



GUIDANCE NOTES ON

REVIEW AND APPROVAL OF NOVEL CONCEPTS

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Foreword

The mission of the American Bureau of Shipping (ABS) is to serve the public interest, as well as the needs of its clients, by promoting the security of life, property, and the natural environment. This is primarily accomplished through the development and verification of standards for the design, construction and operational maintenance of marine and offshore facilities. These standards or Rules are established from principles of naval architecture, marine engineering and other engineering principles that have been proven satisfactory by service experience and systematic analysis.

The marine and offshore industries frequently develop novel applications or processes that have no previous experience in the environment being proposed. These novel concepts have such little precedent and may be so different from existing designs that the guidance encompassed in the class Rules may not be directly applicable to them.

The guidelines presented herein offer ABS clients a methodology for requesting classification of a novel design. These Guidance Notes describe the process and responsibilities for ABS review of proposed novel concepts from the project concept stage through maintaining Classification on the novel concept. The process described in the document draws upon engineering, testing and risk assessments in order to determine if the concept provides acceptable levels of safety in line with current offshore and marine industry practice. The methodology relies heavily on risk assessment techniques as a way to better understand and anticipate structural and operational issues related to the novel concept.

These Guidance Notes are more suited to an application with a high degree of novelty. This document provides guidance, in the form of a checklist, to assist the client in identifying if a proposed design would be categorized as new or novel with regards to ABS classification. If a client is proposing an alternative to one or a small number of current Rule requirement(s), it may be more appropriate to follow the methodologies outlined within the *ABS Guide for Risk Evaluations for the Classification of Marine-Related Facilities* in order to gain ABS approval.

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GUIDANCE NOTES ON NOVEL CONCEPTS

CONTENTS

SECTION 1	Introduction	1
1	Purpose.....	1
2	Background.....	1
3	The Evolution of a Concept	1
4	Path to Class Approval	3
5	Definitions	3
	FIGURE 1 Concept Evolution.....	2
SECTION 2	Application.....	5
1	General	5
2	New/Novel Concept Checklist	6
	TABLE 1 Novel Concept Checklist.....	6
SECTION 3	Novel Concept Approval Process	11
1	Overview	11
1.1	Determine Approval Route	12
1.2	AIP (with Approval Road Map).....	12
1.3	Final Class Approval	12
1.4	Maintenance of Class.....	12
	FIGURE 1 Novel Concept Approval Process	11
	FIGURE 2 Process Flow for ABS Approval of Novel Concepts	13
SECTION 4	Approval in Principle	15
1	Scope	15
2	Required Information to be Submitted	16
2.1	Novel Application Description	16
2.2	Support Information.....	17

3	Concept Engineering Evaluation	17
3.1	Verification of Conventional Features	18
3.2	Verification of Novel Features	18
3.3	Verification of Operability	19
3.4	Verification of Interface Issues	19
3.5	Verification of Inspectability and Maintainability	20
4	Concept Level Risk Assessments	20
4.1	Qualitative Risk Techniques	20
4.2	Comparative Risk Assessment	22
4.3	Concept Level Risk Assessment Submittal Requirements	22
5	Granting “Approval in Principle”	23
5.1	Conditions for Approval in Principle	23
5.2	Issuance of AIP Letter	23

TABLE 1	Qualitative Risk Techniques	21
---------	-----------------------------------	----

SECTION 5 Final Class Approval 25

1	Information Required for Engineering Evaluation	25
2	Review and Verification of Engineering Analyses for Full Approval	25
2.1	Reconfirmation of Relevant Design Codes and Standards Applied	26
2.2	Calculation Dossier	26
2.3	Confirmation of Interface Issues	26
2.4	Confirmation of Inspectability and Maintainability	26
3	Detailed Risk Assessment	27
3.1	Quantitative Risk Techniques	27
3.2	Selection of Target Reliability and Risk Acceptance Criteria	28
3.3	Comparative Risk Assessment	29
3.4	Detailed Risk Assessment Submittal Requirements	30

