

Different directions for Flettner rotors

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'MV Estraden' with the second Rotor Sail fitted. Photo: Norsepower

Flettner rotors have a great deal going for them. In fact, early signs show they could prove an untapped goldmine – but getting it right will make or break those involved in the innovation, writes Stevie Knight.

“The reality is that Flettner sails are very simple,” explains Andrew Scott of the Energies Technology Institute (ETI). “All of them work by spinning a vertical tower as the wind flows around it.” The so-called Magnus effect creates forward drag rather in the same way backspin is used by ball players to gain extra lift.

It may be straightforward, but the benefits are not to sniffed at: “You can transform unfavourable crosswind conditions to something that works for you: we have found this could give you about 2MW of difference in the best-case scenario,” says Tuomas Riski of Norsepower, the company which got such good returns on its first installation of a rotor sail on the *MV Estraden* that it was asked to fit a second on the same vessel.

Further, there are some interesting effects associated with it: although the device results in some mass being located high above the deck, it actually works a little like a gyroscope – or an old-fashioned sail – to exert a stabilising influence.

However, though the principle is simple its application is not - and more than one kind of technology is trying to find its way into the market.

Tuomas Riski explains that the Flettner rotor installed on the *MV Estraden* is a fixed, lightweight structure made of carbon composite which rotates around an internal steel structure, held in place by two sets of bearings: “It makes it easy to retrofit because after adapting the deck and installing the base structure we can just take the entire external unit with all the devices inside and drop it on.”

He admits there were some initial challenges: “We had to get the right materials and components to take the spin velocity, in fact we spent six months land testing it,” he says, before constructing the first seagoing prototype.”

The Rotor Sail was then put through a year of strenuous checks: after the vessel’s baseline profile in normal operation was established it was activated and deactivated at random intervals in order to make sure any effects that showed up were due to the sail, and that any benefit was measurable across the vessel’s operating profile.

In fact it behaved beautifully says Mr Riski: NAPA’s trial figures showed an average verified fuel savings of about 2.6% for a single rotor sail.

Norsepower and shipowner Bore say that the full two-rotor system on *MV Estraden* is achieving a touch over 6.1% fuel

savings overall or 367kW: cutting to the nitty gritty, Mr Riski says figures (worked with MGO at US\$400 tonne) put the payback for an installation with two rotors at five years. He adds that 20% savings could be reached on the same route with a number of bigger rotors.

The commercial environment is as important as those at sea: Mr Riski believes that a rotor sail like this “has to be simple or you can’t make a business case for it... At least at the moment that’s what the market demands”. So while the company has recently been developing a collapsible design which folds down using a hinge just below the rotor, it still keeps to this basic premise.

Magnuss, says CEO James Rhodes, is aiming at something rather different. This is because despite a promising theory, he believes there are a number of issues when it comes to installing a Flettner device on larger carriers – and despite the success of the *MV Estraden*, he says an alternative is needed when it comes to crossing the rotors over into larger ships. “Not because the technology itself isn’t scaleable, but because it has to meet different demands,” he explains.

So although Mr Rhodes says “the rotor sails could, theoretically, be fitted to many types of vessels,” he adds “the quest is to have it make sense.” He explains a significant amount of a fixed Flettner rotor’s potential benefits are lost to drag in unfavourable conditions, this mounts up if the ship is navigating a large portion of its route through open ocean waters with powerful winds.

Further, as Mr Rhodes points out: “Dry bulk carriers, for example, have big grabs that come sweeping over the deck and you really don’t want anything in the way.” He also adds, “in general, any installation on deck higher than a ship’s original profile will impede air flow. And in unsuitable conditions that obstruction may produce unwanted drag”.

So for Magnuss, the clear area was very important – and it has gone one stage further than a folding sail which still leaves a fairly chunky object on the deck.

Magnuss’ retractable Vertically-variable Ocean Sail System (VOSS) solution focuses on a base design for carriers of between 60,000dwt and 400,000dwt (with up to six units per vessel). The company has developed both a pack-down, on-deck design for tankers while on a dry bulk carrier the VOSS will telescope down below the deck to leave a flush surface. Not only does this get the device out of the way for loading and unloading while in port, but also since the VOSS is retractable it simply doesn’t produce drag in adverse winds.

Moreover, it’s steel, which Mr Rhodes says “is a familiar material” for technicians, yards and maintenance crew. In all, the Magnuss VOSS is envisaged as a highly automated system that would be integral to the ship and structure; although Mr Rhodes does admit there is ship work to be done “as with all retrofits” in his estimation the overall gains are well worth the work.

Certainly on paper, Mr Rhodes’ projected savings are larger than those presented by the original Norsepower sail: “Under optimal wind conditions, we believe fuel consumption can be cut up to 50% and under typical operating conditions, annual fuel costs can be reduced by 15% to 35%,” he says.

There is another element that makes comparisons difficult: onboard technology isn’t the whole picture. Sail efficiency has much to do with the route and this needs very careful evaluation; what will succeed for a bulk carrier on one route simply might not provide the savings on another; Magnuss has developed software for predictive analysis with firms such as AWT Worldwide to map real-life voyages as well as forecast simulations in order to gauge the savings while Norsepower provides the data but leaves the weather routing service to its end user.

