

### **Arms Control Verification Research at AWE**

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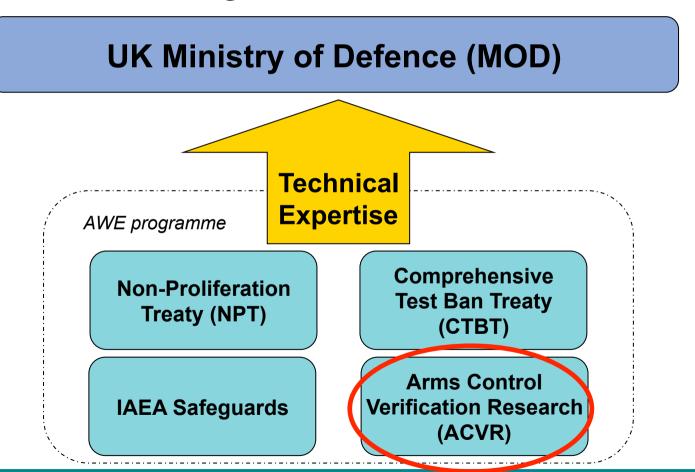
### **Outline**

- Our purpose & history
- Our challenges and how we work to meet them
- Our thoughts on how UK academia can help





# **Nuclear Treaty Verification**





# Support and advice to government

- We aim to place the UK government in a position of strength in the event of its participation in the negotiation of future nuclear-related treaties
  - Research and develop technical options to support verification of these treaties
  - Analyse proliferation & security risks associated with deployment of technologies and conduct of onsite inspections
  - Prepare to support government in implementing any future verification activities
- We help the UK government in its efforts to make progress on multilateral disarmament, towards the long-term goal of a world free of nuclear weapons
  - Work internationally to co-operatively address technical verification issues and build global capacity
  - Contribute to technical aspects of the P5 process
  - Brief on UK arms control activities at NPT Preparatory Commissions and Review Conferences

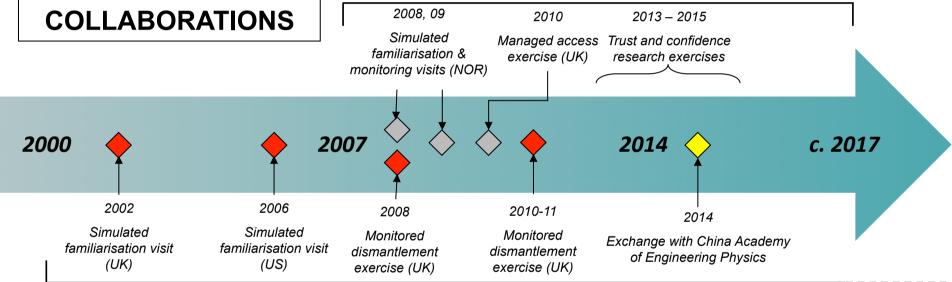


# UK ARMS CONTROL VERIFICATION COLLABORATIONS

# UK-Norway Initiative Managed access exercises Information barrier technology Hardware & software authentication Trust and confidence research

#### **UK-Sweden**

Explosive detection Facility study



#### **UK-US**

Non-destructive analysis
Remote monitoring & low intrusion measurement equipment
Hardware and software authentication
Information barrier technology
Chain of custody methodologies
Measurement campaigns
Managed access exercises

The Quad: Norway / Sweden / UK / US

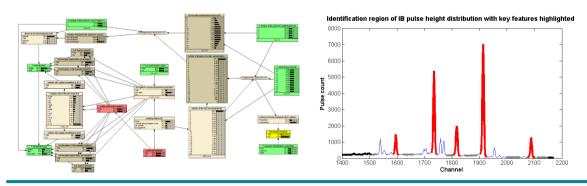
Managed access Technology assessment

International Partnership for Nuclear Disarmament Verification (IPNDV)



## Programme areas

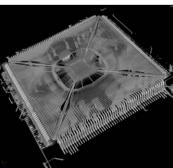
- Verification science
- Inspection studies
- Support and advice













# VERIFICATION SCIENCE

### Device and Material Monitoring

- Algorithm development
- NW attributes and characteristics
- Radiation transport modelling

#### **Explosives Detection**

- X-ray diffraction
- Nuclear quadrupole resonance

#### **Chain of Custody**

- Tags & seals
- Boundary control
- Item tracking / templating
- Data management
- Communication over unsecure networks

#### **Authentication**

- Destructive and non-destructive testing
- Analysis of microcontroller and FPGA systems
- High-integrity software methods
- Embedded COTS software authentication



#### **INSPECTION STUDIES**

### Inspection Implementation

- Assessment of inspection regimes
- Options & impact analysis

#### Inspection Modelling and Risk Analysis (IMRA)

- Analysis of facility signatures
- Identification of security & proliferation impacts

#### **Remote Sensing**

- Visual observation techniques
- Geospatial methods
- Multi- and hyperspectral imaging



#### **SUPPORT & ADVICE**

### Capability Development

- Arms control training
- Development of SQEP cadre
- Building broader
   UK capability base

#### **Decision Support**

- System-level analyses
- Bayesian Belief Networks
- Game Theory

### International Collaborations

- UK-Norway Initiative
- UK-Sweden
- The Quad: Norway / Sweden / UK / US
- IPDNV

### Support to Government

- NPT representation
- P5 process
- Emerging requirements



## How can UK academia help?

- An intellectually-rewarding space...
  - Novel technical challenges, with read-across to other applications
  - Potential for research with direct impact on national security and government policy-making
- ...but relatively few UK-based academics working on the technical issues
  - AWE working with Imperial, KCL, Manchester, Bristol, Cranfield...



There is a vibrant community of technical verification researchers in US academia – how can we help make this happen in the UK?



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www.awe.co.uk/what-we-do/national-nuclear-security