An Arms Control Association Briefing Book

Now More Than Ever

THE CASE FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY

FEBRUARY 2010

Tom Z. Collina with Daryl G. Kimball

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Cover Photo

The Nevada Test Site was the United States' primary location for nuclear weapons test explosions. Between 1951 and 1992, it was the site of 100 atmospheric and 714 underground detonations.

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To achieve a global ban on nuclear testing, my Administration will immediately and aggressively pursue U.S. ratification of the Comprehensive Test Ban Treaty. After more than five decades of talks, it is time for the testing of nuclear weapons to finally be banned.

—**President Barack Obama**, April 5, 2009

[Republican senators] might have been right voting against [the CTBT] some years ago, but they would be right voting for it now, based on these new facts… [There are] new pieces of information that are very important and that should be made available to the Senate.

—**Former Secretary of State George Shultz**, April 17, 2009

The devil is in the details. If we could get it done, if it is acceptable, then it is a step forward on the path to the president's goal and mine of a nuclear free world.

—**Senator John McCain**, July 22, 2009

U.S. ratification [of the CTBT] has become, in the eyes of many, a litmus test for U.S. leadership in the overall global effort to prevent the use and spread of nuclear weapons.

—**Council on Foreign Relations**, "U.S. Nuclear Weapons Policy," April 2009, William J. Perry and Brent Scowcroft, Chairs

Executive Summary

Nuclear testing is a dangerous and unnecessary vestige of the Cold War that the United States rejected almost 20 years ago. In 1996, the United States became the first nation to sign the Comprehensive Nuclear Test Ban Treaty (CTBT), which "prohibits any nuclear weapon test explosion or any other nuclear explosion," and establishes a global verification network with short-notice, on-site inspections to monitor compliance.

Today, there is no military justification to resume U.S. nuclear testing. The United States does not need nuclear tests to maintain an effective nuclear arsenal.

It is in the U.S. national security interest to prevent nuclear testing by others and to improve U.S. and international verification capabilities. Even though the United States has already signed the CTBT and thus assumed most treaty-related responsibilities, it cannot reap the full security benefits of the treaty until the Senate approves it by a two-thirds majority.

President Barack Obama has declared his support for U.S. ratification of the CTBT as a key component of his broader international efforts to prevent the use and spread of nuclear weapons. A growing list of bipartisan leaders agree that by ratifying the CTBT, the United States stands to gain an important constraint on the ability of other states to build new and more deadly nuclear weapons that could pose a greater threat to American security.

As the Senate revisits the CTBT for the first time in more than a decade, it needs to consider the following ways in which the case for the treaty has become significantly stronger:

CTBT's Increasing National Security Value

Global efforts to stop the spread of nuclear weapons are in jeopardy. The nuclear Nonproliferation Treaty (NPT) regime has grown weaker after years of neglect by the nuclear-weapon states. Unpredictable nations such as North Korea and Iran have active nuclear programs, and Pakistani scientists have been sharing their nuclear weapons know-how. A resumption of nuclear testing by China, India, Pakistan or Russia would put the non-proliferation regime at even greater risk.

U.S. ratification of the CTBT is an essential first step to rebuilding international support for measures to prevent the use and spread of nuclear weapons. In 1995, the United States and the other nuclear powers promised to deliver on the CTBT in exchange for the indefinite extension of the NPT. Action on the CTBT would give the United States additional leverage to win international support for tougher nuclear inspections and more effective responses to cases of NPT noncompliance.

A global, verifiable ban on nuclear testing would substantially constrain the ability of nuclear-armed states, such as China, to develop new and more deadly nuclear weapons. Without nuclear weapon test explosions, would-be nuclear-armed nations—like Iran—would not be able to proof test more advanced, smaller nuclear warhead designs that could be used to arm ballistic missiles.

As Dr. Siegfried Hecker, former director of Los Alamos National Laboratory, recently said: "The single most important reason to ratify the CTBT is to stop other countries from improving their arsenals."

Proven Ability to Maintain the Arsenal

Over the past decade, the success of the U.S. Stockpile Stewardship Program has demonstrated that the nuclear arsenal can be reliably maintained under a CTBT. Successful Life Extension Programs have shown that existing weapons can be refurbished and recertified without nuclear testing. Key plutonium parts in warheads have been shown to last 85–100 years, decades longer than previously thought, and limited production capacity has been reestablished to make new parts when needed. Former Secretary of State George Shultz, former Defense Secretary William Perry, former Secretary of State Henry Kissinger and former Senator Sam Nunn wrote in the Jan. 20, 2010 *Wall Street Journal* that the success of efforts to extend the service lives of existing weapons has "obviated the need for underground nuclear explosive tests."

The United States has more to gain from the CTBT than any other nation.

The United States has no need to resume nuclear testing. It has the most advanced and deadly nuclear arsenal in the world. The United States has conducted 1,030 nuclear tests, more than all other nations combined, including Russia (715) and China (45). Given this advantage, it is in the U.S. national security interest to prevent other nations from testing nuclear weapons.

Proven Ability to Verify Compliance

Today, no would-be cheater could confidently conduct an undetected nuclear explosion large enough to threaten U.S. security. The international verification system, together with U.S. national technical means of verification, would detect militarily significant tests. Unless it ratifies, however, the United States cannot take advantage of the international system's full benefits, such as on-site inspections.

In 1999, only 25 percent of the CTBT monitoring stations had been built. As of January 2010, 90 percent of the planned global verification network was complete or under construction. North Korea's nuclear tests in 2006 and 2009 demonstrated that the CTBT verification system is working well and can detect very small explosions.

The Importance of U.S. Leadership

The CTBT has now been signed by 182 nations, including the United States, China, France, Russia, and the United Kingdom, and ratified by 151, including Russia, Japan, South Korea, Australia, and all U.S. allies in NATO. The CTBT's entry into force awaits ratification by nine states, including the United States, China, India, and Indonesia.

U.S. ratification would spur other key nations, such as China, to ratify and would reinforce the global taboo against nuclear testing. Without positive U.S. action on the CTBT, the risks of nuclear weapons proliferation and the resumption of testing will only grow.

The Time for the CTBT is Now

Today, the United States has more to gain from the CTBT than any other nation. U.S. approval of the CTBT would reinforce the global test moratorium and accelerate the Treaty's formal entry into force, helping to constrain the ability of other nuclear-armed states to improve their nuclear weaponry. Equally important, U.S. ratification would reestablish strong U.S. leadership to stop the spread of nuclear weapons to additional nations and to terrorist groups. The CTBT would strengthen American security for years to come.

Introduction

A global halt to nuclear weapons testing has been a central, bipartisan objective of the United States since the late 1950s, when President Dwight Eisenhower first sought a comprehensive ban. It has long been recognized that, without the ability to conduct nuclear explosive tests, a country cannot confidently develop more advanced nuclear weapons. As the nation with the most sophisticated nuclear arsenal in the world and the most nuclear testing experience, the United States has the most to gain from the global ban on testing embodied in the Comprehensive Test Ban Treaty (CTBT).

International progress toward the CTBT accelerated following the end of the Cold War, when the Soviet Union announced a moratorium on nuclear tests in 1991. President George H. W. Bush initiated a moratorium on U.S. nuclear testing in 1992, at the direction of Congress.[1] President Bill Clinton extended the moratorium in 1993, 1994, and 1995 to help galvanize the world's nations to negotiate the CTBT.

In September 1996, the United States became the first nation to sign the CTBT, which "prohibits any nuclear weapon test explosion or any other nuclear explosion" and establishes a global monitoring network and the option of short-notice, on-site inspections to detect and deter cheating. President Clinton submitted the CTBT to the Senate in September 1997.

Then-Chairman of the Senate Foreign Relations Committee Jesse Helms (R-N.C.) declined to consider the treaty until the fall of 1999. On September 30 of that year, Senate Majority Leader Trent Lott (R-Miss.) offered a quick debate and vote on the treaty, and the Democratic leadership agreed. The Senate Armed Services Committee held hearings October 5–7, and the Foreign Relations Committee held one hearing October 7. As it became clear that the process was moving too quickly and leading to failure, senators from both sides sought delay. The day before the vote, 62 senators sent a bipartisan letter to their leaders stating, "[W]e all agree on seeking a delay. We believe many colleagues are of a like view, irrespective of how they would vote at this point." This bipartisan request was denied, and the Senate declined to give its advice and consent to ratification on October 13, 1999. The treaty remains on the executive calendar of the Foreign Relations Committee.

Without the ability to conduct nuclear explosive tests, a country cannot confidently develop more advanced nuclear weapons.

Described by Senator Richard Lugar (R-Ind.) as "abrupt and truncated" and "highly politicized,"[2] the October 1999 vote said more about the highly partisan atmosphere in the Senate at the time than it did about the CTBT itself. Less than a year before the CTBT vote, President Clinton had been impeached by the House of Representatives and then acquitted by the Senate. The November 2000 presidential election was just a year away. Many senators cast their votes reluctantly, would have preferred more time for debate, and ultimately believed that the treaty did not get a fair hearing. "A process that normally would take many months has been reduced to a few days," lamented Lugar, who voted against ratification.

The administration of George W. Bush did not ask the Senate to reconsider the CTBT, nor did it seek to resume nuclear testing. According to then-Secretary of State Colin Powell, "[W]e do not see any need for such testing in the foreseeable future."[3]

Global support for the CTBT has grown substantially. To date, the CTBT has been signed by 182 nations, including the United States, China,

France, Russia, and the United Kingdom, and ratified by 151, including Japan, Russia, South Korea, and all U.S. allies in NATO. The CTBT's entry into force awaits ratification by just nine key countries, including the United States, China, India, and Indonesia.

The Obama administration has now renewed hopes for the test ban. On April 5, 2009, in Prague, the president said, "To achieve a global ban on nuclear testing, my administration will immediately and aggressively pursue U.S. ratification of the Comprehensive Test Ban Treaty. After more than five decades of talks, it is time for the testing of nuclear weapons to finally be banned."[4]

Today, the CTBT is more important than ever. U.S. approval of the treaty and its entry into force would substantially constrain the ability of other nuclear-armed states to develop new and more deadly nuclear bombs, and perhaps most importantly, it would re-establish U.S. leadership to stop the spread of nuclear weapons to additional nations and to terrorist groups. The treaty would strengthen U.S. security for years to come.

Although the 1999 treaty debate was brief and inadequate, it did shed light on senators' views on the CTBT. Some senators who voted "no" in 1999 expressed legitimate concerns about the ability of the United States to maintain its arsenal in the absence of testing and to verify compliance with the treaty. Now, ten years later, there is much new information to bring to bear. As former Secretary of State George Shultz said in 2009, "[Republican senators] might have been right voting against [the CTBT] some years ago, but they would be right voting for it now, based on these new facts … [There are] new pieces of information that are very important and that should be made available to the Senate."[5]

The goal of this briefing book is to bring new information about the CTBT to the Senate, to lay out the national security case for the treaty, and to show how the United States' ability both to maintain its arsenal and verify compliance has dramatically improved over the last decade. With the support of President Obama and bipartisan opinion leaders, and armed with the new facts presented here, the prospects and arguments for ratification of the CTBT are stronger than ever before.

Getty Images

President Barack Obama speaks in Prague April 5, 2009, where he pledged to "immediately and aggressively" pursue U.S. ratification of the CTBT.

MARIO TAMA/AFP/Getty Images

Former U.S. Secretary of State George Shultz said in 2009 that "[Republican senators] might have been right voting against [the CTBT] some years ago, but they would be right voting for it now …."

SECTION 1

The Comprehensive Test Ban Treaty Strengthens U.S. National Security

While a state could develop a first-generation Hiroshima-type nuclear bomb without nuclear testing, the CTBT would prevent a state from gaining guaranteed technical assurance through nuclear testing that advanced nuclear weapons would work reliably. The political benefit of the CTBT is that it has been strongly linked to the vitality of the nonproliferation regime. The Task Force believes that the benefits outweigh the costs and that the CTBT is in U.S. national security interests.

—**Council on Foreign Relations**, "U.S. Nuclear Weapons Policy," April 2009, William J. Perry and Brent Scowcroft, Chairs

The single most important reason to ratify the CTBT is to stop other countries from improving their arsenals – China, India, Pakistan, North Korea, and Iran if it ever progresses that far… We gain substantially more from limiting other countries than we lose by giving up testing.

—**Siegfried Hecker**, former director, Los Alamos National Laboratory, October 2009

Ratifying the CTBT is central to getting U.S. nuclear policy priorities right. It will send a clear signal that the United States is de-emphasizing the role of nuclear weapons in U.S. security policy and emphasizing the need to work cooperatively with other nations to stop the spread of nuclear weapons. The United States can ratify the CTBT, strengthen global nonproliferation efforts, and maintain its deterrent all at the same time.

A global ban on nuclear explosions would constrain the ability of all parties to develop more-advanced nuclear weapons. Technically, a state might have some degree of confidence that a simple, relatively cumbersome fission device would work without testing, as the United States did with the Hiroshima bomb in 1945. An emerging nuclear state might attain a primitive, ambiguous nuclear capability without testing, but under the test ban, it could not use a nuclear test to demonstrate or advance its capability, as did India and Pakistan (1998) and North Korea (2006, 2009), with a resulting rise in regional and global tensions.

The test ban constrains nuclear weapons development by blocking the progression from simple fission designs to boosted fission designs and two-stage thermonuclear designs with better yield-to-weight ratios. The treaty essentially rules out the possibility of a nation gaining confidence in an untested thermonuclear weapon, especially a sophisticated one that could be placed on a long-range ballistic missile.

Treaty signature by India and Pakistan would help prevent their development of more-sophisticated weapons and help reverse a destabilizing nuclear arms race in South Asia. For example, influential voices in India claim that its May 1998 test of a thermonuclear design was a "fizzle," i.e., it failed to produce as large an explosion as scientists expected, and thus New Delhi should conduct more tests.[6] According to the U.S. Council on Foreign Relations, India and Pakistan "would likely welcome the opportunity to renew testing if the de facto moratorium were lifted and the international norm against testing weakened or collapsed."[7]

The CTBT would complicate any efforts by Iran to build nuclear weapons. If Iran decides to build nuclear weapons, it may want to test them to gain

confidence that they would work or to gain prestige, as North Korea did. Yet, to conduct a nuclear test in violation of a globally supported CTBT would risk further isolation and sanctions for Tehran. The United States would be in a better position to lead a successful international campaign against Iranian nuclear testing if the United States had itself ratified the treaty.

In China's case, a new round of nuclear testing could advance the miniaturization of warhead designs and help it to put multiple warheads on its relatively small arsenal of strategic ballistic missiles, an increase to its nuclear strike capability that is clearly not in the U.S. interest.

The CTBT would deter a state from conducting nuclear tests for political purposes. For example, India's tests in 1998 were seen to have been used to build support for the nationalist Bharatiya Janata Party, which had risen to power in part on its promise to conduct nuclear tests.[8] India's actions were then used as a political excuse by Pakistan to conduct its own tests soon after.

