



Working Group 3 - Deliverable Seven

Summary

A series of presentations, workshops, or seminars on key activities and lessons learned from the U.S.-UK Technical Cooperation for Arms Control program, the UK-Norway Initiative, and other relevant activities.

Working Group 3: Technical Challenges and Solutions

November 2017

Specific technologies and methods will be needed to support future nuclear arms control and disarmament initiatives. Nuclear weapon verification and monitored dismantlement of nuclear weapons, in particular, will require extensive collaboration and the development and testing of new technologies. Although significant contributions have already been made, this work has largely been focused within a handful of countries and many issues remain unresolved, specifically when it comes to providing enough information about a nuclear weapon without providing proliferative information to the inspecting party, which would violate Article I of the Nuclear Non-Proliferation Treaty (NPT).

The Working Group on Technical Challenges and Solutions (Working Group 3) sought to find solutions to key technical challenges, for countries with and without nuclear weapons, associated with monitoring the dismantlement of a nuclear weapon, in particular for nuclear weapon authentication (is the item presented really a nuclear weapon?), methods for establishing and maintaining chain of custody of both items and facilities, and monitoring data and equipment authentication (is the data genuine and is the equipment functioning as expected?). The Working Group's initial focus was on the nuclear weapon dismantlement process and the monitored temporary storage of nuclear materials and high explosives resulting from the dismantlement procedure.

Working Group 3 began by surveying research and initiatives undertaken to date. Activities and lessons learned from the U.S.-UK technical cooperation for arms control program, and from the UK-Norway Initiative (UKNI), were presented and discussed at the kickoff meeting held in Washington, D.C., in March 2015 as well as at the plenary meeting held in Oslo, Norway, in November 2015. In addition, a walkthrough and facility visit to the Institute for Energy Technology (IFE), where one of the exercises within UKNI was performed, was carried out in connection to the plenary meeting in Oslo.

Furthermore, at the March 2015 Washington, D.C., kickoff meeting, presentations and general overviews related to the work within Working Group 3 were held on:

- Agreement between the Government of the United States of America and the Government of the Russian Federation concerning the disposition of highly enriched uranium from nuclear weapons;
- Nuclear warheads and fissile material transparency: Experience of the U.S.-Russian collaboration; and
- On-site inspection overview (New START Treaty escort case study).

All of this allowed the Working Group to recognize the technical requirements and constraints for monitoring nuclear weapons and nuclear weapons dismantlement, and to identify various technologies available for the given scenario.

A series of technical presentations from the Partners were also given to the group. At the Working Group meeting convened in Geneva, Switzerland, in February 2016, technical experts from participating countries gave presentations on:

- Muon tomography;
- Active neutron interrogation with delayed neutrons;
- Fast neutron direct interrogation (FNDI);
- Mobile change detection system;
- START Treaty radiation detection equipment (RDE);
- Trusted radiation identification system (TRIS);
- Passive gamma spectrometry and neutron multiplicity counting;
- Radiation-proof passive radio frequency identification;
- Explosives detection;
- Use of gamma spectrometry in the UKNI information barrier project;
- Unattended non-destructive assay (NDA) measurement system; and

- Information barrier technique for nuclear material characterization.

During the Working Group meeting hosted by the European Commission's Joint Research Centre (JRC) in Ispra, Italy, in May 2016, technical experts from participating countries gave presentations on:

- HiSPECT gamma camera;
- Radiation detection and categorization equipment; and
- Portable neutron device for explosives detection.

Additionally, at the Ispra meeting technical experts from the JRC displayed and gave presentations on several chain of custody technologies, including on seals, 3D technologies for facility verification, change detection, identification and containment of containers, and surveillance of an area. Moreover, presentations were given on:

- Pulsed neutron interrogation test assembly (PUNITA), including discussions on:
 - fissile mass—differential die-away technique;
 - design of a compact pulsed neutron device;
 - detection of Special Nuclear Material (SNM);
- Prompt Gamma Neutron Activation Analysis (PGNAA) for explosives detection; and
- Design and implementation of equipment for enhanced safeguards of plutonium storage in a reprocessing plant (PuO₂ Storage Project), including:
 - Unattended Combined Measurement System;
 - Neutron portal monitors;
 - Radio frequency identification (RFID) tags and reader;
 - Double Laser Curtain; and
 - Events, data, and video reviewing.

In addition, and beyond the actual work streams, two presentations were given on national research activities directly linked to the specific work within the Working Group.

All presentations and subsequent in-depth discussions throughout Phase I resulted in the Working Group 3 Chain of Custody Technologies Mapping Table and the Working Group 3 Nuclear Explosive Device and Component Monitoring Technologies Tables with references to more detailed technology papers on each potential technology.

International Partnership for Nuclear Disarmament Verification

The International Partnership for Nuclear Disarmament Verification (IPNDV), is an ongoing initiative that includes more than 25 countries with and without nuclear weapons. Together, the Partners are identifying challenges associated with nuclear disarmament verification, and developing potential procedures and technologies to address those challenges. Learn more at www.ipndv.org.

About Working Group 3: Technical Challenges and Solutions

Throughout Phase I, the IPNDV Technical Challenges and Solutions Working Group has investigated effective technologies, methods, and procedures that can be used for the specific technical challenges in the dismantlement process, such as identifying a nuclear device, maintaining chain of custody, and protecting proliferation sensitive material. This group is co-chaired by Sweden and the United States.