.S. Senate does not ratify the CTBT: other arms control efforts allegedly will founder. The same claims were made in 1999, with several Senators declaring that rejection would be a catastrophe for nonproliferation and arms control. The disasters predicted from the CTBT rejection did not occur following the 1999 vote. In fact, a number of noteworthy nonproliferation initiatives (see Table 1) have been successfully implemented. There is no reason to believe that the effects today would be any different.

The deficiencies of the CTBT are serious. It is a very poorly crafted treaty of indefinite duration that amazingly does not define what it limits, i.e., what constitutes a nuclear test. This makes it possible for other states to test at undetectable levels of nuclear yield without being in non-compliance. It is not verifiable because there are no technologies that can detect tests conducted in several scenarios, including decoupled nuclear tests of a few kilotons—perhaps as many as 10 kilotons; tests that are masked by other explosions or earthquakes; or that which are conducted in containment vessels and carefully positioned geologically and geographically. The CTBT's organization is akin to a mini-UN and as a consequence CTBT procedures for on-site inspections are so vulnerable to political pressures as to be inherently unreliable.

For the United States and its allies, the risks associated with the CTBT are large and growing. U.S. observance of a zero-yield nuclear test moratorium is eroding the capability of the United States to appropriately modernize and adapt its nuclear weapons to contemporary threats, as well as its ability to certify its existing stockpile. In the context of a rapidly changing threat environment, this is a serious problem and an asymmetry. Since 1992, the United States has not conducted nuclear tests. Apparently Russia and possibly China have not observed the same strict U.S. zero-yield restrictions on nuclear testing and may have realized tremendous advantages. Any claims such as those made in 1999 that such testing could not confer military advantage are demonstrably false. The issue is not simply that Russia and China have developed new, reliable warheads and have modernized their arsenals, although this is extremely important. Nor is it that they have diversified weapons types to include very low-yield warheads. The issue is that the very process of nuclear development and testing enables a generation of experienced, proven designers and technologists; it necessitates a working nuclear weapons infrastructure; and, it signals clearly to those nations' leaderships—as well as to the world—that the government from the top down supports the maintenance of those countries' nuclear arsenals and deterrence goals.

In the United States, the signal has been the opposite. Congress has not adequately funded SSP, nor has it funded all components of the safeguards associated with the existing nuclear test moratorium. In addition, Congress has prohibited studies and other development activities which would have exercised critical skills and helped to maintain competency in nuclear design and engineering. Governmental debate regarding nuclear weapons is not about how to modernize and maintain the nuclear deterrent; it is about how many more weapons can be cut and how nuclear missions can be reduced. This history does not suggest confidence in CTBT safeguard promises and those states whose security depends on the U.S. nuclear umbrella are likely to reassess their reliance on the United States if this trend continues.

Significant problems have already been found in the current stockpile and, with each certification process, the level of confidence in weapons reliability has eroded. Some fixes have been made, but the changes may have had unintended effects. We cannot know without nuclear testing.

The nature of the threats faced by the United States and its allies has changed dramatically since the end of the Cold War and the threat environment remains highly fluid. We cannot predict what threats we may face in the future. Will radical militants come to power in Pakistan and inherit a nuclear arsenal? Will North Korea develop peacefully or collapse in war? Will Iran field nuclear weapons? Will Russia continue threatening NATO allies with nuclear weapons and engaging in local wars? Will some country develop a new type of weapon of mass destruction? Will there be a dispute in which China uses EMP weapons? We cannot know if these, or any other presently unimaginable events, will occur. U.S. preparedness for the future demands the necessary flexibility and ability to adapt to new threats. This is precisely what would be hampered greatly by the U.S. technological freeze that would be locked in by CTBT ratification.

It is wise to protect the U.S. ability to adapt its nuclear arsenal as necessary by protecting the right to test as may be necessary in light of the tremendous uncertainties ahead. We cannot predict the future and must hedge against a broad set of potential security challenges. Given the fragility of the envisaged CTBT benefits and its potentially significant risks, the only prudent bottom line is that the CTBT is not in the national security interests of the United States or its allies.

