Trident and the future of the British Nuclear Deterrent

Standard Note: SN/IA/3706
Last updated: 5 July 2005
Author: Tim Youngs & Claire Taylor
International Affairs and Defence Section

The British nuclear deterrent is based entirely on the three components of the Trident weapons system. This comprises four Vanguard-class nuclear-powered submarines, each carrying a maximum of 48 nuclear warheads, which are mounted on up to 16 Trident II D5 submarine-launched ballistic missiles.

The Trident system entered service in late 1994 and has a projected lifespan of 30 years. Due to the lengthy procurement process required for complex weapons systems, the current Labour Government has said that a decision on a Trident replacement will be required at some stage during the current parliament. It has said it believes the current "minimum nuclear deterrent" is likely to remain a necessary element of the UK's security.

This note summarises the evolution of the British nuclear deterrent since the 1950s and looks at the various components of the Trident system. It then considers the possible options available, such as upgrading the existing system, procuring a direct replacement, or developing a new capability.

Contents

A. Evolution of the British Nuclear Deterrent 3
B. Trident 4
1. Procurement 4
2. Technical Capability 6
3. British Tactical Nuclear Weapons 7
C. Current British Nuclear Posture 8
D. After Trident? 10
1. Projected Lifespan for the Trident System 10
2. Procurement Options 11
a. Service Life Extension 11
b. Direct Replacement 12
c. New capability 14
E. Developments at AWE Aldermaston 15
a. New Laser Facility at Aldermaston 16

b. Hydrodynamics 17
c. Aldermaston and a Trident replacement? 17

A. Evolution of the British Nuclear Deterrent

The UK first tested a nuclear device in October 1952[1] and deployed an operational nuclear weapons capability the following year. Initially, the British nuclear deterrent rested on the 10 kiloton[2] Blue Danube free-fall bomb, carried by the V bombers of the Royal Air Force's strategic bomber force. Further tests at Malden Island and Christmas Island in the Pacific in 1957-8 involved the detonation of a 3 megaton thermonuclear device.[3] The UK's first operational thermonuclear weapon, the 1 megaton Yellow Sun Mk.2, entered service in 1961.

In 1958 the UK and the United States concluded a 'Mutual Agreement for Co-operation on the Uses of Atomic Energy for Mutual Defence Purposes'.[4] The Agreement, which has come to be seen as the cornerstone of the British nuclear weapons programme, enables exchanges of technical information and allows the UK to draw on US warhead designs. An amendment to the Agreement was introduced in 1959, allowing purchases and exchanges of fissile and thermonuclear material. Another important benefit of the Agreement was to allow the UK to use the US test site in Nevada.

The USA and UK were also engaged in a joint project to develop the Skybolt air-launched stand-off missile, which the British viewed as the central component of their future nuclear capability. In 1962, however, the Kennedy administration cancelled the project. To fill the gap, the British Government reached agreement with the USA in December of that year to procure the Polaris submarine-launched missile system, which entered service later that decade.

The shift to a submarine-launched missile system represented a dramatic improvement in capability. The RAF's bomber force required large, static bases and was vulnerable to a first strike by the most likely opponent, the Soviet Union. By contrast, the new submarine fleet was mobile and difficult for the Soviets to track. Furthermore, strong air defences could deplete the bomber force before it reached its targets, whereas a missile attack could be mounted from a distance, minimising the risk to the crew and the submarine. Furthermore, the cost and technical challenges of designing an effective missile-defence system meant that a ballistic missile strike was extremely difficult to defend against.[5]

The Polaris system comprised four Resolution-class ballistic missile submarines, which were designed and built in the UK, each armed with sixteen Polaris missiles. The missiles and their launch systems were purchased from the United States, while the warheads were built in

---

1 The test, codenamed Hurricane, was conducted in the Monte Bello Islands off the north-west coast of Australia.

2 A kiloton is an explosive force equivalent to that of 1,000 metric tons of TNT.

3 A megaton is an explosive force equivalent to that of one million metric tons of TNT.

4 For more detail on the MDA and the recent 10-year extension of the provision relating to the transfer of materials, see Library Standard Note SN/IA/3147, UK-USA Mutual Defence Agreement.

5 For a discussion of the history of ballistic missile defence and the current US attempts to develop an effective system, see Library Research Paper 03/28, *Ballistic Missile Defence*, 26 March 2003 and Library Standard Note SN/IA/2972, *Ballistic Missile Defence - Latest Developments*, 23 March 2004.

the UK. Initially, the warhead used was a scaled-down version of the existing British WE-177 warhead, but this was subsequently replaced in 1982 by the Chevaline warhead, which was designed to defeat Soviet anti-ballistic-missile defences.

