

## Targeting Trident and nuclear dependence

The town of Corsham in Wiltshire has been a place of secrets for over 70 years. Quarrying for Bath stone in the 19<sup>th</sup> and early 20<sup>th</sup> centuries left the area honeycombed with underground tunnels and caverns. In the 1930s the Ministry of War converted some of these into underground factories manufacturing aircraft engines and weapons. Other quarries became parts of a massive ammunitions depot.

During the Cold War part of this complex took on a new role. Millions of pounds were spent converting Spring Quarry into the alternative centre of government. In the event of nuclear war the Queen, Prime Minister and 1,000 senior officials would all have been ferried from Whitehall to Corsham. The existence of this huge command bunker was only declassified in 2004.<sup>1</sup> The codename was changed every few years. It was initially called SUBTERFUGE, then BURLINGTON and was later known as SITE 3. Site 3 no longer has any military role. It was sold to a media company in 2005.

800 metres from Site 3, at the end of a short lane there is an artificial mound with a doorway.<sup>2</sup> This leads underground into the Corsham Computer Centre or CCC. The centre is at the East end of the old Tunnel Quarry ammunitions store. This Quarry is an underground complex with a total area of 44 acres. It had its own internal railway system linked to the nearby main line. It ceased being an ammunition depot in 1962.

Ministers have never told Parliament the purpose of the Corsham Computer Centre. There is a reference to the facility in the 2001 National Assets Register. This says that the land, offices and plant of the centre are worth £29.8 million.<sup>3</sup>

The intense secrecy surrounding the centre has led to various rumours. One theory is that it carries out research into Unidentified Flying Objects. This is not completely wide of the mark. Inside the hidden complex scientists analyse how objects perform in space. But they are not studying UFOs. They are calculating the trajectories that Trident nuclear missiles would follow if they were launched towards their targets.

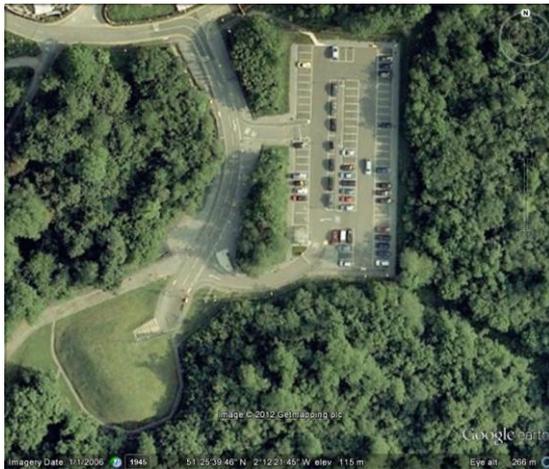
At one end of the old underground labyrinth nuclear weapons are a historical curiosity. The issue is how to conserve the Prime Minister's Cold War bolt-hole for future visitors. At the other end of Tunnel Quarry the potential of nuclear weapons is very real and current. The computers crunch the numbers to calculate exactly where a Trident warhead must land in order to bring death and destruction to someone hiding in a deep underground bunker thousands of miles away.

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<sup>1</sup> In 1998 the MoD would not reveal to Parliament the true purpose of Spring Quarry, saying only that until 1995 it had been used as "a bulk storage area with both military and civil communications facilities". Hansard 21 July 1998.

<sup>2</sup> The aerial photograph shows a car park for over 70 cars near the Centre which is on Peel Circus. Today there is a large housing development under construction North of the Centre. The development includes the car park site. In 2001 the MoD were granted planning permission to relocate a car park in Peel Circus. The security arrangements for Corsham were reviewed when the housing development was proposed - Hansard 5 December 2001.

<sup>3</sup> In comparison Northwood is valued at £76 million. The value may not include computers.



