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Diving Manual, Great Britain. Ministry of Defence (Navy), Stationery Office, The, H.M. Stationery Office, 1980, 0117723460, 9780117723467, . .

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After an unexpected and diabolical farewell breakfast conversation with his father, Spud Milton returns to boarding school for his 1993 Matric year, his last as a schoolboy. Armed with a prefects' tie and a raging libido, Spud soon discovers that being a large(ish) fish in a small pond has its fair share of challenges.

When literature student Anastasia Steele interviews successful entrepreneur Christian Grey, she finds him very attractive and deeply intimidating. Convinced that their meeting went badly, she tries to put him out of her mind - until he turns up at the store where she works part-time, and invites her out.

Gideon Cross came into my life like lightning in the darkness - beautiful and brilliant, jagged and white hot. I was drawn to him as I'd never been to anything or anyone in my life. I craved his touch like a drug, even knowing it would weaken me. I was flawed and damaged, and he opened those cracks in me so easily.

Operated by the Royal Navy and based at Clyde Naval Base on Scotland's west coast, at least one submarine is always on patrol to provide a continuous at-sea deterrent. Under the terms of the 2010 Strategic Defence and Security Review,[1] each will be armed with a maximum of eight missiles and 40 warheads, although their capacity is much larger.

The UK Trident programme was announced in July 1980, and patrols began in December 1994. Since 1998, Trident has been the only British nuclear weapon system in service. Its stated purpose is to provide "the minimum effective nuclear deterrent as the ultimate means to deter the most extreme threat."[1]

Trident would replace the Polaris system of four Resolution-class submarines, equipped with the US-built Polaris A3 missile. These missiles were originally armed with triple ET.317 warheads aimed at a single target, later upgraded by the UK Chevaline programme to two hardened warheads accompanied with countermeasures.[3]

Following the acceleration of the US Trident II D-5 programme, the existing Polaris Sales Agreement was modified in 1982 to permit the supply of the more advanced missiles.[4] Under the agreement, the UK would lease 65 Trident II D-5 missiles from a larger pool of such weapons based at Naval Submarine Base Kings Bay in the United States. The US would retain responsibility for the maintenance of the missiles, and the UK would manufacture its own warheads and submarines.[5]

The entire project was projected to cost £5 billion, including the four submarines, the missiles, new facilities at Coulport and Faslane and a five per cent contribution to Trident II D-5 research and development. The option for a fifth submarine was discussed at the time but later discounted, and the number of missiles leased was later reduced from 65 to 58.[6]

The Vanguard-class submarines were built between 1986 and 1998 by Vickers Shipbuilding and Engineering at Barrow-in-Furness, Cumbria. The first British Trident missile was test-fired from HMS Vanguard on 26 May 1994, and Vanguard went on to begin the first Trident patrol in December of that year. According to the Royal Navy, at least one submarine has always been on patrol ever since.[8]

The UK Trident programme was initiated during a period of increased tension known as the Second Cold War, and its capabilities were designed to deter powerful Warsaw Pact forces. By the time of the first Vanguard patrol in December 1994, the Soviet Union no longer existed and UK nuclear policy was gradually adjusted during the following years.[5]

The final decision on firing the missiles is the responsibility of the British Prime Minister. Upon taking office, the Prime Minister is required to write four identical letters of last resort which are locked in a safe aboard each submarine. In the event of irrevocably losing contact with the UK, the commanding officer must follow the instructions in the letter if he believes that the United Kingdom has suffered an overwhelming attack.[10] The content of the letters is not disclosed, but the orders may include launching a devastating retaliatory strike.

The Trident system was designed to provide an ongoing independently-controlled deterrent against major threats to the security of the United Kingdom and NATO.[2] At the time, these threats were perceived to come from the Soviet Union and its Warsaw Pact allies.[5] To provide an effective deterrent, the system was intended to "pose a potential threat to key aspects of Soviet state power" while remaining invulnerable to surprise or pre-emptive attack.

The independent deterrent was seen as necessary in case the Soviet Union believed that it could threaten nuclear attack on Western Europe without the risk of US retaliation, because of US fears of a Soviet counter-strike against its own population centers.[2] Without a credible US umbrella, European leaders would be susceptible to nuclear blackmail which could force them into major concessions.[13]

It was considered crucial that the independent British deterrent could penetrate existing and future Soviet anti-ballistic missile (ABM) capabilities. A powerful ABM system, the ABM-1 Galosh, defended Moscow and NATO believed that the USSR would continue to develop its effectiveness. The deterrent logic required the ability to credibly threaten the destruction of the Soviet capital and other major cities.[5] The expensive Chevaline upgrade to Polaris had been designed to keep pace with the ABM developments, but the full MIRV capabilities of the Trident missiles were deemed necessary to assure the credibility of the deterrent into the late 1990s and beyond.[2]

The USSR collapsed in 1991, and NATO military posture was relaxed. Trident's missiles were "detargetted" in 1994, ahead of the maiden voyage of the first Vanguard-class SSBN.[14] This means that the warheads are no longer aimed at specific targets but await coordinates that can be programmed into their on-board computers and fired within 15 minutes.

