INNOVATION - DYNAMIC STABILITY SYSTEM

Foil technology a first in superyachting

With the advanced carbon composite hull of the Baltic 142 Custom almost complete, the Baltic Yachts' team and external experts are well advanced with the Dynamic Stability System (DSS) foil, which will provide this spectacular yacht with extra speed and comfort.

The DSS, a transverse, 29ft 6in (9m) long, sliding foil, built into the yacht just below the waterline, has proved highly effective in smaller yachts, but this is the first time it has been used in a superyacht.

It is the type of innovation highlighted in our symposium last year – The Next Generation of Superyachts – which illustrated the importance of new ideas such as this being key drivers of business.

America's Cup technology from Ben Ainslie Racing's BAR Technologies in Portsmouth UK is being used to help design and engineer the roller bearing and drive systems which enable the foil to be deployed under load at speed and extend 22ft (6.5m) to leeward.

When the foil is deployed it has the potential to create 40 tonnes of lift, in turn reducing heel, increasing speed and reducing pitching to enhance comfort. At over 20 knots, the dynamic load on the outboard upper bearing could amount to 140 tonnes, so the engineering and naval architecture for the yacht had to take the foil into account from the outset.

Simon Schofield, chief technology officer at BAR Technologies, emphasised the importance of the surface finish of the foil, precise tolerances, bearing design and the need to reduce friction. "For instance, the trailing edge of the carbon composite foil, which will be heavily loaded at the point it meets the hull, is finished in titanium because it's harder than carbon and will create less friction as it runs over its corresponding bearing inside the hull," he said.

Simon Everest, senior design engineer at Gurit Composite Engineering said that with the foil generating a large proportion of the yacht's righting moment, displacement and hull volume could be reduced, but finding space to install the foil and to locate its bearings correctly was a challenge.

"We collaborated with Baltic Yachts to make small adjustments to the accommodation and with Farr Yacht Design to alter the hull shape creating a subtle blister around the foil exit," said Simon, who explained that this achieved a greater bearing separation which in turn reduces the engineering requirements for the foil, supporting structure and mechanical parts.

Roland Kasslin, Baltic Yachts head of research and development, said: "The foil will run on four sets of 25 Torlon bearings contained in titanium housings. The outboard bearing set will take the upward load and the inner set the downward load when the foil is deployed."

The foil is moved by a pulley system driven by an electric captive winch installed at deck level. To prevent water escaping from the casing, the control lines are fed through lightweight, composite tubes built into the casing, leading to a level well above the waterline.

The foil itself is being built by French specialist fabricators ISOTOP. It weighs about 1 tonne and is designed to deflect through more than 700mm at its tips to help dampen motion. The core of the foil comprises a number of carbon fibre spars which extend over its full length, wrapped together with layers of off-axis carbon.

The detailed laminate scheme is designed to minimise hull damage in the event of the foil breaking.

Collisions scenarios were an important consideration, with close attention being paid to minimising hull damage and ensuring the safety of the vessel.

Gordon Kay of Infiniti Yachts who has developed the DSS over the past eight years and is working with Baltic Yachts to optimise the 142's performance, said that in 25 knots of true wind the 160-ton yacht could reach 25 knots of boat speed in flat water with just 9 degrees of heel. In a conventional yacht of the same size the heel angle would be in the region of 23 degrees and speed in the teens.

The advantages are clearly obvious.