THE APPLICATION OF THE CLASSIFICATION PROCESS TO GOVERNMENT VESSELS

By
Dev Dutta, A. K. Seah
American Bureau of Shipping

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SYNOPSIS

The American Bureau of Shipping (ABS) has worked together successfully with the Governments of many nations applying the ship classification process to a wide range of naval, coast guard and other government vessels. In the U.S. alone one-half of all U.S. Government vessels built have been classed with ABS. In recent years, because of similarities between past naval ship certification practice and ABS classification practice, the U.S. Navy and ABS decided to partner to address the lower risk aspects of designing and certifying non-nuclear naval combatant ships. Such an approach allows in-house navy engineering resources to be focused more on the higher risk mission related aspects of combatants, while maintaining technical control via close collaboration with ABS on the naval Rules applied – the foundation for the process. The navy retains technical authority, but uses ABS as a partner to administer the naval Rules, and as an agent in classing ships to the naval Rules.

In light of the reduction of resources within navies, the ABS ship classification approach provides a mechanism for the continued accomplishment of the core naval technical authority role of certification. Its success lies in clear alignment of the naval technical authority with the designated ship classification and certification agent along with the need for open, continuous communication amongst all parties regarding the engineering aspects of certification.

The first complete set of Rules resulting from this effort were embodied in the ABS Guide for Building and Classing High Speed Naval Craft. The High Speed Naval Craft Guide has been used in the classification of the U.S. Navy X-Craft and the mine countermeasures control ship HSV-2 SWIFT and is also being used for the new Torpedo Recovery/Security Craft and the new naval academy training vessels. The structural Rules in this Guide are being used for classing the new littoral combat ships (LCS).

This presentation will focus on the general approach for applying classification processes to government vessels using the recent experience with the X-Craft as a basis for discussion. It will summarize the approach to applying this tool on naval craft and will address how the requirements fit (or do not fit) together. In addition, valuable lessons learned from the ongoing applications will be presented.

INTRODUCTION

It is difficult in today's world to find an enterprise that is not moving at lightning speed while being resource constrained. Most organizations must maintain a continuous process of self-examination and improvement in order to keep pace with the challenges they face. This is certainly true for Government organizations and key support agents in their area. An increasing number of Government groups are restructuring themselves in an effort to sustain a clear and relevant mission, identify core capabilities, improve alignment and streamline the processes which will drive them toward their vision. As a result, Government agencies are proactively seeking alternatives to better address budget and personnel resource limitations, while looking for efficiencies to minimize the total cost of their operations. A major policy-driven alternative, stimulated by acquisition reform initiatives, is the application and leveraging of commercial products, services, and resources where possible in order to eliminate duplicative Government processes, take advantage of market-driven R&D and to allow commercial industry to align the systems and processes they have been using to support Government work with those used for their commercial business lines. Such approaches reduce both Government and commercial overhead, and thus, make more efficient the processes necessary to support Government programs. As a result, naval ship acquisition projects worldwide are varying significantly from historical acquisition approaches, requiring functional and procedural changes on the part of the shipbuilding industry as a whole and the navies involved. Industry is challenged to take the lead in developing, designing, and producing integrated systems to meet specific performance capabilities within strict affordability constraints. To accomplish this, industry must apply revised technical and business processes and procedures that are cost-effective and technically adequate. Equally essential is the ability of Naval Administrations to maximize use of industry products and services so they may focus resources on the development of transformational...
mission capabilities, global life cycle fleet maintenance and readiness management issues, and the safety and effectiveness issues associated with military-unique systems. This requires effective and efficient planning, oversight, and monitoring to ensure that unique mission capabilities are realized and that next generation transformational capabilities are fully satisfied within budget.

BACKGROUND

A key underpinning of delivering those capabilities is to meaningfully engage the designated naval technical authorities at each step of the process. A robust concept development approach, coupled with the top level requirements generation process, is an absolute necessity for the Navy to make conscious value judgments concerning future programs, and further, to gain broad understanding and insight into the mission effectiveness and business implications of potential shipbuilding decisions. This involves the development and application of design analysis tools and ship synthesis models that leverage the wealth of experience gained on past engineering efforts across many programs. That activity must be followed by the application of design rules and certification criteria that must influence the development of individual ship designs. For naval combatant ships, those rules and criteria must be approved and subsequently tailored by the naval technical authorities who are ultimately accountable for the safety and effectiveness of those ships and systems.

