

# BACKGROUND

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## Keeping Nuclear Testing on the Table: A National Security Imperative *Michaela Dodge and Baker Spring*

### Abstract

*The United States has not tested nuclear weapons or conducted any yield-producing nuclear weapons experiment since 1992. In a few short years, all nuclear weapons engineers and scientists that have any experience in nuclear testing and weapons design will have retired. These developments will have a profound impact on the nation's ability to innovate, assure allies, and deter adversaries. The United States must reverse this dangerous situation in its National Nuclear Laboratories, which stems from years of neglect and underfunding. The goal of the United States should be to create a culture that does not preclude innovation, and allows the United States to develop and maintain responsive nuclear weapons options in proportion to the challenges of the 21st century.*

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Since 1992, the United States has not tested nuclear weapons or conducted any yield-producing nuclear weapons experiment. In a few short years, all nuclear weapons engineers and scientists with experience in nuclear testing and weapons design will have retired. These developments will have a profound impact on the nation's ability to innovate, assure allies, and deter adversaries. The U.S. must reverse this dangerous situation in its National Nuclear Laboratories, which stems from years of neglect and underfunding. The goal is to create a culture that does not preclude innovation, and allows the country to develop and maintain responsive nuclear weapons options for the 21st century.

Opponents of nuclear weapons testing argue that it is “dangerous and unnecessary.”<sup>1</sup> They assert that there is no technical or military reason for the United States to test nuclear weapons—despite the fact that it is not possible to know whether a change in circumstance will result in a compelling technical or military reason to test nuclear weapons. Opponents also claim that the cessation of U.S. nuclear testing makes it more difficult for other nations to test and develop new—destabilizing—nuclear weapon

### KEY POINTS

- The United States has not tested nuclear weapons or conducted any yield-producing nuclear weapons experiment since 1992. In a few years, all nuclear weapons engineers and scientists with experience in nuclear testing and weapons design will have retired.
- The U.S. must reverse this dangerous situation in its National Nuclear Laboratories, which stems from years of neglect and underfunding.
- Opponents of nuclear weapons testing not only assert—incorrectly—that conducting such tests is dangerous and unnecessary, they also fail to acknowledge the technological, military, and political benefits that the United States could obtain if it pursued a robust nuclear weapons testing regime.
- The goal is to create a culture that does not preclude innovation and allows the country to develop and maintain responsive nuclear weapons options for the 21st century.

designs. Of course, North Korea and several other countries are unlikely to forgo nuclear testing.

The opponents of nuclear weapons testing not only assert that conducting such tests is dangerous and unnecessary, they also fail to acknowledge the technological, military, and, most important, political benefits that the United States could obtain if it pursued a robust nuclear weapons testing regime. Among the latter is maintenance of an effective deterrence posture and escalation dominance as well as reassurance of U.S. allies.

The history shows that such tests can be conducted in a way that impacts the environment only minimally. Nuclear testing with an explosive yield between one to two kilotons would provide the United States with valuable knowledge about changes in its current stockpile.<sup>2</sup> Ambassador Paul Robinson, president emeritus and former director of the Sandia National Laboratories, stated that during the Comprehensive Test Ban Treaty (CTBT) negotiations, the directors of the National Nuclear Laboratories requested that they be permitted yield-producing experiments below one kiloton in order to “determine whether the first stage of multiple stage devices was indeed operating successfully.”<sup>3</sup> Sadly, the Clinton Administration changed its interpretation to a zero-yield level. This effectively meant that the U.S. would not be allowed to conduct any yield-producing experiments. For a comparison, the largest conventional weapon in the U.S. arsenal, the GBU-43/B Massive Ordnance Air Blast bomb, has a yield of about 11 tons.<sup>4</sup>

High-yield explosive testing is not absolutely necessary to develop new nuclear weapon designs. According to Siegfried Hecker, former director of the Los Alamos National Laboratory, “[M]ost [new] designs could be adequately tested at yields between one and ten kilotons.”<sup>5</sup> Remarkably, Russia and, likely, China are conducting low-yield nuclear weapons tests despite the U.S.’s self-imposed moratorium on any such experiments.<sup>6</sup> The two countries also do not share the U.S. zero-yield interpretation of the CTBT.

