Beyond Trident: AWE prepares for the future

Peter Burt examines the major redevelopment of the Atomic Weapons Establishment, and points out how new facilities could allow the UK to sidestep international controls on nuclear weapons development.

Aldermaston Women's Peace Campaign

The Orion nuclear test laser building at AWE Aldermaston.

For 60 years, the Atomic Weapons Establishment (AWE) has been responsible for providing and maintaining the warheads for the UK's nuclear weapons. The Establishment, based on two principal sites at Aldermaston and Burghfield in West Berkshire, has designed, tested, and built all the UK's nuclear weapons including, most recently, the current arsenal of Trident warheads. AWE's work covers the entire life-cycle of nuclear warheads: from initial concept, assessment and design, through to component manufacture and assembly, in-service support, and eventual decommissioning and disposal.[1]

AWE's current role is based mainly around maintenance and surveillance of the Trident warhead arsenal. Around 200-225 warheads were produced for Trident, based on the US W-76 Mk4 design, with production ending in 1999. To ensure that the stockpile remains reliable and 'safe' and that weapons function as they are designed to, deployed warheads are returned to AWE on a regular cycle to allow inspection and replacement of ageing components. AWE also operates an extensive research and development programme aimed at generating the data needed to upgrade Trident warheads and also develop a successor to the current warhead design if required in due course.

Although the 2006 White Paper on the replacement of Trident stated that "decisions on whether and how we may need to refurbish or replace this warhead are likely to be necessary in the next Parliament,"[2] the new government announced in the recently published Strategic Defence and Security Review (SDSR) that a replacement for the current Trident nuclear warhead will not be required until at least the late 2030s. The SDSR also announced that the total number of warheads in the UK's nuclear arsenal (both operational and in reserve) will be decreased from around 225 to not more than 180.[3] These announcements set the context for the work that AWE will be undertaking over the years ahead.

Paving the way for the next generation of nuclear weapons?

The SDSR and the current squeeze on public spending are forcing a rethink of the Labour government's plans for AWE. In July 2005 John Reid, then Secretary of State for Defence, announced: "Agreement has been reached with AWE Management Ltd to take forward a programme of investment in sustaining key skills and facilities at the Atomic Weapons Establishment. This will include the provision of necessary extra supporting infrastructure ... The purpose of this investment of some £350 million over each of the next three years is to ensure that we can maintain the existing Trident warhead stockpile throughout its intended in-service life."[4] This was the first public mention of the Nuclear Warhead Capability Sustainment Programme – a programme that had its inception in 2002 but was not announced until three years later, by which time well over £100 million had already been spent on upgrade work at AWE.

John Reid's statement stressed that investment work at AWE was needed to replace ageing facilities needed to maintain the existing Trident warheads and, at the same time, recruit new scientists so that AWE could retain its skills base. However, the investment programme is also essential in allowing joint warhead research work with the USA to continue, and the new facilities will allow AWE to develop and build a new warhead if asked to in future. Worryingly, it sends out a signal that the UK is ready to retain its nuclear weapons capability for the next 50 years, regardless of the commitment under Article VI of the Non-Proliferation Treaty, which requires nuclear weapon states to "pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date."[5]

AWE's site development strategy maps out an extensive infrastructure upgrade programme, which will almost entirely rebuild the Aldermason and Burghfield factories. In part, the work is needed to replace facilities dating from the 1960s and 1970s, which do not meet modern building and safety standards, but it will also upgrade and update AWE's scientific research facilities. The investment programme will require the construction of a number of large, complex, facilities which will take up to ten years to design, build, and commission. According to AWE's staff newspaper AWE Today: "At its peak the construction work will make AWE one of the largest construction sites in the UK – similar in scale to the Terminal 5 project at Heathrow."[6] Expenditure on AWE's investment programme has rocketed upwards since John Reid's announcement in 2005, and will reach around £1 billion per year between now and 2013.[7]

Work already is nearing completion on a number of projects at AWE. New office space has been constructed, partly to provide accommodation for the new staff who have been recruited, and AWE has recently taken delivery of three new supercomputers, each able to perform trillions of calculation per second for modelling the events that take place inside a nuclear warhead as it explodes. Orion,[8] AWE's new £183 million nuclear test laser facility, is expected to undertake its first firing next year, as part of a programme of plasma physics research aimed at heating materials to the extreme temperatures created during a thermonuclear explosion.[9]

Construction work is well underway on a number of other projects: manufacturing facilities for high explosives and conventional items at Aldermaston, and a small-scale components manufacturing facility at Burghfield. Construction of a brand new warhead assembly-disassembly facility, Project Mensa, has begun at Burghfield. This is a controversial location because, although the project will replace an existing facility that faces severe safety challenges and will play a vital role in decommissioning warheads when they are taken out of service, the Burghfield site is situated in a flood risk area and is close to the urban area of Reading.

