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Independence of Trident

Def Cmt 6 Feb Des Browne, was clearly prepared to answer a question on whether Trident was independent, he wasn't asked - but nevertheless took the opportunity to make his case -

"The first point about independence in relation to the nuclear deterrent is that it is entirely operationally independent and we jealously guard that operational independence"

The White Paper makes five points about operational independence: Three of these I wouldn't argue with:

- (1) Only the PM can authorise the use of UK nuclear weapons
- (2) The instruction to fire would be transmitted using UK codes and equipment
- (3) Trident does not rely on GPS satellites

However there are two more general points that I would query:

- (1) Decision-making and use of the system remains entirely sovereign to the UK
- (2) All the command and control procedures are fully independent

The reason I query this is because the UK may be able to get a launch message from the PM to the RN missile technician on the submarine, in front of his computer, but once he enters the instruction into the computer it is handled by American software. It is at this final stage in the chain that we may lose control.

Computer software is becoming critical to more and more aspects of life - whether it is road charging, the ambulance service, air traffic control, or the Health Service - IT systems are increasingly at the heart of modern life. No more so than in nuclear weapons planning. In the 1960s the most powerful computers of their day were used to prepare the target plans for Polaris missiles.

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As the US moved from Polaris to Poseidon, then Trident 1 and then to Trident 2, the software demands increased substantially. Trident is designed to be far more accurate than earlier missiles. This accuracy is achieved by creating computer models of every aspect of the system. Trident submarines only launch from areas of the seabed which have been surveyed in detail - because the missile is very sensitive to the localised effects of gravity. Minute changes in velocity can also have a substantial impact on where the warhead lands. So the US Navy produced a series of very complex computer models which lie at the heart of the Trident system. For example the Weapons System Accuracy Model for Trident includes over 900 tables of data.

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When Britain decided to buy Trident the initial intention was that at least some of the software should be created here. This was revealed in an Audit Office report in 1988 which said:

"proving the effectiveness of the system for UK purposes is dependent on the production in the UK of software for targeting, modelling and effectiveness assessment".

The same report revealed that this was a weakpoint in the Trident system, because the MoD was finding it impossible to recruit enough people with the necessary qualifications. When asked about this 6 years later they said that they had solved the problems using a mix of internal expertise and contractor support. At that time, in the early 1990s, I had contact with one of the US experts involved in accessing the British Trident system, and I was told that the UK had to rely on experts from the US laboratories, because British expertise was negligible.

The main source of data for Trident is test flights. When missiles are fired from British submarines the tests are monitored by the Applied Physics Laboratory of John Hopkins University in Maryland – the Laboratory then analyse the data. They probably also carry out the main overall assessment of the UK Trident system.

Over the last 10 years the US Navy has placed a series of contracts with US companies for fire control and targeting software for the British Trident system. One of these contracts refers to reference/simulation and targeting models for the UK. These models are at the heart of the Trident system.

This software is then handed over to British experts. For some time I have been wondering where, in the UK, this work was done. Over Christmas I accidentally stumbled across the answer. I was helping with a study into the number of jobs dependent on Trident, as part of this I was trying to find out how many people work on Trident at Abbey Wood in Bristol, when I came across several reference to the Corsham Computer Centre with relation to Trident. This is a mysterious facility 30 metres underground near Bath. During the 1930s a complex of subterranean factories and stores were built in old stone quarries. One of these was equipped as Britain's number one command bunker. This is where the Queen and Prime Minister would have been sent in the event of nuclear war. It was kept secret for 40 years and only declassified 4 years ago. There was a feature on it in the Guardian recently. It is no longer active. However 800 metres away is another bunker which is still operational. This is the Corsham Computer Centre. This houses the IT system which is used to prepare nuclear attack plans. The analysts who use these computers assess the performance and effectiveness of Trident. If the MoD wants to find out what would happen if they drop one nuclear warhead on a building in Iran, this is where they will find the people who can tell them.

I came across one reference describing the work of one of these analysts. One of his tasks is to update and modify US models for inclusion in the suite of computer software in the UK Trident system.

This is a very secretive area, no minister has ever disclosed the function of the Corsham Computer Centre. The need for secrecy dominates and determines the nature of the Anglo-American relationship when it comes to nuclear planning. There are several US documents which hint at how this relationship works. Basically a lot of US nuclear targeting information is given a special classification, SIOP ESI, data with this security level should only be handled by US citizens. So before nuclear targeting software is passed to Britain it must first be sanitized – ie all the elements that are too highly classified must be removed. This doesn't just affect the tables of data, it also includes the computer code and the instruction manuals. So what the US hands to Britain are Trident models where there are lines of code missing from the software, tables of data missing, and sections of the manual deleted.

If you try to buy a computer game, or other software for home, then you often have the choice of paying say £30 for the full version, or you can get a free "demo" version. The problem with the free version, is it has been crippled. Either it only works for 30 days, then stops completely, unless you pay up. Or it will do some things, but not what you most want it to do. The software which the US Navy gives to Britain is a bit like a "demo" version of a computer game – it is not complete.

Could the US use this control over software – to give themselves a veto over the British Trident system ? From the perspective of Washington it would be desirable to create the impression that Britain can use Trident independently while at the same time maintaining a veto over actual use. One particular concern will be the potential for Britain to launch 144 nuclear warheads at the United States.