## Nuclear Weapons Testing History

United Nations Secretary-General Ban Ki-moon stated in 2012 that “[n]uclear tests remain a threat to human health and global stability.” The Secretary-General’s comment reflects an often-held misconception about the state of today’s technology and how nuclear weapons tests would be conducted in the United States. Nuclear weapons testing is currently subject to four major international agreements: the 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and under Water (also known as the Limited Test Ban Treaty); the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (also known as the Outer Space Treaty), which prohibits nuclear weapons tests on the Moon and other celestial bodies; the 1974 Treaty on the Limitation of Underground Nuclear Weapon Tests (also known as the Threshold Test Ban Treaty) banning nuclear weapons tests above 150 kiloton; and the 1976 Treaty Between the United States of America and the Union of Soviet Socialist Republics on Underground Nuclear Explosions for Peaceful Purposes.

In addition, there are other international agreements that indirectly impact states’ abilities to test nuclear weapons, such as agreements established by the nuclear-weapons-free-zone treaties. These agreements limit nuclear weapons testing that has the most destructive impact on the environment. The Obama Administration is now seeking to revive the CTBT, which the Senate rightfully rejected after a full-floor debate in 1999.

## U.S. Policies and Nuclear Weapons Testing

The self-imposed nuclear testing moratorium has been in place since 1992 when President George H. W. Bush signed the Energy and Water Development Appropriations Act for fiscal year (FY) 1993. The Administration at the time disagreed with a provision in the law:

1. Daryl Kimball, “Why We Don’t Need to Resume Nuclear Testing: A Reply to Senator Jon Kyl’s ‘Why We Need to Test Nuclear Weapons,’” Carnegie Endowment for International Peace, November 3, 2009, <http://www.carnegieendowment.org/2009/11/03/why-we-don-t-need-to-resume-nuclear-testing-reply-to-senator-jon-kyl-s-why-we-need-to-test-nuclear-weapons/6a3> (accessed February 8, 2013).
2. Kathleen Bailey and Thomas Scheber, “The Comprehensive Test Ban Treaty: An Assessment of the Benefits, Costs, and Risks,” National Institute for Public Policy, 2011, p. 36.
3. Paul Robinson, John Foster, and Thomas Scheber, “The Comprehensive Test Ban Treaty: Questions and Challenges,” Heritage Foundation *Lecture* No. 1218, November 7, 2012, <http://www.heritage.org/research/lecture/2012/11/the-comprehensive-test-ban-treaty-questions-and-challenges>.
4. “GBU-43/B ‘Mother of All Bombs,’ MOAB-Massive Ordnance Air Blast Bomb,” Global Security.org, <http://www.globalsecurity.org/military/systems/munitions/moab.htm> (accessed February 8, 2013).
5. Siegfried Hecker, letter to Senator Jon Kyl, September 24, 1997, Attachment, p. 5.

Specifically, Section 507 of H.R. 5373, which concerns nuclear testing, is highly objectionable. It may prevent the United States from conducting underground nuclear tests that are necessary to maintain a safe and reliable nuclear deterrent. This provision unwisely restricts the number and purpose of U.S. nuclear tests and will make future U.S. nuclear testing dependent on actions by another country, rather than on our own national security requirements.<sup>7</sup>

The moratorium remained in place despite these objections and expanded when the Clinton Administration signed the CTBT. While the treaty itself does not define what constitutes a nuclear weapons test, the United States adheres to a zero-yield interpretation thus banning *any* experiments that would produce a nuclear yield.

The Obama Administration affirmed this policy in the most recent Nuclear Posture Review (NPR) published in 2010. The Administration committed itself to pursuing the CTBT's ratification and entry into force.<sup>8</sup> The NPR also states that "the United States will not develop new nuclear warheads" and "will not support new military missions or provide for new military capabilities."<sup>9</sup> These policies are detrimental to the health of the U.S. nuclear weapons complex and place limits on U.S. strategic systems modernization. The United States today has the oldest nuclear weapons arsenal it has ever had. The average age of U.S. nuclear warheads is approaching 27 years, which is well beyond their originally intended operational life.<sup>10</sup>

Weapons in the current stockpile were developed during the Cold War, which also means that the Department of Defense specified their military requirements during that time. In fact, the current stockpile is based on technology from the 1970s. During the Cold War, the

requirements included: nuclear safety, operational reliability, yield, conservative use of nuclear materials, and operational simplicity (in order of priority).<sup>11</sup> They were primarily driven by demands of Cold War deterrence based on the mutually assured destruction policy with the Soviet Union as the prime adversary.

