

## Ministry of Defence memo on submarines

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This is the text of a memo sent by a senior [Ministry of Defence](#) official to the chief engineer on the [Royal Navy's](#) submarine programmes, Dr John van Griethuysen, who reports directly to the head of submarines, Rear Admiral Simon Lister.

The memo was sent on 20 June and is an appraisal of four documents that relate to HMS Astute and HMS Ambush. The author starts by referencing the papers he is reviewing and then "discusses" his findings.

QA stands for Quality Assurance – the standard required to ensure components are fitted correctly.

The author notes that corrosion is widespread on the HMS Astute, has already affected HMS Ambush, and says action is required now to stop parts on the final four submarines suffering from the same problems.

The author suggests cost-cutting is to blame – and warns short-term savings will cost more in the long run because the submarines affected by corrosion will have to be repaired more regularly.

### The Ministry of Defence memo

Ref 1. BAE Systems Astute Class project. Corrosion review (Draft) July 2011 (Ref DMS) by (redacted)

Ref 2. BAE Systems Astute Class project. Phase 2 Corrosion Report January 2012 (Interim) (Ref DMS 1720308) by (redacted)

The above mentioned Ref 1 & 2 have been raised over corrosion concerns on valves and pipe work fittings mainly due to the lack of or inadequate paint application for the protection of fasteners and flanges. From the photographs that the NAG-MT has witnessed, the corrosion is widespread and a cause for major concern.

Ref 3. BAE Systems Astute Class project. Ambush Design: AMBUSH Design Change to Ship & Battery Ventilation System Pipework Safety Justification. Reference: eDMS Iss 2 1724425 May 2012 by (redacted)

This report is on the paint flaking from the bore surface of the ship and battery system vent pipes passing through the reactor compartment of AMBUSH due to inadequate surface preparation.

Ref. 4. E-mail from (redacted) to (redacted) forwarding an e-mail from BAe Systems- on an assessment of the cost benefit of changing the bilge fasteners from Mild Steel to Stainless. (Redacted) team have perused the reports, met up with some of the Astute project staff and then with the BAE systems staff (Manager and a staff member of Metallic Materials

and Manager – Non metallic Materials) to discuss the reports and find out more on the history and causes of events leading to such corrosion. I am writing this due to the concerns of the QA failures, general attitude towards QA and the lack of understanding and negligence towards the corrosion related issues.

## **Discussion of References 1 and 2.**

Reference 2, reports that the Inspection of corrosion was carried out by a team which included Astute project (MOD) QA staff but no MoD staff with corrosion and metallurgical knowledge was in the team. The report states that in all the designated wet areas (defined in the Paint Schedule ACP/00009247) paint had either not been applied to flanges and fasteners or inadequately for no doubt various reasons. Also the team had observed that under the casing, paint had either not been applied to fixtures, flanges and fasteners or inadequately for no doubt various reasons. Has the Astute project team found out what these various reasons are? No effort has been made or there is no recommendation to find out how this Quality Assurance failure had occurred, who was responsible for such quality failure and more importantly how to avoid such QA failures in the future. DESNAG-MT finds that this is a very poor attitude to handle such an important issue and advise Astute project to carry out a proper QA investigation to find out answers.

Also the report also states that the current Paint Schedule is a development from various MoD documents but it was unclear who owned it and the report itself questioned whether the technical content was adequate to prevent a repeat of Astute's corrosion issues. I have not been provided with the Paints Schedule but have obtained another document WS 450875 Rev 6 dated 15.07.2010 (issue date 16.08.2000) entitled "Preparation , Application & Inspection of Paintwork". The Section 14 of this document lists "Items not to be painted", a lengthy list which contains items that are should have been painted. Proper advice on various materials to reduce corrosion is given in Defence Standards and clearly this is a case that such advice has been ignored.

On querying, it has come to knowledge that the BAES Materials group has not been a party in making the document WS 450875. It was also found that the submarines have been designated as being DRY, but from the inspections it is clearly apparent that this was not the case. The BAE Systems Materials Group also certainly had concerns on this list and agreed with us that corrosion prone items should not have been included in this list. They are preparing a Laboratory report and a draft (Lab report XXXX) was provided to (redacted). This draft report also clearly outlines the failures of the WS 450875 document in relation to the decision not to apply paint on certain components, going against the advice provided in Defence Standards. This raises the question of how these documents and procedures have been produced by the BAE Systems for Astute. Has the objective been the prevention of corrosion in submarine components or was it just a cost cutting exercise? It seems a decision has been taken to keep the painting to a minimum in Astute class build to reduce costs.

