We enable shipowners to reduce fleet fuel cost by up to 20%, with solutions that combine our patented Air Lubrication technology, insight and artificial intelligence, to continuously reduce fuel consumption, lower emissions, and control fouling

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Introduction

Marine Performance Systems B.V. is a Danish-Dutch marine engineering & technology company, based in the Port of Rotterdam. We have developed a novel approach to air lubrication by using oscillators. These oscillators are so-called 'fluidic' devices that use fluids to perform analog or digital operations similar to those performed by electronics. NASA used fluidic systems in the early days of space travel, because they were extremely reliable, having no moving parts.

We took the technology further and developed oscillators that produce (micro) air bubbles that can be injected into the boundary layer of ships to reduce friction or 'drag'. With this innovative approach to Air Lubrication, viscous drag can be reduced by up to 60%, resulting in up to 20% lower fuel consumption and emissions.

2nd generation air lubrication technology, generating 80 million micro bubbles per second

By controlling the oscillation frequency, we can change the size of the bubbles to match the ship. The current designs have a preset frequency of ~ 300 Hz, producing some 30,000 (micro) bubbles per second per oscillator or about 80 million bubbles per second for a larger tanker. The MPS Air Lubrication technology using oscillators is protected with 13 global patents while 4 new patents are pending.

Savings

The system is mounted under the Flat of Bottom area of the ship. Potential savings of the system mainly depend on the FoB area available for installation and the draft of the vessel.

We define the efficiency ratio (reff) as the ratio between FoB area / Total Wetted Area of the vessel, typically 0.5–0.6. The reff and thus the savings increase with:

- A large FoB area: ships with a high 'block coefficient', like tankers, bulk carriers and container ships.
- A relatively small operational draft: ferries, some tankers, ships sailing empty for extended periods of time, etc.

We make a distinction between gross and net savings. Gross savings are the overall savings that will reduce the torque required to propel the vessel. The net savings are the overall savings in fuel consumption and will typically include the power to compress the air and any additional friction by the bands. The net increase in draft is negligible (1-2 mm) and therefore not accounted for in these calculations.

Net savings can be improved by, for example, using waste heat for compressed air generation (5-6%) or integrating the bands during new build (~ 1%).

Gross savings are typically in the range of 12-19% with net savings of 14% depending on type of vessel, operational draft, amount of bottom covered and sailing speed1.

The monetary savings depend on installation cost, type of ship and cost of fuel and operational profile. MPS provides ship-owners with a technical/ economic model to calculate the savings that can be

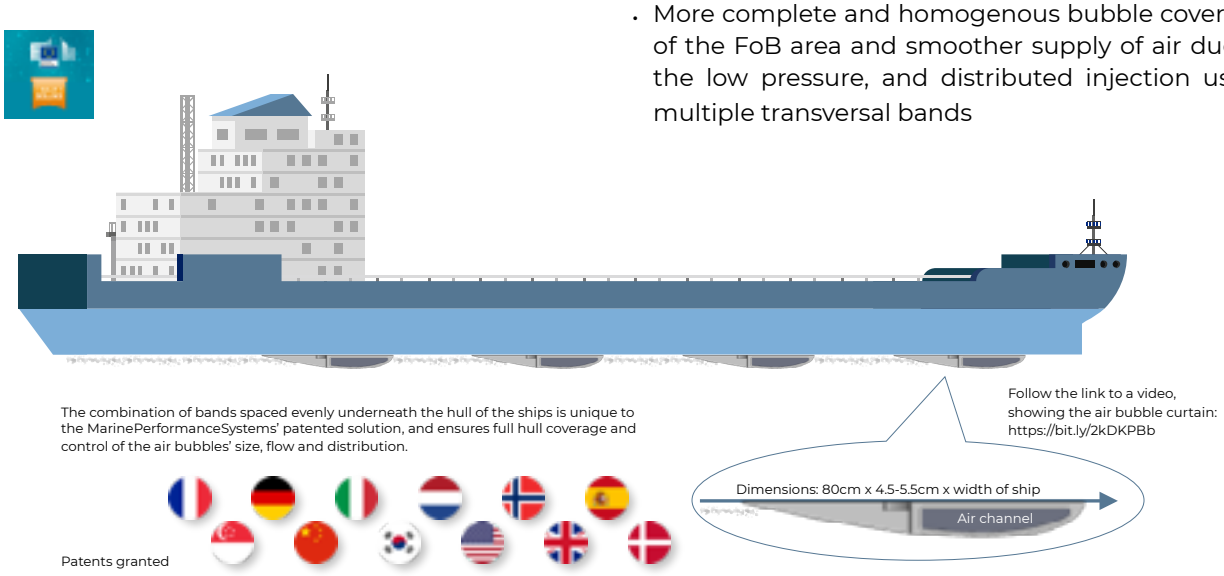
achieved for specific ship types and operational profiles.