The success of that approach is fundamentally limited by the ability of the Navy to continue resourcing those efforts either with in-house expertise, or via a partnering relationship where a trusted third party functions as an adjunct to the cognizant authorities. Because the navies have built confidence in working with the American Bureau of Shipping (ABS) ship classification process on a number of past programs, and because of similarities to naval practice in certifying the many shipboard systems typically covered by ABS, several navies are deciding to partner with ABS to address the lower risk aspects of designing and certifying naval craft and ships. That allows in-house Navy engineering resources to be focused more on the higher risk mission related aspects of combatants, while maintaining technical control via close collaboration with ABS through the naval classification process.

Two definitions will aid in the discussion which follows:

1. **Naval Administration**: The program office, department, directorate, bureau, agency, command or Program Executive Office to whom the national government has delegated authority over the acquisition, acceptance and maintenance of naval vessels, and who acts on the government’s behalf in all matters relating to the procurement and support of warships and government vessels. In the case where these authorities are vested in separate departments within the naval organization, the term “Naval Administration” means the ensemble of departments having those authorities, or the command that overarches these departments. The Naval Administration may exist as part of the navy, or within a separate arm of the government such as a materiel procurement directorate. The term Naval Administration may also represent that entity with the responsibility designated above as applied to naval-like vessels for other agencies such as the Coast Guard.

2. **Naval Technical Authority**: The department, directorate, bureau or command having ultimate accountability for the safety and effectiveness of naval ships and systems, and authority to establish engineering standards and set technical policy. The Naval Technical Authority is also generally assigned the responsibility on ship acquisition programs to assess the level of compliance of a program to technical policies and to provide top-level design approval.

CERTIFICATION AS A PROCESS

Verifying that a complex system such as a naval vessel meets the expectations of those that must use it is central to both the acquisition and through-life maintenance processes. With respect to any given acquisition and at any point in the life of a vessel, the cognizant Naval Administration must be assured that key technical and production issues are being addressed correctly and adequately. Critical to gaining such assurance is the ability to credibly verify and document proven engineering and production practices as verified by the designated technical authorities. In pursuit of this goal it must be recognized that there are several competing dynamics at work. The acquisition manager, the designer, the shipyard, the vendor, the owner, the operator and the general public each have separate and sometimes conflicting objective functions related to the vessel. Expectations and the constraints within which they are to be fulfilled must be clearly defined. Experience has demonstrated that when the process of assessing satisfaction of these expectations is placed in the hands of an independent, trusted agent, disappointments and disputes can be minimized and quickly resolved. It is best if this agent does not have a vested interest; that is, its sole job is to assess satisfaction of agreed-upon criteria. When this can be done, conflicts of interest can be eliminated and both the procurer and the provider can rest assured that decisions relating to certification are being made independent of economic, political or organizational
The central philosophy in the development of a Ship Certification Plan is the application of acceptable commercial standards and practices to the greatest extent practicable, while maintaining a robust combatant level of performance. This contributes to a final product that is in line with acquisition reform goals, takes advantage of the proven cost benefit of commercialization, and still satisfies combat readiness requirements. The main elements of the Certification Plan are the Certification Matrix, the technical justifications that support the information contained in the matrix, and descriptions/definitions of the processes required for proper implementation and maintenance of the matrix and its contents over time.

The Certification Matrix is indexed to the work breakdown structure of the shipboard systems as defined by the design team. The matrix identifies the certification standards and criteria for all physical systems, as well as referring to the basic requirements of these systems that relate to system performance or are otherwise essential to proper ship life cycle design and support. For a multi-ship contract, the standards identified in the matrix are applied consistently to each ship of the class; however, the plan also provides for changes to the matrix over time and the resultant minor differences between vessels of the same class. In this regard, the plan addresses the need for collecting the resulting certifications for each delivered ship. Thus a complete compendium of certifications unique to each ship can be developed and maintained throughout each ship’s life.

Ship acquisition projects span many years; thus the plan should account for design changes as well as future modifications to vessels in service. Accordingly, there is a need to capture the technical justifications and underlying assumptions that are part of the evaluation process for generating the original data in the matrix. These justifications also serve to support the technical determinations made by system designers in their selection of commercial standards. The plan further addresses the process for exporting ship-specific information to historical records systems and for exporting new data (e.g., lessons learned) to maintain and update the information in the matrix to keep pace with new or improved standards, technologies, and best industry practices. Changes to the matrix due to technology refresh, new product data or lessons learned from applying the matrix would be accomplished during the maintenance phase of the Certification Plan life cycle.