The military requirements also impacted the way the United States designed its delivery systems: bombers and in particular intercontinental-range ballistic missiles and submarine-launched ballistic missiles. Missiles have to withstand extreme temperatures and stresses during acceleration and re-entry to deliver the warhead to its intended target. Indeed, each type of warhead has to be "mated" to its delivery vehicle to ensure that the system as a whole will perform exactly as intended. As the delivery vehicles age and need to be replaced, Congress must examine the trade-offs involved in trying to fit U.S. existing warheads to the new systems.

The current nuclear weapons testing moratorium is not the United States' first. The U.S. stopped nuclear weapons testing in 1958 after a gentleman's agreement with the Soviet Union. The result was that "4 of the 24 weapon designs in the 1961 stockpile had problems that could be resolved only by additional nuclear tests."<sup>12</sup> The United States fielded nuclear weapons with problems—and found out about these problems only after testing and yield-producing experiments resumed. These tests and experiments also revealed serious undetected stockpile problems.<sup>13</sup> After three years, the Soviets violated the moratorium and conducted a series of experiments carefully designed and prepared while both countries were under the moratorium. The U.S. effort to respond and resume nuclear weapons testing as soon as possible "was technically agonizing, operationally painful, and economically very costly. The atmospheric component of test

6. "America's Strategic Posture," in *The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, D.C.: U.S. Institute of Peace Press, 2009), p. 83, [http://www.usip.org/files/America's\\_Strategic\\_Posture\\_Auth\\_Ed.pdf](http://www.usip.org/files/America's_Strategic_Posture_Auth_Ed.pdf) (accessed February 8, 2013).

7. George H. W. Bush, "Statement on Signing the Energy and Water Development Appropriations Act, 1993," October 2, 1992, <http://www.presidency.ucsb.edu/ws/index.php?pid=21558> (accessed February 8, 2013).

8. Nuclear Posture Review Report, April 2010, p. 13, <http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf> (accessed February 19, 2013).

9. *Ibid.*, p. xiv.

10. National Defense Industrial Association, Air Force Association, and Reserve Officers Association Capitol Hill Breakfast Forum with Don Cook, Deputy Administrator for Defense Programs, National Nuclear Security Administration, July 7, 2012, <http://www.afa.org/hbs/transcripts/2012/7-10-2012%20Dr.%20Donald%20Cook.pdf> (accessed February 11, 2013).

11. George Miller, Paul Brown, and Carol Alonso, "Report to Congress on Stockpile Reliability, Weapon Remanufacture, and the Role of Nuclear Testing," Lawrence Livermore National Laboratory, October 1987, p. 3.

12. A caveat: One design of the 18 weapon designs in the 1958 stockpile had been retired, and seven new designs were added. *Ibid.*, p. 16.

13. *Ibid.*, pp. 7-8.

resumption had especially high political obstacles and costs.”<sup>14</sup>

## U.S. Reliance on Problematic Computer Codes

Recently, the State Department’s Bureau of Arms Control, Verification, and Compliance released a fact-sheet titled “Enhanced U.S. Nuclear Weapon Stockpile Surveillance Tools.”<sup>15</sup> While the document was intended to convince the public about the reliability of the tools used for evaluating the health and viability of the stockpile, it raised yet more concerns about the direction of the Stockpile Stewardship Program. The State Department maintains that the use of data from surveillance of U.S. nuclear weapons “has improved significantly over the past decade and provides us with the capability to ensure an effective nuclear stockpile.” The problem is that the last yield-producing experiment was conducted more than 20 years ago. As nuclear weapons age, they depart from their tested envelopes which served as a basis for computer codes and simulations.

This raises a question whether the computer codes that American scientists and engineers use to predict and certify nuclear performance are correct. As David Sharp, the chief scientist at the Los Alamos National Laboratory, points out:

The only unequivocal way to *demonstrate* that predictions made with simulation codes meet expected standards of confidence is by establishing a track record of correct and reliable predictions that have been made using that code. For nuclear weapons this means successful prediction of nuclear performance. A track record of this kind is the essential reality check on claims of predictive capabilities; it is the indispensable source of confidence that is needed if codes are ever to replace nuclear tests. *However*, the ability to make correct, reliable predictions of nuclear performance using codes *has not* been demonstrated and *cannot*

be demonstrated without a nuclear test program.”<sup>16</sup> [Emphasis in original.]