By the final decade of the Cold War the British nuclear deterrent had two main components; Polaris Chevaline, which was in the process of being replaced by the Trident submarine-launched ballistic missile system, and the air-dropped WE177 free-fall bomb, which was eventually phased out by March 1998. In addition, US nuclear warheads were deployed on heavy artillery and short-range Lance missiles under a US-UK dual-key arrangement, although these were withdrawn in the late 1980s following a joint US and Soviet decision to reduce tactical nuclear weapons. Polaris and Trident were designed to operate in a strategic role, whereas the other elements of the arsenal served in a tactical or non-strategic role.[6]

B. Trident

The Polaris/Chevaline system was phased out by 1998, and replaced by four Vanguard-class submarines armed with Trident missiles. The Trident system now fulfils both the strategic and non-strategic nuclear roles for British forces.

1. Procurement

The decision to acquire Trident dates back to 1980. In a Statement to the House on 15 July 1980 the then Secretary of State for Defence, Francis Pym, stated:

> With permission Mr Speaker, I should like to make a statement on the eventual replacement of the Polaris force, which now provides Britain's strategic nuclear deterrent.
>
> As the House knows, the Government regard the maintenance of such a capability as an essential element in the defence effort that we undertake for our own and Western security […]
>
> We have studied with great care possible systems to replace Polaris. We have concluded that the best and most cost-effective choice is the Trident submarine-launched ballistic missile system developed by the United States […]
>
> The agreement that we have reached is on the same lines as the 1962 Nassau agreement, under which we acquired Polaris. We shall design and build our own submarines and nuclear warheads here in the United Kingdom, and buy the Trident

---

[6] The distinction between tactical and strategic weapons has become increasingly blurred in recent years as there is often overlap between the two categories in terms of range and yield (i.e. explosive power). A more useful distinction can perhaps be made in terms of the type of target. Strategic weapons would be used against targets in the adversary's homeland, such as missile silos, industrial complexes or centres of

> missile system, complete with its MIRV capability, from the United States. Once bought, it will be entirely in our ownership and operational control, but we shall commit the whole force to NATO in the same way as the Polaris force is committed today.[7]

After detailed consideration the decision was taken in March 1982 to acquire the Trident II D5 missile instead of the Trident I C4 missile as originally envisaged. Justifying this decision to the House the then Secretary of State for Defence, John Nott, outlined;

> After detailed consideration here, and with the United States, we have now decided also to purchase the Trident II D5, instead of the Trident I C4 missile system, from the United States.
>
> The number of warheads that the trident II D5 missile will carry, and therefore Trident's striking power, remains wholly a matter of choice for the British Government. Our intention is that the move to D5 will not involve any significant change in the planned total number of warheads than we originally envisaged for our Trident I C4 force.
>
> The reasons for our choice of Trident II are briefly as follows. Just as the Polaris system will, by the mid-1990s, have been in service for approaching 30 years and will have reached the end of its operational life, so the Trident system must remain operational until 2020- that is, 40 years from now.
>
> Our experience with Polaris and the decision – endorsed by the last labour Government – to modernise the Polaris missile with Chevaline at great cost has shown us the financial and operational penalties of running and developing a United Kingdom unique system. Following President Reagan's decision to accelerate the Trident II D5 programme, if we were to choose the C4 missile, it would enter service with the Royal navy only shortly before it left service with the United States. This would mean that the United Kingdom alone would be responsible for keeping open special Trident I C4 support facilities in the United States, and the United Kingdom alone would be forced to fund, as with Chevaline, any research and development needed to counter improved Soviet anti-ballistic missile defences. For these reasons, our judgement is that the through life costs for Trident I would almost certainly be higher than for Trident II.[8]

In light of this decision the capital costs of procuring and maintaining Trident were estimated at 1981 prices to be £7.5bn.[9] In 1991 those cost estimates were revised upwards to £9.8bn.[10]

Under the Trident agreement the UK has access to 70 Trident missiles held in a communal pool at the Strategic Weapons facility at the Kings Bay Submarine Base in Georgia, USA.

---

population, whereas generally smaller tactical weapons would be used on the battlefield against enemy troops and equipment.

7 HC Deb 15 July 1980, c1235

8 HC Deb 11 March 1982, c975

9 HC Deb 11 March 1982, c976

10 DEP 6739, 12 February 1991

Maintenance and in-service support of the missiles is undertaken at Kings Bay at periodic intervals. This arrangement was considered to be far more cost effective as the UK would not have to construct its own reprocessing facilities.