*Corsham bunker (bottom left) & car park*

*Bunker entrance*

Two MoD logistical documents reveal the link between Corsham and Trident. They list the supply codes for installations involved in the Trident programme. One refers to the “Corsham Computer Centre” while the other includes the “Corsham Software Facility”.<sup>4</sup>

The Strategic Systems Integrated Project Team (Stratsys IPT) support the Trident programme from their base at Abbey Wood in Bristol, 20 miles from Corsham. One of the functions of the IPT is to provide the hardware and software for targeting Trident. In 2000 they issued a contract to Mass Consultants Ltd for the management of a highly secure computer centre for the British nuclear weapons’ system.<sup>5</sup> The facility concerned is the Corsham Computer Centre. The contract is worth £43 million and runs until 2010.<sup>6</sup> Several IT companies are involved in the project.<sup>7</sup>

The leader of the Stratsys IPT is also the Chief Strategic Systems Executive (CSSE).<sup>8</sup> One MoD document refers to the “CSSE Corsham User Community”.<sup>9</sup> This will include people who work in the Corsham Centre and possibly others who can access the system remotely.<sup>10</sup>

<sup>4</sup> Listing of Polaris/Trident Services, JSP 336 Vol 11 Part 8 Annex 20.1

[http://www.ams.mod.uk/ams/content/docs/jsp336/3rd\\_ed/vol11/pt8/c20a20\\_1.doc](http://www.ams.mod.uk/ams/content/docs/jsp336/3rd_ed/vol11/pt8/c20a20_1.doc)

; Listing of Trident Customers and UINs Annex A to SCMI 2.32, 20 September 2006

[http://www.ams.mod.uk/ams/content/docs/jsp336/3rd\\_ed/vol11/scmi/pg000054.doc](http://www.ams.mod.uk/ams/content/docs/jsp336/3rd_ed/vol11/scmi/pg000054.doc)

<sup>5</sup> Mathematic and Associated Scientific Services (Mass Consultants) [www.mass.co.uk](http://www.mass.co.uk);

<sup>6</sup> The contract accounts for almost 40 % of the turnover of Mass Consultants Ltd and could employ around 40 of their staff. The company employ around 100 people in total. Acquisition of Mass Consultants by Cohort plc, 2006.

<http://www.cohortplc.com/downloads/060727%20Acquisition%20of%20MASS.PDF>

<sup>7</sup> In addition to Mass Consultants the other firms Matra Bae Dynamics, Computer Sciences Corporation, CSF Solutions, IBM and Planned Management Engineering. INSYS are not listed but are likely to provide support to Corsham.

<sup>8</sup> The current holder of both posts is Commodore David Jarvis.

<sup>9</sup> Nuclear Weapon Functional Competence; probably written in Abbey Wood.

<http://www.ams.mod.uk/ams/content/docs/peopacq/comframe/nuc/nucweap.pdf>

<sup>10</sup> Mass Consultants say that they are seen as a member of Stratsys IPT to the “user community” and not as a contractor team. [www.mass.co.uk](http://www.mass.co.uk)

The document indicates that one function of the Corsham Computer Centre is to assess the performance and effectiveness of the Trident nuclear system.<sup>11</sup> This performance and effectiveness assessment work is broken down into three skill areas:

1. Nuclear Weapons Effects Analysts use computer programmes to calculate the effect of nuclear weapons on people, equipment facilities and infrastructure.<sup>12</sup>
2. Nuclear Weapons Performance Analysts produce assessments of the performance of Trident. This data is used in operational planning and in effectiveness studies. Those working in this skill area are expected to understand how accuracy, reliability and yield affect the performance of Trident.
3. Nuclear Weapons Effectiveness Analysts use computer tools to analyse the effectiveness of Trident. They produce data files that are used in operational planning and studies. Those working in this skill area are expected to understand:
  - a. Fratricide. This is how one nuclear weapon can destroy another if they are aimed at the same target or at targets that are close together.
  - b. Threats to the system. This will include calculating the effects of Anti-Ballistic Missiles systems, particularly the one around Moscow.
  - c. Battle Modelling
  - d. Weapon interaction with targets and collateral facilities.

The assessment procedures described above are part of the nuclear targeting process. Plans are drafted then assessed in simulations. Each draft is adjusted and run through a simulation until the plan is perfected.

If the MoD plans a nuclear attack on a facility in Iran then the Corsham Computer Centre will plot the precise trajectory of the Trident missile and its warheads. They will calculate how close to the target the warhead will land and then work out what damage is done to the facility and how many people would be killed and injured by the nuclear blast. They will then plot the fallout from the explosion and determine how many civilians would be killed by the radiation. They would also predict the extent of long-term environmental damage.

