Trident and the Future of the British Nuclear Deterrent

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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 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 initial decisions about replacing the Trident system 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 examines the debate surrounding a possible replacement, including the international treaty considerations, before considering the options available, such as upgrading the existing system, procuring a direct replacement, or developing a new capability.

A list of suggested reading material is set out in Appendix One.

Contents

A. Evolution of the British Nuclear Deterrent[1]

The UK first tested a nuclear device in October 1952[2] and deployed an operational nuclear weapons capability the following year. Initially, the British nuclear deterrent rested on the 10 kiloton[3] 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.[4] 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'.[5] 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, although final responsibility for building and maintaining the warheads remains with the UK's Atomic Weapons Establishment (AWE).[6] 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 perceived to be vulnerable to a first strike by the most likely opponent, the Soviet Union, whereas the new submarine fleet was mobile and difficult for the Soviets to track.[7] Strong air defences could deplete the bomber force before it reached its targets, in contrast to a missile attack which could be mounted from a distance, minimising the risk to the crew and the submarine.

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1 Some commentators view the term "nuclear deterrent" as an unhelpful euphemism and believe the more accurate term "nuclear weapons" should be used. See for example the memorandum from Dr Rebecca Johnson to the House of Commons Defence Select Committee, 6 March 2006, SND 53, http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/uc986-i/ucm0402.htm

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

3 A kiloton is an explosive force equivalent to that of one thousand metric tons of TNT.

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

5 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*.

6 See Section E 4 below for more detail on AWE Aldermaston.

7 The UK has a geographical advantage in this regard, in that ballistic missile submarines departing on patrol have a range of routes out in the deep waters of the Atlantic or North Sea, making detection by an opposing hunter-killer submarine extremely difficult. See Michael Clarke, 'Does my bomb look big in this? Britain's nuclear choices after Trident', *International Affairs*, January 2004, Vol 80, Issue 1, page 50, footnote 6.

Furthermore, the cost and technical challenges of designing an effective missile-defence system meant that a multiple ballistic missile strike was extremely difficult to defend against.[8]

The Polaris system comprised four Resolution-class ballistic missile submarines, each armed with sixteen Polaris missiles. The submarines were designed and built in the UK, albeit with initial assistance from the US in designing the nuclear propulsion system. The missiles and their launch systems were purchased from the United States, while the warheads were built in the UK, again with US collaboration. Initially, the warheads used were a scaled-down version of the existing British WE 177 warhead, which had entered service in 1966. Three warheads could be carried on each missile, but concerns about the ability of Polaris to penetrate Soviet defences subsequently resulted in the development by the UK of the more advanced Chevaline system, which could carry two warheads mounted on a redesigned Polaris 'front end'. Chevaline was "hardened" against nuclear attack and employed decoys and penetration aids to help it defeat Soviet nuclear-armed anti-ballistic-missile defences around Moscow.

By the final decade of the Cold War the British nuclear deterrent had three main elements: strategic, sub-strategic and tactical.[9] Polaris Chevaline served in the strategic role for use against multiple targets in the adversary's homeland, such as missile silos, industrial complexes or centres of population, while the sub-strategic role for a more "limited" strike against individual targets on enemy territory was fulfilled by the WE 177 free-fall bomb carried by the RAF's Vulcan and Tornado aircraft. Lower yield WE 177 devices served in the tactical role for use against enemy troops and equipment on the battlefield and in a naval role for use as a nuclear depth charge against submarines. Furthermore, US tactical 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 as a result of a US-Soviet initiative to reduce tactical weapons.

By 1998 the WE 177 had been withdrawn from service and the Polaris/Chevaline system phased out and replaced by four Vanguard-class submarines armed with Trident missiles. This left the UK with no dedicated tactical nuclear capability, and with Trident as the sole remaining nuclear weapons system fulfilling both the strategic and sub-strategic roles.

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8 For a discussion of the history of ballistic missile defence, the rather rudimentary Soviet system around Moscow 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.

9 There is some overlap between these three roles in terms of the weaponry's range and explosive power (known as yield), and a more useful distinction can perhaps be made in terms of the type of target.

B. Trident

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 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.[10]

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

[10] HC Deb 15 July 1980, c1235

> 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.[11]

In light of this decision, the capital costs of procuring and maintaining Trident were estimated at 1981 prices to be £7.5bn.[12] In 1991 those cost estimates were revised upwards to £9.8bn.[13]

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.

A series of documents relating to the Trident decision were published by the Ministry of Defence in the early to mid 1980s.[14] These were recently re-published in response to a freedom of information request to the MOD. A link to the electronic version of these documents is available in Appendix One – Suggested Reading.

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,[15] and a new tactical weapon system for self-defence purposes, including a new submarine command system.

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[11] HC Deb 11 March 1982, c975
[12] HC Deb 11 March 1982, c976
[13] DEP 6739, 12 February 1991
[14] *The Future United Kingdom Strategic Nuclear Deterrent Force,* Defence Open Government Document 80/23 *The United Kingdom Trident programme,* Defence Open Government Document 82/1 and *Trident and the Alternatives,* Defence Open Government Document 87/01
[15] Pressurised Water Reactor

Each submarine has 16 independently controlled missile tubes, which makes the Vanguard-class technically capable of carrying 192 warheads.[16] However, under limits imposed in the 1998 Strategic Defence Review (SDR) each submarine carries a maximum of 48 warheads while on patrol.[17] 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 system, which is manufactured in the US by Lockheed Martin, is a three-stage solid-fuel inertially-guided rocket approximately 13m long, nearly 2m in diameter and weighing 60 tonnes. It has a range of between 6,500km and 12,000km, dependent upon payload, and its accuracy is measured in metres.[18] Each missile is capable of carrying up to 12 warheads, although under the limitations imposed by the SDR, each missile is believed to carry an average of 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 UK had intended to purchase 65 Trident missile bodies, but this was reduced to 58 by the incoming Labour Government in 1998.[19] The UK has title to these 58 missile bodies, which are held in a communal pool at the Strategic Weapons facility at the Kings Bay Submarine Base in Georgia, USA.[20] Maintenance and in-service support of the missiles is undertaken at Kings Bay at periodic intervals, normally after a submarine has been through refit. This arrangement was considered to be far more cost effective as the UK has not had to construct its own servicing facilities.[21]

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

17 This is examined in greater detail in Section C below.

18 The precision of ballistic missiles is measured by what is known as the circular error probability or CEP, which is the radius of the circle within which half the strikes would impact. The CEP for Trident is reported to be around 90 metres: thus, each warhead will impact within 90 meters of the target point with a probability of 50%.

19 In July 1998 the Government announced six missiles had been test fired as part of the work-up of the submarines, with a further eight to be test-fired over the life of the Trident programme. A further four missiles were to be held as a "processing margin". Some of the seven missiles not purchased by the Government were required as in-service spares, while the remainder were to be sold back to the US. HC Deb 30 July 1998, cc448-9w

20 A missile that is deployed on a US submarine may later deploy on a British submarine and vice versa.

21 Commodore Tim Hare, Royal Navy (retired) suggested in evidence to the Defence Committee that the arrangement had saved the UK in the region of £3.8 billion. Uncorrected Transcript of Oral Evidence to be published as HC 986-iii, 28 March 2006, Q145. Please note, neither witnesses nor Members have had the opportunity to correct the record. The transcript is not yet an approved formal record of these proceedings.

Warhead

According to the Ministry of Defence, the warhead on the Trident II D5 is of British design and built at AWE Aldermaston. Public information is scarce, although it is believed to be closely related to the American W76 warhead, a thermonuclear warhead in the 80-100 kiloton deployed by the US on its Trident missiles.[22] The warheads undergo regular maintenance and refurbishment at AWE Aldermaston when components with a shorter lifespan are replaced.

