

The Atomic Weapons Establishment (AWE) Aldermaston & Burghfield

- preparing for the next generation of nuclear weapons

The Comprehensive Test Ban Treaty dictates the way that nuclear designers at Aldermaston go about their work. Testing a warhead by blowing it up is no longer an option. Instead substantial scientific resources are dedicated to trying to understand exactly how a nuclear warhead ~~works~~ behaves. This approach is called Science Based Stockpile Stewardship.

Supercomputers

At the centre of the design effort is the production of computer models. These simulate how a nuclear warhead functions. In 2002 AWE Aldermaston installed the Blue Oak computer, with a power of just under 3 Teraflops. In 2006 an order was placed for a new computer with a maximum power of 40 Teraflops. If this machine were in service today it would be the most powerful computer in Europe. And this is only a stepping-stone. Aldermaston plans to have a 100 Teraflop computer by 2010. The US example suggests that they won't stop there. Thoroughly assessing the reliability of a complete nuclear warhead would require a 350 Teraflop computer.¹

The Aldermaston computing project is running 4 or 5 years behind its American equivalent. ~~For most of the last decade the biggest computers in the world have been those in the US nuclear weapon laboratories. The one exception has been the Japanese Earth model, which for a few years was at the top of the supercomputer league. The Japanese Earth model simulates tsunamis and the effects of climate change. The same money, technology and human ingenuity can be used either to prevent disaster or to cause it. It can be applied to understand climate change, or to construct Weapons of Mass Destruction.~~

Experimental facilities

The computer models are verified by comparing the results of the simulations with experimental data. Laser, hydrodynamic and sub-critical tests provide much of this data.

Lasers

AWE Aldermaston are is preparing to build a powerful new laser called 'Orion' in a large building within the site. British scientists currently have access to two lasers in the US – the National Ignition Facility (NIF) and the 'Omega' laser facility. The US laboratories primarily use NIF and 'Omega' to understand the secondary (fusion) element of nuclear weapons, although they can support other work. It is likely that the focus of work at 'Orion' will be similar. Its construction is a sign that scientists at Aldermaston envisage that they will continue to support and design high-yield thermonuclear weapons in the future.

Hydrodynamic facilities

New hydrodynamic testing facilities are planned as part of the redevelopment of AWE Aldermaston. Hydrodynamic tests analyse how metal responds when explosives detonate next to it. The tests use steel in place of plutonium. The resulting data illustrates how the primary (fission) part of a nuclear weapon works. The design of any new or modified primary will rely heavily on these tests.

¹ The basis of the US approach to warhead certification is Quantified Modelling of Uncertainties (QMU). The US warhead development plan is to achieve QMU for the W76-1 warhead in 2009. By this time they plan to have a 350 Teraflop computer in service.

Sub-critical tests

Sub-critical tests are similar to hydrodynamic tests, but use plutonium that is the material at the core of a nuclear weapon. High explosive is placed next to a small quantity of plutonium, which is not enough for a nuclear yield. This device is then detonated in an underground chamber. This provides further information on the primary (fission) part of the warhead.

There have been two British sub-critical tests – 'Etna' in February 2002 and 'Krakatau' in February 2006. Both took place at the Nevada nuclear test site in the US and both used devices manufactured at Aldermaston.

Is AWE Aldermaston designing a new nuclear bomb-?

In response to a question in Parliament, John Reid said that Britain is not designing a new nuclear weapon. However the MoD also says that AWE Aldermaston maintains the capability to design a new warhead, should one be required. When Aldermaston changed hands in 2000 the new owners were asked to come up with a plan of how they would achieve this goal of a new-design capability.

US Developments

The nuclear warheads currently deployed on British submarines are Anglicised copies of the American W76-0 design. Today in the US there are two programmes to substantially modify the W76.

W76-1

The first W76-1 warhead is due to be completed in 2007. This will re-use the nuclear material at the heart of a dismantled W76 warhead, but many crucial components will be replaced with new designs. It will have a new Arming, Fuzing and Firing system, a new Gas Transfer System and a modified high explosive package.