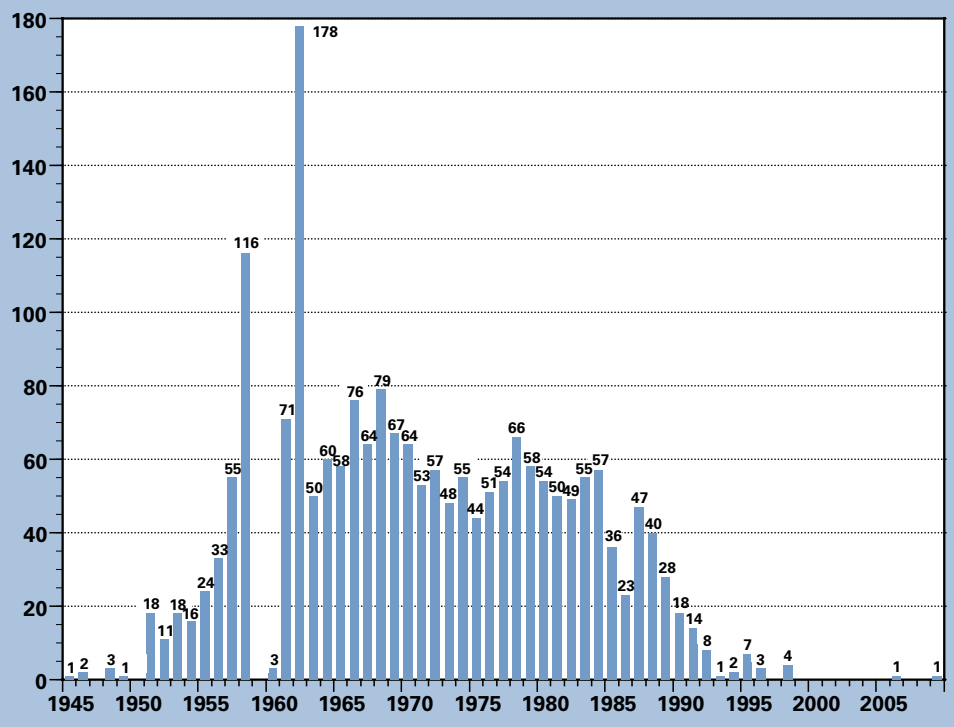
The CTBT is essential to strengthening a global consensus that nuclear testing is no longer an internationally accepted activity. The treaty embodies the view that nations that test are outside the bounds of the international mainstream and will bear the consequences of global isolation. For example, former Indian Foreign Secretary Kanwal Sibal recently said, "The cost is intolerable if India tests.... We will suffer international isolation. It will be a huge setback to our bid for permanent membership of the United Nations Security Council."[9]

"The single most important reason to ratify the CTBT is to stop other countries from improving their arsenals—China, India, Pakistan, North Korea, and Iran if it ever progresses that far...We gain substantially more from limiting other countries than we lose by giving up testing," said Dr. Siegfried Hecker, former director of Los Alamos National Laboratory.[10]

CTBT and Nonproliferation

The CTBT is critical to sustained political support for the NPT and related U.S. and global efforts to stop the spread of nuclear weapons. According to former Chairman of the Joint Chiefs of Staff General John Shalikashvili, "Proliferation is held in check by an intricate web of bilateral, regional, and global arrangements. Weakening or removing one element can damage other components and erode the overall system of constraints.... Our closest allies see the Test Ban Treaty as something that they have fought for alongside the United States since the days of President Eisenhower. All other NATO members, Japan, South Korea, and most of our other security partners have ratified it."[11]

Figure 1. Global Nuclear Test Explosions by Year



Source: U.S. Department of Energy, Arms Control Association

The international community views the test ban as a vital component of global nonproliferation efforts. It is no accident that the preamble to the NPT specifically mentions the test ban and that Article 6 of the NPT calls on the nuclear-weapon states and all other parties to pursue nuclear disarmament. The 1995 NPT Review and Extension Conference agreed to an indefinite extension at a time when hopes for the CTBT were high. Indeed, commitments by the nuclear-weapon states to complete CTBT negotiations by the end of 1996 were essential to this vital nonproliferation success. It is difficult to imagine the nuclear-weapon states mounting a successful campaign to win indefinite extension of the NPT today based on their arms control achievements since 1995.

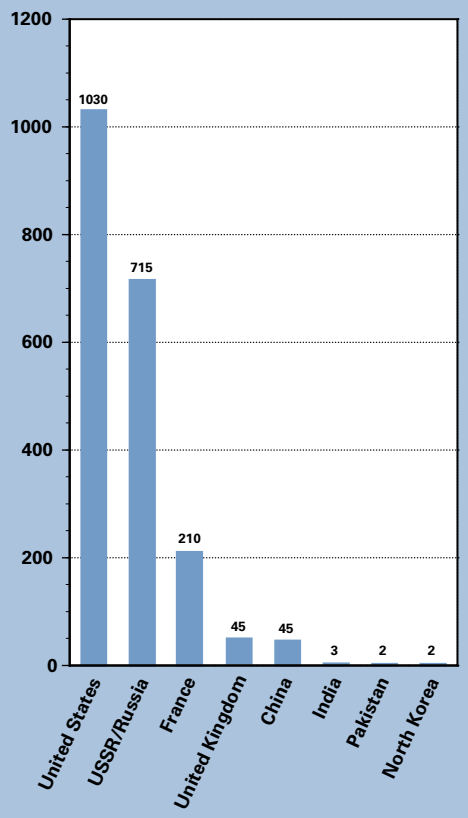
In an April 19, 1995, letter from France, Russia, the United Kingdom, and the United States (China agreed later) to the 1995 NPT review conference, the nuclear-weapon states coupled a determination to complete the CTBT with a request to the nonweapon states to make the NPT permanent, i.e., a quid pro quo: "We reaffirm our determination to continue to negotiate intensively, as a high priority, a universal and multilaterally and effectively verifiable comprehensive nuclear test-ban treaty, and we pledge our support for its conclusion without delay. We call upon all States parties to the [NPT] to make the treaty provisions permanent. This will be crucial for the full realization of the goals set out in article VI."[12]

In the 1995 Statement of Principles and Objectives on Nuclear Non-Proliferation and Disarmament that accompanied the resolution to extend the NPT indefinitely, all NPT parties agreed to conclude a CTBT in one year. The 1995 NPT review conference agreed on the following objective: "The completion by the Conference on Disarmament of the negotiations on a universal and internationally and effectively verifiable Comprehensive Nuclear-Test Ban Treaty no later than 1996. Pending the entry into force of a Comprehensive Test Ban Treaty, the nuclear-weapon States should exercise utmost restraint."[13]

As could be expected, CTBT setbacks have had negative NPT consequences. For example, U.S. failure to ratify the CTBT was a contributing factor to the collapse of the 2005 NPT Review Conference, and undermined U.S. leverage to focus states' attention on challenges to the nonproliferation regime posed by countries such as Iran, Iraq, and North Korea.

Lack of progress on arms control has also complicated U.S. efforts to strengthen the International Atomic Energy Agency (IAEA) inspection system. After the Persian Gulf War, the United States helped lead an effort at the IAEA to strengthen the safeguards that states agree to have on their civilian nuclear programs under the NPT. More intrusive inspections, known as the Model Additional Protocol, were finally adopted by the IAEA in 1997, but each nation must still individually accept them. Many nations have been less willing to accept more intrusive inspections on their territory in the face of U.S. opposition to the CTBT. According to then-IAEA Director-General Mohamed ElBaradei, "The Senate vote against the ban on nuclear tests was a devastating blow to our efforts to gain acceptance of more intrusive inspections of nuclear facilities around the world."[14]

Figure 2. Nuclear Test Explosions by Country



Source: U.S. Department of Energy, Arms Control Association

General John Shalikashvili, former chairman of the Joint Chiefs of Staff, examined the net benefit of the CTBT and concluded that "it is very much in our national interest to secure these benefits through entry into force of the Test Ban Treaty. If this opportunity is lost, the United States' ability to lead an effective global campaign against nuclear proliferation will be severely damaged."[15]

Once the United States ratifies the test ban, Washington will be in a much better position to enlist cooperation on export controls, economic sanctions, and other coordinated responses to specific problems. In the words of Ellen Tauscher, undersecretary of state for arms control and international security,

"We are not so naïve as to believe that problem states will end their proliferation programs if the United States and Russia reduce our nuclear arsenals. But we are confident that progress in this area will reinforce the central role of the NPT and help us build support to sanction or engage states on favorable terms to us. Our collective ability to bring the weight of international pressure against proliferators would be undermined by a lack of effort towards disarmament."[16]

The United States has not tested nuclear weapons for almost two decades. There is neither the technical need nor the political support in Congress for renewed U.S. nuclear weapons testing. Yet until the Senate consents to ratification, the treaty cannot enter into force. In the current state of limbo, the United States is denying itself the national security and political benefits of the treaty, which are to compel other nations to stop testing and to fully implement the treaty's verification system to detect and deter

Table 1. Purposes and Plausible Achievements for Testing at Various Yields

In its 2002 report, *Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty,* the National Academy of Sciences summarized the utility of nuclear tests at various yields. The NAS concluded that:

> Those countries that are best able to successfully conduct … clandestine testing already possess advanced nuclear weapons of a number of types and could add little, with additional testing, to the threats they already pose or can pose to the United States. Countries of lesser nuclear test experience and design sophistication would be unable to conceal tests in the numbers and yields required to master nuclear weapons more advanced than the ones they could develop and deploy without any testing at all.

Yield*	Countries of lesser prior nuclear test experience and/or design sophistication†	Counties of greater prior nuclear test experience and/or design sophistication
Subcritical testing only (permissible under a CTBT)	• Equation-of-state studies • High-explosive lens tests for implosion weapons • Development & certification of simple, bulky, relatively inefficient unboosted fission weapons	same as column to left, plus • limited insights relevant to designs for boosted fission weapons
Hydronuclear testing (yield < 0.1 t TNT, likely to remain undetected under a CTBT)	• one-point safety tests (with difficulty)	• one-point safety tests • validation of design for unboosted fission weapon with yield in 10-ton range
Extremely-low-yield testing (0.1 t < yield < 10 t, likely to remain undetected under a CTBT)	• one-point safety tests	• validation of design for unboosted fission weapon with yield in 100-ton range • possible overrun range for one-point safety tests.
Very-low-yield testing (10 t < yield < 1–2 kt, concealable in some circumstances under a CTBT)	• limited improvement of efficiency & weight of unboosted fission weapons compared to 1st-generation weapons not needing testing • proof tests of compact weapons with yield up to1-2 kt (with difficulty)	• proof tests of compact weapons with yield up to 1-2 kt • partial development of primaries for thermonuclear weapons
Low-yield testing (1–2 kt < yield < 20 kt, unlikely to be concealable under a CTBT)	• development of low-yield boosted fission weapons • eventual development & full testing of some primaries & low-yield thermonuclear weapons • proof tests of fission weapons with yield up to 20 kt	• development of low-yield boosted fission weapons • development & full testing of some primaries & low-yield thermonuclear weapons • proof tests of fission weapons with yield up to 20 kt
High-yield testing (yield >20 kt, not concealable under a CTBT)	• eventual development & full testing of boosted fission weapons & thermonuclear weapons	• development & full testing of new configurations of boosted fission weapons & thermonuclear weapons

* t = tons, kt = kilotons TNT equivalent

† That is, lacking an adequate combination of nuclear-test data, advanced instrumentation, and sophisticated analytical techniques, and without having received assistance in the form of transfer of the relevant insights.

violations. The United States has already assumed most CTBT-related responsibilities, but it cannot reap the full security and political benefits until the Senate approves the treaty.

The United States has more to gain from the CTBT than any other nation. It has the safest, most reliable, and most capable nuclear arsenal in the world.[17] The United States has conducted 1,030 nuclear tests, more than all other nations combined (1,022), including Russia (715) and China (45). Given this quantitative and qualitative advantage, it is in U.S. national security interests to prevent other nations from testing.

According to former Defense Secretary William Perry, "the capability the United States has to maintain confidence in nuclear weapons without testing far exceeds that of any other nation…we of all nations are the least ones that are going to be needing testing to maintain our confidence, and therefore are the last ones that should be arguing that we would need to test in order to maintain our deterrence."[18]

New Since 1999

- **The UN Security Council unanimously adopted a resolution on September 24, 2009, calling on all states to sign and ratify the CTBT and to refrain from conducting tests until the treaty enters into force.**
- **Global efforts to stop the spread of nuclear weapons are in jeopardy. The nuclear Nonproliferation Treaty (NPT) has grown weaker after years of neglect by the nuclear-weapon states. Unpredictable nations such as North Korea and Iran are advancing their nuclear programs. Terrorist groups are seeking nuclear weapons.**
- **The CTBT has been ratified by France, Russia, and the United Kingdom—151 nations in all. U.S. ratification of the CTBT is widely recognized as an essential first step to rebuilding the NPT and advancing global nonproliferation efforts. The NPT is the key international agreement aimed at stopping the spread of nuclear weapons to other nations and to terrorist groups.**

Key Points

- **The CTBT will prevent aspiring nuclear states, such as North Korea and Iran, from confidently developing advanced types of nuclear weapons that would pose a greater threat to the United States.**
- **The treaty will help prevent Russian and Chinese development of nuclear weapons based on new designs and will prevent Beijing from developing miniaturized nuclear warheads for its ballistic missiles, thereby avoiding a new threat to the United States.**
- **U.S. ratification of the CTBT will help restore U.S. global leadership and strengthen international support for the NPT. In 1995 the United States and the other nuclear powers promised to achieve the CTBT in exchange for the indefinite extension of the NPT, a good deal that must be honored. Visible progress toward U.S. ratification of the CTBT before the May 2010 NPT Review Conference will be important to achieving agreement on new measures to strengthen global nonproliferation rules.**
- **Entry into force of the test ban treaty would make it easier to mobilize domestic and international support for dealing with suspected nuclear tests and for responding vigorously if any nation conducts a nuclear test.**
- **The United States has not conducted a nuclear test for almost 20 years, and the need for future testing is highly unlikely. It is in the U.S. interest to ensure that other nations are not conducting nuclear tests. Widespread testing would put the NPT system at risk.**

SECTION 2

The United States Does Not Need Nuclear Tests to Maintain Its Arsenal

The U.S. nuclear deterrent remains safe, secure and reliable; no one should doubt our capabilities or our resolve to defend U.S. and allies' interests by deterring aggression.

—**Secretary of Defense Robert Gates**, January 2009

Lifetimes of today's nuclear warheads could be extended for decades, with no anticipated loss in confidence.

—**JASON Report on "Lifetime Extension Program,"** September 2009

During the Cold War, the United States conducted more than 1,000 nuclear tests, primarily to develop new types of nuclear warheads of ever-increasing sophistication. Once new nuclear warheads were certified and introduced into the stockpile, they were rarely if ever tested again.

In 1992, President Bush halted nuclear testing for the purpose of developing new weapons. Almost 20 years later, the United States has not conducted a nuclear test, even though Congress specifically authorized 15 additional tests in 1992. The United States did not sign the CTBT until 1996, the Senate rejected it in 1999, and the George W. Bush administration actively opposed the treaty. Nuclear testing has not been resumed because once the development of new types of weapons ended, there was no need to test and compelling national security reasons not to test.

