INTERNATIONAL MARITIME ORGANIZATION

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SUB COMMITTEE ON SHIP DESIGN AND CONSTRUCTION
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Agenda item 15

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ANY OTHER BUSINESS

Experience gained with larger FRP structures in ship construction

Submitted by CESA

SUMMARY

Executive summary:	This submission provides access to application experience with larger FRP structures provided by the EU research project RAMSSES. The project deliverables also contain recommendations regarding review of and potential amendments to MSC.1/Circ.1574 with a view to overcoming the current limitation to smaller FRP elements. CESA recommends starting the review process now in order to expand the regulatory basis for the utilization of lightweight structures as soon as possible, significantly increasing the energy efficiency and climate friendliness of shipping.
Strategic direction, if applicable:	2
Output:	152
Action to be taken:	Paragraph 17
Related documents:	SDC 8/18; MSC 105/20 and MSC 100/19/3

Introduction and background

1 In 2017, the Maritime Safety Committee adopted the *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues* (MSC.1/Circ.1574) (Interim guidelines), which now have been in use for five years. MSC.1/Circ.1574, paragraph 5 states that the Interim guidelines should be reviewed four years after their approval in order to make any necessary amendments based on experience gained.

2 For that purpose, the output *Guidelines for use of fibre-reinforced plastics (FRP) within ship structures* has been kept on the post-biennial agenda and interested Member States and international organizations are invited to consider the need to review MSC.1/Circ.1574 and to submit any proposals to the SDC Sub-Committee.

3 Since approval of the Interim guidelines, the EU research project RAMSSES (*Realization and demonstration of Advanced Material Solutions for Sustainable and Efficient Ships*) has extensively studied FRP structures in ship design and production and investigated the structural integrity of these materials from a fire safety perspective, including related fire test procedures.

4 With this submission CESA would like to bring the application experience to the attention of the Organization with a view to facilitating the review and potential amendment of the Interim guidelines and to improve the uptake of new technologies for greener shipping.

Discussion

5 The application of the Interim guidelines is currently limited to FRP elements only, which are defined as a structure that may be removed without compromising the safety of the ship. This limitation hampers a broader utilization of lightweight structures in ship construction, which is a significant design element in order to increase the energy efficiency and climate friendliness of shipping.

6 The Interim guidelines still cannot be utilized for ships constructed completely of FRP materials or FRP composite structures contributing to the global strength of the ship because the Interim guidelines currently do not fully address the risks of progressive structural collapse or global loss of structural integrity due to fire.

7 In order to overcome these limitations RAMSSES has developed and documented large-scale demonstrators, verifying that larger FRP structures can be safely used in real ships if appropriate fire test procedures and extended evaluation of mechanical performance of FRP materials are employed in the design and verification process.

8 The final RAMSSES brochure, which provides an overview on the technical scope and overall results as well as the project consortium, can be downloaded here: RAMSSES Brochure.

9 The RAMSSES application case *Custom Made Hull for Offshore Vessel* demonstrates a ship entirely constructed of FRP. The safety assessment of the FRP structure included coupon scale testing, components testing, full-scale joints testing, severe impact testing, full-scale testing on global bending moments and full-scale fire testing representative for a helicopter deck fire after impact with damaged helideck. This demonstrator is briefly introduced in the brochure and described in detail in a separate document which can be downloaded here: Scaling up Composites Technology, and its Acceptance.

10 In particular, the following main aspects of fire safety, which are affected by the introduction of FRP composite structures, have been addressed within the final RAMSSES recommendations for rule development:

.1 Fire growth potential – the reaction to fire properties of exposed internal and external FRP composite surfaces and how fire development will be affected when the combustible materials of the FRP composite structures become involved;

.2 Fire containment – avoidance of fire spread by the FRP composite structures; and

.3 Structural integrity – the impact on load-bearing capabilities and global strength by potential deterioration of FRP composite structures.

11 Each of these aspects is discussed with reference to relevant regulations and test procedures in the Fire Test Procedures (FTP) Code used to ensure sufficient performance of ship building materials.

12 The RAMSSES recommendations also address the issue of constructing "A" and "B" class divisions using FRP composite materials. Based on the three fire-resistance classes "R" (load-bearing capacity), "E" (integrity) and "I" (insulation) a process is defined to determine appropriate FRP test procedure (see figure 1 in the annex).

13 The results are presented in detail in RAMSSES public Deliverable D06.7 – Final Recommendations to Rule and Policy makers, which can be downloaded here: RAMSSES Recommendations

14 The material presented could be used as a starting point for the review of the Interim guidelines with a view to amending them so that the scope of application can be expanded beyond smaller FRP elements not contributing to the global strength of the ship.

Way forward

15 Based on the results of the RAMSSES projects, SDC 9 is invited for an initial consideration of the scope and timeline for the review and potential amendment of the Interim guidelines.

