Stepping down the nuclear ladder
Options for UK nuclear weapons policy

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British Government 'Optioneering': Alternative Force Postures of Relevance Today

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This article will examine what alternatives there were to upgrade Britain's *Polaris* force and what to replace it with over the period from 1964-1980. There were several phases to this. In 1964 it was already recognised that the Polaris missiles Britain were potentially vulnerable to Soviet anti-ballistic missiles (ABMs) and steps needed to be taken to address this situation. From 1964-1975 a range of options was looked at to mitigate this threat, these included improvements to Polaris or purchasing the next generation *Poseidon* missile from the United States. After the decision was made to carry forward the *Chevaline* upgrade to Polaris thoughts then moved to a successor system. As a result from 1977-1982 the British government decided to purchase *Trident* C-4 from the United States in 1980 and then the D-5 version in 1982.

1. HR 169 and A-3T

As a result of the ABM problem the UK looked into what could be done in a cost-effective manner to overcome these problems. The first proposal was known as *HR 169* and began in 1964. It proposed a more numerous and lighter suite of decoys than the original A-3 front-end. The HR 169 study team suggested 'hardening' the re-entry bodies to withstand defensive nuclear explosions outside of the atmosphere. It would also have replaced one of the re-entry vehicles containing the warheads with a Penetration Aid Carrier (PAC).

However, HR 169 was found wanting and would not have solved the vulnerability of Britain's Polaris warheads.[1] As a result research into HR 169 was discontinued in 1967. Although US Polaris missiles could also be vulnerable the Americans could saturate the Soviet ABM screen through sheer weight of numbers. Nevertheless they continued to develop improvements to Polaris "as a backup to the next generation FBM system".[2] Alongside these studies the government were looking into the possibility of purchasing a 'hardened' version of the A-3 missile being developed in the United States

[1] Confidential correspondence, 28 July, 2006.
[2] Graham Spinardi, *From Polaris to Trident: The Development of US Fleet Ballistic Missile Fleet Technology* (Cambridge: Cambridge University Press, 1994), p. 74.

– the A-3T. The hardened parts of the A-3T did not include the re-entry system.[3] The eventual decision to purchase the A-3T was based on logistical arguments (with the Lockheed production lines already moving in this direction). Drawing on the experiences of HR 169, and with work now proceeding on a number of follow on studies, in January 1967 the Ministry of Defence (MoD) was forced to recognise that any future work was "virtually dependent on the extent of U.S. cooperation".[4] Throughout its lifetime Polaris required American help and assistance.

2. Next Generation Systems

The Americans were already looking beyond Polaris to weapon systems that would keep them ahead of the Soviets in offensive nuclear technology. These advancements were of great interest to the British government, who were committed to staying as closely in step with the Americans in the nuclear field as politically and economically possible. This system was designated the Poseidon *C-3*. Poseidon was a far more sophisticated delivery system than Polaris with up to fourteen manoeuvrable re-entry vehicles (MRVs) per missile as opposed to Polaris's three non-manoeuvrable RVs. They had in effect decided on a policy of defeating Soviet ABM systems by saturating the defence with real warheads i.e. no penetration aids or decoys.

However, there severe reliability problems with the missile and these were never fully solved.[5] Despite these difficulties in developing this leading-edge technology, Poseidon was a remarkable leap in missile performance. When initial studies to examine the improvement options for Polaris were conducted by AWRE they "identified Poseidon as the preferred option".[6] It could have been accommodated in the submarines Britain was designing for Polaris with relatively minor modifications but there were many problems with a UK request for Poseidon. Despite these considerable obstacles the US offered Poseidon to the British in 1967.[7] The government refused to take up the offer and in June 1967 Prime Minister Harold Wilson instead announced to parliament that Britain would not attempt to purchase Poseidon.[8] The upper echelons of the Navy Department in the Ministry of Defence pressed for Poseidon as its preferred option even after Wilson's 1967 rejection as they felt it was buying proven technology with a guarantee of success.[9]

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[3] Confidential correspondence, 29 December 2007.
[4] The National Archives, Kew, UK (henceforward TNA). TNA, DEFE 13/547, MO/26/10/6 Aide Memoire, undated January 1967.
[5] In 1973 reliability was estimated by Admiral Levering Smith at 68% whilst press reports were putting it as low as 58%. TNA, PREM 15/1360, ACO(W)600/2/630 Notes on a meeting held at Crystal City, Alexandria VA at 1030hrs 28th Aug 73, 29 August 1973.
[6] However it might also have been the case that designing a warhead small enough for Poseidon might have proved problematic for AWRE. Confidential correspondence, 29 December 2007.
[7] TNA, DEFE 19/190, V.H.B. Macklen DCA(PN) to DUS(P), 6 June 1972.
[8] Lawrence Freedman, *Britain and Nuclear Weapons* (Basingstoke: Macmillan, 1980), p. 38.
[9] Frank Panton, '*Polaris* Improvements and the Chevaline System 1967-1975/6', *Prospero*, Proceedings from the British Rocketry Oral History Conferences at Charterhouse, No. 1 (Spring 2004), pp. 110-113.

