

The United Kingdom's Future Nuclear Deterrent: 2016 Update to Parliament

Introduction

The Dreadnought submarine programme is the United Kingdom's programme to replace the four Vanguard Class ballistic missile submarines (SSBNs) that carry the UK's independent nuclear deterrent. The new submarines will deliver the Government's commitment to maintain a Continuous At Sea Deterrence (CASD) posture into the 2050s and beyond. This is the fifth update that, as with previous reports, details the progress the Ministry of Defence and its industrial partners have made on the programme since that last update in the 2015 Strategic Defence and Security Review (SDSR15).

The Government reaffirmed its commitment in SDSR15 to maintain a continuous at sea deterrent by replacing the Vanguard Class of nuclear-armed submarines with a new class of four submarines. On 18 July 2016 Parliament debated the principle of maintaining CASD and continuing with work to build four new SSBNs. The subsequent vote, carried by a significant majority (472 to 117), endorsed the Government's plans to maintain the strategic nuclear deterrent beyond the life of the existing system. On 21 October 2016 the successor submarines were officially named the Dreadnought Class and the first in class will carry the same name.

Background

The Government White Paper, "The Future of the United Kingdom's Nuclear Deterrent" was presented to Parliament in December 2006 and set out the Government's policy to continue maintaining a strategic nuclear deterrent. In May 2011, the then Defence Secretary announced the Government's decision to accept these recommendations and to begin the Assessment Phase. A report, "The United Kingdom's Future Nuclear Deterrent: The Submarine Initial Gate Parliamentary Report" was published at the same time, outlining the MOD's plans for the Assessment Phase.

In July 2013, the Government published the Trident Alternatives Review, a Cabinet Office led study into alternative deterrent systems and postures. The Review demonstrated that no alternative system is as capable, or cost effective, as a Trident-based deterrent. It concluded that while there are alternative non-continuous postures that could be adopted, none would offer the same degree of resilience as a CASD posture.

The commitment to maintain the UK's independent nuclear deterrent to deter the most extreme threats to our national security and way of life was confirmed in SDSR15. The deterrent is not about short term threats, but the threats the nation and our allies may face in the future. These threats are not diminishing and we need the capability to match the threat.

SDSR15 also reset the estimated cost for the design and manufacture of the four Dreadnought submarines and announced the move away from a traditional single 'Main Gate' approach to a staged investment approach with multiple control points. The first control point was approved in July 2016, and production started in September 2016. On 5 October 2016 the Defence Secretary carried out the symbolic cutting of steel for the new submarines. The programme is the largest UK submarine project in a generation and will be one of the most complex undertaken by British industry.

Assessment Phase overview and progress since last report

The design has progressed well, with 70% of spatial arrangements now complete. Overall, the functional design programme has been largely completed, demonstrated by the successful conclusion of the Detailed System Design Review during April 2016.

Work has continued with Rolls-Royce to complete the Nuclear Steam Raising Plant primary plant design, culminating in the Critical Design Review milestone being achieved in December 2014. The main effort is now focused on the MOD design approval for the Pressurised Water Reactor 3 (PWR3), which is well advanced.

Rolls-Royce has been undertaking a set of comprehensive pre-production manufacture readiness programmes for the PWR3 design. This has involved producing all the detailed component production drawings along with demonstrating a number of new manufacturing processes and techniques that are new for PWR3 and are sufficiently mature to de-risk the programme in advance of commencing a full manufacturing procedure.

BAE Systems are continuing with the detailed plant design along with system integration of PWR3 within the overall submarine platform design. Work has also continued to develop and mature the Submarine Machinery Installation Test Establishment upgrade programme in Barrow that will be required to assemble and test the secondary propulsion plant.

