

A Brief Summary of the National Academy of Sciences 2012 Report

The National Academy of Sciences (NAS) released in March 2012 an update of its 2002 report on technical issues associated with the Comprehensive Test Ban Treaty (CTBT), the international treaty to ban all nuclear-explosion testing. In brief, the new report finds that the United States “has the technical capabilities to maintain a safe, secure, and reliable stockpile of nuclear weapons into the foreseeable future without nuclear-explosion testing” and “is now better able to maintain a safe and effective nuclear stockpile and to monitor clandestine nuclear-explosion testing than at any time in the past.”

The United States signed the CTBT in 1996. In 1999, the Senate debated, but declined to ratify, the treaty. The Obama administration has said that it will pursue ratification and in 2009 directed the NAS to produce an updated report. The NAS assessment focuses solely on technical, not political, issues. It looks at risks to national security that might arise as a result of ratification. It finds that those risks are limited because the Stockpile Stewardship Program (SSP), established to maintain the reliability, safety and security of U.S. arsenal without nuclear-explosion testing, has been very effective.

The new report, *The Comprehensive Nuclear Test Ban Treaty—Technical Issues for the United States*,¹ strengthens the 2002 report’s conclusion that the United States does not need to resume nuclear testing to maintain its security or the reliability of its nuclear weapons. It describes technical improvements since 2002 in U.S. capabilities to maintain its nuclear stockpile, monitor treaty compliance, and detect cheating. It finds that the Stockpile Stewardship Program and U.S. national and international monitoring capabilities are more capable than anticipated in 1999.

Overall, the report concludes, the United States has no technical reason to resume nuclear testing. As the panel states, “although there are legitimate concerns about maintaining the capabilities needed to sustain U.S. national security into the future...these concerns are *not* the result

of intrinsic technical limitations and are *not* limited by a possible future under the CTBT.” [emphasis in original]

Maintaining the U.S. nuclear stockpile

While noting that sustaining the U.S. arsenal will require a continuing commitment of resources and skilled personnel, the report finds that the United States now has a greater technical ability to maintain the safety, security, reliability, and effectiveness of its nuclear stockpile than was anticipated in 2002.

The report identifies a number of significant developments since the 2002 report that support this conclusion, including new findings that plutonium “pits” (the core of all U.S. nuclear weapons) have a lifetime of at least 85-100 years; large increases in computing power that improve weapons modeling and assessment; the completion of major SSP-related research facilities; production of certified W88 pits; successful experience with warhead life-extension programs; and enhanced stockpile surveillance programs for the U.S. arsenal. In addition, the report states, over the past ten years the nuclear weapons complex has demonstrated its ability to resolve technical issues encountered during its surveillance and design work. Directors of the nuclear weapons labs told the committee that “there is no evidence of any technical issues that cannot be resolved with the present competency.”

Monitoring and verification

To ensure compliance by CTBT signatories, and to detect tests by non-signatories, the United States and other treaty parties need to monitor nuclear testing worldwide. A number of systems can be used for this, including an International Monitoring System (IMS) run by the CTBT Organization (CTBTO), national technical means (NTM) of member states, and independent sensor networks deployed for other purposes (e.g., seismic networks designed to monitor earthquakes). The treaty also provides for on-site inspections at the request of signatory states.

Concern that monitoring systems might not detect low-yield or concealed tests played a role in the U.S. decision not to ratify the CTBT in 1999. Since then, significant improvements in monitoring capabilities—including near completion of the IMS; enhanced seismic (underground

¹ Committee on Reviewing and Updating Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty; Policy and Global Affairs; National Research Council of the National Academies, *The Comprehensive Nuclear Test Ban Treaty—Technical Issues for the United States*, 2012, available at: http://www.nap.edu/catalog.php?record_id=12849

motion), radionuclide (radioactive particle), and hydroacoustic (underwater sound) capabilities; establishment of an infrasound (low frequency sound wave) network; improvements in U.S. satellite capabilities; and experience detecting two North Korean nuclear tests—have addressed these concerns.

The report concludes that although U.S. NTM are more capable than the IMS, the latter is still valuable, both to supplement U.S. data and to allow discussion of events when the United States does not want to share sensitive or classified data. Thus, whether or not the CTBT is in effect, supporting the IMS network is in the U.S. national interest.

Sustaining U.S. technical capabilities under the CTBT

The 2012 panel was explicitly told to address sustainment of U.S. technical capabilities under a CTBT. It found that, “The most serious requirement for sustaining the U.S. stockpile and monitoring capabilities is a clear statement of policy regarding the capabilities that must be maintained, combined with management and support focused on achieving well-defined technical goals underpinning those capabilities” and adds, “The need for such action arises whether or not the United States ratifies the CTBT.”

The 2002 report included several observations about the need to maintain a high-quality workforce and the difficulty in attracting and retaining top-tier scientific talent due to competition with the private sector, budget constraints, and uncertainty about the future of the nuclear weapons program.

The current report concludes that workforce and budgetary issues are still of concern, and that several other factors will also be key to sustaining U.S. technical capabilities, including improved management of nuclear weapons complex facilities; full support for the CTBTO’s monitoring and on-site inspection work; continued investment in U.S. monitoring capabilities; and “safeguards” to mitigate potential risk to the U.S. from ratifying the treaty and constraining its future options.²

² Safeguards are unilateral provisions included with the Senate resolution giving advice and consent to ratification of a treaty that make ratification contingent on their implementation. In addition to safeguards previously proposed by the Clinton administration in 1995, the report recommends adding maintenance of adequate production and non-nuclear explosion

The report includes straightforward recommendations on sustaining monitoring and verification capabilities, and notes that the United States has an interest in maintaining these capabilities independent of any decision about the CTBT. According to the report, the tougher challenge will be maintaining U.S. technical capabilities relevant to its own nuclear weapons program. However, as the panel notes, those challenges exist whether or not the United States ratifies the CTBT.

Potential technical advances from nuclear-explosion testing

Like the 2002 report, the current report considers the potential threat to the United States from a state carrying out an undetected nuclear-explosion test.

The main change since 2002 is that improved monitoring capabilities make evading detection increasingly less likely, even if states attempted to conceal their tests.³ While states might be able to develop lower capability weapons without detection, this would be the case with or without the CTBT. A fully functioning IMS and on-site inspection program, however, would reduce the chance of undetected testing. And, the report concludes, “such developments would not require the United States to return to testing in order to respond because it already has—or could produce—weapons of equal or greater capability based on its own nuclear-explosion test history.”

The threat that could most plausibly lead to a technical need for the U.S. to resume nuclear-explosion testing, the panel finds, would be an adversary developing a capability that would require the U.S. to develop a new (not previously tested) type of nuclear weapon. This type of adversarial development would be unlikely without significant testing, to build confidence in the new design. Such testing would be detectable by NTM or the IMS, allowing the United States to decide whether it could respond with its current capabilities or would need to invoke the supreme national interest clause and withdraw from the treaty.

testing facilities, and requiring an annual evaluation of the effectiveness of safeguards.

³ The report finds that even an advanced nuclear weapons state such as Russia or China would not have high confidence of avoiding detection of a test at the 1 kiloton level or higher, while testing below the 0.001 kiloton level would likely be undetected.

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