Reliable Replacement Warhead (W76-2)

This is a programme to design a new weapon for the US arsenal. The study is initially focusing on a new plutonium pit for the primary of the W76 warhead. The likely designation of this warhead is W76-2. The new primary could also be used in other warheads.

The new US pit design is expected to avoid using Beryllium, which is a toxic component of the existing W76 warhead and its British counterpart. Beryllium for Trident warheads was originally fabricated at the Atomic Weapons Establishment in Cardiff. When this factory closed, vital equipment was transferred to Aldermaston. Machining Beryllium is a problematic issue for AWE Aldermaston.

The head of Los Alamos nuclear Laboratory has said that data from the British 'Krakatau' sub-critical test would be used for the *Reliable Replacement Warhead* project. He also said he would be surprised if the British were not watching this programme pretty closely.

British plans

When asked about British collaboration with the American W76-1, W76-2 and Reliable Replacement Warhead projects Defence Ministers have refused to confirm or deny their involvement, saying only that they discuss a range of issues with their American counterparts.

In 2000 a British contribution to a US scientific report said that the main objective of the British nuclear weapon's programme was to ensure that the Trident warhead could remain in service for significantly longer than its original planned life. This paper was probably written in AWE Aldermaston.

This emphasis on planning beyond the original lifespan (2025) is revealed in other statements. When quizzed about the 'Krakatau' sub-critical test the MoD said their interest was in understanding the effects of ageing on the warhead. Their concern is not just about how the warhead will perform during its planned life, but whether they can continue to use the nuclear components at the heart of each warhead for many years after 2025.

It is unlikely that AWE Aldermaston are ~~is~~ seriously considering continuing with the current design as it is. A number of critical components are procured off-the-shelf from the US. These include the Arming, Fuzing and Firing System, the Gas Transfer System and the Neutron Generator. In 2002 a new American model of Neutron Generator began to be installed on British warheads. It is likely that Aldermaston plans to replace several components when new ones become available from the US.

The US Laboratories currently plan to convert only a limited proportion of their Trident warheads to W76-1. They have not yet decided whether to roll out this programme further, or to replace it with the W76-2. The MoD ~~have~~ has probably not yet chosen whether they will adopt the W76-1, W76-2 or an alternative. However it is likely that AWE Aldermaston are carrying out initial work on a range of possibilities to keep their options open.

While the emphasis will be on Trident, their work will extend beyond this. One possible option would be to resurrect the warhead design developed for the Tactical Air to Surface Missile (TASM) in the 1980s. This design was tested in the 1980s but never built. One problem is that the US equivalent was also never manufactured.

Production and refurbishment

The original batch of Trident warheads was assembled at Burghfield between 1992 and 1998. However production did not stop then. ~~New warheads Aldermaston have~~ been manufactured ~~new warheads~~ every year since and plans remain to continue to do so for many years.

Each year several Trident warheads are returned from Scotland to Burghfield where they are dismantled. Some of the warheads are then rebuilt with several components, such as the high explosive, replaced. But other warheads are decommissioned. Their nuclear components are taken apart and analysed. New warheads, assembled from scratch, replace those that have been decommissioned. It is not clear what proportion of returned warheads are replaced rather than refurbished.

The Strategic Defence Review and Parliamentary answers in 1998 showed that at the time there were between 180 and 200 Trident warheads in the stockpile. The total has probably been sustained around the same level since then.

The two main facilities in AWE Aldermaston are A90 and A45. A90 is a copy of a building in Los Alamos and produces plutonium pits for new warheads. A45 produces the secondary part of the warhead, using Highly Enriched Uranium and other materials. A45 is almost 50 years old and parts of it are being decommissioned.

New weapons for new roles

The US laboratories are being asked to design weapons that can be used in new scenarios, as well as in an all-out attack on Russia. The new emphasis is on increased accuracy and lower-yield. This is seen as making nuclear weapons more "useable".

