



Trident: Strategic Dependence & Sovereignty

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“Britain’s ability to continue with nuclear weapons without US support becomes very slim to the point of invisibility.¹

- Julian Lewis MP when Shadow Defence Minister

Introduction

Britain’s strategic dependence on the United States is far greater than Britain’s economic and social dependence has ever been on the EU. The Trident system demonstrates this. In the public mind, ‘Our Bomb’ is there to save us if we faced a ‘Hitler’ again without the US. But there is no point investing in this weaponry if the United States can prevent its use by the UK. The public line from the Ministry of Defence is that at sea British Trident submarines vanish into the ocean and are untraceable by friend and foe alike. In fact US – UK command centres always know where each other’s submarines are.

While it is extraordinarily unlikely that Britain would want to use nuclear weapons when the United States did not. But this is the only circumstance that fundamentally justifies the expense on Trident rather than on other national priorities. This paper not only demonstrates that the US military have the ability to physically prevent the use of Trident but also spells out the general total dependence of Trident on US goodwill. In contrast to the strong arguments concerning giving up sovereignty to Brussels there seems little concern amongst those most concerned with sovereignty with its loss to the US in the field of national security.

In 2005 I wrote an analysis of Trident and the relationship to the US. In his last ever column, Robin Cook wrote about it that, **“Dan Plesch documents in an impressive forthcoming report that all levels of the Trident system depend on US cooperation.”** The Sunday Times published a front page news story based on this report by the Foreign Policy Centre. Subsequently, the House of Commons Defence Committee under the Chairmanship of the Conservative MP James Arbuthnot, conducted an enquiry into the independence of Trident to which I gave evidence. It concluded that Trident’s independence should be a key part of the public debate on renewal.²

“The independence of the UK’s Strategic Nuclear Deterrent

66. The public debate over the future of the UK’s strategic nuclear deterrent should address:

- the independence of the UK’s current system; and
- the operational and diplomatic impact of any potential dependency on the United States of any future UK nuclear deterrent.

67. We heard a range of conflicting opinions about the degree to which the UK’s current strategic nuclear deterrent represented an independent system.

Potential dependencies on the United States

68. Some witnesses to our inquiry questioned whether the UK’s nuclear deterrent was genuinely independent. Witnesses pointed to a range of technical and operational dependencies of the UK’s Trident system upon the United States and suggested that such dependencies fundamentally detracted from the UK’s independence at a international political and diplomatic level.

69. The warhead: Greenpeace told us that the UK warhead fitted to the Trident II D5 missile is a direct copy of the US W76 warhead; that the arming, fusing and firing system used by the UK was designed by the US Sandia Laboratory and was “almost certainly procured from the USA”; that the neutron generator

¹ Remarks by Julian Lewis MP at the Royal United Services Institute, 6 July 2005.

² <http://www.publications.parliament.uk/pa/cm200506/cmselect/cmdfence/986/98607.htm>

used on UK warheads was manufactured in the USA and was acquired "off the shelf"; and that the re-entry body shell, which contains the warhead, was purchased by the UK from the United States.[57]

70. The missile: Dan Plesch, of the School of Oriental and African Studies, told us that the Trident II D5 missile was designed and manufactured entirely in the United States; that the UK did not own its Trident missiles in any meaningful sense, that they were, in effect, leased from the United States and held in a communal pool at the US Strategic Weapons facility and were not identifiably British; that servicing of the missiles was conducted exclusively by the United States at King's Bay, Georgia; and that the Mark 6 guidance system used on the UK's Trident missiles was designed and made in the United States by Charles Stark Draper Laboratories.[58]

71. The platform: Dominick Jenkins, of Greenpeace, told us that although the UK's Vanguard-class SSBN submarines were designed and built in the UK, many aspects of the design "are copied from US submarines and many components are bought from the USA"; that in order to assure the accuracy of the missiles, the exact position of the UK's submarines had to be precisely determined, that this was achieved by relying on two US-systems, GPS and ESGN, and that the US "has the ability to deny access to GPS at any time, rendering that form of navigation and targeting useless if the UK were to launch without US approval"; that targeting software was based upon US designs, that weather and geodetic data, which help ensure the accuracy of the missile, was supplied by the US Navy, and that "all the hardware and software used by the [fire control] system is US-produced", with the hardware manufactured by General Dynamics Defense Systems.[59]

72. The onshore and warhead infrastructure: Dan Plesch told us that Devonport dockyard, which serviced and repaired the UK's Vanguard-class submarines, was managed by DML, a consortium which was part owned by the US firm Halliburton, and that the Atomic Weapons Establishment at Aldermaston was managed by a consortium part owned by the US firm Lockheed Martin.[60] He also claimed that the A-90 plant used at the Atomic Weapons Establishment (AWE), Aldermaston, to manufacture warheads was a direct copy of the T-55 plutonium processing plant at Los Alamos and that the UK used the US nuclear testing site in the Nevada desert for sub-critical nuclear tests to ensure that the system continued to work effectively.[61]

73. Some of our witnesses felt that such technical dependencies upon the United States compromised the UK's independence of policy and diplomatic decision-making and that, as a consequence, several of the UK's continental allies regard the UK as "a vassal state".[62]

74. Dan Plesch argued that the current US-sourced Trident system failed what might be termed "the 1940 requirement" (an ability to be used in situations of extreme national emergency when the UK was alone and isolated) and that the UK would, in practice, not be able to use its nuclear deterrent in circumstances in which the US was either neutral or actively opposed to UK policy, or where the US was an adversary. Mr Plesch asserted that although such circumstances are highly unlikely "this is precisely the test that an independent force must pass to be worth the expenditure of financial and political capital". He also stated that "any US sourced successor to Trident will be subject to similar dependence".[63]

75. Professor Colin Gray accepted the UK's dependence on the United States, but claimed that he was not concerned by it:

Britain's nuclear deterrent since the 1960s... has been thoroughly dependent upon the co-operation and indeed the willingness of the United States to sell us or loan us the most vital equipment... the independence of the deterrent is obviously highly questionable... I am not the least troubled by the American connection, but for anyone who wishes to question the true independence of the British nuclear deterrent I would concede that it is... a hostage to American goodwill... the dependency is critical and will continue.[64]

Operational independence

76. Other witnesses took the view that, in an operational sense, the UK's nuclear deterrent is independent.

77. The warhead: Commodore Tim Hare, a former Director of Nuclear Policy at the MoD, told us that although the US had long shared its warhead designs with the UK, and that the British warhead closely resembled the American W76 design, the UK retained the design authority on its Trident warhead. Commodore Hare also told us that whilst AWE Aldermaston was managed by a consortium which included Lockheed Martin, it was nevertheless owned by the MoD.[65]

78. The missile: Dr Lee Willett, of RUSI, stated that the Trident II D5 missile was "a totally self-contained package" which had "an inertial guidance system that takes it to a point in space, and then the ballistic

trajectory then takes it to the latitudinal and longitudinal point on the target" and that "[i]t does not... rely on external guidance systems such as American satellites".[66]

79. The platform: We heard that the Vanguard-class submarines were designed and built entirely in the UK and that the UK retained design authority on the boats.

