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# GOAL-BASED NEW SHIP CONSTRUCTION STANDARDS

## A proposal for the further development in consideration of the future safety-level based standards

**Submitted by Germany**


| SUMMARY | |
|---|---|
| *Executive summary:* | This document provides a proposal for the future safety-level based standards |
| *Strategic direction:* | 10 |
| *High-level action:* | 10.0.1 |
| *Planned output:* | 10.0.1.1 |
| *Action to be taken:* | Paragraph 23 |
| *Related documents:* | Resolution A.1011(26); MSC 77/2/5, MSC 78/6/2, MSC 81/6/8 and MSC 81/WP.7 |


## Background

1 The Committee, at its eighty-seventh session, invited Member Governments and international organizations to submit proposals to MSC 88 regarding the continuation of the work with respect to the strategic direction of developing and applying goal-based standards for maritime safety.

2 The initial submission proposing this topic to be included in the strategic plan, from the Bahamas and Greece (MSC 77/2/5), was asking for basic goal-based standards (GBS) focused on the design and construction of hull structures. Such standards should provide adequate safety and environmental protection of shipping without setting prescriptive requirements or solutions. Furthermore, these standards should be capable of adapting to changes in technology (MSC 78/6/2).

3 A first step towards this goal has been performed by developing goal-based new ship construction standards for bulk carriers and oil tankers. However, these standards address only some parts of the basic idea of goal oriented standards. And still several question marks exist with respect to the efficiency of the verification process and future technology development of classification rules.

4 From Germany's point of view, developing standards that fulfill these high-level generic requirements leads to safety-level based standards that specify the safety level for shipping and the functions to be fulfilled. Such standards would allow a direct consideration of safety in the design process. Furthermore, such standards would be a consequent continuation of the process initiated by the adoption of SOLAS amendments for alternative design.

5 In order to initiate a discussion on the future work plan for the development of safety-level based standards, this submission briefly summarizes the previous work of developing goal-based standards and highlights unresolved issues. Germany is of the opinion that the *loose ends* of the previous work should form the basis to develop a work plan for safety-level based standards.

**Summary of the GBS development**

6 As mentioned above, the discussion of goal-based standards began at MSC 77 and became a new item of the Strategic Plan for the Organization at the twenty-second extraordinary session of the Council. Basic principles of a goal-based regulatory framework with a tier structure were proposed (MSC 78/6/2). One of these basic principles was that GBS should provide the standards against which ship safety should be verified both at design and construction stages and during ship operation. Furthermore, goals should be defined that do not set prescriptive requirements or give specific solutions.

7 Already in the beginning of the discussion it became obvious that this proposed basic principle opens space for interpretation how GBS may be developed and consequently the discussions in the working groups (WGs) and correspondence groups (CGs) yielded in essence two basic approaches:

.1 deterministic; and

.2 probabilistic or risk-based approach, later re-named to safety-level approach.

8 Since the beginning it seems to have been the general consensus that in order to start the development of goal-based standards the work should be focused on the design and construction of hull structures. Pertinent goal-based standards for machinery and equipment were proposed to be considered at a later stage.

9 The following discussions both in WGs and CGs raised issues linked to the safety-level approach that mainly focused on details like availability of data to feed the risk models, accuracy of risk analysis, definition of ship types, etc. For instance, with respect to fleet size (important parameter to determine the current safety level), different sources were compared yielding different numbers of ships.

10 Accordingly, the progress achieved by the work of the WGs and CGs deviated from the expectations. To overcome this issue, a parallel approach was proposed by Germany and supported by Denmark, Netherlands, Norway and Sweden: a short-term focusing on the functional requirements for tankers and bulk carriers to be built and a long-term to develop risk-based considerations with a possible starting point being established at the current safety level.

11 The basic principle of the safety-level approach was outlined in document MSC 81/6/8, showing how IMO could use the already available know-how to adjust the acceptable safety level for ships by the so called safety knob. This safety knob is the

regulating screw turned by IMO, for instance re-adjusting thresholds used in the ALARP principle (GCAF, NCAF) and, hence, to prescribe a new acceptable safety level for regulations and rules. The application of the ALARP principle is flanked by thresholds specifying the intolerable risk level and the negligible risk level.

12 Germany is of the opinion that the safety level adjusted via the safety knob must be regarded as a characteristic value rather than an exact safety level (correct value of current safety). In this context, characteristic means that the achieved safety level is regarded to be acceptable for all stakeholders, including society in general. The threshold values are used to adjust rules and regulations via risk models that, from our point of view, should take into consideration the main risk contributor, but not a one-to-one mapping of reality.

13 The short-term activities yielded the deterministic goal-based new ship construction standards for bulk carriers and oil tankers adopted at MSC 87.

