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AIR POLLUTION AND ENERGY EFFICIENCY

Progress report of SHOPERA and JASNAOE projects for development of the revised minimum propulsion power Guidelines

Submitted by Denmark, Germany, Japan and Norway

SUMMARY

Executive summary: This document provides information on collaboration between SHOPERA and JASNAOE projects for development of the proposal for revised Guidelines for adoption of MEPC 71

Strategic direction: 7.3

High-level action: 7.3.2

Output: 7.3.2.1

Action to be taken: Paragraph 13

Related documents: MEPC 64/4/42, MEPC 64/23; MEPC 67/4/16, MEPC 67/4/25, MEPC 67/INF.14, MEPC 67/INF.22, MEPC 67/WP.12, MEPC 67/20; MEPC 68/3/7, MEPC 68/3/11, MEPC 68/INF.32; MSC 93/21/5, MSC 93/INF.13; resolutions MEPC.232(65) and MEPC.255(67); MEPC 68/WP.9 and MEPC 68/21

Introduction and background

1 The 2012 *Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.212(63)), represent a major step forward in implementing the regulations on energy efficiency of ships (resolution MEPC.203(62)). However, concerns have been expressed regarding sufficiency of propulsion and steering abilities of ships to maintain their manoeuvrability in adverse conditions if the EEDI requirements are achieved by simple reduction of the installed engine power. This gave reason for additional considerations and studies by IACS, which served as basis for the Interim Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ship in adverse weather conditions (MSC-MEPC.2/Circ.1 (2012), updated in document MEPC 65/4/3, annex 1 (2013) and subsequently adopted by resolution MEPC.232(65) and updated by resolution MEPC.262(68)).

2 To address the challenges of this issue by more in depth research, several research projects started at international level, among them the research project Energy Efficient Safe Ship Operation (SHOPERA, www.shopera.org), funded by the European Commission in the frame of FP7, and the JASNAOE research project, coordinated by the Japan Society of Naval Architects and Ocean Engineers and funded by Class NK, both aiming at submitting their main results for consideration to MEPC 71 (spring of 2017).

3 During a recent joint workshop of these two projects, carried out during the Second SHOPERA Public Workshop in October 2015 in Lisbon, the Steering Committees of SHOPERA and JASNAOE projects have agreed on a collaboration leading to the development of a proposal for the revised Guidelines for Sufficient Manoeuvrability under Adverse Conditions and possible joint submissions to MEPC.

4 The aim of the present submission is to inform all interested stakeholders about the status of these two projects.

Assessment framework

5 The revised Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions ("revised Guidelines" hereinafter) should allow for the application of assessment procedures of different complexity, ranging from simple, albeit conservative, empirical formulae, to advanced numerical and experimental methods, depending on the needs of particular design, such as propulsion and steering characteristics of the ship under assessment. There is a clear need for practical simple checks, which can be used in practice by engineers and Administrations, next to comprehensive assessment procedures and evaluation methods, which can be applied to cases with large uncertainties, such as innovative propulsion and steering design solutions, which should be promoted by EEDI regulations.

6 In particular, it is foreseen to develop a flexible assessment framework as a basis for the proposal for the revised Guidelines, where the designers and Administrations are free to select between three different assessment procedures. It should be noted that lower level assessments require with larger safety margin:

- .1 the most accurate, Comprehensive Assessment procedure, which requires the solution of coupled nonlinear motion equations. In this procedure, required engine power is calculated by numerical simulation validated by tank test. Still, the designer is free to choose the evaluation methods for different forces and moments in these equations: model tests, numerical methods or empirical formulae, depending on particular design needs. This possibility is an important element of the proposal for the revised Guidelines, necessary for ships with innovative propulsion and steering systems;
- .2 a less complex, Simplified Assessment procedure, which still takes into account all physics, relevant for propulsion and steering, but is based on significant simplifications, such as reduced number of assessment cases and reduced complexity of the motion equations. This procedure takes into account some data (i.e. ship's hull shape, windage areas, propeller and engine characteristics, and relevant forces and moments due to waves and wind). This procedure is similar in complexity to the existing Level 2 assessment in the 2013 Interim Guidelines, but does not necessarily require model tests to define wave forces; and

- .3 the simplest assessment procedure, a conservative check of sufficient propulsion and steering abilities, which requires few simple calculations to define the required minimum installed power as a simple function (i.e. deadweight, block coefficient, windage area, rudder area, engine type). Whereas this assessment level is similar in complexity to the existing Level 1 assessment in the 2013 Interim Guidelines, it takes into account not only the installed power, but also propulsion and steering characteristics of the vessels.

Scenarios of adverse conditions and manoeuvrability criteria

7 The revised Guidelines should reflect actual ship operation and be based on realistic scenarios and corresponding environmental conditions. This means that, beyond environmental data and occurrence frequency of severe and extreme events, more relevant are statistics of navigational type of accidents, such as rates and locations of collisions, groundings and contacts for which the weather conditions were noted as significant factors. Based on a related statistical analysis of accident data undertaken in SHOPERA, recorded wave heights and wind speeds are much more moderate than those adopted in the 2013 Interim Guidelines. Therefore, it is a common understanding that an increase of the severity of the weather conditions specified in the 2013 Interim Guidelines is not warranted.

8 Interviews with many ship masters and accident statistics were also used to define realistic scenarios of adverse conditions. Two scenarios are currently considered for the assessment of ship's manoeuvrability in adverse weather conditions:

- .1 safe escape from coastal areas; and
- .2 survival away from coast.

9 Scenario 8.1, safe escape from coastal areas, imposes strong functional requirements on ship manoeuvrability: in principle, any manoeuvre, in seaway from any direction and current, may be required, perhaps in a complex navigational situation. However, the relevant weather conditions will be rather moderate, because in an increasing storm, ship masters timely search for shelter or leave to the open sea. This scenario requires both sufficient propulsion ability, to leave the dangerous coastal area in a sufficiently short time, and sufficient steering ability, including seaway headings not favourable for steering.

10 Scenario 8.2, survival away from coast, imposes less strict requirements to manoeuvrability, albeit in more severe weather conditions. It is disputable whether norming manoeuvrability in most extreme weather away from coastal areas is necessary, as the safety of ships, not able to manoeuvre and drifting away in adverse weather conditions, should be ensured by the weather criterion of the Intact Stability Code. Weather-vaning in bow to bow-quartering waves is investigated as a candidate criterion for the required minimum of manoeuvrability.

11 In addition to the scenario described in paragraphs 9 and 10, SHOPERA considers also other scenarios, for example, low speed manoeuvring in restricted areas during approaching or entering ports. Due to navigational restrictions, ship's speed is limited, which leads to a reduced controllability of the ship in strong winds. This scenario will not lead to any restriction on minimum power, and thus to a possible contradiction to the EEDI requirement, nevertheless, this scenario would eventually lead to additional requirements on the steering devices of ships, thus to a possible enhanced manoeuvrability criteria.

International benchmarking study

12 In order to evaluate the available numerical methods and software tools used in the assessment procedures in the proposal for the revised Guidelines, an international benchmarking study is being carried out by the project SHOPERA. Results of this benchmarking study will be presented and discussed at the 3rd Public SHOPERA workshop in London, on 15 April 2016. So far, more than 30 institutions from about 20 states have registered their participation in the above benchmark study.

Action requested of the Committee

13 The Committee is invited to note the above information on collaboration between SHOPERA and JASNAOE projects for development of the proposal for the revised Guidelines for adoption of MEPC 71.