80. It is important to distinguish between two different types of independence: independence of acquisition and independence of operation. We heard that independence of acquisition is what the French have opted for at a significantly higher cost to the defence budget. Independence of operation is an alternative concept of independence and it is this which the UK has opted for at a lower price.

81. Sir Michael Quinlan told us that the UK's decision to choose independence of operation meant that "in the last resort, when the chips are down and we are scared, worried to the extreme, we can press the button and launch the missiles whether the Americans say so or not".[67] He argued that the decision to fire is an independent, sovereign decision. The United States "can neither dictate that the [UK's] force be used if HMG does not so wish, nor [can it] apply any veto—legal or physical—if HMG were to decide upon [its] use".[68]

82. Commodore Hare told us 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". He told us that the United States does not have a "technical golden key" which can prevent the UK from using the system.[69]

83. The potential disadvantage of the UK decision to forego independence of acquisition is that "if, over a very long period, we became deeply estranged from the Americans and they decide to rat on their agreements, we would be in... great difficulty".[70] Commodore Hare told us that such a risk was, in reality, "very low" and that, ultimately, "one must balance that risk against the enormous cost benefits that we have in procuring an American system to house in our submarines. That should not be underestimated".[71]

84. We call upon the MoD to clarify the technical dependencies of the UK's Trident system upon the United States and to respond to the argument that the UK's nuclear deterrent is not truly independent. In weighing the importance of maintaining independence, attention needs to be paid to the differing concepts of independence adopted by the UK and France."

One of my 2005 report's main findings was that nuclear warheads and computer technology in the firing system were dependent on the US, in addition to the recognised dependence on the supply of missiles. As a result of the debate around my report, Trident advocates, including the late Michael Quinlan and Julian Lewis MP accepted the dependence of all Trident procurement on the US. Since then Trident advocates have mostly rested their case for independence on the claim that Trident operates and can be fired independently of the US.

Independence of operation of Trident is usually justified on the basis that there is an independent British firing chain of command, a system described by Professor Peter Hennessy when he revealed the famous letter from the Prime Minister kept in the safe of the Trident submarines giving instructions on what to do if Britain had been destroyed.

But this is not the real issue. The key question is whether Britain could use Trident if the United States wished to prevent it. A decade ago Quinlan dismissed my concern in an article for Chatham House on the basis that US would never use force against the UK and would be considered by adversaries as independent.

"See e.g. Dan Plesch, *The future of Britain's WMD*, published by the Foreign Policy Centre, March 2006, and in *New Statesman*, 27 March 2006, 'Trident—we've been conned again'. To sustain his denial of UK independence, Plesch has to predict a massive and successful US military operation to neutralize UK forces pre-emptively should their use contrary to US preferences ever appear to be in contemplation. On hypotheses and interpretations as remarkable as these the independence of French, Indian, Israeli or Pakistani capability could also be questionable.

One might further wonder what adversary would be so confident of the prospect of such extraordinary action against non-US forces as to assign no deterrent weight to their existence."³

In an extreme situation the US long ago demonstrated a willingness to consider fighting Britain. The columnist [Peter Hitchens has demonstrated](#) that just 11 years after their joint victory in World War Two the US seriously considered fighting the British fleet in the Mediterranean as it devised a strategy to defeat Britain in the Suez crisis of 1956. In the event economic power was sufficient. Sixty years later the relationship is weaker but the balance of power in the US's favour is even greater.

The US can interfere with British communications with Royal Navy submarines, with the satellites and computer software upon which they rely; use its formidable Anti-Submarine Warfare capability and knowledge of British operations to hunt for the British submarines and use its dozens of anti-ballistic missile systems on its Navy's vessels to shoot down British Trident missiles.

The US and UK operate what is called a "Joint Water Space Management Facility" at the Northwood command centre. This allocates blocks of ocean to individual submarines so that the US knows where UK submarines are at all times and vice versa.

This report discusses examines British dependence on the United States and concludes that most of the discussion on the replacement is based on the false premise that the UK has an independent nuclear weapon. To support this conclusion the report reviews the history of Britain's involvement with nuclear weapons from 1940 to the present day to show a sixty-year-old pattern of British dependence on the US for WMD.

The report recommends that Trident should not be replaced and should be phased out now, as neither Trident nor any US-supported successor would meet the '1940 requirement' for a system that the nation can rely on if it stands alone as in 1940. Back in the Second World War the British government concluded it could not develop nuclear weapons without US support. Dependence remains decisive and has increased over the years. President George Bush Snr ordered his officials to 'produce additional nuclear weapons parts as necessary for transfer to the United Kingdom'. For fifty years successive governments have concluded that Britain cannot afford an independent nuclear deterrent. An independent system is not an option for financial reasons alone since Harold Macmillan chose to abandon and independent British nuclear weapon some fifty years ago.

US support for Britain's Nuclear Weapons

British dependence on the US for nuclear weapons started in the Second World War. This history shows that it is incorrect to think that the UK was ever an independent nuclear state like France, Russia or China.

In 1940, Churchill initiated work on a British atomic bomb, rejecting a suggestion of cooperation from the US President, Franklin Roosevelt in October 1941.⁴ It was not until the 1943 Quebec Agreement that Britain joined the Manhattan project that built the Hiroshima and Nagasaki bombs.

Margaret Gowing, the official historian of Britain's nuclear weapons explains that: 'Britain had then become only a junior partner in the business, contributing significantly in various ways but present largely on American sufferance'.⁵

³ Michael Quinlan, *International Affairs*, 2006, p.630.

⁴ A.J.R. Groom, 'British Thinking about Nuclear Weapons', Pinter, 1974, Chapter 1

⁵ Margaret Gowing, 'Independence and Deterrence', Macmillan, 1974, Vol 1 p.3

In 1946, the US Congress passed the MacMahan Act to stop nuclear collaboration with any state. British scientists returned home with information on how to build an atom bomb but without detailed knowledge of the industrial production processes.