Submarine Costs

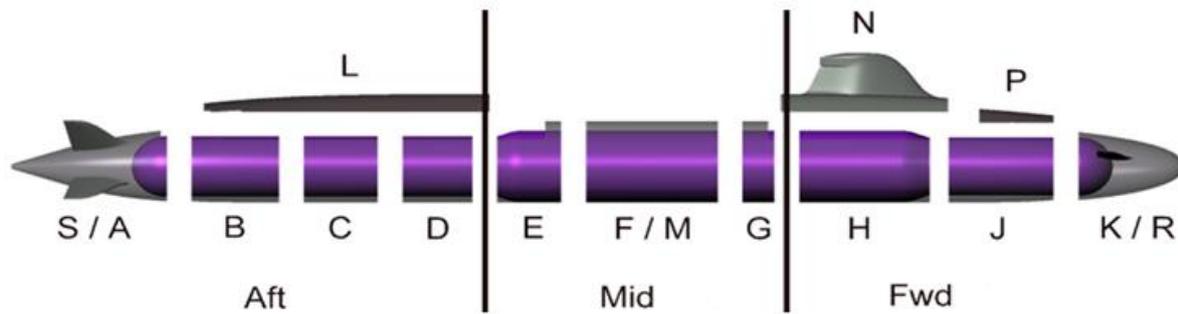
The expected cost for the design and manufacture of the four Dreadnought submarines is likely to total £31Bn (including inflation over the 35 year lifetime of the programme). MOD has also set a contingency of £10Bn, which represents around 35% of the cost to completion, a prudent estimate based on best practice in delivering large, complex projects. The revised cost estimates and schedule reflect the greater understanding of the detailed design of the submarines and their manufacture.

In March 2016, as set out in SDSR15, a further investment of £642M in the design phase was announced, including buying essential long-lead items for the four submarines. This took the total cost of the Assessment Phase approval to £3.9Bn. MOD has so far spent £2,539M, £716M of which was spent in financial year 2015/16. Because of the long-lead nature of some of the goods and services being contracted for, it is expected that payments will continue through to around 2023.

Build Strategy

The Dreadnought submarine building programme continues to develop in line with the overall build strategy, working collaboratively with key industrial partners through a schedule addressing all parts of the programme.

Over the last 18 months, a comprehensive analysis further informed the schedule and facilitated the start of the main production process. On 9 September 2016, the programme entered the Demonstration and Manufacture stage, or Delivery Phase 1, with contracts worth £986M and £277M for platform building and continuation design work. The submarine platform will be built in 16 units that are grouped into 3 mega-units - Aft, Mid and Forward.



This modular approach shortens the overall build timescales. Manufacture and fabrication of the units begins in the New Assembly Shop. The units are painted and applied with acoustic coatings ready for the installation of the intricate systems and equipment in the Central Yard Complex. Finally, the units will pass to the existing Devonshire Dock Hall, to be combined to create mega-units, and mega-units are then combined to form the submarine.

MOD will continue to apply key learning points from the Astute Class and US Virginia Class attack submarine programmes to inform the overall build strategy for Dreadnought, particularly in maturing the design of the submarine to avoid significant re-work during production and in de-risking the build schedule.

Supply Chain

Although MOD has contracted directly with BAE Systems and Rolls-Royce for production, hundreds of suppliers across the UK are working on the Dreadnought submarine programme. This underlines the fact that the nuclear deterrent represents a significant national undertaking, which is drawing on cutting edge capabilities, innovation, design and engineering skills available in the UK, and is providing employment opportunities and development prospects for a substantial number of apprentices, trainees and graduates in a wide range of technical and other disciplines. Broader and deeper engagement with the supply chain is planned in 2017.

Since the report in December 2014, orders have been placed for various long-lead items, including elements of the PWR3 propulsion system, the steam generators for Boat 1 and early long-lead forgings for Boat 2. Other orders have been placed for the Reactor Pressure Vessel, pressuriser forgings and machining; pressuriser heaters and main coolant pumps for the primary plant along with early Gearbox forgings and assemblies. BAE Systems has also acquired the specialised submarine high strength steel, required for the construction of the pressure hull for Boat 1. With production having now commenced, activity through the supply chain will intensify and BAE Systems expect around 85% of their supply chain will be based in the UK.

