GOAL-BASED NEW SHIP CONSTRUCTION STANDARDS

Introducing goal-based standards (GBS) into the existing regulatory framework

Submitted by Germany

SUMMARY

Executive summary: This paper describes a way of introducing goal-based standards (GBS) into the existing regulatory framework. It includes a proposal for taking forward the agreement at MSC 79 of this approach to not being prescriptive but nevertheless being clear and measurable.

Action to be taken: Paragraph 10

Related documents: MSC 79/23, MSC 79/6/3, MSC 78/6/2 and MSC 80/6

1 At MSC 79, the Committee agreed that any development of goal-based standards (GBS) should form the foundation for future advance of international regulatory standards. Likewise the discussion on Tier I concluded in concurring that the goals to be defined should not be prescriptive. The first part of this paper proposes a way to introduce GBS into the existing regulatory framework. In the second part and in annex 1 another proposal is given taking account of the desire to not being prescriptive but nevertheless being clear and measurable. Annex 2 gives an example of the new process.

Relationship between the regulatory framework and GBS

2 Today’s regulatory framework within the shipping industry can be seen to consist of international regulations developed by the IMO (Conventions, etc.) which are implemented by the flag States, national regulations developed by flag States, structural rules developed by classification societies and other (industry) standards. In total the regulatory framework includes all applicable rules and regulations which may conveniently be subdivided into tiers (MSC 78/6/2, annex).

3 It is to be noted that the IMO instruments are developed in the spirit of the IMO mission statement, however, they are not directly linked to it. Other rules and standards may well be developed in some similar spirit but this can only be assumed.
4 Goals clearly formulating the level of safety, security and environmental protection to be ensured by the regulatory framework might form the basis for future development of rules and regulations. In the course of improving IMO instruments, such goals will ensure that new regulations will meet the desired level of safety, security and environmental protection. For rules and standards developed by class and other (industry) bodies such goals would ensure that these rules and standards are in line with the aims of IMO and that IMO maintains control through its request for proving compliance.

5 Any regulatory framework containing such goal-based elements is considered to be called a goal-based regulatory framework. Goal-based standards (GBS) – that might better be referred to as goal-based regulation (GBR) (MSC 79/6/15) – are considered a (substantial) part of such a framework. A model of the elements of the regulatory framework, differentiated in “today” and “tomorrow”, are presented in figure 1. The bodies and organizations that are responsible for each element as well as the application and verification processes that connect these elements with each other are indicated.

![Figure 1: Regulatory framework (with responsible bodies indicated at the left)](image)

**GBS within the regulatory framework**

6 GBS as part of the regulatory framework introduce minimum targets for rules and regulations and their development. GBS shall not regulate individual ships. Rules and regulations developed in accordance with GBS have to be proven for compliance with ultimate objectives. Subsequently, any ship built in accordance with such requirements has to be proven for compliance with these rules and regulations.

**Development of tiers reflecting the new approach in the regulatory framework**

7 Taking into account the discussions held at MSC 79 and the results of the GBS WG achieved at MSC 79, a goal-based regulatory framework shall consist of a governing Tier 0 and further 5 tiers. Having confirmed that Tiers I to III, referred to in document MSC 78/6/2,
constituted the goal-based standards to be developed by IMO, the Committee agreed with yet another proposal, in particular to establish high-level performance goals (so called Tier 0). At that time it was considered that this Tier 0 could be dealt with at a later stage, in order to link goal-based standards for different subjects. However, based on the above described concept of introducing GBS into the existing regulatory framework for all tiers, including a Tier 0, Germany believes that all tiers shall be developed in a consistent manner.

8 Following the proposal outlined in MSC 78/6/2 and further elaborated at the Committee’s previous session, the now six tiers are structured as follows:

.1 Tier 0: Top level safety objectives in direct response to IMO Mission Statement [including acceptance criteria].

.2 Tiers I, II and III: together referred to as “Goal-based Standards”, addressing the ship as a whole (refer to MSC 79/6/3), but as a first step limited to ship hull design and construction. Here, Tiers I and II comprise goals and functional requirements and Tier III includes the description of application and verification processes.

.3 Tier IV: International regulations (e.g. SOLAS regulations), classification rules, industry standards, all being mandatory through IMO instruments.

.4 Tier V: Non-mandatory standards and codes to be applied during ship design process.

The content of each of the Tiers 0 through III is to be developed by the Organization, while Tiers IV and V include the regulations and rules to be developed by the regulatory bodies and developers of structural rules (as well as the Organization). The figure below shows the relation between the different tiers and the regulatory framework described in the first part of this paper.