Some nuclear sharing quickly restarted as the US needed supplies of British controlled uranium ore from the Congo, despite the MacMahan Act.⁶ Until 1952, the US intermittently provided the UK with nine categories of information mostly on the construction of nuclear reactors for making nuclear explosives.⁷ Congressional leaders brought into the negotiations used the threat of withdrawal from the Marshal Aid programme to get the Attlee government to give up joint control over the use of nuclear weapons agreed by Churchill and Roosevelt during the war.⁸

In 1947, the British Atomic bomb project was restarted by the Labour government. In Peter Hennessy's account, it was the Foreign Secretary, Ernest Bevin's intervention that swung the discussion amongst ministers.⁹ And the need to have a 'Union Jack' on top of the bomb, in Bevin's famous phrase, was driven by the humiliating way that Bevin had just been spoken to by the US Secretary of State James Byrnes. The programme was mentioned in Parliament in 1948, with more detail only provided shortly before the first British atomic test in 1952 under Winston Churchill's premiership.¹⁰ Churchill privately expressed surprise at how much money and work had been done in secret by the Labour government.

From 1948 the US began to base nuclear capable bombers in Britain and tested the first H-Bomb in the Pacific in 1952. Churchill's last political acts were to try to reach out to the Soviet leadership after the death of Stalin in order to control the H-Bomb. He found he had no influence in Washington and, shortly before retiring, Churchill began the UK H-Bomb programme, while privately expressing greater concern over the future of the world than he had even in 1940.

In 1957, with great difficulty and expense, the UK exploded its first Hydrogen bomb and shortly thereafter the US agreed to provide full support for the British nuclear weapons programme. As both Lorna Arnold and Peter Hennessy describe in their studies of the British H-Bomb programme, the key purpose in the mind of the Prime Minister, Harold Macmillan, was to show the Americans that the British were important enough a nuclear power to help, rather than to have an independent weapon.

In 1958, the US-UK Mutual Defence Agreement (MDA) was signed although very little was known about it in public. It has been renewed periodically ever since, the last time in 2004. The MDA allows the US to provide the UK with nuclear weapons designs, nuclear weapons manufacturing and nuclear reactor technology, designs and materials.

A secret British government assessment of 'The Dangers of Becoming an American Satellite' only released after 1988 stated

The UK, in its relatively weak position, is already greatly dependent upon United States support. It would be surprising if the United States did not exact a price for

⁶ S. Paul, 'Nuclear Rivals: Anglo-American Atomic relations 1941-1952', Ohio University Press, 2000, passim.

⁷ Ibid.

⁸ Groom, op. cit., p.31.

⁹ Hennessy, op. cit.

¹⁰ Gowing, op. cit.

the support, and to some extent it does so...the more we rely upon them, the more we shall be hurt if they withhold it.¹¹

Warheads and nuclear explosive materials

Tons of uranium and plutonium were traded between the UK and the US during the Cold War. This was flatly denied at the time. In 1997 the Clinton Administration revealed the extent of this exchange, the details of which are in Appendix I. Ross Hesketh wrote that the 5.4 tonnes of plutonium sent to the USA amounted to 'the entire production of plutonium from all the UK civil nuclear power stations, up to April 1969, according to official sources'.¹² These exchanges were useful to the US but were essential to the UK.

The new British interest in nuclear energy should be examined closely for any commercial, political or technical connection to nuclear weapons collaboration with the United States. How, for example, can the British government be serious about being a nuclear weapons power if it is not going to have a modern nuclear industry?

Nuclear warhead design and construction

The 1958 MDA created the Joint Atomic Information Exchange Group and dozens of Joint Working Groups (JOWOGs). Documents obtained by the US Natural Resources Defense Council show that the US supplied the designs of many weapons to the British. The UK national archives on the JOWOGs even from 1960 are still sealed. The titles of some documents from that era show that the UK was briefed on the use of beryllium, plutonium and uranium and the Americans were presented with the results of British experiments using US supplied bomb parts. US officials also benefit from the exchanges because of the innovative and skilful approach of their resource-starved British counterparts.

In the early 1960s public concern over the nuclear arms race focused on the test explosions of nuclear weapons in the atmosphere and the accumulation of radiation in milk. After the 1963 UK/US/USSR agreement of the atmospheric test ban, the UK was only able to carry out test explosions jointly with the US at the underground test site in Nevada. Then President Clinton's support for a test ban forced John Major's government to follow suit and sign the Comprehensive Test Ban Treaty in 1996. The last US/UK tests at Nevada were codenamed Barnwell (1989), Houston (1990) and Bristol (1991).

For many years, the JOWOGs were secret and were only obliquely referred to in the open literature. Thus two of the main British academic studies on Anglo-American defence relations and nuclear weapons make no more than a passing reference to them.¹³ It was only through the work of the Natural Resources Defence Council in Washington, D.C., Greenpeace UK and BASIC, that the JOWOGs were first discussed in public. Subsequent activity by MPs such as Frank Cook and Alan Simpson led to the British government providing occasional lists of the JOWOGs to Parliament.¹⁴

The principal role of the JOWOGs is to assist the British in producing nuclear warheads. Since the mid-1960s the UK has deployed four types of nuclear weapon, some with variants. These are the

¹¹ 'Planning Paper on Interdependence', Foreign Office, SC (58)8, Steering Committee, 27 January 1958, PRO FO371/132330, quoted in J. Baylis, 'Anglo American defence relations 1939-1984', 2nd edition, Macmillan, London 1984.

¹² <http://www.timesonline.co.uk/article/0,,60-1091224,00.html> 29 April 2004, accessed 1 July 2005.

¹³ J. Simpson, 'The Independent Nuclear State', MacMillan, London, 1986 and J. Baylis, 'Anglo American Relations since 1939', Manchester University Press, 1997.

¹⁴ Alan Simpson MP, House of Commons, Hansard, 15 December 1994, c 1222.

WE-177, Polaris, Chevaline/Polaris and Trident. Only the Trident is in service today. The RAF and Royal Navy used the WE-177 free-fall bomb with three versions for different military tasks. However, the British only conducted three nuclear tests in the period when the weapon was developed making a British-only design most unlikely. The secret remains, although a declassified US document from 1960 obtained by the Natural Resources Defense Council says that the UK: 'plans to produce several versions of the [US] Mark 57.'¹⁵ NRDC's analysis concludes that the WE-177 variants were probably based on this and one other US weapon, the B61.

