2015 MARITIME INNOVATION AWARD WINNER

Hull Vane

WITH ITS ROOTS IN RESEARCH FOR AMERICA'S CUP SAILING YACHTS IN 2002, THE HYDROFOIL-TYPE appendage called Hull Vane has evolved into a fuel saving device for medium to fast speed displacement vessels.

Invented by Dutch hydrodynamicist Pieter van Oossanen, the Hull Vane has often been referred to as the 'Underwater Spoiler' and the 'Bulbous Bow of the Stern'. While both of these comparisons hold some truth, neither is complete. For example, spoilers on race cars placed in the downward airflow at the rear, not only give the car downforce, but also provide a forward thrust force. This is because the lift generated by the wing is angled forward, as it is almost perpendicular to the incoming flow. The same applies to the Hull Vane, but upside down and under water. Water flows upwards toward the stern and the wing produces a lift force angled upward and forward. In essence, the Hull Vane sees a flow similar to wings of a glider plane.

Bulbous Bow of the Stern

The bulbous bow generates an underwater pressure that compensates for the pressure caused by the ship's bow. As both pressures cancel each other out, less of a bow wave is produced, and the wave-making resistance of the ship is reduced. The Hull Vane generates an area of low pressure just behind the ship's transom and therefore influences the wave profile generated by the ship. If the stern wave produced by the ship is reduced, the resistance is lowered and so is the fuel consumption.

Improved Seakeeping

The vertical component of the lift force resulting from Hull Vane keeps the bow down, as do many other devices, such as trim tabs, stern flaps, trim wedges and interceptors. However, the Hull Vane also results in improved sea-keeping of the ship while sailing in waves. CFD studies and model tests have shown that the Hull Vane dampens pitching and heaving motions. It therefore reduces the vertical accelerations on board, one of the main contributors to seasickness. In addition, it reduces the added resistance caused by these motions. Sea trials have also shown an improvement in controllability. While the turning »

The Hull Vane can easily be retrofitted to existing ships.


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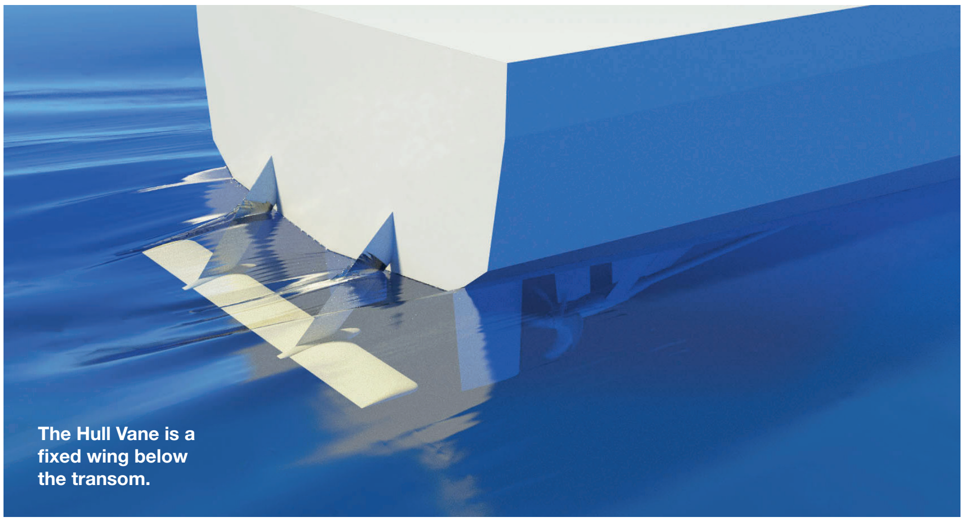
radius is slightly larger, the overshoot in zig-zag tests is drastically reduced. This means a more direct response from rudder input, as well as reduced yawing in stern- or bow-quartering waves, another source of seasickness and added resistance. Finally, the Hull Vane increases the roll damping of the vessel, much like the bilge keels do.

Comparative Sea Trials

In the summer of 2014, the Hull Vane was installed on the Fast Supply Intervention Vessel Karina, built by Shipyard de Hoop. In order to precisely quantify the effect of the Hull Vane, two sea trial programmes were executed, one without the Hull Vane and a second in the same conditions with Hull Vane. During the speed trials, the vessel's speed and shaft power measurements were independently recorded by the sea trial specialists Belkoned, allowing for an exact comparison. The speed/power graphs showed a reduction in propulsion power (and in fuel consumption) of 10% at 12 knots, which increased quickly to 13 - 14% and topped out at 15% at the maximum speed of 21 knots. A CFD analysis in waves done by Hull Vane sister company Van Oossanen Fluid Dynamics showed a reduction of added resistance in waves of 30%, and a reduction in vertical accelerations of 10 to 20%.
An even higher resistance reduction was achieved on motoryacht Alive, delivered by Heesen Yachts in 2014. Comparative sea trials were not possible on this vessel, as the Hull Vane was integrated on the vessel but CFD work showed savings in the speed range of 12-16.4 knots exceeding 20%. Adding to this, the Hull Vane increased the range of the yacht from 3,250 to 4,000 nautical miles.

Applications

Ships onto which a Hull Vane can be applied are generally steel or aluminium displacement vessels, sailing at a relatively high speed-to-length ratio. It is only on ships with a significant portion of wave-making (or pressure) resistance that the Hull Vane can make a real difference. Examples are offshore supply vessels, superyachts, ferries & RoRo vessels, medium-sized cruise ships and, in particular, naval and coastguard vessels. For several of these ship types, the improvement of the sea-keeping characteristics is at least as important as the fuel saving aspect. While it is relatively easy to retrofit the Hull Vane to an existing ship, all installations so far have been on new vessels.



The Hull Vane is a fixed wing below the transom.

The wavemaking resistance is reduced by modifying the flow at the stern.

Holland-Class

It takes a CFD analysis to find out if Hull Vane is beneficial on a particular vessel. Hull Vane has recently concluded such a study for the Holland-Class Oceangoing Patrol Vessels of the Royal Netherlands Navy. These 108-metre vessels spend most of their time sailing at a low speed, but the CFD analyses over a speed range from 5 to 22 knots, showed annual savings in fuel consumption of 12.5%, taking into account the operational profile of the ships. Further benefits were quantified, such as safer helicopter operations in rough seas (due to the reduced vertical accelerations), safer launch and recovery of RHIBs from the slipway in the stern and a range increase from 5,000 to 5,850 nautical miles. As the benefits can even be bigger on new builds, at a lower cost, the Dutch navy will also consider the Hull Vane for their future vessels.

Maritime Innovation Award

In November 2015, Hull Vane received the Maritime Innovation Award. The jury's decision was based on the Hull Vane being a proven system to reduce fuel consumption and improve the sea-keeping of ships. The design process requires know-how and relies heavily on the capabilities of Computational Fluid Dynamics, to take into account the interactions between the hydrofoil and the ship's hull, both in terms of frictional and pressure resistance. The Hull Vane is custom-designed for each vessel with the technology patented in all relevant countries worldwide and sold exclusively by Hull Vane and appointed resellers.

i. www.hullvane.nl

New Order

Hull Vane recently received an order for a Hull Vane for an 88-metre Crew Change Vessel, under construction at Zamakona Shipyards in Spain The ship is designed with a focus on fuel-efficiency and sea-keeping. As the Hull Vane improves on both fronts, it was a logical addition to the vessel. The ship will be delivered in 2017.