

Could windpower drive the vessels of the future?

The quest for alternative fuels and innovative sources of energy continues unabated, with Lloyd's Register playing a significant role in the research and development. As well as LNG, methanol, fuel cells and other key alternatives, we have been involved with a significant number of windpower projects. *Horizons* looks at three major schemes

Computerised image of the B9 sailpower concept



Sailpower could save up to 50% fuel, says leading technologist

Using wind as a source of power – not total propulsion but as an auxiliary source – for commercial vessels is being trialled and tested by a consortium led by Ireland's B9 Shipping.

The idea of sailpower first caught the marine industry's imagination when the German company SkySails carried out trials on a towing kite five years ago. Then in July 2011, Canada's Cargill Ocean Transportation signed an agreement with Greek ship management company, Ambros Maritime, for a 320 m² kite to be fitted to one of the company's dry bulk vessels.

Last year, a B9-led consortium including Rolls-Royce, Lloyd's Register, University College London and the University of Southampton carried out tests on a model of a sail-powered concept, combining a 21st-century square rig, an automated sailing system and an off-the-shelf Rolls-Royce LNG engine fuelled with waste-derived bio-methane.

The tests were carried out at the University of Southampton's Wolfson Unit



Diane Gilpin, Director of B9 Shipping

towing tank. "The results showed that the concept could be saving up to 50% of fuel on particularly windy routes against a comparable ship on the same route," said Diane Gilpin, Director of B9 Shipping, who was involved with the trial.

"Our high-level calculations indicate that payback on additional capital cost for a B9 ship can be achieved in eight years if fuel prices remain the same and there is no value attributed to carbon. Both factors, we expect, will change in our favour over time. Additionally, with back-



A SkySails kite during early tests (Credit: SkySails)

to-back long-term fuel supply contracts in place, B9 ships offer users greater levels of long-term price predictability.

"The market for vessels of up to 5,000 dwt is growing, expanding to meet demand stimulated by increased global trade. Sailing hybrids offer significant operational advantages over conventional ships and the consortium's strategy is to secure first mover advantage. It then aims to go on to be the global market leader for sailing hybrids."

Following in the wake of the *Maltese Falcon*

Northern Ireland-based B9 Shipping's concept is to develop sailing ships of up to 15,000 dwt with auxiliary biogas fuelled propulsion to provide carbon-neutral ocean transportation. A specialised hull form with a dyna-rig sail system (as famously used on the *Maltese Falcon* superyacht) would both evoke and evolve the square-sailed clipper concept of 150 years ago to carry cargo efficiently in the near future.

The ships' likely operational range would be short- to medium-length voyages in northern Europe, such as the Upper Baltic to eastern England. With rising fuel prices, and in talks with companies like Dow Chemical, which are interested in reducing their carbon footprints, B9 is working to make a real step change using existing technology. The trick seems to be to combine the best of many worlds to create a competitive concept.

If the prices of carbon fuels continue to rise and a carbon pricing market also emerges, B9's concept will only strengthen from a financial perspective. And, although the vessels' auxiliary power is based on existing LNG engine technology, they will be using biogas rather than LNG so that it's not just another fossil fuel in the tank.

The main designer is Rob Humphreys. The Hampshire-based yacht designer, his son Tom and their team at Humphreys Yacht Design are responsible for many highly successful Blue Water racing yacht designs.

Technical cross-over between yacht and cargo ship designs is a leading feature of the B9 project and, commenting on the challenges they faced in

optimising a sail-powered cargo ship, Rob said: "The fundamental issue is can it go upwind? This will be a massive issue regarding viability." As for performance, he was talking about potential speed through the water of around 20 knots, although most sailing would be at far lower speeds. "It's fascinating, great fun and we're scratching the surface of what's possible."

Rob Humphreys (right) and his son Tom



Zodiac, Totempower and Lloyd's Register plot a carbon-free future

Last year, Lloyd's Register's Strategic Research Group joined forces with Totempower Energy Systems and Zodiac Maritime Agencies to assess the potential of wind energy for commercial ships, as the maritime industry steps up its pursuit of viable carbon-free energy.