The documentation from the past tests is not sufficient to determine whether the computer codes the scientists and engineers use today are good enough. This is because nobody in the past assumed that the United States would forgo all yield-producing experiments. As a result, “Data from past nuclear testing is, in general, too coarse to test the validity of the high resolution, complex models that SSP [Stockpile Stewardship Program] seeks to develop.”<sup>17</sup> In addition, “the right answer could be obtained as a result of compensating errors, a circumstance in which two or more errors balance each other so they have no net effect.”<sup>18</sup> Such errors could adversely impact judgments about the condition of the stockpile.

## Challenges of the Stockpile Stewardship Program and President’s Safeguards

The Science-Based Stockpile Stewardship Program, established in 1995, achieved some successes but has been hampered by inconsistency in congressional support and a lack of funding. The Department of Energy (DOE) eventually changed the name to Stockpile Stewardship Program (SSP) in recognition of the fact that it rejects the essence of science, which is testing. The program was never meant to be a substitute for yield-producing experiments. As Ambassador Paul Robinson testified to Congress, “[T]o forego that validation through testing is, in short, to live with uncertainty.”<sup>19</sup> In addition, the program “failed to provide the necessary surveillance of the aging warheads, was prevented by Congress from pursuing the Reliable Replacement Warhead, the Nuclear Penetrating Warhead or any ‘new’ designs. Those actions denied the laboratories the opportunity to develop and demonstrate nuclear weapons competence from design through to production and flight tests.”<sup>20</sup>

14. William Ogle, “An Account of the Return to Nuclear Weapons Testing by the United States after the Test Moratorium 1958-1961,” United States Department of Energy, Nevada Operations Office, October 1985, p. 6.
15. “Enhanced U.S. Nuclear Weapon Stockpile Surveillance Tools,” U.S. State Department *Factsheet*, December 13, 2012, <http://www.state.gov/t/avc/rls/202012.htm> (accessed February 11, 2013).
16. David Sharp, “Nuclear Testing: Deterrence, Stewardship, and Arms Reduction,” Theory, Simulations and Computation Directorate, Los Alamos National Laboratory, Los Alamos, NM, LA-UR-08-06803, p. 10.
17. Kathleen Bailey, “The Comprehensive Test Ban Treaty: An Update on the Debate,” National Institute for Public Policy, March 2001, p. 10, <http://www.nipp.org/National%20Institute%20Press/Archives/Publication%20Archive%20PDF/CTBT%20Update.pdf> (accessed February 8, 2013).
18. Sharp, “Nuclear Testing: Deterrence, Stewardship, and Arms Reduction,” p. 11.
19. Paul Robinson, testimony before the Armed Services Committee on the Comprehensive Nuclear Test Ban Treaty, U.S. Senate, October 7, 1999.
20. Robinson, Foster, and Scheber, “The Comprehensive Test Ban Treaty: Questions and Challenges.”

New safeguards, submitted to the Senate with the CTBT in 1997, were a means to curtail debate over the risks of U.S. accession to the CTBT and should have been in place regardless of whether the CTBT entered into force. The Administration vowed to fulfill these safeguards:

- To conduct a science-based Stockpile Stewardship Program to ensure a high level of confidence in the safety and reliability of the nuclear weapons in the active stockpile;
- To maintain modern nuclear laboratory facilities and programs;
- To maintain the basic capability to resume nuclear test activities prohibited by CTBT;
- To conduct a comprehensive research and development program to improve U.S. treaty monitoring;
- To conduct intelligence programs that would gather information on worldwide nuclear arsenals, nuclear weapons development programs, and related nuclear programs; and
- To establish an understanding that there is an option for the President, in consultation with Congress, to withdraw from the CTBT if the Secretaries of Defense and Energy determine that a type of nuclear weapon critical to U.S. national security can no longer be certified.<sup>21</sup>

While these safeguards did not preclude the option of resuming nuclear weapons testing when the safety and reliability of weapons in the stockpile cannot be certified, military effectiveness of the U.S. nuclear deterrent, and

the need to respond when a new military mission is identified, depend on continuous testing. The testing, therefore, should be as important as other safeguards in and of itself.