16 In case sufficient further input can be expected from Member States and observer organizations, the Sub-Committee should request to put this output onto the agenda of SDC 10.

Action requested of the Sub-Committee

17 The Sub-Committee is invited to consider the information provided in paragraphs 5 to 14 as well as the RAMSSES deliverables and proposals for the way forward provided in paragraphs 15 and 16 and take action, as appropriate.

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ANNEX

FLOWCHART ILLUSTRATING THE PROCESS OF REPLACING "A" OR "B" CLASS DIVISIONS WITH FRP COMPOSITE STRUCTURES

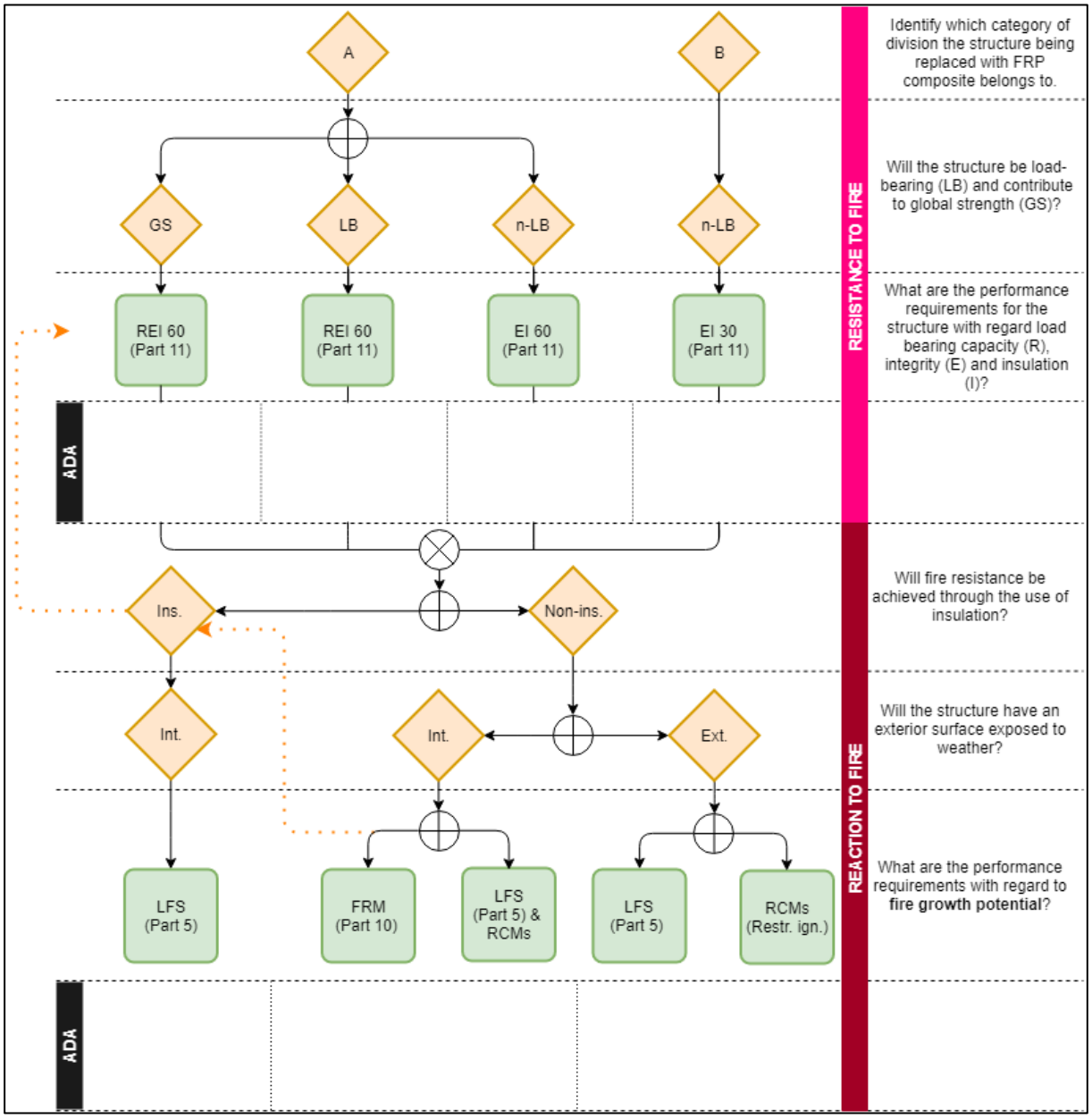

Figure 1: Flowchart illustrating the process of replacing "A" or "B" class divisions with FRP composite structures. (RAMSSES Deliverable D06.7 Final Recommendations to Rule and Policy makers, p.60)