From the decision in 1980 it took 14 years to complete the acquisition of the Trident capability with the first Vanguard-class submarine entering service in December 1994.

2. Technical Capability

The technical capability of the Trident system can be divided into three component parts:

- The platform (Vanguard-class submarine)
- The delivery system (Trident II D5 missile)
- The warhead

Vanguard-Class Submarine

Designed and purpose built in the UK the submarine was designed solely as a nuclear-powered ballistic missile carrier. As such it differed greatly from its predecessor the Resolution-class 'Polaris' submarines, whose design was adapted at the time from the existing Valiant-class submarine. Despite having a smaller complement of personnel, the Vanguard-class vessels were larger than the Polaris submarine in order to accommodate the Trident II D5 missile. They also incorporated several improvements from previous submarines including a new custom-designed nuclear powered propulsion system, based on the second generation Rolls Royce PWR2,[11] and a new tactical weapon system for self-defence purposes, including a new submarine command system.

Each submarine has 16 independently controlled missile tubes, which makes the Vanguard-class technically capable of carrying 192 warheads.[12] However, under limits imposed in the Strategic Defence Review each submarine carries 48 warheads while on patrol.[13]

The limits placed on the number of warheads leaves considerable spare capacity within the Trident system. However, in contrast to the US, the government has ruled out the deployment of conventional warheads on Trident and thus provide a multi-role capability for the submarine.[14] An article in *The Times* in August 2002 reported:

> Ministers have rejected a Royal Navy proposal to convert the four Trident ballistic-missile submarines into a more flexible force capable of launching Tomahawk land attack cruise missiles -as well as providing Britain's nuclear deterrent patrol […]

---

[11] Pressurised Water Reactor

[12] Each Trident-II D5 missile is capable of carrying 12 warheads.

[13] This is examined in greater detail in section C.

[14] "Conventionally armed Trident", *RUSI Journal*, February 2002

> Ministers decided that to guarantee one Trident submarine was always on patrol, all four had to be committed to the nuclear deterrent cycle.[15]

The submarine also has four torpedo tubes capable of firing conventional Spearfish torpedoes.

In February 2002 HMS *Vanguard* arrived at Devonport Naval Base to begin a two year refit, including the incorporation of a new reactor core (Core H) which will eliminate the need to undertake further reactor fuelling before the end of the service life of the submarine. HMS *Victorious* entered re-fit in January 2005.

Trident II D5 missile system

The Trident II D5 missile is a three-stage solid-fuel inertially-guided rocket approximately 13m long, nearly 2m in diameter and weighing 60 tonnes. It has a range between 6,500km and 12,000km dependent upon payload and is accurate to within a few metres. Each missile is capable of carrying up to 12 warheads, although under the limitations imposed by the SDR (see below) each missile is estimated to carry only three apiece.

The missile is ejected from the submarine by high-pressure gas and only when it reaches the surface does the first rocket stage automatically fire. The missile's own inertial guidance system then takes over. After the third rocket motor has separated the warhead carrier takes a star sighting to confirm the missile's position and then manoeuvres to a point at which the warheads can be released to free-fall onto their targets. Each missile has an MIRV (multiple independently targetable re-entry vehicle) capability which enables each missile to simultaneously engage multiple targets.

The Trident II D5 is manufactured in the US by Lockheed Martin and serviced at Kings Bay.

Warhead

According to the Ministry of Defence, the warhead on the Trident II D5 is of British design and built at AWE Aldermaston. Very little public information is available, although it is believed to be closely related to the American W76 warhead which is a 100 kiloton thermonuclear warhead deployed on some of the US' Trident missiles.[16]

3. British Tactical Nuclear Weapons

The British Government asserts that, following the withdrawal of the WE177 free-fall device, the UK holds no tactical nuclear weapons.[17] Some commentators believe, however, that the

---

[15] "Missile Plan is Rejected", *The Times*, 12 August 2002, p.6

[16] Center for Defense Information (CDI) Nuclear Weapons Database, http://www.cdi.org/issues/nukef&f/database/uknukes.html

[17] HC Deb 9 December 2002, c20w

UK retains around 100 warheads that could be deployed on Trident in a sub-strategic, or tactical, role, by using only the first fission stage of the weapon.

