



Background

Aspire was contracted by the UK Ministry of Defence (MoD) to derive the structural survey plan for the Landing Platform Dock (LPD) class (HMS Albion and HMS Bulwark).

The LPD is an amphibious assault ship designed to provide amphibious landing capability for troops, vehicles, equipment and stores. This involves landing craft and helicopter lift operating from the flight deck.

Additionally, LPD provides fighting command, control and communication facilities for the Assault Force, Task Group and Landing Force during the transit, landing and consolidation phases of an amphibious assault. It is able to upload returning forces using the same landing craft and helicopters.

Purpose

The purpose of this task was to enable the Royal Navy (RN) to address the topic of hull surveys to **optimise the Preventive Maintenance activities** for the hull structure.

The deliverable was a detailed list of Structural Maintenance tasks and associated task frequencies.

Approach

The Reliability Centered Maintenance (RCM) methodology was mandated and Aspire provided the RCM expertise, being responsible for the validation of a list of Structurally Significant Items (SSIs) derived by the ship designer. The vessel is designed to Lloyds Register Rules and the derived maintenance schedule has to meet Lloyds inspection requirements. Aspire consulted with Lloyds during the process to gain an understanding of their requirements as the process developed.

The study was conducted using a combined MoD / Aspire team approach, bringing together the following attributes:

- ❑ Knowledge and experience of the RCM process
- ❑ Detailed knowledge of RN design and maintenance philosophies
- ❑ Ship's staff who understood how operational roles would affect the ultimate maintenance schedule
- ❑ Specialist knowledge of constraining issues such as Health and Safety issues, regulatory bodies etc.

RCM for structures requires significant data to be gathered. This data is used, with a set of pre-determined and authorised assumptions, to establish a recommended survey task and interval. These calculations are based on the criteria for structural failure which requires an understanding of how structure could fail and the mechanics of such failures.

This was addressed by analysing the effects of failure, using Failure Modes, Effects and Criticality Analysis (FMECA) principles.

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In order that the recommended survey and interval took into account the safety and operational aspects of failure the shortest task interval, calculated for Fatigue Damage, Environmental Deterioration or Accidental Damage Failure Modes, for each SSI, was used.

Results

The original shipbuilder's SSI list was rationalised to just over 1200 SSIs which were subjected to further analysis. These SSIs generated over 3,000 Failure Modes which were used to derive the interval for each SSI survey.

Job Information Cards (JICs) were produced for each survey routine, providing valuable information relating to the application of each survey, e.g. the need for gas free certificates for tanks, the need to refer to higher authority when failure is found, etc.

This study established that, by intelligent and innovative use of underwater engineering tasks, the structural survey plan no longer drove the need for a docking, purely for structural survey. Removal of this constraint should allow LPD docking intervals to be extended with consequent cost reductions.

It was identified that not all compartments contained SSIs and consequently not all compartments would have been visited for structural survey purposes.

In order to comply more fully with the mandated Lloyds Register requirement Aspire developed a Compartment Analysis to run alongside this detailed study. This secondary analysis established a general survey routine for each compartment within the ship over a 5 year period. This complimented the more detailed surveys dictated by the core process.

The two studies (analysis of SSIs and compartment analysis) were consolidated to provide the RN with a concise and complete survey regime.

Conclusion

The study has created a maintenance hull survey plan which **ensures safety** by concentrating on SSIs, both internal and external. The compartment analysis directs the Ship Staff to address the "other structure", not designated an SSI, on a more formal basis than was previously adopted.

The implementation of the study results in the LPD class is a first for the RN.



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