Modernization of nuclear weapons infrastructure is not faring much better. After years of delay, the Obama Administration's decision to further defer construction of the Chemical Metallurgy Research Replacement Facility effectively terminated one of the key enablers to meet the Strategic Command's requirements and confidence to support future nuclear reductions.<sup>22</sup> The President took this step contrary to his own certification that he would *accelerate* its design and engineering phase.<sup>23</sup>

The Administration recognized that there is a significant need to increase investments in the nuclear weapons complex during the New START ratification debate in the Senate. To that end, the President pledged to provide more than \$85 billion for the Weapons Activities account over the next 10 years.<sup>24</sup> This is only about 1.5 percent of the Department of Defense's budget. In addition, this amount includes some of the funding for nuclear dismantlement. Very little of these funds are actually devoted to nuclear weapons modernization.<sup>25</sup> Even so, the Administration's promises did not survive New START's first year.

The basic capability to resume nuclear test activities has deteriorated in recent years. In FY 2006, Congress denied the National Nuclear Security Administration's (NNSA's) funding request to conduct a nuclear test within 18 months of a presidential notice, and lengthened the response time frame to 24 months. Budgetary pressure led to further deterioration of U.S. test preparedness.<sup>26</sup>

These examples show that the safeguards or modernization pledges and the SSP are not enough to sustain a long-term political consensus on the need of maintaining an effective and healthy nuclear infrastructure. Indeed, they may not be enough to sustain the weapons that have

21. Kathleen Bailey and Thomas Scheber, "The Comprehensive Test Ban Treaty: An Assessment of the Benefits, Costs, and Risks," National Institute for Public Policy, 2011, p. 49, <http://www.nipp.org/CTBT%203.11.11%20electronic%20version.pdf> (accessed February 8, 2013).

22. Paul Hommert, hearing to receive testimony on "National Nuclear Security Administration Management of Its National Security Laboratories," Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate, April 18, 2012.

23. News release, "Message from the President on the New START Treaty," The White House, February 2, 2011, <http://www.whitehouse.gov/the-press-office/2011/02/02/message-president-new-start-treaty-0> (accessed February 8, 2013).

24. News release, "Fact Sheet: An Enduring Commitment to the U.S. Nuclear Deterrent," The White House, November 17, 2010, <http://www.whitehouse.gov/the-press-office/2010/11/17/fact-sheet-enduring-commitment-us-nuclear-deterrent> (accessed February 8, 2013).

25. Michaela Bendikova and Baker Spring, "Bait and Switch on Nuclear Modernization Must Stop," Heritage Foundation *Backgrounder* No. 2755, January 4, 2013, <http://www.heritage.org/research/reports/2013/01/bait-and-switch-on-nuclear-modernization-must-stop>.

26. Committee on Reviewing and Updating Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty, Policy and Global Affairs and National Research Council, "The Comprehensive Nuclear Test Ban Treaty: Technical Issues for the United States," 2012, p. 30.

safeguarded the U.S. and allied security for more than 60 years.

### Planning in the Post–Cold War Environment

Today, the United States faces quite a different environment than during the Cold War. While arms control treaties and unilateral steps lowered the number of operationally deployed nuclear warheads, both long-range and short-range, Pakistan, India, and North Korea emerged as new nuclear weapons players. Pakistani scientist A. Q. Khan and his efforts to transfer nuclear weapons technology to anyone willing to pay enough cash further underscored the dangers associated with the potential transfer of nuclear weapons to terrorists' hands. These developments also mean that the U.S. faces a more unpredictable, unstable, and dangerous international environment.<sup>27</sup> Iran is emerging as yet another new nuclear weapons player, and if it successfully manages to conduct a nuclear test, it will have profound implications for the countries in the Middle East.

The question is whether the Pentagon's military requirements are significantly different today than during the Cold War and, if so, whether these changes warrant a development of new nuclear weapons designs to meet them. For example, U.S. military leaders and policymakers placed a value on yield-to-weight ratio because it was assumed that the weapons will be used to destroy hardened ballistic missile silos and other targets essential for Soviet survival. This left the nation with a legacy stockpile of mostly high-yield nuclear weapons that might be unsuitable for the conditions after the end of the Cold War.<sup>28</sup>