There is no clear indication that a lower-yield or variable-yield warhead for Trident is being developed in by the US Laboratories or ~~Aldermaston~~ AWE. However both are probably interested in going down this road. The variable-yield option is more likely as it would enable a smaller stockpile of weapons to be used for a variety of roles.

Lockheed Martin has ~~ve~~ designed an "Accuracy Adjunct" for the Trident warhead. This was flight tested in 2002 and 2005. It substantially increases the accuracy of Trident by adding flaps to the Re-entry Vehicle so it can be manoeuvred. The Accuracy Adjunct was designed for nuclear Trident. Current proposals to arm some US Trident missiles with conventional warheads are based on the same technology. The Accuracy Adjunct would provide the increased accuracy which a lower yield warhead would require. So it is likely that Britain is interested in this.

Expenditure

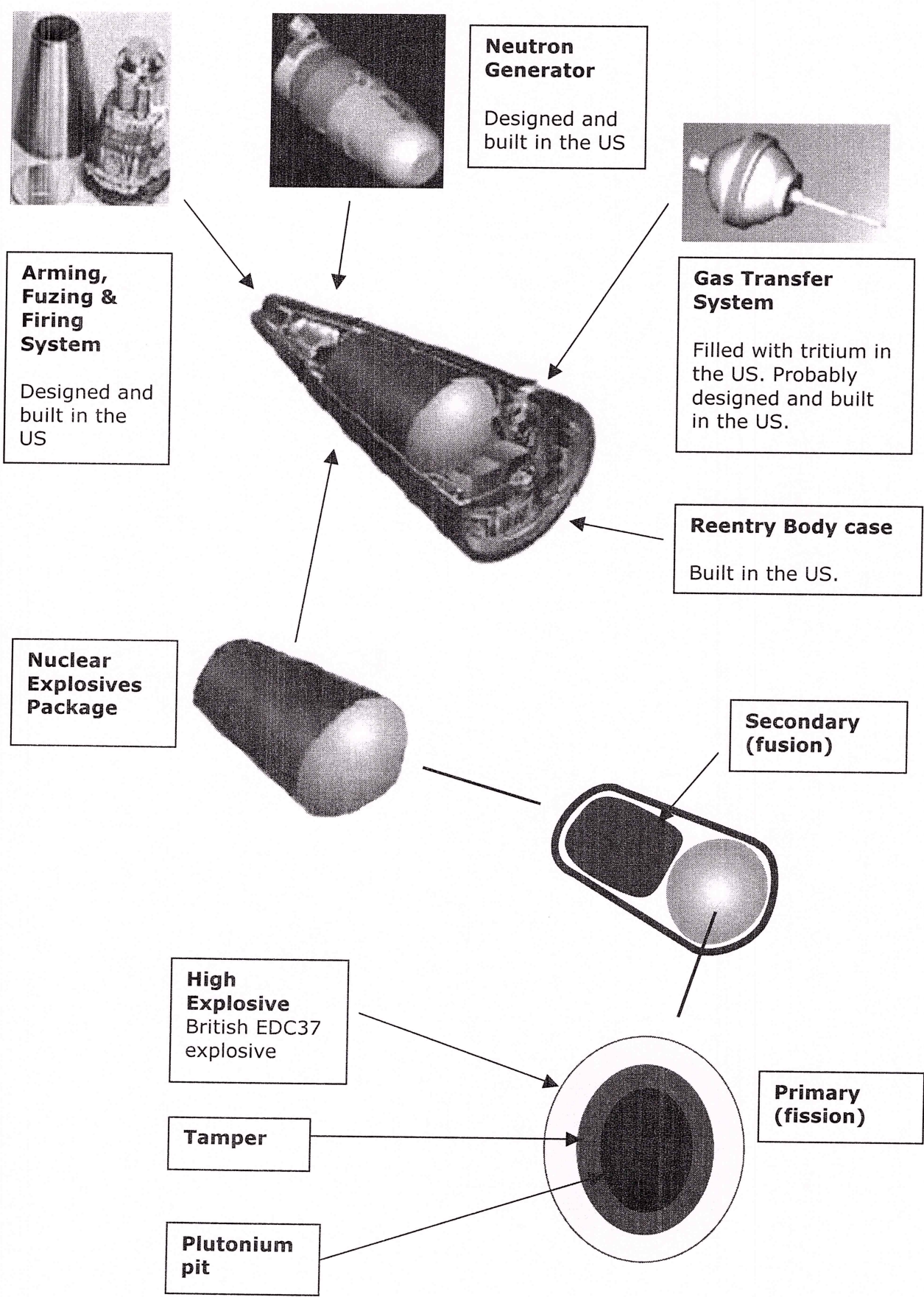
In 2000 the new operators, AWE Management Ltd were issued a contract worth £2.3b to operate Aldermaston for 10 years, later increased to over a 25 year contract worth a further?????????/ £5.1b. period. In 2005 the government announced that an additional £1.5 billion would be spent on building new facilities over a three--year period. If AWE Aldermaston continues to design and produce nuclear warheads then this is likely to involve substantial additional expenditure over many years.

