Naval Ship Assurance – A New Approach

James Buckley
BMT Defence Services Ltd, UK
James.Buckley@nsass.org.uk
Supporting Authors:
Paul James / Ben Cuckson
Lloyds Register EMEA, UK
Ben Cuckson
Lloyds Register EMEA, UK
Steve Marshall
Ministry of Defence, UK

© BMT Defence Services Ltd / Lloyd’s Register
This document contains proprietary and confidential information which may not be used or reproduced in whole or in part, or communicated to a third party without prior written consent of BMT Defence Services Ltd / Lloyd’s Register.

UK APPROACH TO NAVAL SHIP ASSURANCE

Introduction
It is widely recognized that Navies around the world are subject to increasing pressure from their Governments to reduce the cost and establish a more consistent approach to the design, operation and assurance of naval fleets.

The UK MoD (MoD), in conjunction with Class and industrial stakeholders has been investigating, and increasingly adopting, a more commercially based approach for the assurance of naval ship acquisition and operation in an effort to reduce costs, whilst maintaining safety, environmental, and military capability. The approach being taken in the UK is based on a Naval Ship Assurance (NSA) framework. Significant work has been undertaken towards development of the NSA framework.

This paper will begin by describing the UK MoD's approach to NSA and how it is working to define a framework for its implementation. The paper concludes by outlining some potential adaptations in order to suit other Navies’ ship assurance requirements or other applications.

What is Naval Assurance?1

Assurance can be defined as an overall process that provides confidence from an independent party that compliance with key requirements or standards is achieved for a platform through life. It will generally comprise of a series of assurance events or activities, which demonstrates compliance with legislative requirements or key risks for safety, (e.g. lifesaving), ship function (e.g. electrical generation), environmental, capability (e.g. specific weapon systems), commercial or programme risk. Assurance should be established from concept through to disposal through design approval, equipment approval, build survey, acceptance into service and through life survey.

Acceptance can be defined as a specific process that provides confidence contractual requirements have been achieved for a specific activity. Historically is has been associated with delivery of the ship to obtain the owners agreement that the contract requirements have been achieved. More recently it has been extended to cover key project milestones such as concept, design and manufacture.
Development of the UK MoD Approach to Naval Ship Assurance

The MoD has traditionally developed and maintained its own comprehensive set of naval standards which were implemented by contractors and assured by naval overseers. These standards were maintained through a combination of feedback from operation and from research and development.

With reduced resources for the maintenance of these naval standards, the MoD has made increasing use of civilian standards on naval ships. However, the selective use of merchant standards, if applied without due consideration, can result in duplication and gaps (e.g., landing craft davits on HMS OCEAN, National Audit Office Report 864/1993).

In 1998, the MoD recognised the need to re-align its arrangements for ship safety leading to the recommendation that MoD practice be harmonised with civilian practice; a key aspect of which was to form Naval Authorities that would equate in purpose and approach to Statutory Authorities for merchant shipping.

Recognising that the MoD was no longer resourced to rely solely on developing and maintaining its own standards, a project was initiated in 1995 with Lloyd’s Register to develop rules for naval ships. The rules were first published in 1999 and have continued to develop with feedback of experience gained from their application.

NAVAL SHIP ASSURANCE FRAMEWORK

The benefits of a Naval Ship Assurance Framework

The benefits of the proposed framework are:

**Performance:** benchmarked against best merchant practice, improved accuracy of application, naval requirements clearly communicated;

**Cost:** elimination of overlaps and gaps between purely merchant practice and traditional naval practice drives out risk and supports early acceptance, and avoids costly modification to ships once in-service; and

**Time:** a much simplified framework that is dependent on far fewer key publications reduces the time required for MoD to select options, industry to apply in design and construction, and assurance organisations to review and confirm compliance; leading directly to further cost savings.

The Framework

The framework brings together the elements of Naval Assurance into a coherent structure to enable the user to identify how to apply the requirements, codes and standards and is pertinent to both submarines and surface ships.

