



RECOMMENDED PRACTICE

DNV-RP-H104

---

# Ballast, Stability, and Watertight Integrity - Planning and Operating Guidance

SEPTEMBER 2011

## FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

DNV service documents consist of amongst other the following types of documents:

- *Service Specifications*. Procedural requirements.
- *Standards*. Technical requirements.
- *Recommended Practices*. Guidance.

The Standards and Recommended Practices are offered within the following areas:

- A) Qualification, Quality and Safety Methodology
- B) Materials Technology
- C) Structures
- D) Systems
- E) Special Facilities
- F) Pipelines and Risers
- G) Asset Operation
- H) Marine Operations
- J) Cleaner Energy
- O) Subsea Systems

The electronic pdf version of this document found through <http://www.dnv.com> is the officially binding version  
© Det Norske Veritas AS September 2011

Any comments may be sent by e-mail to [rules@dnv.com](mailto:rules@dnv.com)

For subscription orders or information about subscription terms, please use [distribution@dnv.com](mailto:distribution@dnv.com)

Computer Typesetting (Adobe Frame Maker) by Det Norske Veritas

## CONTENTS

<b>1. General.....</b>	<b>4</b>
1.1 Introduction.....	4
1.2 Objective.....	4
1.3 Scope.....	4
1.4 Document Structure.....	4
1.5 Definitions.....	4
1.6 Abbreviations.....	5
1.7 References.....	6
<b>2. Management of Significant Themes.....</b>	<b>6</b>
2.1 Introduction.....	6
2.2 Philosophy.....	6
2.3 Design and Equipment.....	7
2.4 Retrofitted Equipment.....	7
2.5 Verification of Technical Capability Against Operational Requirements.....	8
2.6 Control / GUI / Mimics / Ergonomics.....	8
2.7 Watertight Integrity.....	8
2.8 Stability.....	9
2.9 Ballasting and Bilge Systems.....	9
2.10 Inspection, Repair, and Maintenance.....	10
2.11 Vessel Documentation, Operating Manuals and Contingency Planning.....	10
2.12 Training, Competencies and Project Specific Familiarization.....	11
<b>3. Development and Implementation of Operational Guidance.....</b>	<b>11</b>
3.1 Introduction.....	11
3.2 AMOG Overview.....	11
3.3 Ownership and use.....	12
3.4 Development.....	12
3.5 Pre-Mobilization Check.....	13
3.6 Field Arrival Requirements.....	13
3.7 Execution Requirements.....	13
3.8 AMOG Awareness and Preparedness.....	13
3.9 Reporting.....	14
<b>Appendix A. Implementation Matrices.....</b>	<b>15</b>
<b>Appendix B. Ballast Management Strategy Content.....</b>	<b>18</b>
<b>Appendix C. AMOG Development and Implementation Process Flow.....</b>	<b>20</b>
<b>Appendix D. AMOG Development Checklist.....</b>	<b>21</b>
<b>Appendix E. Safest Mode Configuration Example.....</b>	<b>28</b>
<b>Appendix F. AMOG Example.....</b>	<b>32</b>
<b>Appendix G. Activity Matrix Example.....</b>	<b>35</b>
<b>Appendix H. Marine Operating Manual Guidelines.....</b>	<b>37</b>

## 1. General

### 1.1 Introduction

This RP documents the process for planning and operating Marine Systems that are essential to vessel ballast operations, stability and watertight integrity during the conduct of the vessel's Industrial Mission and to assist with assurance processes.

### 1.2 Objective

The primary objective of this RP is to provide guidance on managing risk associated with Ballasting, Stability and Water Tight Integrity during planning and execution of the Industrial Mission. Guidance is provided on

- Managing above risk by addressing ten identified themes associated with safe operation of marine systems
- Developing Activity Marine Operating Guidelines (AMOG).

The AMOG is a key tool for managing risk during execution. The AMOG's purpose is to readily identify critical vessel operations, technical safety and criteria for activities dependent on ballast, stability and watertight integrity. Additional detail on AMOG is provided in section 3.2.

### 1.3 Scope

This RP is applicable to the following activities:

- MODUs
- Project/Construction Vessels/MOUs
- Logistics Vessels.

In addition to providing guidance on managing risk, this RP assists in establishing and implementing a verification process for vessel readiness prior to undertaking the required Industrial Mission.

An implementation matrix providing guidance on the level of detail for the themes identified in Section 2 and the AMOG for general categories of Industrial Missions is provided in Appendix A.

### 1.4 Document Structure

The structure of this document is as follows;

Section 1: General introduction and background information

Section 2: Discussion on ten identified themes

- associated with safe operation of marine systems
- and highlighting specific aspects of these themes.

Section 3: Development and Implementation of Operation Guidance during planning and Execution of the Industrial Mission

- guidance on development of Activity Marine Operating Guideline (AMOG) and its use as a decision support tool
- guidance on execution.

Appendices: Examples of risk management tools, and checklist, flow diagrams to develop such tools.

### 1.5 Definitions

*AMOG*: Activity Marine Operating Guidelines is a decision aiding process document for managing marine risks associated with ballast, stability, and watertight integrity while undertaking mission activities

*Agreed for Implementation* means agreement between stakeholders.

*Industrial Mission*: The primary operational role of the vessel, typically applicable to MODUs and project construction vessels. The Industrial Mission by definition for logistics vessels is to support logistics.

*Mission Activity*: An operational activity of the vessel to achieve a particular objective, as a subset of the Industrial Mission.

*Associated Activity*: A mission activity that relies on Marine Systems and is essential to accomplish the Industrial Mission (e.g. Ballasting during Heavy Lift operations).

*Non-Associated Activity*: A Marine System activity that is not essential to accomplish the Industrial Mission (e.g., Tank inspection during Heavy Lift operations).

*Activity Matrix*: Identifies the assessed level of risk from execution of an associated or non-associated activity during a mission activity in a tabular format.

*Marine System*: Is the vessel structure, machinery, pipework, or controls related to ballast, watertight integrity and stability.

*Critical Equipment:* The components of Marine Systems that are essential to effective operation of those systems and to safeguarding vessel safety.

*Retrofitted Equipment:* Equipment which has been modified or installed after the initial vessel construction or documented modification.

*Control Stations:* Those spaces containing control and monitoring equipment for Marine Systems. These may be collocated with other vessel control stations or may be separated. (e.g. In the case of column-stabilized units a centralized ballast control station is a “control station”).

*Mal Operation:* A failure in a Marine System (including human error) which results in an escalation of risks.

*Management of Change (MOC):* A systematic process to verify that any changes (agreed to procedures, controls, and unplanned activity) necessitated during project execution is evaluated and managed to the detail required to, ensure the safety, health and environmental and operational risks arising from these changes are clearly understood and controlled.

*Safe Condition:* As defined in this document a vessel condition in which all marine system functioning is in conformity with AMOG green condition criteria.

*Task Appropriate Safe Condition:* A vessel condition which prevents escalation of the risk arising from an incident of mal-operation and allows time to make informed decisions or evaluate potential actions.

*Critical Operation:* An activity specific to the accomplishment of the Industrial Mission with a high potential for exposure to loss of life, asset damage, and environmental spill. It should be recognized that a routine operation may become critical due to vessel mal-operation. Non critical operations are any other operation.

*Safest Mode Configuration (SMC):* A tabulated presentation of the configuration of the vessel’s Marine Systems and auxiliaries to deliver the required integrity and control of associated and non-associated activities and deliver incident free execution.

*Mode Of Operation:* A condition or manner in which a vessel may operate or function while on location or in transit. Modes of operation of a vessel include the following:

- *Operating Mode:* Conditions wherein a vessel is on location for the purpose of conducting operations, and combined environmental and operational loadings are within the appropriate design limits established for such operations.
- *Severe Storm Mode:* Conditions wherein a vessel may be subjected to the most severe environmental loading for which the vessel is designed. Operations are assumed to have been discontinued due to the severity of the environmental loading.
- *Transit Mode:* Conditions wherein a vessel is moving from one geographical location to another.

*Time to Terminate (TTT):* The amount of time required to physically release the vessel from its project activity following an abort status and allow it to be brought to a safe condition. The Time to Terminate is not fixed for the duration of the operation but will vary according to the circumstances. (e.g.:- In case of a drilling vessel this may be the time required to set a storm packer at the onset of deteriorating weather).

*Time to Undertake (TTU):* The amount of time required to safely undertake a project activity with appropriate allowances for potential inefficiencies and contingency. (e.g.:- Weather dependent operations in Offloading a barge: Weather windows appropriate to the weather conditions and operational efficiencies (dependencies on crane operability, deck workability).

## 1.6 Abbreviations

AFI	Agreed for Implementation
ALARP	As Low as Reasonably Practicable
AMOG	Activity Marine Operating Guidelines
CCTV	Closed Circuit Television
FMEA	Failure Mode and Effect Analysis
GUI	Graphic User Interface
HEMP	Hazards and Effect Management Plan
HIRA	Hazard Identification Risk Assessments
IMO	International Maritime Organization
IRM	Inspection Repair and Maintenance
MOC	Management of Change
MOM	Marine Operating Manual
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
PM	Preventive Maintenance
PTW	Permit To Work
RP	Recommended Practice
SCADA	Supervisory Control and Data Acquisition
SCE	Safety Critical Element

SMC	Safest Mode Configuration
TASC	Task Appropriate Safe Condition
TTT	Time to Terminate
TTU	Time to Undertake
VMS	Vessel Management System
WT	Water Tight

## 1.7 References

Further information addressing principles documented in this RP can be found in the following:

- /1/ UK Health Safety Executive Research Report 387, “Stability”, 2005
- /2/ International Standard “Petroleum and Natural Gas Industries - Specific Requirements for Offshore Structures - Part 6: Marine Operations” ISO/FDIS 19901-6:2009
- /3/ DNV - “VMO-Standard”: DNV-OS-H101, DNV-OS-H102 & DNV-OS-H201 through DNV-OS-H206.

## 2. Management of Significant Themes

### 2.1 Introduction

This section discusses the following significant themes identified as relevant for the safe execution of maritime operations:

- Design and Equipment
- Retrofitted Equipment
- Verification of Technical Capability Against Operational Requirement
- Control / GUI / Mimics / Ergonomics
- Watertight Integrity
- Stability
- Ballasting and Bilge Systems
- Inspection, Repair, and Maintenance
- Vessel Documentation, Operating Manuals and Contingency Planning
- Training, Competencies and Project Specific Familiarization.

The themes are addressed in more detail from section 2.3.

