UK NUCLEAR WEAPONS

Resolution Class (A3 Polaris missile) Submarines carried 16 missiles fitted with 3 warheads each.

- Range 2500 nautical miles
- Each warhead (200kt) was roughly equivalent to 12 x Hiroshima*
- 1 missile with 3 warheads was therefore equivalent to 36 x Hiroshima
- A full 16 missile salvo would have been equivalent to 576 x Hiroshimas.

Vanguard Class (D5 Trident missile) Submarines can carry 16 missiles* with up to 8 warheads each

- Range 7500 nautical miles
- Each warhead (100 Kt) is roughly equivalent to 6 x Hiroshimas
- 1 missile with 8 warheads is therefore equivalent to 48 x Hiroshima
- A full 16 missile salvo is equivalent to 768 x Hiroshimas

* The UK has reduced its onboard loadout of weapons. Each Trident submarine now carries only 8 missiles with a total of 40 warheads dispersed amongst them. So total destructive capability is much reduced at 240 x Hiroshima. Targeting data is not loaded into missiles on patrol but would be if a threat was imminent.

Dreadnought Class (D5 Trident missile) Submarines - this successor to the present Vanguard Class will carry 12 missiles with up to 8 warheads each

- Range 7500 nautical miles
- Each warhead (100 Kt) is roughly equivalent to 6 x Hiroshimas
- 1 missile with 8 warheads is therefore equivalent to 48 x Hiroshima
- A full 12 missile salvo is equivalent to 576 x Hiroshimas

Radiation effect is far harder to assess as it is entirely dependent on blast height and wind direction/force and could affect millions of square miles downwind.

UK DEPENDENCY ON US

When the Government says UK Trident is 'Independent' they are being very economical with the facts. Whilst it is correct that a missile can be launched from an RN submarine on patrol without US support, whether the missile can accurately hit its target is dependent on US technical support. We are also heavily dependent on having any missiles to fire in the first case.
• "(The Trident WeaponSystem) is...a hostage to American goodwill...the dependency is critical and will continue to be" (Professor Colin Gray in evidence to the Defence Committee in 2006)

• "If the United States were to withdraw their cooperation completely, the UK nuclear capability would probably have a life expectancy measured in months" (Report published by British American Security Information Council July 2104. Cross party groups of both nations comprise BASIC's members)

The UK Parliament's Defence Select Committee detailed report of UK dependency on US support (see report following) shows that the level of dependency is significantly higher than the Government would lead the public to believe. Not included in the report is the fact that the UK is designing and building (with US assistance) a common 12 missile module for both USN and RN Trident Successor submarines. This is planned to go to sea with the RN before the USN.

UK Parliament Select Committee on Defence 7 March 2006 (para numbers are as in Annex B to their report)

**UK'S TRIDENT SYSTEM NOT TRULY INDEPENDENT**

33. Acquiring Trident gave the UK a greater nuclear weapons capability than it could ever have achieved on its own. This enhanced capacity, however, had significant consequences.

34. The fact that, in theory, the British Prime Minister could give the order to fire Trident missiles without getting prior approval from the White House has allowed the UK to maintain the façade of being a global military power. In practice, though, it is difficult to conceive of any situation in which a Prime Minister would fire Trident without prior US approval. The USA would see such an act as cutting across its self-declared prerogative as the world's policeman, and would almost certainly make the UK pay a high price for its presumption. The fact that the UK is completely technically dependent on the USA for the maintenance of the Trident system means that one way the USA could show its displeasure would be to cut off the technical support needed for the UK to continue to send Trident to sea.

35. In practice, the only way that Britain is ever likely to use Trident is to give legitimacy to a US nuclear attack by participating in it. There are precedents for the USA using UK participation in this way for conventional military operations. The principal value of the UK's participation in the recent Iraq war was to help legitimise the US attack. Likewise the principal value of the firing of UK cruise missiles as part of the larger US cruise missile attack on Baghdad was to help legitimise the use of such weapons against urban targets.

36. The most likely scenario in which Trident would actually be used is that Britain would give legitimacy to a US nuclear strike by participating in it.

37. The well-established links between the US Strategic Command (STRATCOM), in Omaha Nebraska and the UK's Permanent Joint Headquarters in Northwood, London would facilitate the planning of such attacks. In a crisis the very existence of the UK Trident system
might make it difficult for a UK prime minister to refuse a request by the US president to participate in an attack.

38. The UK Trident system is highly dependent, and for some purposes completely dependent, on the larger US system. The assembling of information available in the USA, but kept secret in Britain, by John Ainslie in his 2005 report *The Future of the British bomb*, shows how extensive this dependency is (see table below).

39. The UK's dependency on the USA has operational significance. For example, the UK's reliance on US weather data and on navigational data provided by the US Global Positioning System (GPS) means that, should the USA decide not to supply this data, the capacity of the UK's Trident missiles to hit targets would be degraded.

