



Defence Nuclear
Organisation

Defence Nuclear Opportunities

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MoD CSA-N



Outline

- The Defence Nuclear Organisation and Enterprise
- MoD CSA (Nuclear) Role
- Warhead Programme (AWE)
- Submarine Reactor Programme (RR Submarines)
- Key contacts for more information.



The Defence Nuclear Organisation

- Established April 2016, as recommended in 2015 Strategic Defence and Security Review, to oversee all aspects of defence nuclear business.
- Responsible for all submarines (from procurement to disposal), nuclear warheads, skills, related infrastructure and day-to-day nuclear policy.
- Specific responsibilities include:
 - Coordination of nuclear policy across the Enterprise and supporting national-level decision making on nuclear-related matters
 - Supporting Ministerial engagement with Parliament, the public, and the media on the nuclear deterrent and the wider nuclear enterprise
 - Management of the nuclear equipment programme
 - Sponsorship of the Submarine Delivery Agency (SDA). The SDA's role is to buy and maintain the UK's submarines on behalf of the Royal Navy and DNO.
 - Engagement with US, Australian and French Government bodies and agencies on nuclear cooperation.



CSA (Nuclear) Role (defined by GO Science).

- Clarify Science System which explains DNO system for commissioning, understanding, and using S&T and includes people, organisational functions and structures
- Ensure mechanisms are in place so policy making is underpinned by S&T
- Articulate Science System in a single document integral to overall DNE business plan (the Science and Technology Strategy) which explains DNEs operational work and policy cycle, demonstrating how it meets R&D needs.
- Develop DNE R&D Strategy including Public Sector Research Establishments (AWE Aldermaston and DSTL Porton Down), National Laboratories (NNL, NPL, etc.) and Industry Laboratories (RR Raynesway etc.).
- Must link and coordinate MoD and MoD-N S&T.
- Not the role of CSA (Nuclear) to run the plan, but to provide the overall assurance and approval that such a plan is in place, and that the department (DNO/DNE) has the scientific resources it needs to implement it.
- Have oversight of S&T budget.



CSA (Nuclear) Role

- Ensure *external*, independent, expert Scientific Advisory Committees are heard at senior level in Government.
- Building *internal* nuclear Science Advisory team in pan MoD's Defence Science and Technology (DST) department to provide support to CSA (Nuclear) and link with DNO and wider Enterprise (DNE).
- Working with CSAs in other Government departments (e.g. Paul Monks DESNZ) to share good practice across government and to identify and resolve cross-departmental science issues (CSA Network meetings, Nuclear Emergency Preparedness Scientific Advisory Group).
- Use network of contacts in civil nuclear and more general industry, academia and Learned Societies (RAEng, RS).



Some Focus Areas

- Alignment of areas of common interest between civil nuclear (DESNZ) and defence nuclear (MoD) including Skills, Materials and Testing Facilities.
 - Nuclear Collaboration Board with representatives from civil nuclear (DESNZ) and defence nuclear MoD.
 - Ministerial backing and involvement: James Cartlidge (Minister for Defence Procurement MoD) and Andrew Bowie (Minister for Nuclear and Networks DESNZ).
- Support for skills at all levels including PhD research training via CDTs.
 - Work closely with Julie Morris SRO Defence Nuclear Skills.
 - Reporting into Nuclear Skills Task Force (Sir Simon Bollom).



Building Skills for the Nation's Nuclear Capability

- On 25 May 2023, representatives of Government, Civil and Defence Industry, and academia gathered at the Institution of Engineering and Technology, London for a Nuclear Skills Conference. The following message from the Prime Minister Rishi Sunak was shown:
- “The UK’s defence and civil nuclear sectors are hugely important – for our security, our energy needs and our prosperity. That’s why we have made ambitious commitments through the Integrated Review Refresh and Powering Up Britain, which will help to deliver on our priority to grow the economy, while also sharpening our technological edge and supporting investment across the whole of the UK. Our brilliant nuclear workforce are at the heart of this and so we will support them to make sure they have the skills needed to match our level of ambition.”

Building Skills for the Nation's Nuclear Capability

Conference Programme

Agenda

09:30	Registration and Refreshments
10:15	Welcome from Conference Comper Simon Bowen Chair of Great British Nuclear and Chair of Devonport Royal Dockyard
10:25	Nuclear Sector's Contribution to the UK James Cartlidge MP Minister for Defence Procurement Nuclear's Role in Energy Security and Net Zero Andrew Bowie MP Minister for Nuclear and Networks

HM Government

Integrated Review Refresh 2023
Responding to a more contested and volatile world

HM Government

POWERING UP BRITAIN

March 2023



AWE Delivery Opportunities

The 2020 Integrated Review committed the UK to remaining a nuclear armed power, triggering the need for investment to support fissile material processing, manufacturing, storage and certification.