Soon after, a positive decision to proceed with a more advanced series of studies on improving UK Polaris was taken. Following this the American weapons establishments began to provide the UK with their ideas for increasing the effectiveness of Polaris. Their preferred system was known as *Antelope.*[10] Antelope was designed to complicate the tasks of the defence by increasing the number of targets (through decoys) and providing extra protection to the RVs which contained the warheads through 'hardening' to a similar level proposed for HR 169. However there was considerable uncertainty surrounding the effectiveness of the Antelope system for British needs.

In December 1967 it was decided to conduct a further technical study into these proposals.[11] To assist with these discussions the British began to ask for information regarding Poseidon. In April 1968 this was vetoed by the Americans and communicated to them by Dr. John Foster, Director of Defense Research and Engineering for the US Department of Defence (DoD).[12] Instead Foster indicated that the Chief Polaris Executive (CPE) had been asked by the US Director of the US Navy's Special Projects team "to study the technical, operational and cost factors involved in the development of a MIRV capability for Polaris A-3 'similar to that of Poseidon'".[13]

The idea proposed by the nuclear defence establishments (principally AWRE and RAE) was for a 'mini-Poseidon' carrying anything up to six Mk 3 re-entry vehicles with some MIRV capability.[14] This would have proved more effective than Antelope but cost was to prevent development of this 'mini Poseidon' system. Also, as far as the British were concerned, it would have been difficult to have modified the weapon and management sections of their Polaris submarines as they were incompatible with the USN George Washington and Ethan Allen class for which 'mini Poseidon' would have been primarily designed[15].

The Polaris Re-entry Systems Study Group (PRESSG) had also been charged with looking at the feasibility of Antelope or developing an indigenous derivative using some of the concepts of Antelope. This proposal became known as *Super-Antelope*. Super Antelope, like Antelope, would have replaced one re-entry vehicle (RV) with a separate Penetration Aid Carrier (PAC). These proposals represented a step forward in making a British contribution to high level nuclear research. This was also important as the US (who had made the Antelope design available to Britain) were now themselves undecided whether to pursue

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[10] On the US development of Antelope see Spinardi, *From Polaris to Trident*, pp. 72-74.
[11] TNA, DEFE 13/547, F.L. Lawrence Wilson to Private Secretary to the Secretary of State for Defence, 6 December 1967.
[12] TNA, DEFE 13/548, CA(PR)152/68 Polaris Improvements William Cook to Secretary of State, 9 April 1968.
[13] *Ibid*.
[14] TNA, DEFE 19/190, W.R. Cook to CPE Mini-Poseidon, 12 February 1968.
[15] Confidential correspondence, October 2002.

Antelope for the George Washington and Ethan Allen class due to the shortcomings that had been highlighted by the British.[16]

3. 1970-1974

During the Heath government the *Super Antelope* proposals were being further refined by the UK's nuclear establishments. The areas for discussion under the 1958 agreement required a Presidential Determination for new techniques, designs and materials that would assist US/UK nuclear cooperation. The value which the US nuclear research and development establishments placed on the UK's ability to contribute was an essential part of this process towards acquiring new Presidential Determinations.[17] Although Peter Carrington, the Defence Secretary, rightly foresaw difficulties with the US administration if the British were to request the second generation MIRVed Poseidon system, he nevertheless felt it wise to have begun a thorough technical assessment of both Poseidon and its successor the *Trident C-4* (formally known as the Underwater Long-Range Missile System or ULMS).[18] At this stage a request to purchase Poseidon was under serious ministerial consideration with the MoD proposing that a request could be made for Poseidon minus the MIRVed portion of the missile. They would be the most difficult part of the system to acquire.[19]

Full design information for a warhead useful both for Poseidon or Super Antelope was in hand as part of the proposed underground test series scheduled for late 1973.[20] It was believed that if a firm decision was made in 1973 both could be in service by early 1980.[21] Continuing support for Poseidon would depend on the integration of Trident into the US Navy but the American government was anticipating a service life of twenty years for Poseidon and could therefore provide full support to Britain during this period.[22] This would sustain Poseidon into the mid 1990s when the last of the UK Polaris submarines was expected to end its service life.