Credibility is at the heart of deterrence. Enemies of the U.S. must believe that the President will use these weapons in retaliation, and that U.S. weapons will be able to effectively destroy targets that the adversaries value.<sup>29</sup> U.S. moral values require nuclear weapons

that produce as little collateral damage as possible—and population centers are not what most enemies value.<sup>30</sup> If policy banning new nuclear weapons, missions, capabilities, and nuclear weapons tests would change, would the Department of Defense's requirements change, too? Would they be significantly different from military requirements set during the Cold War when fewer nuclear weapons states existed? Would such changes open the way for the National Nuclear Laboratories to develop new nuclear weapons with lower yields and better security features? What are the trade-offs and costs associated with maintaining the Cold War stockpile of weapons versus developing new designs? Could the United States lower the overall yield of its nuclear weapons stockpile if it could develop more modern warheads? These questions should be answered without policy limits, although the execution of recommendations will always be a complex policy matter. The key is credible deterrence—and action, should deterrence fail.

The Obama Administration is currently seeking to further reduce the number of operationally deployed U.S. nuclear warheads—currently at about 1,700 under New START counting rules. Some public reports even suggested that the number should be as low as 300.<sup>31</sup> If accepted, the number would mean that the U.S. has moved toward a minimal deterrence posture. Such a step would be foolhardy because:

- It would require a shift in U.S. targeting policy since, at low numbers, the United States would be able to threaten only population centers.<sup>32</sup> For decades, such policy has been deemed an insufficient foundation for an effective and moral deterrence, especially for a country that values life above anything else.
- Depending on the force posture, it would be increasingly difficult to maintain a triad of nuclear delivery

27. Nuclear Stability Working Group, *Nuclear Games: An Exercise Examining Stability and Defenses in a Proliferated World*, Heritage Foundation Special Report, November 9, 2005, <http://www.heritage.org/research/reports/2005/11/nuclear-games-an-exercise-examining-stability>, and Nuclear Stability Working Group, *Nuclear Games II: An Exercise in Examining the Dynamic of Missile Defenses and Arms Control in a Proliferated World*, Heritage Foundation Special Report No. 83, July 26, 2010, <http://www.heritage.org/research/reports/2010/07/nuclear-games-ii-an-exercise-in-examining-the-dynamic-of-missile-defenses-and-arms-control>.

28. Bailey and Scheber, "The Comprehensive Test Ban Treaty," p. 41.

29. Rebecca Heinrichs and Baker Spring, "Deterrence and Nuclear Targeting in the 21st Century," Heritage Foundation *Backgrounder* No. 2747, November 30, 2012, <http://www.heritage.org/research/reports/2012/11/deterrence-and-nuclear-targeting-in-the-21st-century>.

30. Andrei Shoumikhin and Baker Spring, "Strategic Nuclear Arms Control for the Protect and Defend Strategy," Heritage Foundation *Backgrounder* No. 2266, May 4, 2009, <http://www.heritage.org/research/reports/2009/05/strategic-nuclear-arms-control-for-the-protect-and-defend-strategy>.

31. Bill Gertz, "Nuking our Nukes," *The Washington Free Beacon*, February 14, 2012, <http://freebeacon.com/nuking-our-nukes/> (accessed February 8, 2013).

32. Heinrichs and Spring, "Deterrence and Nuclear Targeting in the 21st Century."

systems. This could lead to decreased survivability of the remaining nuclear force and increased risks associated with technical failures in the remaining systems.

- Low numbers of deployed nuclear warheads would not necessarily translate into cost savings because the nuclear weapons infrastructure is more sensitive to changes in the number of stockpiled nuclear weapons. If the Administration chooses to change the size of the stockpile, it will have to re-assess the way the U.S. ensures the reliability of its nuclear weapons.
- At a time when all other nuclear weapon states, including those undeclared under the Nonproliferation Treaty, pursue nuclear weapons modernization programs, the United States must adopt a policy of maximal, not minimal, deterrence.

The maximal deterrence policy would be designed to discourage adversaries from developing means of strategic attack against the United States and its allies, and to deter the use of those means. It would encompass nuclear weapons, conventional strategic strike weapons, and defensive weapons. The employment doctrine would be guided by principles of counter-force targeting.<sup>33</sup> U.S. foes value the assets that enable them to blackmail or influence the U.S. by holding the U.S. and its allies at risk of strategic attack, as well as the means of maintaining oppressive control of their domestic populations.<sup>34</sup>

The Russians, and possibly the Chinese, conduct very low-yield nuclear weapons experiments.<sup>35</sup> Over time, depending on circumstance, these and other countries conducting covert or overt yield-producing experiments will be able to sustain their stockpiles better than without these experiments. Such nations will also improve their capability and confidence in computer codes, assessing weapons performance, and sustaining or expanding the knowledge and skill sets in this field for their scientists and engineers. Since “[a]ll of the weapons in the current

U.S. stockpile were designed using codes that ran on computers far less powerful than those widely available today,”<sup>36</sup> it is possible for U.S. adversaries to figure out and exploit the weaknesses of weapons in the U.S. nuclear stockpile.