Test ban critics claim that nuclear tests are needed throughout the stockpile life of a warhead and that if the United States cannot test, it cannot maintain its arsenal. In fact, nuclear tests have never been used for maintaining the arsenal or "spot-checking" warheads. So-called stockpile confidence tests involved new warheads, not old ones, and are better described as "production verification tests."[19] According to a 2002 National Academy of Sciences (NAS) study, whose participants included former directors of Los Alamos and Sandia National Laboratories, "Even in the absence of constraints on nuclear testing, no need was ever identified for a program that would periodically subject weapons to nuclear tests."[20]

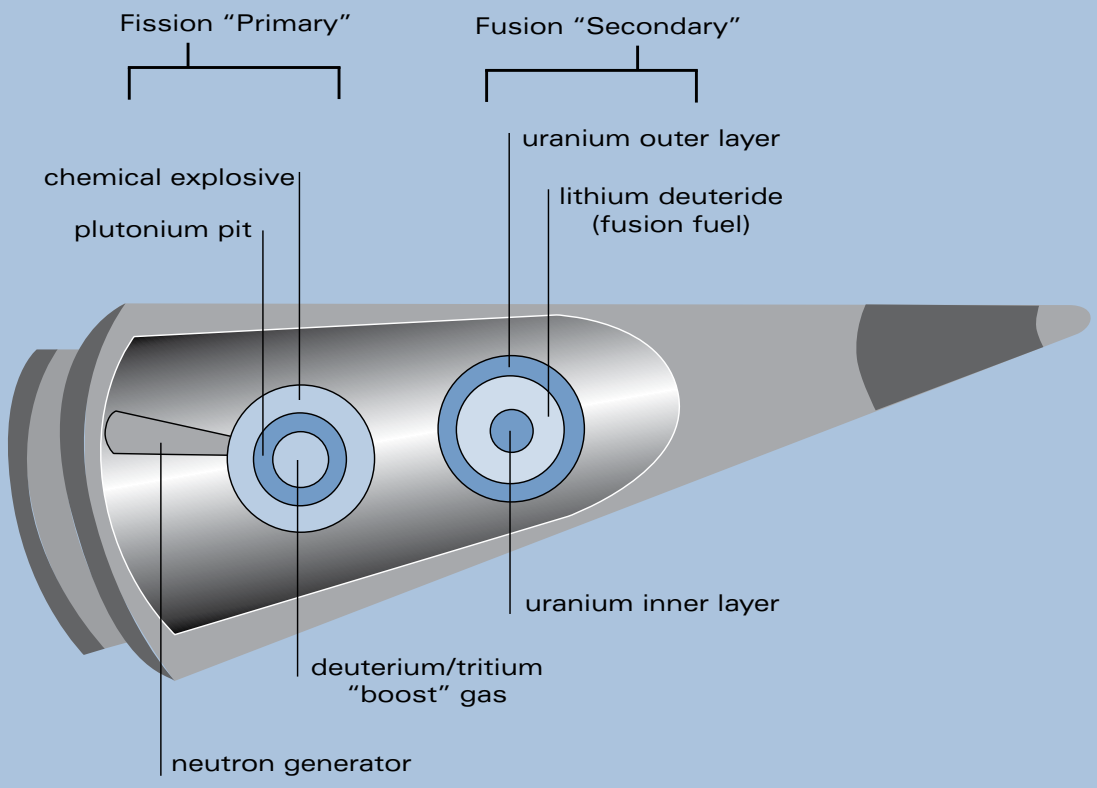
Maintaining the existing nuclear arsenal without nuclear testing is not new—it is the way it has always been. What is new is that warheads are no longer being replaced at regular intervals and are staying in the arsenal longer than originally planned. This is a manageable challenge.

Stockpile Stewardship

The Department of Energy's Stockpile Stewardship Program (SSP) started in earnest soon after the United States halted nuclear testing in 1992. The program has resulted in annual certifications of U.S. warheads as safe and reliable and has been so effective that the Energy Department's National Nuclear Security Administration (NNSA), which oversees the SSP and the U.S. nuclear weapons complex, noted in 2008 that "[t]he scientific and analytical tools of stockpile stewardship (which were not available to [the] previous generation of designers) have led to a much better understanding of the intricacies of nuclear weapons operation. We know more about the complex issues of nuclear weapons performance today than we ever did during the period of nuclear testing."[21]

The primary job of maintaining the existing arsenal is surveillance: observing warhead parts

Figure 3. Interior View of a Thermonuclear Weapon



Source: Amanda Wait/Union of Concerned Scientists

closely for signs of degradation that might justify refurbishment. The SSP includes a surveillance program that removes actual warheads from the stockpile, takes them apart, inspects individual parts, and if all is well, puts them back together. Some warhead parts are destructively examined and have to be replaced. This process takes on greater importance as the arsenal ages and more age-related defects can be expected to be found. According to the NAS report, however, "[N]uclear testing is not needed to discover these problems and is not likely to be needed to address them."[22]

A typical U.S. nuclear warhead has approximately 6,000 individual parts. Of these, only those parts in the weapon's primary and secondary—the nuclear components—would be subject to testing limitations under the CTBT. The non-nuclear parts of the warhead and its delivery system can be fully tested under the test ban.

Lifetime Extension Program

The Lifetime Extension Program refurbishes warheads and recertifies them to extend their service life beyond original expectations. Through the LEP, the NNSA has refurbished the W87 Minutemen warhead and the B61-7/11 strategic bomb; is in the process of refurbishing 2,000 W76 Trident D5 missile warheads; is planning to refurbish the W80-1 cruise missile warhead, the B83 strategic bomb, and the B61 tactical bomb; and is evaluating a common approach to life extension for the W78 Minutemen and W88 Trident D5 missile warheads.[23] LEP refurbishment involves swapping older warhead parts with new ones of nearly identical design or that meet the same "form, fit, and function," according to the NNSA. LEPs generally involve the non-nuclear parts of warheads and the lithium-deuteride secondary components, also known as "canned subassemblies".[24] So far, LEPs have not refurbished nuclear primaries, which contain plutonium cores, or "pits." The NNSA has concluded that pits can last 85 to 100 years or more (see below).

The NNSA has shown that it can deal with unexpected hiccups in the LEP process. For example, when the NNSA set out to refurbish the W76 warhead, it realized it could not immediately produce a key classified material, to which the NNSA refers only as "Fogbank." The NNSA first sought to re-create Fogbank but ran into difficulties. It then sought to produce an alternative material. In the end, it succeeded in doing both. According to the

NNSA, "The newly produced Fogbank has been demonstrated to achieve its design requirements. The Fogbank being produced today is as good as, if not better, than the original product."[25]

How Long Do Warheads Last?

The fact that warheads are no longer replaced by new designs means that the average age of existing plutonium pits (but not necessarily the non-nuclear parts, or secondaries, which are being refurbished) will increase beyond previous experience. The performance of the primary is the key factor that determines the overall performance of the warhead, so concerns about warhead aging typically focus on the primary's plutonium pit. Fortunately, pits can last much longer than previously thought.

When the CTBT was considered by the Senate in 1999, the Energy Department estimated that plutonium pits would last roughly 45 to 60 years. Given that the average stockpile age at that time was approximately 15 years, one might have expected to see aging effects in 30 years or so, or by 2030.

In late 2006, however, using tools in the SSP, the Lawrence Livermore and Los Alamos National

Table 2. U.S. Nuclear Stockpile, 2010

Weapon System/Warhead	Year Deployed[a]	Estimated Number Deployed[b]	Lifetime Extension Program (LEP) Status[c]	Modern Safety Features[d]	Notes
ICBMs: Minuteman III, Air Force					
W78	1979	350	Begin 2011	EEI	Being partially replaced by W87
W87	1986	200	Completed 2004	EEI, IHE, FRP	Lifetime extended 20–30 years
SLBMs: Trident II D5, Navy					
W76	1978	768	2006 though 2021	EEI	Lifetime extended 30 years
W88	1989	384	Begin 2020	EEI	Production resumed 2007
Strategic Bombers: B-52H and B-2, Air Force					
B61-7/11 Bomb	1985	85	Completed 2009	EEI, IHE	Lifetime extended 20 years
B83 Bomb	1983	65	Begin 2010	EEI, IHE, FRP	In storage
W80-1 Cruise Missile	1982	350	Begin 2013	EEI, IHE	In storage
Tactical Forces: Tactical Aircraft, Attack Submarines					
B61-3/4/10 Bomb, AF, NATO	1979	400	Begin 2011	EEI, IHE	In storage
W80-0 Cruise Missile, Navy	1984	100	No plans	EEI, IHE	In storage
Total Stockpile		~2,700			

a. National Nuclear Security Administration, *Maintaining the US Nuclear Arsenal Through Forefront Science, Technology and Engineering,* viewgraphs by Dr. Allan A. Hauer and Dr. Robert Hanrahan, August 12, 2009.

b. "US Nuclear Forces, 2009," *Bulletin of the Atomic Scientists,* March/April 2009. In addition to the 2,700 deployed warheads, there are approx. 2,500 warheads in reserve and approx. 4,200 retired warheads awaiting dismantlement.

c. National Nuclear Security Administration, FY08 Refurbishment Planning Schedule, as of Jan. 25, 2008 and Department of Energy, FY2011 Congressional Budget Request, Vol. 1, Feb. 2010.

d. Lawrence Livermore National Laboratory, *Report to Congress: Assessment of the Safety of U.S. Nuclear Weapons and Related Nuclear Test Requirements,* R.E. Kidder, July 26, 1991. EEI=Enhanced Electrical Isolation, IHE=Insensitive High Explosive, FRP=Fire-Resistant Pit.

Laboratories concluded that the plutonium pits in current nuclear weapons have a shelf-life of 85 to 100 years or more. This conclusion was endorsed by JASON and by the NNSA. "These studies show that the degradation of plutonium in our nuclear weapons will not affect warhead reliability for decades," said then-NNSA Administrator Linton Brooks. "It is now clear that although plutonium aging contributes, other factors control the overall life expectancy of nuclear weapons systems."[26] Based on the new estimates, plutonium parts in the 2010 stockpile will not be facing significant aging issues for roughly 50 years or more.

Plutonium pits may eventually need to be refurbished, and a limited production process has already been established. When the Rocky Flats Plant in Colorado, the main U.S. pit production site, was shut down in 1989 for safety reasons, it had not yet completed production of plutonium pits for the W88 warhead. The Energy Department decided to re-establish pit production at Los Alamos' TA55 using a different process (mold casting at Los Alamos, wrought production at Rocky Flats), and, after significant effort, succeeded. According to the NNSA, "[T]he recent success of the TA55 pit production capability demonstrated that the process of qualifying the manufacture of a known pit design is possible."[27] NNSA resumed W88 pit production at Los Alamos in 2007.[28]

It would still be prudent to increase the performance margins of existing warheads in ways that do not require nuclear tests. The most likely source of an age-related problem that could affect warhead performance is a primary yield that falls below the minimum needed to "drive" the secondary to full yield. Primary yield margins can be increased by measures relating to tritium, a gas used to boost the yield of the primary. For example, because tritium decays 5.5 percent per year, increasing the frequency of tritium replacements can increase the performance margins of the primary.[29]

New Warhead Designs?

Some have argued that making small changes to warheads to address aging issues may over time lead to the inability to certify the warhead's overall performance. For example, Defense Secretary Robert Gates told the Air Force Association in September 2009 that, "in one or two cases," the United States would "probably" need "new [warhead] designs that will be safer and more reliable."

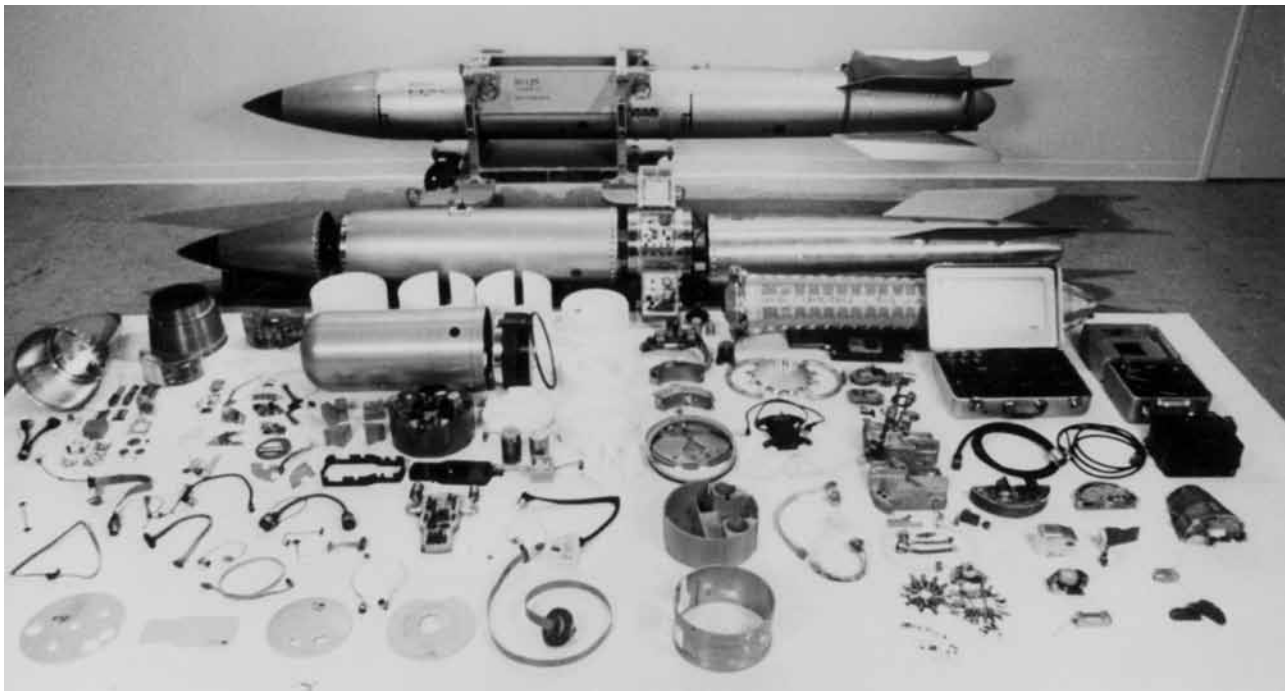
Yet, the 2009 JASON study on the LEP found no basis for concern that warhead aging and efforts to address it reduce reliability. The panel, which had access to classified nuclear weapons data, found "no evidence that accumulation of changes incurred from aging and LEPs have increased risk to certification of today's deployed nuclear warheads" and that current U.S. warheads could last "for decades, with no anticipated loss in confidence, by using approaches similar to those employed in LEPs to date."[30]

"The JASON study offers yet more evidence that the United States can maintain a safe, secure, and effective nuclear arsenal without resorting to nuclear tests," an Obama administration official said in a November 20, 2009, interview with the authors. "The burden of proof is now on CTBT skeptics to lay out why the United States must continue to plan for future testing when we have not tested for almost two decades and our weapons experts enjoy a greater understanding of how our nuclear weapons work than at any previous time, thanks to the demonstrable successes of our Stockpile Stewardship Program," the official said.

Although the JASON report should put concerns about warhead reliability to rest, it points out that current warheads do not have the latest "surety" systems, a term that encompasses safety, security, and use control. This discussion goes back to 1992, when President Bush approved a congressionally mandated moratorium on nuclear tests and, at the same time, authorized additional tests for safety and security purposes. Those tests were never conducted because the Air Force and the Navy determined that the marginal improvements were not worth the budgetary cost of deploying the new systems. Two decades later, those cost-benefit analyses may be changing. The September 11 terrorist attacks and the August 30, 2007, incident in which the Air Force lost track of six nuclear cruise missiles have focused attention on the potential vulnerability of nuclear weapons to theft. The U.S. military may now be more willing to make operational changes to prevent terrorist acquisition and possible use. According to the U.S. Strategic Command, the "current stockpile is not designed to address [the] potential for nuclear terrorism."[31]

However, the 2009 JASON report did not endorse the need for surety improvements but instead found that "[f]urther scientific research and engineering development is required." The panel noted that implementation of "intrinsic" surety features, i.e., those inside the nuclear explosive package, would require "reuse or replacement" options. Such changes could not be made through typical "refurbishment" of existing designs. Instead NNSA would have to "reuse" surplus nuclear parts with modern safety features or develop new "replacement" designs.

Reuse options exist for improving the surety of nuclear weapons carried by strategic bombers, the panel found. This is likely a reference to a safety feature known as a fire-resistant pit, which is intended to prevent the dispersal of plutonium during an aircraft fire. This feature is used in the most recently



U.S. Department of Energy

A typical U.S. nuclear warhead has approximately 6,000 parts, of which only the nuclear components would be subject to testing limitations under the CTBT. A B61 gravity bomb is pictured.

developed weapons, including the W87 warhead and the B83 strategic bomb. The tested primaries of these weapons or others in reserve could be "reused" in combination with other warhead parts.

Unlike intrinsic safety, intrinsic security and use control options do not generally exist in the current arsenal and would require new designs. According to STRATCOM, a "small percent of [the] stockpile has internal disablement features to prevent unauthorized use." Concepts under consideration are highly classified, but STRATCOM refers to "Active Protection Systems" that presumably involve ways to prevent a stolen nuclear warhead from being detonated, such as by deforming the pit so it is no longer spherical and thus unable to implode correctly. This approach may still leave enough plutonium available for reforming into a sphere, so another approach could be to disperse the plutonium fully with explosives, but without nuclear detonation, in such a way that the material could not be recovered.

