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DEVELOPMENT OF A SAFETY REGULATORY FRAMEWORK TO SUPPORT THE REDUCTION OF GHG EMISSIONS FROM SHIPS USING NEW TECHNOLOGIES AND ALTERNATIVE FUELS

Information on the European Union's research project Orcelle

Submitted by the European Commission (EC)

SUMMARY

Executive summary:	This document provides information on the European Union's research project Orcelle. The project aims to develop and demonstrate a solution for wind as main propulsion.
Strategic direction, if applicable:	3
Output:	3.8
Action to be taken:	Paragraph 18
Related documents:	None

Background

1 The Organization adopted its first resolution on CO_2 emissions from ships in 1997 and in the following decades adopted related regulations like the Energy Efficiency Design Index (EEDI). Today, additional measures for reducing greenhouse gas (GHG) emissions from ships are discussed, following the adoption of the revised 2023 GHG Strategy aiming for decarbonisation of the shipping sector.

2 A way of reducing CO_2 emissions by shipping is the replacement of conventional fossil fuel by carbon-free energy sources. Wind is such an energy source.

3 Wind sails used to be the primary means of propelling ships until the 19th century, but with the advent of steam and diesel engines, sails came to be used for recreational vessels only. Today, while looking intensively for measures to effectively reduce CO_2 emissions in shipping, more sophisticated technologies like wing sails or flettner rotors provide increased effectiveness and easier integration into current ship designs. Even though the implementation of wind assisted propulsion systems (WAPSs) is steadily increasing in recent time, the uptake in commercial shipping is still limited. Reasons for this include access to capital for the development of wind propulsion technologies, incentives to improve energy efficiency

or reduce CO_2 emissions of ships, and verifiable information on performance, operability, safety, durability, and economic implications of the technology.

4 Currently, both cargo and passenger ships mainly use wind assistance, meaning that wind power replaces a smaller part of the energy requirement of the vessel (1% to 10%). However, there is a tendency for higher energy contributions/savings up to 50% in the future, like the Orcelle project presented in this document.

5 Recent statistics of the WAPS technology implementations (status: 1st half 2023) are shown in figure 1. The tendency of increased implementations is presently steady positive.