TABLE 1	Quantitative Risk Techniques	27
---------	------------------------------------	----

SECTION 6 Input to Surveys and Maintenance of Class..... 31

1	Knowledge Gained	31
1.1	Input to Survey during Construction	31
1.2	Input to Survey during In-Service Operation	32

SECTION 7 Government and Regulatory Involvement..... 33

APPENDIX 1 Sample Risk Matrix 35

SECTION **1 Introduction**

1 Purpose

This document provides guidance to ABS clients related to the ABS methodology for review and approval of new/novel concepts. The document describes the process and responsibilities for ABS review of proposed new/novel concepts from the project concept stage through maintaining Classification on the novel concept.

2 Background

A new or novel concept is defined as an application or process that has no previous experience in the environment being proposed. These Guidance Notes are intended to cover proposed applications that have not been proven in the marine or offshore industry and would therefore be considered novel for those environments. Marine and offshore installations which contain novel features of design with respect to the structural aspects, machinery systems, storage or process aspects to which the provisions of the current Rules, Guides and existing industry standards are not directly applicable may still be classed or certified. This approval is on the basis that the Rules, Guides and existing industry standards insofar as applicable have been complied with, and that special consideration through appropriate risk assessment and engineering analyses has been given to the novel features through the application of this guideline.

In some instances, certain features of a particular system or structure may not meet the intent of the current Rule requirements. The guidelines presented herein are more suited to an application with a high degree of novelty. If a client is proposing an alternative to one or a small number of current Rule requirement(s), it may be more appropriate to follow the methodologies outlined within the *ABS Guide for Risk Evaluations for the Classification of Marine-Related Facilities* in order to gain ABS approval.

3 The Evolution of a Concept

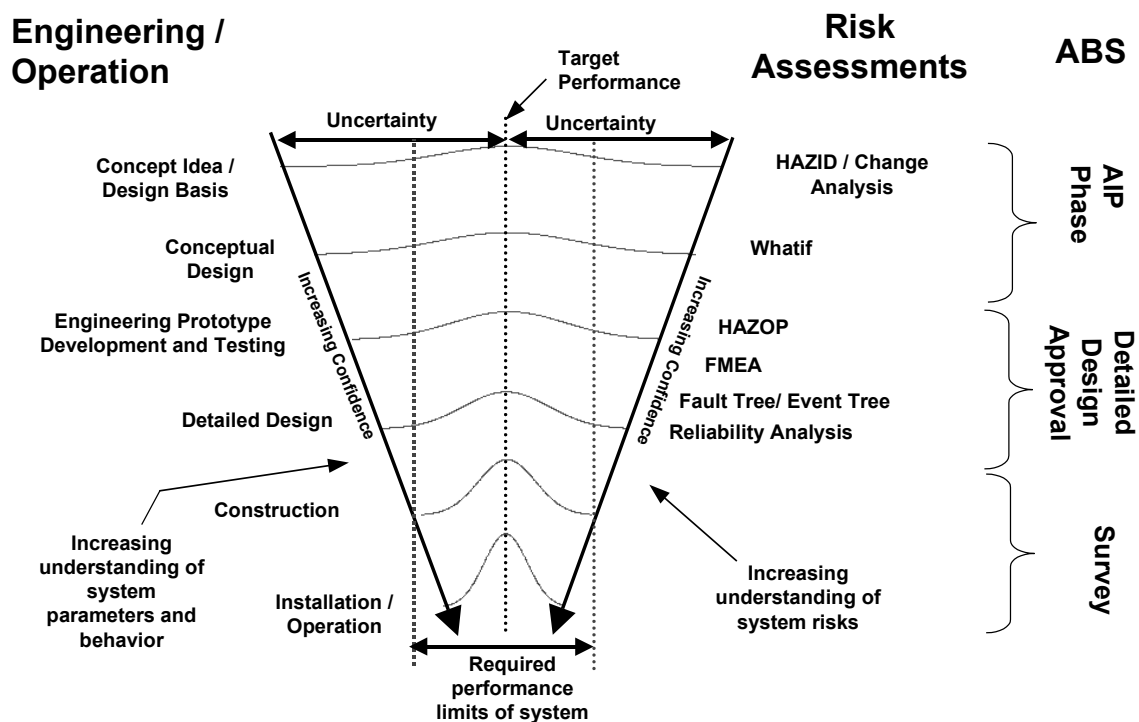
The document contained herein is structured to provide a general procedure for clients that guides them through the process of obtaining and maintaining class approval of new/novel concepts. The process described in the document draws upon engineering, testing and risk assessments in order to determine if the concept provides acceptable levels of safety in line with current offshore and marine industry practice. It also provides guidance, in the form of a checklist, to assist the client in identifying if a proposed design would be categorized as new or novel with regards to ABS classification. Guidance is also provided on the general level of evaluation and review conducted for different types of concepts. ABS recognizes that there are varying degrees of new concepts (e.g., level of uncertainties or similarities to existing applications), and hence not all proposed new concepts will require the same level of evaluation and review.