Because these approaches would require new warhead designs, JASON noted that upgrading intrinsic surety features would "require more than a decade to complete," as almost the entire arsenal would need to be replaced. At the NNSA's planned surge production rate of 125 warheads a year, it would take 20 years to replace 2,500 warheads. This production rate for pits is not likely to be achieved until roughly 2020, however, when the new Chemistry and Metallurgy Research Replacement is planned for operation at Los Alamos National Laboratory. The current production rate for plutonium pits at Los Alamos is only 10 to 20 per year.[32] As a result, in the next decade, at most 200 warheads could be upgraded with intrinsic surety, and the entire project would likely take 20 to 30 years to complete, depending on the scale of the effort.

There are other, much faster approaches to surety than rebuilding the nuclear stockpile, such as increasing physical security around nuclear weapons, centralizing their storage, and removing them from forward deployment. In 1991, President Bush did this with nonstrategic nuclear weapons when he announced that the United States would remove almost all tactical nuclear forces from deployment so that Russia could undertake similar actions, reducing the risk of nuclear theft. President Bush also took strategic bombers off alert and transferred their nuclear weapons into storage. These steps were taken in a matter of weeks or months, not years or decades.

Even if the United States were to begin a decades-long effort to produce new warheads with intrinsic surety, which were theoretically perfect against misuse, terrorists in the meantime could target the large supply of older weapons; the surety of the entire system would not increase much until all warheads were replaced. "Of course, a U.S. [surety optimized warhead] does nothing to increase the surety of Russian or Pakistani weapons," noted JASON member Dick Garwin. "Encouraging other nations to develop [new weapons designs] or their equivalent is not something that should be advocated, although they should take steps to increase the surety of existing weapons."[33]

At a minimum, the United States should not pursue surety improvements in ways that increase the risks of nuclear proliferation or reduce confidence in the reliability of the stockpile. After all, the greatest security concerns relate not to U.S. nuclear weapons but to those in Pakistan, Russia, and other nations. If the United States were to rebuild its arsenal in ways that undercut the credibility of U.S. nonproliferation commitments, it could lead to greater proliferation risks and a net loss in global nuclear security.

Concerns along these lines were recently raised by the International Commission on Nuclear Non-proliferation and Disarmament, which stated in its December 2009 report that "[e]ven if the CTBT were not directly breached, it would raise questions about its value—and certainly undermine the presentational impact worldwide of U.S. ratification of it—if new weapon designs could be developed, especially ones with a new military role."[34]

New Since 1999

- **Over the past decade, the success of the Stockpile Stewardship Program (SSP) has demonstrated that the nuclear arsenal can be effectively maintained under a CTBT. Successful Life Extension Programs (LEPs) have shown that weapons can be refurbished and recertified without nuclear testing.**
- **In a September 2009 report, JASON, a panel of senior defense scientists, found that "[l]ifetimes of today's nuclear warheads could be extended for decades, with no anticipated loss in confidence," using approaches similar to the current LEP and without nuclear testing. JASON also found "no evidence that accumulation of changes incurred from aging and LEPs have increased risk to certification of today's deployed nuclear warheads."**
- **In May 2008, former Los Alamos National Lab director Siegfried Hecker testified before the Senate, "I definitely come out in favor that it's in our nation's and the world's interest to actually ratify the [CTBT]."**
- **The National Nuclear Security Administration (NNSA) concluded in 2006 that plutonium parts in nuclear warheads can last at least 85 to 100 years, decades longer than previously assumed. With a current average stockpile age of 25 years, existing plutonium parts may not need refurbishment for 50 years or more. There is ample time to refurbish these parts as needed.**
- **In 2003, the NNSA demonstrated the ability to produce new plutonium parts and began new production in 2007.**
- **Confidence in the reliability of U.S. warheads has been increased by improving boost gas systems, which does not require nuclear testing.**
- **The Obama administration has proposed a 10 percent increase for National Nuclear Security Administration stockpile programs for fiscal year 2011 to ensure the nuclear weapons complex has "state-of-the-art facilities, highly-trained and motivated people that allow us to maintain our arsenal without testing."**

Key Points

- **Every year since 1994, each warhead type in the U.S. nuclear arsenal has been determined to be safe and reliable through a rigorous certification process instituted following the end of U.S. nuclear testing.**
- **Maintaining confidence in the reliability of proven U.S. nuclear warhead designs does not depend on a program of nuclear test explosions. In fact, nuclear testing has never provided a statistical basis for confidence in the nuclear stockpile. Historically, stockpile surveillance has served this propose and will continue to do so.**
- **Maintaining the existing nuclear arsenal without nuclear testing relies on well-established methods. That warheads are no longer being replaced with new designs at regular intervals and are staying in the stockpile longer than originally planned is a manageable challenge.**
- **The U.S. nuclear stockpile can be maintained through non-nuclear tests and evaluations, combined with the refurbishment of key nuclear components to design specifications.**
- **There is greater confidence in previously tested warhead designs that have been refurbished than in new designs that have not been tested. Building new-design warheads, such as envisioned under the Reliable Replacement Warhead (RRW) program, does not make sense. Moreover, concerns about the "surety" of nuclear weapons can be addressed without nuclear tests.**
- **Section 3143 of the fiscal year 2003 Defense Authorization Act defines a "new nuclear weapon" as a nuclear weapon "that contains a pit or canned subassembly" not in the stockpile or in production as of 2002.**
- **In the highly unlikely event that the United States concluded that a nuclear test was needed for national security reasons, it can exercise its right under the CTBT's "supreme national interest" withdrawal clause and resume testing.**

SECTION 3

The Comprehensive Test Ban Treaty Is Effectively Verifiable

As of now, the [Comprehensive Test Ban Treaty Organization] is capable of performing the monitoring mission given to it by the Treaty. And as of tomorrow, no State will be able to carry out a nuclear test without the knowledge of the international community.

—**Bernard Kouchner**, Foreign Minister of France, September 2009

The goal for any treaty monitoring regime is to provide effective verification. It is generally recognized that no verification system gives absolute assurances. Effective verification means that any attempts to cheat in ways that could threaten U.S. national security must be uncovered in a timely manner. Describing this concept in the context of the Intermediate Nuclear Forces Treaty, Ambassador Paul Nitze said, "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."[35]

If CTBT parties know the treaty is effectively verifiable, cheating would be deterred because the potential gains of a nuclear test that might escape detection would be small (not militarily significant) and the potential costs would be high in terms of international reaction and the possibility of sanctions and military measures in response. The goal of the CTBT verification system is thus not only to detect significant cheating, but to *deter violations in the first place* by convincing potential cheaters that the risks and costs of cheating outweigh any plausible benefits.

Global Alarm System

The CTBT established the International Monitoring System (IMS) to detect potential nuclear explosions using four primary technologies: seismic, hydroacoustic, radionuclide, and infrasound. Since 1999, 160 additional IMS stations have been built and, of the planned 337 IMS facilities, to date 276 have been built and 28 are under construction. New technologies such as InSAR (Interferometric Synthetic Aperture Radar) can now pinpoint the location of an explosion within 100 meters. An International Data Center based in Vienna collects and analyzes information from the IMS and disseminates the raw and processed data to member states for their own evaluation.

The nuclear-weapon states are well monitored, with 32 IMS sites in Russia, 12 in China and 39 in the United States. The South American cone has 23 sites in Argentina, Brazil, and Chile. North Korea is well covered with 23 sites in China, Japan, and South Korea. The Middle East has 17 sites. India and Pakistan are surrounded with more than 40 sites in Australia, Bangladesh, China, Sri Lanka, and Thailand. To these assets must be added the IMS sites not listed here, hundreds of seismographs that are not part of the IMS, and additional data from U.S. intelligence services.[36]

Importantly, the CTBT recognizes the right of the United States and others to monitor compliance using their own highly sophisticated satellites and other national technical means (NTM). In the United States, the Air Force Technical Applications Center (AFTAC) operates a global network of nuclear event detection sensors called the U.S. Atomic Energy Detection System (USAEDS). This system can detect a suspicious event underground, underwater, in the atmosphere and in space. In addition to the CTBT, AFTAC

monitors compliance with the 1963 Limited Test Ban Treaty, the 1974 Threshold Test Ban Treaty, and the 1976 Peaceful Nuclear Explosions Treaty.[37]

In the event of a suspected nuclear explosion that cannot be resolved by remote sensing, once the CTBT is in force states may call for short-notice, on-site inspections (OSIs) of a suspected test location. The Preparatory Commission for the Comprehensive Test Ban Treaty Organization (CTBTO) in Vienna has been conducting field exercises to test different on-site inspection methods. In September 2008, it carried out a simulated on-site inspection at the former Soviet nuclear test site at Semipalatinsk, Kazakhstan, which demonstrated that the organization has the capacity to conduct a real OSI once the treaty is enacted. On-site inspection requests can be based on IMS data or solely on a state's national intelligence data.

According to the 2002 NAS report, the entire international monitoring regime can detect and identify with high confidence (90 percent probability) underground nuclear explosions with a yield of one kiloton or more worldwide, and in specific regions, it can do much better. Across Asia, Europe, North Africa, and North America, underground tests with a yield as small as 0.1 kiloton (100 tons) can be reliably detected. At Novaya Zemlya, Russia's former nuclear test site, underground tests of 0.01 kiloton (10 tons) or less can be detected. Atmospheric explosions can be detected with high confidence anywhere on the globe from 500 tons to 1 kiloton, and underwater ocean explosions as small as 1 ton or less.[38]

Tests even below these levels can be detected. Test preparations may be revealed by satellites or informants. Underground tests may "vent," releasing radioactive materials that can be detected after the fact, even if no seismic signal is registered. For example, 90 percent of Soviet underground tests at Novaya Zemlya vented, as did 40 percent of all Soviet tests. In the United States, 17 percent of underground tests since 1970 released radioactive materials into the atmosphere.[39]

North Korean Tests

North Korea provided two recent real-world tests of the CTBT verification system. In October 2006, the IMS detected North Korea's relatively low-yield (0.6 kiloton) nuclear explosion at 22 seismic stations and had a solid estimate of its location within five hours of the event. Radionuclides from this test were detected in South Korea and 4,600 miles away in Yellowknife, Canada.

The second North Korean test on May 25, 2009, with a yield of two to three kilotons, was detected by 61 seismic stations. No radionuclides were detected from this test, a surprising outcome given the 2006 test and that many tests vent radioactive gases. Although a potential violator cannot count on perfect containment, the seismic evidence alone would

Figure 4. The International Monitoring System

As of 2010, 90 percent of the planned 337 international monitoring stations (including seismic, hydroacoustic, radionuclide, and infrasound) are complete or under construction, compared to only 25 percent in 1999. Significant progress has been made since 2006, as shown below.

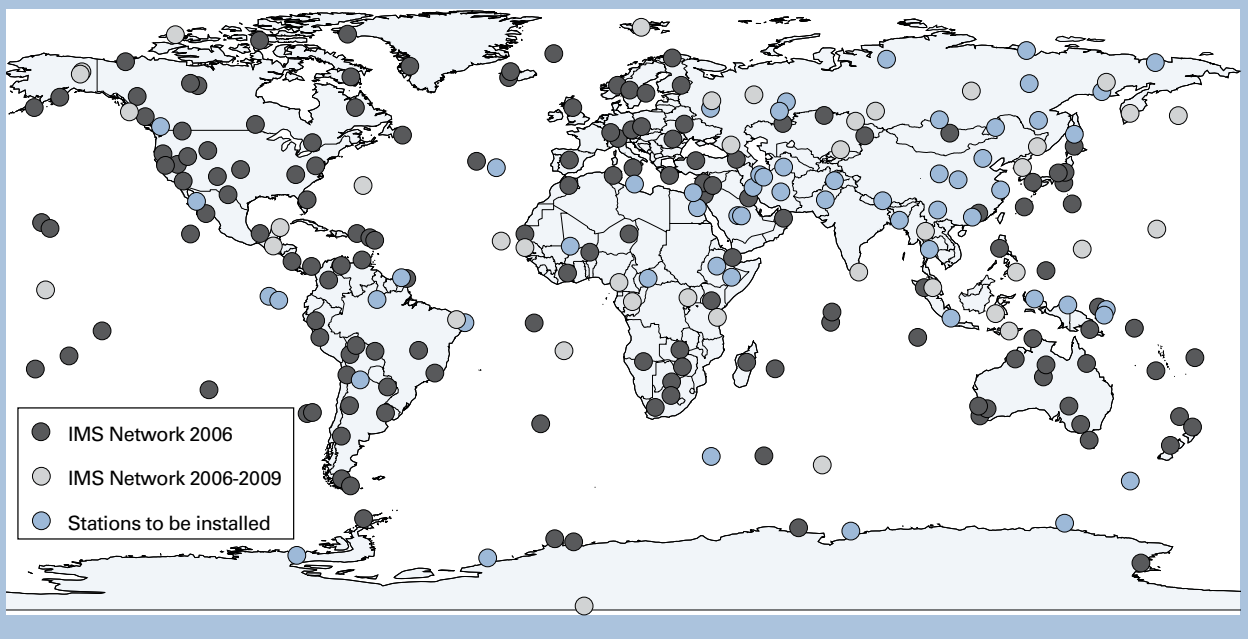
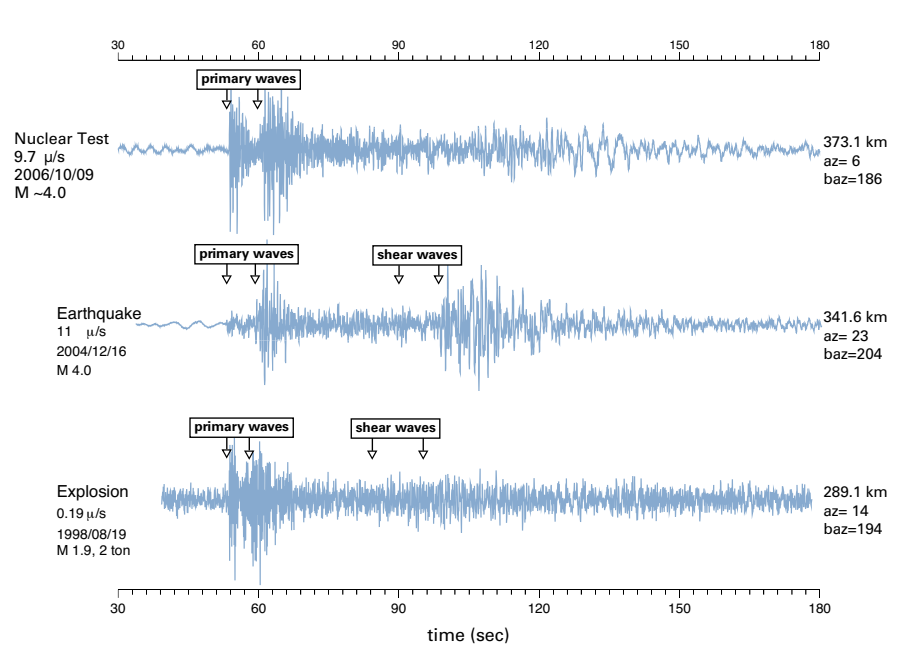


Figure 5. Identifying Low Yield Explosions: The North Korean Example

Seismograms of the October 9, 2006 North Korean test show that nuclear explosions can be differentiated from earthquakes. The graphic below depicts seismograms recorded in northeast China from the North Korea nuclear test (top); from an earlier nearby earthquake (middle); and from a small chemical explosion (bottom). The nuclear test (magnitude 4, approximately 0.6 kilotons) can be distinguished from the earthquake (magnitude 4) by the fact that the nuclear test has stronger primary waves and weaker shear waves. The primary wave amplitude oscillates in the direction the wave travels, whereas the shear wave amplitude oscillates at right angles to the travel direction, such as a "wave" at a sporting event where people oscillate up and down but the wave travels horizontally. The nuclear test can be differentiated from a two-ton chemical explosion (magnitude 1.9) with a similar pattern of primary and shear waves by the fact that the chemical explosion's seismic signal at this station is of lower quality and is about fifty times smaller than the nuclear test. Combining seismic data with other tests, such as air sampling for radionuclides, indicates that nuclear explosions below 0.010 kiloton yield (below 10 tons yield) could be detected in the region.