The Federation of American Scientists web site suggests the UK retains 100 strategic nuclear warheads and 100 other warheads that could be used in a tactical role, adding that:

> Their sole nuclear force will be based on four new Vanguard class SSBNs armed with U.S.-supplied Trident II D-5 missiles. While only retaining one means of delivery (albeit a flexible and reliable one), the British will also reportedly use a mixture of strategic and smaller tactical warheads.[18]

The US research organisation, the Center for Defense Information, has claimed that:

> Given the elimination of British air-delivered tactical nuclear weapons, some D-5s will carry only 1 warhead to assume the sub-strategic role. Lower yields for tactical missions could be achieved by using only the first fission stage of the weapon.[19]

C. Current British Nuclear Posture

Under the *Strategic Defence Review* White Paper (SDR), published by the new Labour Government in July 1998, it was announced that the British nuclear warhead stockpile would be reduced from the previous ceiling of up to 300 operationally available warheads to a new level of less than 200.[20] It was also announced that each submarine would carry a maximum of 48 warheads while on patrol, down from the previous ceiling of 96.[21] Furthermore, the usual patrol cycle of the Trident submarines was reduced to one submarine on patrol at any one time.

The Government asserts that the potential explosive power of the Trident system equals around 30 per cent of the stockpile held during the 1970s. It also says that the ceiling of 200 operationally-available nuclear warheads represents a halving of the numbers held in the 1970s. In addition, it holds that the explosive power of a Trident submarine would be less than one third of that of the previous Polaris Chevaline submarine.[22]

Some commentators, however, have expressed doubt over these figures, noting that the potential *destructive* power of the Trident system is considerably greater than that of the Polaris Chevaline. Rebecca Johnson of the Acronym Institute wrote in a critique of the SDR from July 1998:

---

18 http://www.cdi.org/issues/nukef&f/database/nukestab.html

19 http://www.cdi.org/issues/nukef&f/database/uknukes.html

20 *Strategic Defence Review*, Cm 3999, Para 64

21 Cm 3999, Paras 66-67

22 See for example FCO website at http://www.fco.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1087554459698

> Fewer nuclear weapons are of course better than more, but at around 192 warheads of around 100 kt [kilotons], Britain's nuclear forces still pack a potential explosive power of more than 19 megatons. The SDR especially underlined that the new policy represents a reduction of more than 70 percent in the potential explosive power of Britain's nuclear forces since the end of the Cold War. Explosive power, however, does not necessarily equate with potential damage: single large bombs or lots of nuclear artillery shells used on a battlefield would kill fewer people and wreak less havoc than *Trident*-type medium-sized (100 kt) multiple warheads, independently targeted as part of a strategic strike force.[23]

Commander Robert Green (Royal Navy, retired), also writing in July 1998, noted that the potential explosive power of a Trident warhead was "eight times the yield of the Hiroshima bomb", adding that:

> the lower-yield, highly accurately delivered *Trident* warheads can be more destructive than higher-yield, inaccurate ones. Moreover, unlike Chevaline each *Trident* warhead is independently targetable. This means that a *Trident* submarine with 48 warheads can still strike one third more targets more destructively than a Polaris submarine could with Chevaline.[24]

The Government said in the Defence White Paper of December 2003, *Delivering Security in a Changing World* (Cm 6041), that:

> We are committed to working towards a safer world in which there is no requirement for nuclear weapons and continue to play a full role in international efforts to strengthen arms control and prevent the proliferation of chemical, biological and nuclear weapons. However, the continuing risk from the proliferation of nuclear weapons, and the certainty that a number of other countries will retain substantial nuclear arsenals, mean that our minimum nuclear deterrent, currently represented by Trident, is likely to remain a necessary element of our security. The SDR noted the need to ensure that Trident could remain an effective deterrent for up to 30 years, and the New Chapter noted the continuing role of nuclear weapons as the ultimate guarantor of the UK's national security. Decisions on whether to replace Trident are not needed this Parliament but are likely to be required in the next one. We will therefore continue to take appropriate steps to ensure that the range of options for maintaining a nuclear deterrent capability is kept open until that decision point.[25]

Further background on the policy of the British Government towards nuclear disarmament and its obligations under Article VI of the nuclear Non-Proliferation Treaty can be found in sections A and G of the Library Standard Note, SN/IA/491.