An alternative use for Aldermaston

Today a small part of the work of ~~Aldermaston~~ AWE is monitoring observance of the Comprehensive Test Ban Treaty. A report by Pugwash has explained how the resources of the Atomic Weapons Establishment could be diverted away from building nuclear weapons towards verifying nuclear disarmament.²

² Verifying Nuclear Disarmament: A Role for AWE Aldermaston, Tom Milne & Henrietta Wilson, British Pugwash Group, 1999.

British Trident nuclear warhead



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Update

21st April 2003

AWE STRATEGY PLAN 2002

New 25 year Contract

The new 25 year contract was signed between MoD and AWEML on Monday 3rd March 2003. This extension, from 10 to 25 years attracted unwelcome media attention for AWE when local MPs questioned the MoD decision to award a further contract to the BNFL, Lockheed Martin and Serco consortium. AWE rebutted the criticism by stating that, " AWE wanted to make it clear that what happened in parent companies was the responsibility of that company and had no bearing on safety at AWE. Performance at AWE was totally the responsibility of AWE plc".

AWEML Managing Director, Bill Haight said, "This [is] excellent news for the future of AWE as it allow[s] the Company to take proper and strategic time frames to develop AWE for the 21st century".

The contract is intended to open up access to private finance. "Government finance [is] always year to year and therefore did not always match requirements. This would mean that the **Site Development Strategy Plan** *could* bring earlier cost savings on infrastructure.

MoD comments on AWE's openness

At the signing of the contract, the Chief of Defence Procurement, Sir Robert Walmsley is reported to have commented on AWE's communications strategy and openness.

Super- Computer

The new supercomputer suite, Blue Oak is now officially open.

High Energy Laser

AWE has now been awarded a contract for the assessment phase for a new high-energy laser facility to support the UK nuclear programme. The laser will use the latest technology to study plasma physics. It may yet be built at the Rutherford Appleton Laboratory at Harwell, but AWE wants the facility not only for its own use, but to hire out to academic researchers.

Conference Centre

The area intended for the new conference centre at the west end of the site is now being cleared.

AWE Burghfield

MoD has had a rethink about transferring the weapons assembly and disassembly plant at Burghfield to the Aldermaston site, and it is now to remain where it is for the lifetime of Trident, according to Bill Haight. The current position is that Burghfield is to remain open for the lifetime of the AWEML contract, as a minimum. However, this problem seems to return every few years. Clarification is being sought from AWE as to whether means 10 or 25 years.

AWE Emergency Telephone System

The emergency telephone system is now said to be "technically" operational. AWE report that the delay was due to the need to design, and agree with the vendor, enhancements to the system to make it sufficiently robust and proof against accidental or malicious initiation. It remains for protocols to be agreed with Thames Valley Police before they system can go "live".

