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Increased savings through hydrodynamics

Not all innovations take place in the engine room – the hull vane aims to recover energy from the flow of water at the stern, reducing resistance and saving fuel, says Bruno Bouckaert of Hull Vane BV

► Bruno Bouckaert, sales director, Hull Vane BV

There are a number of fuel-saving devices on the market, ranging from propeller boss cap fins or pre-swirl ducts, to air lubrication of the bottom. It is not very often that a new fuel saving device is focused on reducing the hydrodynamic resistance of a vessel, as most are either trying to reduce friction or increase propeller efficiency.

The most famous 'hydrodynamic' fuel saving device has been around for over 100 years: the bulbous bow. Peter van Oossanen, a Dutch hydrodynamicist known for his research work in ship resistance, recognised that there was room for improvement at the stern too, and invented a fuel saving device to recover energy from the upward flow under the aft ship.

The device is called a hull vane, and while it works much as a bulbous bow does (creating an area with low pressure just behind the stern), it actually looks most like a hydrofoil. The horizontally-mounted submerged wing generates a lift force perpendicular to the flow under the transom, which is therefore angled forward. This means that there is a horizontal component which actually pushes the vessel forward. By reducing the stern wave, it also reduces a ship's wavemaking resistance.

The vertical component of the lift keeps the bow down – much like other devices such as trim wedges, stern flaps or interceptors – but it does so at a lower resistance penalty. Last but not least, the large submerged surface, located far from the centre of the vessel, dampens the vessel's pitching motions when it is sailing in waves. This reduces the added resistance caused by pitching.

Most fuel saving devices have a specific range in which they are effective, and this is no different for the hull vane. As the wetted surface of the hull vane adds up to the frictional resistance, it needs to reduce the wavemaking resistance by a sufficient amount in order to overcome its own drag. Many vessels sailing at a very low speed-to-length-ratio have almost exclusively frictional drag and the hull vane therefore does not work on them (examples are tankers and bulk carriers). There are, however, a significant number of ships sailing at a high speed while staying in the displacement or semi-displacement mode, such as OSVs, ferries, super-yachts, and naval ships. A common characteristic of these ships is that they either transport people or high-value cargoes.

One existing application of the hull vane concerns an offshore vessel: the 55m fast supply intervention vessel ***MV Karina***, designed to deliver crew and cargo to offshore platforms. The ship, built by Shipyard De Hoop in the Netherlands, had its sea trials in 2014 both with and without the hull vane. Shaft power measurements showed a clear difference: at 12 knots, 10 per cent less power was needed with the hull vane, and this percentage got bigger with increasing speeds, finally reaching 15 per cent at the ship's maximum speed of 21 knots.

Bruno Bouckaert, sales director of the Hull Vane company, said that model tests are currently being done for a 90m offshore vessel. Besides the fuel-saving aspect, the focus there lies on directional stability (improved by the vertical struts of the hull vane) and increased operability in higher sea states. Naval ships are another sector specifically interested in the hull vane, as it dampens pitching motions and reduces vertical accelerations, which broadens the operational envelope in which helicopter operations can be safely carried out.

Asked about the biggest challenges in the offshore market, Bouckaert mentioned two: "First there is the disconnect between ship owners and charterers. While one pays the investment to build and maintain the vessel, another pays the fuel bill. However, we see that charterers are increasingly looking at fuel consumption when selecting their ships, which makes it worthwhile as an owner to invest in this, particularly in a competitive market as we're seeing now. I think charterers are also prepared to pay a slightly higher day-rate, if this is offset by a much bigger cost saving in fuel expenses.

"The second challenge is the fact that the hull vane 'sticks out at the back', which is the case for some retrofit applications, although not all. If Mediterranean-style mooring is used frequently, the hull vane can be protected with a bullbar-type construction above the waterline, or an extension of the cargo deck, but not every vessel is allowed to have an increase in length overall."

Cost savings are biggest for newbuilds, as the installed engine power can be reduced to achieve a certain top speed. On high-powered vessels (over 3,000kW), this cost saving often already exceeds the investment in a hull vane. But retrofitting to an existing ship is also fairly easy: apart from some strengthening of the transom, no internal work is needed. It should not take more than a few days at most. With a lower resistance curve and the same tank volume, the operator has two options: increase the range of the vessel, or take less fuel on board to increase the payload.

The design of the hull vane is specific for each vessel. A computational fluid dynamics study is needed to determine the exact size, shape and position of the hull vane.

The hull vane system is patented worldwide and exclusively sold, designed and built by Hull Vane BV, a sister company to Van Oossanen Naval Architects and Van Oossanen Fluid Dynamics.

► *From top: design image of the installed hull vane;* **MV Karina***; lifting the hull vane into position*