General restrictions

Preventing the use in all circumstance except tests, or preventing the missiles from being fired Westward, towards the US from the normal patrol areas, should be possible.

Restricting the system to only NATO or joint US/UK plans

The fire control system can probably distinguish an independent British plan from a NATO or Anglo-American plan. Any allied or joint plan would have to be deconflicted. This is a process of integrating two plans to ensure that they do not undermine each other's effectiveness. For example debris in the fallout cloud from the explosion of a British nuclear explosion could cripple a US nuclear weapon and prevent it from detonating. For reasons of complexity and classification it is not possible to run a US attack plan through the British computer system. Deconflicting can only be carried out by running the British plan through the main US nuclear planning system

at Strategic Command in Omaha.¹ This deconflicting process is likely to leave a trace in the data which could be detected by the fire control software on the submarine. If the software can distinguish a NATO plan from an independent one, then it could possibly prevent the independent plan from being implemented.

Restricting use by manipulating weather data

A NATO or Anglo-American plan would probably use US weather data. The fire control system requires details of weather over the target area if it is to achieve the desired level of accuracy. For an attack on Russia a large amount of data is required on wind speed and air density at various altitudes. This data has to be transmitted over VLF. It is compressed and formatted in the US into Ballistic Parameters (Balpars).² These are transmitted every 12 hours. There are similar mechanisms for producing detailed weather data when Trident is being retargeted against specific targets.³ It is possible that information could be contained within Balpars or other weather data that would have the effect of switching on or off the UK fire control system.

If the US tampered with the software would we find out ?

The US Navy asked Mountain State Information Systems to check the security of the US Trident software. The company's description of this work reveals that this was a complex task for which they had to develop new techniques. This suggests that if the US programmers tried to hide commands within the software it would not be easy for British experts to find them.

The task is made particularly difficult because of the holes in the code, data and manuals where items have been removed for reasons of security. This means that there will be parts of the UK software which do not make sense. But the US manufacturers will not be able to explain the anomalies because the missing material is classified.

As the software has a mixture of cut-down US components and British elements it will be a difficult task to get it to work. This is probably the main focus of the British software effort. Checking to see if the Americans have crippled the code is probably not a priority.

This does not establish that the software has been crippled, but does suggest that it could be. The only way that Britain can guarantee that the Trident software has not been modified would be to produce it all ourselves. But we do not currently have the expertise to do this.



¹ Rear Admiral Irwin said "We plan and deconflict our NATO target plans with the targeting centre in Omaha", Minutes of meeting on 10 March 1993; Progress of Trident, 6th Report, House of Commons Defence Committee 1993.

² Computation of Ballistic Parameters for SLBM, NSWCDD Technical Digest 1997.

³ The hardware and software of the US and UK Trident systems were upgraded in 2002 to increase flexibility in retargeting. Research was carried out into metrological inputs for both systems as part of the upgrade.

Submarines

Barrow – Astute problems – turned to Electric Boat in US for help
Reactor – British design evolved from US design
Fuel – HEU – final enrichment at Portsmouth Ohio

Missiles

Polaris – purchased missiles from US, remotored at Coulport on Clyde
Trident – not just procured from US, but overhauled there –
withdrawn from a common pool of missiles

Warhead

Possible parallel – Eurofighter or Airbus – where the wings of an aircraft are built in one country, and the fuselage in another.

Warheads – Anglo American.

The warheads on British submarines contain some components made at Aldermaston, and others manufactured in the US. Just as a plane like Eurofighter won't fly without wings, so the warhead won't work unless it has both the British and American parts.

The White Paper –

“The UK produced a new nuclear warhead to coincide with the introduction into service of the Trident system. This warhead was designed and manufactured in the UK by AWE, although it was decided that it would be more cost effective to procure certain non-nuclear components of the warhead from the United States”

This implication that this is a British design is misleading - the PRO paper on this says “Anglicised” – ie a US design was modified.

With regard to components from the US - the term “non-nuclear” is being stretched a bit. One of the components purchased off the shelf from the US is the Neutron Generator, this contains small amounts of tritium, a radioactive material. The NG plays a critical role in initiating the nuclear reaction. There are references in US sources to the supply of NG to the UK.

A second crucial component is the arming, fuzing and firing system – this triggers the warhead – AF&F includes a radar system so the warhead can detonate at a fixed height, and a contact fuse – so it can explode when it hits the surface. This works as part of the overall missile system and is designed by Sandia Laboratory.

A third part is the tritium reservoir – this is a small sphere of stainless steel which holds the tritium until the warhead is about to detonate. Tritium from the British stockpile is flown to the Savannah River Site in the US where it is loaded into these small reservoirs – and flown back to Britain.

Tritium supply is a critical part of the nuclear weapons programme. Until 2002 tritium was produced at Chapelcross Power station – but this has now closed down and the tritium plant is being

decommissioned. Tritium has a short half life – this means that in 50 years time we will only have 8th of the current stock, the other 7/8th will have changed into helium. To keep NW until 2055 AWE will have to either (a) use an existing or new reactor and build a new processing plant; or (b) buy tritium from the US. This does not appear openly in the costs in the White Paper.

Warhead is not identical to US version – eg HE not PBX9501 but EDC 37 – but critical tests of EDC 37 are carried out in US. Even where the warhead is uniquely British – it depends on US support.