This Naval Assurance Framework is for the overall assurance of Through Life Capability Management, encompassing: Safety, Environment, Operability, Supportability, Affordability and Programme.
Tailoring General Requirements to Ship Specifications

With reference to Figure 1 below, the framework consists of a central cone that makes the link between the capability requested by the customer and the capability delivered in the platform. At the top of the central cone is the customer requirement input - i.e. requirements from Director Equipment Capability (DEC). Working down the cone, this is translated, through the procurement process of preparing general naval requirements and general system specifications, to produce detailed system specifications that can be contracted against.

![Figure 1 - Naval Ship Assurance Framework](image)

The process for developing the General Naval Requirements into a set of General System Specifications and Detailed System Specifications is aided by the General Naval Specification document (GNS).

A key benefit of using the General Naval Specification as a template is the incorporation of learning from experience and so avoiding costly mistakes that are a repeat of history.

The General Naval Specification supports the layers of the specification process, so providing the ability to exit at different levels appropriate to the procurement process and the shipbuilding contractual arrangement.

With reference to the central cone, for the 1st layer down from the customer the General Naval Specification document provides a template for a project team to develop their own tailored and specific User Requirement and System Requirement documents. Use of this template aids the project team to ensure that the output is comprehensive and coherent. If allied across a Navy it will provide consistency and provides a place to store lessons learned from experience.
In the 2nd and 3rd layers, the General Naval Specification document provides a template for a project team to take the User and System Requirements to develop system specifications, which are then developed into detailed system specifications that could form the basis of contracting. Implicit in these levels are the development of acceptance criteria against the requirements.

At the core of the central cone is the backbone of Deep Design Knowledge. This is a knowledge base that aids the generation of the capability requirements, through development of the User Requirements and System Requirements and down to final acceptance of the ship/submarine into service.

A key part of this design knowledge base is the Maritime Platform Characteristics (MPCs). These enable the 'sponsor' to define the 'attributes' that they expect the solution to the requirements set to exhibit. It is not the function of MPCs to tell the project team delivering a new capability how to derive its solution; however, they provide a check list against which any solution could be assured. In addition, MPCs contain a wealth of information that can be accessed by the project team to help ensure they are on the right track when working their way towards the specification tailored for that platform.

Another example of the content of this design knowledge base is ship specific design knowledge which aids the project team in developing the specification; for example the Landing Craft Design Guide, Guide to the Naval Ship Code, Stability for Surface Ship Acquisition publication MAP01-024. Other content might cover systems, functions or stages of the procurement process.

Tailoring Lenses of the Framework

![Figure 2 - Applying the Safety Lens](image)

Around the central cone (in Figure 1) are lenses defining the codes and standards used throughout the design process. The lenses can be viewed from either direction.
The project team views them from the inside and sees the “regulatory” framework that it has to apply and which impacts on the solution. The regulator views them from the outside and sees the “regulatory” framework reflected in the requirements documents and specifications that have been tailored to provide the necessary assurance for that ship.

The lenses providing the framework are: Safety, Environment, Operability, Supportability, and Affordability & Programme, as shown in Figure 1. These provide a route map for guiding the development of the specification through to the end certification and acceptance, which records attainment of the required standard and so contributes to the overall assurance. Figure 2 shows the safety lens expanded showing Policy, Codes and Standards for surface ships.

The link between the development of customer requirements into detailed system specifications with the “regulatory” framework are key for the defence project team and industry to ensure all bases have been covered and to provide the required documentary evidence of assurance to the top level military customer.

The choice of lenses is coherent with the categories found in both the General Naval Specification template and the design knowledge contained in the Maritime Platform Characteristics. This does not preclude the use of other lenses but provides the initial framework for managing the assurance.

These diagrams depict the concept of the assurance framework. The detail will adapt to the platform under consideration, surface ship or submarine, and the specifics depending on choices made by the project team as they navigate the framework. The framework is comprised of several key document sets, which are at different levels of maturity. A key aim is to raise the maturity level of all documents as we ensure that the framework is comprehensive, coherent and clear.

DEVELOPING AND IMPLEMENTING THE FRAMEWORK

What does it actually mean?