Notes

[1] U.S. Department of State, Fact Sheet, October 8, 1999, http://www.fas.org/nuke/control/ctbt/news/fs_991008_whyctbt.htm (Accessed January 24, 2010)

[2] "Technical Issues Related to the Comprehensive Test Ban Treaty," Report of the National Academy of Sciences (Washington, D.C.: National Academy Press, 2002) p. 71.

[3] President Barack Obama, remarks, Prague, Czech Republic, April 5, 2009, http://prague.usembassy.gov/obama.html.

[4] Rose Gottemoeller, Assistant Secretary of State for Verification, Compliance, and Implementation, "The Long Road From Prague," speech delivered at Woodlands Conference Center, Colonial Williamsburg, Virginia, August 14, 2009, p. 5.

[5] Brent Scowcroft, et al., "U.S., Russia Must Lead on Arms Control," October 13, 2009. Available at http://www.politico.com/news/stories/1009/28201.html (Accessed December 13, 2009).

[6] Daryl Kimball, "Why We Don't Need To Resume Nuclear Testing," November 2009. Available at http://www.armscontrol.org/act/2009_11/focus (Accessed December 13, 2009).

[7] This policy was demonstrated most recently by the decision to choose a design for the now-defunct reliable replacement warhead. The requirement to have only design elements that had been tested precluded any new military capability, and was the primary reason that the design proposed by Lawrence Livermore National Laboratory was chosen over the Los Alamos design. See "Design Selected for Reliable Replacement Warhead," Press Release dated March 2, 2007, available at http://nnsa.energy.gov/news/1136.htm (Accessed November 22, 2009).

[8] Robert M. Gates, Secretary of Defense, Speech on U.S. Nuclear Deterrent, delivered at Carnegie Endowment for International Peace, Washington, D.C., p. 3.

[9] Interview with Russia's Deputy Defense Minister Vladimir Popovkin, *Ekho Moskvy Radio* (in Russian), September 19, 2009, translation by Open Source Center, CEP20090920950089. Also see "Russian Military to be Equipped with Modern Weapons – Putin," *RIA Novosti*, February 17, 2010.

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[11] Rossiya otkazalas' ot vozoobnovleniya gonki vooruzheniy. March 24, 2009, www.lenta.ru, as cited in Balatsky, Galya, ibid.

[12] "Russia to Keep Silo-Based Ballistic Missiles in Future," *RIA Novosti*, December 8, 2009.

[13] "Moscow Emphasizes Quality of its Nuclear Potential," January 13, 2005, available at http://www.ghana.mid.ru/nfr/nfr331.html. Also see: *Planning the Future U.S. Nuclear Force*, *Volume II: Foundation Report,* National Institute Press, October 2009, p. B-13.

[14] Mark Schneider, *The Nuclear Forces and Doctrine of the Russian Federation*, National Institute Press, Pub. 0003, 2006, p. 23.

[15] "Russian Ex-Minister Mikhaylov Argues for Nuclear Deterrent," *Izvestia* (in Russian), December 4, 2002. Open Source Center translation CEP20021204000244.

[16] Harold M. Agnew, "Nuclear Weapons Testing," *Strategic Review*, Vol. XXIV, Winter 1996, p. 75.

[17] India, however, did conduct one nuclear test in 1974. Indian officials at the time claimed that it was a peaceful nuclear device.

[18] R. Jeffrey Smith and Joby Warrick, "Pakistani scientist Khan describes Iranian efforts to buy nuclear bombs," *Washington Post*, March 14, 2010, p. A14.

[19] Thomas C. Reed and Danny B. Stillman, *The Nuclear Express* (Minneapolis, MN: Zenith Press, 2009).

[20] Michael Rühle, "The Bomb for Beginners: A do-it-yourself guide to going nuke in a few easy steps," *International Politik* – German and Global Edition, February 2010, p. 37.

[21] Bob Graham, Chairman, and Jim Talent, Vice Chairman, *Prevention of WMD Proliferation and Terrorism Report Card*, Commission on the Prevention of Weapons of Mass Destruction, Proliferation and Terrorism, January 2010, pp. 9-11.

[22] Gottemoeller, op. cit., pp. 1-6.