During the discussions with the Astute staff, initially NAG-MT was informed that most of the corroded fasteners would be replaced by a good selection of materials. I was happy with the decision but later on the decision has been reversed and was informed that the corroded areas would be cleaned and painted. Our advice was completely ignored in the name of meeting the schedule. The cleaning of corroded areas in flanges, fasteners and other fixtures would be a difficult task. It has to be accepted that the rust effected areas will not be 100% removed and therefore, the painting will occur on partly cleaned surfaces. This will result in corrosion spreading under the paint with time and lifting off the paint at

certain areas leading to further expansion of corrosion. It could be categorically stated that corrosion life of these components has been compromised and further corrosion problems could be expected before the planned maintenance period.

### **Discussion of Reference 3.**

The Reference 3 states "During a recent and late stage in the Boat 2 build programme, Quality Control Non-Conformances were raised, reporting that the paint scheme applied to the internal surfaces of the Ship and Battery Ventilation System pipework running through the Reactor Compartment (RC) was spalling (de-laminating). The paint is intended to provide protection of the mild steel pipework from corrosion. The root cause of the problem has been ascribed to inadequate pipework surface preparation prior to paint application.". The purpose of this document was to provide a safety justification but there has not been any effort taken to find out the reasons for this failure. This is clearly a Quality Assurance failure. It is important that the MoD/Astute project finds out who was responsible for such a quality failure and more importantly how to avoid such QA failures in the future.

The recommendation made by the investigating panel seems to be the removal of all the paints and leaving the tubes unpainted. It was suggested that whilst it may be possible to completely remove the existing paint, it was generally considered that establishing a suitable preparation for repainting will not be practical within the available timescale. In-situ cleaning to remove all paint in this application is a difficult task and therefore I have agreed with the recommendations but have raised concern mainly of the suggested paint removal process which would leave a surface roughness of troughs up to 2.9mm. This would most certainly lead to future deterioration through pitting corrosion.

### **Discussion on Reference 4**

It was noted that only the cost benefit has been discussed. No staff from the BAE Systems Materials Group was involved to take a decision on whether stainless or mild steel fasteners should be used.

#### **General:**

It seems that the first three Astute Class Boats would have the same problems and therefore, the Submarine In-Service team could expect severe problems in the future. These failures show a lack of giving prominence to the materials and corrosion issues and taking decisions mainly with the objective of reducing costs. The MoD even after the re-organisation with the formation of DE&S seems to be concentrating on the procurement costs without consideration to through-life costs.

There seems to be a severe lack of quality control and quality assurance. In perusing these reports one gets the view that quality control has not given due prominence. All the corrosion issues raised in Ref 1-3 have been due to the lack of quality control yet the investigators in Ref 1 and 2 have put them aside as "for no doubt various reasons". I do not think that it is the appropriate way a corporate body should address quality control issues? I would advise Astute project to make a thorough investigation and obtain an understanding of why and how such failures occurred? Most importantly, quality control should be strengthened to avoid such corrosion failures in boat 4 or 5 onwards. I am not too sure whether it is already too late for the Boat 4.

The project is in a hurry to stick to the schedule get the boat finished and. I do understand

cost implications due to any delays but finishing a submarine, which would be corroding inside will cost the MoD through out its life!

It is important that for the future, MoD Projects place proper procedures in order to take sound decisions with suitable justification.

Correct professionals should be involved in decision making. I also suggest that Astute project team should not rely only on the paints systems for corrosion protection but also use better corrosion resistant materials to reduce corrosion. The BAES Materials Group informed me that they are working on new materials and coatings. The Defence Standards on fasteners etc have been reviewed recently and we have included some good guidance. I suggest that the Astute Project team should advise the BAE Engineering team to get together with the BAE Materials team and come up with a strategy for corrosion resistance for Boat 4 or 5 onwards, based on both the selection of materials and application of paint. Would be happy to guide, if required.