The US supplied the W-58 design for Polaris and in heated exchanges in the House of Commons between the Prime Minister Lord Home and Harold Wilson, Home replied that the British weapon was probably 'both' the US design and a British design of the same size.¹⁶ He saw no need to test the Polaris warhead at all, although Harold Wilson did get US permission to conduct one. Lawrence Freedman stated in a 1986 analysis that, 'it had originally been planned to purchase the A-2 warhead of one megaton, but in 1964 it was decided to go with the A-3 with three (not independently targeted) two-hundred-kiloton warheads.'¹⁷

In the early 1970s the US stopped cooperation when the Labour government said they would not have a new nuclear weapon. There was consternation at Aldermaston. Then, US support resumed when under the premierships of Edward Heath and Harold Wilson, a secret programme to put a new warhead on Polaris was begun. This programme, known as Chevaline or 'Super-Antelope' in Britain was based on Lockheed's US Antelope project. It had the technical function of confusing Soviet defences that might be able to shoot down the existing missiles and the political function of keeping the nuclear support going.¹⁸

In 1979, Margaret Thatcher's new Defence Secretary, Francis Pym, announced Chevaline in Parliament. This caused much infighting in the Labour Party, whose members had known nothing of a programme that was pursued, in violation of the decisions of the party conference. On the one side, David Owen argued that the Cabinet had taken the decision and, on the other, Tony Benn took the view that it had not.¹⁹

The Trident warheads

President George Bush Snr issued National Security Directive 61, now partly de-classified. He ordered that the Department of Energy 'shall produce additional nuclear weapons parts as necessary for transfer to the United Kingdom pursuant to the Agreement of Cooperation' for a period up until 1997.²⁰

According to the UK National Audit Office, 'warhead development and production [and] ... Most of the development and production expenditure is incurred in the US'. These costs included the cost of testing the weapons in Nevada. '[Regarding] special materials ... in 1982 Ministers decided...that a substantial proportion [of the explosive nuclear material] should be purchased in the UK [from]

¹⁵ W. Peden, 'Safety of British Nuclear Weapon Designs', British American Security Information Council, 1991.

¹⁶ House of Commons, Hansard, 12 May 1964, c222-223

¹⁷ L. Freedman, 'British Nuclear Targeting', in 'Strategic Nuclear Targeting', D. Ball and J. Richelson (eds), Cornell, New York, 1986.

¹⁸ G. Spinardi, 'Aldermaston and British Nuclear Weapons Development: Testing the "Zuckerman Thesis"', Social Studies of Science, Vol 27, 1997, pp547-582.

¹⁹ House of Commons, Hansard, 15 February 1989, c 383.

²⁰ <http://bushlibrary.tamu.edu/research/directives.html>.

British Nuclear Fuels plc'.²¹ Therefore, the remaining portion of the nuclear materials in the warheads comes from the US. Baylis describes how by the mid-1980s Britain was 'dependent for "vital materials" for weapons for warhead production'.²² The British warhead was test-fired at the US underground test-site in Nevada.

The A-90 manufacturing facility for the nuclear explosive materials 'appears to be a direct copy of the Plutonium Processing Facility (TA-55) at Los Alamos'.²³

The US provided Britain with details of its Trident nuclear warhead design²⁴ and sold its cone-shaped casing.²⁵ The US Sandia plant 'also designs the arming-fusing-firing mechanisms for all of the United Kingdom's nuclear weapons'.²⁶

British WMD	US dependence
Trident warhead design	Based on the US W-76
Trident warhead nuclear components	Some imported from US
Trident warhead nuclear component factory (A90)	A copy of the US TA-55 at Los Alamos built by the US Fluor corporation.
Trident nonnuclear components	Some imported from US
Trident detonator	Designed and built in the US
Trident D-5 Missiles	"Although specific missiles in the pool of such missiles held at King's Bay, Georgia, will not be identifiably British, the UK Government will take title to the missiles it purchases." ²⁷
Trident missile guidance system	Imported from the US
Trident submarines	British designed and built with the import of US components and reactor technology
Reading WMD factory (AWE Aldermaston)	US management – 33.3 per cent Lockheed Martin technology – much US sourced ²⁸
Plymouth submarine maintenance base	US management/ownership – 51 per cent Halliburton ²⁹

In order to prepare for a decision on a new system around £300 million was spent to refit the factory at Reading (Aldermaston), an investment equal to some 60 per cent of the current book value of the factory, estimated by the government at some £500 million.³⁰ The refit includes: a new high-powered laser and a supercomputer. Lockheed Martin part manage the factory. The extent of the

²¹ 'Ministry of Defence and Property Services Agency: Control and Management of the Trident Programme', National Audit Office, 1987, appendix 4, pars 1-4; 'Progress of the Trident Programme', HC 1987-1988, Defence Committee, Third Report, p 22.

²² Baylis, op. cit., p.195.

²³ Norris, op. cit., p.72 ff

²⁴ Annual Historical Summary [U], Joint Atomic Information Exchange Group, HQ Defence Nuclear Agency, 1 October 1982-30 September 1983.

²⁵ 'Annual Summary', Joint Atomic Information Exchange Group, 1983-1984.

²⁶ D. Kramer, 'Inside Energy / with Federal Lands', May 1994, cited in W. Peden, 'The Next Chevaline Scandal', Campaign for Nuclear Disarmament, London, 1999.

²⁷ The Progress of the Trident Programme, Defence Committee 6th Report, 16 June 1993, HC 549

²⁸ See, for example, the table of Joint Working Groups and the provisions of the Mutual Defence Agreement.

²⁹ In-service support and refurbishment for Britain's nuclear submarines is provided by the Devonport Management (DML) group, 51 per cent owned by Halliburton, www.devonport.co.uk.

³⁰ House of Commons, Hansard, 11 Jan 2005.

expenditure that is used to procure US technology is not yet known. However, earlier in the Labour government there were plans to invest in a US facility in California. The Nuclear Information Service tracks the ongoing construction of new facilities and the recruitment of staff to make the next generation of nuclear weapons.³¹

Figure 5: US/UK Joint Working Groups³²

Joint Working Group	Title
6	Radiation Simulation and Kinetic Effects
9	Energetic Materials
22	Nuclear Materials
23	Warhead Electrical Components and Technologies
28	Non-Nuclear Materials
29	Nuclear Counter-Terrorism Technology
30	Facilities
31	Nuclear Weapons Engineering
32	Nuclear Warhead Physics
34	Computational Technology
36	Aircraft, Missile and Space System Hardening
37	Laboratory Plasma Physics
39	Manufacturing Practices
41	Nuclear Warhead Accident Response
42	Nuclear Weapon Code Development
43	Nuclear Weapon Environment and Damage Effects
	Methodologies for Nuclear Weapon Safety Assurance

Michael Portillo makes similar arguments but concludes that the UK should depend totally on the United States.³³

³¹ <http://www.nuclearinfo.org>.

³² House of Commons, Hansard, 22 Feb 2005, column 601.

³³ Michael Portillo, 'Does Britain Need Nuclear Missiles? No. Scrap them', Sunday Times, 19 June 2005.

Missiles

Forty years ago Harold Macmillan had to deal with the fact that not only could the government not afford independent bombs, it could not afford independent missiles either. His government first sought a US air-launched missile, Skybolt and, when this was cancelled, was offered the US Navy's Polaris missile.

