The United Kingdom's Future Nuclear Deterrent: 2014 Update to Parliament

Introduction

In March 2007, Parliament voted to maintain the strategic nuclear deterrent beyond the life of the existing system, supporting the Government's plan to renew the UK's independent strategic nuclear deterrent. A new class of 'Successor' Ballistic Missile Submarines (SSBN) will replace the four Vanguard Class SSBNs currently in service. Early concept phase work led to the MOD announcement on 18 May 2011 of a five year long, £3Bn Assessment Phase, the main purpose of which is to refine the design of the submarine and mature the costs in order to make a "Main Gate" investment decision in 2016.

The Successor programme is now more than half way through the five year Assessment Phase. It is the largest UK submarine project in a generation and will be one of the most complex ever undertaken by British industry.

This is the third annual report published since the Assessment Phase began in 2011. As with previous reports it details the progress the MOD and its industrial partners have made on the programme over the last twelve months and sets out the plans for the coming year.

Background

The Government White Paper, "The Future of the United Kingdom's Nuclear Deterrent", presented to Parliament in December 2006, set out the United Kingdom Government policy on, and expressed the intention to continue to maintain a strategic nuclear deterrent. The White Paper concluded that there remained a requirement for a nuclear deterrent capability and compared a range of alternative systems that could deliver a nuclear deterrent. The White Paper assessed that, although at the time there was no specifically identified threat from an entity with both the capability and the intent to threaten the independence or integrity of the UK, the possibility of a major direct nuclear threat to the UK re-emerging could not be dismissed. The White Paper determined that, of the potential ways to deliver a nuclear deterrent capability, the most effective system was a further class of submarines carrying ballistic missiles. In March 2007, a Parliamentary vote endorsed the conclusions of the White Paper.

Following this Parliamentary endorsement, the MOD began the process of assessing the options for the design and delivery of a new class of SSBN, which would meet the demanding technical and operational requirements needed to maintain a credible independent deterrent capability. In the Coalition Agreement, the Government confirmed it would maintain the nuclear deterrent, and that the renewal of Trident should be scrutinised to ensure value for money; whilst the Liberal Democrats would continue to make the case for alternatives. The Trident value for money review in 2010 identified savings of approximately £1.2 Bn, and deferred spending of up to £2 Bn.

Current planning assumptions are based on a future four boat SSBN deterrent fleet, but a final decision on the number of submarines needed to maintain continuous at sea deterrent patrols will be taken in 2016 at the end of the Assessment Phase, when the necessary information on the maintenance requirements of the new submarine design becomes available.

Following early Concept Phase work, which culminated in a recommendation to design and develop a submarine platform, with a new nuclear propulsion system (known as

Pressurised Water Reactor 3 (PWR3)), an opportunity was identified to work collaboratively with United States in the development of a Common Missile Compartment. The Concept Phase also recommended proceeding to the Assessment Phase during which the design would be refined, preparations made for the build programme, and the essential long lead items ordered. 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 showed that there are alternative non- continuous postures that could be adopted, although none that would offer the same degree of resilience as continuous at sea deterrence. Government policy remains to maintain a continuous at sea deterrent and proceed with the Assessment Phase programme to build a new fleet of ballistic missile submarines.

Assessment Phase Overview and Progress Since Last Report

Over the last year, the Programme has continued to make good progress in maturing the design of the submarine and developing realistic costs, and is on target to allow a Main Gate investment decision in 2016.

At Initial Gate, a set of Key User Requirements were approved as the mechanism for the "Ship Specification" process. Against this set of specifications, the first phase of the detailed design has developed comprehensive definitions for each of the submarine systems (around 200 individual systems). These have been developed further by the lead partner in the submarine build, BAE Systems, and have been shared with the supply chain through development contracts; the functional designs have now all reached the required level of maturity, and preliminary data has been received to specify around 75% of the materials needed for the submarine build (around 20,000 parts total). This has enabled some sections of the submarine to move into Stage 2 (spatial) design, where the parts are arranged in their final physical location, and their mounting arrangements, and associated cables, pipes etc. designed. Functional design is due to complete over the next 18 months, with detailed designs finalised for all systems at the next level of maturity, along with their associated parts. The remainder of the submarine will commence Stage 2 design, with the lead areas progressing towards production of manufacturing drawings, from around mid-2016. Across the platform, draft functional designs have been produced for all platform systems and were reviewed in November 2014.

Since publication of last year's report, the MOD, with agreement from HM Treasury, has re-profiled £261M of funding into the Assessment Phase in order to bring forward essential elements of the programme and offer better overall value for money. This allows for investment in facilities at the submarine construction yard in Barrow in Furness and ordering of platform and secondary propulsion system Long Lead Items. The total Assessment Phase approval is now £3.3Bn.