The document is organized around the general steps involved with developing initial concepts, through detailed design and ultimately to the implementation of the marine or offshore application. The primary milestones related to these steps for obtaining and maintaining class include:

- i) Approval in Principle (concept development phase)
- ii) Final Approval for Classification (detailed design/construction/commissioning phase)
- iii) Maintenance of Classification (implementation/operational phase)

Section 1, Figure 1 demonstrates graphically the evolution of a concept in terms of engineering and operation, risk assessment and ABS involvement in these phases. Clients who are just beginning to explore the possibilities of a new technology or concept often seek ABS input and expert opinion on its perception of the concept in terms of Class or ABS approval. Thus, clients will seek a preliminary approval from ABS on the novel feature or concept. This preliminary milestone in the ABS Class process is called Approval in Principle (AIP). The benefit of gaining AIP from a Class Society is that the client now has a document issued by a knowledgeable independent marine and offshore society attesting to the acceptability of the concept for classification. At the AIP stage, risk is assessed on a high level through qualitative techniques. Engineering within the AIP phase is to be progressed to the point of demonstrating that likely failure modes and consequences have been identified and at least considered in the concept design. The need for proof or model testing and data gathering will have been identified. Further need for refined risk assessment and engineering analysis will have been identified as well. Once granted AIP, the client will then most likely advance into the next phases of the project, involving the detailed design and also the advanced risk assessment and testing which may have been identified in the conceptual phase. This will aid the client and ABS in gaining certainty in their design as the level and accuracy of the risk assessment and engineering evaluation increases. This phase of the project would involve traditional Class participation in the form of design review and survey and would ultimately result in Class approval. Maintenance of Class would be performed in the traditional sense, involving periodic surveys to validate renewal of the Class Certificate. However, in this instance, the maintenance of Class for a novel concept may involve a modified and/or expanded survey scope or frequency as a condition of Class, until the concept has built up a satisfactory service experience.

FIGURE 1
Concept Evolution



4 Path to Class Approval

This document outlines the steps of the Class process for a novel concept that will aid the client in understanding of the process via the identification of a clear path to achieving both AIP and full ABS approval. This process involves ABS and the client working together to accomplish the following:

- i) Determine, as a first step, the approval route to achieve AIP. This will involve the client and ABS meeting to discuss the concept, its purpose, its novel features and where it deviates from traditional approaches, the proposed operating envelope and the potential impact of the concept on other systems or components. Agreement will be reached as to the best methods to assess risk in the AIP phase as well as the appropriate level of engineering analysis.
- ii) Meeting throughout the AIP phase as the concept is being evaluated to formulate an Approval Road Map that will lay out conditions to achieving full approval. This road map will form the basis for the conditions attached to the AIP issuance. The road map will define clearly the approach needed from a risk assessment and engineering analysis standpoint to justify those novel aspects not covered by existing Rules, codes and standards.
- iii) Participating in and evaluating the necessary risk assessments, analyses and tests necessary to satisfy the conditions outlined in the AIP Road Map to achieve a level of confidence that the design and the risk are acceptable.
- iv) Determining the necessary additional conditions assigned to maintenance of Class via additional survey scope or frequency of attendance, condition monitoring, required maintenance and inspection techniques to maintain levels of monitoring assumed in the design phase which may have been necessary to achieve various design parameters, and finally as a means to verify assumptions and predictions made throughout the process.