Source: Paul Richards and Won-Young Kim, "Seismic Signature," *Nature Physics* (2007); "North Korean Nuclear Test: Seismic Discrimination at Low Yield," *EOS* (2007).

have provided a firm basis for on-site inspections. The treaty specifies an area of up to 1,000 square kilometers for an inspection, and the seismic data located the test well within this limit. According to the CTBTO, "The data would have provided a clear lead to the inspection team regarding where to look."[40]

Cheating Scenarios Unlikely

In its 2002 report, the NAS examined 10 evasion scenarios suggested by the U.S. intelligence community and concluded that the only potentially credible ones are cavity decoupling and mine masking. Neither withstands close scrutiny. The most commonly cited concern in the 1999 Senate debate was cavity decoupling, in which a large underground cavity is used to muffle the shock wave from an explosion. During the debate, Senate Majority Leader Trent Lott (R-Miss.) mistakenly claimed that a 70-kiloton explosion in a cavity could be hidden from IMS detection. In practice, this would require a 200-meter-wide cavity equal to the height of a 50-story building. No such cavity has ever been built, and it would be essentially impossible to do so without anyone noticing. In addition, the need to conduct multiple tests for weapons development would increase the risk of detection even if a cavity were used. The former chairman of India's Atomic Energy Commission, P.K. Iyengar, said recently that "nobody makes a weapon out of a single test."[41]

Getting away with cheating would be no simple matter. It is unlikely that a state could simultaneously overcome all of the technical hurdles listed below and conduct a test having a significant yield. Even if each of these tasks could be carried out with a 90 percent chance of success, there would be a cumulative 50 percent chance of not getting caught for one test and only a 15 percent chance that three tests would not be discovered.

1) Violators must avoid significant yield excursions. All successful first tests, if they had been carried out in a cavity, would be detected by the IMS: United States (21 kilotons), Soviet Union

Figure 6. Was it a Nuclear Test?

Below are the steps that would be taken if an on-site inspection were launched under the Comprehensive Test Ban Treaty (CTBT).

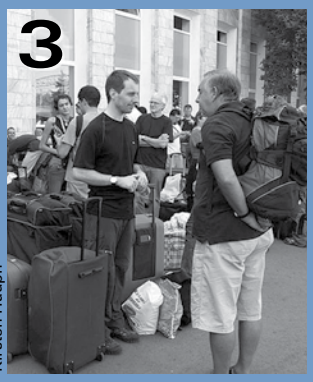
1

A suspicious event is detected. A CTBT state-party requests an on-site inspection to clarify whether a nuclear test explosion has taken place in violation of the treaty.

2

The CTBTO director-general transmits the on-site inspection request to the state-party that is to be inspected and requests clarification for suspicious event. The Executive Council immediately begins consultations and votes on the request no later than 96 hours after it was filed. If at least 30 of the 51 Executive Council member states vote in favor, the inspection is approved and the inspected state-party cannot refuse the request.

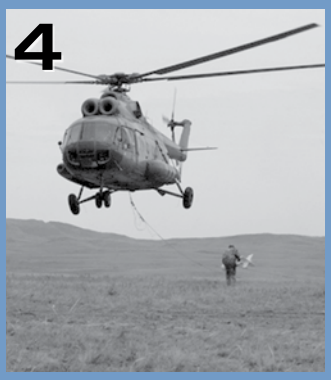
3



Kirsten Hauph

The inspection team begins assembling and arrives at the point of entry in the inspected state-party no later than seven days after on-site inspection request has been filed. No later than 72 hours after the team has arrived at the point of entry, the inspection begins.

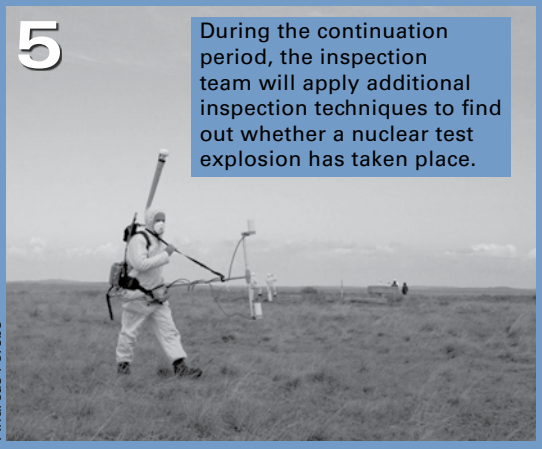
4



Andreas Persbo

During the initial inspection period, the inspection team will try to narrow down the inspection area, which has a maximum size of 1,000 square kilometers. No later than 25 days after the inspection request was filed, the team will send a progress inspection report to the Executive Council. Unless a majority of the council decides not to continue the inspection, the next phase begins.

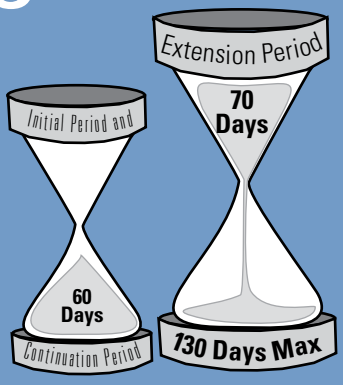
5



Andreas Persbo

During the continuation period, the inspection team will apply additional inspection techniques to find out whether a nuclear test explosion has taken place.

6



The continuation period ends no later than 60 days after the on-site inspection request was filed, but the inspection team can request that the Executive Council approve an extension of the inspection if it considers this to be essential to fulfil its task. If a majority of the council approves the request, the inspection can continue for a maximum of another 70 days. An inspection thus ends at the latest 130 days after the request for it was filed.

7

Kirsten Hauph

No later than 24 hours after the conclusion of the inspection, the inspection team will meet with the inspected state-party to review the preliminary findings document, which the inspectors can then submit to the director-general. The inspection report will be written and transmitted to the Executive Council as soon as possible after the team has departed from the inspected state-party. Should the council come to the conclusion that a nuclear test explosion has been conducted in violation of the treaty, the CTBT conference of states-parties can either recommend collective actions, such as sanctions, or bring the issue to the attention of the United Nations Security Council.

(20 kilotons), United Kingdom (25 kilotons), France (65 kilotons), India (12 kilotons), Pakistan (9 kilotons), North Korea (0.6 kilotons observed by 22 IMS stations in October 2006).

2) The materials removed to create a test shaft and cavity must be hidden from satellites.

3) Crater and surface changes due to testing must be hidden from space-based InSAR, a remote sensing technique that uses radar satellite images and other technologies. The Indian, North Korean, and Pakistani test sites were located with commercial satellite images.

4) Practically all the radioactive gases and particles must be trapped. Detectors on airplanes can fly into radionuclide plumes.

5) Cheaters must avoid detection of weak seismic signals by closer stations and arrays; and

Table 3. Tools for Comprehensive Test Ban Treaty Verification

The following array of technologies and assets provides capabilities to detect potential violations of the Comprehensive Test Ban Treaty (CTBT). They could be further enhanced with various means of national intelligence and monitoring, such as satellites. Together, these capabilities make the CTBT "effectively verifiable."

Technology/Method	Description	IMS Assets (When Completed)
Seismic	The National Academy of Sciences (NAS) concluded this technology can detect explosions above 0.1 kilotons in Asia, Europe, North Africa, and North America. International Monitoring System (IMS) arrays and regional seismology can do significantly better. Tests conducted in cavities can be detected if their yield is greater than 1-2 kilotons for advanced nuclear states and at much lower levels for other states.	The IMS will use 50 primary and 120 auxiliary seismic stations. In addition, 140 Global Seismic Network stations and more than 10,000 national and civilian research seismographic stations will produce relevant data that can be used to monitor and trigger an on-site inspection if so voted by the Comprehensive Test Ban Treaty Organization (CTBTO) Executive Council.
Hydroacoustic	The NAS says this technology can detect explosions with a few kilograms of explosive yield in the Southern Hemisphere and those explosions of less than 1 ton for all oceans.	The IMS will use six hydrophone arrays and five T-phase monitoring stations.
Infrasound	NAS says this technology can detect explosions with a yield of more than one kiloton for atmospheric nuclear explosions (0.5 kilotons over continents), with the ability to discriminate between chemical and nuclear explosions.	The IMS will use 60 infrasound monitoring stations.
Radionuclide	The NAS says this technology can detect tests with a yield of 0.1-1 kiloton. This number has fallen substantially in relation to radioactive particles and noble gases, which are keys to interpreting nuclear tests. The IMS detected the 0.6-kiloton October 2006 North Korean nuclear test at a distance of 7,000 kilometers.	The IMS will use 80 monitoring stations to detect particles; 40 of these detect radio-xenon. National technical means (NTM) sensors on airplanes have greater sensitivity because they can fly close to the test. NTM sensors can also be placed close to suspected test sites.
Inteferometric Synthetic Aperture Radar (InSAR)	This technology can measure subsidence of the earth by as little as 0.2-0.5 centimeters in many locations. Using InSAR, analysts can determine the location of a nuclear test within 100 meters.	The United States can use this technology with four classified Lacrosse satellites. Canada, European countries, and Japan also sell unclassified data that can be utilized for this purpose.
On-Site Inspections	Any CTBT state-party can request the CTBTO Executive Council to conduct an on-site inspection.	On-site inspections measure radioactivity and geological and other data.
Confidence-Building Measures	After the CTBT enters into force, states-parties could agree to locate sensors at known test sites. With such sensors, very low detection levels would be possible.	Close-in sensors could detect seismic, infrasound, electromagnetic-pulse, radionuclide, and other data indicative of nuclear test explosions.

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6) Cheaters must prevent detection by NTM, which are more powerful than the IMS at specific locations. Human intelligence must also be considered; it provided the locations of Iran's enrichment facilities and other clandestine sites. [42]

As for potential mine masking scenarios, where mining explosions would be used to "hide" a nuclear one, most chemical explosions in mines are ripple-fired and thus distinct from single-point nuclear explosions. A high-yield, singled-fired mine explosion is rare and would draw suspicion and inspection. Again, the need for multiple tests would increase the risk. The NAS study concluded that "taking all factors into account and assuming a fully functional IMS, we judge that an underground nuclear explosion cannot be confidently hidden if its yield is larger than 1 or 2 [kilotons]."[43]

What Is Militarily Significant?

Ultimately, the United States must be confident that no nation could alter the strategic balance between it and the United States through successful cheating under the CTBT. The NAS study concluded that it would be very difficult for states with less nuclear testing experience, such as India, Iran, North Korea, and Pakistan, to conduct small tests in secret because controlling yields of less than 1 kiloton is technically challenging. Moreover, the information that could be gained from tests in this yield range would have limited use for states that already have simple fission weapons. The NAS also found that states with extensive testing experience (China and Russia) would be more likely to succeed at clandestine testing but do not have the technical need to try, nor would such tests significantly alter the military threat they already pose.

In essence, the NAS study concluded that states that might benefit from cheating do not have the experience to pull it off, and states that could do so do not need to cheat. Moreover, nuclear explosions large enough to be useful for advanced weapons design would likely be detected by the IMS, while smaller tests that might escape detection would be much less useful.

For example, the 1995 JASON study concluded that, for the United States, arsenal tests with yields less than 500 tons are less important than the SSP for maintaining warheads, and tests at any yield less than that required to initiate boosting, including hydronuclear (the equivalent of four pounds of TNT or less) and 100-ton tests, are of limited value.[44]

When it considered ratification of START in 1994, the U.S. Senate concluded that potential violations were not militarily significant, meaning that Russia would gain little from cheating that would alter the U.S.-Russian strategic balance. By this same standard, the Senate should find the CTBT effectively verifiable as well.

New Since 1999

- **In 1999, only 25 percent of the planned International Monitoring System (IMS) facilities had been built. As of 2010, 90 percent of the planned global verification network was completed or under construction.**
- **National technical means (NTM) of verification have improved since 1999 and have greater capacity to detect and locate nuclear tests at sensitive locations than the IMS.**
- **During the Senate debate in 1999, some critics claimed that verification could only detect underground explosions at or above one kiloton in yield. In reality, nuclear test monitoring capabilities were much better than that in 1999 and have improved substantially in the last decade. North Korea's nuclear tests in 2006 and 2009 demonstrated that the CTBT monitoring system is working well and can detect tests well below one kiloton.**
- **The Global Seismic Network, a public partnership of seismic stations across the world that can supplement the IMS, now has more than 150 stations.**

Key Points

- **The United States has the most sophisticated national technical means of verification in the world. The CTBT verification system will add to this capability.**
- **Under the CTBT verification system, no would-be cheater could confidently conduct an undetected nuclear explosion large enough to threaten U.S. security. The verification system would detect militarily significant tests.**
- **According to the NAS, countries that are best able to successfully conduct clandestine tests already possess advanced nuclear weapons. Countries of lesser nuclear test experience would be unable to conceal tests in the numbers and yields required to develop more-advanced weapons.**
- **The United States' capability to detect and deter clandestine nuclear testing by other states will be significantly greater with the CTBT in force than without it. U.S. ratification of the CTBT is essential to making short-notice, on-site inspections possible and maintaining long-term political and financial support from other nations for the operation of the CTBT's monitoring system.**

SECTION 4

U.S. Ratification Will Encourage Entry Into Force

As we work with the Senate to ratify the CTBT, we will encourage other countries to play their part—including the eight remaining Annex 2 countries. Those who haven't signed should sign. Those, like us, who haven't ratified, should ratify.

—**Secretary of State Hillary Rodham Clinton**, September 24, 2009

U.S. ratification would be a circuit-breaker, having an immediate impact on the other CTBT hold-out states, and creating much new momentum in itself for the broader non-proliferation and disarmament agenda.

—**International Commission on Nuclear Non-proliferation and Disarmament**, December 2009

To date, the CTBT has been signed by 182 nations, including China, France, Russia, and the United Kingdom, and ratified by 151, including Russia and all U.S. allies in NATO. The CTBT cannot enter into force without ratification by 44 nuclear-capable states as defined by Annex 2 in the treaty. Of those states, China, Egypt, India, Indonesia, Iran, Israel, North Korea, Pakistan, and the United States have yet to ratify.

U.S. ratification is the essential step toward entry into force. David Hannay, a former British ambassador to the United Nations, said in September 2009 that "[i]f the United States does not take the lead, in essence, as we saw in the last eight years, nothing happens."[45]

Once the United States ratifies, China will likely follow. Beijing submitted the CTBT to the National People's Congress for ratification in 2000. In September 2009, Beijing stated that "China is the Treaty's constant supporter and abides by its commitment to moratorium on nuclear test [sic]" and will "continue to work with the international community to facilitate the early entry into force."[46]

In December 2009, Indian Prime Minister Manmohan Singh told his Japanese counterpart, Yukio Hatoyama, that if the United States and China ratify the CTBT, then "it will create a new situation."[47] In August, India's National Security Advisor M. K. Naranyanan said, "As of now, we are steadfast in our commitment to the moratorium. At least there is no debate in the internal circles about this."[48] He continued, "I think we need to now have a full-fledged discussion on the CTBT." In 2005, India said that "it will not stand in the way of entry into force of the treaty."[49] If India ratifies, Pakistan would likely follow.

In June 2009, Indonesian Foreign Minister Hassan Wirajuda said, "We share [Obama's] vision of a world in which nuclear weapons have been eradicated. We trust that he will succeed in getting the CTBT ratified—and we promise that when that happens, Indonesia will immediately follow suit."[50]

With no shortage of conflict and hostility in the Middle East, ratification by Egypt, Iran, and Israel, which have all signed the treaty, would reduce nuclear weapons-related security concerns in the region. Also, it would help create the conditions necessary for the realization of a zone free of nuclear weapons and other weapons of mass destruction in the Middle East, as called for in the Middle East resolution adopted by the 1995 NPT review conference.

Likewise, Israel's ratification the CTBT, which is the sole nuclear arms control treaty it has signed, would bring it closer to the nuclear nonproliferation mainstream and encourage other states in the region, such as Egypt and Iran, to ratify as well.