3. Cost of Trident[23]

The current estimate of the total acquisition cost of the Trident programme in cash terms is £9,804m. Payments already made are expressed at the prices and exchange rates actually incurred and future spend at the current financial year exchange rate. If all expenditure, past and projected, is brought up to current economic conditions the real terms estimate is £14,893m.[24]

The Ministry of Defence has been unable to provide cash figures on the costs of maintaining the United Kingdom's nuclear deterrent. Since Trident became operational in 1994 up to 2004–05, annual expenditure for capital and running costs, including the costs for the Atomic Weapons Establishment, has ranged between three and four percent of the annual defence budget.[25] This is equivalent to £0.8bn - £1,1bn in 2004/05.[26]

4. US Involvement

Critics who question the value of the British nuclear deterrent argue that, due to the reliance on the US for aspects of procuring and servicing the Trident system, the UK deterrent cannot be deemed to be truly independent.

Others dispute this view. Commodore Tim Hare, Royal Navy (retired), said in evidence to the Defence Committee that:

> operationally the system is completely independent of the United States. Any decision to launch missiles is a sovereign decision taken by the UK and does not involve anybody else. I have read talk in the press about the Americans having some technical golden key. That is just not right; they do not. […] the only engagement with the United States that we have now, and which we have had for a very long time, relates to the design authority for the missile and supporting launcher, fire control and navigational sub-systems that are housed in the Vanguard-class submarines. […]

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

23 This section was provided by Gavin Berman from the Library's Social and General Statistics Section

24 HC Deb 18 January 2005 c30WS

25 HL Deb 5 December 2005 c87WA

26 Using Stage One RAB/ Near cash defence expenditure figure from Table 6, *The Government's expenditure plans 2005/06 to 2007/08*, MoD

> The best analogy I can give is that if Ford went bust tomorrow all the Ford Focuses in the country would not suddenly come to a grinding halt. Certainly, it would be difficult if the United States withdrew its design authority and logistics support for the missiles, fire control launcher and navigational sub-systems. Eventually, it would cause some difficulty, but I argue that that would take quite a long time.[27]

He added that the UK was in no way dependent on the US for the process of targeting the missiles.[28] Others contend that the guidance system would require data from the US GPS satellite system.[29]

IISS characterises the degree of UK dependence on the US as follows:

> Britain has […] accepted dependence on US supply for key elements of its capability, although ownership of them rests with the United Kingdom. The United States would be able, if it went back on its commitments, to pose over a period of years increasingly severe difficulty for the maintenance of Britain's capability.
>
> Operational decisions on the use of the capability remain entirely with the United Kingdom government; neither the United States nor NATO – to which the force is formally declared – has either legal or physical power to override such decisions.[30]

By contrast, France has retained a far greater level of independence in procurement terms, but at a greater financial cost: the French nuclear arsenal is commonly believed to account for between 10-20% of the defence budget, as opposed to 3-5% for the UK deterrent.

C. Changes to the British Nuclear Posture since 1992

With the end of the Cold War in the late 1980s the then Conservative Government undertook a reassessment of the British nuclear posture. The US tactical nuclear warheads mounted on heavy artillery and the Lance missile system were withdrawn, the Royal Air Force's sub-strategic air-launched nuclear weapons were phased out and the Royal Navy's surface ships lost the capability to carry or deploy nuclear weapons. Once complete in 1998, these reductions left Trident as the country's sole nuclear system. The total warhead stockpile was reduced by around 20 per cent and the number of operationally available warheads fell from around 400 during the 1980s to under 300. The result was a sharp fall in the explosive power of the operationally deployed deterrent, which dropped to an estimated 40 per cent of the megatonnage available during the 1970s.[31]

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27 Uncorrected Transcript of Oral Evidence to be published as HC 986-iii, 28 March 2006, Q152-3

28 *ibid.* Q158

29 Evidence from Rebecca Johnson, Uncorrected Transcript of Oral Evidence to be published as HC 986-i, 14 March 2006, Q16

30 'The future of Britain's nuclear deterrent', *IISS Strategic Comments*, March 2006, Vol 12, Issue 2

31 Figures from the *Strategic Defence Review: Supporting Essays*, July 1998, Supporting Essay Five: Deterrence, Arms Control and Proliferation, p.5-2 – 5-3, para 8 and Figure 1.

The new Labour Government re-examined the nuclear deterrent in its *Strategic Defence Review* White Paper of July 1998 and announced further reductions as a response to the improved strategic environment:

- The number of operationally available nuclear warheads was reduced to fewer than 200, a reduction of one third from the previous Government's planned level of up to 300;
- The total nuclear stockpile of active and inactive warheads was reduced by around 50 per cent compared to the levels seen in the 1970s, down from just under 80 per cent under the previous Government;
- The number of warheads carried by Trident submarines on deterrent patrol was reduced to 48, down from the previous Government's ceiling of 96;
- As a result of these reductions, the Government said the potential explosive power of the Trident system would equal around 30 per cent of the operationally available warheads held during the 1970s. It also asserted that the explosive power of the 48 warheads deployed on each Trident submarine would be one third less than the 32 Chevaline warheads that had been eventually deployed on each Polaris submarine.[32]

By contrast, of the five recognised nuclear powers, Russia and the USA have the largest arsenals with an estimated 5,830 and 5,735 active warheads respectively. France and China have around 350 and 130-400 active warheads respectively.[33] Of the three nuclear powers outside the Non-Proliferation Treaty, India is believed to have between 40 and 90 warheads, Israel between 75 and 200, and Pakistan between 30 and 50. North Korea is believed to possess a handful, at most.

The true value of the reductions made under SDR was questioned by some commentators, on the grounds that the potential *destructive* power of the Trident system remained considerably greater than that of the Polaris Chevaline. Rebecca Johnson of the Acronym Institute wrote in a critique of the SDR from July 1998:

> 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.[34]

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[32] Figures from the *Strategic Defence Review: Supporting Essays*, July 1998, Supporting Essay Five: Deterrence, Arms Control and Proliferation, p.5-2 – 5-3, paras 9-10 and Figure 1.

[33] Accurate figures are difficult to obtain, given the secrecy that often surrounds nuclear issues. There is also a frequent lack of clarity about the number of active warheads and the number held in reserve or at lower stages of readiness. If both active and inactive stockpiles are taken into consideration, the Russian and US nuclear arsenals are believed to number close to 16,000 and 10,000 respectively. For more detail, see Library Standard Note SN/IA/3817, *State Possession of Nuclear Weapons*, 9 December 2005

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

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.[35]

Nicola Butler of the Acronym Institute argued in November 2004 that:

> Despite the figures, the UK's record on nuclear disarmament is very weak. It cites the dismantlement of weapons such as the WE177 free fall bomb and the Chevaline warhead, but these are weapons that had reached the end of their service life and were in fact replaced by the more capable Trident system.
>
> Although the UK Government highlights a reduction in the "potential explosive power" of its warheads, qualitative improvements make this comparison somewhat misleading. Trident's greater speed, accuracy, and independently targetable warheads enable it to reach more targets than Polaris Chevaline […]. As the Defence Select Committee noted in 1994, "Trident's accuracy and sophistication in other respects does - and was always intended to - represent a significant enhancement of the UK's nuclear capability. We have invested a great deal of money to make it possible to attack more targets with greater effectiveness using nominally equivalent explosive power".[HC 297 of Session 1993-94, p.xiv][36]

In addition to changes in capability, the Strategic Defence Review announced changes to the operational posture of the British deterrent, so that the usual patrol cycle was reduced to one Trident submarine on patrol at any one time. The missiles on board were also de-targeted, meaning that target data would need to be loaded into the guidance system before launch, an operation that takes a few minutes. The "notice to fire" period was increased from the few minutes' quick reaction alert sustained during the Cold War to a notice period measured in days. This reduction in alert status was essentially a political and operational matter rather than a technical issue: the system itself could still be brought rapidly to readiness at a time of crisis, if a political decision were taken to do so.[37]

The SDR also considered the question of when British nuclear weapons could be brought into multilateral talks with the other nuclear powers:

> On nuclear arms control, the Government hopes for further bilateral reductions in US and Russian strategic weapons through the Strategic Arms Reduction Treaty process […] Our own arsenal […] is the minimum necessary to provide for our security for the foreseeable future and very much smaller than those of the major nuclear powers.