A fully autonomous wind-monitoring system designed and assembled by Totempower was installed on the Zodiac-managed bulk carrier, *Cape Flamingo*. Sensors were installed in locations where the best wind conditions could be expected for measurement of wind speed, direction and turbulence. This was done with a view to determining the most effective potential locations for onboard wind engines, such as Flettner rotors and generators (see following story for the latest news on this project).

The project has successfully identified and measured the potential generating capacity from windpower for the ship's trading patterns. This data will be used to support the development of computational fluid dynamics (CFD)-based simulation models suitable for predicting the potential energy yields on other Zodiac ships.

Wolf Dietrich, Chief Executive Officer, Totempower Energy Systems commented: "This project demonstrated that wind-assisted power generation onboard commercial vessels may be one of the future options considered for auxiliary power generation. The results illustrated the importance of placing a wind energy generator in way of the bridge wing stations, where the vessels received

the best quality of unobstructed air-flow. Designing a wind turbine for the prevalent conditions and the environment it is used in are important factors to consider at implementation level. Wind turbines of the conventional type may be able to contribute to the onboard auxiliary power supply, but are highly unlikely to replace it completely for practical, as well as operational safety considerations."

// This data will be used to support the development of CFD-based simulation models suitable for predicting the potential energy yields on other Zodiac ships

// He concluded: "We are glad that our in-house developed technology can assist in this process. Future work may help with justifying the benefits and design requirements."

"We are very happy with the outcome of this initiative," said Kalliopi Xypolita, Environmental Superintendent for Zodiac Maritime Agencies. "The data-collection phase lasted for seven months. We now have a better understanding of the feasibility of implementing wind turbines onboard our ships and some of the associated economic and environmental benefits.

"The ideas presented look promising, subject to further design, implementation studies and regulatory aspects," added Xypolita.

As the maritime industry steps up its pursuit of more efficient shipping operations, one key area where we have a number of projects is related to wind energy. Shipowners want good data to help them make decisions, and we have made real progress in that respect with this project.

Supplemental windpower is just one of many cleaner energy options being explored by the marine team at LR's Strategic Research Group, in concert with shipowners, designers and operators. Others include research into low distillate fuels (e.g. LNG as fuel, methane etc.), nuclear propulsion systems, solar and tidal energy and the potential of fuel cells.

"The purpose of this innovative work has been the understanding of the fundamentals for better onboard energy management," said Spyros Hirdaris, Lead Specialist from Lloyd's Register. "To save fuel and maximise the understanding of alternative sources of power, we need good data. This project has been designed to provide the information that Zodiac needs to get general understanding of the effectiveness of potential wind-turbine-driven energy solutions."

The alliance has been formed at a time when commercial shipping is increasingly looking to work with specialised service providers to support the development of new technology; creating alliances that can provide the technical solutions the industry needs.

A Flettner rotor concept is being developed by a number of stakeholders to make use of wind energy. Lloyd's Register has been involved with several stakeholders in this area. Greenwave, which we have written about in the past (look out for more news on the company), and Magnuss, whose co-founder James Rhodes gives his perspective (see next page) on the potential for Flettner type rotors and how the company is developing its product.

Ed Fort

Lloyd's Register's Head of Marine Engineering Systems:



"The potential of wind energy as a source of marine power is obviously unquestioned. The only real unknown is how relevant it is to modern shipping, not least in respect of current and future trading patterns, and in respect of increasingly automated operations, both while underway and alongside the berth. To this extent, Lloyd's Register is engaged with a variety of projects, some of which we can discuss, some of which are more confidential. These aim to provide the support the industry needs, if it is to take the necessary commercial decisions with confidence."