### 2.2 Philosophy

#### 2.2.1 Planning

The planning associated with the operation of Marine Systems should be based on managing exposure to the consequences of mal-operation, in addition to standard marine risk management objectives. This should be based on the principles of:

- a clear understanding of the Marine Systems and Industrial Mission of the vessel
- a clear understanding of the associated activities that are relevant to the execution of any mission activity
- validating onboard capabilities and awareness of emergency and backup methods for operation of Marine Systems.
- executing drills and tests demonstrating emergency and backup operation prior to execution of the Industrial Mission.
- assessing vulnerability of marine systems to damage and develop contingency plans for recovery to Task Appropriate Safe Condition (TASC)
- planning and conducting those activities with the appropriate understanding and fit for purpose controls or barriers in place
- development and implementation of the AMOG.

#### Guidance note:

The overall objective in addressing safety of marine operations is to perform all mission activities at ALARP risk of accidents or incidents to personnel, environment and property. This can be met by taking the following considerations into account during the development of the AMOG:

- Statistical weather extremes for the area and season
- Specifying the limiting environmental conditions, related to the mission activity and a sufficient period (time) to enable completion of the operation. While establishing period/time required completing operations inefficiencies (equipment and weather related) and trouble time (equipment) is to be taken into account
- Ensuring the vessels and equipment are designed and validated for adequate performance with respect to their intended use to carry out the mission activity
- Ensuring redundancy in the equipment (if required) is provided to cover possible breakdown situations
- Planning the operations in nature and duration, such that accidental situations, breakdowns or delays have a very low probability of occurrence and are covered by detailed contingency plans

- Preparing adequate documentation for a safe, step-by-step execution of the operation, with clear indications of the organization and chain of command and go- no go criteria
- Ensuring the operations are conducted by competent personnel
- Using and documenting systematic risk assessments in the development of the project specific procedures.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

### 2.2.2 Objectives

The objectives of planning should be to:

- define associated activities necessary for execution of project activities
- understand impacts of associated activities in terms of stability and watertight integrity (intact and damaged)
- clearly define criteria for executing associated activities and embed in AMOG
- establish SMC and embed in AMOG
- define and control non associated activities with potential impact on stability and watertight integrity (intact and damaged) by inclusion in AMOG
- ensure common understanding of controls and barriers by all stakeholders
- develop implementable contingency plans
- drill and test contingency plans
- execute associated activities in accordance with the Agreed for Implementation AMOG.

### 2.2.3 Tools

An Activity Matrix should be developed. A well-defined Activity Matrix assists in the development of an effective AMOG. An example of an Activity Matrix is included in Appendix G.

Where the activity matrix identifies ballast operations as an associated activity a ballast management plan should be developed. Ballast plans should contain sufficient detail and evolve from a robust Ballast Management strategy. An effective Ballast Management Strategy should address the following:

- management and control of ballast operations
- failure modes and design failure intent
- current system capability and operational requirements
- minimizing transfer to and from sea and tank usage
- clear identification of tanks to be used and control potential for isolation failures
- monitoring of tank levels (primary and secondary)
- minimization of free surface effects, over pressing or overflowing tanks
- stability impacts (intact and damage)
- personnel understanding of system design and limitations.

An example of a Ballast Management Strategy and Ballast Plan is included in Appendix B.

## 2.3 Design and Equipment

Vessels undertaking an Industrial Mission should meet statutory and regulatory requirements (Class, Flag, and Coastal State). They should have the necessary systems, equipment, operating procedures, and appropriately qualified, trained and competent personnel to carry out the intended mission. Marine Systems and equipment should be in fully operational condition.

### 2.3.1 Marine Systems

Marine Systems referenced in this RP include:

- ballast (includes tanks, vents and sounding pipes, pipework, pumps, and valves)
- bilge (includes pipework, pumps, valves, tanks and oily water treatment equipment)
- watertight doors and subdivisions, hatches, and vent closures
- control systems including field devices related to Ballast, Bilge, and Watertight Integrity
- auxiliary power systems for Marine System (e.g. Power/hydraulic/ compressed air).

### 2.4 Retrofitted Equipment

Retrofitted equipment should be readily identified.

Retrofitted equipment should be reviewed to identify whether it has been installed following a rigorous management of change process or has had regulatory review and approval.

The main vulnerabilities are:

- retrofit may not have been subject to rigorous design and installation review and risk assessment
- inadequate assessment of impact on system operation
- the relevant significance of retrofitted equipment may not have been identified in the IRM system or MOM

Documented evidence assessing and addressing vulnerabilities should be maintained.

**Guidance note:**

Examples of retrofitted equipment would be post shipyard delivery stability software, field initiated modifications to existing equipment/ systems or new equipment added (e.g. Third Party) subsequent to vessel entering into operations.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

## 2.5 Verification of Technical Capability Against Operational Requirements

Operational requirements for the Industrial Mission should be established. Associated activities and vessel Marine Systems required are to be identified.

Actual capability of a Marine System should be verified as sufficient to satisfy operational requirements. The actual capability is the known performance under expected conditions of heel and trim and maintained system condition at the time of the activity.

Where Marine Systems are not operating in accordance with the original design intent, an MOC should be utilized to ensure that the risks are identified, assessed, and control measures implemented.

The TTU and TTT for each mission activity should be validated against the actual capability of Marine Systems required to perform associated activities.

## 2.6 Control / GUI / Mimics / Ergonomics

On many vessels control of Marine System activities is carried out via SCADA systems and graphic user interfaces and mimics. Where GUI have alarm notification capability, a robust alarm management system should ensure that critical alarms are made readily visible.

Display of GUI / MIMICS should be such that inadvertent obscuring of critical information is not possible. Where the system does not have the capability for a dedicated non configurable critical display, a robust control process should be in place to ensure that the optimum GUI display for activity is not changed inadvertently.

Failure consequence and failure intent, if applicable, of Marine System equipment should be established. Consideration should be given to providing a means to bring isolating valves to a closed condition by simple operation from a control station.

The following should be accomplished as part of the planning activity:

- validate onboard capabilities and awareness of emergency and backup methods for operation of Marine Systems.
- execute drills and tests demonstrating emergency and backup operation prior to execution of the Industrial Mission.
- assess vulnerability of control stations to damage and develop contingency plans for local operation.

**Guidance note:**

Configurable Displays: Where inadvertent acts have the potential to obscure critical information on the GUI, the optimum display should be identified, agreed upon and embedded in the SMC and AMOG. No changes should be permitted without initiating a change in status and the ensuing notification process and risk assessments.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

## 2.7 Watertight Integrity

The vessel should have in place procedural controls for maintaining watertight integrity during the Industrial Mission. A plan should be developed that addresses:

- consequence of accidental flooding including machinery space, spaces containing pipes connected to the sea, tank and void flooding related to damage stability criteria
- vulnerabilities due to maintenance activity (e.g. manhole cover opened between voidspaces/tanks) or lack of maintenance
- penetrations likely to compromise integrity
- effect of progressive flooding stemming from either mal-operation or as consequence of loss of watertight integrity.

Internal compartments considered as buoyant should have watertight boundaries. The integrity of bulkhead penetrations including piping and cable penetrations, ventilation ducts, watertight doors and manholes should be confirmed.

Hull penetration closing devices including shipside valves and hydroacoustic trunking / wells should be fully operational, as should have remote closing systems. The integrity of closing devices should be confirmed.

The vessel systems for detection of flooding of internal compartments including sounding pipes, bilge level alarms, leak detection systems, and CCTV systems should be fully operational.

Watertight and weathertight doors, hatches, manhole covers and other opening closures should be fully operational and routinely closed except as may be defined for an associated activity. Such exceptions should be minimized and subject to a MOC.

Tank, space, and void vents should be structurally sound with functional closing devices.

External openings such as ventilators and hatches should be fitted with the appropriate closing devices to prevent down flooding under the worst damage condition. The closing devices should be properly maintained and tested on a periodic basis.

The vessel watertight doors, controls and operating systems should be fully operational. All powered / remote controlled watertight doors should have signs posted adjacent to and on both sides of the door. Signs should be readily visible and contain clear operating instructions and warnings as relevant.

A process for reporting of malfunctions or failures on doors should be in place, such that corrective actions can be taken immediately by responsible personnel.

## **2.8 Stability**

The vessel should have an approved stability manual which contains specific guidance for verifying vessel stability is within the safe operating limits. The stability manual may be part of the MOM.

Lightship changes should be methodically tracked and recorded and current lightship weight and center of gravity validated.

Competent vessel personnel should confirm by following a methodology approved by Flag State and Class that stability is always within safe operating limits, and determine that planned loading scenarios required by the Industrial Mission satisfy stability requirements. The limiting parameters should be clearly established and made visible in the AMOG.

Where activity involves moving objects, equipment, materials or liquids, stability load cases should be ascertained for both intact and damaged case condition.

Detailed loading plans and seafastening design should take into account worst case damage condition.

Load out and dry transport of heavy lift cargos should be given special consideration. This includes having detailed ballast/de-ballast plans. Cargos should be loaded and discharged as close to even keel and list as possible. A detailed strategy and a corresponding contingency plan (Ballast Plan) for emergencies should be prepared for every operation. Project specific limiting parameters should be established in Transport Manual and AMOG.

The vessel should be provided with appropriate stability calculation tools (e.g. stability software) that have been verified as accurate by independent means. Independent means can include review and approval by class. On board personnel should be proficient with stability calculation tools as well as manual calculation methods. Software modifications should be controlled under a MOC process. On board personnel should periodically verify software calculations by validating against a load case from the stability manual. Results should be validated against measured draft readings.

Damage condition scenario and response drills should be conducted by personnel to familiarize themselves with the required corrective actions to be taken to bring the vessel to a safe condition. These can be both a combination of desk top drills as well as emergency response team drills practicing damage control responses.

Task Appropriate Safe Condition should be established for critical operations. This could differ from the Safe Condition. The primary objective of TASC is to stabilize while preventing escalation.

## **2.9 Ballasting and Bilge Systems**

The integrity status and functional capability of vessel Marine Systems and equipment should be understood at all times. Ballasting and bilge systems should be considered as Safety Critical Equipment.

The need for ballasting as an essential part of an Industrial Mission or mission activity should be identified. Any required ballasting should be designated as an associated activity and become subject to the procedures described in this RP.

Where the Industrial Mission requires multiple ballasting operations a Ballast Management Strategy should be developed, as noted in Section 2.2.3.

For each individual ballasting associated activity a Ballast Plan that takes into consideration vessel stability should be developed and agreed prior to execution.

If ballasting is not an associated activity, then no ballasting should be undertaken during execution of the mission activity and if considered, should be controlled by a MOC. MOCs should be accompanied by an appropriate risk assessment.

The same considerations for ballast should apply to other bulk fluid transfer operations such as:

- anti-heeling and anti-roll tank operations
- drilling fluid transfer
- bunker transfer.

