Presentation on the UK –Norway Initiative on Nuclear Warhead Dismantlement Verification

UK/NOR/VERTIC Report

PrepCom

May 2009
Presentation Outline

• Overall Project Objectives (Ole Reistad)
• Managed Access Exercise
  – Development of the Exercise Strategy (Ole Reistad)
  – Exercise Play – December 2008 (Attila Burjan)
  – Observations and Analysis (Attila Burjan)
  – Lessons Learned and Conclusions (Attila Burjan)
• Information Barriers (Dave Chambers)
• Observations (Andreas Persbo)
• Next steps (Ole Reistad)
Project Objectives

• Research project goals:
  – Develop new technologies, methods and procedures for the verification of future multilateral and bilateral disarmament treaties
  – Keep scientific and technical nature of the project

• Project Partners
  – UK: MoD, AWE plc
  – NOR: FFI, IFE, NRPA, NORSAR
  – NGO: VERTIC
Project Elements

• Development of verification methodologies
  – Exercise inspections of a mock-up ‘nuclear weapons complex’ in the course of verified dismantlement of a mock-up nuclear weapon

• Development of IB system
  – Tool needed for successful implementation of a chain of custody without revealing weapons attributes and characteristics
Managed Access Timeline

• Project planning activities (2007/8)
  – Development of technology, identifying facility infrastructure, inspection arrangements and concepts related to implementation at multi / bilateral level

• Dry Run (Nov 08)

• Familiarisation visit (Dec 08)
  – To familiarise the inspectors with the facilities
  – To negotiate the terms for the monitoring visit

• Monitoring visit (June 09)
  – Full scale exercise – verification of the dismantlement of a mock-up nuclear warhead using the IB systems.
Initial Challenges

• Managing proliferation concerns
• Managing expectations
• Difficulties managed through:
  – Trust and determination
  – Good relationship
  – Careful planning of a realistic scenario
Setting the Scene

Exercise Assumptions
• ‘Agreed’ bilateral Nuclear Weapon Protocol or Treaty between NWS & NNWS
• ‘unclassified’ access as an aim
• Mutual will to succeed in transparency & confidence building
• Opportunity to test effectiveness of technique in a verification context

Scenario
• Familiarisation visit by NNWS Luvania (UK) to agree inspection arrangements to monitor the disassembly of NWS Torland’s (NOR) holdings of Odin under a Bilateral Protocol
• Bilateral Protocol ‘drawn up’ by planners
  – Initiated via exchange of letters
  – Details to be worked out by negotiation
Project Equipment

- Mock-up weapon with a Co-60 source simulating fissile material
- Weapon transport containers
- Information barrier system
Adequate facilities suitable for simulating nuclear weapon complex has been identified out of existing Norwegian facilities
Exercise Documentation

Declaration by the Kingdom of Thailand concerning the disarmament of nuclear weapons

1. The Kingdom of Thailand expresses its intention of strengthening its non-nuclear status and is committed to the complete and verifiable dismantlement of its nuclear weapons. This declaration will remain in effect for the duration of the 30-year period.

2. The "Osiris" site, now under international control, will be destroyed in accordance with the terms of this declaration. The dismantlement process will be supervised by the International Atomic Energy Agency (IAEA).

3. The Kingdom of Thailand reiterates its commitment to the peaceful use of nuclear energy and to the Non-Proliferation Treaty (NPT).

4. The rights and provisions of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) will be preserved.

5. The dismantling of the Osiris site will commence within 30 days of the date of this declaration, and dismantlement will be completed within the 30-year period.

Report of the Familiarisation Visit to the Thailand Atomic Weapons Establishment 8th - 17th December 2008

12 December 2008

To: The Norwegian Secretary of State for Defence

Familiarisation Visit

An inspection team, headed by Inger I. Berthe (director general of the Norwegian Nuclear Safety Authority), was sent to the Thailand Atomic Weapons Establishment in agreement with the Thai government. The visit was undertaken to familiarise the Norwegian government with the Thai site.

The visit was a success and is reflected in the accompanying report.

A description of the activities conducted by the team and the host country's research activities.

The Norwegian Inspection Team arrived in Thailand on 8th December and was welcomed by representatives of the Thai government, including the Director General of the Thai Atomic Energy Commission (TAVL). The team was given a tour of the various facilities and was briefed on the research activities undertaken at the establishment.

Three meetings were held to discuss the research activities and the findings of the visit. The discussions were held with representatives from the Thai government, the Thai Atomic Energy Commission, and the Norwegian Nuclear Safety Authority. The discussions focused on the research activities and the findings of the visit, and agreement was reached on the future cooperation between the two countries.

The report includes a detailed account of the inspection team's activities and the findings of the visit, and is available for download on the Norwegian Nuclear Safety Authority's website.
Dry run (November 2008)

- Norway Team made up from various labs
  - Test protocol
- UK present to test scenario
- Useful tour
- Significant work left to do!
Exercise Play (Dec 08)

- Play went ‘Live’ from hotel until return
- Transported by Torian transport
- Access training
- Host presentations
- Negotiation phase
- Site visit
- Further discussions
Fielded Teams

Luvania

- Senior and Experienced personnel
- Team Leader with strong negotiation skills

Torland

- Senior and Experienced personnel
- Team Leader with strong negotiation skills
- Core team from Production, facility management with call on all Depts.
Negotiation Styles

**Luvania**

- Clear plan
- Put onus on Torland
- Develop negotiation strategy
  - Break-out sessions
- Lots of preparation
  - Several Luvanian sessions back home