The Ship Certification Plan is designed to ensure comprehensive development and control of technical requirements through evaluation and selection of appropriate standards and proper integration of competing technical requirements. This facilitates management decision-making and planning through the identification and early selection of appropriate certifying authorities. Thus, the plan is a key management tool for the design, build, and life cycle support of each ship of the class as well as the entire class of ships.

2. TECHNICAL APPROACH

Upon consideration of the above description, it becomes immediately apparent that development of certification matrices for individual platforms will result in criteria which can be documented as generally applicable to a wide range of naval vessels. Thus, individual efforts will contribute to the development and maintenance of naval Rules for general application. In fact, the process for creation of both individual criteria sets and general naval Rules are identical. Systems
are analyzed to determine where commercial standards, with or without supplemental naval-unique requirements, can adequately address life cycle design considerations and where non-commercial standards need to be retained. With careful consideration, this approach provides the best set of standards that can achieve operational effectiveness requirements while remaining balanced against life cycle cost. The basic technical approach is for technical subject matter experts (SMEs) to review the current standards being applied for naval vessel design and construction, evaluate ABS Rules for adequacy in satisfying the performance requirements that current naval standards address, develop supplemental naval-unique requirements which amplify class Rules where necessary, incorporate other applicable industry standards and identify necessary military standards which must be retained. The resulting mix of ABS Rules, industry standards, and military standards are reviewed to identify those for which certification is required. SMEs then identify the most appropriate Certification Authority. This process exactly mimics that used to develop the ABS High Speed Naval Craft Guide and, thus, can be used to ensure that the effort made to identify applicable criteria for a specific program is leveraged by capturing the criteria in the Guide for general application. This not only provides a continually improving baseline of vessel and system standards, it provides the mechanism for maintaining it over time by way of the ABS Rule Development process. This process is inclusive of all maritime infrastructure stakeholders and retains the Naval Technical Authority in both participatory and decision-making roles as these technical standards develop and mature.

3. ABS HIGH SPEED NAVAL CRAFT GUIDE

The ABS Guide for Building and Classing High Speed Naval Craft (aka ABS High Speed Naval Craft Guide (HSNC Guide)) has been developed in cooperation with the U.S. Naval Surface Warfare Center - Carderock Division - Combatant Craft Department, which represents the technical authority for the U.S. Navy’s high speed craft. This is a set of standards that was developed for high speed craft that will operate in a variety of missions in environments that range from riverine to the open sea, and may be called upon to go into harm’s way.

The High Speed Naval Craft Guide is divided into parts, chapters, and sections that reflect the current numbering system of the American Bureau of Shipping. The division of the Guide is as follows:

*Part 1 General Provisions:* Administrative notes and Classification details that apply to the entire craft.

*Part 2 Requirements for Materials and Welding:* These requirements are applicable to all craft that are being Classed and include requirements for steel, aluminum, and fiber reinforced plastics. The High Speed Naval Craft Guide contains the requirements for aluminum and fiber reinforced plastics only. The requirements for steel are part of the Steel Vessel Rules. ABS has also developed a supplement to this book specifically for Naval Vessels.

*Part 3 Hull and Structures:* General requirements for all craft, structures, stability, and fire protection.

*Part 4 Machinery and Equipment:* General requirements for all craft, prime movers, propulsion and maneuvering, pressure vessels, deck machinery, piping systems, fire safety systems, electrical systems, and remote propulsion control and automation.

*Part 6 Survey After Construction:* Requirements for maintaining vessel in Class

The High Speed Naval Craft Guide incorporates the following items as part of the Classification process:

- Hull, mechanical and electrical (HM&E) systems
- Subdivision and stability
- Mission system interface with vessel and HM&E systems (but not the mission systems themselves)

The obvious difference between a naval craft and a commercial craft is that a naval craft is designed and built to go into harm’s way. The Naval Administration determines, on a case basis, the levels of threat from enemy aggressions (weapons and weapons effects) that the vessel will face, the manner in which the vessel will avoid them (e.g., by signature reduction), and the level of survivability against those threats. However, naval craft also encounter hazards at sea during their normal operations, due to the environment, accidents or the inherent risks involved in training for war, and must be able to survive them. Therefore, the requirements for Classification under the High Speed Naval Craft Guide distinguish between “inherent” survivability requirements against fire, collisions, flooding and the operation of own-ship weapons (e.g., gun blast), and requirements imposed by the Naval Administration on survivability and signature reduction against enemy threats. These distinctions are as follows:
• Mandatory for Class:
  • Flooding and damaged stability
  • Fire protection
  • Damage control
  • Protection against own-vessel weapons effects
  • Structural redundancy and residual hull girder strength
  • Propulsion system redundancy
  • Electrical system redundancy