The framework currently provides a high level structure to guide project teams through the assurance process. This structure needs to be developed at the detailed level. It needs to be credible and to recognise the environment in which the project teams are operating and the process for making use of the framework needs to clearly provide benefit balanced with any additional effort required to make use of a structured approach.

What does it look like?

At the most basic level the framework provides a template for defining the assurance requirements for a project by listing subjects and key standards. This template can then be used and populated for a specific project, identifying more detailed requirements. The example below shows how a service requirement is translated into a fatigue requirement which then identifies key standards and assurance activities.
Not redefining ship design

The framework is not a redefinition of the ship design process and it is not intending to create new processes but to provide a structure for processes that should already be conducted; for guiding project teams as they collate the evidence for assurance and consider the evidence holistically.

Using the framework

The framework provides an opportunity to map out key requirements for a project and develop a baseline requirements/standards set upon which cost capability discussions can take place. If the framework is used consistently within a Navy from project to project, these decisions can be benchmarked against legacy projects or at the time of a mid life upgrade, against the original design intent.

Some areas of the framework will have mandatory requirements that relate to safety or environmental compliance. It is important that these are clearly identified. They may well differ between navies and will certainly evolve over time in the same way that commercial legislation changes. Tailoring of the mandatory requirements can occur but, generally, equivalent levels of performance will have to be demonstrated.

For other areas, mandatory performance or capability requirements can be specified but a Navy will need to exercise extreme care when doing this, as mandatory capability can drive project cost. It may be better to specify minimum and desired capability.

Many requirements will be optional and need to be negotiated during the development of a project; the framework offers a consistent and familiar basis on which to do so.

For example, the framework has a placeholder for a steering system. The framework will identify mandatory requirements for safety e.g. Redundancy and rate of turn (NSR Vol II
Pt6 Ch1) but also performance maintenance and operability requirements (GNS Ref Part 1 - S2329/2330 Manoeuvring and Part 2 - 508 Steering Systems and Stabilisation Systems). A decision has to be made about the type and specification of the steering gear on this particular project and this can be recorded in the framework. Ultimately this will form the specification for the ship builder but it can also be used to identify assurance activities (class equipment certificate), acceptance events (test and trials) and record the decision process.

Ten years later when there is a plan to upgrade the capability of the ship the framework can be a reference for the original design intent. The upgrade can then be assessed as compliant or demonstrated as an improvement on that original intent. In a parallel project the framework can be used to clarify requirements which could be copied or used as a benchmark for a new solution.

This example demonstrates use of the framework at a low level (specification level), but similar principles can be applied at a higher level in the framework (user requirement level)

**Applicability to in service**

In implementing this approach to assist managing naval assurance it is important that it is of use not only to the new build project team but also to the in-service project team, particularly for those making significant mid life upgrades but also in support of general operation. In essence it needs to provide support to project teams understanding how they navigate their way to collate the necessary assurance as part of their through life capability management in whatever form that management might take place. When in-service experience demonstrates particular maintenance problems the lessons learned can be stored in a guidance document for use within the framework, to benefit future projects. Where there is a failure, due to an unforeseen mode of operation, design rules within the framework can be updated.

**NAVAL SHIP ASSURANCE SUPPORT SERVICE - NSASS**

**Background**

BMT and LR have formed an alliance with the MoD to support them in developing, managing and enhancing the framework for naval ship specifications, standards and assurance; the NSA framework.

In addition NSASS will undertake tasks to populate the framework, either through the development of specific standards or contributing to existing standards through established maintenance processes.

The identified need arose from the MoD Sea Systems Group, focused predominantly on safety and the key hazard certificates. The Naval Ship Assurance Support Service has been borne out of this requirement.

Whilst Naval Assurance is significantly wider than the framework for key hazard safety assurance “Naval Assurance is about providing the overall assurance underpinning Through Life Capability Management”, the alliance through NSASS provides a route to implement the framework's safety aspects on behalf of the MoD.

The broad remit for NSASS is captured in the following objectives:

Key Objective 1 - Develop a framework for ship safety assurance that is coherent, comprehensive and clear.
Key Objective 2 - Continuously monitor and improve the framework.

Key Objective 3 - Make the framework accessible to MoD regulatory bodies, MoD Integrated Project Teams and Industry and provide guidance for effective navigation.