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35 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

36 *Military and political aspects of British Nuclear Forces and Defence Policy*, Presentation by Nicola Butler, 6 November 2004, http://www.basicint.org/nuclear/legalnb.htm#06

37 See for example Oral Evidence to the Defence Select Committee from Sir Michael Quinlan and Dr Rebecca Johnson, Q5-6, HC 986-I, 14 March 2006, and from Commodore Tim Hare, Q147-8, HC 986-iii, 28 March 2006.

> Considerable further reductions in the latter would be needed before further British reductions could become feasible.[38]

Other measures were discussed, but rejected, such as introducing a policy of "no first use" of nuclear weapons. The Secretary of State of Defence, Geoff Hoon, said in October 1999:

> In conducting the Strategic Defence Review, the Government concluded that a policy of no first use of nuclear weapons would be incompatible with our and NATO's doctrine of deterrence, and that it would not further nuclear disarmament objectives.[39]

The SDR did, however, highlight the limitations placed on the use of British nuclear weapons, such as abiding by the restrictions in place in the three nuclear-free zones around the world[40] and making clear that:

> we will not use nuclear weapons against a non-nuclear weapon state not in material breach of its nuclear non-proliferation obligations, unless it attacks us, our Allies or a state to which we have a security commitment, in association or alliance with a nuclear weapon state.[41]

This would leave open the possibility of a nuclear strike against a non-nuclear weapon state that was "in material breach of its nuclear non-proliferation obligations", an issue that came up to the fore prior to the US-UK invasion of Iraq in March 2003.[42]

1. Sub-Strategic and Tactical Nuclear Capabilities

In the event of a full-scale strategic nuclear strike, all or a significant part of the available Trident force would be launched against an adversary, with the intention of causing catastrophic damage. One level down from a strategic strike is what is termed the sub-strategic option, whereby one or a handful of nuclear warheads would be fired at an adversary as a means of sending a political message and demonstrating resolve, without inflicting the full destructive power and catastrophic effects of the full deterrent. Targets might include smaller regional adversaries with weapons of mass destruction. A further level down is the tactical nuclear option, where weapons would be used for a military purpose against enemy units on the battlefield.

The British Government asserts that, following the withdrawal of the WE 177 free-fall device and nuclear-tipped artillery and Lance missile capabilities, the UK holds no dedicated tactical nuclear weapons for use on the battlefield.[43] A sub-strategic capability remains, in the form of Trident, which in 1998 took over the role formerly assigned to RAF Tornado aircraft armed with the WE 177.

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38 *Strategic Defence Review*, Cm 3999, Para 70

39 HC Deb 25 October 2002, c706w

40 The areas affected are Latin America (Treaty of Tlatelolco), the South Pacific (The Treaty of Raratonga), and Africa (The Treaty of Pelindaba). The UK has signed and ratified the relevant protocols. See Section 3 C of Library Standard Note SN/IA/1404, *Arms Control and Weapons of Mass Destruction*, for more detail on the regional nuclear-free zones.

41 'Deterrence, Arms Control and Proliferation,' page 5-11, *The Strategic Defence Review Supporting Essays*

42 See comments by Defence Secretary Geoff Hoon to the Defence Committee, Minutes of Evidence for 20 March 2002, HC 644-ii, 1 May 2002, Q234-237

43 HC Deb 9 December 2002, c20w

The 1998 Strategic Defence Review declared that:

> The credibility of deterrence also depends on retaining an option for a limited strike that would not automatically lead to a full scale nuclear exchange. Unlike Polaris and Chevaline, Trident must also be capable of performing this "sub-strategic" role.[44]

The Ministry of Defence has argued that:

> A sub-strategic element is an essential component of a nuclear deterrent policy. In extreme circumstances of self defence, a capability for the more limited use of nuclear weapons would allow us to signal to an aggressor that he has miscalculated our resolve, without using the full destructive power that Trident offers.[45]

The British Government has always revealed little about the number and yield of warheads, although, in operational terms, it is widely conjectured that missiles intended for the sub-strategic role carry only a single warhead, potentially with a reduced yield of 1 kiloton or less if the unboosted primary stage is detonated, or a yield of a few kilotons if the boosted primary is used.[46] This compares with a maximum yield for the warhead of around 80-100 kilotons.

It is possible that the sub-strategic role would be carried out by a different boat to the one deployed on deterrent patrol, primarily because launching one or two missiles in a limited strike could reveal the location of the boat and leave it vulnerable to attack, with the risk that it would not be able to mount a follow-up strategic strike if required.[47]

D. After Trident?

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 enter 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

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44 *The Strategic Defence Review*, Cm 3999, July 1998, p.18, para 63

45 HL Deb 1 July 1999, c57WA

46 See for example 'British nuclear forces, 2005', NRDC Nuclear Notebook, *Bulletin of the Atomic Scientists*, November-December 2005, http://www.thebulletin.org/article_nn.php?art_ofn=nd05norris

47 "We wouldn't necessarily use the deployed submarine as the sub-strategic boat. We may sail another specifically in that role, so we have the flexibility of doing either or both." Commander Tom Herman, 1 Submarine Squadron, *Navy News Clyde Supplement*, May 1996

> 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.[48]

1. Timing of a Decision

The Government says that initial decisions on replacing Trident will have to be taken at some stage during this parliament. Dr Reid commented in the House of Commons on 4 July 2005 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.[49]

In evidence to the Defence Committee in December 2005 he underlined that the issue was not whether to retain or dispense with the Trident system in the short-term, but rather whether to extend it beyond the current projected service life of around 2020:

> For the foreseeable future we will be maintaining the nuclear deterrent. We are now entering a discussion about whether that foreseeable future will extend beyond the 15 to the 50-year point.[50]

2. Position of the British Government

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.[51]

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

49 HC Deb 4 July 2005, c5

50 Defence Select Committee, General evidence session with the Secretary of State for Defence, HC 556-I, Session 2005-06, Q.1-19

51 Para 3.11, *Delivering Security in a Changing World*, Cm 6041, December 2003

The Labour Party pledged in its manifesto for the General Election in May 2005 that: "we […] are committed to retaining the independent nuclear deterrent".[52] Since the election ministers have reiterated that position, as Defence Secretary John Reid set out in January 2006:

> As our last manifesto made clear, our minimum nuclear deterrent capability, currently represented by Trident, is likely to remain a necessary element of our security while there continues to be any risk from the proliferation of nuclear weapons, and while other countries retain substantial nuclear arsenals.[53]

In an interview with *The Guardian* in September 2005 Dr Reid reportedly stated that any decision on replacing Trident would be subject to a full and open debate within Parliament. He stated:

> It is not only a good thing that there will be such a discussion, it is an inevitable thing. We are not going to have a secret Chevaline-like decision taken by some of the cabinet which then proceeds without any public discussion or debate. Even if that was desirable, and it is not, it is not possible… it is a matter of political practicality. In the course of the next four years this decision will take place. It will inevitably be more public than such decisions in the past.[54]

He went on to say that "he had given no detailed consideration to whether MPs should be given a vote".[55]

The Defence Committee is currently conducting the first in a series of inquiries into the future of the UK's strategic nuclear deterrent, with the initial focus resting on the strategic context. Three evidence sessions were held during March with a variety of witnesses.[56]

3. Why retain a deterrent?

Some observers question the basis for retaining a deterrent, arguing from a number of different viewpoints that the UK should take a lead internationally and dispense with its nuclear weapons capability.