• Guidance for supplemental requirements determined by Naval Administration:
  • Protection against chemical, biological and radiation
  • Protection against underwater threats, e.g., shock and whipping
  • Protection against above-water threats, e.g., blast, fragmentation, electromagnetic pulse
  • Signature reduction

As stated above, the High Speed Naval Craft Guide is designed to protect the craft during their normal operations, due to the environment, accidents or the inherent risks involved in training for war. The Guide and the philosophy of ABS does not specify materials for certain systems unless we find them to be unfit for use, nor does the Guide specify a specific shape or arrangement of the craft, or any of it’s appendices, unless it will interfere with the overall safety of the craft. If there are any specific preferences by the Naval Administration regarding the material selection or geometry of the craft or any of its’ appendices, it should be specified in the specifications for the craft.

Additionally, there are many areas in the High Speed Naval Craft Guide that allow for relaxation or increases in the requirements based on the needs of the Naval Administration and the concurrence of the Naval technical Authority. If the Naval Administration would like to exercise any of these options, it should be indicated in the specifications for the craft and clear written technical justification produced showing why deviations were made from the Rules and the technical justification for such.

4. NAVAL VESSEL CLASSIFICATION – APPLYING THE ABS HIGH SPEED NAVAL CRAFT GUIDE

In the normal course of Classification to the High Speed Naval Craft Guide, the Bureau would be contracted to provide a Class certificate as required by the Naval Administration. In this scenario, the Naval Administration takes the decision to build its vessel under Class, where ABS acts as the classification agent for the vessel and certification agent for HM&E systems; i.e., those items covered by the Rules. In this scenario, ABS is normally contracted directly by the shipyard and delivers its plan approval and certifications to them. However, it is possible that Classification can be carried out with ABS directly under contract to the Naval Administration. Thus, the Naval Administration has the flexibility to maintain an oversight role while concentrating its resources on more critical technical and programmatic issues, or leave the matter entirely in the hands of the shipbuilder, as has been the case on some auxiliary ship and service craft acquisitions.

During the initial steps of the Concept/Design Phase, the Naval Administration generally concentrates on strategic planning, requirements definition and budgeting, and less on developing a technical framework for execution. ABS involvement will typically begin during early stage design by advising the Naval Administration and Naval Technical Authority on the Rules and Classification. ABS may assist in developing early contract requirements to invoke the High Speed Naval Craft Guide in a Statement of Work that may require a Class certificate from the shipyard as part of the deliverables. ABS may also be tasked to guide the process of developing a total ship certification plan including all elements of the vessel, as well as certifications of voluntary compliance with international conventions. ABS may also assist the Naval Technical Authority and/or Design Agent in preparing the ship specification, which naturally involves tailoring the specific application of the HSNC Guide.

During the Detail Design portion of the Build Phase, ABS works with the shipyard, and HM&E system vendors / integrators to ensure that the vessel, and its HM&E systems and mission system interfaces conform to the Rules and any other requested certification standards, such as SOLAS or MARPOL. The final product to guide Detail Design and construction will be the approved Ship Specification. ABS will issue approvals of design plans or CAD models to the shipyard. ABS will also establish a technical file for the ship including pertinent documents and drawings. The Naval Administration and Naval Technical Authority will accept the design and authorize construction, based in part on the shipyard’s receipt of ABS and other approvals.

During the construction portion, ABS will carry out survey, inspection and testing of the vessel, HM&E systems and mission system interfaces to ensure compliance with approved drawings and the Rules. At the end of the Build phase,
ABS issues a Class Certificate, along with other certifications as requested by the Naval Administration. These certificates are delivered to the Naval Administration as part of the overall package required for acceptance into fleet service.

After delivery, if the vessel is maintained in Class during the service life of the vessel, ABS will conduct both annual and periodic special inspections and surveys, reporting the suitability of the vessel to remain in class directly to the Naval Administration. The technical data base for the vessel will be maintained to reflect the material condition of the vessel and HM&E systems. During maintenance and modifications, ABS will be contracted through the shipyard to conduct engineering plan approvals, survey, tests and certification for the vessel and HM&E systems during overhauls, conversions, repairs and mission system upgrades. These certificates are delivered to the Naval Administration as part of the overall package required for acceptance and return to fleet service.