Iranian ratification would reduce the potential for its nuclear program to be used to develop and deploy deliverable nuclear warheads. Continued failure by Iran to ratify the CTBT raises further questions about the nature of its sensitive nuclear fuel-cycle activities.

In North Korea's case, its ratification of the CTBT will depend on progress in ongoing talks with China, the United States, and other states on its nuclear program.

With U.S. ratification leading to ratification by China, Egypt, India, Indonesia, Israel, and Pakistan, Iran and North Korea would be the final holdouts of the 44 countries specified for entry into force. In this situation, options could be explored that would bring the treaty into force on a provisional basis and allow for full implementation of the IMS and on-site inspections. Creative solutions in situations such as this are not without precedent. For example, when India blocked final consensus approval of the CTBT by the Conference on Disarmament, Australia incorporated the treaty text in a working paper, which was brought to the UN General Assembly for approval.

In the event that Iran or North Korea do not ratify and no other way is found to have the treaty take effect, it is still in the U.S. national security interest to ratify the treaty. Nuclear tests by Iran and North Korea, although serious matters, would not undermine U.S. security in a way that could be addressed by resuming U.S. nuclear testing. Meanwhile, China and Russia would continue to be bound by CTBT restrictions. As a ratifying state, the United States will have greater leverage to increase international pressure on Iran and North Korea to limit their nuclear programs.

New Since 1999

- **In December 2009, Indian Prime Minister Manmohan Singh told his Japanese counterpart, Yukio Hatoyama, that if the United States and China ratify the CTBT, then "it will create a new situation."**
- **In September 2009, Secretary of State Hillary Rodham Clinton addressed the CTBT Article 14 conference on entry into force, the first U.S. representative to do so since the conferences began 10 years ago. "We are glad to be back," Clinton told the gathering.**
- **In June 2009, Indonesia announced that when the United States ratifies the CTBT, "Indonesia will immediately follow suit."**
- **In 2000, China submitted the CTBT to the National People's Congress for ratification. In September 2009, China stated it will "continue to work with the international community to facilitate the early entry into force."**
- **Russia ratified the treaty in 2000. Moscow has repeatedly stated that it intends to continue its moratorium on testing until the treaty enters into force or as long as other nuclear powers do the same.**

Key Points

- **Without entry into force, the United States will be denied the full benefits of the treaty, including on-site inspections and compulsory consultation and clarification procedures.**
- **Without entry into force, it should not be assumed that the treaty's verification system will be available indefinitely or that the current voluntary moratoria will not break down.**
- **The treaty cannot enter into force without U.S. ratification.**
- **Ratification of the CTBT by the United States will prompt other holdout states, including China, to ratify and will put pressure on Egypt, India, Indonesia, Israel, and Pakistan to follow suit.**
- **While it might be possible to sustain the current, de facto global nuclear test moratoria for several years, the risks and uncertainties that one or more states will resume testing will grow unless the CTBT enters into force.**

Conclusion

U.S. nuclear testing policy is in a state of limbo that does not advance U.S. national security interests. After more than 1,000 nuclear test explosions, there is neither the need nor the political support for renewed U.S. nuclear testing. Instead, the United States would benefit greatly by outlawing nuclear testing for all. Though the United States has already assumed most CTBT-related responsibilities, it cannot reap the full security benefits of the CTBT until the Senate approves the treaty by a two-thirds majority.

U.S. ratification of the CTBT would substantially constrain the ability of other nuclear-armed states to perfect new and more deadly nuclear bombs, limit the capabilities of would-be nuclear-armed nations, substantially improve national and international capabilities to detect and investigate surreptitious nuclear testing, and bolster U.S. leadership to stop the spread of nuclear weapons—enhancing U.S. security for years to come.

As the Senate prepares to reconsider the CTBT in the coming months, it will be important to evaluate new technical advances that strengthen the overall case for U.S. ratification. These advances include evidence confirming that the United States can maintain an effective nuclear stockpile without resuming testing or building new-design warheads and that it can effectively verify compliance with the treaty.

It is also important to recognize there is nothing to gain and much to lose by delaying U.S. ratification of the CTBT. While it might be possible to sustain for several years the testing moratoria undertaken by the world's nuclear-armed states, uncertainties and the risk of a resumption of testing will only grow with time. Without the CTBT in force, concerns about clandestine nuclear testing might arise that could not be resolved in the absence of inspections provided for under the treaty. If Washington fails to fulfill its commitment to ratify the CTBT, U.S. efforts to organize international support for strengthening the beleaguered NPT—including tougher safeguards, restrictions on the spread of sensitive nuclear technologies, and automatic penalties for noncompliance or withdrawal—would be severely weakened. Leaving the CTBT in limbo would increase uncertainty and reduce U.S. security.

As this briefing book makes clear, the United States stands to benefit from entry into force of the CTBT more than any other nation. At the same time, if the hard-fought international trend against nuclear testing were to collapse, the United States would have the most to lose. The stakes are high, and the path is clear. The time for the CTBT is now.

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APPENDIX A

Summary of the CTBT

The Comprehensive Test Ban Treaty (CTBT) prohibits "any nuclear weapon test explosion or any other nuclear explosion" anywhere. In order to verify compliance with its provisions, the treaty establishes a global network of monitoring facilities and allows for on-site inspections of suspicious events. The overall accord contains a preamble, 17 treaty articles, two treaty annexes, and a protocol with two annexes detailing verification procedures.

Preamble

The preamble, which lists disarmament principals and objectives, sets the overall political context of the treaty. In particular, it stresses the need for the continued reduction of nuclear weapons worldwide with the ultimate goal of their elimination. Also of significance, the preamble recognizes that a CTBT will constitute an effective measure of nuclear disarmament and non-proliferation by "constraining the development and qualitative improvement of nuclear weapons and ending the development of advanced new types of nuclear weapons." It further recognizes that a test ban will constitute "a meaningful step in the realization of a systematic process to achieve nuclear disarmament."

Scope

Article I establishes that all states parties are prohibited from conducting "any nuclear weapon test explosion or any other nuclear explosion." On the basis of the negotiating record, this includes all nuclear explosions, in accordance with President Bill Clinton's August 1995 "zero yield" proposal.

Implementing Organization

Article II establishes the Comprehensive Nuclear-Test Ban Treaty Organization, which will ensure treaty implementation and provide states-parties with a forum for consultation and cooperation. The organization will consist of a Conference of the States Parties, an Executive Council and a Technical Secretariat. The organization, which is located in Vienna, is structurally independent from, but operating in collaboration with, the International Atomic Energy Agency (IAEA).

The Conference of the States Parties is the overall governing body of the organization. It handles treaty-related policy issues and oversee the treaty's implementation, including the activities of the Executive Council and the Technical Secretariat. The conference will meet once a year, unless otherwise decided.

The Executive Council, which will meet regularly and act as the treaty's principal decision-making body, will consist of 51 members. In order to distribute membership evenly throughout the world, the Executive Council will comprise 10 states-parties from Africa; seven from Eastern Europe; nine from Latin America and the Caribbean; seven from the Middle East and South Asia; ten from North America and Western Europe; and eight from Southeast Asia, the Pacific and the Far East. The states in each of these geographical regions are listed in Annex 1 to the treaty.

The members of the council will be elected by the conference. In order to ensure that those countries with a vested interest in a CTB are adequately represented in the council, at least one-third of the seats allotted to each region will be filled by states-parties on the basis of their nuclear capabilities applicable to the treaty, such as the number of monitoring facilities they contribute to the International Monitoring System (IMS). One seat allocated to each region will be designated on an alphabetical basis and the remaining seats will be determined by rotation or elections. Thus, each state-party will eventually have the opportunity to serve on the council.

The Technical Secretariat is the primary body responsible for implementing the treaty's verification provisions. In this capacity, it supervises the operation of the IMS and receive, process, analyze and report on the system's data. It also manages the International Data Center (IDC) and performs procedural tasks related to conducting on-site inspections. Until the treaty enters into force, these functions are being handled by the Provisional Technical Secretariat.

Article III requires each state-party, in accordance with its constitutional process, to take any necessary measures to implement its treaty obligations.

Verification and Compliance

Article IV and the verification protocol establish the treaty's verification regime, which will consist of four basic elements: the IMS, consultation and clarification, on-site inspections and confidence-building measures. The verification regime will not be completely operational until the treaty enters into force. For instance, on-site inspections cannot be authorized until the treaty formally comes into effect.

The purpose of the IMS is to detect nuclear explosions, which are prohibited under Article I. The monitoring system will comprise a network of 50 primary and 120 auxiliary seismological monitoring stations designed to detect seismic activity and distinguish between natural events, such as earthquakes, and nuclear explosions. In addition, the system will incorporate 80 radionuclide stations and 16 radionuclide laboratories that seek to identify radioactivity released during a nuclear explosion. The IMS will also include 60 infrasound (acoustic) and 11 hydroacoustic stations designed to pick up the sound of a nuclear explosion conducted in the atmosphere or underwater, respectively. The host state and the location of each facility is listed in Annex 1 to the protocol.

Information collected by the IMS will then be transmitted to the IDC-an essential part of the Technical Secretariat responsible for data storage and processing. Because the IMS will generate an enormous amount of raw data, the IDC will regularly provide states-parties with a number of services designed to help them monitor compliance with the treaty's provisions. In this regard, the data center will produce integrated lists of all signals picked up by the IMS, as well as standard event lists and bulletins. In accordance with the parameters outlined in Annex 2 to the protocol, the center will also generate standard event bulletins that screen out those events that appear to be of a non-nuclear nature. However, notwithstanding this analysis role, the IDC must make both the raw and processed information available to all states-parties.

The consultation and clarification component of the verification regime encourages states-parties to attempt to resolve, either among themselves or through the organization, possible instances of non-compliance before requesting an on-site inspection. A state-party must provide clarification of an ambiguous event within 48 hours of receiving such a request from another state-party or the Executive Council.

Each state-party has the right to request an on-site inspection in the territory of the party in question. The inspection request must be based on information collected by the IMS; data obtained through national technical means (NTM) of verification, such as satellites, in a manner consistent with international law; or a combination of IMS and NTM information. The request must contain the approximate geographical coordinates and the estimated depth of the ambiguous event, the proposed boundaries of the area to be inspected (not to exceed 1,000 square kilometers), the state-party or parties to be inspected, the probable environment and estimated time of event, all evidence upon which the request is based, the identity of the proposed observer (if available) and the results of the consultation and clarification process (if any).

The Executive Council will make a decision on the on-site inspection request within 96 hours of its receipt from the requesting state-party. The inspection will be authorized to proceed if it has been approved by at least 30 of the council's 51-members, the so-called "green light" procedure. An inspection team will arrive at the point of entry within six days of the council's receipt of the inspection request. During the course of the inspection, the inspection team may submit a proposal to extend the inspection to begin drilling, which must be approved by 26 council members. The duration of the inspection must not exceed 60 days, but may be extended by a maximum of 70 additional days (subject to council approval) if the inspection team determines that more time is needed to fulfill its mandate.

If the Executive Council rejects an on-site inspection request (or terminates an inspection already underway) because it is of a frivolous or abusive nature, the council may impose punitive measures on the requesting state-party. In this regard, it may require the requesting state-party to provide financial compensation for preparations made by the Technical Secretariat and may suspend the party's right to request an inspection and serve on the council for an unspecified period of time.

The verification regime also incorporates confidence-building measures intended to promote treaty compliance. In order to reduce the likelihood that verification data may be misconstrued, each state-party will voluntarily provide the Technical Secretariat with notification of any chemical explosion involving a magnitude of 300 tons or more of TNT-equivalent on its territory. Each state-party may also assist the Technical Secretariat in the calibration of IMS stations.

In order to ensure compliance with the treaty's provisions, Article V empowers the conference to revoke a state-party's rights under the treaty, recommend to the states-parties punitive measures such as sanctions or bring the case to the attention of the United Nations. Article VI describes the

mechanism by which disputes pertaining to the application or interpretation of the treaty may be settled.

Amendment Process

Under Article VII, each state-party has the right to propose amendments to the treaty after its entry into force. Any proposed amendment requires the approval of a simple majority of states-parties at an amendment conference with no party casting a negative vote.

Peaceful Nuclear Explosions

Under Article VIII, a conference will be held 10 years after the treaty's entry into force to review the implementation of its provisions, including the preamble. At this review conference, any state-party may request that the issue of so-called "peaceful nuclear explosions" (PNEs) be put on the agenda. However, the presumption is that PNEs remain prohibited unless certain virtually insurmountable obstacles are overcome. First, the review conference must decide without objection that PNEs may be permitted, then an amendment to the treaty must also be approved without objection at a separate amendment conference, as is explained above. The amendment must also demonstrate that no military benefits would result from such explosions. This double hurdle makes it extremely unlikely that peaceful nuclear explosions will ever be permitted under the treaty.

Duration and Withdrawal

Under Article IX, the CTB treaty will be of unlimited duration. In addition, each state-party has the right to withdraw from the treaty if it decides, "extraordinary events related to the subject matter of this Treaty have jeopardized its supreme interests." Notice of intent to withdraw must be given at least six months in advance.

Miscellaneous Provisions

Article X specifies that the treaty's annexes, protocol and annexes to the protocol are a formal part of the treaty. Article XI declares that the treaty is open to all states for signature prior to its entry into force. Article XII maintains that each signatory state will ratify the treaty according to its own constitutional procedures. Under Article XIII, any state that has not signed the treaty prior to its entry into force may accede to it any time thereafter.

Entry into Force

Under Article XIV, the treaty will not enter into force until it has been signed and ratified by 44 states listed by name in Annex 2 to the treaty. These states include the five original nuclear weapon states—United States, Russia, Britain, France and China—as well as India, Israel, North Korea, and Pakistan. (Actual entry into force will occur 180 days after all 44 states deposit their instruments of ratification with the UN Secretary General.) The 44 states, all of which are participating members of the recently expanded Conference on Disarmament, possess nuclear power and research reactors as determined by the IAEA.

If the treaty has not entered into force "three years after the date of the anniversary of its opening for signature," then a conference may be held for those states that have already deposited their instruments of ratification to "decide by consensus what measures consistent with international law may be undertaken to accelerate the ratification process." Since 1999, the Conference Facilitating Entry Into Force of the CTBT has been convened every other year.

Other Provisions

Article XV stipulates that the treaty's provisions will not be subject to reservations. Article XVI establishes the UN Secretary General as the depositary of the treaty. Under Article XVII, the treaty will be authentic in six languages.

APPENDIX B

CTBT Signatories and Ratifiers

The CTBT will formally enter into force after 44 designated "nuclear-capable states" have deposited their instruments of ratification with the UN secretary-general. To date, 182 states have signed and 151 have ratified the treaty. Yet of the 44 specified countries, India, Pakistan, and North Korea still have not signed, and only 35 have ratified the treaty.

The following chart identifies the treaty's signatories and ratifiers. States whose ratification is required for the treaty to take effect are shaded.