The third option that had emerged from the Project Definition Study was to mate Poseidon to improved British warheads and a re-entry system based on the technology of Super Antelope. This was the 'Hybrid' option, an option that soon evolved the codename '*Stag*' and could be in service by 1980. The range of options now opened out to include six

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[16] *Ibid.*
[17] Confidential correspondence, 28 July 2006.
[18] TNA, PREM 15/1361, S. Zuckerman to Prime Minister, 18 February 1972.
[19] TNA, PREM 15/1359, Strategic Nuclear Options (Memorandum by the Ministry of Defence), 2 November 1972.
[20] TNA, PREM 15/1359, C to Prime Minister, 15 May 1972.
[21] TNA, PREM 15/1359, Strategic Nuclear Options (Memorandum by the Ministry of Defence), 2 November 1972.
[22] *Ibid*

alternatives through the combination of two forms of re-entry vehicles and three types of missile.[23] These options would be subject to political approval by the President and would be subject to costings made of the various options. This substantially increased the British government's room for manoeuvre.[24] One of the options was for the American Mk III warhead to be made available, combined possibly with either the Poseidon C-3 or Trident C-4 missile.[25] The Mk III could be carried by the existing Polaris UK missiles.[26] With the Mk III system up to 10 warheads could be carried at a range beyond 2,500nm or 5 warheads at full range and, subject to testing, it was felt this could be built in the UK in three years.[27] Each of these solutions would require the British to develop a modified guidance and warhead dispensing mechanism.

One of the other alternatives that had become available was *Option M*. Option M would include Mk III re-entry vehicles, housed on a Poseidon missile, with the British manufacturing the nuclear warheads.[28] Option M had been offered by the Americans following further technical discussions as there had been unforeseen technical difficulties with de-MIRVing Poseidon.[29] This added to an increase in the anticipated costs.[30] The Chiefs of Staff (COS) very quickly came to favour Option M on technical, logistic and operational grounds.

In view of Britain's continuing economic difficulties, the Treasury were favouring the most cost effective option regardless of the MoD's preference.[31] The MoD continued to strongly favour Option M if an agreement could not be reached on a MIRVed Poseidon. The strength of both Option M and Poseidon was that it was felt to be 'proven technology'; a system in service with the United States Navy that had demonstrated its reliability. However recent disclosures by a number of senior scientists have cast doubt on the wholly positive assessments of Poseidon. They put the reliability of Poseidon reaching their targets at 75% and there were considerable problems with the whole system which led to a recall on three occasions due to design problems.[32] Partly for these reasons Poseidon was not pursued.

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[23] TNA, PREM 15/1359, Ref. A03540 Burke Trend to Prime Minister Nuclear Deterrent, 16 February 1973.
[24] *Ibid*.
[25] TNA, PREM 15/1359, Top Secret Draft Message from Sir Burke Trend to Dr. Kissinger, 21 February 1973.
[26] TNA, PREM 15/1359, Top Secret MO 18/1/1 Lord Carrington to Prime Minister Improvement of the Strategic Nuclear Deterrent, 21 February 1973.
[27] TNA, PREM 15/1359, Summary Record of Conversation between HM Ambassador & Dr Kissinger on 1 March 1973, undated March 1973.
[28] TNA, PREM 15/1360, Top Secret UK Eyes B MO 18/1 Lord Carrington to Prime Minister Improvement of the Strategic Nuclear Deterrent, 2 May 1973.
[29] It has been suggested that de-MIRVing Poseidon would have been extremely problematic and might have necessitated a completely new system with several flight trials needed then to prove that system. It was also possible that a new fire control software and targeting arrangement was going to be needed. The proposals were seen from a working level as part of the political in-fighting in London, both to placate the Royal Navy and to delay decisions and expenditure. Confidential correspondence, 6 April 2006.
[30] TNA, PREM 15/1360, Top Secret UK Eyes B MO 18/1 Lord Carrington to Prime Minister Improvement of the Strategic Nuclear Deterrent, 2 May 1973.
[31] TNA, PREM 15/1360, Sir Burke Trend to Prime Minister The Nuclear Deterrent, 4 May 1973.
[32] Confidential correspondence, October 2002 and views expressed at the Fifth Meeting of Nuclear History Seminars, held at the Mountbatten Centre for International Studies, October 2003.