The December 1962 Nassau agreement to provide the UK with Polaris provided the UK with missiles, submarine and reactor technology. President Kennedy offered a similar deal to the French President Charles de Gaulle.³⁴ In January 1963 De Gaulle made a speech rejecting the US offer of Polaris to France and vetoing British membership of the Common Market on the grounds that the British had now come under US control.

Macmillan's Permanent Secretary, Sir Robert Scott, recorded that the decision has 'put us in America's pocket for a decade'.³⁵ The commander of the V bomber force wrote privately that the deal had been done to sustain the 'myth' of an independent force.

The Labour government of Harold Wilson came to power in 1964. Its manifesto said that Polaris: 'will not be independent and it will not be British and it will not deter.' Nevertheless, with most of the money committed, the Wilson cabinet, with the support of Parliament, continued the programme. Although even in retirement he said: 'I never believed that we had a really independent deterrent.'³⁶

Air Vice Marshal Stuart Menaul wrote in 1980 that:

Britain no longer has an independent nuclear deterrent...strategic considerations as far as Britain is concerned are no longer relevant...it could only be used after authority for the use of nuclear weapons had been conveyed from the President of the United States to SACEUR [the US general at NATO].³⁷

James Callaghan confirmed that, in deliberate contradiction of Labour party policy, he sought a private understanding with the US President Jimmy Carter that the US would supply Trident as a successor to Polaris. He explained how, in 1979, at a summit in Guadeloupe, he had a chat with Carter in his beach bungalow and secured the deal.³⁸

When Margaret Thatcher became Prime Minister, Trident was a natural choice. Proud of the policy, she held a debate in parliament. The Trident D-5 was designed to destroy Soviet missiles before they could be launched. It has a launch to target time of seven to thirty minutes, 'a range of over 4,000 nautical miles and an accuracy, which can be measured in metres'.³⁹

US management and technology, including nuclear materials, is involved throughout the Trident weapons system. According to the National Audit Office report of 1987:

The US will supply the missiles and associated strategic weapon systems equipment, certain warhead-related components and services, and missile preparation and

³⁴ http://news.bbc.co.uk/onthisday/hi/dates/stories/december/21/newsid_3815000/3815251.stm

³⁵ Both cited in I. Clark, *op. cit.*, p 413 and 418.

³⁶ Hennessy, *op. cit.*, p70 ff

³⁷ S. Menaul, 'Countdown', Hale, London, 1980, p 7 and 172.

³⁸ This is discussed in Hennessy, *op. cit.*

³⁹ Royal Navy description, <http://www.royal-navy.mod.uk/static/pages/177.html>.

refurbishment services: the remainder of the programme will be carried out by the UK.⁴⁰

The supply of Trident commanded a political price from the government in London. In his seminal study 'Nuclear Weapons: Who's in Charge?', Hugh Miall records comments from two British officials on the state of US influence in the mid-1980s. 'Sir Frank Cooper, the Permanent Under Secretary of Defence, said, "if you ask me whether the Americans have an undue degree of influence over British defence policy I would have to say yes".'

Clive Ponting, a former MoD official said:

Client state is putting it a bit strongly but there are very clear signs I think that it's not far short of that...They clearly do have an undue degree of influence because when the chips are down we side with the Americans because we think the American nuclear and intelligence material is so important to us that we are prepared to pay that price to keep the material flowing.⁴¹

One area where the price was paid was in support for the US Star Wars programme which was strongly opposed by Foreign Office and Ministry of Defence officials. Initial doubts were expressed by the Foreign Secretary, Geoffrey Howe, only for the Prime Minister to bring the UK into line with Washington – a pattern familiar in recent years.

Trident missile and submarine system

The British version of the US Trident system consists of four submarines built at Barrow in Furness, each fitted with sixteen missiles. The submarines can sail to any part of the world's oceans. Powered by nuclear reactors they can stay underwater, undetected, for months at a time.

The submarines must collect the missiles from a US port in Georgia on the Atlantic coast under a lease-purchase arrangement.⁴² This was a major increase in dependence over the Polaris missiles which were British-owned and stored at a base in Scotland. Denis Healey heaped derision on the arrangement:

Under the rent-a-rocket agreement we have to swap these Moss Bros missiles every seven or eight years for other missiles in the American stockpile...[there are] some serious political disadvantages, which can be summed up as a period of prolonged and humiliating dependence on the United States.⁴³

The Trident D-5 missiles are occasionally test-fired from the submarines at a US naval facility. Each Trident missile can carry up to 14 nuclear weapons able to hit separate targets hundreds of miles apart. However, as a result of successive, unverified, unilateral statements under Conservative and Labour governments, each missile officially carries a much smaller load than its theoretical maximum, with a total of no more than 48 nuclear weapons per submarine – 200 in total.

⁴⁰ 'Ministry of Defence and Property Services Agency: Control and Management of the Trident Programme', National Audit Office, 1987, par 1.1.

⁴¹ H. Miall, 'Oxford Research Group', Macmillan, London, 1987, p77.

⁴² http://www.subasekb.navy.mil/TRIDENT_per_cent20REFIT_per_cent20FACILITY/MISSION.htm

⁴³ J. Dumbrell, 'A Special Relationship', Palgrave Macmillan, 2000, p 145.

Firing Trident – US options for prevention

This section discusses whether Britain could successfully launch nuclear weapons when Washington did not want one and how the British and American governments prepare in peacetime for using their nuclear weapons.

Dr. John Reid the then Defence Secretary explained that, ‘the United Kingdom’s independent nuclear deterrent can be targeted and used without the approval of any other country’.⁴⁴ This statement on its own reinforces the idea that the UK does have an independent nuclear deterrent. However, if one asks ‘can it be used if the United States disapproves?’ we can see from the previous analysis that this is most unlikely. Half a century ago at Suez the British had to abandon a military operation under economic pressure from Washington.

In 1962 Robert McNamara the US Defense Secretary spoke out about the ‘dangerous’ contribution of small nuclear powers. This created headlines in Britain and was seen as an attack on the UK force, then consisting of the RAF V Bombers. McNamara and his advisors sought to sooth the British press by explaining that they were only talking about the French, since the British ‘did not operate independently’.⁴⁵

In any crisis where the US and the UK were at odds the US would have every ability and incentive to prevent its use even if the US does not have to be asked for permission. And this is precisely the circumstance of ‘Britain alone’ that the public have been told that Trident and its successors are for.

Both governments state that the UK weapons are assigned to NATO. What does this mean in practice? According to sources familiar with the process, the US is aware through the NATO command structure and the US Strategic Command (STRATCOM) of the location and deployments of the Trident submarines. US communications and satellite facilities are normally used for keeping in touch with the boats and for targeting the missiles. Nevertheless the command chain from the British PM to the submarine captains does not involve the Americans.

