Membership case study:
Rio Tinto

Wind Assisted Propulsion on large bulk carriers

Evaluating the use of rotating masts and wind to create forward thrust vectors which facilitate the reduction of main engine power (and fuel consumption) while maintaining required service speed.

CONTEXT & OBJECTIVES:

The goal of this study has been to identify and evaluate technologies which have the potential to deliver significant (+10%) fuel and emissions saving on large bulk carriers. The use of wind as a 'free' resource to provide motive power has largely remained with small vessels and leisure craft, but is there ready to be used if the technology can harness it effectively. The initial objective was to have a trial of the rotor technology installed and testing, but the complexity has stretched the programme out.

SOLUTION

The concept of rotating cylinders delivering useful thrust to a vehicle is well researched and is known as the Magnus effect after the German physicist who described it in 1852. In shipping terms it is perhaps best known as Flettner rotors. Anton Flettner fitted them to a trial vessel, the Buckau, in 1924 and demonstrated that the vessel could sail at speeds of up to 9 knots or so in winds of 15 knots without the use of any other propulsion.

The basic theory supposes that by rotating a vertically mounted cylinder while an airflow (wind) is passing over it, low and high pressure zones will be created on opposite sides of the cylinder. These pressure zones create a force on the cylinder perpendicular to the wind, that is transferred to the ship as thrust. The maximum thrust is generated when the wind is approximately on the beam of the ship, but useful vectors of thrust are generated with the wind more than 20 degrees from the bow or stern. Analysis of typical routes sailed by our vessels and their performance characteristics has been made and indicates savings of greater than 10% may be possible depending on route and navigational constraints.

While the theory looks promising, the physical installation of rotors is highly problematic on modern commercial ships. They are wide, tall masts that obstruct the working area of the ship making them difficult to accommodate. Past trials have seen fixed rotors (which are awkward for navigation, cargo work and bad weather) and lowerable rotors (which require deck space, lifting arrangements and have handling risks).

However the project has been looking at the Magnuss VOSS™ highly automated system which would be integral to the ship and structure and would allow the rotors to be retracted out of the way when required for navigation, cargo work or very bad weather. This would remove many of the concerns. The degree of integration does mean that significant structural changes to the ship would be required with the associated time in dry dock for the necessary steel work.

The project so far has engaged us as owners, Magnuss as system designers and technology providers, Namura as the ship designers/builders, Lloyds Register as the classification society and the MCA as flag state authority. It is presently looking further at the technical considerations, installation and operational risks and subject to a satisfactory outcome will progress to a detailed costing of the system and installation. This will be evaluated together with the anticipated operational savings and a go/no-go decision can be made.

OUTCOMES

This project is still ongoing. At this time, while a potential trial vessel has been identified, there is a significant amount of technical, engineering and risk review work to be done to confirm that the system can be installed and operate properly in the wide range of adverse conditions that exist on ships at sea. The benefits of this technology and the Magnuss VOSS™ system will not be quantified until a trial is completed.

What are the first steps people can take to replicate this idea/initiative?

1. Research Flettner rotor technology

2. Assess trade routes for wind patterns

3. Review ship types for suitability

More information:

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Magnus effect
Rotor Ship

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