This is one of a series of Energy Saving Technologies (EST) factsheets that provide a brief description of emerging technologies which are available to ship owners and other stakeholders who are aiming to reduce fuel consumption and/or Greenhouse Gas (GHG) emissions.

**HISTORY**

Post World War II, warships began to experiment with a system called Prairie-Masker. Expelling bubbles through the hull and propeller in order to mask the acoustic signature as a defence from submarines, it was found that these bubbles also reduced hull friction under certain conditions.

Since the 1980s, studies on the effectiveness of using microbubbles as a drag reduction method have gathered momentum, with positive results. These air bubble technologies have been extensively model tested by numerous researchers in Japan, the Netherlands, the USA and Sweden to assess energy saving benefits.

Over the last 30 years a range of studies have investigated the various interactions in relation to hullform, ship speed, bubble size, propeller performance and energy requirements when generating microbubbles.

Since the early 2000s the technology maturity has increased further, to the point where products are in service and available for adoption today.

**HOW DO THEY WORK?**

Microbubbles reduce the skin friction component of the hull resistance by injecting small bubbles into the boundary layer around the ship’s hull. When coupled with an appropriate hull design to ensure the air bubbles remain at the boundary layer, this reduction in friction translates into fuel savings.

The pressurised air required is generated by compressors, powered from the vessel, which is then piped to the outlets.

The injected air naturally spreads out into a v-shape. Air injection outlets are positioned to ensure the necessary air bubble coverage. Design of the air injection system takes into account the vessel service speed, hull design and underwater features.
SELECTING THIS TECHNOLOGY

Careful consideration has to be given to the suitability of the hull design and selection of the optimum locations for injecting air apertures, whilst understanding the typical vessel operating speed, draft and sea states.

Systems can be retrofitted, though the greatest benefits are attainable with a matched hull design at new build.

KEY INTEGRATION FACTORS

- Suitability of the hullform. Flat bottoms have the potential to deliver increased benefits.
- Whilst relatively simple & compact the apertures, compressors, power & controls need integration into the vessel design.
- Retrofitting must be performed in drydock.
- Speed of the vessel is a key consideration to gaining optimum efficiencies. At higher speeds wave friction starts to dominate skin friction & microbubbles can start to separate from the hull boundary layer, reducing efficiency.
- Selection of appropriate hull coatings can help to maintain the microbubbles at the ship's surface.
- Can be integrated with most other EST.
- The additional power required for operating compressors may be offset by other green power generation technology.

TYPICAL APPLICATIONS

- Flat-bottomed vessels operating at consistent slower speeds, generally those with a higher block coefficient, i.e. most tankers & bulkers are well suited to this technology.
- Cruise ships & ferries with the required hullform stand to benefit as well when coupled with careful consideration of the ship’s operational profile.

BENEFITS SUMMARY

- Fuel savings & greenhouse gas emission reductions.
- Microbubbles reduce the frictional resistance of the hull.
- System suppliers report the reduced presence of bio-fouling.
- Microbubbles could reduce the impact of underwater ship noise on marine mammals.

SFC V ENGINE LOAD PLOTS
Selecting the right EST for the trades a vessel will undertake is critical to the investment decision. iTEM, at the heart of the VTAS independent assessment process, will consider the technical features of the vessels, the voyage profile all in combination with candidate EST. This is integrated with the risk and financial evaluation using your parameters or those investors are likely to recognise. Collectively this provides an informed view of how selecting appropriate EST contributes to reducing fuel consumption, lowering your operating costs and reducing your greenhouse gas emissions.

To embed this core offering VTAS is able to support you with independent consulting, analysis, feasibility and design integration advice, vessel performance and whole life cost evaluation.

Further information can be found by visiting www.VTAS-fes.com or contacting us via info@VTAS-fes.com