Faslane Infrastructure

The MOD is investing in Faslane, the largest military establishment in Scotland, and from 2020 it will become the Royal Navy's 'Submarine Centre of Specialisation' with all the UK's operational submarines based there. The infrastructure programme intended to support the whole Royal Navy submarine fleet, including the introduction of the Dreadnought submarines into service, continues to develop. The Dreadnought submarines have been designed with maximum compatibility with existing infrastructure wherever possible. Where changes and upgrades to existing infrastructure have been identified, such as at Her Majesty's Naval Base (HMNB) Clyde, these have typically been incorporated into existing projects, ensuring that the infrastructure to support operation, training, maintenance, docking and berthing of the

submarines can be safely ensured to the end of the submarines operational lives. Overall, the infrastructure projects at HMNB Clyde represent a significant investment in the site and secure the long term future for all operational Royal Navy submarines and the personnel based there. Overall the pace of activity in the Clyde infrastructure programme will increase in the next few years, ahead of the arrival of the first Dreadnought submarine, supporting jobs and companies in the local area.

Barrow Infrastructure

In the last 15 months the Barrow facilities programme has progressed the build of the early critical facilities. Final technical design has completed allowing full construction of the new logistics facility to start, providing an extra 28,000m² of equipment and material storage. Work has also commenced on refurbishment of the New Assembly Shop and up-grades of other infrastructure. The New Assembly Shop is in use for the manufacture of Astute submarine steelwork with new machines already installed for prototyping advanced manufacturing techniques that will be used for Dreadnought's module construction. The ongoing investment in Barrow will remove production bottlenecks and provide modern information systems to speed up processes.

International Collaboration

In December 2014 the UK and the US renewed the 1958 Mutual Defence Agreement (MDA)¹, elements of which are time-limited and therefore require periodic amendment and renewal. The MDA underpins all nuclear defence co-operation between the UK and the US, and allows the exchange of nuclear materials, technology and information between the two states. The MDA is of considerable mutual benefit to the UK and US, and allows the UK to significantly reduce the cost of maintaining its capability while retaining an independent nuclear deterrent.

Collaboration with the US on nuclear propulsion and the strategic weapon system continues. This includes the Trident D5 missile, Common Missile Compartment, and associated navigation, fire control and launch systems.

The missile tubes for the Dreadnought programme are being procured as part of the collaboration with the US Department of Defense on the Common Missile Compartment project. The US company General Dynamics Electric Boat are the design and integration authority for the Common Missile Compartment and they are working collaboratively with BAE Systems in Barrow, ensuring the design accommodates UK requirements and can be integrated with the Dreadnought submarine.

In late 2015, contracts were placed for the second round of missile tube long-lead material, and through an open competition, Babcock International were awarded orders to the value of around £15M. In October 2016 Babcock International secured a contract for around £80M for a batch of 22 missile tube assemblies, securing highly skilled jobs in Rosyth.

The MOD's programme of investment in capability includes the development of new testing facilities under the UK/France Treaty on Joint Radiographic/Hydrodynamics Facilities of 2010 (known as the Teutates programme). The Technology Development Centre supporting the Teutates programme at Atomic Weapons Establishment (AWE) Aldermaston has been in operation since 2014. At the French Atomic Energy Commission's Epure facility at Valduc, France, UK personnel are supervising construction of UK test facilities and carrying out preparatory work for future UK hydrodynamic and radiographic experiments. Due to a

¹ The full title of the 1958 MDA is "The Agreement between the UK and the USA for Co-operation in the Uses of Atomic Energy for Mutual Defence Purposes 1958".

change in contracting strategy, the British facilities at Epure originally scheduled under the 2010 Treaty to be in place by 2016 will now be commissioned in 2018. In addition, a second and third radiographic machine to be in place respectively by 2019 and 2022 will now be installed in a single construction phase, with full operating capability by the end of 2022.

Warhead

Work continues to determine the optimum life of the UK's existing nuclear warhead stockpile and the range of replacement options. A replacement warhead is not required until at least the late 2030s, possibly later. Given lead times, however, a decision on replacing the warhead may be required in this Parliament or early in the next. In the meantime, MOD continues to invest significantly in the Atomic Weapons Establishment to maintain the facilities and skills necessary to assure the safety and security of the current stockpile, and to sustain the ability to develop a replacement warhead when there is a need to do so. This includes important technical co-operation with the US under the auspices of the 1958 MDA.