4. 1974-82 – Chevaline to Trident

When Harold Wilson was returned to office in 1974 Super Antelope was granted the codename *Chevaline*. Cheaper alternatives (known colloquially as the 'Poor Man's Deterrent') were again discounted. It was also hoped that the Polaris missiles could be made to be operational for as long as possible to gain the maximum advantage from the Chevaline improvement.[33] However Fred Mulley, the new Defence Secretary, issued the *caveat* that to push Polaris beyond its life expectancy of the mid 1990s risked running into "serious operational, technical and financial difficulties".[34] This was due to the expected life of the submarine hulls (anticipated not to last beyond the mid 1990s), the longevity of the missiles (which were being phased out by the United States in favour of Poseidon and Trident) along with the need to adapt to Soviet ABM defences to guarantee the 'assurance of destruction' of the UK nuclear deterrent.[35]

Alongside the debates about Chevaline, thoughts were beginning to turn to a possible replacement system. It was estimated it would take around a decade to procure and develop a working system through to completion by the mid 1990s when Polaris would have to be withdrawn. At the beginning of 1978, consideration was being given in the Ministry of Defence to a number of options for a successor system. These included *Cruise Missiles*, Trident or an indigenous SLBM programme capable of carrying multiple re-entry vehicles (MIRVs).[36]

The Duff-Mason Report recommended that a replacement system have a greater numerical capacity than Chevaline, either through a MIRV capability or through Cruise Missiles, given that Soviet defences (including the ABM defences around Moscow) were expected to improve significantly from the early 1980s. Air-launched and ground-launched systems were discounted on grounds of the vulnerability of the platform in-flight. It was decided in January 1979 that an informal request should be made to the United States for the Trident C-4 but without further commitment.

In 1979 it was believed there was little value in Britain seeking to design a Polaris successor system with the French "unless the US were to offer us an inadequate successor system, or one so hedged with restrictions that it was no longer truly independent".[37] This decision, along with the management of Chevaline through to completion, would pass to the incoming administration of Margaret Thatcher following the Conservative victory in the General Election of May 1979.

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[33] TNA, DEFE 25/335, D.W.H. to Prime Minister Chevaline, 26 Jan. 1979.
[34] TNA, DEFE 25/335, FM to Prime Minister Chevaline, 9 Feb. 1979.
[35] Bill Jackson and Dwin Bramall, *The Chiefs The Story of the United Kingdom Chiefs of Staff* (London: Brassey's, 1992), pp. 385-386.
[36] TNA, DEFE 25/325, Terms of Reference for a Study of Factors Relating to Further Consideration of the Future of the United Kingdom Nuclear Deterrent, undated 1978.
[37] TNA, DEFE 25/335, The Future of the UK Nuclear Deterrent, 13 August 1979.

When serious considerations began what the Defence Policy Staff (DPS) in the MoD recommended was somewhat surprising. They did not, as might be expected, favour the best system – the Trident II D-5 – as they felt its large size presented submarine design and basing problems (which they felt could not be dealt with in time). Instead they suggested requesting the C-4 with "a re-motored and modernised POLARIS A-3 using some Trident technology. For convenience we call this missile the A-4".[38] This hybrid would not only have represented a unique UK solution it would only be able to carry five MIRV warheads which might have to be designed indigenously. As the C-4 would be ending its production life in the mid 1980s it would be less of a long-term solution than the D-5 but it would solve the re-motoring problems the British were experiencing with the current Polaris missile.

On 6 December 1979, a formal decision was made to try to procure the Trident C-4 system, minus the warheads and submarines which would be built in Britain. This bargain was agreed on 2 June 1980. On 27 August 1980 the US government confirmed that the Polaris Sales Agreement would provide the framework for the transfer of Trident[39]. Amendments to the classified minutes of the Polaris Sales Agreement deleted any references to the exclusion of penetration aids (the MIRVed Trident used the inert re-entry vehicles as penetration aids to overcome Soviet ABM defences).[40] However a new research programme of penetration aids began through the Joint Working Group (JOWOG) exchange forum, maintained under the MDA. It has been claimed by one official who worked on Trident, that whilst this research effort was a guarantee in case Soviet defences improved it turned out to be "a bit one sided as the UK gave its current research and the US exposed old work".[41]