Progress on the design of Successor's propulsion system, the new PWR3 Nuclear Steam Raising Plant, has been satisfactory, with a key design review milestone planned for the

end of 2014. This review of the PWR3 design effectively marks the “design freeze” of the reactor plant and supports the procurement of long lead items for the reactor.

Programme Management

The Programme Management Office at BAE Systems Barrow is responsible for providing independent analysis of design data and ensuring the three industrial partners, BAES Submarines, Rolls Royce and Babcock International, collaborate to work efficiently and effectively. It is co-located with the Integrated Project Management Team, which brings together representatives of MOD and the three partners to manage the integration of constituent elements of the programme. This collaborative approach to managing the programme has been adopted to maximise the capability of the UK Submarine Enterprise.

The programme schedule continues to be driven through the use of an Integrated Master Schedule which ensures that all parties engaged in the Successor programme are working to the same plan and that interdependencies are managed effectively. A higher-level Integrated Master Plan and Timescale Risk Analysis are also being developed, to provide a comprehensive picture of the Successor schedule, critical risks and dependencies.

The programme was reviewed by the Major Projects Authority (MPA) in February 2014 and by the Major Projects Review Group in March 2014. The review concluded that the design of the submarine was progressing satisfactorily and suggested areas where further work would be beneficial ahead of a Main Gate Business Case to explore how the programme’s organisational, commercial and financial arrangements could be optimised. This exploratory work is now in hand and will inform the Main Gate Business Case in 2016.

Build, Test and Commissioning Strategies

The Successor Assessment Phase has been constructed in such a way as to allow build to begin against a much higher level of design maturity than was the case for the Astute Class submarines; this should avoid significant re-work during production.

The overall build strategy for Successor has been formulated to address a number of key learning points, particularly from the Astute Class and the US Virginia Class programmes. Build confidence for Successor will be enabled by:

- A collaborative approach to programme management, with MOD and its key industrial partners engaged from the outset. Key to this is having a credible schedule – the Integrated Master Schedule - that addresses all elements of the programme.

- De-risking the build schedule through early procurement of essential long lead items, prototyping key areas of build, and ensuring key skilled personnel are ready for production commencement.

- Progressive design against a maturing ship specification, where key features necessary to implement ‘build, test and commissioning’ are designed from the start (Design for Production).

- A modular approach to ‘build, test and commissioning’ that shortens the overall build timescales.

- Planning for build with a full understanding of the Barrow site capacity constraints (people and facilities), ensuring a balance between on-site work and strategic outsourcing. This includes investing in new build facilities to remove bottlenecks and information systems to speed up processes.

With the full build, test and commissioning strategy now embedded within the Integrated Master Schedule, planning for the commencement of key pre-production activities has started. This includes contract development, a production readiness assessment including ensuring the contractors will be ready to commence the build and undertake work to remove risk from the programme, such as, the construction of a reactor compartment mock-up.

The Successor submarine represents a major step forward in integrating safety into the submarine design process, and the safety case, currently under development, will demonstrate that the submarine meets extremely stringent safety requirements.

Design Strategy

The Successor submarine is designed to be one of the stealthiest submarines in the world during its operational service from the late 2020s to 2060s. It will also be the largest, safest and most technically advanced submarine ever built in the UK, requiring step changes in manufacturing processes and practices.

Successor is being designed to be built more efficiently than the smaller Astute class submarines. To meet these aims, a number of world beating new and adapted technologies are planned. The range and scale of innovation in production and other disciplines is being carefully managed to provide clear and deliverable benefits to schedule and cost performance without introducing unwarranted risk to the production process. There is an extensive engineering and development programme underway to prove the efficiency and safety of the design, with major innovations in the design and integration of the PWR3 reactor.

International Collaboration

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

The missile tubes for the Successor programme are being procured as part of the collaborative Common Missile Compartment (CMC) project with the US. In October 2014 General Dynamics Electric Boat was awarded an $83 million contract modification by the US Department of Defense to continue development of the CMC. The contract provides funding for 17 missile tubes, of which, approximately $59 million is for the first 12 missile tubes for the Successor programme. Costs beyond the first 17 tubes have yet to be agreed. The MOD is not planning to commit to further missile tubes prior to Main Gate approval in 2016. The design activities for the missile compartment remain on schedule, with the focus being the spatial integration of the Missile Compartment and Missile Control Centre Module by the end of 2015.