New nuclear weapons designs could mitigate this risk. In addition, it would allow new safety features to be introduced to the stockpile, which the current test moratorium prevents. Even if new safety features could be incorporated into the existing stockpile, the effort would likely be cost-prohibitive absent testing.<sup>37</sup> Even worse, a test moratorium precludes new safety features, for example, materials making a detonation less likely or additional mechanisms to prevent terrorist use and access.<sup>38</sup>

### **Dwindling Motivation in U.S. Nuclear Weapons Laboratories**

There are additional benefits for the United States if it resumed nuclear weapons testing. Since the cessation of U.S. nuclear weapons experimenting and testing, the U.S. nuclear weapons complex began to rely more on computer simulations instead of “hands on” work on the engineering side.

Last year, Thomas D’Agostino, the Under Secretary for Nuclear Security and the Administrator of the NNSA, stated that in about five years the United States will not have a single active engineer who had “a key hand in the design of a warhead that’s in the existing stockpile and who was responsible for that particular design when it was tested back in the early 1990s.”<sup>39</sup> This is a significant problem, because, for the first time since the dawn of the nuclear age, the nation will rely on the scientific judgment of people who were not directly involved in designing the weapons that they are certifying.

The uncertainty regarding the funding and direction of the nuclear weapons complex significantly complicates the National Laboratories’ efforts to attract and maintain young talent. The shift of focus away from the nuclear mission after the end of the Cold War caused the National

33. Ibid.

34. Shoumikhin and Spring, “Strategic Nuclear Arms Control for the Protect and Defend Strategy.”

35. Congressional Commission on the Strategic Posture of the United States, “America’s Strategic Posture.”

36. Richard Wagner, letter in response to Senator Jon Kyl’s letter related to nuclear testing and the Comprehensive Test Ban Treaty, October 20, 2009.

37. Testimony of Dr. Robert B. Barker before the Subcommittee on International Security, Proliferation, and Federal Services, Committee on Governmental Affairs, U.S. Senate, October 27, 1997, p. 40.

38. Kathleen Bailey, “The Comprehensive Test Ban Treaty: An Update on the Debate,” National Institute for Public Policy, March 2001, p. 3, <http://www.nipp.org/National%20Institute%20Press/Archives/Publication%20Archive%20PDF/CTBT%20Update.pdf> (accessed February 11, 2013).

39. Kate Brannen, “Nuke Expert Pool Shrinking,” April 14, 2012, *DefenseNews*, <http://www.defensenews.com/article/20120414/DEFREG02/304140002/Nuke-Expert-Pool-Shrinking/> (accessed February 11, 2013).

Laboratories to lose their sense of purpose and to feel compelled to reorient their focus and change their relationship with the government. The creation of the NNSA was supposed to address these problems, yet it largely failed in this task, partly because “the relationship with the NNSA and the National security labs appears be broken.”<sup>40</sup>

In 1999, the Commission on Maintaining U.S. Nuclear Weapons Expertise concluded that 34 percent of the employees supplying critical skills to the weapons program were more than 50 years old. This is more than the average in the U.S. high-technology industry, and the number further increased to 40 percent in 2009.<sup>41</sup> Last year, at least 550 employees of the Los Alamos National Laboratory had to leave in anticipation of a \$300 million shortfall.<sup>42</sup>

The renewal of nuclear weapons testing would act as an incentive for scientists and engineers to innovate. Under present conditions, this incentive is removed because even if one designs a new security feature or has an idea for a new nuclear weapon design, it is barred by policy and regulation to turn the idea in reality.<sup>43</sup>

### Hardening of U.S. National Security Systems and Critical Infrastructure

In the past, the United States used nuclear experiments to assess and evaluate the best modes of deployment for its forces (including command and control and supporting infrastructure), their survivability, and properties of different materials that would be used in these different concepts. The experiments and tests also served to learn about how delivery vehicles, re-entry vehicles, and nuclear warheads operate and perform in a radiated environment.