One argument is that the demise of the Soviet Union as the main potential adversary has removed the justification for its retention. Former foreign secretary Robin Cook argued in July 2005 that:

> The justification for both Polaris and Trident was that we faced in the Soviet Union a great, hostile bear bristling with nuclear claws. The missiles were put on submarines precisely because the ocean bed was the only place they could hide from Russian firepower. But those are calculations from a long-vanished era. The Soviet Union has disintegrated, its satellites are our allies in the European Union, and the west is now

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

53 HC 23 January 2006, c1151-2

54 "Britain faces long-term nuclear threat and must plan for it, says Reid", *The Guardian,* 13 September 2005

55 *ibid.*

56 The transcripts of evidence and memoranda submitted to the Committee can be found on its website: http://www.parliament.the-stationery-office.co.uk/pa/cm/cmdfence.htm#evid

> sinking large funds into helping Russia to defuse and dismantle the warheads that we once feared.
>
> No other credible nuclear threat has stepped forward to replace the Soviet Union as a rationale for the British nuclear weapons system. To be sure, two or three other nations have emerged with a crude nuclear capability, but none of them has developed the capacity or the motivation to attack Britain. […] the collapse of the cold war has removed even the theoretical justification for our possessing strategic nuclear weapons.[57]

Others question the view that in the coming decades there will be no potential threat from a major power that combines both the capability and intent to strike the UK. Some point to the growing military and economic power of China or the risk of future instability or increased authoritarianism in Russia.[58] Furthermore, it is argued that our ability to foresee emerging threats is extremely limited and that no-one in 1906 could have foreseen the developments that occurred over the ensuing decades of the twentieth century.

Opponents of maintaining the deterrent argue that the main threats that the UK is likely to face in the coming decades include climate change and mass casualty terrorism. Mr Cook took the view that:

> nuclear weapons are hopelessly irrelevant to that terrorist threat. The elegant theories of deterrence all appear beside the point in the face of a suicide bomber who actively courts martyrdom. And if we ever were deluded enough to wreak our revenge by unleashing a latter-day Hiroshima on a Muslim city, we would incite fanatical terrorism against ourselves for a generation.[59]

Others disagree with the position that nuclear weapons would have no deterrent role to play in combating chemical, biological or nuclear terrorism, particularly if the group involved were seeking backing and assistance from another state.[60]

The Government contends that the threats to the UK have indeed evolved, but that nuclear weapons still remain an important part of the country's force balance. Dr Reid commented in January 2006:

> It is perfectly true that there are new threats arising from terrorism, but that does not mean that the old threats have disappeared. It is equally true that the type of forces that we would need to develop to counter terrorism, such as special forces, extra surveillance and extra mobility, are not necessarily nuclear weapons. That nuclear weapons are not a response to the threat of terrorism does not mean, however, that we should, for instance, get rid of special forces because they are not a response to the threat of nuclear weapons. The truth is that we need a range of responses to a range of threats.[61]

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57 Robin Cook, MP, 'Worse Than Irrelevant', *Guardian*, 29 July 2005

58 See for example comments by Dr Colin Gray of the University of Reading to the Defence Committee, Uncorrected Transcript of Oral Evidence to be published as HC 986-ii, 21 March 2006, Q73.

59 Robin Cook, MP, 'Worse Than Irrelevant', *Guardian*, 29 July 2005

60 See for example comments by Dr Colin Gray of the University of Reading to the Defence Committee, Uncorrected Transcript of Oral Evidence to be published as HC 986-ii, 21 March 2006, Q97

61 HC Deb 23 January 2006, c1153-4

The extent to which the UK's nuclear weapons are critical to its standing internationally is also the subject of debate, with some supporters arguing that the capability guarantees it a permanent seat on the UN Security Council[62] and allows it, in the commonly used phrase, to "punch above its weight" in international affairs.

Others dismiss this view as dangerous, warning it imbues nuclear weapons with a cachet and a status that encourages other states to seek to acquire them, thereby undermining international efforts to stem proliferation. David Broucher, the former UK permanent representative to the Conference on Disarmament, warned in March 2006:

> I think this line of reasoning is absolutely pernicious and we need to be very clear that that is not the purpose of nuclear weapons. They do not confer, as it were, the right to sit on the Security Council and you do not need a nuclear weapon in order to be, for historical, economic, diplomatic or whatever reason, entitled to sit on the Security Council.[63]

Former defence secretary Michael Portillo wrote in June 2005 that: "we encourage developing countries to believe that we will take them more seriously and invite them to the top table if they acquire nuclear weapons."[64]

4. Treaty Considerations

The Ministry of Defence declared in a Memorandum to the Defence Committee in January 2006 that:

> were a decision taken to acquire a successor system, we foresee currently that the most relevant international obligations would be: a) the Treaty on the Non-Proliferation of Nuclear Weapons; b) the Comprehensive Nuclear Test-Ban Treaty; c) the Hague Code of Conduct; d) the Missile Technology Control Regime [MTCR]; and e) the Nuclear Weapons Free Zones treaties. The Government will continue to comply fully with these international legal and political commitments.[65]

Comprehensive Test Ban Treaty (CTBT)

The UK has maintained a moratorium on nuclear testing since 1991 and it ratified the Comprehensive nuclear Test Ban Treaty (CTBT) in April 1998. The treaty has yet to enter into force as it is still awaiting ratification by the US and China, but the UK has said it will maintain its moratorium on testing. The implication of the Government's decision to ratify the CTBT is that it believes the UK can maintain the safety and reliability of its weapons through computer modelling and sub-critical tests (whereby components are tested without causing a full nuclear explosion).

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62 The four other permanent members of the Security Council (China, France, Russia and the United States) also possess nuclear weapons, although that is purely coincidental as the seats were allocated at the time of the UN's founding at the end of World War Two, well before four of the five had acquired a nuclear capability.

63 Uncorrected Transcript of Oral Evidence to be published as HC 986-ii, 21 March 2006, Q86

64 Michael Portillo, 'Does Britain need nuclear missiles? No. Scrap them', *Sunday Times*, 19 June 2005

65 Memorandum submitted by the Ministry of Defence, Annex A (Possible Constraints on future UK decision-making on any replacement for Trident), 19 January 2006 http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/835/835m03.htm

Controls on Ballistic Missiles

The MTCR and the Hague Code of Conduct relate primarily to technology transfer and inhibiting the proliferation of ballistic missile capabilities. The former imposes a strong presumption to deny transfer of missiles between member states, but the Government holds that there is has an exemption to that for transfers between NATO states.[66] The Hague Convention seeks mainly to increase the transparency of missile capabilities and ensure advance notification of testing. In addition, it includes an undertaking by member states to reduce, where possible, national holdings of ballistic missiles.

Nuclear Weapons Free Zones

As a consequence of its ratification of the Protocols to the three nuclear weapons free zones in South America, Africa and the South Pacific, the UK has given an undertaking not to test or station of nuclear weapons on territories within the zones.[67]

Non-Proliferation Treaty (NPT)

Arguably the most significant obligation in relation to the decision about replacing Trident is the *Treaty on the Non-Proliferation of Nuclear Weapons 1968* (the Non-Proliferation Treaty, or NPT). At the heart of the treaty is an implicit bargain between the five recognised states with nuclear weapons and those without. Those without agree to forego nuclear weapons in return for access to civilian nuclear technology and a commitment from the nuclear weapons States to pursue nuclear disarmament. This is enshrined in Article VI of the treaty, which states that:

> Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a Treaty on general and complete disarmament under strict and effective international control.[68]

The bargain rested on an assumption by the non-nuclear weapons states that retention of nuclear weapons by the five powers was a temporary condition, pending moves towards eventual abolition.[69]

The language of Article VI was reinforced at the 1995 Treaty Review and Extension Conference when the treaty was extended indefinitely. At the conference, the nuclear weapons States reaffirmed "their commitment, as stated in article VI, to pursue in good faith negotiations on effective measures to nuclear disarmament", and agreed a programme of action that included concluding a Comprehensive Test Ban Treaty, progressing towards a

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66 Memorandum submitted by the Ministry of Defence, Annex A (Possible Constraints on future UK decision-making on any replacement for Trident), 19 January 2006 http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/835/835m03.htm