[23] White House Press Statement, September 15, 2009, http://www.whitehouse.gov/the_press_office/Statement-by-the-Press-Secretary-on-the-US-delegation-to-the-Conference-on-Facilitating-the-Entry-into-Force-of-the-Comprehensive-Nuclear-Test-Ban-Treaty/ (Accessed January 25, 2010).

[24] William J. Perry, Chairman, James R. Schlesinger, Vice-Chairman, *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, D.C.: United States Institute of Peace Press, 2009) p. 17.

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[26] *Proliferation Implications of the Global Expansion of Civil Nuclear Power*, a report by the International Security Advisory Board of the U.S. Department of State, April 7, 2008, p. 8.

[27] Arlen Specter, Statement on the Comprehensive Test Ban Treaty," *Congressional Record*, October 8, 1999, S12266.

[28] "Conditions Toward Zero: 11 Benchmarks for Global Nuclear Disarmament," Mr. Hirofumi Nakasone, then-Minister of Foreign Affairs, remarks delivered at Japan Institute of International Affairs, April 27, 2009.

[29] See the concerns cited in *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*, op. cit., pp. 81-87.

[30] Stephen Younger, Letter to Senator Jon Kyl, August 7, 2009, Attachment, p. 1.

[31] Senate Armed Services Committee Hearing on Report of the Congressional Commission on the Strategic Posture of the United States, May 7, 2009, CQ Congressional Transcripts.

[32] Testimony by Ambassador Steve Ledogar to the Senate Foreign Relations Committee, 1999, pp. 16-17. (Available at http://www.fas.org/nuke/control/ctbt/text/100799ledogar%20.htm. Accessed November 17, 2009).

[33] Enclosure, in letter from Jeffrey T. Bergner, Assistant Secretary, Legislative Affairs, U.S. Department of State, to The Honorable Jon Kyl, United States Senate, August 9, 2007, as cited in Jonathan Medalia, *Comprehensive Nuclear-Test-Ban Treaty: Issues and Arguments*, Congressional Research Service, updated March 12, 2008, p. 21.

[34] "Russia: Developing New Nuclear Warheads at Novaya Zemlya?," *CIA Intelligence Report*, Office of Russian-European Analysis, July 2, 1999. Available at: http://gww.edu/~nsarchiv/.

[35] "Russian Nuclear Complex Falling Apart, Russian Federation Security Council Outlines Measures to Revive It," Moscow, *Nezavisimaya Gazeta*, April 30, 2005, Translated in Foreign Broadcast Information Service, Doc. ID: FTS19990430000599, as cited in National Institute for Public Policy, *Planning the Future U.S. Nuclear Force*, op. cit., p. B-15.

[36] One definition of a hydronuclear test is one in which the nuclear yield is less than the yield of the high explosive driving the nuclear yield. For some modern U.S. weapons this would be tens of pounds of yield. For older weapons this could be a few hundred pounds. If one were designing a special experiment (not a stockpiled weapon) hundreds of pounds of high explosive would legitimize a hydronuclear yield of hundreds of pounds of nuclear yield.

[37] In conversation at Lawrence Livermore National Laboratory, November 3, 2003. As recounted by Dr. John Foster, who participated in this event.

[38] Vitaly I. Khalturin, Tatyana G. Rautian, Paul G. Richards, and William Leith, "A Review of Nuclear Testing by the Soviet Union at Novaya Zemlya, 1955-1990," *Science and Global Security*, 13: 1-42, 2005, p. 28.

[39] Robert Thorn and Donald Westervelt, "Hydronuclear Experiments," Los Alamos National Laboratory Report LA-10902-MS, February 1987, p. 4.

[40] Secretary of Defense Robert Gates, Letter to Senator Jon Kyl, December 9, 2008.

[41] In 1988, Paul Nitze offered a widely-used definition: by effective verification, "[w]e mean that we want to be sure that, if the other side moves beyond the limits of the treaty in any militarily significant way, we would be able to detect such violation in time to respond effectively, and thereby deny the other side the benefit of the violation." U.S. Congress. Senate. Committee on Foreign Relations. *The INF Treaty.* S.Hrg. 100-522, pt. 1, 100th Congress, 2nd Session, 1988, p. 289.