In addition to the guidance as outlined in this document, it is important to stress the continuous, forthright and timely communications between the client and ABS throughout the concept approval process. This will ensure smooth evaluation, review and ultimately implementation of the new/novel concept, minimizing the potential for uncertainties while maximizing the client's efforts and efficient use of resources to gain approval of the concept.

5 Definitions

Approval is intended to mean that the plans, reports or documents submitted to ABS have been reviewed for compliance with one or more of the required Rules, Guides, standards or other criteria acceptable to ABS.

Approval in Principle (AIP) is a process by which ABS issues a statement that a proposed novel concept design complies with the intent of ABS Rules and/or appropriate codes although said design may not yet be fully evolved (i.e., concept appears to have technical feasibility from both safety [personnel and environment] and functional perspectives), subject to a list of conditions that must be addressed in the final design stage.

Classification is a representation by ABS as to the structural and mechanical fitness for a particular use or service, in accordance with its Rules and standards. In the context of a novel concept, this would also mean that the conditions outlined within the approval road map identified during the AIP stage have been demonstrated to the satisfaction of ABS.

Consequence is the measure of the impact of an event occurrence in terms of people affected, property damaged, outage time, dollars lost or any other chosen parameter usually expressed in terms of consequence per event or consequence amount per unit of time, typically per year.

Controls are the measures taken to prevent hazards from causing undesirable events. Controls can be physical (e.g., safety shutdowns, redundant controls, added conservatism in design), procedural (e.g., operating procedures, routine inspection requirements) and can also address human factors (employee selection, training, supervision).

Event is an occurrence that has an associated outcome. There are typically a number of potential outcomes from any one initial event that may range in severity from trivial to catastrophic, depending on other conditions and add-on events.

Existing Application is a design or process that has been accepted previously by ABS or other Classification Society for which there is at least one complete 5-year survey cycle of proven experience in the proposed environment.

Failure is the loss of the ability to perform the intended function

Failure Mechanism is a physical or chemical process resulting in a form of damage which will ultimately lead to failure.

Failure Mode is the specific manner of failure that the failure mechanism produces.

Final Concept Design Stage is the stage in the design evolution at which the feasibility of the technology from an engineering and risk perspective can be assessed.

Final Design Stage is the stage when all design issues have been addressed and all risk concerns mitigated to acceptable levels.

Frequency is the occurrence of a potential event per unit of time, typically expressed as events per year.

Hazards are conditions that exist which may potentially lead to an undesirable event.

Maintenance of Classification is the fulfillment of the requirements for surveys after construction. In the context of a novel concept, this would mean all requirements within the applicable ABS Rules, as well as any additional requirements outlined in the conditions of class for the concept.

Marine Applications are those applications where the majority of the general requirements for design, construction, installation and continued class of the concept will be derived from the *Rules for Building and Classing Steel Vessels*, ABS related Guides for special vessel types and the codes and standards utilized by the marine industry.

New Application is an overall process that has not been accepted previously by ABS or other Classification Societies or that there is none or limited (less than one complete 5-year survey cycle) proven experience in the proposed environment.

New/Novel Concept is a design or process that has no previous experience in the environment being proposed.

Offshore Applications are those applications where the majority of the general requirements for design, construction, installation, and continued class of the concept will be derived from applicable ABS Rules and Guides for offshore installations and the codes and standards utilized by the offshore industry.

Preliminary Conceptual Design Stage is the early stage of development of a new project/concept.

Risk is defined as the product of the frequency with which an event is anticipated to occur and the consequence of the event's outcome.