Integration

The oscillators are mounted in low profile 'bands' that transversally span the width of a vessel to inject air directly in the viscous (sub)layer under the flat of bottom part of the hull.

The spacing between bands is approx. 25-45 meters depending on the ship's speed, draft and the required volumetric flow of air through the oscillators and distribution between bands.

The bands are connected through an adapter piece to air piping, which in turn is connected to a blower or centrifugal compressor to supply pressurised air to the system.



The system works at low pressures, typically between 1.5 - 3.5 bars, mainly depending on draft and internal pressure losses.

For smaller vessels < 40,000 DWT and up to 25 m width, the system uses a single small hull penetration per band. Larger vessels will require two penetrations per band (PS & SB).

The system does not require any additional Class Approvals, as it uses common marine components like low pressure piping, Class Approved PN 10 overboard valves and marine rated compressors. The hull penetrations are small and do not require to be structurally compensated to allow for reduction in section modulus of the ship's hull.

Advantages over competing systems

The combination of oscillators mounted in multiple bands offers the following advantages over competing systems:

- The system offers stable performance with ship movements and varying sea states. It is dynamically stable because the oscillators are relatively insensitive to backpressure
- More complete and homogenous bubble coverage of the FoB area and smoother supply of air due to the low pressure, and distributed injection using multiple transversal bands
- Maintenance of lubrication efficiency with repeated make-up of air losses over the full length of the ship using multiple bands
- Better control of bubble sizes: oscillators are designed to be frequency controlled and provide optimal drag reduction tailored to the type of ship
- Robust, intuitive control: only required to optimise the flow for the ship's sailing conditions, not to stabilise the system

- Constant performance over a range of ship speeds
- Diver replaceable oscillators for easy maintenance as well as to allow the system to be upgraded over time

Because of the advantages mentioned, we estimate that the MPS system will perform 30-50% better than currently available Air Lubrication systems or technologies. Depending on the ship's parameters and operational profile, a pay-back time of 2-3 years is predicted.

Installation

All installations of the MPS system are turn-key and include:

- Class Approved Integration Package
- Specifications for shipyard scope of work (also to be used for the shipowner in the tendering process with yards)
- Supervision
- (Pre)commissioning
- As-built package (supervision/commissioning by MPS)
- Piping and system installation normally done by the selected shipyard and supervised by shipowner or MPS.

Scope of supply by MPS:

- Bands with oscillators and adapters
- Compressor(s)
- Control system
- Efficiency monitoring (integration with owner's systems)

Lead time

The MPS system is fabrication ready and delivery time of a complete system is currently 20-26 weeks, which includes the detailed integration engineering package and Class Approval.

Conceptual integration engineering packages are available for:

- 40,000 DWT Handy Bulker
- RoRo ferry
- 105,000 DWT Aframax Tanker
- 175,000 DWT Capesize Bulker
- 4000 DWT coaster (new-build integration)

Data gathering and support

The air supply to each band is monitored and controlled, as well as the main parameters of the ship (torque/revs of tail-shaft, speed, fuel consump–tion, ship attitude, sea state etc.).

For first installations an MPS control engineer will sail with the ship to optimise the system settings to yield the most economic set-up, using minimum air whilst achieving maximum efficiency. The unique MPS design makes this possible.

NOTE: The figures presented assume that the percentage drag reduction (%DR) is 40%. This means that the frictional resistance has been reduced by 40% over the area covered by air bubbles.

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SEAL OF EXCELLENCE

European Commission

Certificate delivered by the European Commission, as the institution managing Horizon 2020, the EU Framework Programme for Research and Innovation 2014-2020

The project proposal **946610, Marine Bubbles**

Making ships glide on air bubbles to reduce fuel consumption

Submitted under the Horizon 2020's **SME Instrument (grant only and blended finance)** call **H2020-EIC-SMEInst-2018-2020 (H2020-EIC-SMEInst-2018-2020-3)** of **9 October 2019** in the area of **EIC-SMEInst-2018-2020**

SME instrument
by
Marine Performance Systems B.V.
Galileïstraat 15
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Netherlands

following evaluation by an international panel of independent experts

WAS SCORED AS A HIGH-QUALITY PROJECT PROPOSAL IN A HIGHLY COMPETITIVE EVALUATION PROCESS*

This proposal is recommended for funding by other sources since Horizon 2020 resources available for this specific Call were already allocated following a competitive ranking.

* This means passing all stringent Horizon 2020 assessment thresholds for the 3 award criteria (excellence, impact, quality and efficiency of implementation) required to receive funding from the EU budget Horizon 2020.

Corina Cretu,
Commissioner for
Regional Policy

Carlos Moedas
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