Corsham works in tandem with the Nuclear Planning and Operations Centre inside the MoD building in London. The US Trident planning system is also split between two sites.<sup>13</sup> If the tasks are divided on the same basis as the American system, then the target plans are generated in London and processed and validated in Corsham.<sup>14</sup>

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<sup>11</sup> Nuclear Weapon Functional Competence outlines essential skills required to maintain a nuclear capability. Experts in Performance and Effectiveness Assessment are expected to have worked for 3 years as practitioners in the CSSE Corsham User Community.

<sup>12</sup> To qualify in this area analysts are expected to attend a course in the USA on nuclear weapons effects. Nuclear Weapon Functional Competence

<sup>13</sup> In 1994 the Defence Select Committee was told that the introduction of sub-strategic Trident would require an upgrade of the “shore-based target planning system” at a cost of £1 million. In 2004 the Defence Minister revealed that upgrades to this system cost an average of £250,000 per year, but in 2001-02 the cost was £584,000. The term “shore-based target planning system” could refer to the Corsham Computer Centre, NOTC, or both.

<sup>14</sup> US target plans for Trident are generated at STRATCOM in Omaha Nebraska and processed and validated at the Naval Surface Warfare Centre, Dahlgren, Virginia.

Corsham is probably responsible for the production of software for the whole system.<sup>15</sup>

In 1988 a report on Trident by the National Audit Office 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”.<sup>16</sup> The Audit Office report revealed that the MoD was having problems recruiting people who were able to carry out this work. Six years later Roger Freeman, the Junior Defence Minister, said that this software work had been completed “using a mix of internal expertise and specialist contractor support”.<sup>17</sup>

The experts who use Corsham are expected to have sufficient competence to enable them to select the appropriate American tools to carry out their work.<sup>18</sup> In addition they are also expected to be able to develop some tools and techniques of their own. They appear to be largely dependent on US support.

The Applied Physics Laboratory of John Hopkins University in Maryland (APL) have “assisted the UK Royal Navy with evaluations of their FBM fleet” from Polaris to Trident.<sup>19</sup> APL designed the system that collects data during all Trident missile tests. They have produced a detailed report on every missile test from a British submarine. APL analyse the electronic logs from all US Trident patrols and they produce the annual evaluation of the US Trident system. It is likely that APL analyse the logs from British patrols and produce a similar overall assessment of the British system.

One of the key components of the Corsham system will be the US Trident Weapon System Accuracy Model. The software code for the model will be acquired from the US Navy. Most of the key data that the model uses can only come from APL.

The one company in the UK with a background of research into ballistic missile systems is Hunting Engineering. They played a leading role in the Chevaline system, deployed on British Polaris submarines in the 1980s and 1990s. They probably provide assistance to the Trident programme. However today the company is a subsidiary of the Lockheed Martin, the American firm who designed and built Trident.

In practice some components of the British software system are purchased from the US and others are created with assistance from American contractors. The Fire Control software, which runs on the submarine computers, is bought from the US Navy under the Polaris Sales Agreement.<sup>20</sup> In addition US contractors assist in the

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<sup>15</sup> In the US system Dahlgren is responsible for software for Trident.

<sup>16</sup> Comptroller and Auditor General Report 1987 para 3.13, Q64.

<sup>17</sup> Letter from Roger Freeman MP to Frank Cook MP, 22 August 1994.

<sup>18</sup> Nuclear Weapon Functional Competence

<sup>19</sup> John Hopkins APL Technical Digest Volume 19, Number 4 (1998)

<http://techdigest.jhuapl.edu/td1904/index.htm> FBM – Fleet Ballistic Missile.

<sup>20</sup> There are numerous references to the Fire Control software for UK Trident in contracts placed by the US Navy. The software is regularly revised. “Each new release of Trident fire control software is certified by the US Government under the terms of the Polaris Sales Agreement (as amended for Trident). Under the agreement, the UK has the capability to validate the software models for software performance and verify that the findings are correct. This is undertaken and independently verified by UK experts to ensure the software meets our requirements before being issued to Royal Navy submarines.” Hansard 6 July 2006 reply by Des Browne.

development of the software for shore-based target planning and analysis.<sup>21</sup> The same models lie at the heart of both the submarine and the shore-based components of the system. One contract shows that the Ministry of Defence buys these reference, simulation and targeting models from the US Navy.<sup>22</sup> The programmers in the Corsham bunker maintain, update and modify these American models and integrate them into their overall software system.