SECTION 2 Application

1 General

This document is applicable to all marine vessels and offshore facilities for which new/novel concepts are being proposed. New/novel concepts may be the entire concept of a vessel or facility, a system or subsystem or an individual component. New/novel concepts may be defined in several ways:

- i) *Existing design/process/procedures in new or novel applications.* An example of this could be a proposed use of an onshore existing technology application, such as the use of a chemical process or storage medium on floating structures.
- ii) *Existing design/process/procedures challenging the present boundaries/envelope of current offshore or marine applications.* An example of this could be a proposed use of an existing type of floating structure, typically only used for drilling and processing hydrocarbons that would also include hydrocarbon storage.
- iii) *New or novel design/process/procedures in existing applications.* An example of this could be a new type of offshore floating structure that has not been used before in the industry.
- iv) *New or novel design/process/procedures in new or novel application.* An example of this could be a proposed use of an onshore existing technology application, such as the use of a particular storage medium on a new type of floating structure which contains an unproven or novel process system.

In order to help determine if a proposed design falls into the category of new/novel, the checklist in Section 2, Table 1 is provided. The objective of the checklist is to:

- i) Establish if the new design qualifies as a new/novel concept and whether the use of these Guidance Notes are appropriate for evaluating the concept and;
- ii) Gain a general understanding of the variation from existing or proven marine or offshore applications, and thus the degree of novelty.

The checklist is meant to act as a trigger that would indicate that the proposed design might be categorized as novel, and thus potentially require additional considerations and evaluation outside the standard class approval process as prescribed in the ABS Rules. The number of yes/no answers gained from the use of the checklist does not directly dictate what evaluations need to be performed in order to class the design. Rather, the answers provide an indication that discussions with ABS should be initiated to ensure there is a mutual understanding between the designers and ABS on how the design may deviate from existing applications, the degree of novelty present, the lack of suitable Rules, codes and standards to address that novelty and what plan of action will be required to address these deviations. In general, if a high degree of novelty is confirmed via the checklist, then these Guidance Notes should be applied. As an alternative, it may be concluded upon completion of the checklist query that the degree of novelty is such that the approval route is best achieved through the application of the *ABS Guide for Risk Evaluations for the Classification of Marine-Related Facilities*. It is understood that ABS and the client will have to mutually agree as to what constitutes a high degree of novelty and therefore the appropriate document to be used in the approval process.

2 New/Novel Concept Checklist

Section 2, Table 1 is the novel concept checklist. The checklist is intended to help identify proposed new or novel concepts applied to marine and offshore systems. When evaluating whether or not an application is novel, all questions should be answered with “Yes”, “No” or “NA” (Not Applicable).

The first set of checklist questions identifies potential general aspects of a proposed application that would indicate it is a new or novel concept or application. The next set of questions address marine systems and structural features, covering possible new concepts related to moorings, structural configurations, material applications, ballasting systems, mechanical or electric systems.

The next category relates to novel processes (e.g., chemical or hydrocarbon processing/production), activities or storage within marine or offshore applications. Novel processes may include new types of hydrocarbon production that have not been applied commercially before, or it may include the extension of a process that has never been applied on an offshore application. Novel activities may include the use of a vessel or offshore facility for purposes other than the original design purpose. Novel concepts may include a new type of mooring system for an offshore floating installation. Novel storage applications may include the application of new types of cargo tanks to transport highly volatile gases or liquids. In all of these examples, the proposed function of the vessel or offshore facility is affected by the application of the new technology, concept or activity.

The last checklist category covers possible new or novel ancillary systems in which the function of the vessel or offshore facility could be impacted by the performance of this system.