Windpower – will history repeat itself?

asks James Rhodes, CEO and Co-founder of Magnuss Ltd



Magnuss CEO
James Rhodes

Lofty energy prices and emissions regulation are two leading factors influencing change in the maritime shipping industry. A glance across the shipping space further indicates little relief to the industry's economic woes, amid sustained high bunker fuel costs and the compounding effects of emissions regulations.

Maritime shipping has seen significant challenges over the past few years with, most notably, the introduction of the Ship Energy Efficiency Measurement Plan (SEEMP), the Energy Efficiency Design Index (EEDI) and Emission Control Areas (ECAs). As regulations add to the economic demands of shipping, the importance of fuel efficiency is further amplified: a trend that is set to continue.

Innovation and technology will play a vital role as industry leaders prepare for change. Few would argue that new technology is the single most important means to reducing costs and increasing profits. However, for the shipping industry to benefit, the technology must be certified and approved before it is installed onboard a working vessel.

The guidance and verification needed to advance new technology is supported by various organisations and remains essential in order to comply with regulations. Importantly, a strong collaboration is required between innovator and verifier for that process

to succeed. And if it does succeed, the shipping industry is poised to be the direct beneficiary in its time of need.

Consider this entrepreneurial collaboration over the past 100 years and the curious near-truth of travelling full circle from sailing ships, to engine-propelled ships, to hybrids. A century ago, Lloyd's Register witnessed the sea trials of the East Asiatic Company's first diesel-powered merchant ship. The propulsion technology on trial then dominates the industry today; nearly all ships currently use marine heavy fuel oil in diesel engines.

However, with bunker fuel costs peaking last year, shipping industry leaders have cast a keen eye on cost savings resulting from reduced fuel use. Introducing Magnuss Ltd, a maritime technology firm positioned well to deliver a suite of fuel efficiency solutions. Chief among them is the patent-pending Vertically-variable Ocean Sail System (VOSS™), a mechanical sail earning critical acclaim for its innovative design and fuel savings potential.

Founded in 2010, Magnuss designed the VOSS™ based on German engineering, first applied to shipping in the 1920s by

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Measures that make shipping economically efficient and environmentally friendly are attracting much attention. Leading industrials and global shipping organisations do not need to be convinced that managing fuel requirements directly results in improved financial performance and reduced regulatory risk

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Anton Flettner. The VOSS™ is a rotating, cylindrical metal column installed on the deck of a ship. Leveraging a principle of physics called the Magnus effect (corr), the VOSS™ converts wind into forward thrust perpendicular to the direction of the wind. The Magnuss VOSS™ is an advanced take on the Flettner's original technology. One key difference and advantage of the VOSS™ is that it's retractable, thereby allowing the system to be stowed below deck during loading/unloading and in adverse weather conditions.

The driving force created by the wind over the VOSS™ means the vessel needs less power from its main engine, resulting in lower fuel consumption. Under typical operating conditions, a ship's average annual fuel costs can be reduced by 10-35%. Savings of this magnitude are meaningful, especially on a line item that often represents more than two-thirds of a shipowner's/operator's annual expense. Moreover, savings afford a quick payback. In many cases, customers can recoup the cost in just two to three years.

When Magnuss sought a partner to help classify the Magnuss VOSS™, Lloyd's Register was a clear choice, validated by demonstration and test bed candidates on whose ships the VOSS™ will be installed. In the past year, Magnuss has been working with Lloyd's Register to ensure certification of the VOSS™ design and the ship integration plans. Lloyd's Register approval means the VOSS™ meets the highest standards expected of the world's leading shipowners and shipyards.

Measures that make shipping economically efficient and environmentally friendly are attracting much attention. Leading industrials and global shipping organisations do not

need to be convinced that managing fuel requirements directly results in improved financial performance and reduced regulatory risk. Industry participants agree; much is at stake. Magnuss and Lloyd's Register understand this, while sharing a deep-rooted commitment to ensuring innovative technologies like the VOSS™ are accessible and viable options, not only affording a substantial cost advantage for operators worldwide, but also helping these organisations meet the demands of increasing environmental legislation.