14 Major unresolved issues in the discussion of the safety-level approach that slowed down the progress have been:

.1 role of Formal Safety Assessment (FSA) in context of GBS;

.2 determination of current safety level; and

.3 monitoring of current safety level.

**The role of FSA in the context of GBS**

15 Another issue comprehensively discussed is the relation between GBS and FSA. Meanwhile, several FSAs, most of them performed in the European funded research project SAFEDOR, were submitted to the Organization by Denmark (e.g., MSC 83/21/1, MSC 83/INF.3, MSC 83/21/2, MSC 83/INF.8, MSC 85/17/1, MSC 85/INF.2, MSC 85/17/2 and MSC 85/INF.3) and reviewed by a Group of Experts (GoE).

16 All FSAs provide examples for the application of risk-based methods to determine and evaluate the risk for ship types in a high-level analysis. FSA is the process to determine and, if deemed necessary, to adjust the safety level of regulations. In this context, the reports of the GoE (MSC 86/WP.9 and MSC 87/WP.7) provided comprehensive information which, from our perspective, is relevant for the further development of safety-level based standards.

**Determination of current safety level**

17 The FSAs recently submitted to the Organization provide high-level investigations of the current risk level, mainly focused on human safety. Even if it was raised by the group that the used data could not be verified by the GoE and, hence, the validity could not be attested, no doubts were raised that FSA can provide the current safety level for different ship types.

**Monitoring of current safety level**

18 As already noted in the GBS-related discussion, the currently available casualty databases have gaps with respect to consequence details and causes. Additionally, as noted in the interim reports of the FSA for general cargo ships (MSC 87/20/1 and MSC 87/INF.3), for some ship types the issue of under-reporting must be taken into consideration. This (in-complete information, under-reporting) influences the accuracy in determining the current safety level as well as the identification of areas for improvement.

19 Furthermore, the complexity of safety monitoring will increase with the degree of detail under consideration, because long periods of data collection are expected before confident conclusions could be drawn from the historical data.

20 Other effects, like small fleets or single catastrophic events, must be taken into consideration when discussing a monitoring process. However, Germany is of the opinion that this issue should not be regarded as a show stopper for the development of safety-level based standards. From our perspective, there is more a need to specify the accuracy of the monitoring parameters.

**Starting point for safety-level based standards**

21 As a starting point for the revision of the work plan for safety-level based standards, an attempt to summarize the current situation is made on basis of the work plan proposed in document MSC 81/WP.7.

(*In concluding the discussion, the group arrived at the following list of items, which was proposed and supported, that needed to be considered in order to develop goal-based standards using the safety level approach*):

.1 *develop risk model, considering, inter alia, such factors as assumptions, models, scatter diagrams, random variables and their probability distributions, failure scenarios and terminology:*

The FSAs recently submitted to the Organization contain risk models for the majority of present ship types (e.g., container, crude oil tanker, cruise ships, ro-pax). These risk models contain high-level scenarios for the different accident categories. If regarded necessary, these risk models can be further elaborated, for instance, to consider probability distributions.

.2 *develop goal-based standards guidelines;*

The draft Generic guidelines for developing goal-based standards (GOAL-BASED NEW SHIP CONSTRUCTION STANDARDS) exist. These guidelines provide the GBS framework, an example for functional requirements categories. Both could be used for the safety-level approach.

.3 *determine the current safety level in a holistic high-level manner and determine the relationship between the different design measures; e.g., structure, stability, manoeuvrability, fire protection, etc.;*

The available high-level FSAs cover all accident categories and provide the current safety level in a holistic high-level manner. However, no investigation with respect to the relationship between different design measures are currently contained in these high level FSAs.

.4 *examine and reconsider the five-tier system and, if needed, adapt appropriately to develop a structure suitable for the safety level approach;*

For the time being, the draft Guidelines for goal-based new ship construction standards provide a sound basis for a continuation of the work using the five-tier system.

.5 *examine and, if appropriate, modify Tier I and Tier II as developed for oil tankers and bulk carriers for use in the safety level approach*;

.6 *consider the relationship between overall failure of the ship and the contribution of individual failure modes; and*

.7 *further develop and refine the long-range work plan*.

**Proposal**

22 Germany is of the opinion that now is the time to pick up the loose ends of the work carried out in the context of GBS and subsequently to start with the development of safety-level based standards. From our perspective, the following items should be included in a future work plan:

.1 finalize the draft Guidelines for GBS to a degree suitable for the preparation of regulations for future safety-level based standards within current or future review processes (definition of goals and functional requirements, etc.), taking into consideration recent experiences, e.g., in the discussions of the IGF Code and the International Code of safety for ships operating in polar waters;

.2 clarify how the acceptable safety level should be specified (basic philosophy of safety-level based standards); and

.3 specify the model to determine the safety level of standards.

**Action requested of the Committee**

23 The Committee is invited to note the above information, including the proposal in paragraph 22, and take action as deemed appropriate.