Country	Signature	Ratification
Afghanistan	9/24/03	9/24/03
Albania	9/27/96	4/23/03
Algeria	10/15/96	7/11/03
Andorra	9/24/96	7/12/06
Angola	9/27/96	
Antigua and Barbuda	4/16/97	1/11/06
Argentina	9/24/96	12/4/98
Armenia	10/1/96	7/12/06
Australia	9/24/96	7/9/98
Austria	9/24/96	3/13/98
Azerbaijan	7/28/97	2/2/99
Bahamas	2/4/05	11/30/07
Bahrain	9/24/96	4/12/04
Bangladesh	10/24/96	3/8/00
Barbados	1/14/08	1/14/08
Belarus	9/24/96	9/13/00
Belgium	9/24/96	6/29/99
Belize	11/14/01	3/26/04
Benin	9/27/96	3/6/01
Bolivia	9/24/96	10/4/99
Bosnia and Herzegovina	9/24/96	10/26/06
Botswana	9/16/02	10/28/02
Brazil	9/24/96	7/24/98
Brunei Darussalem	1/22/97	
Bulgaria	9/24/96	9/29/99
Burkina Faso	9/27/96	4/17/02
Burundi	9/24/96	9/24/08
Cambodia	9/26/96	11/10/00
Cameroon	11/16/01	2/6/06
Canada	9/24/96	12/18/98
Cape Verde	10/1/96	3/1/06
Central African Republic	12/19/01	

Country	Signature	Ratification
Chad	10/8/96	
Chile	9/24/96	7/12/00
China	9/24/96	
Colombia	9/24/96	1/29/08
Comoros	12/12/96	
Congo	2/11/97	
Cook Islands	12/5/97	9/6/05
Costa Rica	9/24/96	9/25/01
Côte d'Ivoire	9/25/96	3/11/03
Croatia	9/24/96	3/2/01
Cyprus	9/24/96	7/18/03
Czech Republic	11/12/96	9/11/97
Dem. Republic of Congo	10/4/96	9/28/04
Denmark	9/24/96	12/21/98
Djibouti	10/21/96	7/15/05
Dominican Republic	10/3/96	9/4/07
Ecuador	9/24/96	11/12/01
Egypt	10/14/96	
El Salvador	9/24/96	9/11/98
Equatorial Guinea	10/9/96	
Eritrea	11/11/03	11/11/03
Estonia	11/20/96	8/13/99
Ethiopia	9/25/96	8/8/06
Fiji	9/24/96	10/10/96
Finland	9/24/96	1/15/99
France	9/24/96	4/6/98
Gabon	10/7/96	9/20/00
Gambia	4/9/03	
Georgia	9/24/96	9/27/02
Germany	9/24/96	8/20/98
Ghana	10/3/96	
Greece	9/24/96	4/21/99
Grenada	10/10/96	8/19/98
Guatemala	9/20/99	

Country	Signature	Ratification
Guinea	10/3/96	
Guinea-Bissau	4/11/97	
Guyana	9/7/00	3/7/01
Haiti	9/24/96	12/1/05
Holy See	9/24/96	7/18/01
Honduras	9/25/96	10/30/03
Hungary	9/25/96	7/13/99
Iceland	9/24/96	6/26/00
India		
Indonesia	9/24/96	
Iran	9/24/96	
Iraq	8/19/08	
Ireland	9/24/96	7/15/99
Israel	9/25/96	
Italy	9/24/96	2/1/99
Jamaica	11/11/96	11/13/01
Japan	9/24/96	7/8/97
Jordan	9/26/96	8/25/98
Kazakhstan	9/30/96	5/14/02
Kenya	11/14/96	11/30/00
Kiribati	9/7/00	9/7/00
Kuwait	9/24/96	5/6/03
Kyrgyzstan	10/8/96	10/02/03
Laos	7/30/97	10/5/00
Latvia	9/24/96	11/20/01
Lebanon	9/16/05	11/21/08
Lesotho	9/30/96	9/14/99
Liberia	10/1/96	
Libya	11/13/01	1/6/04
Liechtenstein	9/27/96	9/21/04
Lithuania	10/7/96	2/7/00
Luxembourg	9/24/96	5/26/99
Macedonia	10/29/98	3/14/00
Madagascar	10/9/96	9/15/05
Malawi	10/9/96	
Malaysia	7/23/98	1/17/08
Maldives	10/1/97	9/7/00
Mali	2/18/97	8/4/99
Malta	9/24/96	7/23/01
Marshall Islands	9/24/96	10/28/09
Mauritania	9/24/96	4/30/03
Mexico	9/24/96	10/5/99
Micronesia	9/24/96	7/25/97
Moldova	9/24/97	1/16/07
Monaco	10/1/96	12/18/98
Mongolia	10/1/96	8/8/97
Montenegro	10/23/06	10/23/06
Morocco	9/24/96	4/17/00

Country	Signature	Ratification
Mozambique	9/26/96	11/4/08
Myanmar	11/25/96	
Namibia	9/24/96	6/29/01
Nauru	9/8/00	11/12/01
Nepal	10/8/96	
Netherlands	9/24/96	3/23/99
New Zealand	9/27/96	3/19/99
Nicaragua	9/24/96	12/5/00
Niger	10/3/96	9/9/02
Nigeria	9/8/00	9/27/01
North Korea		
Norway	9/24/96	7/15/99
Oman	9/23/99	6/13/03
Pakistan		
Palau	8/12/03	8/1/07
Panama	9/24/96	3/23/99
Papua New Guinea	9/25/96	
Paraguay	9/25/96	10/4/01
Peru	9/25/96	11/12/97
Philippines	9/24/96	2/23/01
Poland	9/24/96	5/25/99
Portugal	9/24/96	6/26/00
Qatar	9/24/96	3/3/97
Romania	9/24/96	10/5/99
Russia	9/24/96	6/30/00
Rwanda	11/30/04	11/30/04
St. Kitts and Nevis	3/33/04	4/27/05
St. Lucia	10/4/96	4/5/01
St. Vincent and the Grenadines	7/2/09	9/23/09
Samoa	10/9/96	9/27/02
San Marino	10/7/96	3/12/02
Sao Tome and Principe	9/26/96	
Senegal	9/26/96	6/9/99
Serbia and Montenegro	6/8/01	5/19/04
Seychelles	9/24/96	4/13/04
Sierra Leone	9/8/00	9/17/01
Singapore	1/14/99	11/10/01
Slovakia	9/30/96	3/3/98
Slovenia	9/24/96	8/31/99
Solomon Islands	10/3/96	
South Africa	9/24/96	3/30/99
South Korea	9/24/96	9/24/99
Spain	9/24/96	7/31/98
Sri Lanka	10/24/96	
Sudan	6/10/04	6/10/04
Suriname	1/14/97	2/7/06
Swaziland	9/24/96	

Country	Signature	Ratification
Sweden	9/24/96	12/2/98
Switzerland	9/24/96	10/1/99
Tajikistan	10/7/96	6/10/98
Tarzania	9/30/04	9/30/04
Thailand	11/12/96	
Togo	10/2/96	7/2/04
Trinidad and Tobago	10/8/09	
Tunisia	10/16/96	9/23/04
Turkey	9/24/96	2/16/00
Turkmenistan	9/24/96	2/20/98
Uganda	11/7/96	3/14/01
Ukraine	9/27/96	2/23/01

Country	Signature	Ratification
United Arab Emirates	9/25/96	9/18/00
United Kingdom	9/24/96	4/6/98
United States	9/24/96	
Uruguay	9/24/96	9/21/01
Uzbekistan	10/3/96	5/29/97
Vanuatu	9/24/96	9/16/05
Venezuela	10/3/96	5/13/02
Viet Nam	9/24/96	3/10/06
Yemen	9/30/96	
Zambia	12/3/96	2/23/06
Zimbabwe	10/13/99	
TOTAL	**182**	**151**

APPENDIX C

Nuclear Testing, 1945 to the Present

1940s

1945 July 16, first nuclear test explosion, TRINITY, is conducted near Alamagordo, New Mexico.

August 6 and 9, U.S. bombings of Hiroshima and Nagasaki, leading to over 200,000 casualties.

1946–1962 The United States conducts 193 atmospheric tests mainly in the Pacific and in Nevada involving over 200,000 military and civilian personnel, of which 2,000-3,000 serve as subjects of government-sponsored medical research.

1949 August 29, the U.S.S.R. explodes its first nuclear test, accelerating the nuclear arms race. By 1962, the Soviets explode a total of 142 atmospheric nuclear tests.

1950s

1952 October 3, the U.K. conducts its first nuclear test in Western Australia. November 1, the first hydrogen bomb test explosion, the U.S.'s MIKE, results in 10 megaton explosion which obliterates the island of Elugelab in the Marshall chain in the Pacific.

1954 The U.S. CASTLE series of tests and Soviet tests in Siberia arouse international outrage about radioactive fallout, particularly after the 15 megaton BRAVO test contaminates the Marshall Islands and the Japanese fishing vessel, *Lucky Dragon*.

April 2, Indian Prime Minister Jawaharlal Nehru proposes a nuclear testing "standstill" agreement, which is later forwarded to the United Nations Disarmament Commission. Albert Einstein and Pope Pius XII call for a cessation of nuclear testing. May 10, the Soviet Union proposes, for the first time by either superpower, a nuclear test ban as the initial step toward nuclear disarmament.

1957 The United Kingdom conducts its first hydrogen bomb test and the U.S. and U.S.S.R. accelerate testing. These countries conduct 42 above-ground nuclear blasts during the year.

May, U.S. and U.S.S.R. trade test ban and weapons production cut-off proposals but fail to reach agreement.

1958 March 31, Soviets announce unilateral suspension of testing after completing their latest series of blasts. April 8, Eisenhower proposes technical conference to explore test ban verification.

August 22, Eisenhower proposes 1-year test moratorium if Soviets also refrain from testing and the initiation of U.S.-U.K.-U.S.S.R. test ban negotiations, which begin on October 31.

1959 Test Ban negotiations continue in Geneva despite opposition from lab scientists about test ban verification.

1960s

1960 February 13, France conducts it first nuclear test in Algeria.

February 11, 1960, the Eisenhower Administration redoubles its efforts by proposing a phased approach to achieving a comprehensive ban. The proposal is endorsed by British Prime Minister Harold Macmillan, and with some further modifications, is accepted by Soviet Premier Khrushchev, making it likely that the test ban treaty could be signed at a Paris summit that both President Eisenhower and Premier Krushchev agreed to attend in May. However, the shoot-down of an American U-2 spy plane over the Soviet Union on May 1st leads to an atmosphere of hostility that cuts short the Paris summit and the chance for the test ban.

1961 January–July, Kennedy accelerates U.S. nuclear weapons deployments and East-West relations deteriorate over the Berlin crisis. August, resumption of Soviet nuclear tests followed by resumption of U.S. testing in September. October 30, Soviet Union conducts largest nuclear test explosion ever, a 58 megaton atmospheric blast.

1962 Eighteen Nation Committee on Disarmament, later to become the Conference on Disarmament, will continue multilateral discussions on the test ban for over three decades. October, Cuban Missile Crisis brings the U.S. and U.S.S.R. to the brink of nuclear war.

1963 June 8, 1963, Khrushchev invites British and American negotiators to a conference in Moscow in July to negotiate a comprehensive nuclear test ban treaty.

June 10, President Kennedy accepts the Soviet invitation for renewed talks in his commencement address at American University and says that peace without competition between the United States and the Soviet Union is not possible, but the prevention of nuclear war is.

July 15, U.S., British, and Soviet negotiators meet in Moscow to try to work out an agreement on a comprehensive test ban. But due to disagreements concerning on-site inspections, agreement on a comprehensive ban is not reached. Negotiators turn their attention to the conclusion of a limited ban, prohibiting tests in the atmosphere, outer space, and beneath the surface of the seas.

July 25, the Limited Test Ban Treaty (LTBT) is signed by the United States, Britain and the Soviet Union.

July 26, 1963, President Kennedy addresses the nation on the merits of the LTBT and asks for their support in ensuring Senate approval. August 8, Kennedy places the Treaty before the Senate for its advice and consent.

September 24, 1963, the LTBT is ratified by the Senate and receives an overwhelmingly favorable vote of 80 to 14. October 11, 1963, the Treaty goes into effect.

Nuclear weapons development and production continue with underground nuclear testing.

1964 October 16, China explodes its first nuclear bomb, a 20 kiloton atmospheric blast, at Lop Nor in northwestern China.

1968 June, nuclear Non-Proliferation Treaty (NPT) signed in Washington, London, and Moscow. Among other obligations, the NPT requires parties to the Treaty to "seek to achieve the discontinuance of all test explosions of nuclear weapons for all time and to continue negotiations to this end," and under Article VI, to "pursue negotiations in good faith on effective measures relating to the cessation of the nuclear arms race at an early date and to nuclear disarmament...."

1970s

1972–1974 Australia and New Zealand ask the International Court of Justice to halt continuing French atmospheric tests in Polynesia and send naval vessels to the test area to signal their opposition.

1974 May, India conducts its first nuclear test in the Thar Desert near its border with Pakistan. Bowing to international pressure, France announces that all of its future nuclear tests will be conducted underground.

1974–1976 The United States and the Soviet Union conclude the Threshold Test Ban and Peaceful Nuclear Explosions Treaties limiting military and non-military underground tests to explosive yields below 150 kilotons. They continue to design, develop and produce new warhead designs.

1977–1980 American, British and Soviet negotiators make substantial progress toward an agreement on a Comprehensive Test Ban Treaty but opposition from the Pentagon, the Energy Department, and Congress, combined with the deterioration of East-West relations after the Soviet invasion of Afghanistan scuttle the chance for a Test Ban agreement as well as further controls on U.S. and Soviet strategic nuclear arsenals.

1980s

1982 July, President Reagan decides to set aside the comprehensive test ban effort, calling it a "long-term" U.S. objective, and approves the development, deployment, and testing of new nuclear warheads.

1985–1987 U.S.S.R. observes unilateral test moratorium.

1986 U.S. House of Representatives passes a non-binding resolution led by Reps. Schroeder, Markey and Leach (224–155) calling for a 1-year U.S. testing moratorium if the Soviets accept on-site inspections.

Reagan and Gorbachev meet in Reykjavik, Iceland and discuss nuclear disarmament but fail to reach agreement.

1988 August, six non-aligned states request a special conference to consider amending the 1963 LTBT to make it comprehensive.

1990–1994

1991 January, LTBT Amendment Conference convenes but no decision is made to amend the limited test ban into a comprehensive one because of opposition from the declared nuclear powers. However, the Conference gives its President a mandate to reconvene the Conference at a later stage.

October 5, Soviet President Gorbachev announces a unilateral, one-year moratorium on Soviet nuclear testing and invites the U.S. to join. October 29, a bipartisan Congressional coalition led by Rep. Kopetski and Sen. Hatfield introduce legislation that would effect a 1-year U.S. testing moratorium.

December 26, the Soviet Union is dissolved.

1992 April 8, French President Mitterrand announces a unilateral French nuclear testing moratorium. June, Russian President Boris Yeltsin extends the Soviet test moratorium.

September 13, the U.S. Senate adopts the "Hatfield-Exon" amendment that would effect a 9-month U.S. testing moratorium; place strict conditions on any further U.S. testing; and require test ban negotiations and a prohibition on U.S. testing after September 30, 1996, unless another nation conducts a test. The test moratorium amendment is approved 55–40.

September 24, House of Representatives adopts the "Hatfield-Exon" amendment by a margin of 224–151. October 2, President Bush reluctantly signs the law containing the test moratorium legislation.

1993 March 3, National Security Advisor Anthony Lake orders completion of an interagency Presidential Review of U.S. policy on nuclear testing and a Comprehensive Test Ban Treaty (CTBT).

April, CTBT advocates uncover a Clinton administration draft plan to renew U.S. testing and to substitute a one-kiloton threshold treaty in place of a comprehensive one. April 30, *The Washington Post* breaks the story, triggering national debate.

May, Senators Exon, Hatfield, and Mitchell and Rep. Kopetski express opposition to the one-kiloton plan. They and Senator Harkin organize letters from 38 Senators and 159 Representatives in support of a moratorium extension and a total ban. Polls show 72 perecnt of the U.S. public favor continuing the moratorium.

June, Clinton administration debates testing policy with the Energy Department, the Arms Control and Disarmament Agency and the White House Science Advisor favoring extension of the moratorium.

July 3, President Clinton announces that he will extend the moratorium at least through 1994 unless another nation conducts a test and will pursue completion of a CTBT by September 1996. Clinton states that the current U.S. arsenal is "safe and reliable" and that there is no immediate need for further tests.

August 10, the Conference on Disarmament (CD) decides to give its Ad Hoc Committee on a Nuclear Test Ban a mandate to begin negotiations on a CTBT in January 1994.

December 16, the United Nations unanimously adopts a resolution calling on the Conference on Disarmament (CD) to proceed with the negotiation of a Comprehensive Test Ban Treaty as rapidly as possible.