Bilge monitoring and bilge pumping systems should be fully operational. Potential vulnerabilities arising from pipework connections with other pumping systems, back flooding and methods of bilge pumping control

should be evaluated. Any requirement for bilge pumping during TTU and TTT of mission activities should be evaluated and included in AMOG as required.

**Guidance note:**

When assessing integrity and functional capability of vessel Marine Systems and equipment the following should be considered:

- equipment includes pumps, eductors, strainers, valves, actuators, sensors, control network
- all equipment should be operationally ready, including emergency back-up systems
- primary and secondary means of tank level gauging to be available and accessible
- bilge system fully functional including bilge level alarms
- intact piping systems and effective isolations during maintenance
- fluid management in extreme environmental conditions.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

## 2.10 Inspection, Repair, and Maintenance

A robust Inspection Repair Maintenance (IRM) program should be in place and in use which clearly identifies critical equipment.

The IRM should incorporate effective spare parts management including maintaining a defined inventory of critical equipment spares.

The IRM should be integrated with an effective Permit to Work scheme encompassing identified high risk maintenance activities.

Any potential detrimental impact on mission activity and associated activities of the current status of the IRM program, defects, backlogs and deferred maintenance (if any) should be evaluated.

Defects and outstanding maintenance should be:

- evaluated for impacts on Industrial Mission
- made subject of a remedial plan and addressed prior to commencement of the Industrial Mission.

Necessary intrusive IRM activities during mission activities should be controlled by the AMOG and a MOC.

**Guidance note:**

The IRM should address all Marine Systems and maintain the integrity and functionality of system components as well as:

- ensuring a continuous appreciation of the running condition of all critical equipment.
- directing the maintenance program so as to keep all critical equipment in a satisfactory, functional, reliable, safe state of repair.
- directing the scheduling of critical equipment running hours and maintenance so as to maximize the MTBF
- directing the management of defective critical equipment so as to minimize the MTTR
- ensuring visibility of status of safety critical equipment.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

## 2.11 Vessel Documentation, Operating Manuals and Contingency Planning

The vessel should have on board a complete inventory of manufacturers' technical, maintenance and operating documentation for Marine Systems and equipment. Documents and drawings of systems should be up to date and show the current arrangement on board. Out of date or obsolete documentation and drawings should be removed.

The vessel should be provided with a comprehensive Marine Operating Manual (MOM). The MOM should:

- contain guidance for the safe operation of the vessel for both normal and defined emergency conditions
- provide necessary general information about the vessel
- contain guidance on procedures for operations that are critical to the safety of personnel and the vessel.
- be concise and be compiled in such a manner that can be easily understood.
- include a contents list, an index and wherever possible be cross-referenced to up to date additional detailed information which should be readily available on board
- chain of command with general responsibilities during normal operations
- emergency operations and contingency plans
- person in charge during emergency conditions.

Additional guidance on the content of the MOM is provided in Appendix H.

Emergency procedures for all mission activities should be prepared to cover foreseeable hazards, including those due to adverse weather conditions, human errors, technical failures or changes to the configuration of the operations.

The objective of the emergency procedures should be to return the vessel to a safe condition, or TASC. For operations passing a point where the operation cannot be reversed, a point of no return should be defined. Safe conditions after passing a point of no return should be defined and considered in the emergency procedures.

**Guidance note 1:**

The information developed in the MOM should, where necessary, be supported by the additional material developed in the form of plans, manufacturers' manuals and other data necessary for the efficient operation and maintenance of the vessel. Detailed information developed in manufacturers' manuals need not be repeated in the operating manuals. The information should be referenced in the MOM, readily identified, and easily accessible on the vessel and be available at all times.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

**Guidance note 2:**

Contingency, backup plans and emergency planning should form part of the Industrial Mission procedures. Plans should be developed for foreseeable emergencies that are identified by risk identification/risk management processes.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

## 2.12 Training, Competencies and Project Specific Familiarization

Personnel should be appropriately qualified, trained and competent for the work they are expected to undertake.

Personnel identified for critical roles should have an adequate knowledge of the English language.

Supervisors should possess a thorough knowledge of the entire operation under their control and have prior experience with similar operations. Other key personnel should have knowledge and experience within their area of responsibility.

Job categories critical to safe operations should be identified and qualification requirements specified. Qualification Requirements should be aligned with Industry Guidelines where available. Where suitable industry guidelines or accepted best practice are nonexistent, qualification requirements appropriate to the task should be developed.

Before commencement of an Industrial Mission, personnel involved should be briefed by the supervisors on mission activities and responsibilities. Personnel should have received the required training.

Pre commencement training should include:

- mission specific familiarization for operational teams (includes AMOG familiarization)
- drills as required.

**Guidance note 1:**

Decision Support tools (e.g. Computer simulations, model tests, project specific simulator training) can be valuable tools to enhance training, competencies and familiarization.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

**Guidance note 2:**

Training requirements should include refresher training to ensure that personnel knowledge and skills are maintained. Positions requiring refresher training should be specified. Course content and training intervals should be identified and documented. Records should be maintained and reviewed periodically to ensure training goals are being met.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

## 3. Development and Implementation of Operational Guidance

### 3.1 Introduction

This section addresses development and implementation of Operational Guidance and covers the following topics:

- Introduction of the Activity Marine Operating Guideline (AMOG), its ownership and development
- Its operational use in the following execution phases:
  - Pre-mobilization Check
  - Field Arrival Requirements
  - Execution Requirements
  - AMOG awareness and preparedness
  - Reporting.

### 3.2 AMOG Overview

An AMOG is developed and used as a decision support tool to assist in managing risk associated with Marine Systems during execution of the Industrial Mission. An AMOG should be developed for the mission activities,

agreed for implementation by the stakeholders and utilized during execution. Process flow for AMOG development and implementation is included in Appendix C.

The AMOG documents information about the Safest Mode Configuration (SMC) pertinent to Marine Systems and specifies limits to operating criteria by a traffic light system relevant to the Industrial Mission. The established limits trigger escalation from normal operating condition depicted by a green status through a hierarchy of other status, Blue, Yellow and Red. It identifies the notifications required and actions to be taken in response to a change of status.

An example of an AMOG is included in Appendix F.

### 3.3 Ownership and use

The AMOG is owned by the vessel's on board operational leadership. The onboard operational leadership is responsible for the development and application of the AMOG during the execution of the Industrial mission.

#### Guidance note:

The AMOG is not bounded by a specific mission or charter party. The AMOG is an evergreen document incorporating the knowledge and lessons learned from executing missions and adapted as needed for follow up missions/ customers.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

Project teams (including project, operational and vessel personnel) should carry out activities in accordance with the agreed for implementation AMOG. They should have a clear understanding of the criteria and the traffic light system used in the AMOG.

It is highlighted that the AMOG is a decision support tool incorporating criteria for change of status, and notification and initial reaction requirements following changes of status. Detailed follow up actions/reactions should be part of the contingency planning and is usually contained in MOM, Emergency Response Plans and other such documents. The level of detail in the AMOG should be appropriate for its use as a decision support tool.

**The AMOG should not be used as a repository for detailed execution procedures and contingency planning.**

### 3.4 Development

The AMOG should have inputs from:

- a review of relevant documentation;
- output from a verification process and testing (if applicable)
- risk analyses
- the specific nature of the mission activities
- contingency plans.

Development of the AMOG should:

- identify areas to be managed
- validate the technical suitability of the Marine Systems of the vessel for the mission activities and address condition, functionality and operability
- establish criteria for undertaking operations of the Marine Systems required for the Industrial Mission. (Criteria should be established by analyses of the mission activities.)
- identify the safest mode configuration – see Guidance Note 2.

The documented checklist in Appendix D assists in developing the AMOG.

The AMOG may specify requirements more stringent than regulatory requirements or industry guidelines.

The vessel's operational personnel should be engaged in risk identification and assessment practices and have a key role in the development of the AMOG. The safest mode configuration should be decided in collaboration with the stakeholders. An example of an SMC can be found in Appendix E.

The AMOG should when relevant include summary information from appropriate contingency plans and emergency response plans.

The AMOG should not conflict with the MOM. If during the development of the AMOG inconsistencies with the MOM are identified, they should be addressed appropriately.

#### Guidance note 1:

It is recognized that a vessel often has several different configurations, however to meet the objectives of the mission activity, the safest mode configuration to enable the operation should be identified, and made visible in the AMOG. Critical operations should be conducted with the vessel configured in the safest mode,

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

#### Guidance note 2:

Where the determination has been made that non critical operations can be carried out with the vessel configured in a mode other than the safest mode, a separate AMOG should be developed for such non critical operations.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

### 3.5 Pre-Mobilization Check

A pre-mobilization check of the vessel being used for a mission activity should be conducted. Appropriately trained personnel should conduct the pre-mobilization check focusing on the relevant Marine Systems

The objective of this pre mobilization check are to:

- verify operational readiness of identified Marine Systems
- validate suitability of AMOG criteria
- mentor operational teams on use of AMOG during execution.

On board operational leadership should make available the appropriate resources to facilitate an efficient execution of the pre-mobilization check.

### 3.6 Field Arrival Requirements

Pre arrival checks should be carried out as agreed. As part of pre arrival checks, compliance with green status of criteria identified in the SMC should be verified.

Compliance with AMOG criteria status should be included in field arrival requirements, documented and verified by on board operational leadership before commencement of the mission activities.

### 3.7 Execution Requirements

Mission activities should be conducted in accordance with the AMOG.

Notifications resulting from escalation of AMOG criteria should be given to required parties identified in the AMOG.

AMOG criteria escalating to yellow or red status may trigger additional notifications.

Environmental operating limits should be agreed with all stakeholders prior to execution. These limits should not exceed the limits set in the AMOG.

On board operational leadership should ensure that the AMOG is discussed with new hires and at crew changes prior to the crews engaging in execution activity.

Prior to conducting any associated activity, a job safety assessment should be undertaken as required.

In the event that unplanned activities are required:

- the appropriate degree of risk assessment should be undertaken and potential hazards identified and appropriate notifications made
- risk assessments should involve all levels of stakeholders and operational personnel
- unplanned activities should be controlled by a defined MOC process
- the AMOG may be modified in the field, subject to the explicit consent of the on board operational leadership and stakeholders.

Nothing in AMOG should relieve the operational personnel of the vessel of their responsibility to take the necessary actions in order to bring the vessel to a Safe Condition or TASC in the event of:

- mal-operation of a Marine System
- the onset of an unplanned/unforeseen incident.

