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FORMAL SAFETY ASSESSMENT

Comments by SAFEDOR on the report of FSA Experts Group (FSA on cruise ships)

Submitted by Denmark

SUMMARY

Executive summary:	This document comments on the report of the first intersessional meeting and the correspondence group of the Formal Safety Assessment (FSA) Experts Group. This document sets out the SAFEDOR responses to the FSA Experts Group's concerns regarding the FSA on cruise ships (annex 1 to document MSC 87/18).
Strategic direction:	12.1
High-level action:	12.1.1
Planned output:	12.1.1.2
Action to be taken:	Paragraph 4
Related documents:	MSC 87/18, MSC 85/17/1 and MSC85/INF.2

1 This document is submitted in accordance with the provisions of paragraph 4.10.5 of the Guidelines on the organization and method of work of the MSC and MEPC and their subsidiary bodies (MSC-MEPC.1/Circ.2) and comments on document MSC 87/18.

2 As a partner in the SAFEDOR project, Denmark has collected responses from the SAFEDOR experts who performed the FSA on cruise ships.

3 The following comments are related to the major items discussed at the first intersessional meeting of the Formal Safety Assessment Experts Group, as set out in annex 1 to the main report, document MSC 87/18.

Action requested of the Committee

4 The Committee is invited to note the information and take action as appropriate.

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ANNEX

COMMENTS ON THE REPORT OF FSA EXPERTS GROUP REGARDING THE FSA ON CRUISE SHIPS

To limit the number of pages, only parts of the questions posed by the FSA EG are repeated. Responses by the SAFEDOR FSA experts are given in *italics*. The numbering below refers to the main report, document MSC 87/18, by the FSA EG.

Whether the expertise of participants in the FSA study was sufficient for the range of subjects under consideration (TOR 1.7)

1 Although some members felt that more details for each expert were needed and sufficient number of expert on designing these types of ships should be included, the group noted that the expertise of participants in the HAZID of the FSA study was reported and sufficient. However, similar information on the remaining FSA steps in regard to the expertise was not found.
The reason that short CV are given for HAZID and where expert elicitation is used, is that such analysis is subjective – therefore we need to know the expertise of those subjects. For the rest of the FSA based on data that can be reanalyzed by anyone, there should not be a need for providing CVs.

The validity of the input data and its transparency (TOR 1.3)

The reasonableness of the assumptions and whether the scenarios adequately addressed the issues involved (TOR 1.2)

2 The group noted some data discrepancies included in the main report (MSC 85/17/1) and detailed report (MSC 85/INF.2) (e.g., fatalities in fire/explosion accidents in table 6-5, 7-3 and 9-1).
The final report is written based on the detailed analysis. It is therefore usually the detailed reports that will be correct, as errors may be done in compiling the summary. In this case the number of Table 6.5 of MSC 85/INF.2 is correct. The accident frequency for fire and explosion is 9.2 10^{-3} per ship year. This can be verified by the accidents in Table 6.4 (16) and the number of ship-years in Table 6.3 (1742). 16/1742 = 9.2 10^{-3}.

3 The group noted that the casualty data from RoPax were used in the FSA study on cruise ships recognizing that only limited casualty data on cruise ships were available due to the relatively small fleet/casualty number.
This is not correct. There is a mention of Ro-Pax, but no data from Ro-Pax is used. Some members of the review team should know this as this has been explained repeatedly at meetings during the project.

The group also noted some casualty data were omitted (i.e. cases of OCEANOS 1991).
The reason that OCEANOS accident of 1991 is not included is that the accident is out of the defined scope (7,554 gt).

The group further noted that the worst case scenario was used in the study, utilized the RoPax data, and was of the view that the sensitivity assessment was necessary.
Information from RoPax accidents was only used in this FSA to assist judgments about what might occur in worst case cruise ship accidents. No data is available from cruise ships as no similar accidents involving cruise ships have occurred. The SAFEDOR partners agree that sensitivity analysis on this aspect would be interesting but doubt that it would alter the final conclusions of the study.

4 Some members were of the opinion that the use of RoPax casualty data in this FSA study for cruise ships was unjustified, due to significant differences in design and operation between the two types of ships.
The statement is based on a misunderstanding. During the presentation at IMO at MSC 86 it was mentioned several times that no casualty data from Ro-Pax was used.

They also expressed concerns on the large number of assumptions regarding probabilities in the event trees and consequences of accident scenarios, many of which they found unjustified. Others mentioned that there are similarities of design between them.

The report describes the basis for selecting probabilities at every level in the event trees and in many cases references previous relevant detailed studies as justification.

Due to the lack of data and uncertainty in knowledge, assumptions have been made. Assumptions will always be an inherent part of an FSA. That needs to be acknowledged and that assumptions should be explicitly highlighted so that they may be challenged. This was done in the FSA report, and a critical review and challenging of these assumptions would be welcome. Indeed, if new knowledge becomes available, it is stressed that the assumptions should be revisited, as appropriate. Since the comment is rather general about the validity of assumptions in an FSA and not directed towards particular assumptions in the FSA report, but assumptions will need to be challenged and discussed on a case-by-case basis if some of them seem unrealistic.

5 In the view of the comments above, the group agreed on the need for better input casualty data for cruise ships and was concerned about the validity of use of the casualty data of RoPax and reasonableness of the assumptions.
There are fortunately few data on casualties for cruise ships – as the fleet is rather small. Therefore the normal FSA procedure is that risks must be estimated based on models and expert judgment.

