

Overview of US and UK Cooperation to Address Technical Challenges in Verification of Nuclear Disarmament

**United Kingdom and
United States of America**

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US-UK Technical Verification Cooperation History

- The technical verification cooperation program was initiated in October 2000 at the invitation of the UK MoD and AWE
- Initial meetings explored each country's arms control and non-proliferation programs.
- A step-by-step co-operative path forward was developed to address mutually beneficial collaboration.
- Our first joint verification study was an exercise involving the interaction of two Nuclear Weapon States in an arms control scenario.

US-UK Technical Verification Cooperation History

- Early work explored feasibility of allowing foreign NWS access to sensitive nuclear facilities to assess the impact on domestic security sensitivities and international proliferation obligations ('Managed Access' concept).
- Perceived Issues
 - Degree of intrusiveness
 - Security and proliferation risks
 - Managing access
 - Training staff
 - Proving robustness of the process

US-UK Technical Verification Cooperation History

- UK hosted a Familiarisation Visit by 'foreign' NWS in 2002
- Managed access concept modelled on experience
 - Routine regulatory inspections
 - Office of Nuclear Regulation
 - Environmental Agency
 - Simulated Challenge Inspection under Chemical Weapons Convention (CWC)



Uncertainties, Control and Mitigation

- Understanding risks and potential pitfalls
- Negotiation
- Managing expectations
- Route planning
- Escorting methodology
- Emergency planning
- Security and safety procedures
- Handling Q&As
- Close supervision
- Protective clothing
- Restricted note taking
- Use of guidance scripts
- Time limits
- Shrouding
- Limited access to personnel
- Robust procedures
- No measurements

Lessons Learned

- Exercise provided a good starting point to explore key issues
- Intrusive, resource intensive and challenging for facility staff
- Managed access permits a degree of access into sensitive nuclear warhead facilities
- Highlighted the need to develop an holistic approach
- Paved the way for further development
 - Technology development
 - Chain of custody development



Step-by-Step Progression of Activities

- Over time, activities became progressively more complex and incorporated the results from previous joint activities
- Technical workshops and seminars to discuss techniques and methods
- Joint cooperative measurement campaigns
- Joint development of specific methods or technologies
- Exercises on managed access and information protection

Importance of a Step by Step Process

- Exchanges improve scientific and technological abilities in support of existing arms control and nonproliferation agreements and the negotiation of new agreements
- The “devil is in the details” – a number of challenges must be addressed in implementing a warhead dismantlement regime
- Developing the necessary technologies and approaches to successfully monitor warhead dismantlement takes time
- Many times breaking the activities into smaller projects can make the harder, more complex problems easier to solve

US-UK Technical Cooperation on Verification of Warhead Dismantlement

US-UK technical cooperation focuses on facility issues and technologies

- **Goals** - achieved through technical exchanges at nuclear facilities in both countries
- **Objectives** - to assist technical experts in developing, evaluating, and gaining experience with technologies, monitoring procedures and verification in real nuclear weapon facilities
- **Activities** - demonstration of radiation measurements on warheads and their components and exercises at real-world nuclear facilities

The key to effective verification is the ability to balance the need to protect classified and sensitive information with the desire to obtain sufficient information to inform the process.

US-UK Cooperation

Ongoing Goals and Technical Focus

The ongoing goals and technical focus of the bilateral technical verification cooperation include:

- Understanding the nuclear weapons dismantlement process
- Identifying and developing technologies and procedures to:
 - Protect sensitive information
 - Increase monitoring confidence in warhead dismantlement
 - Provide chain-of-custody throughout the dismantlement process
 - Monitor storage of HEU and Pu resulting from nuclear weapon dismantlement

US-UK Cooperation Technical Areas

- Non-destructive analysis
- Remote monitoring techniques
- Low intrusion measurement equipment
- Hardware and software authentication
- Information barrier technology
- Chain of custody methodologies
- Measurement campaigns
- Exercises on managed access and information protection



Specific Example: Monitored Dismantlement Exercise

Key Elements:

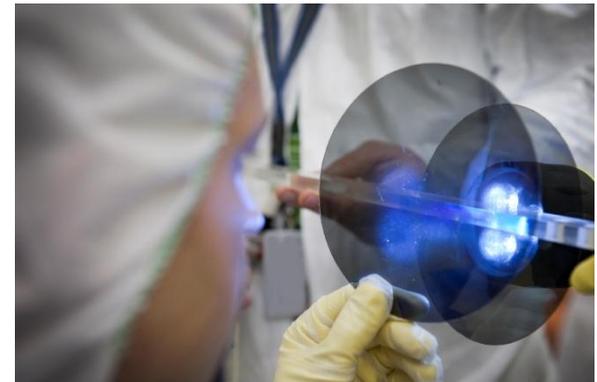
- Fewer notional elements than before
- Negotiated Agreement
- Tested new and existing technical equipment and methodologies
- Developed methodologies to address key aspects of monitored dismantlement
- Significant resources but still overstretched
- Identified technologies and methodologies where further development is still needed



Overarching Exercise Aims and Objectives

Building on past cooperation, develop a robust Chain of Custody (CoC) as part of a realistic dismantlement transparency exercise to:

- Implement what we have learned
- Test extant methodologies (including technologies)
- Identify gaps
- Develop needed capabilities, expertise and expand knowledge
- Minimize notional aspects
- Develop, and test procedures
- Investigate authentication issues



Exercise Scenario

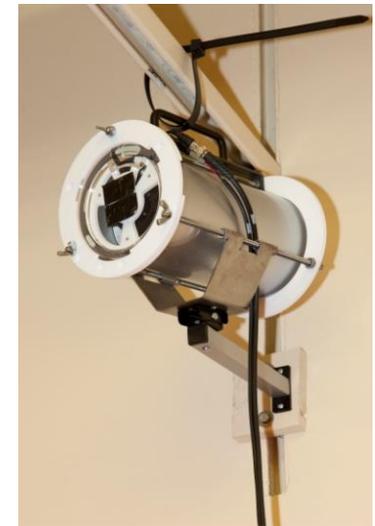
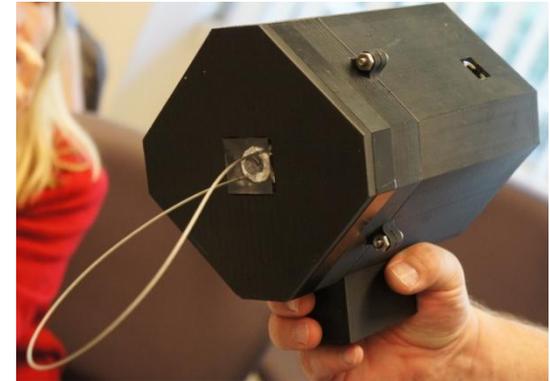
- Two nuclear weapon states
 - Avalonia (UK)
 - Tachonia (US)
- Mutual nuclear weapons reductions via monitored dismantlement
- Negotiated an Agreement and Protocol
- Avalonia's first nuclear device dismantlement to be monitored in 2011



A monitored dismantlement exercise performed in an operational nuclear facility with representative quantities of fissile material and simulated high explosives.

Exercise Identified Areas for Future Development

- **A systems approach** for the development of monitoring regimes
- **Equipment design principles** to allow certification and authentication information protection
- **Data authentication**, acquisition, and management
- **Next Generation of Tamper Indicating Devices, Enclosures, and systems**
- **Next Generation Attribute Measurement Systems** that can adequately measure a wide variety of device designs
- **Understanding sensitivities** of information contained in data sets
- **Methodology to confirm** that the object is truly a nuclear warhead



Lessons Learned from US-UK Work

- The US and UK have been cooperating for over 10 years in this area.
- Even after all this time, the US and UK still have differences of opinion that require further discussions.
- States can successfully collaborate on sensitive technical disarmament and verification topics

Conclusions

- Managed technical cooperation can facilitate:
 - Increased understanding for protecting sensitive information
 - Determining which technologies, skills and techniques are needed to monitor the nuclear weapons reduction process effectively
 - Expanding the technical and procedural knowledge base for warhead dismantlement and transparency
 - Gaining real-world experience with potential methods and technologies
- There are still many technical issues that require further work
 - Small steps can be accomplished by any country with a knowledge of nuclear physics and general inspection activities.