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AIR POLLUTION AND ENERGY EFFICIENCY

EU Project "Energy Efficient Safe SHip OPERAtion" (SHOPERA)

Submitted by Germany, Norway and the United Kingdom

SUMMARY

Executive summary: This document provides information on an ongoing international research project related to the *2013 Interim guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions*

Strategic direction: 7.3

High-level action: 7.3.2

Planned output: 7.3.2.1

Action to be taken: Paragraph 10

Related documents: MEPC 64/4/13, MEPC 64/INF.7; MEPC 65/WP.10; resolution MEPC.232(65); MSC-MEPC.2/Circ.11 and MEPC 65/4/3

Background and introduction

1 The Committee, at its sixty-fifth session, adopted *the 2013 Interim guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse weather conditions* (resolution MEPC.232(65)) for bulk carriers and tankers. **In relation to this, a new international research project called "SHOPERA", which is being funded by the European Commission in the frame of the seventh Framework Programme (FP7) was launched in October 2013, aiming at addressing the challenges of this issue by in-depth research studies and upon completion to submit its main results for consideration to the Committee.**

2 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 in implementing the regulations on energy efficiency of ships, (resolution MEPC.203(62)), through the introduction of a series of specifications for calculating the EEDI for various types of ships.

3 There are, however, concerns regarding the sufficiency of propulsion power and steering devices to maintain the manoeuvrability of ships in adverse conditions, hence the safety of ships, if the EEDI requirements are achieved only by simply reducing the installed

engine power. This gave reason for additional considerations and studies by IACS, which were submitted to the Committee, in documents MEPC 64/4/13 and MEPC 64/INF.7, and served as basis for the *Interim guidelines for determining minimum propulsion power to maintain the manoeuvrability of ship in adverse conditions* (MSC-MEPC.2/Circ.11) in 2012, as updated by resolution MEPC.232(65) in 2013.

4 Furthermore, whereas present EEDI regulations aim to increase energy efficiency of ships and reduce GHG impact, they have to be accounted for as a new constraint in ship design and operation. Thus, it is urgent to look holistically into integrated ship design and operational environments and implement multi-objective optimization procedures to optimize ship's powering while ensuring safe ship operation, looking for the right balance between ship's efficiency and economy, safety and reduction of GHG emissions.

5 Based on the above, a strong European RTD consortium was formed, representing the whole spectrum of the European maritime industry, including classification societies (DNV-GL, Lloyds Register and Registro Italiano), universities (National Technical University of Athens, Instituto Superior Tecnico, University Duisburg-Essen, Strathclyde University, Denmark Technical University, Technical University Berlin and Delft University of Technology), research organizations and model basins (MARINTEK, VTT, Flanders Hydraulik Research and CEHIPAR), ship designers and shipyards (Flensburg Schiffbau Gesellschaft, Naval Architecture Progress and Uljanik Shipyard) and ship operators (Danaos Shipping Company, FOINIKAS Shipping Company and Calmac Ferries) under the coordination of the National Technical University of Athens (Ship Design Laboratory).

6 The consortium has proposed to the European Commission a new research project with the acronym SHOPERA. The three-year project SHOPERA (October 2013 to September 2016) was approved for funding in the framework of the fourth call of FP7 and will address the above raised issues by:

- .1 developing and fine-tuning existing high-fidelity hydrodynamic simulation software tools for efficient analysis of the sea-keeping and manoeuvring performance of ships in complex environmental and weather conditions. The efficiency of steering devices and the effect of restricted waterways will be considered. Extensive use will be made of state-of-the-art numerical simulation tools available to the consortium, which will be adapted to the needs of the project and supported by a comprehensive model testing programme;
- .2 performing sea-keeping and manoeuvring model tests in seaways by using a series of prototypes of different ship types to provide the basis for the validation of employed software tools. Full-scale measurements available to the consortium will be exploited for the validation of tools and scalability of model tests;
- .3 integrating validated software tools for the hydrodynamic assessment of ships in adverse weather conditions into a ship design software platform and setting up a multi-objective optimization procedure in which ship's performance is assessed holistically, looking for the sufficient manoeuvrability in adverse weather conditions, including minimum powering and steering efficiency requirements, while keeping the right balance between ship economy, efficiency and safety;
- .4 development of new guidelines for the sufficient manoeuvrability in adverse weather conditions, including minimum propulsion power and steering performance, to ensure safe operation for various types of ships. Preparing and submitting to IMO a summary of results and recommendations for further consideration; and

