

Written evidence submitted by BAE Systems

This document is in response to a request from the Defence Select Committee to provide additional detail on the Type 45 Power Improvement Programme progress; and on the Type 26 Risk Register and any measures BAE Systems is taking beyond ordinary practice to mitigate them.

Type 45 Power Improvement Programme (PIP)

HMS Dauntless, the first of class to be fitted with the T45 Power Improvement Programme (PIP), is expected to complete the initial phase of acceptance of the installation work in Birkenhead by the end of summer 2021. This is broadly aligned to plans agreed following reassessment to account for the impact of the COVID-19 pandemic which continues to affect project progress. The next phase of the testing programme will see her undertake a rigorous trials programme in harbour and subsequently at sea.

We regret that we are unable to provide a detailed schedule of when subsequent ships will complete the PIP upgrade. These details form part of the terms and conditions of our contract with the Ministry of Defence and are thus commercially confidential. We can confirm that all six Type 45 ships will have undergone the PIP upgrade by the mid-2020s. We must however stress that the programme is dependent on the availability of ships to undertake the upgrade, balanced against the Royal Navy's standing and future operational commitments.

Type 26 Risk Register and mitigation

Overview

- BAE Systems is currently under a Batch 1 contract to produce three Type 26 Anti-Submarine Warships for the Royal Navy. BAE Systems is currently in discussions with the customer for the Batch 2 contract, which is for a further five Type 26 frigates.
- By its very nature the design and build of the first of class has brought challenges, and engineering design work, supply chain issues and the impact of COVID-19 have introduced schedule and cost risk to the programme.
- BAE Systems Naval Ships reviews risk on a systematic and regular basis under four lenses to understand differing impacts, and ensure mitigation is effective and timely. These are: **programme, technical, cost and schedule impacts**. Each risk is managed within our Active Risk Management (ARM) System and has associated mitigations and controls assigned to it, along with an accountable owner and senior sponsor within the business.
- The BAE Systems Type 26 Risk Register currently has 201 risks and 526 active mitigations in place to help manage the risk exposure profile of the program for the business and customer. There are significantly more closed risks and mitigations from previous phases of the programme.

- Additionally BAE Systems manages opportunities for the program, primarily where activities can be undertaken to reduce cost, improve schedule or provide a better technical solution for our customer. Currently we have 45 active opportunities, reviewed monthly as part of our Risk and Opportunity management processes.
- A summary of the top eight grouped risks is detailed, that cover the areas of Program, Technical, Cost and Schedule.

Programme Risks

A number of key risks were identified at the outset of the programme, and are consistent with the challenges typically experienced when embarking on the design and construction of a complex warship. These risks are well understood and we have the skills and experience to understand how to best mitigate these risks. We have well-established, monitored and measured mitigations in place and we work closely with our customer to implement these mitigations to protect the critical path of the programme.

The following list represented risk that could have a potential impact on the Batch programme as a whole:

1. Resourcing

There is a risk that the business cannot acquire the highly skilled trades and crafts people and suitably qualified and experience persons (SQEP) to fulfil critical roles, resulting from increased competition for trades across industry and adjacent sectors.

The impact may include delay to schedule, increased costs and lower quality of work as a result of the potential requirement to outsource work to lesser SQEP

We are managing this risk through a number of interventions which include:

- Short term - Driving operational efficiencies through digital enablement of workforce and improving productivity of the workforce, providing more “wrench time”
- Short term - High quality trade tests (multi day) prior to employment being granted on site
- Short term – Partnering with strategic resource partners to provide SQEP in certain critical areas
- Long term – developing a National Applied Shipbuilding Academy on the Clyde. Enabling the development of critical skills locally, in order to increase the talent pool for industry.

2. Engineering Maturity and Change

There is a risk that the required maturity of the engineering design is not achieved within the scheduled timeframe, and to a lower quality as a result of in increased change during manufacture, driven by immature supplier data and preliminary design decisions.

The impact may include increased spend and schedule delay due in order to rework and increase resource to process and implement the change.

We are managing this risk through a number of interventions which include:

- Full review of compartment spaces for functionality, habitability and safety with the customer
- Application of design assurance and review processes to manage equipment, system and compartment design and development
- Use of independent Subject Matter Experts reviewing the design documentation and risks
- Robust configuration and change management control systems and processes.

3. Supply Chain Failure to perform

There is a risk that our supply chain will not meet its contractual commitments and may require post-contract change.

The impact may include increased material cost, incorrect technical data supplied, and late arrival of equipment to the yard, affecting installation, testing and commission dates.

We are managing this risk through a number of interventions which include:

- Monthly contract reviews with key suppliers
- Supplier Audits
- Embedding of staff into critical supplier programs that are underperforming, to bolster expertise
- Validation activity of technical information for equipment delivered, through additional testing and inspection.

4. Operational Performance

a. *Schedule Integration (Sequencing) & Control*

There is a risk that our planning is not robust enough resulting in incorrect sequencing of work or unscoped work being required.

The impact of this may include increased demand on the resourcing profile, increased spend and sub-optimal sequencing of work

We are managing this risk through a number of interventions which include:

- Application of learning from experience from past programs such as OPV and QEC
- Utilisation of look ahead processes such as our Quarterly Look Ahead (QLA) and 12-month look ahead processes to ensure the correct level of detail and resources are in place
- Longer term – Review of site facilities to consider any changes for how we manufacture the ships and how the work is sequenced and moved around the yard.

b. *Work Execution to norm*

There is a risk that we do not achieve ship-build norms for design and manufacture of the ship

The impact of this may be an ineffective and non-competitive operation, resulting in unnecessary spend and schedule increases.

