Increasing the Effectiveness of Nonproliferation and Verification Technology Development Programs

Initial Findings And Recommendations

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This draft paper presents initial findings and recommendations for strengthening the nation's nonproliferation programs and verification technologies. In collaboration with Nuclear Watch New Mexico, this project is a direct follow-on to Dr. Doyle's February 2013 article *Why Eliminate Nuclear Weapons?* Whereas that study convincingly argued for global nuclear weapons abolition (which the Los Alamos Lab retroactively classified), it mostly did so in the policy sphere as an historic review of why the elimination of nuclear weapons is necessary. Dr. Doyle now seeks to move forward, advocating for broad deployment of existing verification and monitoring technologies and development of more refined future technologies.

The overarching aim of this project is to help make a verifiable future world free of nuclear weapons technically and politically feasible. A final paper will be presented in mid-January 2015.

Initial Findings

- There is strong and enduring U.S. Government (USG) support for improving nonproliferation, verification and monitoring technologies and capabilities.[1]
- Despite this, national investment in this aspect of nuclear security remains insufficient to fill gaps in current capabilities and prepare for future challenges.
- Almost five years after the 2010 Nuclear Posture review called for a national program on *expanded work on verification technologies and the development of transparency measures* there has been no substantial follow-up. No U.S. government agency or team of agencies has been assigned responsibility for creation or implementation of such a program.
- Sufficient offensive nuclear capabilities are needed to maintain nuclear deterrence, but such forces alone cannot counter the full spectrum of nuclear security challenges facing the nation and the world in the decades ahead.
- The technical and human capabilities needed to reduce the most likely nuclear threats to the nation are being neglected with perilous consequences.
- These security challenges include, above all, preventing the acquisition of nuclear or

radiological weapons capabilities by terrorists and other non-state actors.

- Challenges also include the continued verification of nuclear weapons reduction treaties, and efforts to ban testing of nuclear weapons and the production of fissile materials for military purposes. Finally, and in support of the first objective, they include preventing the proliferation of nuclear weapons to additional states.
- A multi-agency national program is urgently needed that would include the State Department's Bureau of Arms Control, Verification and Compliance (AVC); the Office of Defense Nuclear Nonproliferation (NA-20) within the Department of Energy's National Nuclear Security Administration (NNSA); and the Defense Department's Defense Threat Reduction Agency (DTRA).
- This program should be on the order of $130-150 million annually and funded as part of modernization of the nuclear security enterprise. This amounts to far less than 1 percent of the planned $200 billion or more to be spent on nuclear weapon infrastructure in the next decade.

Key Capabilities Currently Lacking

- In order to meet the nuclear security challenges of the 21st Century and move towards a world without nuclear weapons, America must develop a set of core technical capabilities in the fields of nonproliferation, verification and monitoring.
- Currently the following essential technical and procedural capabilities are lacking:
  - The means to confirm how many total nuclear warheads or how much weapons-grade nuclear materials other nations possess – this is critical to establishing a baseline both for the purposes of assessing the capabilities of potential nuclear adversaries and verifying nuclear reductions.
  - The means to assure that a nation claiming to cease or limit production of nuclear warheads or fissile materials has done so.
  - Finalized verification arrangements for confirming the conversion of 68 tons of weapons plutonium deemed excess to military needs into non-weapons usable forms under the US-Russian Plutonium Management and Disposition Agreement.
  - Proven methods for verifying reductions in non-deployed and nonstrategic nuclear warheads, priorities identified by the 2010 NPR for the next round of U.S.-Russian arms control.
  - The means to cooperatively verify that a certain number of strategic or nonstrategic foreign nuclear warheads have been dismantled, placed in permanent storage, or eliminated.
- These verification tools could also help assess the security of remaining nuclear weapons and nuclear materials as reductions proceed.

Proposed National Program Structure and Level of Effort

- The program should be jointly led by the National Nuclear Security Administration (NNSA) and Defense Threat Reduction Agency (DTRA), with guidance from the State

Department, intelligence community and national laboratories. Its primary mission should be the development of technologies, procedures and international initiatives that support nuclear security and nonproliferation and enable secure, verifiable steps toward a world free of nuclear weapons.

- Current investment in these capabilities is declining while requested budgets and out-year projections for offensive nuclear forces are soaring.
- The estimated $1.4 billion cost for the tail-kit of the modernized B-61 nuclear bomb would be enough to fund a dedicated nonproliferation and verification technology program as recommended here for a decade.
- The program should maximize international collaboration. For example, program plans and activities should be a central element of the P-5 dialogue on verification. Other non-nuclear weapons states that support verification and monitoring R&D should also be involved.
- The program structure should ensure a common understanding among agency leads for defining the challenges and implementing a national program framework, including policy, diplomacy, operations, and research, development, test & evaluation (RDT&E).[2]
- The program will need to develop managed access procedures to some nuclear facilities and test ranges by all involved agencies and foreign partners at which detection technologies and operational approaches can be explored using real special nuclear materials.

New Mission Areas for National Laboratories

- The national laboratories, consistent with their nuclear security mission, can contribute to the formulation of a national verification and monitoring program. They have the skills and experience to successfully develop the needed technology and procedures.
- The national laboratories should be engaged in the planning and assigned a leading role in program implementation. A critical aspect of the program plan should be to engage the national laboratories of other nuclear weapons states and interested non-nuclear weapons states. Allowing for these interactions may require modification of some facilities or creation of new facilities at the U.S. labs.
- As America's nuclear arsenal continues to be reduced and new nuclear security challenges emerge, this mission can be a vehicle of positive transformation at the labs.
- Some construction or refurbishment of appropriate R&D and testing facilities for nonproliferation, verification and monitoring technology at the national labs and other NNSA/DoD sites will be required. This will help prevent disruption at current facilities involved with nuclear stockpile operations and allow experimentation with foreign-designed equipment and technology.