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**Figure 2: The six-tier system within the regulatory framework**

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9 In annex 1 to this paper, a proposal is given on how the individual tiers should be developed in order to ensure a systematic, measurable and conclusive approach. Noting that for the time being the main focus is on structural matters only, goals related to other issues are set in italics.

Action requested of the Committee

10 The Committee is invited to note the German proposals and take action as deemed appropriate.

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ANNEX 1

The top-level safety objectives and goals have to be made measurable. Therefore, suitable acceptance criteria which can be broken down to specify design targets for functional requirements are presented below for each goal. Proposed criteria are printed in (round) brackets.

**Tier 0 - Top-level safety objectives**

- Limit loss of life and property (to acceptable levels)
- Limit environmental damages (to acceptable levels)

Acceptable levels are proposed in, e.g., MSC 72/16. For environmental protection, the CG for FSA is tasked to develop suitable acceptance criteria (MSC 79/23, paragraph 15.4.4).

**Tier I - Goals**

The following list presents a set of goals for all ship types. For the time being, goals not relevant for structural matters are in *italics*.

Goals are set for the ship’s entire lifetime under specified environmental and operating conditions.

- The ship shall not capsize in intact conditions (probability of ship to withstand capsizing).
- The ship shall have sufficient structural integrity (probability of structure to remain intact).
- The ship shall be designed for reasonable redundancies (safety margins in cases of flooding, fire, equipment failure, etc.)
- The ship shall survive reasonable damages, including damage stability (probability of surviving a set of damage scenarios, e.g., water ingress, grounding, fire, explosion).
- The ship’s equipment shall be designed for reliability (designed and fit for relevant scenarios of operational modes).
- *The ship shall have sufficient life saving capabilities (availability of life saving equipment and evacuation performance for a set of damage scenarios).*
- *The ship shall have sufficient manoeuvrability (availability of a set of components that are needed to deliver a certain minimum manoeuvrability).*
- *The ship shall have minimum navigation capabilities (availability of a set of specified navigational functions).*
- *The ship shall have appropriate security features (availability level to be specified).*
- *The ships environmental performance shall not exceed globally accepted limits (marine as well as air pollution limits to be developed).*

Ship-type specific goals shall be added as necessary, e.g. for bulk carrier, tanker, passenger ship, etc.

**Tier II – Functional requirements**

Functional requirements are derived from above goals. Indicated acceptance criteria can be broken down to design targets for each function. The process of goal breakdown is detailed in Tier III. Note: Functional requirements must not impede technical developments. However, the
appropriate set of functional requirements can only be detailed at a later stage once the top-level tiers are agreed.

**Tier III - Processes of goal breakdown and verification**

Tier III shall comprise a description of the processes needed to break down top-level goals (including their acceptance criteria) down to lower-level requirements as well as to demonstrate compliance of lower-level rules and regulations with top-level goals. Demonstration of compliance shall be part of development of rules and regulations.

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ANNEX 2

POSSIBLE PROCEDURE OF INTRODUCING AND DEVELOPING NEW RULES OR REGULATIONS WITHIN THE PROPOSED REGULATORY FRAMEWORK

Initiating event
This scenario assumes that a flag State becomes aware of an increasing number of damages on the fore end of a certain ship type and considers it necessary to consider these damages in some more depth. Such an initiative could of course be taken by any other party in the shipping world within the scope of the method of work of the organization.

Hazard identification
The following process of further identification and evaluation remains mainly unchanged to the existing procedure, e.g. applied for the revision of SOLAS XII.

Review of GBS
A new step is the evaluation whether there is a shortcoming in the goals (Tier I) or in the functional requirements (Tier II). In that case e.g. a new functional requirement can be formulated requesting a special minimum probability on structural integrity in the fore part of a ship.

Development of new structural rules
The classification societies have in due course to review their rules and to develop new requirements as necessary to get their rules in line with the new functional requirement.

Additionally the Organization may consider it necessary reviewing their own regulations, e.g. about protection of crew.

Review process
The rule developing body submits a detailed documentation showing that the new rules are in compliance with the new criteria set forth in Tier I and Tier II.

The scheme below shows this process in form of a flow chart.
Flow of rule development process

**Initiating event**
Flag State identifies a new hazard, e.g. green water damage on ship’s fore end

**Action**
FSA is performed to identify to assess causes and consequences, new item on work programme proposed

Independent review of FSA is carried out at IMO level

Check whether hazard identified is covered by the Goals in Tier I and the Functional requirements in Tier II e.g. probability of occurrence vs. probability considered acceptable. If necessary Tier I or Tier II are to be amended

Structural rules related to strength of fore ship are developed/updated by classification societies and/or new safety regulation to be developed by the organization

It has to be shown that the new rules achieve the requested improvement of safety level (Tier III)