40. Conversely, the close relationship between US and UK systems also means that the upgrades to the US Trident system have already been incorporated into the UK Trident system. The Royal Navy's adoption of the new US fire control system has most likely already improved its capacity to retarget its Trident missiles rapidly in order to hit a range of targets outside Russia—thereby adding to other states' concerns that they could be the target of a combined US/UK Trident strike.

<table>
<thead>
<tr>
<th>System</th>
<th>Degree of dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warhead</strong></td>
<td>The UK warhead is a copy of the US W76 warhead.</td>
</tr>
<tr>
<td>Arming, fusing and firing system</td>
<td>This triggers the explosion. The model used in UK warheads was designed by the US Sandia Laboratory and is almost certainly procured from the USA.</td>
</tr>
<tr>
<td>High-explosive (HE)</td>
<td>This starts the nuclear explosion. The UK uses a different HE to the USA. Key explosives calculations for the US warhead cannot simply be duplicated so US labs assess the UK HE's long-term performance.</td>
</tr>
<tr>
<td>Neutron generator</td>
<td>This initiates nuclear fission. The neutron generator used in UK warheads is the MC4380, which is manufactured in the USA and acquired &quot;off the shelf&quot;.</td>
</tr>
<tr>
<td>Gas reservoir</td>
<td>This supplies tritium to boost the fission process. It is most likely that the reservoir used in UK warheads is manufactured in the USA. UK gas reservoirs are filled with tritium in the USA.</td>
</tr>
<tr>
<td>Re-entry body shell</td>
<td>This is the cone-shaped body which contains the warhead. The UK purchases the Mark 4 re-entry body shell from the USA.</td>
</tr>
<tr>
<td><strong>The D5 missile</strong></td>
<td>The UK does not own its Trident missiles—they are leased from the USA. UK Trident submarines must regularly visit the US base at King's Bay, Georgia to return their missiles to the US stockpile for maintenance and replace them with others.</td>
</tr>
<tr>
<td>Guidance system</td>
<td>The Mark 6 guidance system used on the UK's Trident D5 missiles is designed and made in the USA by Charles Stark Draper Laboratories.</td>
</tr>
<tr>
<td><strong>Submarines</strong></td>
<td>UK Vanguard-class Trident submarines are UK-made, but many aspects of the design are copied from US submarines and many components are bought from the USA.</td>
</tr>
<tr>
<td>Navigation</td>
<td>The high accuracy of the Trident D5 missile depends on the submarine's position being precisely determined. This is achieved using two systems: GPS, which relies on satellites, and the Electrostatically Supported Giro</td>
</tr>
</tbody>
</table>
Navigation System (ESGN), which uses gyroscopes. In both cases UK Trident submarines uses the same US system as the US Navy submarines. The USA 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.

**Targeting**

Target packages are designed and formatting tapes produced on shore, then stored on the submarine—using US software at each stage.

**Onshore targeting**

The software installed in the computers at the Nuclear Operations and Targeting Centre in London is based on US models and is probably derived from the US Navy's Submarine Launched Ballistic Missile Integrated Planning System.

**Weather and gravity data**

The US Navy supplies local gravitational information and forecasts of weather over targets, both of which are vital to high missile accuracy, to US and UK submarines.

**Fire control system (FCS)**

Used to assign targets to the warheads on the submarines. UK submarines carry a slightly different model to that on US submarines. However, all the hardware and software used by the system is US-produced. The hardware is produced by General Dynamics Defense Systems. The contracts show that the UK uses similar, if not quite identical, software.

**Management**

British nuclear warheads are designed and made at Aldermaston near Reading. Aldermaston is part managed by the US corporation Lockheed Martin. Repairs to Britain's Trident submarine are carried out at Devonport, which is part managed by another US corporation, Halliburton.

**Research and development**

There is extensive cooperation between Aldermaston and America's nuclear weapon laboratories—Los Alamos in New Mexico and Sandia and Lawrence Livermore in California.

**Testing**

The W76 warhead was tested at the US nuclear test site in Nevada in the early 1990s. The UK has no test site of its own. The missiles are test launched from British submarines under US supervision at Cape Canaveral off the Florida coast. These tests are analysed by the Applied Physics Laboratory (APL) at Johns Hopkins University and by the Charles Stark Draper Laboratories.

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**THE SUBMARINE COLD WAR - RECOMMENDED READING**

**Hunter Killers** by Iain Ballantyne. Iain is well know naval author to whom four of us submarine Captains told our experiences and who incorporated them into a history of the submarine Cold War seen largely through the eyes of the participants.

**The Silent Deep** by Lord Peter Hennessey and James Jinks. Both are professional historians who wrote this MOD authorised history of the UK submarine Cold War. It is particularly interesting in their account of the politics behind the UK/US relations leading to the development of nuclear submarines and the Nassau Agreement (December 1962) by which the UK acquired the Polaris Missile System and subsequent Cold War political shifts.