MOD has conducted a number of technology studies to support planned refurbishment of the current system and explore options for a future warhead. As part of a range of strategic collaborations under the 1958 MDA, MOD is working on a shared US/UK Joint Technology Demonstrator (JTD) project dedicated to the development of a series of joint integrated system demonstrators that support new safety, security, and advanced manufacturing technologies. The collaboration will be a significant focus of US/UK joint activities over the next several years and involves engagement with the US National Nuclear Security Administration, the US Department of Defense, and nuclear weapon laboratories and production facilities in both nations. The JTD is not a new warhead programme, but is intended to help sustain skills and develop the capabilities, processes and technology needed to inform potential options being considered in future, and to reduce future technical, cost and schedule risks.

Additionally, in April 2016 the Defence Secretary announced the conclusion of a review conducted on the contract between MOD and AWE Management Limited (AWEML) for the Management and Operation of the AWE sites at Aldermaston, Burghfield and Blacknest. As a result of the review, the contract with AWEML has been improved. It now provides the opportunity for higher performance incentives, as well as reductions if targets are not met. The duration of the contract was unchanged, running through to 2025. The contract is now a Qualifying Defence Contract under the terms of the Defence Reform Act 2014 and Single Source Procurement Framework, which is overseen by the Single Source Regulations Office.

The core commitment in the contract remains extant: to provide and maintain the nuclear warhead stockpile for the UK's nuclear deterrent, efficiently and effectively without compromising safety or security, for as long as the Government requires. The review has led to MOD having greater control over the programme while ensuring that AWE continues to deliver value for money for the taxpayer.

Submarine Nuclear Enterprise

The scale of the programme continues to grow, along with the number of people employed. The total number of MOD, BAE Systems, Rolls-Royce and Babcock International employees directly working on the programme is now in the region of 2,600 with more than half working as engineers and designers. The ability of these key suppliers to deliver their programmes depends heavily on an extensive network of sub-contractors who are indirectly working in support of the Dreadnought programme. The demand for skilled workers continues to grow throughout the supply chain as the programme moves towards full production and MOD expect the Dreadnought programme to sustain thousands of jobs at Barrow. In addition, increased demand in the civil nuclear sector will place additional demands on this skilled

workforce, requiring further growth. Building and sustaining these key skills for the future is an enterprise wide priority which the Government is supporting through a number of workstreams, including the recently announced National College for Nuclear. In addition, the Nuclear Industry Council is supported by the Nuclear Skills Strategy Group (NSSG) comprising of representation from Government, including MOD and the Department for Business, Energy and Industrial Strategy, and from industry representatives. The NSSG is the UK's lead strategic skills forum for the sector, taking over responsibility from the Nuclear Industry Council's Skills Work stream, and published the Nuclear Skills Strategic Plan in December 2016. It represents both the civil and defence nuclear sectors accountable for developing a nuclear skills strategy, addressing the skills infrastructure, educational needs in consultation with Department for Education, processes and the training provision to secure the required supply of qualified and competent personnel.

Acquisition Governance and Strategy

The SDSR15 also noted the intention to strengthen arrangements for the procurement and in-service support of nuclear submarines by establishing a new delivery body with the authority and freedom to recruit and retain the best people to manage the submarine enterprise. Subject to formal approval, MOD will establish the body as an Executive Agency of the Department, alongside the Defence Equipment & Support (DE&S) organisation, with similar freedoms. From 1 April 2017, DE&S personnel working on submarine related activity will begin moving to the new body. The new body will undergo a process of transformation and be optimised for submarine delivery and support under the leadership of a new Chief Executive that MOD now intends to recruit. To assist in the process of establishing the body, Robert Holden CBE has been appointed as interim Chair of the Board. The Department will advertise publicly for a permanent Chair in due course.

The Department is also working with industry to improve collective performance on the Dreadnought programme. Proposals are being explored for a new commercial and organisational model, in the form of an alliance, between the MOD and the two key industrial leads BAE Systems and Rolls-Royce. This draws on best practice in Government and the private sector and aims to drive continuous improvement and provide greater assurance of progress, with supporting risk and reward arrangements.

Next report

MOD plans to next report to Parliament in late 2017.