Yet the UK makes use of US satellites to target Trident and US communications facilities to contact the submarines. Former UK Trident launch control officers have said that it would be very difficult to fire the missiles without the use of the satellites.⁴⁶ John Ainslie has provided the details of the British reliance on US computer software, satellite generated targeting information and related systems that would permit the US to interfere with a British Trident launch.⁴⁷

US involvement with the UK targeting and fire control

Key Sites

United Kingdom Software Facility

One of the least well-known, but most important parts of the British Trident system is the United Kingdom Software Facility (UKSF). This is located in an underground bunker at Corsham in Wiltshire. It is the one remaining fragment of what was once a massive underground complex in which the Prime Minister and Queen would have taken refuge in the event of nuclear war. The Ministry of

⁴⁴ House of Commons, Hansard, 31 Oct 2005, Column 720W.

⁴⁵ I. Clark, ‘Nuclear Diplomacy and the Special Relationship: Britain’s deterrent and America, 1957-1962’, Clarendon Press, Oxford, 1994, pp 334-337.

⁴⁶ Private information.

⁴⁷ <http://www.comeclean.org.uk/articles.php?articleID=132>.

Defence avoids revealing the location of UKSF, although the site was clearly identified several years ago.

UKSF is run by the Strategic Weapons Project Team (SWPT) with support from Mass Consultants. Mass Consultants employ mathematicians and computer programmers at UKSF. The Project Manager for Mass Consultants at UKSF is a former Trident missile officer.

The information which programmes missiles to attack specific targets is generated in the UK Strategic Weapons Targeting System (SWTS) and would be implemented by the Fire Control System on a Trident submarine. UKSF is a critical part of SWTS. It produces the software for the targeting system, using a mix of UK and US components, and it coordinates the computer network over which targeting is carried out.

UKSF also tests the US-supplied software for the Fire Control System and issues it to submarines. UKSF has a Mk98 Fire Control System. This hardware is identical to that on a Trident submarine. Like the submarine hardware, it is purchased from the US. When the Navy is introducing a hardware upgrade, UKSF operates both the old and the new modifications of the system. Personnel at UKSF who work on the Fire Control System software visit the US Navy site at Dahlgren, Virginia, where this software is produced. American technicians from Dahlgren are seconded to UKSF when required.

UKSF are involved in assessing the performance of Trident, including analysing data from missile tests and the detailed electronic logs from each submarine patrol. Personnel involved in this work visit the Applied Physics Laboratory (APL) at John Hopkins University in Maryland. APL has unique expertise in analysing and modelling the performance of Trident missiles. Much of the analysis of the performance of UK Trident is carried out by APL. APL created the Trident Weapon System Accuracy Model which is likely to be a critical component of the UK Strategic Weapons Targeting System and the Fire Control System software on Royal Navy submarines. APL analyse the detailed data logged on each US Navy Trident patrol. They are almost certain to assist the UK in doing the same for Royal Navy patrols.

The people associated with UKSF have been described as the “CSSE Corsham User Community”.⁴⁸ Some of those in the Corsham Users Community are expected to have knowledge of three specific aspects of Trident: nuclear weapons effects, performance and effectiveness.⁴⁹

The UK has developed some of its own models of the effects of nuclear weapons, but it also works closely with the US in this area. Research is shared through Joint Operating Working Group 43 (JOWOG 43).

The Corsham personnel with expertise in “performance” are expected to be familiar with the accuracy, reliability and yield of Trident and with nuclear weapon system information. These are areas in which the UK is almost wholly dependent on models and data provided by the US.

⁴⁸ Nuclear Weapons Functional Competence, MOD, 2006. This document is no longer available online. The revised version which is online (Nuclear Competence Framework, MOD, 2012) provides less detail.

⁴⁹ These people are described as the “Corsham user community”.

Those with expertise in “effectiveness” are expected to know about battle modelling, fratricide and how nuclear weapons interact with their targets and collateral infrastructure. This is another area where UK expertise is limited and the personnel will be largely reliant on US information.

The staff who are “practitioners” in performance or effectiveness produce data files for use in operational planning and studies. Those who are “experts” in these areas certify and approve data files for operational use and studies.

Nuclear Operations and Targeting Centre

The Nuclear Operations and Targeting Centre (NOTC) is located within the Ministry of Defence.

United Kingdom Liaison Office

The United Kingdom Liaison Office (UKLO) is within the United States Strategic Command (USSTRATCOM) headquarters at Offutt Air Force Base, Nebraska. It provides an interface between the UK and US nuclear targeting systems.

Target planning

In Autumn 2015 an updated UK Trident targeting system entered service. In describing this development, Desider (the internal magazine of Defence Equipment and Support) said that this targeting system was one area “where we have to go it alone”.⁵⁰ This is very misleading.

The article says that a similar area, where the UK goes it alone, is the nuclear warhead. Far from being an isolated British development, the current UK Trident warhead is very much the product of collaboration over decades between the US and UK. A senior US official described it as a variant of the UK W76 warhead.⁵¹ The MOD has reluctantly admitted that the UK warhead contains at least three components manufactured in the US. Comparing the targeting system with the warhead only serves to illustrate how it is heavily reliant on US support.

While the overall UK Strategic Weapon Targeting System has been pulled together in Britain, it contains vital components which are of US origin. Its development has only been possible because of US support and there is a formal interface with the US targeting system.

In 2006 the junior defence minister Adam Ingram admitted, “The UK shore-based target planning system for Trident is validated through a range of UK and US research programmes”.⁵²

Soon after the UK decided to move from Polaris to Trident D5, the MOD realised that the complexity of planning attacks with Multiple Independently Targeted Re-entry Vehicles (MIRVs) meant that there would need to be closer cooperation with the US on the technical details of target planning.⁵³

⁵⁰ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484828/20151210-desider_90_Dec2015.pdf

⁵¹ Project On Nuclear Issues interview with Franklin Miller KGB, Special Advisor to President George W Bush & Senior Director for Defense Policy and Arms Control.

⁵² Written Answer by Adam Ingram, Hansard 12/10/2006.

⁵³ Project On Nuclear Issues interview with Franklin Miller KGB,

At the heart of the UK target planning system are a number of complex mathematical models which have been acquired from the US nuclear planning system. These models and the systems that use them are not static, but are subject to regular upgrades. The description of these upgrades reveals the dependence on US software. For example, the US rewrote some of its models into a new computer language, C++ rather than Fortran. Computer programmers at UKSF then had to modify the UK system to accommodate the change.

In the 1980s the US supplied the UK with the footprinting model which calculates the area within which nuclear warheads on a specific Trident missile can be targeted, taking account of range and trajectory.⁵⁴ Since 2005 the US Navy has been using a footprinting model which is part of the SLBM Integrated Planning System (SIPS). It is likely that the UK SWTS is based on this and the other modules in SIPS.