**Torland**

- Natural Conservative negotiation style
- Draw out Luvanian position
- Used presentations to answer questions
- Agreed to things ‘in principle’
- Referred up to higher authority
Luvianian Team Intent

- Team Leader Briefs - Objectives
  - Understand processes
  - Stitch together information
  - Confirm route of products
  - Find chain of custody ‘weak points’
  - Propose fixes; seals, inspection and/or measurement - produce verification framework
  - Agree Diagnostic protocol

- Get an agreed position by end of visit
Torian Team Intent

Strategies:
• Close escorting
• Under control of facility
• Good shrouding
• Unscripted
• Information well protected – controlled opportunities to question facility staff
• Well Timed
• Well handled by hosts

Visits:
• Explosives Stores
• Corridors
• Receipt & Dispatch Area
• Dismantlement Area
• Storage Area
• Repository
<table>
<thead>
<tr>
<th>Negotiation Strands</th>
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<tbody>
<tr>
<td><strong>Luvianian Request</strong></td>
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<tr>
<td>Inspectors in Facility to monitor movements</td>
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<tr>
<td>Radiometric measurements</td>
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<tr>
<td>Access to records &amp; procedures</td>
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<tr>
<td>Use of Tamper Indicating Devices</td>
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Key Lessons Learned

• Negotiated a controlled degree of access into sensitive facilities.
• Luvian Aims met – Verification Protocol agreed ‘in principle’
• Dry run found to be indispensable
• Extensive use of Break-out sessions crucial to assimilate information effectively
• Intrusive, resource intensive
• Challenging for Facility and security personnel
• Does not address ‘initialisation’
• Devil is in the detail – even at this basic level
• Recognition that needs highly structured process
• C of C complements technology measurements
Exercise Conclusions

- Exercise was deemed a success as all NOR/UK aims were achieved.
- Far exceeded planners’ expectations
- Highlighted importance of Tags & Seals and Information Barriers
- Chain of Custody can’t be maintained without the use of measurements and seals
Information Barrier Development
The Requirement

Our mission is to try to work out methodologies to verify the dismantlement of nuclear warheads without release of proliferate or sensitive information.

Verification Inspectors will be faced with items like these. Without looking inside the container, how do you know what’s in it?

Non-Destructive assay technologies using the radioactive signatures in gamma ray and neutron emissions.
The Task

Inspectors will be looking to verify against a declaration made by the host.

This may include attributes such as:

- Fissile material presence.
- Isotopic ratio/weapons grade.
- Fissile material mass.
- Fissile material age.

Usually a lower bound will be given rather than precise numbers – must be non-proliferative.

Difficult to give enough information to satisfy Inspectors without being proliferative, hence the need for Information Barriers.
Information Barriers

An Information Barrier in its simplest state takes data from a measurement device, processes the data and provides a pass/fail answer to a predetermined criteria.

The information barrier must protect the measurement data from being released to one of the operating parties.

This can either be done through hardware engineered controls or by procedures controlled by all parties.

The information barrier is only as good as the level of trust in it by the parties involved.
Technical Approach

Use of a surrogate material - Co60. Address all the relevant technical challenges but without proliferation issues.

Start with the initial problem of material presence. Do not preclude moving forward to look at isotopic ratios – Co57 or another element.

Starting point of high resolution gamma spectroscopy – measurements facilitate high confidence of the correct result and less chance for being fooled.

Initially the detector will not be part of the project – includes all supporting electronics.
Prior Assumptions for Project

Very basic assumptions at the start of the project:

Solution will only be trusted through joint development

Complex equipment/computing will be hard to authenticate.

Even if authentication is possible, proving this to non-technical decision makers will be difficult.

Need to keep as simple as possible.
Current stage of the project

Detailed design requirements are captured

Prototype Barriers for the presence of Co60 are being built

Testing to be undertaken in May/June 09

Methodology review – How simple is it? Can we trust it?

Enhanced prototype at the initial design point

To be capable of looking at more complex spectra and determining an isotopic ratio

We will report on progress at the NPT Review Conference 2010
VERTIC’s role

• Non-technical advisor or facilitator
  – What can be done?
  – How should we proceed?
  – Are there examples from other regimes?

• Public diplomacy component
  – How can our results be understood by a laymen audience?
  – Communicating the status of the project with the broader community.
VERTIC’s role (cont.)

- Observer
  - *Evaluation component*: i.e. how are we fulfilling the goals we set for ourselves?
  - *Assessment component*: i.e. what are the main lessons learned? How can cooperation be improved? Where is there room for further collaboration?
  - *Reporting component*. 
Preliminary conclusions

• Resource intensive. Likely to be intrusive.
• Chain of custody very important.
• Information barrier system is likely critical for warhead dismantlement verification – proved instrumental for December 2008 Luvenian-Torland agreement on monitoring.
• Cooperative vs. non-cooperative verification. Different challenges.
Preliminary conclusions (cont.)

• Negotiations matter. Technology facilitates discussions, not the other way around. The human-human interface is a subject for further study. The inspected needs to convince the inspector. How is that done?
• The key is to identify strong links in the chain of custody and shore up weak links – through tamper indicating devices (tags and seals)
Final thoughts

• Language matters – precise and clear formulations of the norm/statement/declaration to be verified. Unclear language leads to uncertainty, no exceptions.

• The verification system needs to be trusted – by the inspector and by the inspected. Paradoxically, no trust, no verification.
The Way Ahead

• Monitoring exercise to be held June 2009
  – Aim to integrate managed access and real time diagnostics as part of ‘inspection’

• Information Barrier Development
  – Prototype to be trialled in June
  – Further prototype in 2010

• Aim to publish report on these projects for RevCon 2010