AWRE proposed that the Trident C-4 would need penetration aids, improvements in its accuracy or alternative attack tactics. The adoption of one of these alone would not be sufficient to meet the damage criteria set out in the Duff-Mason Report. AWRE was then asked whether the adoption of these measures or a change in targeting policy to attack Soviet ABM sites could reduce the number of missiles needed to maintain the 'Moscow Criterion'. This required further studies in AWRE related to the possible configurations of the C-4.[42]

The deal also held open the possibility of the British purchase of the Trident D-5 version which had a longer range and greater payload capacity but was still in development in the United States[43]. At this stage the US Navy were asked by the British government to brief them on the D-5 but were reluctant to do so as they had not yet made up their own minds on the final configuration and did not want the choices influenced by UK needs. In this

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[38] *Ibid*.
[39] TNA, DEFE 25/325, COMMGEN FCO London to MODUK, 27 August 1980.
[40] TNA, DEFE 25/325, AAP to Minister of State Trident: Amendment to Polaris Sales Agreement, 19 September 1980.
[41] Confidential correspondence, 6 April 2006.
[42] Meanwhile the British nuclear weapons establishments were looking to increase the accuracy of the C-4 from a CEP of 1,500ft to 1,100ft. Confidential correspondence, 6 April 2006.
[43] TNA, DEFE 25/325, Britain's Strategic Nuclear Forces: The Choice of a System to Replace Polaris, July 1980.

endeavour the UK government were motivated by the 'Chevaline imperative'[44]. This was to indicate that keeping in step with American developments of Trident should be a guiding principle of UK/US cooperation. If this path was followed there was every chance of avoiding a need for a unique mid-life upgrade of the British Trident force, such as that necessitated by the Chevaline modification for Polaris. In this endeavour 70% of the estimated total cost of £5billion for the building the UK Trident force was planned to be spent in the UK.[45]

During the early technical exchanges with the Americans it was quite uncertain what 'build' of Trident would be bought. The US were considering a 'flat-top' variant with the British having to provide all the re-entry vehicles, warheads and heat shields. AWRE ran contracts with specialist American defence firms to evaluate the vulnerability of their designs based on the size and characteristics of the Mk. 4 re-entry vehicle (RV) used on both the C-4 and D-5 versions of Trident. The Royal Aircraft Establishment (RAE) in turn used these contacts to obtain knowledge for their own studies.[46]

When Ronald Reagan became US President in January 1981 he made it clear that his new Republican administration would seek to modernise US strategic nuclear forces. On 24 August 1981 Casper Weinberger, the new Defense Secretary, informed Mrs. Thatcher that America was going to speed up the development of the Trident II (D-5) programme. This meant "bringing it into the British time frame" and they soon declared they would make this available.[47] On 1 October President Reagan made a formal offer of the Trident D-5 to the British government.[48]

As Mrs. Thatcher recounts in her memoirs, "we were now faced with a new situation. If we were still to go ahead with Trident I [C-4] we risked spending huge sums on a system that would be outdated and increasingly difficult to maintain as the Americans went over to Trident II [D-5]".[49] The total cost of procuring the D-5 was set at £7.5b, a little over 3% of the overall defence budget over the development period and estimated at £1b more than purchasing the C-4.[50] The easing of the research and development costs allowed the government to improve and increase the size of the four submarines to carry the missiles.[51] This made the planned SSBNs more efficient and less detectable to Soviet anti-submarine warfare by allowing the SSBNs to remain on patrol for longer periods.

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[44] Confidential correspondence, 6 April 2006.
[45] TNA, DEFE 25/325, Britain's Strategic Nuclear Forces: The Choice of a System to Replace Polaris, July 1980.
[46] Confidential correspondence, 6 April 2006.
[47] Jackson and Bramall, *The Chiefs*, p. 392.
[48] Margaret Thatcher, *The Downing Street Years* (Harper Collins, 1993), p. 247.
[49] Thatcher, *Downing Street Years*, p. 247.
[50] Ninth Report from the Committee of Public Accounts, v, 15, 20. This figure was revised in 1991 to upwards of £9.8b. DEP 6739, 12 February 1991.
[51] Thatcher, *Downing Street Years*, p. 248.

5. Conclusion

The historical choices regarding Polaris and Trident can be used to highlight elements of the current debate over Trident replacement in a number of ways. Firstly, hard choices had to be made and will have to again. As in the past cost is a major factor which had a bearing on the paths taken. Secondly, keeping in step with the U.S. has been, and continues to be, a guiding light for the British. Thirdly, keeping in step with the Americans and providing the laboratories with innovative design and technical information to trade under the MDA remains pivotal to Trident replacement – particularly if a test moratorium remains in place. These all remain crucial factors in the renewal debate.