At the core of SWTS is a computerised network between UKSF (Corsham), NOTC (London) and UKLO (Omaha). The recent upgrade to SWTS is called the Common Planning System. The term “common” may refer to how it functions across these three sites.

Fire Control System

The Fire Control System (FCS) on a UK Trident submarine processes targeting information and sends instructions to Trident D5 missiles and their nuclear warheads. The FCS handles information on targets and the submarine’s location as well as bathymetric, gravity and metrological data. The hardware and software for the FCS on UK Trident submarines is produced by General Dynamics Advanced Information Systems (GDAIS) at the Naval Surface Warfare Center Dahlgren Division (NSWCDD) in Virginia, US. There have been several complete upgrades of the hardware since the FCS was introduced and there are regular software modifications. There are numerous references in US Navy contracts to providing software and hardware for the Trident Fire Control System on UK submarines, including several references to UKSF. Hardware and software updates to the FCS are tested in UKSF before they are introduced on Royal Navy submarines.

Media Generation System

The US Navy has a Media Generation System (SMGS) at Dahlgren.⁵⁵ This formats software and data on shore prior to it being installed in the Fire Control System on a submarine. There is a similar SMGS system at the UKSF in Corsham. The US Navy has issued several contracts for work on this UK Media Generation System.

Relationship of UK targeting system with US Strategic Command

The British Trident system is designed to be used either as part of a larger NATO nuclear attack plan or independently. Both sets of plans are created within the SWTS system.

⁵⁴ Project On Nuclear Issues interview with Franklin Miller KGB,

⁵⁵ The S in SMGS is for SCSI (Small Computer System Interface) in most Trident contracts, however in two cases, including one referring to the UK, the S is for Software. Inconsistent use of abbreviations is commonplace in US contract summaries.

NATO plans are deconflicted at STRATCOM in Omaha, Nebraska . This is a process which adjusts the use of US and UK forces to reduce mutual interference. For example, the timing of attacks with British and American warheads on targets in the same area will be adjusted to minimise fratricide.

An insight into the integration of US and UK nuclear target planning is provided in two guidance documents from the Chairman of the Joint Chiefs of Staff.

CJCSI 3231.04E shows that, in the case of the use of British Trident in a NATO attack plan, the key targeting data is lifted from STRATCOM's Sortie Data Manual (NATO).⁵⁶ The information is passed by STRATCOM to the UKLO at Omaha who forward it to UKSF (Corsham) and NOTC (London). The UK has access to this data on a "daily and continuing basis".

This US nuclear planning data has a very high security classification - Nuclear Command and Control Extremely Sensitive Information (NC2 ESI). Information which is classified as NC2 ESI should normally only be handled by US personnel. CJCSI 3231.04E says that a sanitized form of some of this information can be passed to the three locations in the British targeting system.

A second US document, CJCSI 5220.01A, says that the normal restrictions on US nuclear planning information are modified "to permit the release of information to United Kingdom (UK) operational personnel assigned to USSTRATCOM".⁵⁷ But the extent of disclosure is controlled – "The number of personnel authorized access to this sensitive information should be limited to those absolutely necessary to carry out the USSTRATCOM mission, including exercises and increased DEFCONs. Briefing and debriefing procedures should be followed for UK personnel being assigned to or leaving these need to know positions."⁵⁸

In the case of a NATO nuclear attack plan, the UK force is heavily dependent on support from STRATCOM. This dependence also has implications for any independent attack. The requirement to process NC2 ESI information will mean that the UK has to be transparent about the SWTS targeting system. So the US will be fully aware of all aspects of the system which Britain might use in an independent attack.

Nuclear Firing Chain

The authorisation for a British nuclear attack is issued by the Prime Minister or an alternative minister designated by the Prime Minister. The order to carry out an attack is issued by the Chief of Defence Staff, or an appointed deputy.

⁵⁶ Guidance for the sanitization and distribution of information pertaining to nuclear command and control to Supreme Headquarters Allied Powers Europe (SHAPE); United Kingdom (UK) Liaison Office; UK Strategic Weapons Integrated Project Team; and UK Nuclear Operations and Targeting Centre in support of North Atlantic Treaty Organisation (NATO) operations. Chairman of the Joint Chiefs of Staff Instruction, CJCSI 3231.04E, 12 August 2008.

⁵⁷ Security classification policy for Multiple Independently Targetable Reentry Vehicles and Maneuverable Reentry Vehicles. Chairman of the Joint Chiefs of Staff Instruction, CJCSI 5220.01A, 1 July 2004.

⁵⁸ *ibid*

The Chief of Defence Staff's encrypted order is passed to Command Task Force (CTF) 345 at Northwood in Middlesex. When the order has been verified, CTF 345 issues the appropriate instructions, using all available means of communications, to the submarine or submarines.

The primary means of communicating with submerged Trident submarines is using Very Low Frequency (VLF). The most important of these is the VLF transmitter at Skelton in Cumbria which is controlled from Northwood.

Northwood is also the Broadcast Control Authority for a NATO VLF transmitter at Anthorn in Cumbria and it coordinates a network of NATO VLF transmitters in Noviken (Norway), Rhauderfehn (Germany) and Tavalora (Italy).

The NATO Interoperable Submarine Broadcast System (NISBS) enables messages to be sent to British submarines through a network of American VLF transmitters in Culter (USA), Aguada (Puerto Rico), Sigonella (Italy) and Grindavik (Iceland).

Low Frequency (LF) signals are sent to submarines from the Royal Navy transmitter at Forest Moor.

Other critical vulnerabilities to US cyber attack in the UK Trident system

Nuclear Warhead Arming, Fuzing and Firing System

The Arming, Fuzing and Firing System (AF&F) in the UK Trident warhead is manufactured in the US. It is a slight variant of the AF&F deployed on the US W76 warhead. The hardware and software in the AF&F are produced in the US. UK Trident warheads are currently being upgraded from Mk4 to Mk4A. The modification programme includes replacing the AF&F with a new US-supplied Mk4A AF&F. The new AF&F has substantially more computer power. It can carry out more sophisticated targeting, and monitor the status of the warhead.

Nuclear Warhead Intent Word

The new Mk4A AF&F requires a unique authorisation code (Intent Word) before the warhead can detonate. The hardware and software for the UK Intent Word system is produced in the US. The US Navy issued contracts for the development of UK Intent Word and the displays for UK Intent Word as part of contracts for the Trident Fire Control System.⁵⁹

D5 Missile Flight Electronics and Guidance Systems

The flight of UK Trident missiles is controlled by the Flight Electronic System and the Guidance System. These are replaceable components on the missile. The hardware and software in both systems is produced in the US.