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Update

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AWE STRATEGY PLAN 2002

THE NEXT 50 YEARS

Under a heading "The next 50 years", the February issue of AWE Today * explains that "The apprentices school will continue to develop the training it offers to suit the needs of the business and to meet the expectations of a new generation of apprentices. Students on AWE apprenticeships can "finish their studies without debts ". The initiative aims to recruit local undergraduates who will stay at AWE longer than those from elsewhere.

25 Year Contract*

The 25 year contract "will enable AWE to develop its resources to meet the UK's need for nuclear warheads in the absence of nuclear testing." Strategic Imperative 2 of the plan, "Modernise the capability to deliver the UK's requirements for warheads," has earned a £2.4 million MoD contract for an assessment phase for the new high energy laser. This may be sited at AWE or at the Rutherford Appleton Lab. at Harwell. The new accommodation block and Conference Centre building are projected to be finished in 2005.

Detonator Research*

When referring to the production of explosive detonators for warheads, AWE euphemistically calls the warhead a "nuclear application". Researchers are working on a new generation of detonators using computer models of the way explosives behave in plausible accident scenarios such as impact, fire or nearby explosions.

The Burghfield Site*

Plans to move the warhead assembly plant to the Aldermaston site have been abandoned, although the explosives facility may move after a decision in March.

AWE Emergency Telephone System

For years AWE have been trying to set up an emergency telephone system for local people to be automatically phoned in the event of a nuclear accident at Aldermaston. But nothing happens. AWE say they may have more news in April, but there is no timetable for implementing this publicised facility. Confidence in the ability of AWE to deliver projects it has initiated will not be enhanced by this failure to follow through promises on off-site safety plans.

Future Nuclear Weapons

Given that the current Defence Secretary, Geof. Hoon continues to refuse to rule out the use of nuclear weapons in Iraq, it follows that the kind of weapon that could be used may be revised. New developments at AWE will provide test research facilities for new weapons such as smaller yield bunker-buster warheads for sea launched cruise missiles. Even if we assume that the army will remain nuclear free, it is not inconceivable that the RAF could return to being a nuclear force in future.

"Mr Hoon has previously warned the Iraqi leader that Britain would use nuclear weapons in the right conditions. The international development secretary, Clare Short, said: "I can't see any scenarios where contemplating the use of nuclear weapons would be of any use whatever." However, Mr Hoon said: "We have always made it clear we would reserve the right to use our nuclear weapons in conditions of extreme national self defence. That remains our position and that is the position that has been set out consistently by government ministers."
Guardian, 3rd Feb 03

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2002 STRATEGY PLAN FOR THE ATOMIC WEAPONS ESTABLISHMENT (AWE) ALDERMASTON

The AWE Site Development Strategy Plan describes the aims to "improve the appearance of AWE" and make it "a more attractive place to work". By page five, we read of the proposed hydrodynamics plant, high powered laser (Nuclear Ignition Facility) and materials laboratories for research and development. New-build at Aldermaston has been in the pipeline since 1999, when the MoD was considering a tender from the BNFL, Lockheed Martin & Serco consortium, for a ten-year contract to run the nuclear weapons production plant. Part of the deal was to agree a further 25 year contract, although this extension has still to be signed. Between July and December 2002, the Ministry of Defence was expected to start lodging planning notices with West Berkshire District Council in Newbury, but no notice has yet appeared.

Testing new weapons

The new facilities at AWE will enable research on nuclear weapons to continue without underground testing, banned under the Comprehensive Test Ban Treaty. It isn't a question of building new production facilities. The A90 warhead production complex can be used to build and service nuclear warheads for many years ahead, with appropriate re-tooling. The skills and equipment to build small nuclear weapons also exist. But what is not available is the means to test them – hence the long term alternative plans to offer methods of testing a new warhead design.

