Looking to the Future
of Nuclear Arms Control

The Changing Strategic Environment

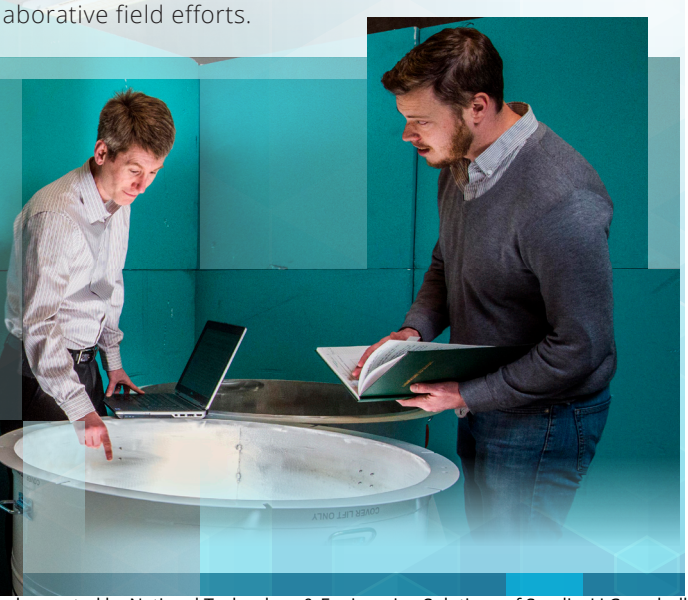
The future of nuclear arms control has increasingly been placed on unsteady ground. Numerous factors play a role in this dynamic including the lack of trust between the U.S., Russia, and China; Russian and Chinese nuclear expansion; asymmetric nuclear capabilities and postures; dual-capable delivery systems and growing integration of conventional and nuclear capabilities; and the role of emerging technologies in strategic systems. For arms control to remain a useful tool of national security policy, it should be updated to meet the evolving landscape.

The development of enabling capabilities for future arms control agreements needs to consider the challenges and opportunities in the arms control space that could be addressed by the development of enabling technologies. For example, if the terms of a future arms control treaty include all nuclear warheads, it will be necessary to determine appropriate points within the nuclear weapons lifecycle where monitoring may occur. An important challenge will be to provide capabilities that allow for absence verification and "chain of custody" across lifecycle stages throughout the duration of an agreement.

Sandia's Treaty Monitoring Expertise

Sandia's history of technology development for warhead monitoring includes the radiation detection equipment that was first deployed for the Intermediate Range Nuclear Forces (INF) Treaty – and later for the START and New START treaties. Sandia also developed the Portal-Perimeter Monitoring System used to monitor Russian missile production facilities under the INF Treaty. In advanced development work, Sandia designed the Trusted Radiation Identification System (TRIS) and Trusted Radiation Attribute Demonstration System (TRADS) that could help confirm that a declared item is a warhead. Chain of custody technologies identify and track items during storage and transportation and provide evidence that the integrity of treaty-accountable items has been maintained. Sandia's contributions include unique identifiers, tamper-indicating devices, facility surveillance, and unattended monitors, such as the Chain of Custody Item Monitor (CoCIM).

Additionally, Sandia worked with NNSA and interagency partners to develop and evaluate monitoring technologies and concepts in a relevant environment in a number of campaigns, including the Warhead Monitoring Technology Project, the Warhead Monitored Dismantlement Exercise, the End-to-End Warhead Monitoring Campaign, and the Quad Nuclear Verification Partnership's Letterpress Exercise. Sandia contributed new insights to both treaty system design and technology development through these collaborative field efforts.



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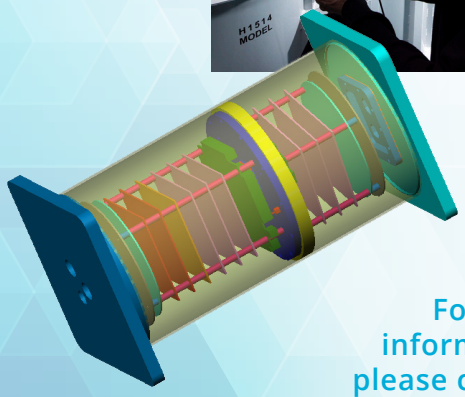
Research and Development

Since technical measurements have the potential to reveal sensitive information, trade-offs in a monitoring regime must balance the need for security and possible impacts at operational facilities. These aspects are explored through research and development that includes technologies, systems, and concepts of operation.



Technology Development for Future Arms Control

The National Nuclear Security Administration has a strategic interest in research to provide technical options for the arms control policy community. Sandia is contributing innovative ideas to this mission in several areas.

Signature Verification

Absence confirmation is the process by which a monitor confirms an item declared not to be a warhead. Likewise, warhead confirmation is the process by which a declared item is accepted as a nuclear warhead. The major technical challenge in both activities is to provide confidence in the declaration based on the physical signatures that can be measured (either the absence of those signatures or the authentic presence of them) while simultaneously protecting sensitive information. In addition, dismantlement confirmation provides confidence that a declared warhead has been dismantled. Its major technical challenge is to provide confidence that the resulting components came from the initial treaty-accountable item.

Chain of Custody

Chain of custody provides evidence of the integrity of a treaty-accountable item ("continuity of knowledge"). Chain of custody can also ensure the integrity of monitoring equipment. Its major technical challenge is to be robust against tampering or substitution during unattended operation in host facilities.

Certification and Authentication

Tools used in signature verification or chain of custody activities must be trusted by all parties to a treaty. The host must be assured that the equipment brought into their facility is safe, secure, and will not reveal sensitive information that is not part of the agreement to the monitors. The monitors must be assured that the equipment is producing correct and complete data, and that it has not been tampered with or substituted by the host.

For more information, please contact

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