Some US nuclear planning material is classified Top Secret SIOP-ESI and can only be handled by US citizens with the appropriate clearance. Software and documents that originally had this classification can be processed at Corsham and at the Nuclear Operations and Targeting Centre in London.<sup>23</sup> However the material is sanitised in the US before it is handed over to any British citizens.

The process for the computer models used at Corsham is as follows:

- The models are created in America for the US Trident system. They include components which are US-only.
- The American software writers remove the US-only components to create models for the UK Trident system.
- An American contractor assesses the models and verifies that all US-only items have been removed.
- The models are transferred to the Corsham Computer Centre.
- Experts at Corsham integrate the models into their system and verify them.
- The models are released for use at Corsham, on submarines and/or in the London targeting centre as appropriate.<sup>24</sup>

The failure to be able to independently produce the software required for Trident leaves the system vulnerable to deliberate sabotage by the Pentagon. From an American perspective it would be understandable if they deliberately crippled the software to prevent Britain from using Trident without US approval. The process above shows that Corsham checks the software before it becomes operational. However it also reveals that there will be substantial holes in the programme code, data tables and the software manuals where every reference to US-only components has been removed. Because the system includes these highly classified gaps, the British experts cannot really verify that it has not been crippled to prevent Britain from launching Trident outwith US plans.

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<sup>21</sup> “The UK shore-based target planning system for Trident is validated through a range of UK and US research programmes. UK experts then independently verify the system against requirements before issuing it to Royal Navy submarines” - Hansard 12 October 2006 reply by Adam Ingram.

<sup>22</sup> Statement of Work for an Omnibus Contract for K Department Dahlgren;  
[http://www.egginc.com/seaportenhanced/TO/006/BP/K\\_Omnibus\\_SOW-Final.pdf](http://www.egginc.com/seaportenhanced/TO/006/BP/K_Omnibus_SOW-Final.pdf)

<sup>23</sup> The two points of contact for Top Secret SIOP-ESI information in Britain are the UK Strategic Targeting Cell in London and the Director General Strategic Weapons Systems (DGSWS) in Bath. The second reference is to the Corsham Computer Centre which is only a few miles from Bath. CJSCI 3231.04C, 6 July 2004, listed in Compendium of Current CJSI Directives, 14 January 2005.

<sup>24</sup> “For the QA of UK models, the contractor shall assist K52 by analysing the software, data and documentation to verify that all US-only items have been removed” - Statement of Work for an Omnibus Contract for K Department Dahlgren; “The UK shore-based target planning system for Trident is validated through a range of UK and US research programmes. UK experts then independently verify the system against requirements before issuing it to Royal Navy submarines” - Hansard 12 October 2006 reply by Adam Ingram.

The site for the Corsham Centre has carefully chosen. It is inside a deep bunker, providing some protection in the event of a nuclear attack. It is also less than 500 metres from Basil Hill Barracks, Headquarters of the Defence Communications Services Agency and hub of the British military communications network. Basil Hill controls the communications system at the operational headquarters in Northwood and will have high-grade secure communications to the MoD building in London. They control the two VLF transmitters in Cumbria that would send launch authorisation and targeting messages to British Trident submarines. Basil Hill is also the site of the Cryptographic Distribution Agency.

Assessment of the Trident system is probably not all that goes on in the Corsham Computer Centre. One function of the equivalent US facility, at Dahlgren in Virginia, is to generate the targeting data. They format prearranged targets plans onto Magnetic Tape Cartridges. These are taken on submarines when they sail on patrol. In addition Dahlgren can format Targeting Change Messages, which are radio signals sent to submarines with new attack plans.

It is likely that Corsham produces not just the software for British Trident submarines but also the highly classified target data, in tape or radio-message form. It is likely that specialised US software is used to format and compress the data.<sup>25</sup>

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<sup>25</sup> One US contract refers to the software for the UK SCSI Media Generation System for Trident.