Under the current testing moratorium, the United States is forgoing the opportunity to learn about the benefits of new materials and technologies for its nuclear system and their contributions to the survivability and

security of its forces. This also opens up the U.S. to attack by a nuclear weapon that was specifically designed to overcome hardness levels built into the current nuclear systems and infrastructure. William Graham, chairman of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack, noted that the DOE and the NNSA failed to develop and initiate a program “to understand the effects that nuclear weapons produce on modern systems.”<sup>44</sup> With respect to EMP, the Commission concluded that “the U.S. is rapidly losing the technical competence and facilities that it needs in the Government, the National Laboratories, and the Industrial Community.”<sup>45</sup> This competence will be harder to restore if the moratorium banning all yield-producing experiments remains in place.

### What Congress Should Do

To revive the knowledge base regarding the effects of nuclear weapons on U.S. military systems and infrastructure, Congress should:

- **Direct the President to adopt a “protect and defend” strategic posture.**
- **Direct the DOE and the NNSA to inform Congress on trade-offs that must be made on follow-on strategic delivery systems** because the U.S. has to fit them to old nuclear warheads.
- **Direct the DOE and the NNSA to conduct a study examining health and environmental issues associated with nuclear weapons testing below one kiloton.**
- **Direct the DOE and the NNSA to conduct a study assessing benefits of conducting low-yield nuclear**

40. Statement of Charles Shank, Senior Fellow, Howard Hughes Medical Institute and Co-chair, National Research Council Committee on Review of the Quality of the Management and of the Science and Engineering Research at the DOE's National Security Laboratories-Phase 1, hearing to receive testimony on National Nuclear Security Administration Management of Its National Security Laboratories, Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate, April 18, 2012.

41. Task Force on Leveraging the Scientific and Technological Capabilities of the NNSA National Laboratories for 21st Century National Security, “Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century,” The Henry L. Stimson Center, March 2009, p. 11, [http://www.stimson.org/images/uploads/research-pdfs/Leveraging\\_Science\\_for\\_Security\\_FINAL.pdf](http://www.stimson.org/images/uploads/research-pdfs/Leveraging_Science_for_Security_FINAL.pdf) (accessed February 11, 2013).

42. Robinson, Foster, and Scheber, “The Comprehensive Test Ban Treaty: Questions and Challenges.”

43. Bailey, “The Comprehensive Test Ban Treaty: An Update on the Debate.”

44. William Graham, statement before the Armed Services Committee, U.S. House of Representatives, on behalf of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack,” July 10, 2008, <http://www.empcommission.org/docs/GRAHAMtestimony10JULY2008.pdf> (accessed February 13, 2013).

45. Ibid.



**weapons experiments** with regard to judgments about the health of U.S. stockpiles, designing new safeguards, and judgments about nuclear weapons programs of other nations.

- **Establish an independent panel comprised of nuclear weapons experts with nuclear weapons engineering and testing experience and a range of opposing views to provide an independent review of the study.**
- **Direct the DOE and the NNSA to revive the program for assessing effects of nuclear weapons on modern critical infrastructure and military systems**, building on the research the United States conducted in this area in the past.
- **Increase nuclear weapons modernization funding**, which would help to attract and retain young talent to work and stay in the nuclear weapons field.
- **Change the 2010 Nuclear Posture Review policy barring innovation.**
- **Establish a policy standard of maximal deterrence.**

These steps will help to inform the public policy debate as the nation decides on the future of its nuclear weapons arsenal.

## Conclusion

Current policies and a lack of funding further exacerbate existing problems. Unless there are changes in both, the future of the U.S. nuclear enterprise is bleak. As Charles McMillan, Director of the Los Alamos National Laboratory testified, “Today I cannot say with confidence that we are on a path to a healthy program.”<sup>46</sup> Conducting low-yield nuclear weapons experiments with a minimal impact on the environment would help to restore the morale in the National Nuclear Laboratories, improve U.S. predictive and monitoring capabilities, verify that current U.S. capabilities are sufficient, and potentially develop new nuclear weapon designs with better safety features.

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46. Charles McMillan, hearing to receive testimony on National Nuclear Security Administration Management of Its National Security Laboratories, Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate, April 18, 2012.