- **Technical novelty:** projects include new technologies as well as delivering complexity not previously required
- **Scale and complexity:** major infrastructure works in constrained and secure nuclear licensed sites, adjacent to regulated operations and within a constrained market
- **Pace:** accelerating to deliver capacity when needed
- **Operational capability:** recruiting and training up skilled operators and transitioning into operational use



AWE Science



- **University Engagement**
 - Drive to increase partnership activity to support capability and capacity
 - Leverage greater national value
- **Key Research Areas**
 - **Physics**
 - Scientific computing, Scalable physics algorithms, algorithm innovation, better software engineering
 - Developing a stronger 'supply chain' base, e.g. invigorating pulsed power technology in the UK
 - Invigorating dwindled research areas, e.g. nuclear theory and experiment
 - **Materials**
 - Materials modelling
 - Actinide analytical chemistry and metallurgy
 - High temperature composites (including functionalised composites and ceramic-carbon joining)
 - RA detection technologies (including new detector types and nuclide detection algorithms)
 - **Trials, Test and Evaluation**
 - Enhancing capability in diagnostics, trial data capture and instrumentation control
 - **Threat Reduction**
 - Nuclear forensics including materials & reaction modelling and validating ageing models
 - Enhanced nuclear detection technologies
 - Support to arms treaties and verification studies
- **Process**
 - Initial; Informal – technical discussions with subject matter experts
 - Completion; Formal – through Supply Chain Management – contracts subject to e.g. Public Procurement Regulations and Subsidy Control
- **Contacts**
 - **AWE Chief Scientist – Robert.Lock@awe.co.uk**
 - **External Technical Partnerships Team – ETP@awe.co.uk**



- **University Engagement**

- AWE partnering with UK academia and industry to build an indigenous UK capability to design, integrate and demonstrate warheads systems & technology.
- Continually developing materials, manufacturing, test and evaluation capabilities in a system context.
- Increase both:
 - Engineering research (low TRL, Official classification)
 - Technology development (low to mid TRL transition, Classified)

- **Key Research Areas**

- Product Technology
 - Concept System Demonstrators
 - Warhead structures / thermal protection systems
 - Electro-mechanical component & sub-system development
- Manufacturing Process, Plant & Equipment development
 - Nuclear / Energetics / Conventional materials
 - Advanced Manufacturing (Additive & Subtractive)
 - Automation & Robotics / Advanced Tooling & Fixturing
 - Composites
 - Digital Engineering & Information Systems
- Trials, Test & Evaluation
 - Product functional test and integration
 - Modelling and simulation
 - Environmental testing capabilities (normal and accident scenarios)

- **Process**

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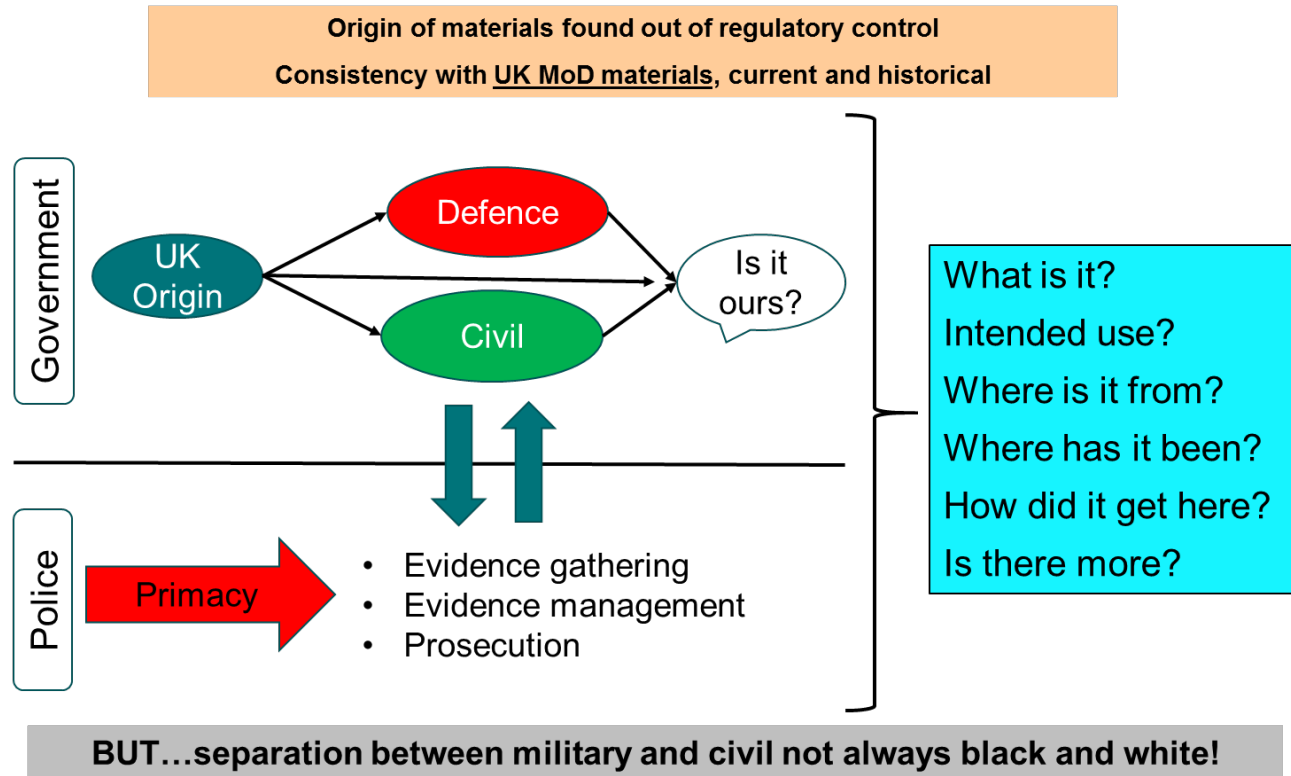
- **Contacts**