67 *ibid.*

68 The full text of the NPT is available at http://www.state.gov/www/global/arms/treaties/npt1.html

69 See evidence to the Defence Committee from David Broucher, the former UK permanent representative to the Conference on Disarmament, Uncorrected Transcript of Oral Evidence to be published as HC 986-ii, 21 March 2006, Q80.

ban on the production of fissile material for nuclear weapons, and pursuing systematic and progressive efforts to reduce nuclear weapons globally.[70]

The following year, the International Court of Justice in 1996 issued a non-binding advisory opinion on the legality of the threat or use of nuclear weapons.[71] The Court concluded that the threat or use would "generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law", but added that it could not conclude definitively whether the threat or use "would be lawful or unlawful in an extreme circumstance of self-defence, in which the very survival of a State would be at stake." However, it did conclude unanimously that:

> There exists an obligation to pursue in good faith and *bring to a conclusion* negotiations leading to nuclear disarmament in all its aspects under strict and effective international control [emphasis added].[72]

Article VI of the NPT was further reinforced the conclusion of the 2000 NPT Review Conference the nuclear weapons States gave

> An unequivocal undertaking […] to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament to which all States parties are committed under Article VI.[73]

These commitments were seen by many of the non-nuclear weapons States as critical to securing their continued support for the Treaty.

Some observers contend that replacing or upgrading Trident would constitute a violation of the NPT.[74] A Commons Early Day Motion tabled by Neil Gerrard on 9 February 2006 and signed by 39 Members stated:

> That this House notes that the Government when elected in 1997 committed itself to working for multilateral nuclear disarmament; further notes that the Non-Proliferation Treaty (NPT) commits nuclear weapon states to negotiate the elimination of their nuclear arsenals and that the [1996] advisory opinion of the International Court of Justice[75] on the use or threatened use of nuclear weapons affirms an obligation `to negotiate in good faith and bring to a conclusion negotiations leading to nuclear disarmament'; further notes that any programme to replace Trident nuclear weapons systems would pre-empt and undermine the effectiveness of such negotiations; and

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70 'Principles and Objectives for Nuclear Non-Proliferation and Disarmament', *Decision Paper from the NPT Review and Extension Conference*, 17 April - 12 May 1995

71 More detail on the ICJ Advisory Opinion can be found in Section III of Library Research Paper 96/90, *Defence Update*, 8 October 1996.

72 ICJ case summary, ' Legality of the Threat or Use of Nuclear Weapons', Advisory Opinion of 8 July 1996, 2(F), http://www.icj-cij.org/icjwww/idecisions/isummaries/iunanaummary960708.htm

73 Para 15, Point 6, 'Final Document Issued by 2000 Review Conference', 20 May 2000

74 Further background on the NPT can be found in Library Standard Note SN/IA/491, *Treaty on the Non-Proliferation of Nuclear Weapons*.

75 The July 1996 advisory opinion of the International Court of Justice (ICJ) recommended progress towards general nuclear disarmament as the best means of resolving the dispute over the legality of nuclear weapons. For more information on the ICJ ruling see Library Research Paper 96/90, *Defence Update*, October 1996, Section III.

> calls upon the Government to support the international rule of law by implementing the obligations of the NPT which would preclude a replacement of Trident.[76]

In December 2005 Rabinder Singh QC and Professor Christine Chinkin of Matrix Chambers provided a legal opinion for the conflict-resolution NGO, Peace Rights, on whether a Trident replacement would breach customary international law and Article VI of the NPT. In their opinion:

> (1) The use of the Trident system would breach customary international law, in particular because it would infringe the "intransgressible" requirement that a distinction must be drawn between combatants and non-combatants.
> (2) The replacement of Trident is likely to constitute a breach of article VI of the NPT.
> (3) Such a breach would be a material breach of that treaty.[77]

Other commentators interpret the language of Article VI differently. Sir Michael Quinlan, a former Permanent Under-Secretary of State at the Ministry of Defence and now a consulting senior fellow at the International Institute of Strategic Studies, argued in a memorandum to the Defence Committee that:

> several considerations tell against claims that the commitment entails a categoric bar to the UK's continuing to possess nuclear weapons:
>
> > a. The Article says nothing about the speed at which, or the conditions under which, eventual elimination is to be achieved. No state has maintained, nor could any reasonably do so, that the commitment is to be interpreted regardless of the world's political and security environment.
> >
> > b. The Article sets the elimination of nuclear weapons alongside "general and complete disarmament" by all parties. Nothing in the text puts the two obligations on different footings. We are not remotely in sight of "general and complete disarmament".
> >
> > c. There is neither evidence nor likelihood that all the other four recognised nuclear-weapon states (to say nothing of non-recognised ones) will be willing to abandon their armouries in the foreseeable future. It would be wholly unreasonable to interpret Article VI as imposing unilateral and total obligations upon the UK regardless of what others do.[78]

He concluded therefore that:

> while Article VI is undoubtedly in a general way a consideration weighing against renewal, especially at the current scale, and should be taken into account accordingly, it is nowhere near constituting an unconditional imperative in either legal or political terms.[79]

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[76] EDM 1614, 9 February 2006

[77] 'The Maintenance and Possible Replacement of the Trident Nuclear Missile System', Joint Opinion of Rabinder Singh QC and Professor Christine Chinkin of Matrix Chambers, 19 December 2005, http://www.acronym.org.uk/docs/0512/doc06.htm

[78] Memorandum submitted to the Defence Committee by Sir Michael Quinlan, SND 76, 12 March 2006, http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/uc986-i/ucm0502.htm

[79] *Ibid.*

The Government also disputes the findings expressed in the legal opinion. Dr Reid declared in February 2006:

> I am content that the current nuclear deterrent meets the Government's legal obligations. The Government will ensure that any decisions taken on a replacement for our current nuclear deterrent system will also be fully consistent with our international legal obligations, including those under the Nuclear Non-Proliferation Treaty.[80]

In June 2005 he was asked to confirm that a replacement for Trident would be compatible with the UK's obligations under the NPT, to which he replied:

> the answer depends on what we do: if we replace the existing system with a massive increase in our capability, that may not be compatible; if we reduce capability, that may well be compatible. So the answer to the question is precisely as I said: it could well be in line with our existing obligations.[81]

The issue then is could the British nuclear capability be reduced further without undermining its credibility? Sir Michael Quinlan has revealed that, during his time at the Ministry of Defence in the early 1980s, he advocated reducing the number of submarines from four to three,[82] although others argue that might undermine the UK's ability to maintain a continuous at sea deterrent. The Government said in its 1998 Strategic Defence Review that it had considered other ways of reducing the deterrent further, by for example taking submarines off deterrent patrol or removing warheads from their missiles and storing them separately ashore. However, it concluded that such moves would undermine the credibility of the minimum deterrent and create the risk of crisis escalation if it proved necessary to sail a Trident submarine during a period of rising tension.[83] An alternative approach would be to carry out further reductions in the overall stockpile of active warheads and perhaps reduce the number of missiles available.

Another option suggested by some would be to extend the current nuclear capability while simultaneously pushing for progress in multilateral negotiations aimed at reducing the capabilities of all the nuclear powers.[84] It is argued that the UK should not unilaterally give up its capability in isolation, without securing similar commitments from other states. David Broucher, the former UK permanent representative at the Conference on Disarmament, has said the Government should take a lead in reinvigorating the moribund negotiations at the CD, with a particular focus on agreeing a treaty that bans the future production of fissile, bomb-making material (the so-called Fissile Material Cut-Off Treaty) and ensuring that uranium enrichment is governed by international treaty and used for peaceful purposes only.[85]

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80 HC Deb 27 February 2006, c1-2w

81 HC Deb 6 June 2005, c987

82 Uncorrected Transcript of Oral Evidence to be published as HC 986-i, 14 March 2006, Q38

83 *Strategic Defence Review: Supporting Essays*, July 1998, Supporting Essay Five: Deterrence, Arms Control and Proliferation, p.5-5, para 13.