Although designed as a strategic deterrent, the more unstable world that emerged after the Cold War[citation needed] led the government to conclude that a sub-strategic (but not tactical) role was required. The 1994 Defence White Paper stated, "We also need the capability to undertake nuclear action on a more limited scale in order to ... halt aggression without inevitably triggering strategic nuclear exchanges." A later statement read, "We also intend to exploit the flexibility of Trident to provide the vehicle for both sub-strategic and strategic elements of our deterrent." On 19 March 1998 Defence Secretary George Robison was asked to provide a statement, "on the development of a lower-yield variant of the Trident warhead for the sub-strategic role." He replied, "The UK

has some flexibility in the choice of yield for the warheads on its Trident missiles.â€•[15]

Trident required the design and construction of four very large submarines, the development, testing and assembly of a new generation of warheads, as well as the construction of new shore facilities. This work began in 1980 and the first patrol took place in late 1994. Submarine production continued until 1998, and it is believed that new warheads are still being assembled at a trickle rate. In addition, the UK government provided five per cent of the costs towards the development of the Trident II D-5 missile.[17]

The Vanguard class submarines were designed and built at Barrow-in-Furness by Vickers Shipbuilding and Engineering, now BAE Systems Submarine Solutions. The Devonshire Dock Hall was built specifically for the construction of the submarines. The missile compartment is based on the system used on the American Ohio class, although with capacity for only 16 missiles, rather than the 24 aboard an Ohio boat.

The 'Vanguard' submarines were designed from the outset as nuclear-powered ballistic missile platforms able to accommodate the Trident II D-5. This required the boats to be significantly larger than the previous Resolution class, and they are some of the largest submarines ever built, only eclipsed by the American Ohio and Russian Typhoon- and Borei-classes.

In addition to the missile tubes, the submarines are fitted with four 21 inch (533 mm) torpedo tubes and carry the Spearfish heavyweight torpedo[18] allowing them to engage submerged or surface targets at ranges up to 65 kilometres (40 mi; 35 nmi). Two SSE Mark 10 launchers are also fitted allowing the boats to deploy Type 2066 and Type 2071 decoys, and a UAP Mark 3 electronic support measures (ESM) intercept system is carried. A 'Core H' reactor is fitted to each of the boats during their long-overhaul refit periods, ensuring that none of the submarines will require further re-fuelling for the rest of their service lives.[19]

The British government maintains that the warheads used in the UK Trident system were "designed and manufactured in the UK at the Atomic Weapons Establishment (AWE), Aldermaston". However, declassified US Department of Energy documents indicate that development of the non-nuclear elements of the warhead may have taken place alongside those of the US W76 nuclear warhead fitted in some US Navy Trident missiles.[21]

The National Audit Office noted that most of the warhead development and production expenditure was incurred in the US.[22][23] The US President authorised the transfer of nuclear warhead components to the UK between 1991 and 1996.[24] This has led the Federation of American Scientists to speculate that the UK warhead may share design information from the W76; a practice encouraged by the 1958 US-UK Mutual Defence Agreement.[25]

The development contract was issued in October 1983, and the first launch occurred in January 1987. The first submarine launch was attempted by the USS Tennessee in March 1989. The launch attempt failed because the plume of water following the missile rose to greater height than expected, resulting in water being in the nozzle when the motor ignited. Once the problem was understood relatively simple changes were very quickly made but the problem delayed the Initial Operational Capability of Trident II until March 1990.[30]

Trident II D-5 was designed to be more sophisticated than its predecessor Trident I C-4, and have a greater payload capacity. It is accurate enough to be used as a first strike weapon. All three stages of the Trident II D-5 are made of graphite epoxy, making the missile much lighter than its predecessor. [31]

Various studies have put the cost of the programme much higher â€“ according to Greenpeace, replacing the program would cost Â£34bn, [35] while the upkeep of the system over its 30-year life could run up to Â£130bn. [36] According to the BASIC think tank, cancelling the program would save the budget over Â£83bn over the next 50 years. [37]

Each of the submarines can carry up to 16 Trident II D-5 submarine-launched ballistic missiles (SLBMs), with each missile capable of carrying up to 12 independently targetable nuclear warheads. This makes for a potential maximum of 192 warheads per submarine. The current loading is unknown, although the 2010 Strategic Defence and Security Review set out that in the future each submarine would be armed with 8 missiles and a maximum of 40 warheads.

During a patrol, the submarine is required to remain silent for three months and is allowed to make contact with the base only in a dire emergency. The submarine navigates using mapped contour lines of the ocean floor and patrols a series of planned "boxes" measuring several thousand square miles. A 1000 metre aerial trails on the surface behind the submarine to pick up incoming messages. Intelligence is constantly relayed to the vessel, giving details of shipping movements and potentially hostile aircraft or submarines in the area.

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