AWE Management

In June 2002, AWE predicted "a potential gap between Company expenditure and available income" and consequently "devised a new model for running the business". Speculation about the competence of AWE Management Ltd and its relationship with MoD revolves around finance and delay: Delay in agreeing the 25 year new-build contract, delay in submitting planning notices promised monthly since July and delay in publication of the AWE 2001 Annual Report and Accounts until December 2002. And now we have the following gobbledegook from December's in-house magazine, AWE Today: *"Company-level plans will be finalised in January with the Directorate Business Area Accountability Plans up-dated in February. This will allow time for more detailed departmental, team, and individual work plans to be agreed before April 1st 2003 so that we can 'hit the ground running', knowing exactly what the plan is."*

The Minister can decide

This is not the first time that a nuclear weapons have become the concern of West Berks. Council in Newbury. In the 1980s, it was the deployment of nuclear cruise missiles at USAF Greenham Common. Local councillors have two options now: either to accept the planning notices from MoD and risk being the focus for national nuclear disarmament protest again, or, to refer the matter up to the Environment Minister who has the power to establish a Public Inquiry.

Di McDonald
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14 January 2003

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Update

22nd April 2003

AWE STRATEGY PLAN 2002

Strategy Plan & Tritium Evaporator Notices

On Wednesday 28th May, West Berks. Planning Committee will hear arguments relating to the Aqueous Waste Treatment Plant (AWTP) that is to evaporate tritiated water, replacing the Pangborne Pipeline. Di McDonald will speak for NIS, agreeing that this is the best of the options, given the amount of decommissioning needed at AWE, on condition that production of weapons ceases. The AWTP has to be seen in the context of other risks at the site, from fire, terrorists and plutonium discharges. Until the plant is wound down, it is a threat to public health and safety, and WBC should say so. No plan has been sent to WBC regarding the Strategy Plan. A 12 month delay in submitting the new conference centre plan at the west end of the site may be because it is too close to sensitive areas and AWE are revising their plans.

Contractorisation

"It is our *intention* to ensure that all our core activities are done by AWE people," according to Director Frank Winter. But that "a number of services can be done by the supply chain with *similar values and beliefs* as AWE." [Ed. italics]

Collaboration with US Labs.

Diamond turning lathes in the Material Science Research laboratory are among the most accurate in the world, and are used to support experiments in the Hydrodynamics group and the HELEN laser. "They are also used in collaboration with some of the more powerful lasers in US labs." A white light interferometer is used to inspect and characterise warhead components that measures diamond turned surfaces with resolutions measured in fractions.

European Society for Precision Engineering (ESPE)

AWE has now become a member of the ESPE and Nanotechnology, since it enables them to keep track of advances in technology, and provides contact with others *carrying on similar work*.

Cost Cutting

Cost cuts of £100,000 a year have been achieved in the A45 Uranium plant and one of £500,000 in A90, the Plutonium warhead production building.

Space Exploration

The Beagle 2 Mars lander has been tested in AWE 's electro-mechanical shaker' for the principal-engineering contractor, Astrium Space. AWE's role has been to provide a suitable environment to carry out final tests on the lander, to be launched by the European Space Agency for the Open University. Ed. Comment: It is surprising that the EU Space Agency is in collaboration with AWE since it has a non-military clauses in its constitutions.

AWE Partnership Share Scheme

AWE employees are being issued share certificates in nuclear weapons production in the first week of June. AWML have injected £2 million into the fund to ensure a guaranteed payout at the end of a 3 year period. The moral implications do not feature in the information to employees.

Donations to Local Schools

Kendrick Girls School in Reading has been donated £10,000 for science equipment. Scott McCulloch for AWE said, "Projects like this establish an excellent exchange process between the school and AWE." One 'old girl' is known to have protested to the school.

AWE Emergency Telephone System

The emergency telephone system is still not active. Details are to be included in the new REPPIR (Radiation Emergency Preparedness & Public Information Regulations) leaflets to be sent to all homes and businesses close to AWE sites.

Source: AWE Today April 2003