84 See evidence by Professor John Simpson to the Defence Committee, Uncorrected Transcript of Oral Evidence to be published as HC 986-ii, 21 March 2006, Q137

85 The UK announced in 1995 that it had stopped the production of fissile material for nuclear weapons or other nuclear explosive devices. The Government says it "continually press for negotiations to begin on a fissile

E. Procurement Options

The procurement of a successor system to Trident is likely to be made within the context of two overarching considerations:

1. **The Defence Industrial Strategy** – The MOD's Defence Industrial Policy which was published in 2002 set out the commitment of the UK to retaining certain key strategic capabilities, including nuclear technology, within the domestic manufacturing base. [86]

   In December 2005 that commitment was reiterated with the publication of the Defence Industrial Strategy (DIS).[87] The aim of the DIS was to build upon the framework and principles of the Defence Industrial Policy by setting out, in detail, what industrial capabilities (including infrastructure, skills, intellectual property, and capacity) would be essential to retain onshore in the long term. Technologies associated with the nuclear deterrent were identified in the document as capabilities essential for "strategic assurance", i.e. important for safeguarding the State.

   The DIS also set out a fundamental shift in policy with regard to warship building. It stated that, in future, not all key maritime capabilities would have to be exercised onshore and would be judged on a case-by-case basis. However, despite this general reversal of policy all capabilities associated with the design, development, support, operation and decommissioning of submarines were highlighted as strategic capabilities for retention onshore.

2. **The Defence Procurement Budget** – This has remained relatively static at approximately £6bn per annum.[88] Between 2008 and 2015 the current forward equipment plan is already expected to create a "bow wave" when the delivery of the procurement programmes currently underway far exceeds available funding. Among those programmes are the Future Carrier (CVF), A400M strategic airlift, the Future Rapid Effects System (FRES), the Joint Combat Aircraft (Joint Strike Fighter) and potentially tranche 3 of the Eurofighter Typhoon.[89] 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.

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material cut-off treaty at the conference on disarmament in Geneva." Sources: HL Deb 16 March 2006, c254-5WA and HL Deb 29 June 2005, c244-5

86 More information on the Defence Industrial Policy is available in Library Standard Note SN/IA/3759, *Defence industrial Strategy,* 23 September 2005

87 Ministry of Defence, *Defence Industrial Strategy*, Cm 6697, Session 2005-06. A copy of the Defence Industrial Strategy is available online.

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

89 A decision on tranche 3 of the Eurofighter typhoon is expected in 2007.

On the basis of these considerations, there are, in theory, several potential options available for the procurement of a successor platform and delivery system for the UK's nuclear deterrent:

- 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. The possibility of procuring an alternative platform to the current submarine-based system is a consideration as part of this option.

1. 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 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".[90]

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.[91] However, major upgrade programmes have proven in the past to be costly, and subject to serious delays due to their complexity. The Nimrod MR4A upgrade programme for example is currently £780m over budget and six years late.[92]

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.

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

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

92 National Audit Office

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.

In its Memorandum to the Defence Select Committee in January 2006 the MOD indicated its interest in the US Service Life Extension Programme, although confirmed that "the UK Government has yet to decide whether or not to participate in this programme". On the issue of extending the life of the Vanguard-class submarine, the Memorandum went on to state;

> A series of studies have considered whether it would be practicable and cost effective to continue to operate the submarines beyond the original design intent. We now believe that, if required, this would be possible, albeit with gradually increasing cost and some increasing risk of reduced availability, perhaps out to the mid-2020s.[93]

2. 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.

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.[94]

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.[95]

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 associate itself closely with the Navy's SSBN programme.

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93 MOD Memorandum to the Defence Select Committee, HC 835, Session 2005-06.

94 'NRDC: Nuclear Notebook: U.S. nuclear forces 2005', *Bulletin of the Atomic Scientists*, January-February 2005, pp. 73-75 (vol. 61, no. 01), http://www.thebulletin.org/article_nn.php?art_ofn=jf05norris

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

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.[96]

Indeed, with the announcement in the DIS that British warships would not, in the future, need to be built 100% onshore, this option has extra appeal in that the US Navy's SSBN solution could be procured "wholesale" or "commercially off the shelf", potentially resulting in even greater cost savings and fewer risks. Writing in *Jane's Defence Weekly*, Howard Wheeldon, a senior columnist with Dow Jones, advocated this potential approach. He argued:

> If the UK decides to continue the nuclear option post 2024 it could buy US-designed nuclear submarines. While this might leave UK defence industrial strategy in tatters, it would be taken as another useful sign of defence industry collaboration worldwide. And it would go some way to addressing greater interoperability requirements of the allies.[97]

Pursuing this approach would, however, prompt a number of concerns. On a technological level it would pose questions over the through-life maintenance of the system and to what degree there would have to be dependence upon the US. Reassurances would have to be sought from the US, for example, over the issue of technology transfer; an issue which has, to many observers, undermined the future feasibility of the Joint Strike Fighter programme.

In turn, any dependence upon the US in terms of maintenance and support would inevitably raise questions over the political independence of that deterrent capability. As Lee Willetts points out in his article in the *RUSI Journal:*

> The UK needs to be able to build, operate and maintain its strategic deterrent on a sovereign platform and to have complete autonomy over use. While there are common design elements in the existing programme and while the UK draws its missiles from a joint pool – missiles whose life expectancy is extended already to beyond 2040 – the *Vanguard*-class boats are UK-designed and built, the warhead is UK-designed and built and, crucially, the UK retains total autonomy in the decision to use the system. The UK will always insist on at least a degree of political independence, so that it can make its own choices on an issue so critical to national survival. Thus, all full joint programmes are unlikely.[98]

In addition, 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,

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

97 "Opinion: Trident upgrade could reshape UK industry", *Jane's Defence Weekly,* 16 November 2005

98 "Questions for the debate on the future of the UK strategic deterrent", *RUSI Journal,* December 2005

as outlined above, with a view to procuring a system largely based upon the US Navy programme in the longer term.

Questions have also been raised as to whether the design of the UK's Astute-class submarine could be adapted to accommodate any new missile system developed by the US. 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 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.[99]

3. 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.[100] Under this proposal, either a new class of submarine or a converted Astute 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. As the current limits placed on the number of warheads leaves considerable spare capacity within the British Trident system, adopting a multi-role capability for the submarine is considered feasible.

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.[101]

However, the estimated costs of designing, manufacturing and supporting an entirely 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 has argued that in order to retain one trident submarine on patrol at any one time four submarines must be dedicated

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99 http://www.globalsecurity.org/military/systems/ship/ssgn-726.htm
100 "Secret plans for Trident replacement", *The Scotsman,* 9 June 2004
101 *ibid.*

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. As such, the Government has reportedly ruled out the deployment of conventional warheads on Trident and thus provide a multi-role capability for the submarine.[102] 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 […] Ministers decided that to guarantee one Trident submarine was always on patrol, all four had to be committed to the nuclear deterrent cycle.[103]

From a political perspective, effective advance notification procedures would also be required to ensure other countries do not mistake a conventional missile launch for a nuclear strike.

In assessing the feasibility of procuring an entirely new capability, it is also necessary to consider the potential for procuring either an air-launched or ground-launched system, as opposed to a submarine-based one.

Giving evidence to the Defence Select Committee in November 2005 Dr Reid commented:

> We have always maintained that as long as some other nuclear state which is a potential threat has nuclear weapons we will retain ours. That is the assumption from which we start but it has to be tested in discussions with others and it will be. Even if we decide that we want to keep the nuclear deterrent, we then have to ask whether we want to keep it in the same form, submarine launched, sea launched, or in air launched or land-based nuclear weapons; and then we have to ask ourselves about the cost, and we will work through those points.[104]

An air-launched capability, like the current submarine-based system, would have the strategic benefit of flexibility, rapid deployability and stealth. However, achieving these advantages would require the procurement of a new aircraft, along the lines of the US Air Force's B-2 Spirit stealth bomber which is capable of delivering both conventional and nuclear munitions,[105] while considerable investment would also have to be made in associated infrastructure in the UK. Overseas basing when necessary and over-flight rights for most operations would also have to be secured which could potentially pose diplomatic problems.