#### Guidance note 1:

Nothing in this section precludes carrying out any activity required to maintain the safety of the vessel and crew.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

#### Guidance note 2:

An example of associated activity arising from criteria escalation due to agreed environmental limits would be MODU ballasting to survival draft in storm conditions. This would not be considered a notifiable criteria change under the AMOG.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

### 3.8 AMOG Awareness and Preparedness

Project teams (including project, operational and vessel personnel) should carry out activities in accordance with the AMOG. They should have a clear understanding of the criteria and the traffic light system used in the AMOG.

Awareness should be validated in the form of documented evidence of:

- participation in HIRAs
- participation in pre-mobilization checks
- development of the AMOG
- final discussions on AMOG prior to commencement of execution activities

- distribution lists for the AMOG
- review with new crews/personnel immediately following crew changes and prior to engaging in work activity.

Preparedness should be validated in the form of documented evidence of:

- drills
- equipment Tests.

### **3.9 Reporting**

Reporting requirements should be as required by the AMOG; In addition the following requirements should be implemented:

- records should be maintained of both field arrival and watch keeping checklists. Any supplemental checklists developed as a result of this RP are to be included in record keeping
- prior to execution, checklists/plans for the mission activity should be developed
- project daily progress reporting should include a section on AMOG condition (“Traffic Light Status” as defined by the AMOG) during the past 24 hours, equipment status and any incidents of Mal-operation. The report should also include current AMOG condition (Status light, highest escalated AMOG (Status Light) condition over previous 24hrs, brief note on trigger for change of condition.

Changes in AMOG criteria status should be subject to the required notifications as part of the established AMOG reporting requirements.

## APPENDIX A IMPLEMENTATION MATRICES

### Drilling and Completion Vessels

THEME	DESIGN AND EQUIPMENT (Ballast & Bilge WT doors / subdivisions VMS. Auxiliary power systems)	RETROFITTED EQUIPMENT	TECHNICAL CAPABILITY	CONTROL (Design/ capability Alarm display Failure intent/ result Vulnerability Drills & tests)	WATER- TIGHT INTEGRITY (IMS Shipside closures Internal WT subdivision Deck closures WT door safety)	STABILITY (Stability manual Load Plans Damage control Capacity tables Mud / brine)	BALLAST AND BILGE (Tk lvl sensor / vents Ballast Draft & trim / VMS Ballast strategy / plans Lvl sensor/ Bilge/ OWS)	IRM (PM system MOC PTW SCE manage- ment)	DOCUMENTATION (Operating manual Plans & equip manuals Emergency procedures SOPEP)	TRAINING AND COMPETENCE (Language Certification / training Job categories/ qualification Briefings)
-------	---	--------------------------	-------------------------	---	---	--	---	--	---	--

**MISSION ACTIVITY**

<b>NON CONNECTED ACTIVITY</b>										
<b>CONNECTED ACTIVITY</b>										
<b>UNDER- BALANCED SITUATION</b>										

	Statement of validation from Contractor, Simplified AMOG
	Statement of validation from Contractor, confirmation that processes exist that are in line with RP intent, verified in SMC and AMOG as necessary
	Statement of validation from Contractor, incorporate/address as needed in SMC and AMOG
	Statement of validations from Contractor, incorporate/address as needed in SMC and AMOG, Actively manage during execution

**Project and Construction Vessels**

THEME	DESIGN AND EQUIPMENT (Ballast & Bilge WT doors / subdivisions VMS. Auxiliary power systems)	RETROFITTED EQUIPMENT	TECHNICAL CAPABILITY	CONTROL (Design/capability Alarm display Failure intent/result Vulnerability Drills & tests)	WATERTIGHT INTEGRITY(I MS Shipside closures Internal WT subdivision Deck closures WT door safety)	STABILITY (Stability manual Load Plans Damage control Capacity tables Mud / brine)	BALLAST AND BILGE (Tk lvl sensor / vents Ballast Draft & trim / VMS Ballast strategy / plans Lvl sensor/ Bilge/ OWS)	IRM(PM system MOC PTW SCE management)	DOCUMENTATION (Operating manual Plans & equip manuals Emergency procedures SOPEP)	TRAINING AND COMPETENCE (Language Certification / training Job categories/ qualification Briefings)
-------	---	-----------------------	----------------------	---	--	---	--	--	---	---

**MISSION ACTIVITY**

<b>SURVEY</b>									
<b>GEOTECH</b>									
<b>DIVING</b>									
<b>PIPELAY</b>									
<b>UMBILICAL LAY</b>									
<b>SS HARDWARE</b>									
<b>PULL IN's (RISER/ UMBILICAL/ MOORING LINES)</b>									
<b>HEAVY LIFT OPERATIONS</b>									
<b>TANKER OFFTAKE</b>									
<b>ACCOMMODATION</b>									

	Statement of validation from Contractor, Simplified AMOG
	Statement of validation from Contractor, confirmation that processes exist that are in line with RP intent, verified in SMC and AMOG as necessary
	Statement of validation from Contractor, incorporate/address as needed in SMC and AMOG
	Statement of validations from Contractor, incorporate/address as needed in SMC and AMOG, Actively manage during execution

**Logistics Vessels**

THEME	DESIGN AND EQUIPMENT (Ballast & Bilge WT doors / subdivisions VMS. Auxiliary power systems)	RETROFITTED EQUIPMENT	TECHNICAL CAPABILITY	CONTROL (Design/ capability Alarm display Failure intent/ result Vulnerability Drills & tests)	WATERTIGHT INTEGRITY(IMS Shipside closures Internal WT subdivision Deck closures WT door safety)	STABILITY (Stability manual Load Plans Damage control Capacity tables Mud / brine)	BALLAST AND BILGE (Tk lvl sensor / vents Ballast Draft & trim / VMS Ballast strategy / plans Lvl sensor/ Bilge/ OWS)	IRM (PM system MOC PTW SCE manage- ment)	DOCUMENTATION (Operating manual Plans & equip manuals Emergency procedures SOPEP)	TRAINING AND COMPETENCE (Language Certification / training Job categories/ qualification Briefings)
-------	---	--------------------------	-------------------------	---	--	---	--	---	---	--

MISSION ACTIVITY										
Logistics (Outside 500 M Zone)	Green	Green	Green	Green	Blue	Blue	Blue	Green	Green	Green
Logistics (Inside 500 M Zone)	Green	Green	Green	Green	Yellow	Yellow	Yellow	Blue	Green	Green

Green	Statement of validation from Contractor, Simplified AMOG
Blue	Statement of validation from Contractor, confirmation that processes exist that are in line with RP intent, verified in SMC and AMOG as necessary
Yellow	Statement of validation from Contractor, incorporate/address as needed in SMC and AMOG
Red	Statement of validations from Contractor, incorporate/address as needed in SMC and AMOG, Actively manage during execution

## **APPENDIX B**

### **BALLAST MANAGEMENT STRATEGY CONTENT**

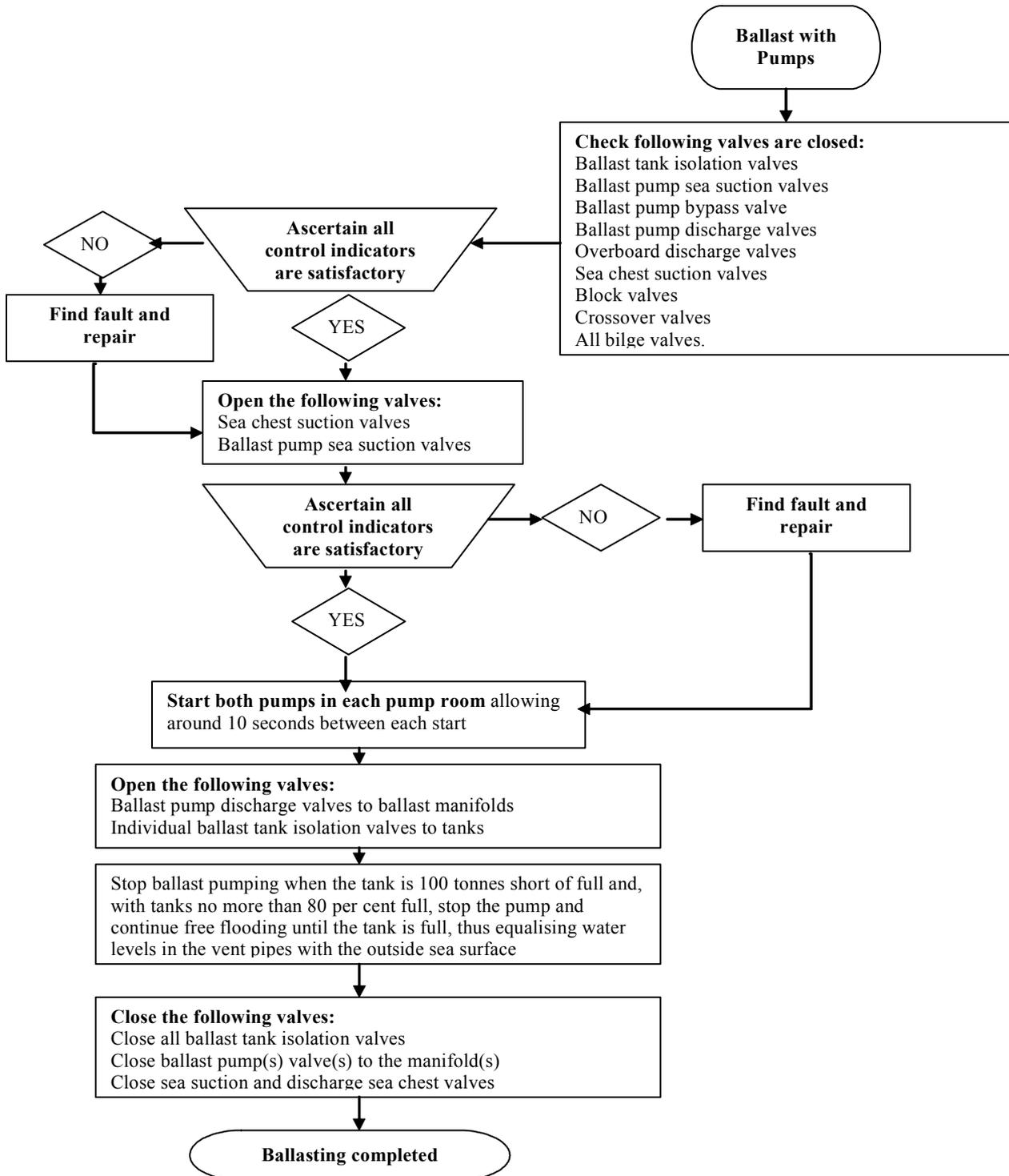
#### **INTRODUCTION**

A Ballast Management Strategy should address four core issues of:

- i) Documenting the philosophy and objectives of vessel ballasting operations with regard to vessel integrity and stability. This may include:
  - analysis of the needs of ballasting operations to control draft, heel and trim requirements for an Industrial Mission and mission activities
  - identifying inputs to the ballasting process
  - identifying potential causes of ballast system failure and escalation of a loss of stability.
- ii) Documenting ballast planning and operational principles This may include:
  - standardization of a consistent approach to ballast operations
  - minimization of sea / tank transfers.
- iii) Documenting ballast operational control principles
- iv) Documenting ballast operational monitoring principles.