5. THE WAY AHEAD

ABS has gathered significant experience now in the application of the High Speed Naval Craft Guide on several programs in various stages of completion and is at the threshold of issuing the first class certificate for a naval vessel designed and constructed to the Guide in the process described above. Classing the U.S. Navy X-Craft has provided valuable insight into the structure and nature of the relationships which are necessary in classing a naval vessel. The US Navy vessel SWIFT (HSV-2) was brought into ABS class under the HSNC Guide after it was chartered to the U.S. Navy and this experience is providing day-to-day lessons regarding keeping a naval vessel in class. the U.S. Navy’s new Littoral Combat Ship is being classed by ABS and the Rules matrix for that vessel includes the structures criteria of the HSNC as the baseline for the LCS. In addition, ABS is now applying the HSNC Guide in classification and certification efforts for the Egyptian Navy, the Government of Oman and the Mexican Navy.

In light of these experiences to date it would be useful to note several observations which might foster discussion that could result in improvement of the application.

1. It is imperative that the criteria against which certification is to be evaluated is clearly stated and that objective thresholds be established to the maximum extent possible. Subjective criteria can result in a range of expectations amongst the various parties involved in the process and invariably lead to disagreement. It will be necessary to retain subjective criteria to some degree and, as such, the importance of the next observation is underscored.

2. The roles of each involved party should be documented and clearly understood. The specification or contract must clearly empower the certification agent and make clear the process by which interpretation of the meaning of criteria is established and the process through which disputes are handled. Of necessity, ABS and the Navy should agree to share the role of interpreting any requirement in the HSNC Guide during their application. In the case of a naval vessel, the final decision for interpretation, equivalency or waiver should remain with the naval technical authority but the class society should be included in all discussion and technical adjudication that leads to the final decision. In that manner, the class society will be equipped to enforce the criteria with a full knowledge of the intent and desire of the naval technical authority. Roles and relationships should be addressed in pre-contract discussions and again at a post-award kickoff conference.

3. The objective of this initiative is to develop the procedure whereby the Navy can rely upon ABS as a classification and certification agent on vessels and associated systems, equipment and components which are more militarily unique than those for which the Navy has engaged ABS in the past (navy auxiliaries and service craft). One goal is that this should be done in such a manner as to allow the Navy to focus its in-house resources on work which could not be delegated. As such, it is imperative that redundant review, inspection and survey be avoided as much as possible. Having the Navy redo all that ABS does would defeat the intent of the practice. Thus, it is not expected that the Navy would analyze each part of the certification process undertaken by ABS, but rather would selectively employ monitoring of the process to ensure that systems certified in vessels built and classed by ABS are designed, built and installed to a level of acceptability equivalent to those certified using the Navy’s traditional approach. This again underscores the importance of establishing at the outset a clear understanding of the roles and responsibilities of each party. Organizations which provide navy or government representation to the designer or at the yard during construction must engage with the classification society very early to establish coordinated and complementary working processes to avoid confusion and misunderstanding.

4. Open communication throughout the entire process is a key to success. It must be understood from the beginning that there will be difficult aspects to resolve enroute, but each party has the same overall objective - to deliver a vessel which meets or exceeds specified expectations. Thus, it is absolutely necessary to avoid selective “information management” in order to try to hide or otherwise misrepresent factual information. The contract
should contain language which facilitates free and open communication between all parties insofar as the acceptability of the systems are concerned. It should also establish a clear adjudication process whereby disagreements or questions of proper procedure may be quickly addressed with all affected parties involved.

6. CONCLUSION

In light of the reduction of retained resources within most governments and navies, the ship classification approach outlined above provides a mechanism for the continued accomplishment of the core navy technical authority role of certification. Its success lies in clear alignment of the navy technical authority with their designated ship classification and certification agent along with the need for open, continuous communication amongst all parties regarding the engineering aspects of certification. The goal is the design, construction and installation of systems, equipment and components for which there is a high degree of confidence that the stated performance requirements will be safely met. The service to be delivered is certification to clearly defined criteria, and the product is a certificate of compliance which the vendor and builder can use to demonstrate to the navy that the requirement has been satisfied.