---

[23] Rebecca Johnson, 'Still Punching Above Our Weight', *Disarmament Diplomacy*, Issue 28, July 1998, from http://www.acronym.org.uk/dd/dd28/28johns.htm

[24] Cmdr Robert Green, Royal Navy (Retired), 'The SDR And Britain's Nuclear Disarmament Obligations', *Disarmament Diplomacy*, Issue 28, July 1998, from http://www.acronym.org.uk/28green.htm

[25] Para 3.11, *Delivering Security in a Changing World*, Cm 6041, December 2003

D. After Trident?

1. Projected Lifespan for the Trident System

The first Vanguard class Trident submarine (HMS *Vanguard*) entered service in December 1994, with the last of the class of four (HMS *Vengeance*) entering service in 2001. It is anticipated that the Trident system will have a thirty-year lifespan, meaning that any potential replacement would need to be in service by around 2024. Given the long design and development process involved with Trident, it seems likely that a decision on a possible replacement would have to be taken at some stage later this decade. Rebecca Johnson wrote in *Disarmament Diplomacy* in March 2004 that:

> While some consider it premature to worry about replacing Trident, which was built with an expected lifetime to 2024, past experience suggests that unless the government has decided to abandon its reliance on nuclear 'deterrence' it will need to begin working on a Trident successor soon. To place this in context, the replacement for the ageing Chevaline system was mooted in the late 1970s and the decision to build four submarines and equip them with American long-range ballistic missiles with British nuclear warheads (tailored, however, to US designs) was taken by Margaret Thatcher in 1980. The first missiles, leased from an American pool of Trident D-5 missiles based in Virginia, were delivered to the Royal Navy in 1992. The first submarine armed with Trident missiles and 100 kt warheads went on patrol in 1994. From decision to deployment, the process took 14 years.[26]

The Labour Party pledged in its manifesto for the General Election in May 2005 that: "we […] are committed to retaining the independent nuclear deterrent"[27] and has said in Government that a decision on replacing Trident will have to be taken at some stage during this parliament. The Secretary of State for Defence, John Reid, commented in the House of Commons on 4 July that:

> Decisions on any replacement of the United Kingdom's nuclear deterrent are likely to be necessary in the lifetime of the current parliament, which will of course last some years.[28]

He rejected allegations that the Government had been not been open about its future intentions, saying:

---

[26] 'Why is Britain's Nuclear Weapons Infrastructure Being Upgraded?', *Disarmament Diplomacy*, Issue No. 76, March/April 2004

[27] *The Labour Party Manifesto 2005*, http://www.labour.org.uk/fileadmin/manifesto_13042005_a3/flash/manifesto_2005.swf

[28] HC Deb 4 July 2005, c5

> First, we pledged no longer than two months ago in our manifesto […] that we would retain the minimum nuclear deterrent, so that is our position. Secondly, the minimum nuclear deterrent that we have at the moment will last us between 10 and 20 years. Thirdly, as far as the situation beyond that is concerned, I have said to my hon. Friend that we have not started even considering, far less taking decisions on, the details of that. That is why I cannot give him costs for the various alternatives. That is as straight as I can make it.[29]

2. Procurement Options

The MOD's Defence Industrial Policy which was published in 2002 re-affirmed the commitment of the UK to retaining certain key strategic capabilities within the domestic manufacturing base. Nuclear technology is one of those listed capabilities.[30] The UK also has a 100% warship building policy. On this basis, any successor system to Trident is expected, like the current capability, to have a UK designed and built platform and warhead. The procurement of a delivery system has, on the other hand, a degree of flexibility.

However, all aspects of a successor system must also be considered within the context of the defence budget which has remained relatively static at approximately £6bn per annum.[31] Between 2008 and 2015 the current forward equipment plan is already expected to create a "bow wave" when procurement programmes far exceed available funding. One of the potential consequences of this could be to push several procurement programmes into later years thereby introducing further pressure on the defence budget well into 2020. The knock-on effect of financial constraints may inform the debate on the procurement of a successor system for Trident.

The potential upgrade of the UK's nuclear warhead stockpile is examined in Section E below.

In terms of procuring a successor platform and delivery system for the UK's nuclear deterrent, in theory there are several potential options available:

- Extend the in-service life of the Vanguard-class submarine and Trident II D5 missile in the near term.
- Procure a direct replacement for Trident in line with the current UK-US agreement.
- Procure a brand new capability.

a. Service Life Extension

In 2002 the US Navy awarded Lockheed Martin a contract for the Trident II D5 Service Life Extension Programme (SLEP). Under the contract it is expected that some 300 missiles will

---

29 HC Deb 4 July 2005, c6

30 More information on the Defence Industrial Policy is available in Library Research Paper RP03/78, *UK Defence Procurement Policy*, 20 October 2003

31 HM Treasury, *2004 Spending Review*, Cm 6237, July 2004, p.129

be upgraded to the D5 (A) version by 2020 and that these missiles will remain in service until 2042 to match the extended life of the US Ohio-class Trident submarine.