- **AWE Chief Technologist – Giles.Hartill@awe.co.uk**
- **External Technical Partnerships Team – ETP@awe.co.uk**

Nuclear Threat Reduction (NTR)

- NTR Programme AWE/NNL
- Example of civil/defence collaboration.
- NTR Net
- University-led, DNO-funded, network.
- PI Tom Scott, Bristol University, with Manchester and Bangor Universities.

Nuclear Forensics Stakeholders



NTR Net.

- Will create an impactful and coordinated national-level problem-driven research-centred delivery network to actively support NTR programmes and requirements within MoD, DNO, Home Office, BEIS, and FCDO.
- Will exploit the learning, experience, and methodologies from the earlier cross-council Nuclear Security (NuSec) Network.
- NTR Net Thematic Areas; Detection Science, Nuclear Forensics, Test and Treaty Monitoring & Verification, and Safeguards, Legacy Material & Facilities.
- NTR Net will support e.g. £20k pilot projects, rapid access grants, training grants, PhD projects....

UK Nuclear Propulsion – Past, Present and Future



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Future Naval Propulsion Development Programmes



2030

2040

2050

2060

2070

SSN AUKUS



- Increase in drum beat
- Increase in quantity
- Technology developments to support operational requirements

Future LWR



- Stretching capability requirements
- New technologies
- Scalable

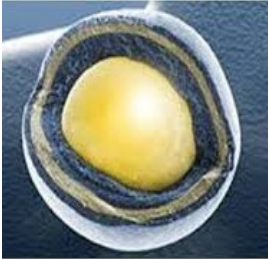
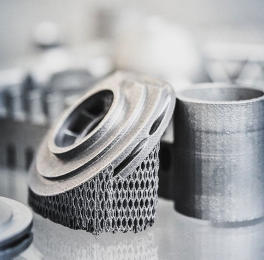

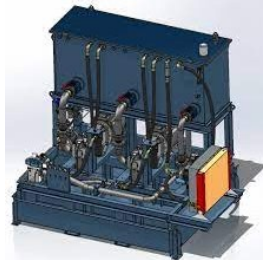

Future Non-LWR



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Rolls-Royce Submarines key research and technology development themes

Fuel Systems	Advanced Manufacturing	Data, Digital and Simulation	Experimental Engineering	Materials Engineering
				
<p>Develop new fuel and cladding systems</p> <p>Core structural materials</p> <p>Core manufacturing techniques</p> <p>UK irradiation capability</p>	<p>Large scale HIP</p> <p>Novel joining and cladding technologies</p> <p>Multi material additive</p>	<p>Data centric engineering</p> <p>Data science</p> <p>Modelling and simulation including multi length scale and surrogates</p>	<p>Large scale thermal hydraulics testing/models</p> <p>Measurement techniques</p> <p>Condition monitoring</p> <p>Small length scale testing</p>	<p>Material development for reactor vessels</p> <p>Composite materials</p> <p>Material archive to support model first approach</p>

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Rolls-Royce
Submarine's
Nuclear
Propulsion
Academic
Portfolio

- Sponsoring PhDs
- Co-funding/industrial supervising as part of CDT network
- Funding Research Fellowships/Research Assistants
- Direct funding of specific research activities
- Strategic partnering with Universities

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Rolls-Royce
Submarines
R&T Contacts

Main Contact:

Andrew Brown
Head of Technology

andrew.brown6@rolls-royce.com

Rolls-Royce Submarines specialists in attendance at Nuclear Academics Meeting:

- Prof. Michael Martin - Rolls-Royce Engineering Associate Fellow
Structural Integrity
- Dr. Dave Stewart – Technical Specialist Materials
- Mr. Mike Rogers – Technical Specialist Materials
- Dr. Andy Perry – Technical Specialist Core Materials

Following up

- DNE plans increased engagement with academia, national labs and industry.
- Support for Research Training including via CDTs
- Helpful suggestions welcome! E.g. on any relevant S&T topic.
- I can help with links to MoD, DNE (includes industry).
- Contact via William.lee116@mod.gov.uk