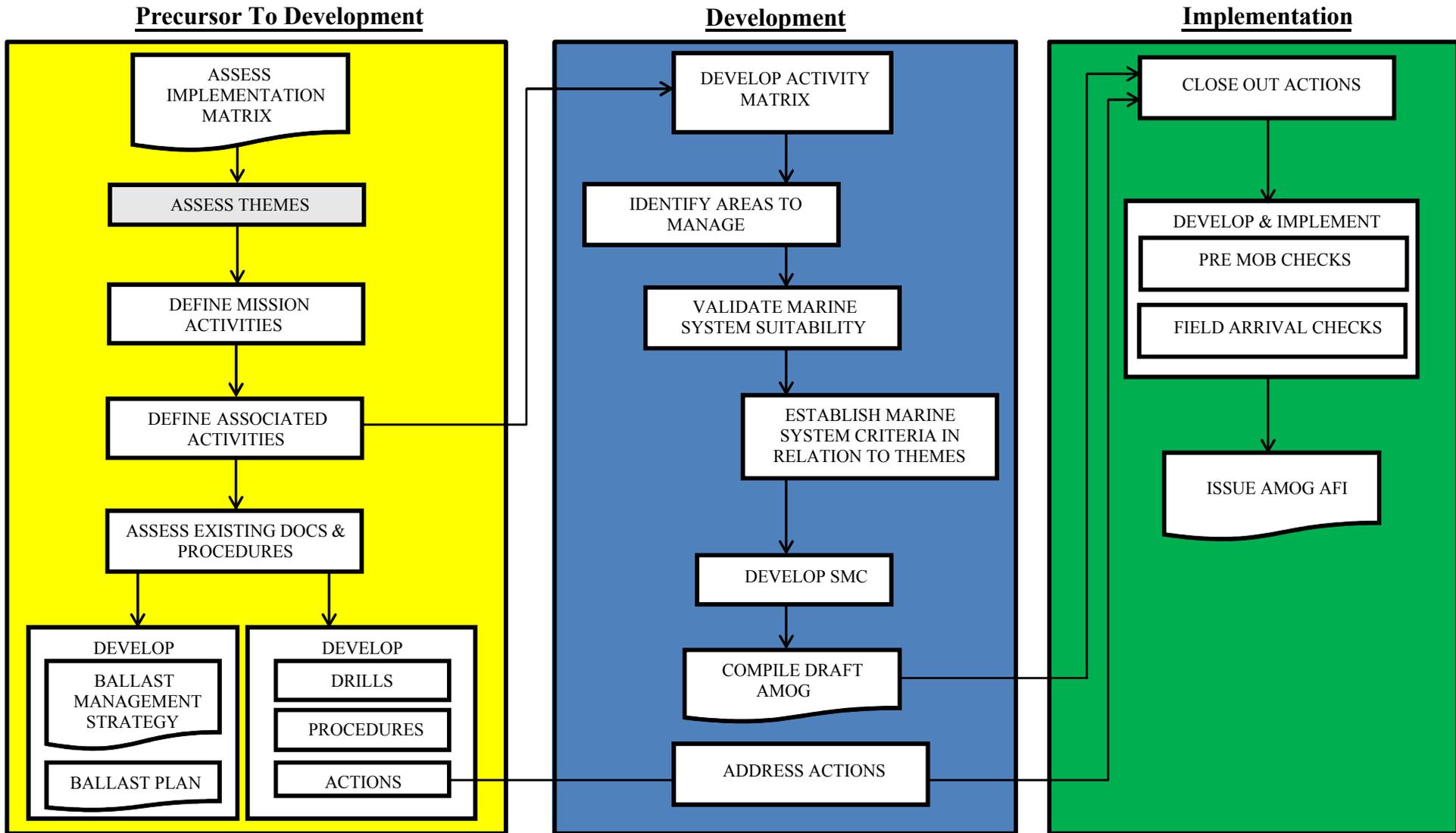
The following particular subjects should be considered for inclusion:

- 1) **Management and control of ballast operations**  
Describe pump and valve control facility. Describe automated management system functionality and manual operational activities. Describe automated pumping setup routines. Describe monitoring facilities, interlocks, alarms and emergency stops and closures. Describe routine primary ballasting operations e.g. draught changes, trimming, intertank transfers, test pumping (sea to sea) and specify prohibited operations. Describe general operating procedures and control screen management. Describe routine valve configuration for primary ballasting operations.
- 2) **Failure modes and design failure intent and control potential for isolation failures**  
Reference ballast system FMEA (if provided). Note maximum single point failure effect. Note valve failure modes (fail close / as set / open). Describe alternate and emergency pump and valve power sourcing. Identify primary ballast main and shell penetration isolating valves. Specify valve testing schedules. Specify acceptable valve leak past rates and testing procedures.
- 3) **Current system capability and operational requirements**  
Include manufacturers pump curves and pipework P&IDs. Include normal valve operating times. Specify acceptable pumping rates and gravity filling rates for particular primary ballasting operations.
- 4) **Minimizing transfer to and from sea and tank usage**  
Identify routine internal transfers used for primary ballasting operations.
- 5) **Identification of tanks to be used**  
Specify tanks to be routinely used for particular primary ballasting operations and tank levels.
- 6) **Monitoring of tank levels (primary and secondary)**  
Describe tank level monitoring procedures. Include sounding pipe location drawing. Describe tank level monitoring system check and calibration procedures.
- 7) **Minimization of free surface effects, over pressing or overflowing tanks**  
Specify normal tank filling and ullage levels and pressing up limits.
- 8) **Stability impacts (intact and damage)**  
Describe limitations on pump capability for all tanks for various states of heel and trim.
- 9) **Personnel understanding of system design and limitations**  
Describe ballast system familiarization requirements for operating personnel. Describe operating training exercises and specify frequency.



**Figure B-1**  
**Example Ballast Plan**

# APPENDIX C AMOG DEVELOPMENT AND IMPLEMENTATION PROCESS FLOW



## APPENDIX D AMOG DEVELOPMENT CHECKLIST

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
<b>2.1</b>	<b>Philosophy</b>		
	Develop matrix of associated activities related to critical systems for each project activity	Identify whether ballasting is an associated activity to the mission activity. Identify whether watertight integrity management is an associated activity. Identify whether stability management is an associated activity	If it is an associated activity, develop details on how ballasting activity will be controlled. If ballasting is a non-associated activity, then confirm steps taken to have ballasting not coincide with the critical phases during project execution. If unavoidable, what steps will be taken to control the ballasting activity, i.e. PTW?
	Ballast Management Strategy	What is the ballast management strategy for the planned operations? Note this should include other fluid handling such as anti-heel liquids, bilge, fresh water, FO, drilling fluids, etc.	Fluid management strategy at the minimum should include: <ul style="list-style-type: none"> <li>— Management and control of ballast operations</li> <li>— Stability impacts (intact and damage)</li> <li>— Failure modes and design failure intent</li> <li>— Current system capability and operational requirements</li> <li>— Minimizing transfer to and from sea and tank usage</li> <li>— Clear identification of tanks to be used and control potential for isolation failures</li> <li>— Monitoring of tank levels (primary and secondary)</li> <li>— Minimization of free surface effects, over pressing or overflowing tanks</li> <li>— Personnel understanding of system design and limitations</li> </ul> Include Ballast FMEA if available.
<b>2.2</b>	<b>Design and Equipment</b>		
	Class, Flag and Coastal State Regulations	Develop list of any outstanding certification pertaining to Class, Flag, and Coastal State Regulations/certification. Identify any dispensations and conditional approvals granted in issuing class, flag, and coastal state certifications.	Note any deficiency or outstanding corrective actions to be taken and plan to address.
<b>2.3</b>	<b>Retrofitted Equipment</b>		
	Identification of Retrofitted Equipment	List retrofitted equipment related to equipment /systems required for associated activities. This Includes installation of equipment post-delivery from shipyard as well as modifications to existing equipment.	
	Assessment of Vulnerabilities	Assess vulnerabilities of retrofitted equipment and establish means to mitigate as warranted.	Use records from risk analyses (FMEA, HAZID/HAZOP, HEMP) utilized in the selection, design engineering, commissioning, and testing of retrofitted equipment.
<b>2.4</b>	<b>Verification of System Against Operational Requirements</b>		
	Understand Operational Requirements	Operational Requirements may include defined stability conditions, cargo loading, required ballast conditions, ballast and liquid transfers, use of active anti-heel/roll	

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
	Understand Marine Systems actual capability	Actual capability should be determined from system operating tests For column stabilized vessels, what is the maximum angle of heel that the ballast pumps can take suction from? Is it documented in MOM and backed up by commissioning / testing records?	For column stabilized vessels, confirm the amount of time required to de-ballast from normal operating to survival draft utilizing primary and secondary ballast systems.
	Time to Undertake	Establish Time to Undertake (TTU) each associate activity	Develop details on how times are derived based on equipment design parameters
	Time to Terminate	Establish Time to Terminate (TTT) each associate activity	Develop details on how times are derived based on equipment design parameters.
<b>2.5</b>	<b>Control/GUI/ Mimics/Ergonomics</b>		
	Alarm Management	Is there a systematic approach to alarm management and response of operator in addressing fault conditions?	Develop alarm management procedures
	GUI Screen Management	Is there a procedure for managing multiple GUI windows to ensure continual visibility of critical information?	Develop control procedures
	Failure Intent/Failure Consequences	Have valve failure positions been established? In the event of loss of power, upon reactivation of control power, those valves intended to close upon loss of control power should remain closed until the ballast control operator assumes control of the reactivated system.	Control utilizing the Ballast Management Strategy. Assess need or findings of ballast system FMEA Special attention should be paid to system controls to eliminate the possibility of any valve or pump being inadvertently activated by a system fault or by any external system interference.
	Emergency and Backup Operation	Are there established emergency and backup arrangements for operation of critical equipment?	Develop emergency and contingency arrangements
	Drills and Tests	Are there established drills and tests to validate and train operators in emergency and backup arrangements?	Develop evidence of drills and tests to demonstrate emergency and backup operations.
	Vulnerability of Control Stations	Has vulnerability to damage of control stations been assessed? Are contingency plans developed in the event of the need for local operations?	Address vulnerabilities through plans and backup arrangements
	Emergency Communications	Are there reliable means to communicate with emergency response personnel at all emergency control locations in the event of a flooding/ loss of stability incident?	For Example: VHF/UHF and sound powered phones
<b>2.6</b>	<b>Watertight Integrity</b>		
	Watertight Integrity Control	What controls are in place for ensuring monitoring and management of watertight integrity?	Plan for addressing vulnerabilities and prevention of flooding.