A ground-launched capability, on the other hand, is largely considered to pose few advantages over either of the other two options. A nuclear deterrent based in the UK would require a significant level of infrastructure investment and lead to disputes over its location. Furthermore, in order to overcome the limitations that would inevitably be imposed upon the

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

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

[104] Defence Select Committee, General evidence session with the Secretary of State for Defence, HC 556-I, Session 2005-06, Q.1-19

[105] More information on this capability is available from the US Air Force at: http://www.af.mil/factsheets/factsheet.asp?fsID=82

global reach of the deterrent, the UK would be required to develop, or procure in partnership, an Intercontinental Ballistic Missile (ICBM) capability.

While the overriding consideration in pursuing either of these different platform options would undoubtedly be the significant costs that they would incur, both an air-launched and a ground-launched capability would also be more vulnerable than a submarine-based system, to attack, thereby undermining the effectiveness of the deterrent.[106]

In an interview with *Jane's Defence Weekly* in early February 2006 the former Chief of the Naval Staff, Admiral Sir Alan West, advocated the retention of a submarine-based deterrent. He stated:

> I am convinced that we should maintain a minimum deterrent and am equally convinced that the navy should continue to operate that deterrent from submarines […] we don't need a new deterrent as such because the Trident missile has a long life ahead of it and we have already made significant investment in the supporting infrastructure.
>
> What we will need are new submarines to replace the Vanguard class and I think now is the time to start design work on that next deterrent boat if we are to maintain the minimum deterrent.[107]

A more far reaching option mooted by some would involve the UK giving up an operational nuclear weapons capability in favour of what is termed a "virtual nuclear arsenal". This would see the UK retain its nuclear weapons design infrastructure and maintain the capacity to reconstitute its nuclear force at short notice, if required. Japan is commonly cited as an example of a state with a virtual capability, with estimates ranging from 6-24 months for the length of time it would take to build an operational nuclear capability if it so wished.[108]

4. Warhead Development and Implications for AWE Aldermaston

The infrastructure for building and maintaining British nuclear warheads is located at the two government-owned and contractor-operated Atomic Weapons Establishment sites at Aldermaston and Burghfield in Berkshire. The Government said in the 1998 SDR that it would retain a robust capability at AWE Aldermaston to "underwrite the safety and reliability of our nuclear warheads, without recourse to nuclear testing", adding that it considered it would be "premature to abandon a minimum capability to design and produce a successor to Trident should this prove necessary."[109] This position was reiterated in the December 2003

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[106] These ideas are examined in greater detail by Lee Willetts, "questions for the debate on the future UK strategic deterrent", *RUSI Journal,* December 2005

[107] "Interview with Admiral Sir Alan West, Royal Navy Chief of Naval Staff and First Sea Lord", *Jane's Defence Weekly,* 8 February 2006

[108] See Memorandum submitted to the Defence Committee by Dr Andrew Dorman of Kings College London, SND 63, 8 March 2006, p.4, http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/uc986-iii/ucm302.htm

[109] *Strategic Defence Review: Supporting Essays*, July 1998, Supporting Essay Five: Deterrence, Arms Control and Proliferation, p.5-5, para 14

Defence White Paper[110] and in subsequent PQs, with the Government saying it would seek "sustainment of capabilities" at Aldermaston.[111]

A new programme of investment at the Aldermaston and Burghfield facilities was announced by Mr Reid on 19 July 2005:

> [A]greement has been reached with AWE Management Ltd. (AWE ML) 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. In the absence of the ability to undertake live nuclear testing given that the UK has signed and ratified the Comprehensive Test Ban Treaty, it is necessary to invest in the facilities at AWE which will provide assurance that the existing Trident warhead stockpile is reliable and safe.[112]

Further details on the focus for investment were provided by the Ministry of Defence in a Memorandum to the Defence Committee in January 2006:

> To provide assurance of warhead safety and reliability without undertaking full-scale testing, scientists must be able to demonstrate their understanding of the physical and chemical processes that occur within the warhead. In addition, age-related changes must be investigated and the implications understood. Computer simulations are used to predict the effect of future changes and warheads are routinely withdrawn from the operational stockpile for forensic examination, which further improves the accuracy of these simulations. The specific capabilities required to undertake this assurance work fall into three main areas - high performance computer simulation, hydrodynamics and high energy density physics. Experiments and models are used to test theoretical understanding of the scientific principles and processes involved. This warhead assurance work represents the core activity presently undertaken at AWE.
>
> […] Particular projects to be taken forward include concept and design studies for the replacement of major facilities for hydrodynamics experiments; and the development of a new high energy laser facility (Project Orion).[113]

It said work was required to refurbish the basic office infrastructure, as well as retaining basic warhead assembly and disassembly facilities:

> […] AWE are required to ensure that we can sustain the Trident warhead in-service throughout its operational life, and also that the warhead can safely be taken out of service at the end of its service life. It is possible that during the in-service life of a warhead, faults can emerge in components as they age. In extremis, this may require

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[110] *Delivering Security in a Changing World*, Defence White Paper, December 2003, Cm 6041-I, chapter I, para 1.2

[111] See for example HC Deb 14 June 2005, c337w

[112] HC Deb 19 July 2005, c59WS

[113] Memorandum submitted by the Ministry of Defence, Annex C (Investment at the Atomic Weapons Establishment), 19 January 2006, paras 7-8

> the remanufacture of new replacement components in order to ensure the safety and performance of the overall warhead. It is therefore necessary that AWE sustain a basic capability to remanufacture key components of the Trident warhead. Moreover, when the time comes to withdraw the Trident stockpile, a range of skills and facilities will be required safely to disassemble the warheads. […]
>
> An additional focus of the programme at AWE will therefore be to replace or refurbish some of the basic assembly and disassembly facilities at Aldermaston and Burghfield. These will include new facilities for handling high explosives and highly enriched uranium, modernisation of the assembly/disassembly facilities at Burghfield, and facilities for non-nuclear components in the warhead.[114]

Finally, the Memorandum set out plans for investing in key skills:

> The average age of the workforce at AWE has been increasing, as the generation recruited to meet the initial requirements of the Chevaline and Trident programmes near the end of their careers. There is therefore a requirement to recruit new members of staff to ensure that the core skills within AWE are sustained. Other new staff will be required to assist the infrastructure sustainment programme and also to operate the new facilities as they come on stream. We have therefore started a programme of recruitment and it is planned to increase the current workforce by around 350 staff per annum until 2007/08, of whom some 70% will be Non-Industrial staff and 30% Industrial staff.[115]

The document concluded:

> This additional investment at AWE is required to sustain the existing warhead stockpile in-service irrespective of decisions on any successor warhead. The investment will sustain core skills and facilities that could also be used in future to develop a successor but no decisions have yet been made either in principle or practice on this issue.[116]

There is little public information available about the timings or factors involved in developing new warhead designs for a potential Trident replacement. Mr Reid declared on 21 March 2006 that there was "no programme at Aldermaston to develop a new warhead"[117] and the Ministry of Defence declared in its Memorandum to the Defence Committee in January 2006 that the "current warhead design can, if required, be maintained in service at least into the 2020s, with some relatively minor upgrading and refurbishment during the first half of the next decade".[118]

A new design could seek to enhance safety and reliability and enable improved stewardship of the stockpile without recourse to full explosive testing, thereby allowing the UK to continue its testing moratorium in line with the Comprehensive Test Ban Treaty.