According to an article in *Jane's Missiles and Rockets* in September 2000, the programme is not envisaged to be "a major re-design, but would involve the replacement of specific components, especially those that are dependent on older technologies which in many cases are no longer being manufactured".[32]

In addition, a service life extension programme for the Mk4 re-entry vehicle, which carries the warheads on the Trident missile, is planned through 2020 in order to support Trident operations up to 2042.

The development of a new Trident variant within the 2020-2042 timeframe presents the UK with a feasible solution for its successor system, at least in the short term. The UK already shares in the pool of Trident missiles that are manufactured and maintained in the US. Therefore the ability of the UK to involve itself in this programme would be relatively easy. For the UK this solution would also be potentially more cost-effective in terms of in-service support of the missile as the infrastructure, as at present, will already be in place.

However, if the UK were to pursue this option then a major upgrade of the Vanguard-class submarine to extend its service life by a further 10-15 years, would also be required. Indeed, an article in *Jane's Navy International* in May 2005 suggested that this option is already under active consideration.[33] However, major upgrade programmes have proven in the past to be costly, and subject to serious delays. The Nimrod MR4A upgrade programme for example is currently £780m over budget and six years late.[34]

Pursuing this option may, therefore, negate any cost savings achieved from involvement in the Trident II D5 (A) upgrade programme and could considerably raise the risks for the UK.

Another disadvantage is that a service life extension to 2042 would only keep the Trident capability in-service for a further 10 years beyond the expected decommissioning date of the final Vanguard-class submarine in 2031. The procurement of a whole new system for 2042 onwards would have to be considered again in 2027.

b. Direct Replacement

US Navy plans to procure a new class of submarine armed with nuclear warheads to replace the Trident system is unclear at present. However the Navy has reportedly called for funding to be assigned from 2014 with a view to a replacement entering service in 2029-2030 when the oldest of the extended Ohio-class is decommissioned.

---

[32] "US navy to extend life of Trident force", *Jane's Missiles and Rockets*, 1 September 2000

[33] "UK faces decisions on submarine design base", *Jane's Navy International*, 1 May 2005

According to the *Bulletin of the Atomic Scientists*:

> The navy has extended the service life of the Trident from 30 to 44 years. The oldest submarine will retire in 2029; the Pentagon is studying two options for a new SSBN to be introduced the same year. One option is a variant of the *Virginia*-class nuclear-powered attack submarine (SSN); the other is a dedicated SSBN based on either a new design or a Trident derivative. The new project would begin in 2016.

In October 2003 the US Navy's Strategic Subsystems Programs Office also reportedly issued a request for information for a submarine-launched intermediate-range ballistic missile. Although not expected to lead to a procurement programme in the near future it is considered to be an assessment of industry's ability to meet the Navy's future requirements in this area. *Jane's Missiles and Rockets* considered that any new missile could have the potential to replace Trident, although its range would be much shorter.[35]

Given the links between the UK and US nuclear deterrent systems and the relatively close timeframe for the introduction of a new US system and the decommissioning of the UK's Vanguard-class fleet, it is considered likely that the UK will closely associate itself with the Navy's SSBN programme.

Indeed, an article in *Disarmament Diplomacy* in April 2004 commented:

> It would be extremely difficult and expensive for Britain even to maintain its existing Trident system, let alone to develop and build a new nuclear weapon system and its associated infrastructure without extensive help from the United States […]
>
> In reality, if the UK decides to go ahead with a replacement for Trident, it is unlikely to choose anything that would not be identical (or very nearly) with an American nuclear weapon system.[36]

However, the US Navy is not expected to begin its SSBN procurement until 2016, while the UK realistically needs to make a decision on a successor for Trident by 2010. Consequently one possible scenario could see the UK extend the in-service life of Trident in the short term, as outlined above, with a view to procuring a system largely based upon the US Navy programme in the longer term.

Questions have been raised as to whether the design of the UK's Astute-class submarine could be adapted to accommodate any new missile system. The feasibility of this proposal would largely depend upon the design of the missile, including its size and weight. Platform conversion to accommodate new munitions is not without precedent however. The US Navy is, for example, currently converting some of its older Ohio-class submarines to carry the

---

34 National Audit Office

35 "USN issues RFI for sub-launched IRBM", *Jane's Missiles and Rockets,* 1 November 2003

36 "US-UK nuclear weapons cooperation up for renewal", *Disarmament Diplomacy,* April 2004

conventional Tomahawk cruise missile or conventionally-armed Trident missiles. However, conversion on this scale is costly and the US programme is currently estimated to be £1.2bn.[37]

c. New capability

The Defence Procurement Agency's Maritime Underwater Future Capability (MUFC) is currently assessing the UK's capability requirements for the underwater battlespace post-2015.

