WIND ASSIST - THE SEARCH FOR MASS MARKET SOLUTIONS

Dasivedo Design Ltd (www.dasivedo.com) seeks research funding for a comparison of the various methods of retrofit mounting of wind assist (WA) devices to existing vessels. The research objective is determining which of these mountings best lend themselves to mass market application.

The shipping industry is facing the challenge of the climate crisis and decarbonisation. No single technology will replace hydrocarbons. There will be a basket of technologies on board each vessel with an internal energy market. Shipping is uniquely placed to benefit from wind power which is delivered free at the point of use with the cost of harvesting residing in the WA device. WA will be in the basket of technologies for nearly every vessel for the rest of time. The shipping industry is beginning to see WA as the lowest business cost alternative power source.

New build ships will not deliver fleet decarbonisation targets in time. Retrofitting wind assist (WA) to the existing fleet of just over 50,000 vessels will be critical. We are facing challenges of time and scale. The principal benefits of modular standardisation are speed and mass application.

As our industry and transport systems became carbonised Brunel foresaw the limitations of the standard gauge rail road lines at 4' 8.5" (1.44m) and his objections were valid. However this gauge – based on Roman war chariot's accommodation of the rear ends of 2 horses - was adopted as standard. Designers have always had to get creative around this standard. It has driven design work in rail but also in other technology up to and including parts of the Space Shuttle.

This proposed WA mounting research seeks to lay the ground work for this standardisation by identifying which mounting method or methods have the required flexibility, simplicity and ease of production, installation and operation to be developed with that modular goal in mind.

Standardised mountings will facilitate the creation of simple, globally extensive supply chains. It will also make WA very easy for crews. Crews from across the world will only need to learn a small set of operational and port procedures. This cultural knowledge will again be future proof.

As a proprietary designer Dasivedo simply seeks to initiate this critical research. We are not aware of this being considered by anyone else. The WA sector has to get the right design/designs to deliver modular standardisation to a shipping industry needing a simple solution or solutions. This will be a huge part of facilitating WA uptake by the industry. This critically important phase in the development of WA must be handled properly.

To ensure this Dasivedo proposes that a panel of assessors is established to monitor, manage and eventually judge and promote the mounting methods selected. This body must be selected from a representative range of existing and future stakeholders within the industry. This group will include all existing designers of WA and mountings. Their input will of course be their specific mountings but must include an effort to assist the researchers in adapting/changing their designs to serve the greater purpose. This will involve compromise. They will have to consider sub optimal mountings/spacings for their proprietary designs in favour of a best average fit for WA as a whole.

The other key members of the group must be shipping companies, charterers, shippers, retailers, international bodies like IMO and government. This looks like a recipe for delay and obfuscation and there is simply no point approaching any companies or institutions that are not already seriously and fully committed to WA. With research funding promised and guidance from the panel Dasivedo will assemble the research team.

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Standardized Universal Wind Propulsor Mount for Ships — Proposed Research

This proposal envisions an openly standardized, plug-and-sail, physical mounting system on the deck of ships available in various nominal sizes that constitutes a mechanical, energetic and data link between the ship and any wind propulsion device of choice that conforms to its specifications. Its objective is to lower some of the currently existing barriers to adoption of wind propulsion on merchant ships, primarily of the retrofit market, by **making the fitting of wind propulsion modular**.

Without a standard, any mounting arrangement is a customized solution and inherently inflexible

A ship fitted with one or more of such mounts would be able to accommodate any type of wind propulsor conforming to the standard. Slots for control units would be present on the navigating bridge or other control stations as appropriate and would have all the cabling with standardized interfaces already installed. Any nominal mount size would have defined a set of maximum forces and moments transmitted to the hull structure. The wind propulsor providers would need to prove that the device cannot exceed these limits under any circumstance. Under unforeseen extreme conditions, it would have to break off to protect the ship from capsizing or being seriously damaged. The vessel's stability calculations would be based on the maximum forces permitted at the mounts, therefore decoupling stability from any particular type of wind propulsor. The propulsors would be part of the ship's deadweight and thus avoid lightweight and tonnage surveys. The physical separation would also mean separation of property, warranty, maintenance etc. if needed. Provisions could also be made to include hydrodynamic devices under water for generating lateral forces, if needed. Please note that this is a conceptual depiction only without all the details worked out.

Flexibility of wind propulsor choice without modifications to the ship

Stakeholder benefits:

Wind Propulsion Providers Supporting maker diversity by avoiding vendor lock-in. Lowering adoption barriers by avoiding the need for customized, individual mount constructions on ships. This would also reduce design costs of the propulsors and letting designers focus on what they do best. Standardized forces measurement can enable pay-as-you-sail business models. Enabling rental models thanks to separation of ownership. This could potentially also make it possible to reclaim wind propulsors in case the vessel gets arrested.

Shipowners Minimized additional investment to enable adoption of wind propulsion. Stability calculations would ideally become independent of wind propulsors used.

Charterers Free choice of wind propulsors to save fuel and reduce emissions without the need to make modifications to the ship. Possibility of wind propulsor rental and ability to use those best suited for the route with short installation time. Avoiding vendor-lock-in.

Marine Industry Quicker and simpler access to solutions to reduce emissions. Wind propulsor market growth and diversification as opposed to monopolization.

