

Human factors at the heart of the NUCLEAR DETERRENT



Clare Pollard and **Andy Bardsley** from the Atomic Weapons Establishment (AWE) look at 20 years of supporting national security

For more than 70 years, AWE's mission has been to support the defence and security of the UK. We do this through developing, manufacturing and maintaining the warheads for the UK's nuclear deterrent, as well as providing our unique skills and expertise to support counter terrorism and nuclear threat reduction activities.

Our scientists and engineers support a wide range of activities – warhead engineering, nuclear forensics capabilities that recreate the design of a weapon post-detonation, and state-of-the-art 3D virtual imagery to visualise complex engineering behaviours and characteristics, to name just a few. We also use sophisticated computer simulations to observe how complex and often intricate components perform under high mechanical and thermal stresses.

We're currently transforming our business to build the highly skilled teams, facilities and capabilities needed to deliver a once-in-a-generation programme to design and produce the Replacement Warhead for the UK's Continuous at Sea Deterrent. We must achieve this while sustaining the current warhead until it's withdrawn from service.

A key part of this transformation is modernising the way we work; from our processes and systems, to the site footprint and skyline, creating an environment that will attract, develop and retain the next generation of talent. This makes AWE a truly exciting place to be.

Human factors and AWE

Supporting this transformation will be AWE's human factors team, which sits at the heart of engineering and safety across the business. Working within AWE's Engineering function, the team provides guidance and expertise on the application of human factors techniques across AWE's estate. The human factors function also works in collaboration with dozens of practitioners from organisations across the country to deliver human factors support to

multiple projects. The scope of the work carried out by the human factors team is broad, including design and assessment of some of the most hazardous processes performed in the UK, not least the manufacture of explosives and processing and handling highly radioactive materials.

The team works on supporting the continued operation of existing facilities, the development of major new facilities and an ongoing decommissioning programme.

Facility layout to gloveboxes

"Our design input covers the breadth of the human factors discipline, with work on facility layout, control room design, alarms, design of interfaces, plant equipment, gloveboxes, communication systems and so much more," said Clare Pollard, Lead Technical Authority at AWE.

"As well as being integrated into designing the facilities, we get involved with developing work procedures, ensuring training and competency, and culture. It certainly keeps us busy."

The human factors team also liaises with counterparts in the US to collaborate on human factors research activities that support AWE's

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mission, through the Mutual Defence Agreement that was signed with the US in 1958.

The growth of human factors

Nuclear sites in the UK are legally bound to comply with the Nuclear Installations Act, which requires them to operate under a system of regulatory control. Up until the mid-1990s, AWE had crown immunity from the Nuclear Installations Act as its operations and sites were managed by the Ministry of Defence.

In 1993, following a review, it was recommended that immunity from the Nuclear Installations Act be removed. This prompted AWE to carry out a significant body of work to meet the conditions required by the Act. The human factors capability at AWE has its roots in this work, notably input to the safety cases needed to demonstrate facilities are safe to operate, and risks to the workforce and the public are as low as reasonably practicable.

Initially, AWE employed a small number of human factors contractor staff but in 2004 an in-house team was established. The team is now an integral part of almost every project, being involved at concept or pre-concept to help set requirements and inform the initial option study phase.

From there, it's on to detailed design and then supporting commissioning activities. Support to operational facilities comes in the form of human factors input to design and process modifications, incident investigations and formal periodic safety reviews. There's also an important role to play in decommissioning and waste management.

Focus on security

Behaviours are critical to security, and the human factors team supports training, procedures and specialist working groups to ensure that AWE maintains the highest levels of security. By focusing on the human element and emotional aspects to security, AWE is building a more collaborative



approach which encourages regular, open and honest interactions.

Human factors has enabled security to consider human behaviours throughout the employment lifecycle. AWE is now leading innovation and application of utilising human factors in security communications, training, leadership and developing and maintaining strong security culture, including with the supply chain.

The next 20 years and beyond

As AWE starts to deliver the once-in-a-generation programme to design and produce the Replacement Warhead, existing facilities must operate alongside the design and build of new facilities. The demand for human factors has never been greater.

We need to ensure human factors methods and tools are applied effectively, efficiently and seamlessly into an engineering-focused world. In parallel, we need to grow our human factors capability to ensure we can successfully deliver human factors across AWE.

"Being able to reflect on the past 20 years, I'm proud to have played a part in establishing a credible human factors capability at AWE," said Andy Bardsley, the first Human Factors Team Leader. "The future at AWE is truly exciting and human factors has a really important part to play."

Mandy Savage, AWE's Executive Director Engineering, added: "AWE has great capability in human factors engineering and it's fully integrated into the design and development of our future manufacturing equipment and processes.

"As we develop our manufacturing capability to support the Replacement Warhead programme, the importance of human factors can't be underestimated. It will ensure that we have safe, maintainable and effective facilities for the future, enabling us to deliver our mission."

If this has sparked your interest in AWE and our mission, where people are at the heart of what we do, please visit www.awe.co.uk or come and see us at the CIEHF's Careers Day on April 22. ■

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About the authors



Andy Bardsley is a Principal Safety Assessment Specialist at AWE. He has spent his career applying human factors methods in high hazard industries. He is currently using his human factors skills and experience to tackle complex safety assessments.



Clare Pollard has spent the past 24 years providing human factors support to many of the nuclear sites across the UK. She joined AWE in 2019 and is now the Human Factors Lead Technical Authority responsible for all aspects of human factors across the AWE sites.