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
	Watertight Subdivision	Includes bulkheads, doors, hatches, manhole openings, etc. What is the on board practice for ensuring watertight boundaries are maintained? What measures are taken to confirm penetrations in watertight boundaries are properly sealed after modifications (e.g. piping or cable penetrations)?	Assess IRM system controls for post modification and maintenance integrity checks. Assess PTW system coverage of activities which compromise watertight integrity.
	Closing Devices	Includes hull penetrations, ventilators, etc. What is the on board practice for ensuring closing devices are functional?	
	Flood Detection	Includes level sensors, leak detection, sounding pipes, CCTVs, etc. What is the on board practice for ensuring flood detection devices are functional?	
	Watertight Door Operation	What are the means to control watertight doors locally and remotely, in both normal and emergency conditions?	
	Management of Malfunctions	Is there a procedure in place that ensures watertight door failures are immediately addressed?	Assess and develop routines for reporting and immediate corrective action.
<b>2.7</b>	<b>Stability</b>		
	Trim and Stability Manuals	Are the updated, class approved, manuals on board?	Check current status of on board manuals
	Lightship Weight	What procedures are followed for addressing changes to lightship weight? How is documentation of changes to lightship weight and center of gravity validated?	Validate stability calculations use valid lightship parameters. (Example: computerized reports clearly identifying lightship weight and center of gravity.
	Stability Verification	What process is followed by on board personnel to confirm that a planned operation can be conducted within the vessel's allowable stability limits? How is this process reviewed and approved?	Assess instructions out of approved Stability Manual (Operating Manual) along with sample load cases.
	Stability Loading Conditions	What planning process is used for developing stability load conditions demonstrating vessel is capable of supporting variable loads required for carrying out the mission activities? Loading condition calculations should show compliance with vessel stability requirement for both intact and damage conditions for ongoing and future mission activities.	Assess and develop procedures for generating and validating variable load cases. Assess and develop procedures for analysis of load case stability implications for ongoing and future mission activities.

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
	Stability Calculation Tools	Is onboard stability software used for determining vessel stability? Is the software reviewed and approved by class or other independent means? When revisions are required, how is the software modified and controlled? Are on board personnel proficient with stability calculation tools and manual calculation methods? Do on board personnel periodically verify software calculations by validating against a load case from the stability manual? Do personnel validate calculations against measured draft readings?	Assess and develop on board stability calculation method familiarization and training. Assess methods for validating remote draft readings against visual checking of draft marks
	Loading and Seafastening Plans	Has a deck arrangement plan been developed for the project activities? Is the worst case damage condition taken into account in Seafastening design?	Develop arrangement of variable loads used during the project activities. Contractor should verify that seafastening design meets criteria for damage case, not just for intact condition.
	Transportation of Heavy Lift Cargos	During load out and dry transportation of heavy lift cargoes, what steps are taken to confirm stability of cargo and transport vessel? What procedures are followed to ensure against Mal-operation?	Transport manual should cover means for safely ballasting / de-ballasting during the loading and offloading of cargo, including steps taken to minimize human error.
	Damage Condition Scenarios	What drills are conducted by personnel to look at damage condition scenarios and familiarize themselves with the required corrective actions to bring the vessel back to a safe condition?	Assess and develop on board procedures and drills. Assess and develop hypothetical damage scenarios for desk top analyses of optimal responses measures. Required corrective actions may include emergency local closure of watertight doors and vents, local closure of pipework isolating valves, operation of emergency bilge suctions, emergency sealing of pipework leakage, deballasting or counter flooding, secondary deballasting system operation, manual tank soundings.
	Task Appropriate Safe Conditions	Task Appropriate Safe Conditions should be established for critical operations. The primary objective of TASC is to stabilize while preventing escalation.	Assess and develop task appropriate safe conditions for critical operations. TASCs may be identified in job safety assessments, HIRA, HEMP, etc.
<b>2.8</b>	<b>Ballasting and Bilge Systems</b>		
	Integrity and Functional Capability	Assess present condition of Marine Systems including pumps, eductors, piping, valves, actuators, back-up accumulators, control air system, primary and secondary means for tank level gauging, bilge system piping, rose boxes, bilge level alarms (high and low), control panel indicators, alarms, pumps start/stop, HPU controls, including back-up systems, e.g. secondary control stations.	Check IRM, visual inspection, and function test. Perform corrective maintenance as required.

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
	Ballast Operations	Is the need for ballasting identified? Any required ballasting should be designated as an associated activity. If ballasting is not an associated activity, then no ballasting should be undertaken.	A need for ballasting may be identified where the mission activity requires a change of draft or heel and trim as an essential part of achieving an operational objective. On board risk assessment procedures should adequately address ballast operations.
	Anti-heel/Anti-roll systems	Operation of active and passive systems should be designated as an associated activity.	Systems should be tested and fully operational System operation should be included in SMC and AMOG criteria
	Bilge Operations	Are bilge monitoring and bilge pumping systems fully operational? Have potential vulnerabilities been evaluated?	Check IRM, visual inspection, and function test. Perform corrective maintenance as required. Evaluate vulnerabilities of pipework connections with other pumping systems, back flooding and methods of bilge pumping control. Establish requirements for bilge pumping during TTU and TTT of mission activities and include in AMOG as required.
	Sounding Arrangements	What arrangements are there for taking tank soundings (both primary and secondary)? How is the remote tank gauging verified? Are manual soundings carried out (frequency)?	Check IRM, visual inspection, and function test. Perform corrective maintenance as required. Validate accuracy of remote tank gauging. Establish provisions to verify tank levels if it is not possible to take manual soundings.
<b>2.9</b>	<b>Inspection, Repair and Maintenance</b>		
	IRM System	Does the maintenance system cover equipment criticality, sparing philosophy, frequency of inspections, preventative and corrective maintenance routines? How is overdue maintenance addressed? Are ballast and bilge systems identified as safety critical equipment and addressed in IRM accordingly?	Equipment identified as safety critical to be addressed in IRM, sparing philosophy, frequency of inspection, greater level of management of condition, greater level of procedural details, and increased training. Maintenance of safety critical equipment should be conducted by appropriately competent personnel with requisite skills.
	Defects, Backlog and Deferred Maintenance	Is there transparency of any outstanding and upcoming maintenance tasks and a clear understanding of potential consequences on mission activities?	Include as part of Pre-mobilization check. A list of outstanding and upcoming maintenance tasks correlated with consequences on mission activity should be developed, risk assessed and appropriately mitigated. Decisions to postpone maintenance on operational and safety critical equipment should undergo a proper risk assessment along with an MOC process involving accountable shore based management in the review and approval.
	Management of IRM Activities	What controls are in place to prevent adverse impact due to non-availability of equipment essential to associated activity (routine maintenance / breakdowns)? Does IRM planning ensure that no intrusive maintenance is scheduled on equipment essential to associated activity during execution of mission activities.	Develop confirmation that intrusive maintenance will not be performed during critical phases of mission activity. Maintenance that must be performed during critical operations should have been HAZID/HAZOP and is properly addressed in AMOG.

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
	Permit to Work	Are effective controls in place to manage potential consequences of intrusive maintenance during execution of mission activities?	Establish and implement an effective PTW system which addresses maintenance tasks during execution of mission activity.
<b>2.10</b>	<b>Vessel Documentation, Operating manual, and Contingency Planning</b>		
	Documentation and Drawings	Are updated documents and drawings available and in use?	The vessel should have on board a complete inventory of manufacturers' technical, maintenance and operating documentation for Marine Systems and equipment. Documents and drawings of systems should be up to date and show the current arrangement on board. Out of date or obsolete documentation and drawings should be removed.
	MOM	Is the vessel provided with an MOM that meets the guidance provided in Appendix H?	The MOM should contain guidance for the safe operation for both normal and envisaged emergency conditions and be readily available to all concerned. Carry out gap assessment of MOM with guidance in Appendix H and undertake remedial action if warranted.
	Emergency Response Plans (ERP)	Do the ERPs cover major events such as: — flooding — loss of stability — loss of position — fire — collision — extreme weather.	Confirm coverage in ERPs
	Emergency Response Plan (Blackout)	Is the impact of vessel blackout (intentional and inadvertent) on ballast, stability, and watertight integrity systems clearly identified and understood? Are mitigating and recovery measures developed and in place?	Develop/ validate documentation on impact of vessel blackout on ballast, stability, and watertight integrity systems. Develop documentation on black out recovery and recovery from dead ship conditions. Implement blackout and dead ship recovery drills

<i>Ref.</i>	<i>Theme</i>	<i>Management Guidance (Intent)</i>	<i>Operational Guidance (Methods)</i>
<b>2.11</b>	<b>Training, Competencies, and Project Specific Familiarization</b>		
	Training, and Competency	<p>Are positions that deal with safety critical equipment (people that manage, maintain and operate) clearly identified?</p> <p>Are training and competency requirements specified for these positions?</p> <p>Is there validation of this training and competency?</p>	<p>Develop/ validate list of positions that deal with safety critical equipment (people that manage, maintain and operate).</p> <p>Develop/ validate training requirements and competencies for these positions.</p> <p>Ensure that personnel occupying identified positions have the training, competencies and thorough knowledge to undertake the associated activities related to the mission activities.</p>
	Briefing, Drills and Safety Assessment	<p>Are personnel executing mission activities adequately briefed (Includes job specific safety assessments)?</p>	<p>Develop description of program for training and familiarizing personnel who operate ballast and bilge systems including drills for managing emergencies or equipment failures.</p> <p>Before commencement of an Industrial Mission, personnel involved should be briefed by the supervisors on mission activities and responsibilities. Personnel should have received the required training. Pre commencement training should include:</p> <ul style="list-style-type: none"> <li>— mission specific familiarization for operational teams (includes AMOG familiarization)</li> <li>— drills as required.</li> </ul>