Within this is the role of influencing the key document sets that populate the framework. This includes the General Naval Specification (GNS), Naval Ship Code (NSC), LR Naval Ship Rules (LR NSR) and Naval Standards.

There are already well defined mechanisms for the maintenance and development of these document sets and the role of NSASS is not to duplicate or contravene these but to provide input through established processes based on lessons learned from application of the framework and standards in a project. NSASS has a role to understand the place and boundaries of new standards within the framework plus take an holistic view of naval assurance and review the standards set for completeness, coherency and clarity.

Benefits Brought by NSASS

The key benefits in supporting the NSA framework through the NSASS arrangement are:

The NSASS team directly involves Commercial and Defence personnel, with experience of specification and standard development and implementation, working on the generation and consolidation of the framework;

The NSASS supports alignment of non-MoD frameworks (i.e. Commercial models) with bespoke MoD processes, to reduce the long term risk of divergence;

Through NSASS, key industry standards and specialist design development knowledge and capability is provided as a managed input to the NSA framework;

Through NSASS, experienced manpower, is focused and made available to provide framework development, implementation and specification / standards development work which continuously improves and assists the implementation of an effective NSA framework.

BMT and LR have a strong and long record of achievement and pedigree in the provision of the document sets that underpin the NSA framework. This collaboration of our two organisations delivers an in depth understanding of the challenges presented by the assurance of naval surface ships.

ADAPTING THE NAVAL SHIP ASSURANCE FRAMEWORK FOR OTHER APPLICATIONS AND NATIONS

Submarines

Whilst the NSA framework has been developed in the context of surface ships, it has also deliberately been constructed to ensure that the overall concept and high level framework is as applicable to submarines. At the detailed level the specific documents and guidance for project teams will be different but the overall issues and routes to providing assurance are similar.

Work is currently ongoing to explore the development of a submarine General Naval Specification. There are also class naval rules for submarines.

As yet there is not a submarine version of Naval Ship Code however this does not prevent application of the framework as the lens can be developed to interface with existing Naval Authority policy and standards prior to such a document being generated.
Other Nations

The framework has also been developed to make it generic enough that at the high level framework it is not specific to an individual country's situation. So the framework concept has been depicted in a way that recognizes there is a process for developing the customer requirements into a specification and a physical product and that this is within the context of a regulatory system.

NSASS can work with any navy to take the high level requirement and develop the lower levels of the framework to incorporate a navy’s specific policies and standards.

The terminology is purposefully generic that the country specific terminology can be inserted, together with the country specific composition of policy and standards.

Generic Placeholders in the Framework

In essence the framework is designed to provide a concept and mechanism for depicting the assurance situation and almost a ‘plug and play’ approach to generating a country specific solution. The detail has to be developed to ensure that the adapted framework is comprehensive, coherent and clear.

CONCLUSION

Comprehensiveness, Coherency and Clarity in Supporting Assurance

This Naval Assurance Framework is for the overall assurance of Through Life Capability Management, encompassing: Safety, Environment, Operability, Supportability, Affordability and Programme.

The framework brings together the elements of naval assurance into a coherent structure to enable the user to identify how to apply the requirements, codes and standards and is pertinent to both submarines and surface ships.

The key drivers for an effective framework are that it is comprehensive, coherent and provides clarity to the regulators and project teams.

The alliance through NSASS provides a route to implement the framework's safety aspects on behalf of the MoD. It is in its early days of developing this framework and adapting it in light of experience of its use in implementation on new procurement and in-service ships, and is beginning exploration of its transfer into submarine assurance.

The MoD has travelled a long way in adopting a more commercially based approach for naval assurance. The NSASS alliance is the next stage in that journey. There remains significant ground to be covered as the Naval Ship Assurance Framework is implemented. The NSASS team would be interested in receiving feedback that the reader, may have in relation to naval assurance in your situation, as we tackle an issue that affects many navies.

Please make contact with the authors through the NSASS team:

Email: enquiries@nsass.org.uk  Website: www.nsass.org.uk  Tel: +44 (0)1225 473572

REFERENCES