1994 January, CTBT negotiations begin at the CD in Geneva.

1995–1999

1995 January, U.S. officials announce that they will pursue a test ban that is permanent in duration. CTBT talks resume in Geneva without agreement on the scope of the Treaty, with the declared nuclear states favoring low-yield, hydronuclear tests under a CTBT. Australia begins effort to get consensus on a zero-yield test ban. March, U.S. officials announce the extension of the U.S. moratorium.

April–May, over 180 nations meet and agree to indefinitely extend the Nuclear Non-Proliferation Treaty and also agree to conclude CTBT negotiations no later than 1996. China conducts a nuclear test one day after the conclusion of the NPT Review and Extension Conference.

June 13, newly-elected French President Chirac announces that France will resume nuclear testing before signing a CTBT, which foments international outrage and a spontaneous worldwide consumer boycott of French goods. U.S. officials debate new proposal backed by the Pentagon and Joint Chiefs of Staff calling for the U.S. to pursue a 500-ton threshold test ban that would allow low-yield blasts.

Clinton administration debates 500 ton threshold proposal with the National Security Council, Energy Department, the Arms Control and Disarmament Agency and the White House Science Advisor favoring a zero-yield CTBT.

August 10, the U.S. Senate unanimously adopts a resolution introduced by Senator Akaka condemning continued French and Chinese nuclear testing. President Chirac announces that France will support a zero-yield test ban.

August 11, President Clinton announces his support for a "true zero yield" test ban.

September 6, France renews nuclear testing despite intentional opposition. CTBT talks in Geneva end for the year without producing an agreement.

September 14, the United Kingdom announces that it will support a zero-yield CTBT.

1996 January, CTBT talks resume in Geneva as India conditions it support on agreement for a commitment to a time-bound nuclear disarmament framework. India will later announce that it does not intend to sign the CTBT. China insists on allowing peaceful nuclear explosions.

May–June, China drops its insistence on peaceful explosions, but new disagreements emerge on verification issues and entry-into-force. June 18, the U.S. indicates its willingness to allow an entry-into-force formula that requires all nuclear capable states to ratify the CTBT.

June 28, CD Chairman Jaap Ramaker presents a final CTBT text but formal agreement is not reached before end of second negotiating session.

July 29, CTBT talks resume in Geneva. China announces that it will not test after September 1996.

August 22, consensus on a final CTBT text is blocked by India and Iran. Australia intensifies work to bring the CTBT directly to the U.N. for endorsement.

September 10, with 127 co-sponsors for the Australian CTBT resolution, a special session of the U.N. General Assembly overwhelmingly approves the CTBT by a margin of 158 to 3, with 5 abstentions, opening the way for CTBT signature and ratification. U.S. Ambassador to the United Nations describes the Treaty as: "... a treaty sought by ordinary people everywhere and today the power of that universal wish could not be denied."

September 24, the Comprehensive Test Ban Treaty is opened for signature at the U.N. in New York. The United States is the first nation to sign.

1997 September 22, President Bill Clinton transmits the CTBT to the United States Senate for its advice and consent for ratification.

1998 January 21, Senator Jesse Helms (R-NC), Chairman of the Senate Foreign Relation Committee writes President Clinton and argues that Senate consideration of the CTBT should wait until the Senate addresses of issues of "higher priority."

January 27, in his annual State of the Union address, President Clinton calls on the Senate to approve of the CTBT in 1998.

May 11 and 13, India, under the leadership of newly elected Prime Minister Atal Bihari Vajpayee of the Hindu-nationalist BJP, announces that India has conducted five underground nuclear test explosions in the Thar Desert. The tests are met with global condemnation and calls for India to sign and ratify the CTBT without conditions.

May 13, Senators Arlen Specter (R-PA) and Joseph Biden (D-DE) draft and circulate a resolution calling for Senate Foreign Relations hearings and a vote on the CTBT "as expeditiously as possible."

May 28 and 30, Pakistan announces that it has conducted 6 nuclear test explosions. The tests are met with global condemnation and calls for Pakistan and India to sign and ratify the CTBT without conditions.

1999 September, deadline for ratification of the CTBT by the 44 countries listed in Annex 2 of the Treaty before a special conference of Treaty ratifiers may be convened to explore ways to accelerate the Treaty's entry into force. Until the CTBT enters into force, all signatories are bound by Article XVIII of the Vienna Convention on Treaties not to undertake any action that violates the "purpose or intent" of the Treaty.

October 13, the U.S. Senate rejects the CTBT 48–51, nineteen votes short of the 67 needed for ratification.

2000–2009

2001 January 17, Secretary of State-designate Colin Powell tells Congress that the George W. Bush administration "will not be asking for the Congress to ratify the Comprehensive Test Ban Treaty," but will uphold the moratorium on nuclear testing.

2006 October 9, North Korea announces its first nuclear test, drawing widespread condemnation. The International Monitoring System (IMS) of the Comprehensive Test Ban Treaty Organization detects the seismic effects of the test, and, weeks later, telltale radioactive gases.

2009 April 5, President Barack Obama announces his intention to "immediately and aggressively pursue" U.S. ratification of the CTBT.

May 25, North Korea announces its second nuclear test. The IMS detects the shockwaves generated by the blast and the test is universally condemned.

APPENDIX D

Statements of Support for the CTBT

GEORGE SHULTZ, former Secretary of State, Reagan Administration

"[CTBT opponents] don't have to say they changed their mind. They can say there's new evidence that we have, and on the basis of new evidence they can support it… [Republicans] might have been right voting against it some years ago, but they would be right voting for it now, based on these new facts… [There are] new pieces of information that are very important and that should be made available to the Senate."

—ROME, APRIL 17, 2009

GEORGE SHULTZ, former Secretary of State, Reagan Administration; **WILLIAM J. PERRY,** former Secretary of Defense, Clinton Administration; **HENRY A. KISSINGER,** former Secretary of State, Nixon Administration; and former Senator **SAM NUNN** (D-GA)

"Near-term steps that the U.S. and Russia could take, beginning in 2008, can in and of themselves dramatically reduce nuclear dangers. They include… Adopt[ing] a process for bringing the Comprehensive Test Ban Treaty (CTBT) into effect, which would strengthen the NPT and aid international monitoring of nuclear activities. This calls for a bipartisan review, first, to examine improvements over the past decade of the international monitoring system to identify and locate explosive underground nuclear tests in violation of the CTBT; and, second, to assess the technical progress made over the past decade in maintaining high confidence in the reliability, safety and effectiveness of the nation's nuclear arsenal under a test ban. The Comprehensive Test Ban Treaty Organization is putting in place new monitoring stations to detect nuclear tests—an effort the U.S should urgently support even prior to ratification."

—*THE WALL STREET JOURNAL,* "TOWARD A NUCLEAR-FREE WORLD," JANUARY 15, 2008

BRENT SCOWCROFT, former National Security Advisor, George H.W. Bush Administration

"Well, on CTBT, of course, it was—it was not ratified when it came to the Senate before. I think—I'm not an expert on vote counting. I think it'll be a tough—I think it'll be a tough struggle, but I think we—we've learned a lot since it was before the Senate before and circumstances have changed. And I am cautiously optimistic that if the administration makes a good, clear case, then it has a chance."

—CONFERENCE CALL HOSTED BY COUNCIL ON FOREIGN RELATIONS, MAY 1, 2009

BRENT SCOWCROFT, former National Security Advisor, George H.W. Bush Administration; **JOSEPH NYE,** former Assistant Secretary of Defense, Clinton Administration; **NICHOLAS BURNS,** former Undersecretary of State, George W. Bush Administration; and **STROBE TALBOTT,** former Deputy Secretary of State, Clinton Administration

"Ratifying [the CTBT] will be to the international advantage of the United States. The CTBT is especially important to the goal of reducing nuclear weapons. Its 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."

—"U.S., RUSSIA MUST LEAD ON ARMS CONTROL," *POLITICO,* OCTOBER 13, 2009

MELVIN R. LAIRD, former Secretary of Defense, Nixon Administration; **HAROLD BROWN,** former Secretary of Defense, Carter Administration; and **WILLIAM J. PERRY,** former Secretary of Defense, Clinton Administration

"In the debate preceding its October 1999 vote on the test ban treaty, the Senate was presented with compelling but conflicting statements on the nonproliferation benefits of the treaty and questions regarding its impact on the long-term safety and reliability—and hence deterrence value—of our nuclear arsenal. But the truncated debate meant there were no adequate answers given on these issues… This treaty is too important for the vote of the last Congress to be the final word… The fact is that the suspension of nuclear tests instituted by President George Bush and Congress in 1992 will remain in place for many years to come. There are advantages to the United States in our international relations in ratifying the test ban treaty. The treaty is an important element of the global nonproliferation regime and crucial to American leadership of those efforts."

—*THE NEW YORK TIMES,* JANUARY 7, 2001

Former Chairmen of the Joint Chiefs of Staff Generals **COLIN POWELL,** George W. Bush Administration; **JOHN SHALIKASHVILI,** Clinton Administration; **WILLIAM CROWE,** Reagan Administration; and **DAVID JONES,** Carter Administration

"On September 22, 1997, President Clinton submitted the Comprehensive Nuclear test Ban (CTB) Treaty to the United States Senate for its advice and consent, together with six Safeguards that define the conditions under which the United States will enter into this Treaty. The Safeguards will strengthen our commitments in the area of intelligence, monitoring and verification, stockpile stewardship, maintenance of our nuclear laboratories, and test readiness. They also specify the circumstances under which the President would be prepared, in consultation with Congress, to exercise our supreme national interest rights under the CTB to conduct necessary testing if the safety and reliability of our nuclear deterrent could no longer be verified. With these Safeguards, we support Senate approval of the CTB Treaty."

—JOINT STATEMENT, JANUARY 28, 1999

Gen. **JOHN SHALIKASHVILI,** former Chairman of the Joint Chiefs of Staff, Clinton Administration

"Banning tests slows the spread of nuclear weapons to more countries by throwing another tough obstacle in the way of anyone who wants to acquire nuclear arms. True, potential proliferators can make simple fission bombs without testing. But a test ban makes it much harder to get nuclear weapons down to the sizes, the shapes and the weights most dangerous to us: deliverable in light airplanes, rudimentary missiles, or even in a terrorist's luggage… Every U.S. ally strongly supports our ratification of the CTBT. All of them have signed the CTBT. Most have ratified it already… Neither they, our allies, nor anyone else outside of our borders has any doubt about the credibility of the U.S. nuclear deterrent. Instead, what our allies fear is that if we walk away from the Test Ban Treaty, U.S. leadership on arms control and nonproliferation will be seriously, seriously weakened."

—MARCH 16, 2000

Dr. **SIEGFRIED HECKER,** former Director of the Los Alamos National Laboratory

"So now what I have to do is trade that off versus the benefits of a nuclear test ban. And there I say today that the greatest risk of going back to nuclear testing is that the Chinese would go back to testing and the Indians would go back to testing, the Pakistanis would go back to testing. And as I personally today weigh those risks, I definitely come out in favor that it's in our nation's and the world's interest to actually ratify the comprehensive test ban treaty."

—TESTIMONY BEFORE THE SENATE APPROPRIATIONS COMMITTEE, ENERGY AND WATER SUBCOMMITTEE, APRIL 30, 2008

"The single most important reason to ratify the CTBT is to stop other countries from improving their arsenals—China, India, Pakistan, North Korea, and Iran if it ever progresses that far… We gain substantially more from limiting other countries than we lose by giving up testing—even with a gradual loss of confidence, which stockpile stewardship has held to an acceptable level. The U.S. has carried out more than 1,000 nuclear tests, and the Chinese have done about 45. You can see the difference in the sophistication of our arsenals."

—"NUCLEAR DISARMAMENT," *CQ RESEARCHER,* VOLUME 19, NUMBER 34, OCTOBER 2, 2009, P. 820.

THOMAS H. KEAN (R) and **LEE H. HAMILTON** (D), former Co-chairmen of the 9/11 Commission

"More nuclear armed states means more risks to peace and stability… We can help by making deeper nuclear arms reductions, ratifying the Comprehensive Test Ban Treaty and fulfilling the Nuclear Nonproliferation Treaty—steps that would have a powerful and positive effect."

—*THE WASHINGTON POST,* NOVEMBER 9, 2008

Ambassador **LINTON BROOKS**, former Under Secretary of Energy for Nuclear Security, George W. Bush Administration

"It certainly can't be done without U.S. leadership, and—but what we don't know is what will actually happen if we take some of the steps, ratification of CTBT being the most obvious. The argument as I understand it is not that it has anything to do with North Korea, but that a number of states whose cooperation is necessary for an effective nonproliferation regime are reluctant to cooperate while the five recognized nuclear powers are not, in their view, meeting their Article VI obligations. And the touchstone of that, at least with regard to the United States, has become CTBT.

What we don't know is whether that's a reason or an excuse. We don't know whether it's a convenient way to blame the United States for things people don't want to spend time and effort and money on. One of the reasons that, I think, we probably ought to go ahead and ratify the CTBT in the United States is it will let us find that out."

—CARNEGIE NONPROLIFERATION CONFERENCE, APRIL 6, 2009

APPENDIX E

Additional Resources

U.S. State Department's Article-By-Article Analysis of the Comprehensive Nuclear Test-Ban Treaty

www.state.gov/t/isn/trty/16522.htm

Report on Nuclear Testing, JASON, 1995

Influential group of independent scientists finds the United States can have high confidence in the safety, reliability, and performance margins of the nuclear weapons in the enduring stockpile.
www.fas.org/rlg/jsr-95-320.htm

Findings and Recommendations Concerning the Comprehensive Nuclear Test Ban Treaty, General John M. Shalikashvili, Special Advisor to the President and Secretary of State, 2001

Concluding a 10 month-long review, General John Shalikashvili reported on the Comprehensive Test Ban Treaty (CTBT) to President Clinton, voicing strong support for the treaty and outlining measures to build bipartisan support for it.
www.armscontrol.org/act/2001_01-02/ctbtreport

Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty, National Academy of Sciences, 2002

The report challenged several concerns expressed by treaty opponents over monitoring global testing and asserted that effective U.S. stockpile stewardship does not require further tests.
www.armscontrol.org/act/2002_09/nassept02

Report on Life Extension Program, JASON, 2009

A congressionally-commissioned scientific study concludes that the effectiveness of the U.S. nuclear arsenal can be maintained indefinitely through the existing program for stockpile stewardship and without nuclear test explosions or pursuit of new warhead designs.
www.armscontrol.org/pressroom/jasonreportpressrelease

Website of the Comprehensive Nuclear-Test Ban Treaty Organization in Vienna

www.CTBTO.org

Website of the Project for the Comprehensive Test Ban Treaty

www.ProjectfortheCTBT.org
www.twitter.com/CTBTnow

The Arms Control Association (ACA), founded in 1971, is a national nonpartisan membership organization dedicated to promoting public understanding of and support for effective arms control policies. Through its public education and media programs and its magazine, *Arms Control Today (ACT),* ACA provides policy-makers, the press and the interested public with authoritative information, analysis and commentary on arms control proposals, negotiations and agreements, and related national security issues. In addition to the regular press briefings ACA holds on major arms control developments, the Association's staff provides commentary and analysis on a broad spectrum of issues for journalists and scholars both in the United States and abroad.

NUCLEAR TESTING is a dangerous and unnecessary vestige of the Cold War that the United States rejected almost 20 years ago. There is no military justification for resuming U.S. testing, and the United States does not need nuclear testing to maintain the effectiveness and reliability of its nuclear deterrent.

The 1996 Comprehensive Nuclear Test Ban Treaty (CTBT) is an essential part of a commonsense strategy to reduce nuclear dangers.

It is in the U.S. national security interest to prevent nuclear weapons testing by others and to improve the U.S. and international ability to monitor compliance with the treaty.

A growing list of bipartisan leaders agree that by ratifying the CTBT, the United States stands to gain an important constraint on the ability of other states to build new and more deadly nuclear weapons that could pose a greater threat to American security.

This briefing book reviews the key facts and issues at stake.

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