Undermining international arms control?

At Aldermaston planning permission has been granted for Project Pegasus, a new facility for processing and storing enriched uranium, and also for Project Hydrus, a new hydrodynamics research facility.[10] AWE undertakes hydrodynamics research to test the properties of materials under immense pressures, which cause solid materials to exhibit fluid-like behaviour. Explosives are used to generate high-pressure shocks in warhead materials and models, and powerful high speed flash x-ray machines capture images of the resulting impact.

AWE's promotional literature emphasises the role hydrodynamics research plays in ensuring the safety and reliability of ageing warheads. However, data from hydrodynamics experiments could also be used to enable warhead upgrade work or even design of a new warhead. AWE's hydrodynamics research, like much of its warhead physics research programme, generates data that was historically obtained from underground nuclear weapons tests, and is thus aimed at allowing the UK to sidestep the controls of the Comprehensive Test Ban Treaty (CTBT). Although a portion of the research time on the Orion laser has been allocated to universities to allow laboratory astrophysics and other civil research work to take place, the Ministry of Defence has indicated that Project Hydrus will exclusively support defence activities.[11]

The current squeeze on public spending has forced the government to look again at the AWE investment programme, which is currently under review to establish how savings might be made. Hydrodynamics research will be a major area affected by the squeeze. This is because of the recently published treaty between the UK and France on co-operation over nuclear weapons research, which states that the two nations will set up a joint hydrodynamics research facility at Valduc in France rather than each build their own individual facilities, thus saving money for both nations.[12] It appears likely that as a result the scope of Project Hydrus will be scaled back considerably.

The big decision

Postponement of the decision on whether to develop a new generation of UK nuclear weapons has raised questions about AWE's role over the years ahead. Rather than undertake development work on a new weapon, AWE now finds itself in a position where its role will be confined to stockpile stewardship and decommissioning for the short and medium term future. The Establishment currently appears to be over-resourced to focus on just these tasks, and is seeking to diversify its role into other aspects of management of the nuclear weapon cycle and national nuclear security programmes.[13]

However, at some time in the future, the government will have to make a decision on whether or not to develop a new warhead design. A warhead replacement programme would cost £2-3 billion at current prices, and ministers would have to make a choice between giving the go-ahead to design of an untested new warhead, which could never be validated without breaking the CTBT, or retaining the current Trident warhead, which is reliable but ageing.

Paradoxically, new warheads may well end up being less safe and reliable than existing warheads. Designing and building new nuclear warheads without testing them is risky, even with the sophisticated models of AWE's warhead physics programme. US analysts Sidney Drell and James E Goodby have pointed out that "it takes an extraordinary flight of imagination to postulate a modern new arsenal composed of such untested designs that would be more reliable, safe, and effective than the current US arsenal based on more than 1,000 tests since 1945."[14]

In contrast, the reliability of the existing warhead arsenal can be guaranteed using engineering-based inspection and re-manufacturing techniques. This requires regular inspection and rebuilding of the weapons, detaching and checking each of the thousands of individual components that make up a warhead and its subsystems. If a part shows any problems or signs of deterioration, it is simply replaced by an identical part. Stocks of identical parts can be created through re-manufacturing parts according to their original specifications. As long as the basic weapon design is not changed, this engineering approach will continue to work. The method (sometimes referred to as curatorship) is a tried-and-tested technique, being the method used to maintain the USA's stockpile of nuclear weapons during the Cold War.

A programme to develop a new nuclear warhead design at AWE is not needed and should not be given the go-ahead by a future government. Rather than increasing the capability of nuclear weapons, the current arsenal of warheads should be 'frozen in time' – maintained and serviced but without any upgrade in performance – until the time comes to retire them from service. Investment in research facilities intended to cheat the CTBT should be cancelled, and work at AWE that supports global arms control – research into disarmament verification techniques and warhead decommissioning – should be stepped up. With President Obama's arms control agenda beginning to bear fruit, prospects for multilateral nuclear disarmament look promising, and this area of work must be the future for AWE.

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