We are managing this risk through a number of interventions which include:

- Effective performance management of the entire team, informed by real time performance data
- Ensuring correct levels of supervision and management across the organisation
- Efficiency drive through digital enablement of workforce
- Contracting of outsourced work to recognised industry norms.

Technical Risks

These risks arise from the novelty of complexity of the product e.g.:

5. System Integration

There is a risk that the integration between systems is not achieved successfully and/or according to the plan: e.g. the Power and Propulsion (P&P) System, the Platform Management System (PMS) and Combat Systems

The impact of poor system integration may result in further design change, reduced or inadequate system performance and failure to meet contractual requirements.

We are managing this risk through a number of interventions which include:

- The use of a dedicated Electrical Integration Test Facility (EITF) which allows the testing of the P&P and PMS systems in a manner which recreates the conditions of the ship
- The use of the Land Based Integration Facility (LBIF) to test the interfaces between Combat Management Systems and supporting equipment
- The use of functional and system modelling and analysis prior to installation.

6. Shaft Line

There is a risk that during the installation of the shaft, issues may occur with alignment of the equipment.

The impact of shaft line misalignment would cause schedule delay, cost increase to rectify the issue, and if not resolved, could potentially impact performance requirements

We are managing this risk through a number of interventions which include:

- Knowledge transfer – Integrated working with our key suppliers and Global Combat Ship (GCS) teams to capture learning from all relevant experience, and sharing our own experience over the last 5 years of installing shaft lines on OPVs and QEC. Refining our approach and processes
- Creation of a new shaft line Integrated Project Team (IPT) ensuring we have a range of dedicated suitably qualified and experience people (SQEP), drawing on global experience
- Engagement of Specialist Lloyds contracts to peer review our processes, modelling and procedures
- Development of new technology to aid with the installation process.

7. Performance

There is a risk that the performance characteristics will not be achieved.

The impact of not achieving our contractual levels of performance could prevent the ship from meeting all its strategic operational requirements.

We are managing this risk through a number of interventions which include:

- Imposing and enforcing rules on all aspect of the design relevant to operational performance
- In-depth modelling and analysis of systems
- Testing of equipment during factory acceptance tests to confirm intended performance characteristics are met
- Installation of equipment in accordance with approved design specifications.

8. Software

There is a risk that additional software development and obsolescence will occur.

The impact of this risk occurring is an increase in cost, late release of software and capability to the ship, causing delay to setting to work and commission and the potential failure to meet the security and performance requirements.

We are managing this risk through a number of interventions which include:

- Early engagement and partnering with the appropriate approval authorities
- Testing of software during the development phase prior to release at our integration facilities
- Supply chain engagement and review of through-life support
- Continuous monitoring of software currency and vulnerability

26 August 2021

Defence Committee Visit to Barrow, 8 July 2021: Key Learning Points

- Submarine manufacturing at Barrow has had a difficult 20 years. There is now growing confidence but this must be measured against performance.
- On the Astute programme, the delivery rate in recent years has been one submarine every three years or so. This was not in line with the contract. The Enterprise's target is to deliver the three remaining submarines by the end of 2026.
- BAE Systems explained how they had integrated lessons from the production and service life of each submarine into production of subsequent vessels and refits of previous ones.
 - BAE Systems utilised the delay to Astute Boat 4 to implement further capability improvements prior to exit. These capability improvements are now being applied to the remaining class in build.
 - BAE Systems have used effective change control to manage the challenge of learning from the completed submarines without effectively having to create a new prototype each time. Changes are only made when the team are confident they understand the cost impact and trade-offs.
 - BAE Systems have built software integration early into the schedule.
- DDQ and D58/D59 facilities:
 - D59 recently achieved initial operating capability.
 - The concrete structure for D58 will have been completed next year with installation of cranes and commissioning work completed the year after.
 - BAE Systems has started piling on the DDQ waterfront facility for Dreadnought.
 - Completing these sites removes a significant risk to the programme.
- The transition from Astute to Dreadnought is being managed and there are no knock on delays anticipated.
- BAE Systems continues to assess the future capability requirements for its submarines programmes.
- The Astute class submarines are fitted with a PWR 2 reactor. These reactors are not anticipated to require refuelling over the course of the vessels' planned in-service lives.
- Workforce and Submarines Academy for Skills and Knowledge
 - BAE Systems predicts hiring requirements every year in advance and have a five year program to deliver training.
 - There are industry wide shortages in nuclear skills linked to projects like Hinkley Point. There are also shortages in high spec welders.
 - The Submarines Academy for Skills and Knowledge has increased female participation in their apprentice population from 19-25% in the last 5 years. Through focused efforts in their attraction strategy they have seen a particular uptake in the fabrication trade areas (caulking, structural welding etc.).

Furthermore the stats in the Higher Apprenticeship and Graduate space continue to be strong, with over 40% year on year females recruited.

- Strong reduction in the number of Apprentice first aid accidents, in July 2017 there were 100 first aid incidents recorded onsite, today July 2021 we can report only 6 – this is a 94% reduction over 4 years. Whilst this is a noted improvement, a target zero philosophy remains priority.