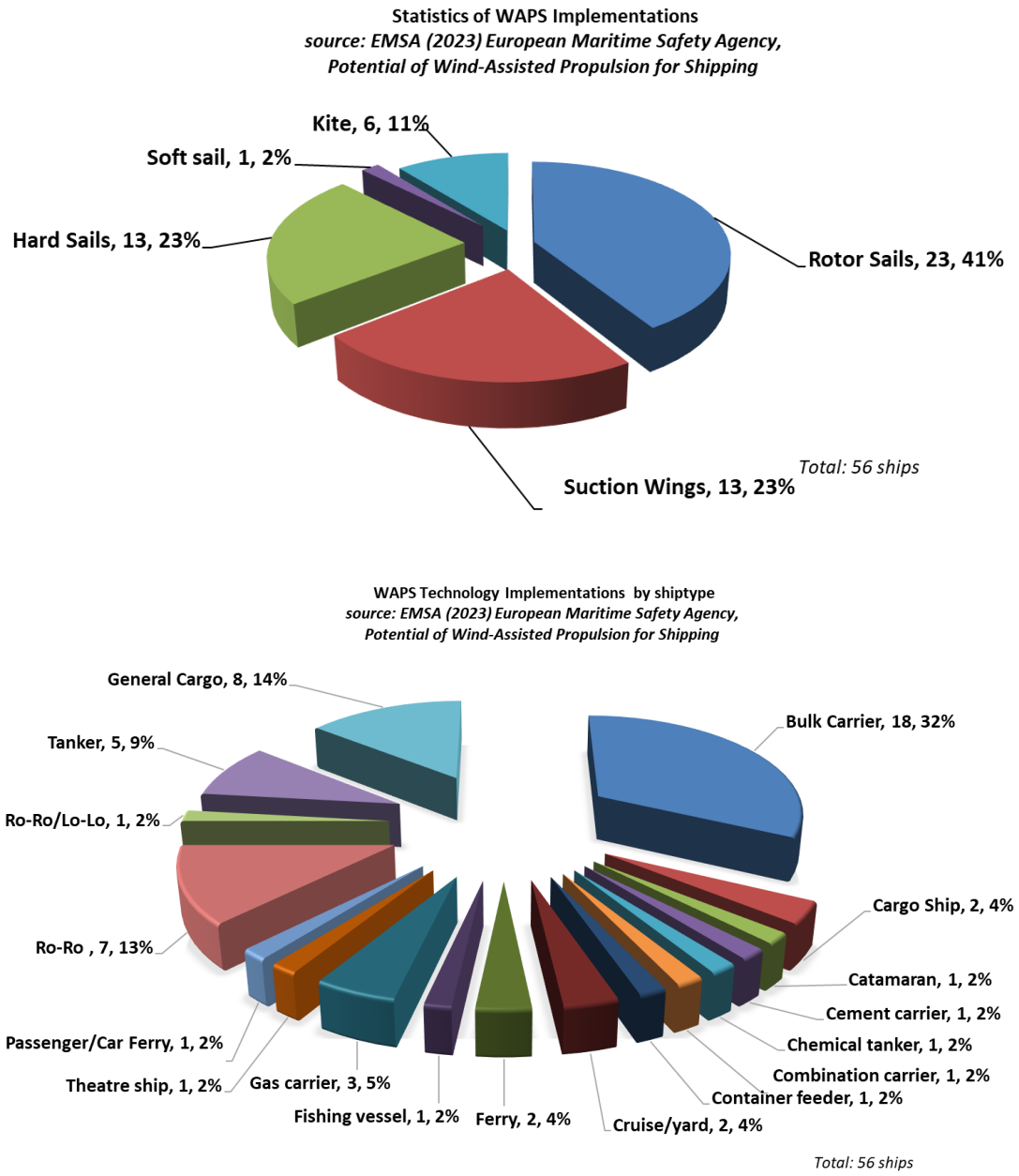

Figure 1: WAPS technology implementations by ship and technology type in terms of installations and relative fraction (Orcelle, 2023).

6 It is expected that wind propulsion systems will challenge the current regulatory framework due to changes in the operational conditions, design loads and ship design, compared to conventional commercial vessels.

7 At present, some classification societies, like Det Norske Veritas (DNV), have rules for wind assisted systems; however, to our knowledge, there is no developed framework for approving ships in large-scale international trade with wind as main propulsion.

8 The European Maritime Safety Agency (EMSA) published a report in 2023[1] on the potential of wind assisted propulsion for shipping, which, among other relevant topics, touched upon the safety and environment regulations (adopted by the MSC, MEPC and others), standards and guidelines that should be considered for WAPSs and potentially amended. The report highlights gaps that must be closed to increase the uptake of the technology.

Orcelle

9 Orcelle (https://orcelle.eu) is a Horizon Europe EU research project lasting five years. Orcelle commenced its work in January 2023, and the consortium is led by Wallenius Wilhelmsen (ship owner and operator) and includes all stakeholders across the value chain: ship designer (Wallenius Marine), wind propulsion system developer (AlfaWall Oceanbird), weather service and route planning provider (StormGeo), cargo owner (Volvo Cars), classification society (DNV), research institute (RISE), academia (National Technical University of Athens, Ghent University, KTH Royal Institute of Technology) and maritime commercial hub (Maritime CleanTech).

10 To enhance the uptake of wind propulsion systems as a measure to decarbonize shipping, the EU project Orcelle seeks to develop and demonstrate a show case for wind as main ship propulsion. By wind as main ship propulsion, it is meant that 50% or more of average propulsion energy in full year operation is provided by wind, compared to a fully fossil fuelled vessel. Under ideal sailing conditions, the wind power gains may be close to 100%, and engines are only used in situations with insufficient wind resources, confined waters, for manoeuvring and, where necessary, for the safety of the ship.

11 With the target of annual CO_2 emission reduction >50%, Orcelle will go far beyond any other built deep-sea cargo transport ship (wind main propulsion) used today or currently under development.

12 Orcelle seeks to enhance the safety standards for wind propulsion technology by a series of large-scale demonstrators with integrated condition monitoring, thereby increasing adoption potential by risk reduction. Operational data will feed back to technology and safety standards development, giving valuable input to assessments of actual safety levels.