TABLE 1
Novel Concept Checklist

No.	Checklist Questions	Yes/No/NA ⁽¹⁾
General		
G1	Is the proposed type of marine or offshore application or facility currently being used in marine or offshore applications?	
	If Yes, what is estimated total operational years of experience of similar marine or offshore facilities?	
G2	Is the vessel or offshore facility design basis (e.g., environmental constraints, operating parameters [temperatures, pressures], topside loads or interface with marine systems) considered within current experience boundaries for this application?	
G3	Are there applicable design guidance documents (e.g., ABS, API, IMO, ASME) specific to the proposed marine or offshore application?	
Stationkeeping Aspects		
SK1	Is the proposed mooring system design considered to be within the current experience boundaries for the vessel or floating facility?	
	Are the proposed mooring line materials considered current industry practice for this application?	
	Is the proposed mooring system arrangement considered existing industry practice (e.g., no unique arrangement features such as lines crossing critical components or other mooring components in close proximity to critical components)?	
	Do the proposed mooring control systems require active monitoring that is similar to existing mooring systems for the same type of applications and designed according to existing standards and recommended practices?	
	Are there existing applications of the proposed mooring anchorage system (e.g., piles, anchors or other)?	
SK2	Is the proposed thruster system design considered to be within the current experience boundaries for the vessel or floating facility?	
	Are the environmental and operating parameters for the thruster system within experience bounds for the vessel or floating facility?	
	Is the control system for the thruster system considered to be within the current experience boundaries for the vessel or floating facility?	

Section 2 Application

No.	Checklist Questions	Yes/No/NA ⁽¹⁾
	Are the potential consequences associated with failure of the thruster system considered to be similar to other thruster applications?	
Structural Aspects		
S2	Is the proposed hull or main structure design considered to be within the existing experience boundaries for the vessel or offshore facility?	
	Are there existing applications of the proposed structural configuration (e.g., unique shape, extreme size [scaled up of version existing application], arrangement [novel layout to enhance stability, motions, construction or speed] or atypical loading or load paths)?	
	Are there existing structural designs that utilize materials, connection details or construction tolerances for similar applications?	
	The proposed design will <u>not</u> require enhanced (i.e., in addition to what is typically required by class Rules) maintenance or structural monitoring procedures to ensure adequate integrity and structural performance due to new features or application of new technology?	
Marine Systems		
MS1	Are the proposed ballast systems considered to be within the existing experience boundaries for the vessel or offshore facility?	
MS2	Are the proposed mechanical/electrical systems (e.g., bilge, power distribution, communication, navigational guidance) considered to be within the existing experience boundaries for the vessel or offshore facility?	
	Is the electric power generation system considered to be within the current experience boundaries for the vessel or offshore facility?	
	Is the fuel system used for electric power generation considered to be within the current experience boundaries for the vessel or offshore facility?	
	Is the control system for power generation considered to be within the current experience boundaries for the vessel or offshore facility?	
	Are the power requirements for the vessel or offshore facility within current experience bounds?	
	Are the mechanical system arrangements (e.g., bilge, ballast) considered to be within the current experience boundaries for the vessel or offshore facility?	
	Is the physical layout of the mechanical systems considered to be within current industry practices?	
MS3	Are there any new hazards in the design of the vessel or offshore facility that require active or passive prevention or mitigation systems not considered to be within current industry practice?	
	Are physical layouts of equipment and structures such that current industry practices for hazard detection (e.g., fire, gas, flooding) are clearly adequate?	
	Are physical layouts of equipment and structures such that current industry practices for egress and evacuation are clearly adequate?	
MS4	Is the proposed propulsion system design considered to be within the current experience boundaries for the vessel or floating facility?	
	Is the fuel system considered to be within the current experience boundaries for the vessel or floating facility?	
	Is the physical layout of the propulsion system considered to be within current industry practices?	
	Is the control system for the propulsion system considered to be within the current experience boundaries for the vessel or floating facility?	
	Are the operation requirements and potential consequences associated with failure of the propulsion system considered to be similar to other propulsion applications?	
MS5	Is the proposed steering system design considered to be within the current experience boundaries for the vessel or floating facility?	
	Is the control system for steering considered to be within the current experience boundaries for the vessel or floating facility?	
	Are the guidance and navigation systems considered to be within the current experience boundaries for the vessel or floating facility?	