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[114] Memorandum submitted by the Ministry of Defence, Annex C (Investment at the Atomic Weapons Establishment), 19 January 2006, paras 9-10

[115] *ibid.* para 11

[116] *ibid.* para 13

[117] HC Deb 21 March 2006, c364w

[118] Memorandum submitted by the Ministry of Defence, Annex B (The Expected Life of the Trident System) , 19 January 2006, para 2a

Some commentators speculate that a new warhead might be developed so as to offer a wider range of yield options, perhaps to allow more "useable" smaller weapons to be deployed against more "precise" targets.[119] The Bush administration has pursued the idea of 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, although efforts to secure funding for such a programme have encountered congressional opposition.

5. Potential Costs

The level of expenditure on a successor system will depend entirely upon the option that is chosen and any changes that may be made to the size and/or readiness of the UK's nuclear deterrent. A solution involving changes to the payload of the warhead or the number and type of platform upon which it is deployed would, for example, incur additional developmental costs and infrastructure costs.

Consequently, attempts to estimate the cost of a Trident replacement have varied considerably. It is generally acknowledged that the procurement of a new system alone would cost at least £9-10bn. The addition of through-life costs (which are currently approximately £700m per year) would result in an overall cost for the programme of approximately 25bn over a 25-30 year period.

In his article in *RUSI Journal*, Lee Willetts suggested that "perhaps £15-£20bn over thirty years is a reasonable estimate",[120] while an article in *Jane's Defence Weekly* in November 2005 placed a cost estimate of "in excess of £20 billion" on a Trident replacement.[121]

In response to a Freedom of Information request in September 2005 on the financial costs of the various options for replacing Trident, the MOD stated:

> The Ministry of Defence, in reliance on the exemptions in s24(2), 26(3), 27(4), 35(3) and 43 (3) of the Freedom of Information Act, neither confirms nor denies whether it holds the information you request. We have determined that in all the circumstances of the case, the public interest in maintaining the exemptions outweighs the public interest in confirming or denying that information is held […]
>
> As the Government has made clear, no decisions on any replacement for Trident have yet been taken and whilst some are likely to be necessary in the current Parliament, they are still some way off. Indeed, as the Secretary of State for Defence said in the House of Commons on 7 July [2005] "I have not even started to consider the position on it".[122]

Critics of acquiring a Trident replacement argue that the money would be better spent on improving the UK's conventional forces and gaining new capabilities for counter-terrorist operations.

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[119] 'Secret plan for N-bomb factory', *The Observer*, 16 June 2002
[120] "Questions for the debate on the future of the UK strategic deterrent", *RUSI Journal,* December 2005
[121] "Trident upgrade could reshape UK industry", *Jane's Defence Weekly,* 16 November 2005
[122] Ministry of Defence, Freedom of Information request 041/05

Former foreign secretary Robin Cook wrote in July 2005:

> Trident cost us more than £12.5bn - roughly half the whole defence budget for a year. Even if its successor did not have a higher price tag, it could not be bought without cutting back on the conventional capacity of our armed forces. It will be more difficult this time to find the funds for a new nuclear weapons system without those cuts being painful, because the defence budget as a percentage of GDP is now much less than the level that accommodated the Polaris and Trident programmes.
>
> Our army is already shedding both troops and tanks. Yet Britain's most valuable role in global stability is the professional, experienced contribution of our soldiers to peacekeeping missions, which earns us much more goodwill round the world than our nuclear submarines prowling the seas. The world would be less stable and Britain would be less secure if we were to trade in even more of those army units for son-of-Trident. It is not just peaceniks who would oppose such a choice. I suspect a clear majority of the officer corps would vote against diverting the defence budget into another generation of nuclear weapons.[123]

Former defence secretary Michael Portillo concurred with the view that diverting funds to nuclear weapons would leave less money for other more "useful" defence projects, arguing that: "We could be more powerful and a more useful ally for America if we did not waste money on renewing the nuclear deterrent."[124]

Others argue that as the ultimate guarantor of the country's security, the price is comparatively small when compared to the risks involved in renouncing nuclear weapons.[125] One view is that, as nuclear weapons are primarily a political rather than a military tool, the cost of replacing Trident should be paid for by the Government as a whole, and not taken from the defence budget.[126]

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[123] Robin Cook, MP, 'Worse Than Irrelevant', *Guardian*, 29 July 2005

[124] Michael Portillo, 'Does Britain need nuclear missiles? No. Scrap them', *Sunday Times*, 19 June 2005

[125] See Memorandum to the Defence Committee submitted by Dr Colin S Gray, 16 March 2006, paras 4-5, http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/uc986-ii/uc98602ma.htm

[126] See Memorandum to the Defence Committee submitted by Dr Lee Willett, 13 March 2006, para 5.3, http://www.parliament.the-stationery-office.co.uk/pa/cm200506/cmselect/cmdfence/uc986-i/uc986m02.htm

Appendix One – Suggested Reading

Documents relating to MOD Freedom of Information (FOI) Requests

1. Documents dealing with the replacement of Polaris with Trident (disclosed 28 November 2005), including:

   The Future UK Strategic Nuclear Deterent Force
   UK Trident Programme
   Trident and the alternatives: modernising the UK strategic Nuclear Deterrent Force.
   http://www.mod.uk/DefenceInternet/FreedomOfInformation/DisclosureLog/SearchDisclosureLog/2005/11/TheReplacementOfPolarisWithTrident2xtifRequired.htm

2. Control of the UK nuclear arsenal (disclosed 19 July 2005):
   http://www.mod.uk/NR/rdonlyres/E2054A40-7833-48EF-991C-7F48E05B2C9D/0/nuclear190705.pdf

Parliamentary Papers and Evidence

MOD Memorandum to the Defence Select Committee, HC 835, Session 2005-06, 19 January 2006. This includes annexes on the possible international constraints on any decision for a successor system to Trident; the expected lifespan of the Trident system and investment at the Atomic Weapons Establishment. Available online at:
http://www.publications.parliament.uk/pa/cm200506/cmselect/cmdfence/835/835m01.htm

Uncorrected transcripts of evidence and memoranda submitted to the Defence Select Committee on 14, 21 and 28 March 2006 as part of its inquiry into 'The Future of the UK's Strategic Nuclear Deterrent: The Strategic Context', http://www.parliament.the-stationery-office.co.uk/pa/cm/cmdfence.htm#uncorr

Articles

Tony Skinner, 'Nuclear debate', *Jane's Defence Weekly*, 12 April 2006

Julian Lewis, MP, 'Nuclear Disarmament Versus Peace in the 21st Century', *RUSI Journal*, April 2006, Vol 151, No 2

'The future of Britain's nuclear deterrent', *IISS Strategic Comments*, March 2006, Vol 12, Issue 2

Rabinder Singh QC and Professor Christine Chinkin (Matrix Chambers), "The maintenance and possible replacement of the Trident nuclear missile system: joint opinion", *Peace Rights,* 19 December 2005

Hugh Beach , "Tactical nuclear weapons: a British view", *Pugwash Colloquium,* 10 December 2005

Lee Willett, "Questions for the debate on the future of the UK strategic deterrent", *RUSI Journal,* December 2005

"Nuclear deterrence tomorrow: value for money?", *RUSI Defence Systems,* Autumn 2005

"Opinion: Trident upgrade could reshape UK industry", *Jane's Defence Weekly,* 16 November 2005

"The Future of the British Bomb", *WMD Awareness Programme,* October 2005

Lord Garden, "The future of UK nuclear weapons", *RUSI Defence Systems,* 22 September 2005[127]

Michael Codner, "Britain's nuclear deterrent: keeping the options open", *RUSI Newsbrief,* August 2005

Tim Hare, "What next for Trident?", *RUSI Journal,* April 2005

Michael Clarke, "Does my bomb look big in this?: Britain's nuclear choices after Trident", *International Affairs,* 80 (I), 2004

"The UK Trident system in the 21st century", *British American Security Information Council,* November 2001

[127] Lord Garden is the Liberal Democrat spokesman for defence in the House of Lords. This article is available via his website at: http://www.tgarden.demon.co.uk/