## APPENDIX E SAFEST MODE CONFIGURATION EXAMPLE

SAFEST MODE CONFIGURATION - SEMISUBMERSIBLE MODU EXAMPLE		
This setup applies when the vessel is undertaking well construction operations at Date:		
An “Associated Activity” shall be any marine system activity that is essential to accomplish a mission activity (e.g. Ballasting during riser running operations)		
All equipment associated with Vessel Integrity (Ballast, Watertight integrity and Stability) shall be operational. Planned maintenance which involves making Marine System equipment unavailable for immediate use during mission activities shall be subject to review and approval.		
A ballast management strategy (BMS) encompassing operations where ballast and stability control are associated activities shall be established. BMS shall include arrival on location and ballasting to operational draft from transit draft and vice versa, ballast transfer operations required to address significant load changes (fluids and solids), transition from operational draft to survival draft and vice versa. Stability margins shall be established and verified against approved stability manual. Tanks that will be used shall be clearly defined and tanks that will not be used shall be clearly marked and use controlled (LO/TO, PTW etc)		
Actions contravening the above will trigger a change in status to Blue and initiate a formal documented risk assessment with appropriate sign offs		
Condition	GREEN	ADVISORY
Notify Master, Rig Manager, RMS and Client	NO	YES
Action	CONTINUE NORMAL OPERATIONS	INFORMATIVE/CONSULTATIVE STATUS (RISK ASSESS)
<b>Ballast System Pumps</b>	All pumps tested sea to sea within last month and available for operation	Not tested within last month or any pumps not operational
<b>Ballast System Pipework</b>	No leaks in system pipework	Unresolved leaks in pipework
<b>Ballast System Manual Valves</b>	All valves operational and marking in good order	Inoperative valves compromise full system functionality and any valve marking obscured or valves not tested monthly
<b>Ballast System Pneumatic Valves</b>	Valve and compressed air system tested within last week	any one valve or compressed air system not tested or inoperative, nor marking in good order
<b>Bilge System Pumps</b>	All pumps tested within last month and available for operation	Not tested within last month or any one pump (fwd and aft) not operational
<b>Bilge System Pipework</b>	No leaks in system pipework	Unresolved leaks in pipework or any open pipework
<b>Bilge System Manual Valves</b>	All valves operational and marking in good order	Inoperative valves compromise full system functionality and any valve marking obscured
<b>Watertight doors</b>	Fully operational and sealing integrity verified	Not verified
<b>Ballast/ Bilge Control System (BCS)</b>	All work stations (primary and secondary) fully operational and tested within last month	Work stations (primary and secondary) not all fully operational or not tested in last 6 months
<b>Compressed Air auxiliary systems for marine system operations (Air bubbler, valves, priming systems)</b>	Static system operating pressure maintained, no leaks	Static system operating pressure not as required, leaks identified

<b>Power</b>	<b>Emergency Generator (EG)</b>	EG Available and load tested in last 6 months	Not fully operational or tested on load in last 6 months
	<b>BCS UPS Power</b>	Available, No alarms, not on bypass, load tested in last 6 months	Any alarms, on bypass or not available
	<b>BCS RTU Power</b>	Available, No alarms, load tested in last 6 months	Any alarms or not available
<b>RETROFITTED EQUIPMENT (Changes and replacements not like for like)</b>	<b>Identified Equipment Design Changes</b>	MOC issues closed out	MOC issues not closed out
<b>VERIFICATION OF TECH CAPABILITY</b>	<b>Ballast System</b>	Suction proved on all ballast tanks within last month System monitoring field devices fully operational Pumps operating to manufacturers pump curves	System deficiencies identified
	<b>Bilge System</b>	Suction proved within last month System monitoring field devices fully operational Pumps operating to manufacturers pump curves	System deficiencies identified
	<b>Bilge Level Measurement</b>	All level sensors tested within last month and fully operational All machinery space bilges clear of standing water All bilge strums cleaned in accordance with IRM schedule	System deficiencies identified
	<b>Tank Level Measurement</b>	All level sensors tested and calibrated within last month and fully operational. System purged before operation. All manual sounding pipes functional and check soundings recorded within last month	System deficiencies identified
	<b>Draft Measurement</b>	All level sensors tested and calibrated within last month and fully operational Check draft measurements against draft marks recorded within last month	System deficiencies identified
	<b>WT Closures</b>	All WT closures open / close and effect watertight seal on closure	Any WT closure does not affect a watertight seal on closure
	<b>Associated Activity Matrix</b>	Provided	Not provided
	<b>Project Associated Activity Time to Undertake (TTU) and Time to Terminate (TTT) - Established and Verified against available operational windows</b>	Established and Verified against available operational windows	Not established

<b>CONTROL, GUI, MIMICS, ERGONOMICS</b>	<b>Work Station Screens</b>	Critical screens for management of Associated Activities have been identified and control of screen display has been implemented	Critical information obscured
	<b>Work Station Login</b>	Work station transfer between Bridge and ECR is verified as functional	Not Functional
	<b>CCTV</b>	Pump room CCTV fully operational and critical views identified in Focused Space Audit are not obscured	Pump room CCTV views obscured or Not operational
	<b>Comms</b>	Secure, clear lines of communication have been established and tested including backup, between all personnel and all work areas participating in Associated Activity	Comms failures identified
	<b>Equipment Local and Remote Monitoring</b>	All field devices fully operational and calibrated in accordance with IRM schedule Local and work station screen visual indication is displayed correctly Warning lights lamp tested in accordance with IRM schedule	Device and indication defects identified
	<b>Alarms</b>	All alarms tested within last month and fully operational (not bypassed) No currently active or nuisance alarms	Alarms not operational or nuisance alarms obscuring system monitoring
	<b>Familiarity with Associated Activity</b>	Personnel familiar with the Operating Procedures as established, understood and in use Personnel familiar with location and operation of equipment used for Associated Activity	Personnel not familiar with Procedures or Equipment
	<b>Bilge Pumping</b>	Pumping of specific bilge suction does not exceeds 10 min/day	Pumping of specific bilge suction exceeds 10min/day
	<b>Shift Change</b>	Associated Activities with TTU greater than shift period is managed in accordance with procedure to control commencement, handover and completion.	Associated Activities with TTU greater than shift period is not managed in accordance with procedure to control commencement, handover and completion.
	<b>WATERTIGHT INTEGRITY</b>	<b>Watertight Door Indicators</b>	All recently tested and operational, audible alarm activated at BCS
<b>Watertight Doors</b>		All in closed position	Any in open position except when transiting through
<b>WT closures below damage waterline</b>		All closed	Any open without permit to work
<b>Manhole closures (tanks and voids)</b>		All Closed and checked for watertight Integrity	Any tank or void spaces open
<b>Vent Closures</b>		All recently tested and operational	Any not tested or operational
<b>Sounding Pipe Caps</b>		All sounding pipe caps closed	Any cap unable to be closed
<b>SIMOPS - OSV Movement Approach</b>		All Water tight doors and tank lids closed on approach side	Any doors or lids open on approach side

<b>STABILITY</b>	<b>Allowable KG</b>	KG calculated for worse case during the operation and $\leq$ Max Allowable KG	Not calculated or KG calculated greater than Allowable KG
	<b>Stability computer</b>	Operational	Not operational
	<b>Draft Verification</b>	Measured Drafts match Calculated Drafts	Measured Drafts do not match Calculated Drafts
	<b>Stability Calculation Verification</b>	Manual Calculations agree with Stability software	Manual Calculations do not agree with Stability software
<b>BALLAST AND BILGE CONTROL</b>	<b>Fluid Transfer Operational Requirements</b>	Necessary fluid transfer operations have been defined	Unforeseen fluid transfer operations required
	<b>Ballast Management Strategy</b>	Ballast Management Strategy established, understood and in use	Strategy not established, understood and in use
	<b>Ballast Plans</b>	Ballast Plans for associated activities are established, understood and in use. Ballast plans for contingencies established, understood and in use	Ballast Plans not established, understood and in use
	<b>Bridge BCS</b>	Manned at all times by either BCO or Barge Engineer	Not manned
<b>Inspection Repair and Maintenance</b>	<b>IRM Work Orders</b>	No outstanding Work Orders for safety critical Marine Systems.	Outstanding Work Orders for Marine Systems
	<b>Work Order Schedule</b>	No intrusive work orders on marine SCE scheduled during critical operations. Associated Work orders to have PTW. Note: Intrusive is defined as performing maintenance, which renders the equipment as non-functional.	Intrusive Work Orders are scheduled for Marine Systems during critical operations. Note: Intrusive is defined as performing maintenance which renders the equipment as non-functional.
<b>DOCUMENTATION, OPS MANUALS AND CONTINGENCY PLANNING</b>	<b>Operating Manuals and Project Specific Procedures</b>	Documentation up to date, established, understood and in use	Documentation not up to date, established, understood and in use
	<b>Emergency Response Procedures</b>	Documentation up to date established, understood and in use	Documentation not up to date, established, understood and in use
	<b>Damage Control Drills</b>	Drills conducted (manual operation of bilge and ballast and damage control) in accordance with specified requirements.	Drills not conducted (manual operation of bilge and ballast and damage control) in accordance with specified requirements.
<b>TRAINING COMPETENCY PROJECT SPECIFIC FAMILIARI</b>	<b>Project Specific Personnel</b>	Personnel and their Roles Identified. Personnel familiar with procedures and equipment	Personnel not familiar with Procedures or Equipment
	<b>AMOG DISCUSSED WITH ALL STAKEHOLDERS</b>	AMOG discussed with all stakeholders as part of field arrival checks	AMOG not discussed with all stakeholders as part of field arrival checks

## APPENDIX F AMOG EXAMPLE

AMOG - SEMISUBMERSIBLE MODU EXAMPLE				
This setup applies when the vessel is undertaking well construction operations at Date:				
An “Associated Activity” shall be any marine system activity that is essential to accomplish a mission activity (e.g. Ballasting during riser running operations)				
All equipment associated with Vessel Integrity (Ballast, Watertight integrity and Stability) shall be operational. Planned maintenance which involves making Marine System equipment unavailable for immediate use during mission activities shall be subject to review and approval.				
A ballast management strategy (BMS) encompassing operations where ballast and stability control are associated activities shall be established. BMS shall include arrival on location and ballasting to operational draft from transit draft and vice versa, ballast transfer operations required to address significant load changes (fluids and solids), transition from operational draft to survival draft and vice versa. Stability margins shall be established and verified against approved stability manual. Tanks that will be used shall be clearly defined and tanks that will not be used shall be clearly marked and use controlled (LO/TO, PTW etc)				
Actions contravening the above will trigger a change in status to Blue and initiate a formal documented risk assessment with appropriate sign offs				
Condition	GREEN	ADVISORY	Yellow	Red
Notify Master, Rig Manager, RMS and Client	NO	YES	YES	YES
Action	<b>CONTINUE NORMAL OPERATIONS</b>	<b>NOTIFY &amp; ASSESS:</b> Assess risks  Assess impact on safe continuation of: non associated activities associated activities primary activity  Make notifications as required	<b>VALIDATE SAFETY:</b> Assess impact on primary activity taking account of: effect on associated activities forecast weather conditions  Validate stability (damaged and intact)  Reevaluate TTT, SC, TASC, and strategy to bring well to Safe Condition  Establish time to bring non associated activities to safe condition	<b>SUSPEND PRIMARY ACTIVITY:</b> Bring rig to readiness to disconnect  Terminate associated and non associated activities to a safe condition
GUI	GUI DISPLAY	Agreed to GUI display	Change to GUI display with potential to obscure critical information	Operational situation requires a change to GUI display obscuring critical information or Loss of GUI display

