Air lubrication

UP TO 15% FUEL SAVINGS

The frictional resistance of the hull can be quite significantly reduced by the introduction of a thin layer of air pumped between hull and water. There are two main variants of this idea.

Air Cavity System

Developed by the pioneers of air lubrication for the marine market, DK Group, the technology was originally applied to custom newbuilds, where a cavity is designed along the length of the hull into which compressed air is pumped. A retrofit version has recently become available.

Micro-Bubbles

In this variant, a stream of bubbles (rather than a single air cushion) is injected below the hull.

While there has been significant progress around the technology in recent years, challenges remain, in particular how to ensure the air remains under the hull when the ship is rolling or pitching.
Note: *that the SMOOTH research project focussed on inland and coastal waters, perhaps for this reason (see Box 2 on Page 27).*

Energy is also required to power the air pumps, which will offset the energy savings to some extent. IMarEST (2010) estimate this additional energy requirement to be in the order of 0.3–0.5 tonnes of fuel per day, but other academic studies have put the energy penalty much higher – in one study of a microbubble system it reduced the savings from lower friction by 42%.

IMarEST (2010) also put the cost of including an air lubrication system at an extra 2–3% of the price of a newbuild ship, although DK Group put the figure at 1%.

Abatement potential Tanker: ~15 %, Container: ~7.5 %, PCTC: ~8.5 %, Ferry: ~3.5% (Wärtsilä 2008)

Ship types Largest saving when fitted to low Froude number ships for which frictional resistance dominates – e.g.: tankers and bulkers, but can also be fitted to RoRo and container ships.

Provider	Product	Savings	Verification	Maturity
DK Group	Air Cavity System	10–15% (tanker/bulker); 5–9% (container)	GL certified small bulk carrier tests in 2009 from company projected savings on a 90m vessel to larger vessel	Full-scale seatrials in 2008, technology commercially available
Mitsubishi Heavy Industries/NYK	Microbubbles	<10%	n/a	Trials announced Feb 2010
Stena Bulk	Airmax air cushion system	20–30%	Expectation based on small scale tests	Proceeding to larger scale tests

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MARIN

DK Group

DK Group has patented its Air Cavity System technology, which integrates the cavity into the flat bottom of the midship and bow section of the vessel and is designed both to minimize the hull/water contact area and minimize air consumption. The cavity is monitored for air volume and pressure and the injection system automatically adjusted to maintain the optimal air level in the air cavity.

DK Group states that it takes only about 0.5–1% of the overall propulsion power to keep the air compression going.

Fitting time 14 days for retrofit option

Claimed saving >15% in tankers and bulk carriers
7–9% in LNG tanker
7.5% in container

ROI
Depending on vessel type and fuel price, ROI is stated to be from 1.3–1.9 years.

Verification
Force Institute and Germanischer Lloyd oversaw the sea-trials.

www.dkgroup.eu

Fathom comment:
The Air Cavity System is a promising technology and despite the range of claims for its fuel saving potential it deserves the attention and further research it is receiving. The sea trials that took place (in 2008 were on a relatively small ship an 81-metre, 3,000 DWT minibulker), so savings claims on large vessels still need to be verified.

Mitsubishi Heavy Industries (MHI)

MHI is testing a micro-bubble air lubrication system on two module carrier vessels operated by NYK subsidiary NYK Hinode. The installation of the systems was expected to be complete by the end of 2010.

Claimed saving approximately 10%

www.mhi.co.jp

Fathom comment:
Clearly, the figure will be subject to verification and possibly modification pending the results of the trial. Watch this space.

Stena Bulk

In March 2010 Stena Bulk Launched the Airmax, a 15-metre, 25-tonne, 1:12 scale model of an air cushion ship. The project is the fruit of a collaboration with SSPA and Chalmers University of Technology, and is the logical next step for Stena after very promising test results on a more conventional 4-metre model in towing tanks. The ship underwent testing throughout the rest of 2010 and results are yet to be made publicly available.

Claimed saving 20–30%

www.stenabulk.com

Fathom comment:
The figure of 20–30% is taken from publicity material at the time of the launch and is based on the earlier small-scale tests. Results from the second round of testing are therefore eagerly awaited. The proliferation of interest in air cavity systems is a promising development, as competition to supply them to the shipping industry can only spur innovation and reduce costs. We applaud Stena for investing a reported 50million SEK (around US $7million) in this project.

Box 2

Air lubrication research

The EU-funded SMOOTH project

The SMOOTH project ran from 2006–2009 and aimed to apply air lubrication to ships and to provide the necessary new products in terms of control and paint systems to introduce air-lubricated ships (both air-cavity and micro-bubble). The focus was on inland and coastal ships, and participants estimate that fuel savings of around 20% will eventually be available from the technology.

The resulting verifiable and measurable objectives were:

1. To provide validated (finally tested on model scale) computational tools for a real ship design.
2. To validate scale effects of air lubrication.
3. To evaluate the economy of air lubrication in practice and demonstrate the concept at full size on an inland vessel.
4. To prepare the safe introduction of air-lubricated ships in practice.

Results of sea-keeping and manouevring tests carried out by MARIN show that air lubrication has minimal effect on manoeuvring and no noticeable effect on seakeeping behaviour. Other results are awaited.