The proposed research should be carried out on existing wind propulsion solutions and establishment of a potential user base with anticipation of future needs, feasibility, safety, legal implications e.g. EEDI/EEXI, definition of the nominal sizes, development of requirements and ultimately the details of implementation leading to the draft standard. There are many challenges, to be addressed with a multiple stakeholder approach.

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WHAT THIS RESEARCH STANDS FOR

This work aims to propose the construction of a simulation software tool using data science, that will gather data to be included in a worldwide database available for those interested in developing and adopting WASP technology, collaborating with the global effort to achieve the required milestones created by IMO in the reduction of greenhouse gases from the world ship fleet.

METHODOLOGY

The methodology selected will follow the accomplishment of the steps listed below:

- Demonstration of how the sailing apparel available today will make the shipping industry more efficient when adapted to the existing fleet or adopted in new builds, through the assessment of key factors such as CAPEX, OPEX and VOYEX of the study cases analysed.
- Build the correlation among ship models with different propulsion systems aboard, as well as different performance variables, such as hull coating, layouts and even purposes, in hypothetical future sailing vessels, applying both the EEXI and the EEDI and using the CII index.

EXPECTED RESULTS

It is expected that the data collected will help evaluate the cost-efficiency of the conversion or building of sailing ships or WASP vessels in routes (regarding size, age type and other parameters), when in comparison to the conventional slow steaming technique of mitigation of emissions of greenhouse effect gases. It is expected that this tool eventually helps to assess ship efficiency parameters, especially under sai, and contributes to the diminishing of the use of fossil fuels in the world trade picture.

A side effect of this research project is that it allows ship owners to better evaluate WASP technology options to be fitted in their ships, contributing to speed up the technology.

BASIC INFORMATION

Research project title	Wind Propulsion Systems for Commercial Ships – Modelling, Design and Cost Optimization
Company	The North Technology Group
PhD Candidate	Martina Reche Vilanova <mrevi@dtu.dk>
Supervisor	Dale Morris <dale.morris@southernspars.com>

BACKGROUND AND PROJECT DESCRIPTION

Driven by the International Maritime Organization's (IMO) strategic targets on greenhouse gases (GHG), and corresponding efficiency incentives (e.g. EEDI, and EEXI), more and more ship owners and operators are becoming interested in the potential of wind propulsion systems (WPS) as a green propulsion alternative, evident by the increasing number of WPS projects. Hence, the commercial WPS market has been identified as a key area of business development for the entire North Technology Group (NTG). Although the NTG is a newcomer to the commercial sector, and competing against strong players already established on the scene, their experience from the conventional sailing industry can offer unique technology and know-how to the WPS market. This includes aerodynamic analysis, design, structural consultation and manufacture, but it is necessary to develop the available tools further and adapt them to the commercial shipping market in order to offer a viable product. Therefore, NTG is ready to embark on a PhD research project that bundles existing know-how, make it viable for the shipping market, and engages with customers early in the design process.

Navigating the actual market for WPS can be daunting and puzzling, as all vendors compete by arguing for the merits of their individual technology without objective scrutiny. Since each technology can be superior for a specific set of route, ship, and operational constraints, it is currently very difficult or even impossible to pick a general winner. Thus, in order to utilize the wind's potential to a maximum, to speed up the green transition (reducing pollutant emissions), and to lower the economic burden on operator expenses, while respecting operational constraints, this research project aims to develop a cost-benefit analysis tool. For a given ship and route, the tool will identify Pareto optima in the WPS design space in order to minimize pollutant emissions and total costs (including potential marked-based measures). The goal is to determine which WPS class, configuration, and arrangement is the optimized technology to achieve the most emission reduction while being the most attractive for the business. The structure of the cost-benefit analysis model to be developed in this research project is depicted in Figure 1. It must be noted that the tool will include multiple WPS classes as well as multiple internal loops to optimize the performance and cost of each design, but that each part is only represented once in Figure 1 for readability.

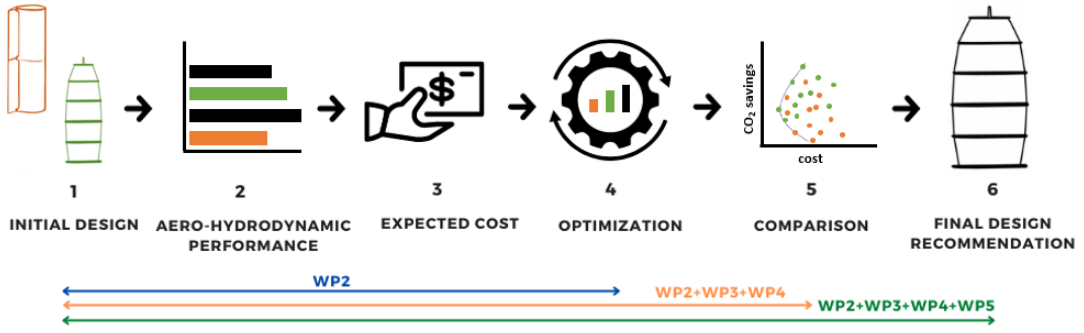

Figure 1: Representation of the cost-benefit analysis tool and how it relates to the work packages (WP)

Beyond strengthening NTG's commercial position in this field, this PhD research project will improve the WPS technology by highlighting the strengths and weaknesses of each solution objectively. Thus, it will facilitate a faster, deeper and ultimately cheaper transition to a fully decarbonized fleet.