

FOI REQUEST REFERENCE 123704-002 – RESPONSE TO PARTS ONE AND TWO.

Part 1: Information summarising the nature of the research and design work that is required during the Vanguard submarine replacement programme 'Assessment Phase'.

The specifics of the research and design work will be dependent on Initial Gate, but summaries of the likely work are provided below, which have been extracted from documents relating to Initial Gate.

Design Work

In terms of design work, Whole Boat Design and Engineering is the main focus of the Assessment Phase. There are three main stages:

- Stage 1 (System Engineering).

This stage aims to deliver System Drawings and Equipment Technical Specifications, and to demonstrate system performance and compliance with system functional requirements. Development of Technical Specifications enables engagement of the lower tiers of the supply chain, whose responses provide actual equipment performance data (used to revisit and confirm system design and performance), physical equipment data (e.g. shape, weight and connection requirements) and development of the test and acceptance plan.

- Stage 2 (Spatial Integration).

This stage is managed primarily by area (compartments), and produces a fully integrated General Arrangement (GA). Stage 2 overlaps Stage 1, with the GA being populated at all times with best available information. However, completion of Stage 2 can only take place when definitive physical data on equipments is received from suppliers.

- Stage 3 (Engineering Outputs).

This stage's outputs are production drawings and manufacturing instructions that provide the information necessary for build.

In addition to the main design sequence, there is also enabling activity such as Value Engineering, and the management of Design Margins.

Design work in the following areas is also undertaken:

- Combat System Design and Engineering.
- Primary and Secondary Propulsion Design and Engineering.

The design process is similar to that employed at the Whole Boat level. The outputs are design information fully integrated into the Whole Boat Design and the maturity of these outputs will be measured via the Whole Boat route.

- Common Missile Compartment.

Work to design a Common Missile Compartment with the United States is already approved and underway and being undertaken by Electric Boat, under a United States-United Kingdom cost sharing agreement. The design process employed uses different terminology to that employed at the Whole Boat level, but is otherwise similar.

Research Work

Technology Development: It is planned that there will be a Technology Programme which seeks to de-risk key technologies in the early stages of design so that they can be incorporated into the new submarine at an acceptable level of risk and enable realisation of opportunities.

All candidate technologies are being pursued on the basis of providing benefits to cost, schedule, performance (including capability, safety and availability); maturing and refining options that were raised in very early stages of the Future Submarine programme. The Technology Programme links to the design and engineering plan to allow understanding of the milestones for delivery of technology options into the design. Using subject matter experts in industry and MOD, the current maturity and development requirements of candidate technologies have been assessed to determine the validity of delivering into the programme.

The actual candidate technologies differ dependent on which Submarine option is selected at Initial Gate, but are likely to include:

- Ship systems. A number of technology design and demonstrator activities to develop systems and components underpinning the options for electric-actuation of ship auxiliaries and control surfaces. Advanced energy storage options for Successor, based on maturing battery technologies.
- The application of fire detection and suppression technologies to the submarine will be matured.
- Technologies to support improved management of the platform.
- Platform structure, materials and hydrodynamics.
- Full validation of the potential use of the pressure hull structure, as well as the possible application of composite materials to hull forms and internal structures.
- The technology and systems to support the integration of advanced sonar arrays, a new countermeasure system, the Successor external and internal communication systems and options for improvement of weapon handling and discharge.
- Improvements to allow Successor to best meet survivability targets.

Part 2: Information summarising any long lead items that would need to be purchased during the Vanguard submarine replacement programme 'Assessment Phase', ahead of the Main Gate decision on whether to proceed with placing contracts for submarine construction.

During the Assessment Phase a number of what are known as “Long Lead” items will have to be ordered and purchased. These are items where we need commitment in advance of the planned start of build. For Boat 1 these include items for both Propulsion and the rest of the submarine. Long Lead items for Boats 2 to 3 relate to Propulsion.

Final decisions as to exactly what long lead items will be required and when, will not be taken until after Initial Gate.

However, the main categories of long leads are expected to be:

Hull Structure and Structural Fittings.

This category includes castings and forgings, steel and control surfaces.

Primary and Secondary Propulsion Systems.

Electrical Generation, Conversion, and Distribution.

This includes turbo generators, platform management system (software), main switchboards, internal communications, diesel generators, main static converters, main DC distribution - distribution convertors, cathodic protection system, degaussing system, computer information systems, main battery, and remote visual surveillance system.

Various components of the Combat Systems.

Ship Services.

This includes the air purification system, chilled water plant, main hydraulics system, HP air bottles, submarine control console and atmosphere analyser system.