Submarine Nuclear Enterprise

As the scale of the programme grows, so does the number of people employed. The total

number of MOD, BAES, Rolls Royce and Babcock International employees directly working on the programme is in the region of 2,200 with more than half working as engineers and designers, with demand for skilled workers continuing to grow throughout the supply chain as the programme moves into full production from 2016, subject to Main Gate approval.

Supply Chain

As the project progresses the scope of the supply chain is maturing. Certain bespoke technologies that have been selected through design decisions are already resulting in supplier selection and the programme is working hard to develop a deeper understanding of its supply chain and key suppliers, and identifying where long term relationships need to be further developed.

As the design of the submarine matures, the MOD and Industrial Partners are able to engage with potential equipment suppliers in order to develop more detailed cost estimates. Work done to date has identified over 850 potential suppliers across the UK. 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.

Barrow Infrastructure

Of the £261M expenditure brought forward into the Assessment Phase, £206M is to support new facilities in the Central Yard at Barrow to improve outfitting, finishing and logistics as well as early implementation steel work in the New Assembly Shop. In adopting a different approach to financing the build of these essential new facilities, the MOD is able to re-pay the company for the cost of the facilities as building work progresses, rather than recovering the costs across the build programme as a whole. This approach is expected to reduce the cost by some £42M from that originally planned.

Work on these facilities is progressing well. The BAE Systems and MOD programme teams are fully established with specialist contractor support for Programme Management, Design Consultancy, Planning, Clerk of Works and Construction Partners in place. The forward programme has been formally configured, establishing the programme delivery structure and financial control baseline to the completion of the programme.

Long Lead Items

Specific long lead items have been ordered for: the PWR3 propulsion system; weapons handling and launch system; gearbox components and associated equipment; material to support the manufacture of missile tubes; and material to support the manufacture of integrated tube and hull fixtures. Further orders up to March 2016 are expected to include: additional PWR3 components; main lubrication oil pumps; main feed flexible couplings; main shaft bearing; hull fittings; pressure plate and stiffeners; turbo generators; main engines and condensers; electrical distribution components and fibre optic components.

At Initial Gate £533M was approved for long lead items; with the additional £55M approval given by the Treasury in late 2014 there is now an approval to spend £588M ahead of Main Gate. By the end of financial year 2013/14 £230M of this was committed.

Submarine Costs

Expenditure in financial year 2013/14 amounted to £513M, bringing the overall sum spent on the Initial Gate Assessment Phase to £1,243M, which is in line with plans set out in the Initial Gate Business Case.

As highlighted in the Initial Gate Parliamentary Report, working with the tier one Industry Partners under the Submarine Enterprise Performance Programme (SEPP) to deliver business improvements and financial savings across the submarine enterprise remains key to delivering the Successor programme to the agreed time, cost and performance. Good progress has been made on delivering SEPP with the signature of three Foundation Contracts, with BAE Systems, Rolls Royce and Babcock International, the establishment of a robust benefits delivery and audit process and the formation of the Submarine Portfolio Office providing a coherent joint planning function across the enterprise. By the end financial year 2013/14, across the Submarine Enterprise, SEPP had delivered a total of £350M of benefits against the ten-year target of £900M set in 2010, with £110M being directly attributable to Successor. Further potential opportunities have been identified by the Successor programme which continue to be developed and refined. In terms of the procurement costs of the Successor Submarine, and taking into account currently planned and future SEPP efficiencies, we expect to remain within the 2006 White Paper initial estimates of £11-14Bn (at 2006 prices). In line with other large procurement projects, we intend to identify at Main Gate an appropriate contingency for the Manufacture Phase.

Warhead

The Nuclear Warhead Capability Sustainment Programme has been underway since 2005. It aims both to guarantee the current warhead remains safe and operational until final disposal following withdrawal from service and to develop at the Atomic Weapons Establishment the necessary science and technology, infrastructure, and manpower to ensure the UK has the ability to implement any decision on a future UK nuclear warhead. The current warhead has been in service since the early 1990s and is planned to remain in service into the 2040s. The 2010 SDSR determined that a transition to a replacement warhead would not be required until at least the late 2030s, meaning a decision on whether to replace the existing warhead will not be required until the next Parliament. Studies undertaken to date suggest that approximately 17 years from an initial procurement decision would be required to develop any replacement warhead for the Trident D5 missile and commence production, if that were the decision taken.

Future Work

Continuing Assessment Phase activity in 2015 will include £250M worth of further design work by BAES. In addition, detailed designs will be developed for the new production facilities at BAES Barrow, including the new Central Yard Outfit and Paint facilities (essential to implement the build strategy) and Nuclear Manufacture and Installation facilities (to deliver PWR3).

We plan to next report to Parliament at Main Gate in early 2016.