13 Several project results are relevant to update IMO regulations. The identification of requirements for crew training for wind propelled ships and suitable training programmes will be covered. Additionally, the project investigates the Organization's regulatory framework for vessels with wind as main propulsion, through a gap analysis, to identify areas where new/amended IMO regulations are needed, in particular:

.1 the operation in adverse weather conditions, considering extreme wind loads and including measures to handle such winds through prediction systems and operational procedures to lower the sails; and

[1] Publications – Potential of wind-assisted propulsion for shipping – EMSA – European Maritime Safety Agency (europa.eu)

.2 ship manoeuvrability to navigate safely in adverse weather conditions in relation to latest minimum powering IMO requirements. It is expected that the wind propulsion technology may affect, inter alia, requirements such as the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) and the International Convention for the Safety of Life at Sea (SOLAS).

14 The project will demonstrate the feasibility through two demonstrators, a retrofit and a newbuilding. These are Ro-Ro (pure car, truck carrier (PCTC)) vessels that will operate in a trans-Atlantic route, equipped with an extensive set of sensor systems to function as research vessels. The demonstrators are:

.1 one retrofitted ship (the PCTC carrier **Tirranna** of Wallenius Wilhelmsen) with one wing and expected savings of 5% to 10%, i.e. similar to existing wind assisted vessels today (expected to go into operation by the end of 2024); and

.2 one newbuild ship, **Orcelle Wind**, which is expected to reach >50% CO_2 savings in commercial operations. The vessel measures 217 metres in length, 39.4 metres in beam and has the capacity to load approximately 7,500 cars or equivalent cargo (expected to be delivered by the end of 2027).

15 The wind contribution target to total propulsion set out by Orcelle requires a combination of research and innovation challenges to be solved, such as:

.1 more efficient wing systems for main propulsion, and safe automated ways to operate them;

.2 improved simulation platforms covering wind propulsion and operation, that allow combining advances in modelling and data capture to safely design and operate new vessels in different segments;

.3 new ship design and design processes that handle the complexity of new wind systems.

.4 new weather routing systems, that handle the added complexity of new wind systems; and

.5 new logistics solutions, that allow for some reduction of speed and some more limitation on the cargo the ship carries that requires additional planning solutions.

16 Orcelle has planned and has already partly organized a series of dissemination events, among them webinars, publications and presentations at international conference and market fora, with the next major dissemination events planned during the Transport Research Arena in Dublin (April 2024), the International Marine Design Conference (IMDC) in Amsterdam (June 2024) and the Shipbuilding, Machinery and Marine Technology trade fair (SMM) 2024 Maritime Exhibition in Hamburg (September 2024). Details of dissemination activities for 2024 and the following years to be announced via the project's website (https://orcelle.eu).

17 In summary, the main objectives of Orcelle are to:

.1 provide an industry simulation platform with significantly improved prediction accuracy of wind power potential, using the Orcelle demonstrators as a benchmark;

.2 provide to the industry a simulation platform and digital tool kit for system design and operation to support retrofit and newbuilt ship wind system projects;

.3 demonstrate the feasibility of a self-adaptive wing design capable of supplying at least 50% of required propulsion energy for full year operations and more at lower speeds;

.4 propose the necessary new safety standards and draft regulations for wind (main propulsion), allowing building of physical demonstrators;

.5 develop and implement logistics systems and business models allowing for two to five days longer trans-Atlantic crossing time to enable an optimal use of wind propulsion;

.6 demonstrate safe operation of a wind powered ship;

.7 demonstrate the feasibility of the Orcelle Wind concept by the building and safe operation of a large PCTC carrier implementing the Oceanbird wing system;

.8 add credibility to modelling of the wind propulsion simulation framework by feedback of demonstrator data and hence increasing the accuracy of predictions; and

.9 demonstrate the technical feasibility and viability of the business model and wind power potential for a wide range of deep-sea tonnage, beyond PCTC carriers (tankers, bulk carriers, containerships, RoPax), reflecting 80% of the world fleet.

Action requested of the Committee

18 The Committee is invited to note the information provided.