Whether risk control options and their interdependence were properly evaluated and supported by the assessment (TOR 1.4)

Whether uncertainty and sensitivity issues have been properly addressed in the FSA study (TOR 1.5)

6 The group noted that the FSA had considered the collision and groundings to be the main hazards to cruise ships and focused on a few RCOs to improve damage stability, using as a sensitivity analysis to select the RCO, as well as improvement of bridge design and navigational equipment.
The implication of this comment is unclear. The study considered a wide range of RCOs related to the most significant risks identified in the risk assessment. Potential RCOs were identified from previous studies, in brainstorming sessions and interviews with experts on fire, stability, navigation and with general industry experience. A screening process was applied using experts from industry and class to reduce the number of RCOs to be assessed to a manageable number within the resources of the study. One of the screening criteria was likely cost-effectiveness under the IMO criteria. This process inevitably lead to a focus on RCOs that related to the most significant risks – collision and grounding.

7 The group noted that collision and groundings are consequences but not causes and focusing on them as first events shifts regulatory focus to RCOs for damage mitigation and not accident prevention.
This statement must be a misunderstanding. There is a detailed model for the preventive part that was submitted to IMO already at MSC 78 (MSC 78/4/2).

8 Some members expressed the opinion that the calculations for risk reduction of the RCOs were not transparent.
These calculations involve the use of damage stability software and are therefore difficult to make fully transparent. The report describes the process used and the results from the damage stability calculations in an endeavour to be as transparent as possible.

9 The group noted that the report of the FSA mentioned that the FSA did not further consider the fire hazards, bearing in mind that the fire hazard appeared to be one of major contributors to the frequency of casualties but the consequence of the case would be small as the results of recent improvement of fire safety requirements.
The SAFEDOR partners can confirm this limitation in scope.

10 With regard to the cost-benefit analysis used in the study, the group, while noting that the methodology of calculating GCAF and NCAF was explained, found it difficult to follow the calculation and justification of such values due to the lack of sufficient information.
It is believed that sufficient information is provided to allow the calculations to be repeated independently given that the standard IMO method is used.

11 The group agreed that the risk control options of these FSAs were derived, in principle, according to the FSA Guidelines. The group noted that uncertainty and sensitivity analysis had been conducted and reported. The group also noted that expert judgment was inevitable in step 3, because FSA itself was pro-active casualty prevention activities and insufficient availability of casualty data. Some members expressed their concern especially with regard to the great number of assumptions on probabilities and other variables.
The SAFEDOR partners agree with the statement. The strength of FSA is that assumptions need to be documented. This is a clear improvement as compared to the standard approach at IMO.

12 The group noted that no interdependency analysis on RCOs had been performed.
The SAFEDOR partners can agree with the statement. However, this process is often done during the decision-making process. It is acknowledged that RCO interdependencies were not included in the initial report, and that maybe they should have been. For most of the RCOs examined in detail there would be little or no interdependency since they are discrete options that cannot be mixed. It is acknowledged that future FSAs should indeed include such interdependency studies, in particular for RCOs that may be sensitive to such interdependencies.

Whether the methodology was applied in accordance with the FSA Guidelines and the Guidance on the use of HEAP and FSA (TOR 1.1)

13 Based on the above consideration, the group noted that the FSA followed the steps specified in the FSA Guidelines but did not fully comply with them. Some members felt that access to casualty database, gap between step 1 and the rest of the FSA, treatment of RCO interdependencies and calculation of concordance among experts were points of departure from the FSA Guidelines.
A list of the casualties included in the database is provided in the report in appendix F annex II. Most casualty databases are proprietary products which restricts full publication.

The "gap between step 1 and the rest of the FSA" is assumed to relate to a gap between the HAZID and the rest of the study. Section 1.1 annex II describes this link. The HAZID undertaken, as would any general HAZID of cruise ships, identified collision, grounding, contact and fire as the main hazards and these were then analysed in the remainder of the study.

See item 12 as regards interdependency of RCOs.

The process by which the experts working on the study reached their judgements was, in general, one of reaching a consensus rather than a mathematical calculation process, therefore calculation of concordance is not particularly relevant.

Other concern was expressed that lack of casualty information on cruise ships made the chosen risk analysis method unreliable. However, bearing in mind that FSA is a tool for pro-active approach to prevent accidents rather than wait for accidents happening, it was also pointed out that development of casualty scenarios should not be done only based on historical casualty data.
The SAFEDOR partners agree with this comment. Risk Assessment is decision support tool to make the best use of the available data, whatever its quality.

The group noted that the FSA reports had not included a human reliability analysis.
Document MSC 78/4/2, that has been used in the process, is largely about human reliability. Further, only one of the RCOs examined in detail, Bridge Resource management (BRM), relates closely to human factors, the others relating to the structural configuration of the ship. A human factors study of bridge watchkeeping operation and bridge design is a major undertaking and beyond the scope of this study. The SAFEDOR partners agree that, where appropriate, human factors studies should be included in FSA.

Consideration of the proposed final recommendations in each FSA study (TOR 2)

15 The group, while recognizing the possible usefulness of the final recommendation (BRM), noted that the FSA did not ask to take immediate action on the final recommendations. Therefore, the group recommends the Committee that as proposed in the final recommendations; further detailed research in the area of BRM would be needed.
The SAFEDOR partners agree with the recommendation.

16 The group noted paragraph 7 of document MSC 83/17/1 that further investigation on damage stability may be necessary if this RCO would be taken for consideration.
The SAFEDOR partners agree with the recommendation.

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