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- .5 putting together design teams comprising designers, shipyards, owners, classification societies and national administrations to conduct investigations on the impact of the proposed guidelines for sufficient manoeuvrability in adverse weather conditions on the design and operational characteristics of various ship types. To investigate in parallel the impact of EEDI by implementation of the developed integrated holistic optimization procedure in a series of case studies.
- 7 The work is organized into the following work packages:
- .1 WP1: **Environmental conditions and requirements for different ships** provides met-ocean data, defines relevant ship types and sizes, conducts a risk analysis of marine accidents related to manoeuvring in adverse weather conditions and proposes safety criteria to be addressed by the project;
- .2 WP2: **Development and refinement of numerical hydrodynamic tools** performs development and refinement of numerical hydrodynamic tools. It is expected to significantly improve the current state-of-the-art in the scientific field of manoeuvring in adverse weather conditions by improving the capabilities of a series of numerical methods;
- .3 WP3: **Experimental Studies provides experimental data for validation of the tools by performing sea-keeping and manoeuvring model tests** for a series of prototypes of different ship types to provide the required basis for the validation of numerical methods;
- .4 WP4: **Validation, Sensitivity Studies** and Level 1 Methods first, validates numerical tools using model test data. Selected test cases will be used in an open benchmarking to evaluate the available state-of-the-art of numerical methods. Secondly, simple models of propulsion and steering devices and engine will be developed for the implementation in the numerical simulation tools. Further, simplified assessment methods (referred to as Level 1 methods) will be developed to reveal ship designs with sufficient safety margins, which do not require more sophisticated assessment. Finally, intact stability problems will be addressed in a coupled way with manoeuvrability in adverse weather conditions;
- .5 WP5: **Adaptation/Integration of Tools** – Multi-objective Optimization Platform integrates software tools for hydrodynamic assessment of ships in adverse weather conditions into a ship design software platform and sets up multi-objective optimization procedures to assess ship's performance holistically, looking for the manoeuvrability requirements in adverse weather conditions while keeping balance between economy, efficiency and safety;
- .6 WP6: **Application – Case Studies conducts investigations on the impact of the proposed new guidelines on the design and operational characteristics of various ship types**, by implementation of the developed integrated holistic optimization procedure in a series of case studies. This will be achieved by putting together teams that comprise designers, classification societies, yards and universities, while operators and ports will provide expertise and data; and

- .7 WP7: **Dissemination, Exploitation, Submission to IMO disseminates the results of the project to the public**, provides for exploitation of the results through submission to IMO of new guidelines for sufficient manoeuvrability in adverse weather conditions, including minimum power and steering performance requirements, and develops exploitation plan for resulting knowledge, numerical tools, software and design methods. Wide dissemination of the project results will be facilitated through technical publications in international scientific journals and conferences.
- 8 Additionally, **four public workshops will be organized:**
- .1 introduction of the project to key stakeholders (8 October 2014, Hamburg). The aim of this workshop is to communicate the objectives of the project and first results to the wide scientific and technical community and gather feedback from external experts in ship design, hydrodynamics, safety and operation, shipowners, regulators and other stakeholders regarding the objectives and adopted way ahead;
- .2 benchmarking of numerical tools for manoeuvrability simulations in adverse conditions (planned for October 2015, Lisbon). The objective of this workshop is to present the results of validation and benchmarking of the numerical tools and demonstrate the state-of-the-art of numerical tools for manoeuvrability assessment in adverse conditions;
- .3 criteria and standards for sufficient manoeuvrability in adverse conditions (planned for April 2016, London). The developed criteria, standards and guidelines for sufficient manoeuvrability in adverse conditions will be presented and discussed, to ensure feedback from the experts in ship design and operation and regulators and fine-tune the results of the project in accordance with the expectation of the key stakeholders; and
- .4 presentation of the results to key stakeholders (planned for October 2016, Athens). The workshop will provide overall presentation of the project, with emphasis on the set objectives, adopted procedures towards the objectives, major achievements, key results, conclusions and recommendations, in particular, the developed guidelines for the sufficient manoeuvrability in adverse weather conditions of various types of ships prior to their submission to IMO, to ensure wide awareness of the key stakeholders of the proposed guidelines and better acceptance of the project results, and to refine the guidelines and develop strategy for the formal submission to the Organization.
- 9 Further information can be found on the project website under <http://www.shopera.org>.

Action requested of the Committee

- 10 The Committee is invited to note the above information.
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