A number of analysts have suggested that a successor to the Trident system could be defined within the context of that assessment. Specifically, combining the nuclear deterrent with the current role of the hunter-killer submarine into a single class of multi-role nuclear-powered submarines has received increasing attention.[38] Under this proposal submarines would be fitted with vertical-launch missile tubes to allow them to fire either nuclear-armed long-range missiles, or conventionally-armed Tomahawk cruise missiles.

An article in *The Scotsman* quoted an unnamed MOD official as commenting:

> By making the submarine more versatile, we get more value for our money and don't have billions of pounds of capital investment tied up in a submarines that can never be used for anything except blowing up the world … It cost more than £9 billion to buy Trident, and there is just no way we can justify that kind of money any more.[39]

However, the estimated costs of designing, manufacturing and supporting a new multi-role class through-life are considered to be unsustainable within any likely procurement budget. One of the main advantages of Trident is that the missile is both produced and serviced in the US allowing for substantial through-life cost savings by the UK. In addition, the Navy equipment plan is already under financial pressure with the current procurement of the Future Carrier, the Type 45 destroyer and the Astute-class submarine.

As outlined above, the feasibility of combining the strategic nuclear deterrent with a conventional role has also been questioned by the government who argued that in order to retain one trident submarine on patrol at any one time, four submarines must be dedicated to the deterrent cycle. In order to maintain this commitment, any multi-role submarine would have to be procured in greater numbers, again potentially adding pressure to the defence budget.

---

37 http://www.globalsecurity.org/military/systems/ship/ssgn-726.htm

38 "Secret plans for Trident replacement", *The Scotsman,* 9 June 2004

39 ibid

E. Developments at AWE Aldermaston

The main sources on developments at the Atomic Weapons Establishment (AWE) at Aldermaston are press reports and PQs.

The Observer newspaper reported on 16 June 2002 that a new facility was to be built at Aldermaston for the construction of a new generation of nuclear warheads, possibly including tactical warheads. If true, that would correspond to a similar interest in the United States in developing smaller and more specialised nuclear warheads that could be used against hardened or underground targets, perhaps to destroy chemical or biological weapons agents in the possession of so-called rogue states.[40]

The day after the report in *The Observer*, the then Parliamentary Under-Secretary of State at the Ministry of Defence, Dr Lewis Moonie, made the following comments about future plans for Aldermaston:

> I point out again that there is no new development of nuclear weapons going on at Aldermaston. We are ensuring that our nuclear deterrent is reliable and capable of being deployed. That involves a great deal of careful work to ensure that there is no chance of us having to go back to testing the weapons physically.[41]

Further clarification was offered in a series of Written Answers from Dr Moonie:

> **Atomic Weapons Establishments**
>
> **Mr. Salter:** To ask the Secretary of State for Defence if employees *(a)* of the atomic weapons establishments and *(b)* from his Department (i) have had involvement in, (ii) are involved in and (iii) are intended to be involved in the advanced warhead concept teams being established by the US nuclear weapons laboratories.
>
> **Dr. Moonie:** Exchanges of information between the United Kingdom and US on nuclear weapon matters take place only under the auspices of the 1958 Mutual Defence Agreement. In particular, employees of the Ministry of Defence and AWE Management Ltd. Participate in the Joint UK/US Working Groups that meet regularly to discuss and exchange technical information. Details of their discussions are withheld under Exemption 1 (Defence, Security and International Relations) of the Code of Practice on access to Government Information.
>
> **Mr. Salter:** To ask the Secretary of State for Defence if he will list construction and engineering projects at the atomic weapons establishments scheduled to begin over the next 12 months, with their estimated cost.

---

[40] Although Pentagon plans for further research into this area have encountered Congressional opposition.

[41] HC Deb 17 June 2002, c3

Dr. Moonie: With the exception of routine minor works in support of operations (at a cost of around £10 million a year), no construction and engineering projects are currently expected to progress beyond project requirement definition in the next 12 months. My hon. Friend may wish to note in this context that the widely-publicised high performance computer, which AWE have purchase to support the science-based programme, is being commissioned in an existing building.

Mr. Salter: To ask the Secretary of State for Defence if he will list construction and engineering projects under way at AWE Aldermaston and Burghfield, and their estimated cost.

