INTERNATIONAL MARITIME ORGANIZATION

E

MARITIME SAFETY COMMITTEE
103rd session
Agenda item 20

MSC 103/20/3
25 February 2021
Original: ENGLISH
Pre-session public release: ☒

ANY OTHER BUSINESS

Progress report regarding IACS work on structural strength of large containerships

Submitted by IACS

SUMMARY	
Executive summary:	This document advises the Committee of the progress of work in IACS pertaining to the strength of the structure of large containerships, forming part of IACS safety initiatives discussed at MSC 95
Strategic direction, if applicable:	Not applicable
Output:	Not applicable
Action to be taken:	Paragraph 14
Related documents:	MSC 95/22 (paragraphs 16.3 and 16.4), MSC 95/16 and MSC 95/INF.11

Background

1 The Maritime Safety Committee (MSC), at its ninety-fifth session, discussed the safety of large containerships. In that context, document MSC 95/16 (Bahamas and Japan) provided recommendations contained in the final investigation report, presented to the Committee in document MSC 95/INF.11. In particular, the following recommendations related to the rules of classification societies and IACS unified requirements were given:

".1 the effect of the lateral loads which induce bi-axial stress of bottom shell plates should be considered in the requirements of the hull girder ultimate strength, taking into account the close relationship between the lateral loads and the hull girder ultimate strength;

.2 effects of whipping responses should be explicitly considered in the requirements of the vertical bending strength; and

.3 representation of technical background of the requirements for vertical bending strength, such as sea states, etc. should be considered."

2 At the same session, IACS responded to those recommended measures as recorded in annex 27 of document MSC 95/22/Add.2. The Committee invited IACS to keep it informed of further developments on relevant IACS requirements for large containership safety (MSC 95/22, paragraph 16.4).

Discussion

3 Responding to the abovementioned invitation, IACS is pleased to provide an update of its ongoing work on the safety of large containerships.

Current status

4 As announced by IACS at MSC 95 (MSC 95/22, paragraph 16.3), the IACS unified requirement (UR) S11A "Longitudinal strength standard for container ships" was published in June 2015 and put into force on 1 July 2016.

5 In addition, UR S34 "Functional requirements on load cases for strength assessment of container ships by finite element analysis" was published in May 2015 and put into force together with UR S11A on 1 July 2016.

6 UR S11A contains requirements regarding longitudinal strength of containerships, including the definition of wave-induced vertical bending moments and shear forces, the combination of these load components, the acceptance criteria for yield and buckling assessment, as well as ultimate strength assessment of the hull girder. An improvement of the buckling method will be included in a revision of UR S11A soon. This improvement will be in line with the general buckling procedure in IACS unified requirements and Common Structural Rules (CSR).

7 UR S34 contains requirements on the strength assessment by finite element analysis (FEA) describing load components and loading conditions to be considered in both global and cargo hold FEA. This ensures that all in-plane stress components from the hull girder loads and the local loads are included.

8 UR S11A, in combination with UR S34, enhances the safety of large containership designs by providing more transparent and consistent requirements. This is achieved by ultimate hull girder strength check, including whipping effects for large containerships. In addition, the combination of all global (hull girder) load and local load components are introduced for yield and buckling assessment.

9 Regarding the whipping of large containerships, IACS established a project team to investigate governing aspects of this phenomenon and to derive an approach for the assessment of the contribution of whipping to the maximum design wave bending moment.

10 The whipping effect on the maximum design wave bending moment is usually expressed by an amplification factor of the maximum wave bending moment (excluding whipping), as defined by UR S11A. The definition of the maximum design wave bending moment, however, is based on hydrodynamic calculations using the wave scatter diagram as defined in IACS Recommendation 34. Hence, the basis for the calculation of the maximum wave bending moment, which is reflecting the environmental conditions, i.e. the wave scatter in IACS Recommendation 34, is of crucial importance with respect to the safety level related to hull girder strength.

11 The results of the investigations in the whipping phenomenon are documented in a comprehensive report. However, due to the ongoing work related to the wave environment (IACS Recommendation 34), IACS have not concluded yet how the results will be incorporated in IACS technical resolutions and recommendations.

12 For the purpose of a possible update of IACS Recommendation 34, IACS is using data obtained by latest technologies, such as ship route information provided by AIS and wave data based on hindcast models. The data provided by the hindcast models are verified by comparison with satellite and wave buoy measurements and will be mapped to the AIS data and finally used for establishing a wave scatter diagram. More details of this project can be found in several publications.*

Perspective

13 IACS has decided to update the longitudinal strength requirement for containerships when the related ongoing work, including the investigations on whipping phenomenon and wave environment, is concluded. This decision was taken to avoid repeated changes of an important requirement governing the scantlings of the longitudinal structure in the midship area. According to the plans, finalization of this work can be expected late 2022.

Action requested of the Committee

14 The Committee is invited to note the above progress report and take action, as appropriate.

_____

* IACS Annual Review 2019; "A crest of accurate wave data" by Philippe Baumans, International Association of Classification Societies (IACS), 2020 (page 16 ff).

NCSR 7/INF.12; Preliminary Report of the WMO/IMO International Symposium on Extreme Maritime Weather: "Towards Safety of Life at Sea and a Sustainable Blue Economy", submitted by IMO and WMO Secretariats, International Maritime Organization (IMO), London, 2019, Annex session 13 (Annex, page 9).

G. Hauteclocque, T. Zhu, M. Johnson, H. Austefjord and E. Bitner-Gregersen, "Assessment Of Global Wave Datasets For Long Term Response Of Ships" in OMAE 2020, Assessment of Global Wave Datasets for Long Term Response of Ships | International Conference on Offshore Mechanics and Arctic Engineering | ASME Digital Collection.