⁵⁹ FBM Fire Control Mod 4/5 software, contract N00030 04 G 0046NJ16, 20 December 2004. FY05 Mod 5 UK Intent Word Displays, contract N00030 02 G 0054NJ52, 17 March 2004. US/UK software, fleet documentation and UK Intent Word, contract N0030 04 G 0046NJ41, 20 July 2005.

Finding and Shooting down Trident

Anti-Submarine Warfare

In addition to the wide range of cyber options open to the US if it wished to interfere with British Trident there are also options for finding the submarines and even shooting missiles down after launch.

The US Navy has devoted huge assets to Anti-Submarine Warfare since the 1950s. These were developed against Soviet and now Russian submarines. Much of this work was conducted with the British. These allies claim that they tracked every Soviet submarine as it left Russian ports. The claim is that the Russians have never had a clear option to use their submarine launched ballistic missiles without great risk of attack.

While it is generally assumed that US and British submarines disappear into the vastness of the Ocean while on patrol things are not that simple. The accidental collision of British and French submarines in 2009 indicates that operating areas and routes of transit to home port are in fact rather more congested than might be assumed.

The reality of submarine deployments is that they are overseen by the high command. This is formalised at the Northwood Headquarters outside London in a joint UK-US Water Space Management Facility. The submarine equivalent of international air-traffic control. A main purpose of this facility is to allocate areas of ocean to individual submarines and to prevent “Blue on Blue” attacks and to organise protection of the missile submarines from Russian or other interference through the deployment of submarines, ships and aircraft to protect the Trident missile firing submarines. The result is that at all times the British and American Navies are aware of the location of each other’s submarines.⁶⁰

The idea of an Anglo-American conflict is unthinkable in this system. In the event of a breach of US – UK relations in conflict, this system would break down. If this happened at very short notice, the British submarines would have to be sent an order to operate outside the system in which case the US would have every interest in continuing to track them, and would know where to start looking. In the pre-digital age the standard area of operation was around 150 nautical miles long and 40 wide. Equivalent to a strip of land running from Manchester to London. In the age of GPS this has shrunk. In either case it is a small target area of ASW and ABM operations. In any longer period, the US navy would be able to wait outside the Clyde waiting to escort Royal Navy submarines. However bizarre this scenario where “The Hunt for Red October” becomes the “Hunt for HMS Vanguard”, it is at the heart of the mythology of an independent sovereign British force.

There is mounting evidence that the Oceans are not as impenetrable to detection technologies as they have been as is discussed by the British American Security Information Council. In this area of technological advance it is the US that is leading and thus this too would impact the vulnerability of UK submarines.

⁶⁰ <http://www.navalreview.ca/wp-content/uploads/public/vol3num3/vol3num3art4.pdf>

Anti-Ballistic Missile Systems

The US Navy is now equipped with a system for shooting down missiles and has it installed on dozens of its warships. Major funding for these deployments began in 2016. This Aegis system has a proven capability against ballistic missiles. It is important to note that in the first – boost – phase after firing Trident missiles travel comparatively slowly and are thus easier to shoot down.

There are more than 20 US Navy Cruisers and Destroyers equipped with missile systems designed to shoot down other missiles. The weapon concerned is the Aegis Block 3 system.⁶¹

The 16 missiles on a British Trident boat are not intended to be fired simultaneously but rather one after the other with a technical delay between each firing. As the submarine nears the surface to prepare for firing it becomes more detectable. As soon as one Trident is launched the intense heat from the missile makes it instantly visible to hostile Anti-Submarine Warfare forces which could then concentrate sea and airborne missiles on the launch point to destroy the launching submarine. A process exercised intensely by the US and the Royal Navy against possible Soviet and now Russian missile attack for decades. Long ago the Soviet response to Allied ASW was to place their submarines underneath their surface fleet for protection, and to prepare to fire missiles through the ice of the Arctic.

⁶¹ http://www.mda.mil/system/aegis_bmd.html

Conclusion

The accumulated evidence of the development of US-UK military co-operation demonstrates that the UK has not for decades been an independent nuclear weapons power and that in extremis the US has every ability to prevent the UK from using Trident even to the level of sinking submarines or shooting down missiles.

There may be other reasons for investing in Trident, but preserving an independent nuclear weapons capability to meet unforeseen worst case threats is not one of them. Such threats by definition would involve a neutral or hostile US which has the clear ability to prevent their use in the immediate, short and long term.

Appendix I:**US-UK trade in nuclear explosive materials**

DECLASSIFICATION OF THE QUANTITY OF PLUTONIUM ACQUIRED FROM THE UNITED KINGDOM UNDER BARTERS A, B, AND C OF THE 1958 UNITED STATES/UNITED KINGDOM MUTUAL DEFENSE AGREEMENT, 22 December 1997

The Department of Energy committed to provide any additional information that could be released regarding plutonium inventories. DOE, with the cooperation of the United Kingdom (UK) Government, is releasing additional information regarding nuclear materials barter, i.e., the quantity of plutonium received from the UK and the tritium and highly enriched uranium provided to the UK under each of the individual Barter (A, B, and C). In addition, the Department is releasing information regarding the quality of the plutonium in terms of Pu-240 content. The release of this information will provide the public with more information regarding plutonium inventories.

SPECIFICALLY:

	Barter A 1960 - 1969	Barter B 1964 - 1969	Barter C 1975 - 1979	Total
Plutonium Received from the UK	0.5 metric tons	4.1 metric tons	0.8 metric tons	5.4 metric tons
Tritium Delivered to the UK	6.0 kilograms	None	0.7 kilograms	6.7 kilograms
HEU Delivered to the UK	None	7.5 metric tons	None	7.5 metric tons

The Pu-240 content of the 5.4 metric tons received under the barter was as follows:

Pu-240 content	Metric Tons Received
2 per cent	0.1
10 - 12 per cent	1.2
13 - 15 per cent	1.9
16 - 20 per cent	2.2
Total	5.4

BACKGROUND:

The total quantity of plutonium received by barter was announced in February 1996; today we are releasing the quantities received for each of the individual barter. Programs for mutual defense and international cooperation in the peaceful uses of atomic energy are authorized by the Atomic Energy Act of 1954, as amended. The 1958 United States/United Kingdom Mutual Defense Agreement had barter provisions for the exchange and safeguarding of atomic material.

Most plutonium was shipped from the UK to the Hanford and Savannah River Sites. Prior to 1964, some plutonium received under Barter A was used for military purposes. In 1964, the U.S. and the UK agreed to use Barter A and Barter B plutonium for civilian programs and that an equivalent amount of U.S. plutonium could be substituted for UK plutonium in U.S. civilian programs. Civilian programs include californium production and reactor research. The Barter C was not so restricted. Some of the plutonium received under Barter C was used in U.S. nuclear weapons.

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