Dr. Moonie: With the exception of routine minor works in support of operations (at a cost of around £10 million a year), no construction and engineering projects are currently underway at these sites.[42]

Details of MoD expenditure on Aldermaston were provided in a PQ answer of March 2005:

The Ministry of Defence's expenditure on AWE Aldermaston in each of the past five years is shown in the following table. All costs are at 2004-05 prices. The figure for 2004-05 is provisional. The allocation for 2005-06 has not yet been finalised.

£ million	
2000-01	303
2001-02	284
2002-03	302
2003-04	300
2004-05	312[43]

a. New Laser Facility at Aldermaston

On 21 May 2005 the Minister of State at the Ministry of Defence, Adam Ingram, said that:

The Ministry of Defence is currently considering a new proposal for a laser facility at AWE to replace the existing HELEN laser. In 2001, because of time and cost overruns on the United States National Ignition Facility, it was decided not to continue with plans, announced on 5 July 1999, Official Report, column 341W, to build a United Kingdom target chamber attached to that facility.[44]

The purpose of the new laser facility was set out by Lord Bach in answer to a Lords PQ on 12 July 2004:

Lord Stoddart of Swindon asked Her Majesty's Government:

---

42 HC Deb 17 June 2002, c601-2w
43 HC Deb 18 March 2005, c477-8w
44 HC Deb 21 May 2005, c1251w

> Whether the proposed replacement laser facility at the Atomic Weapons Establishment, Aldermaston, will be capable of testing and certifying a new generation of nuclear warhead; and, if so, whether this complies with the Nuclear Non-Proliferation Treaty.
>
> **Lord Bach:** The purpose of the proposed ORION facility is to contribute towards ensuring that the United Kingdom nuclear warhead capability remains safe and reliable. The use of such technology with respect to nuclear warheads and nuclear material does not contravene the Nuclear Non-Proliferation Treaty.[45]

The Minister of State at the Ministry of Defence, Adam Ingram, expanded on that in March 2005:

> A key objective of the proposed Orion Laser project is to have the ability to conduct our nuclear warhead assurance programme in compliance with the Comprehensive Test Ban Treaty and the project will achieve this. The use of the Orion Laser would not conflict with Article VI of the Nuclear Non- Proliferation Treaty.[46]

b. Hydrodynamics

In October 2004 Mr Ingram was asked what environmental impact assessment had been conducted on the planned hydrodynamics explosives testing facility at AWE Aldermaston, and what his estimate was of the cost of the facility. He responded:

> A number of options for such a facility are still under consideration and mature costings are therefore not available. Environmental impact is one of a range of issues that will be addressed in the normal way as our plans develop.[47]

c. Aldermaston and a Trident replacement?

Foreign Office Minister Mike O'Brien was asked in a PQ of June 2003:

> what the Government's policy is on the development of a new generation of tactical nuclear weapons; and under what sections of the Nuclear Non-Proliferation Treaty this work is proceeding.
>
> **Mr. Mike O'Brien:** The Government has no plans to develop new nuclear weapons. In line with the policy set out in the Strategic Defence Review, it is the Government's policy to maintain a minimum capability to design and produce a successor to Trident should this prove necessary.[48]

In May 2004 Mr Ingram commented:

---

45 HL Deb 12 July 2004, c124WA
46 HC Deb 3 March 2005, c1342w
47 HC Deb 4 October 2005, c1863w
48 HC Deb 3 June 2003, c13w

> The research and development activities undertaken at AWE are designed to ensure the safe stewardship of the UK's stockpile of Trident warheads and our ability to maintain the capability necessary to meet the policy described in the 1998 Strategic Defence Review. As indicated in Paragraph 3.11 of the Defence White Paper of December 2003 (Cm 6041-1), this includes the need to take appropriate steps to ensure that the range of options for maintaining a nuclear deterrent capability is kept open until decisions are required on whether to replace Trident. This policy is consistent with our international treaty obligations. Research and development activities fall under four principal headings: computer simulation; hydrodynamics; high energy density plasma physics; and materials ageing. The precise nature and scope in the future of such programmes will depend on the outcome of the processes referred to in the December 2003 Defence White Paper.[49]

Mr Ingram was asked in mid-2005 about the relationship between the new building programme at the Aldermaston and the next generation British nuclear weapons. He responded:

> Developments at the Atomic Weapons Establishment (AWE) Aldermaston are consistent with the policy set out in the 1998 Strategic Defence Review and in the December 2003 Defence White Paper (Cm 6041–1). Such developments include the sustainment of the capabilities necessary to meet safety, environmental and operational requirements and to keep open options in respect of any decision on whether or not to replace Trident.[50]

---

[49] HC Deb 11 May 2004, c215w
[50] HC Deb 7 June 2005, c463w