ETI is itself investigating the potential of large-scale installations: “We are looking at fitting Flettner rotors to a vessel between 50,000 to 100,000dwt; putting several rotors on a big ship will give us high quality data on actual performance and a much better idea of what the real savings are, especially since these ships tend to spend more time at sea,” says Mr Scott.

Although certain of the physics, the ETI believes that the demonstration will provide valuable insights into operational practicalities.

“For example these rotors may be fairly tall and wide with a ratio of roughly 6:1 height to breadth, so you have to be conscious of the regulations in terms of bridge visibility,” he says. “This might be achieved more easily on bigger ships as

if you place the rotors toward the bow, there is less of a problem with forward line of sight.” On the other hand since rotors don’t necessarily need to be aligned along the vessel’s centreline, pushing them out to the edges of the deck might also help keep a clear view from bridge.

He adds: “We also need to understand their impact on ship handling, crew interaction and on operations within port.”

However, the requirements may well change over time and while folding rotors would provide a solution for harbours that want the device stowed out of the way during loading or unloading operations, other facilities might be able to accommodate them. Mr Scott, who confesses he’s “a fan of keep it simple”, points out that while you might lose some efficiency in adverse conditions it would lead to a more robust onboard system.

So, while he believes “early installations will need to be folding or collapsible to mitigate port operation risks, the simplicity and higher reliability of a fixed installation will become attractive as the stakeholders gain confidence in the technology”.

Despite the complexity of the questions ETI’s testbed project is now in the process of being firmed up along with owner, vessel, and technology supplier. When pushed on the system to be trialled, Mr Scott only says there’s been a wide variety to evaluate, but making the outer element of composite “shows a great deal of potential”.

However, although the simpler, lightweight sail is already working and the sophisticated, retractable version as yet is still on the drawing board, there’s a long, long way to go before the numbers are finally called. And as Mr Rhodes points out, there will definitely be a case-by-case evaluation.

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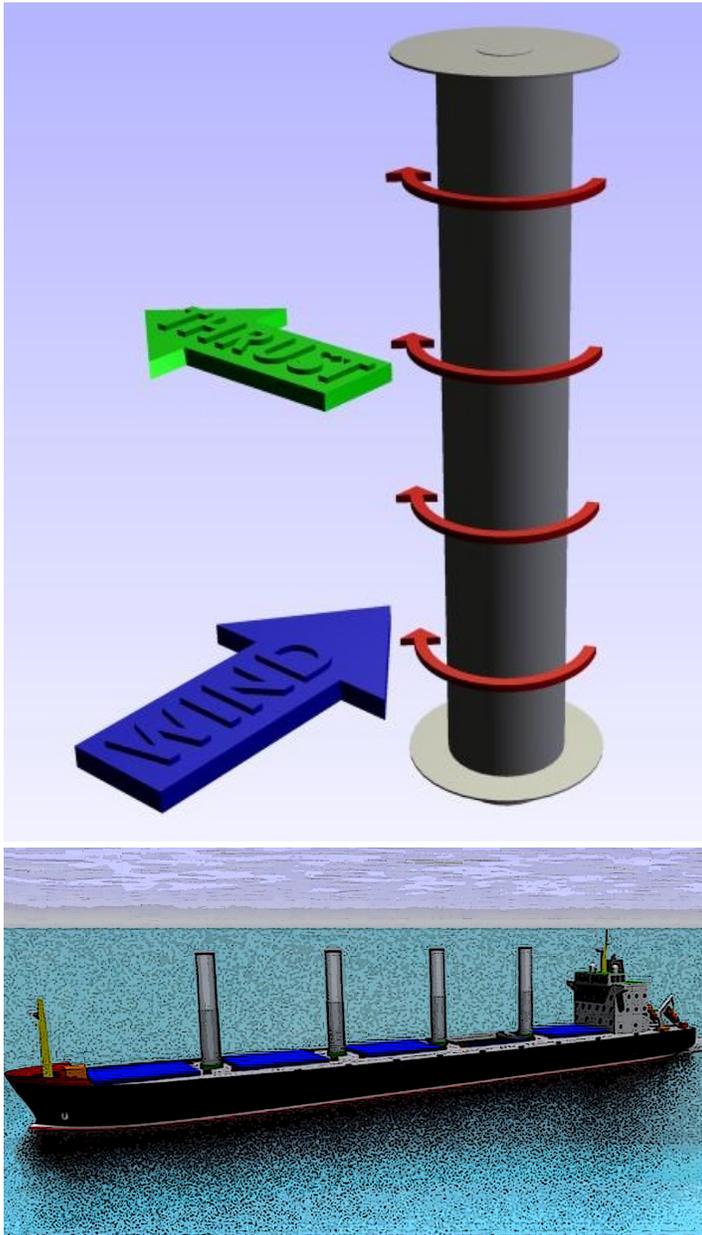


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