Key Technical Objectives

- Develop technologies to detect, localize, and characterize plutonium production processes, including reprocessing, separation, and metal production.
- Develop technologies to detect, identify, collect and analyze samples that provide increased confidence in characterizing uranium conversion and enrichment processes.
- Enable the detection of activities related to nuclear weaponization, including detecting high-explosive activities related to non-nuclear testing and hydrodynamic research.
- Improvements and innovative concepts for enabling technologies; signatures and observable references; test and evaluation methods; and simulation, algorithms, modeling, and remote sensing capabilities.
- Nuclear nonproliferation capabilities must also support international safeguards to verify that material for nuclear energy for peaceful uses is not diverted to make nuclear weapons or other nuclear explosive devices.
- To the extent possible, such capabilities can provide policy makers with actionable information and early warning of the activities of nations or groups interested in developing a nuclear weapons capability.
- Strengthen independent review of ongoing research and development efforts by the National Academy of Sciences and other expert groups.
- Assess the applicability of IAEA technologies for warhead environments. Currently, the IAEA employs a wide variety of safeguards tools and techniques, including tags, seals, unattended monitoring, and environmental sampling. An international team of experts should explore whether or not these technologies would be useful for verification and could be used in a warhead environment.[3]
- Develop verification means to confirm that highly enriched uranium (HEU) designated for naval reactor use is not being used to produce warheads and eventually is phased out for naval reactor purposes.

Summary Recommendations

- A new, integrated multiagency program to develop nonproliferation, verification and monitoring technologies for nuclear security should be initiated without delay.
- The program should be funded as a core aspect of the nation's nuclear infrastructure modernization plan, and thus implemented jointly by the National Nuclear Security Administration and the Department of Defense, with guidance from the State Department, intelligence community and National Academy of Sciences.
- Such a program is affordable at a fraction of the cost of other nuclear infrastructure modernization tasks, and is needed to maintain nuclear security in an evolving security environment.

- These capabilities are essential to verify compliance with current and anticipated nuclear arms agreements and to move safely towards a world without nuclear weapons.
- The need for this program was included as an objective in the 2010 Nuclear Posture Review, and has been repeatedly articulated by both the U.S. government and independent assessments.

- End -

James E. Doyle was a specialist in the Nuclear Nonproliferation Division at Los Alamos National Laboratory from 1997 to July 2014. His professional focus is on systems analysis, strategic planning and policy development. Dr. Doyle holds a PhD in International Security Studies from the University of Virginia. At Los Alamos he managed projects with Russia's nuclear weapons institutes on the joint development of technologies and procedures for verifying the dismantlement and storage of nuclear warheads and fissile materials. In February 2013 he authored Why Eliminate Nuclear Weapons? In July 2014 Doyle was laid off by the Lab, which LANL claims was unrelated to his advocacy of nuclear weapons abolition (he was the only person in his division to be let go). Doyle now looks forward to pursuing his nonproliferation and disarmament goals outside of the Lab.

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[1] 2010 Nuclear Posture Review:
"initiate a comprehensive national research and development program to support continued progress toward a world free of nuclear weapons, including expanded work on verification technologies and the development of transparency measures." NPR Report, page 13:
http://www.defense.gov/npr/docs/2010%20Nuclear%20Posture%20Review%20Study.pdf
Nuclear Non-Proliferation Treaty 2010 Review Conference Action Plan, Action 19:
"All States parties agree on the importance of supporting cooperation among Governments, the United Nations, other international and regional organizations and civil society aimed at increasing confidence, improving transparency and developing efficient verification capabilities related to nuclear disarmament." NPT Final Documents of the 2010 NPT Review Conference available at:
http://www.un.org/ga/search/view_doc.asp?symbol=NPT/CONF.2010/50%20(VOL.I
Under Secretary of State Rose Gottemoeller:

"verification will become increasingly complex at lower numbers of nuclear weapons, while requirements for effectiveness will increase. All of us – every nation here – should be devoting ample time and energy to address this challenge right now."
Rose Gottemoeller, Under Secretary for Arms Control and International Security, remarks to United Nations General Assembly First Committee on Disarmament, New York City, October 7, 2014. http://www.state.gov/t/us/2014/232698.htm
NNSA Strategic Plan, May 2011:
"By 2015 Demonstrate characterization capabilities for foreign special nuclear material production capabilities.
- *By 2016 Demonstrate technologies for detecting foreign Uranium enrichment.*
- *By 2016 Develop warhead monitoring and chain-of-custody capabilities for end-to-end field demonstrations in support of new arms control commitments."*
http://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/2011_NNSA_Strat_Plan.pdf
Defense Science Board - Assessment of Nuclear Treaty Monitoring and Verification Technologies, January 2014.
"Monitoring for proliferation should be a top national security objective––but one for which the nation is not yet organized or fully equipped to address. Nonproliferation verification and Monitoring will need to be continuous, adaptive, and continuously tested for its effectiveness against an array of differing, creative and adaptive proliferators."
http://www.acq.osd.mil/dsb/reports/NuclearMonitoringAndVerificationTechnologies.pdf
[2] This point was made by both the Defense Science Jan. 2014 report and the 2014 Nuclear Threat Initiative (NTI) Verification study.
[3] This is a key recommendation of the NTI Study.