<b>BALLAST AND BILGE CONTROL</b>	<b>Ballast and Bilge Equipment</b>	All Systems operational and available	Faults on equipment requiring intervention and reducing system functionality	Loss of pumping / monitoring capability from system suction(s)	
	<b>Ballast Pumps</b>	All pumps operational and available	Alarm or loss of any one pump		
	<b>Bilge Pumps</b>	All Pumps operational and available	Alarm or loss of any one pump		
	<b>Control Air</b>	All compressors available and reservoirs full	Loss of 1 compressor or alarm	Loss of 50 percent compressors while associated activity being undertaken	Loss of all compressed air generation capacity
	<b>Ballasting Operations</b>	Activities in accordance with the pre-agreed to BMS with stability criteria being verified	Considering deviation from agreed to BMS, changes in tank configuration being considered. Initiating risk assessed associated activities		
	<b>Work Order Schedule</b>	No intrusive work orders on marine SCE scheduled during critical operations	Intrusive Work Orders are scheduled for Marine Systems. Agreed to work orders being carried out (vessel management team to approve documented risk assessment)		
	<b>Time to Reinstate equipment</b>	=/ < time assessed	> time assessed.		
	<b>Ballast/ Bilge Control Computer</b>	Redundant systems available	Alarms on one system	Loss of either control station while undertaking associated activity	Loss of both systems
	<b>Loss of networks affecting VMS</b>	Redundant systems available	Alarms on one system	One system remaining	Loss of both systems
	<b>Ballast/ Bilge Control Stations</b>	Back up control station available and in Hot Standby	Any alarm on backup control station	Backup control station not operational/available	
	<b>Control UPS Power</b>	Available, No alarms, not on bypass, 30min load tested in last 6 months	Any alarms, on bypass, not load tested or not available	Loss of one Control UPS	Loss of both UPSs
	<b>Associated Activities</b>	Associated activities in accordance with pre-agreed matrix and BMS procedures and plans	Associated activities not in accordance with pre-agreed matrix and BMS procedures and plans	Results of NOTIFY & ASSESS activities deem risks unacceptable	
<b>Power</b>	<b>Emergency Generator (EG)</b>	EG Available and load tested in last 6 months	Not fully operational or tested in last 6 months	EG Not available or loss of ESB	
	<b>Field Station Power</b>	Available, No alarms,	Any alarms, on bypass	Loss of one Field Station	

<b>STABILITY</b>	<b>Transition (Transit to operational; operational to survival)</b>	BMS, plans and procedures covers associated activities, tank plans in accordance to BMS, all equipment available and operational	Considering deviation from agreed to BMS, changes in tank configuration being considered, all required equipment not operational or available, tank configuration being contemplated different from agreed to and stipulated in BMS plans and procedures	Deviation from expected vessel attitude (trim, list, draft, orientation) observed	
	<b>Unexpected changes in vessel orientation (list/trim/draft)</b>	No unexpected changes	Approaching expected limits	Exceeding expected limits by < 1 degree (heel and list)-draft < 0.5 m	Exceeding expected limits by > 1 degree (heel and list)-draft > 0.5 m
	<b>Time to Terminate associated activities</b>	TTT < weather window available	TTT approaching weather window available	TTT= weather window available	TTT > weather window available
<b>WATERTIGHT INTEGRITY</b>	<b>Water tight integrity Subdivision</b>	Intact and damaged stability condition not compromised	Intention to undertake activity that could compromise subdivision integrity (access to compartments, voids, tanks)		
	<b>Bilge and Ballast Alarms; status of below water line water tight doors</b>	Non alarming condition and all alarms explicable, spurious alarms identified and being actioned to close out	Fresh alarms, unable to clear spurious alarms	Alarm condition confirmed, inexplicable alarms	
	<b>Hydrophone room Bilge Sensors</b>	Functioning		Not functioning or disabled	
	<b>Tank Pressing</b>	Intended ballast pump usage to < 80% of tank capacity	Intended ballast pump usage to 80 - 90% of tank capacity		

## APPENDIX G ACTIVITY MATRIX EXAMPLE

Activity	Related Rig Mode	Example Mission Activity	Ballast Operation	Stability - Intact	Stability - Damage Scenario	Water Tight Integrity
Associated Activity - Ballast Intake or Discharge	Draft Transition	Transit to Operational, Operational to survival	Y	Y	Y	Y
	Drilling Mode Transition	Weight Changes - BOP Stack and Riser Running Ops - Not latched to well but space out maintained (constant draft)	Y	Y	Y	Y
	Connected to Wellhead	Weight Changes - constant draft (Boat Transfers, Landing Casing)	Y	Y	Y	Y
Associated Activity - Internal Ballast Transfer	Not Connected to Wellhead	Weight Movement - draft allowed to change within Operating range (Top hole section work, BOP stack shift to well center, Boat transfers)	Y	Y	Y	Y
		Weight Movement - Draft allowed to change within Operating range - BOP and Riser Pull, Transfer Mud from Active to Reserve Pits)	Y	Y	Y	Y
	Connected to Wellhead	Material Movement - Transfer tubulars to derrick setback. Draft held constant	Y	Y	Y	Y
Associated Activity - Deck Hatch Open	Drilling or Transit Mode	Material Movement - Transfer of material through open deck hatch	Y	Y	Y	Y
Associated Activity - Boats Alongside	Transit or Drilling Mode	Towing, Anchor Handling or Material transfers to/from boats	Y	Y	Y	Y
Associated Activity - Contingency Ballast Change	At Risk	Heavy weather maneuvering, underbalanced well drilling, or activities which may initiate an emergency response	Y	Y	Y	Y

<b>Non- Associated Activities (To be avoided under critical operations)</b>						
Tank Entry						
Intrusive Preventive Maintenance						
Compromising watertight integrity Subdivision						
			Color Key For Above			
				SMC high risk		
				SMC medium risk		
				Risk to be assessed		

## APPENDIX H MARINE OPERATING MANUAL GUIDELINES

The following guidelines were précised from the IMO MODU Code 2009, Chapter 14, regarding Marine Systems and modified to suit the diversity of vessels. This chapter is considered to contain useful guidance applicable to all vessels covered in this RP.

Operating Manuals containing guidance for the safe operation of the vessel for both normal and envisaged emergency conditions, approved by the flag state, should be provided on board and be readily available to all concerned. The manuals should, in addition to providing the necessary general information about the vessel, contain guidance on and procedures for the operations that are vital to the safety of personnel and the vessel. The manuals should be concise and be compiled in such a manner that they are easily understood. Each manual should be provided with a contents list, an index and wherever possible be cross-referenced to additional detailed information which should be readily available on board.

A8.1 The operating manual for normal operations should include the following general descriptive information, where applicable:

- .1 a description and particulars of the vessel;
- .2 a chain of command with general responsibilities during normal operation;
- .3 limiting design data for each mode of operation, including draughts, air gap, wave height, wave period, wind, current, sea and air temperatures, assumed seabed conditions, and any other applicable environmental factors, such as icing;
- .4 a description of any inherent operational limitations for each mode of operation and for each change in mode of operation (where applicable);
- .5 the location of watertight and weathertight boundaries, the location and type of watertight and weathertight closures and the location of down flooding points;
- .6 the location, type and quantities of permanent ballast installed on the vessel;
- .9 light ship data together with a comprehensive listing of the inclusions and exclusions of semi-permanent equipment;
- .10 stability information setting forth the allowable maximum height of the center of gravity in relation to draught data or other parameters based upon compliance with the intact and damage criteria;
- .11 a capacity plan showing the capacities and the vertical, longitudinal and transverse centers of gravity of tanks and bulk material stowage spaces;
- .12 tank sounding tables or curves showing capacities, the vertical, longitudinal and transverse centers of gravity in graduated intervals and the free surface data of each tank;
- .16 description and limitations of any on-board computer used in operations such as ballasting, anchoring, dynamic positioning and in trim and stability calculations;
- .18 description of the main power system and limiting conditions of operation
- .19 a list of current key plans and schematics as revised to show present arrangements.

A8.2 The operating manual for normal operations should also include, where applicable:

- .1 guidance for the maintenance of adequate stability and the use of the stability data;
- .2 guidance for the routine recording of lightweight alterations;
- .3 examples of loading conditions for each mode of operation and instructions for developing other acceptable loading conditions, including the vertical components of the forces in the anchor cables;
- .4 for column-stabilized units, a description, schematic diagram and guidance for the operation of the ballast system and of the alternative means of ballast system operation, together with a description of its limitations, such as pumping capacities at various angles of heel and trim;
- .5 a description, schematic diagram, guidance for the operation of the bilge system and of the alternative means of bilge system operation, together with a description of its limitations, such as draining of spaces not directly connected to the bilge system;
- .6 fuel oil storage and transfer procedures;
- .7 procedures for changing modes of operation;
- .8 guidance on severe weather operations and time required to meet severe storm conditions, including provisions regarding lowering or stowage of equipment, and any inherent operational limitations;
- .16 procedures for receiving vessels alongside

A8.3 The operating manual for emergency operations should include, where applicable:

- .3 description of the emergency power system and limiting conditions of operation;
- .4 a list of key plans and schematics which may be useful during emergency situations;
- .5 general procedures for de-ballasting or counter flooding and the closure of all openings which may lead to progressive flooding in the event of damage;
- .6 guidance for the person in charge in determining the cause of unexpected list and trim and assessing the potential effects of corrective measures on unit survivability, i.e. strength, stability, buoyancy, etc.

A8.4 The information provided in the operating manuals should, where necessary, be supported by additional material provided in the form of plans, manufacturers' manuals and other data necessary for the efficient operation and maintenance of the unit. Detailed information provided in manufacturers' manuals need not be repeated in the operating manuals. The information should be referenced in the operating manual, readily identified, located in an easily accessible place on the vessel and be available at all times.

A8.5 Operating and maintenance instructions and engineering drawings for ship machinery and equipment essential to the safe operation of the ship should be written in a language understandable by those officers and crew members who are required to understand such information in the performance of their duties.