[42] George Ullrich and Jack Murphy, Briefing on "CTBT Monitoring Capabilities," Defense Threat Reduction Agency, DTRA01-03-D-0017, October 2009, chart 15.

[43] William Leith, op. cit., p. 36.

[44] CTBTO Press Release, accessed at www.ctbto.org/press-centre/highlights/2009/experts-sure-about-nature-of-the-DPRK-event on February 23, 2010.

[45] William Leith, op. cit., p. 37.

[46] Don Linger et al., "The Feasibility of Evasive Underground Nuclear Testing Through Decoupling", Defense Nuclear Agency Technical Report DNA-IR-94-88, November 1994, p. 12.

[47] William Leith, op. cit., pp. 36-37.

[48] Jonathan Medalia, *Comprehensive Nuclear-Test-Ban Treaty: Issues and Arguments*, Congressional Research Service, Updated March 12, 2008, pp. 28-29.

[49] U.S. Department of State. Bureau of Verification, Compliance, and Implementation, "Response to Medalia Questions of 27 Nov [2007]." January 14, 2008. Reported in Jonathan Medalia, *Comprehensive Nuclear Test Ban Treaty: Issues and Arguments*, Congressional Research Service, February 28, 2008, p. 29.

[50] Senate Armed Services Committee Hearing on Report of the Congressional Commission on the Strategic Posture of the United States, May 7, 2009, CQ Congressional Transcripts.

[51] Letter from John H. Moseman, Director of Congressional Affairs, Central Intelligence Agency, to Senator Richard C. Shelby, Vice Chairman of the Senate Select Committee on Intelligence, January 9, 2001, as cited in Kathleen Bailey, *The Comprehensive Test Ban Treaty: An Update on the Debate* (National Institute for Public Policy, March 2001), pp. 15-16.

[52] John M. Shalikashvili, *Report on Findings and Recommendations Concerning the Comprehensive Nuclear Test Ban Treaty*, January 2001, available at http://www.state.gov/www/global/arms/ctbtpage/ctbt_report.html#iv (Accessed November 28, 2009)

[53] Letter from John H. Moseman, op. cit.

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[55] "Technical Issues Related to the Comprehensive Test Ban Treaty," Report of the National Academy of Sciences (Washington, D.C.: National Academy Press, 2002) p. 71.

[56] Anatoliy Mikhaylov, Mikhail Syrunin, Valeriy Tsypkin, "Russia: Explosion Resistant Containers, Fracturing (Neutralizing) Explosive Objects," *Vooruzheniye Politika Konversiya* (in Russian), February 20, 2003, pp. 67-72. Open Source Center translation CEP 20030607000001.

[57] Reported in correspondence on December 29, 2009, from Dr. Don Linger, former Chief Scientist at the Defense Threat Reductions Agency. Dr. Linger led the U.S. team responsible for closing and sealing the testing tunnels at the former Soviet nuclear test center at Semipalatinsk, Kazahkstan.

[58] "Russia: Developing New Nuclear Warheads at Novaya Zemlya?" Intelligence Report from the Office of Russian and European Analysis, Central Intelligence Agency (redacted). July 2, 1999, pp. 1-2. Accessed at http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB200/index.htm.

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[60] General John M. Shalikashvili (USA, ret.), Letter to the President and Report on the Findings and Recommendations Concerning the Comprehensive Nuclear Test Ban Treaty, Washington, D.C., January 4, 2001.

[61] Khalturin, Rautian, Richards, and Leith, op. cit., p. 28.

[62] C. Paul Robinson, Speech before the Congressional Nuclear Security Caucus, September 22, 2009.

[63] Letter from John H. Moseman, op.cit.

[64] Ibid.

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[139] Letter from C. Paul Robinson, former President of Sandia National Laboratories, to Senator Jon Kyl, January 20, 2010, pp. 2-3. Dr. Robinson wrote, "This clause is quite dangerous in my view. ... these laboratory director positions are 'national trust positions' in the extreme, as they are unique in bearing the exclusive responsibility of whether to certify that a nuclear weapon design is adequate for introduction to the U.S. stockpile. The potential that a Presidential political appointee might put pressure on a director to take a certain stance in Congressional testimony is now quite a worrisome possibility."

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