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# Don't Rock the Boat

Stabilisation systems have evolved from exotic technology found only on the largest superyachts to must-have pieces of kit whatever the size of boat. We catch up with some of the main suppliers to find what's happening in this fast-moving field.

BY JUSTIN RATCLIFFE

It is no coincidence that 'nausea' comes from *naus*, the Greek word for 'ship'. Thankfully, whether underway or at anchor, we can now pretty much eliminate what many of us find so disconcerting: roll and the motion sickness it can induce.

Both gyroscopic and fin stabilisers have been around since the early 20th century. Originally devised to improve seakeeping or to provide a stable weapons platform in military applications, it was only with the advent of fast passenger ferries and superyachts that the comfort factor became critical. The stabilisation business has since boomed in line with the luxurious levels of comfort expected by yacht owners and charter guests.

Unlike passive bilge keels, anti-roll tanks or fixed fins that require no independent power source or controls, today's stabiliser devices are nearly always active systems that function by moving masses or controlling underwater surfaces. They basically comprise four main types: fins, foils and rotors, which are external appendages, and internally installed gyroscopes.

Fins use the forward motion of the yacht to create lift and counteract roll while underway, and rotation of the fin along its axis for stabilisation at anchor. Historically, they have relied on hydraulic actuation, but a game-changer arrived in 2008 when CMC Marine in Italy launched the Stablis Electra, a patented fin that uses brushless electric motors. The company has seen its market share expand dramatically in the last ten years.

Fins have long been the industry standard for large yachts, but they are now facing growing competition from gyroscopic

stabilisers by brands such as Seakeeper in the US and VEEM in Australia. Seakeeper's recreational range of gyros focuses on yachts displacing up to 100 tonnes, whereas the higher torque and righting forces of the VEEM products are aimed at larger vessels and its most powerful model, the 1000SD, is suitable for vessels up to 900 tonnes.

Gyros have a flywheel spinning at high speed inside a spherical vacuum chamber. When the yacht rolls, the sphere tilts fore and aft producing a powerful gyroscopic effect to port and starboard that counteracts the roll. Because gyros are mounted within the hull, they have none of the drag associated with fins, an important consideration for faster hulls. Multiple units can be placed virtually anywhere inside the hull (the 50-metre Mangusta 165 *Miss Money Penny V* has 9 Seakeeper units), and, unlike zero-speed fin systems, there are no large external appendages posing a potential danger to swimmers at anchor.

On the downside, gyros rely on precession (the change in the angle of the gyro's axis) and once the gyro reaches the end of its stroke or 'throw' it loses the ability to stabilise. They also take up to an hour to spin up, have been known to generate a high-pitched 'whine' and are most effective at anchor

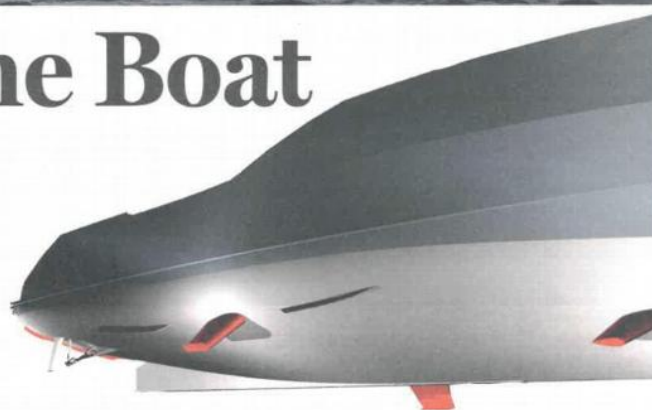
(although VEEM has achieved roll stabilisation at 40 knots).

A few yachts combine the attributes of both fins and gyros. *Vanadis*, the 31-metre hybrid motor yacht launched by CCN last year, is fitted with two Quick MC2 55K gyros and CMC Stablis Electra SE60 fins. The idea is that the gyros provide soft and natural correction forces at anchor, while the fins are much more effective in broaching conditions, so using both systems increases zero-speed comfort and safety underway.

Rotors harness the Magnus effect for stabilisation, a curious phenomenon associated with the deflection of a spinning object moving through the air or a fluid (think of the top spin on a tennis ball that forces it downwards). Foils are essentially modified fins with efficient, high-aspect shapes for minimal drag underway and higher articulation so they can sweep backwards and forwards at anchor. Both foils and rotors can be folded out of the way when not in use.

In the battle between the manufacturers of fins and gyros – and between proponents of hydraulic power over electric – it is easily overlooked that all these devices are principally designed to counteract roll. But what about other unwanted and uncomfortable motions like heave, yaw and pitch?

As a pioneer in the science of total ride control, Naiaid





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## RAISING THE BAR

### BETTER HYDRODYNAMICS

Using hydrodynamic modelling and CFD analysis, manufacturers are constantly tweaking fin profiles to reduce resistance and increase lift. The high-aspect shape of the All-In-One rotors from DMS Holland, for example, will generate less resistance than traditional fins, while the oddly curved Vector Fins from Sleipner Motor in Norway help to offset drag and lift the stern to improve speed.

### CONTROL & ACTIVATION

Any stabiliser device is only as good as the system that controls it and upgrading these systems to make them more reactive, or even predictive, is a hot topic. Naiad's DATUM Adaptive Technology self-tunes to optimise performance, and Quantum completely revised its control algorithms for its Dyna-Foil system. Quicker activation is another area of development and CMC is using fast-acting servo motors from robotic assembly lines in its last-generation stabilisers to increase reactivity and torque while reducing weight.

### REMOTE ACCESS

A faulty fin or gyro can be a danger as well as a nuisance, so stabiliser manufacturers are following other system suppliers by providing remote monitoring capability for predictive maintenance and problem-solving. "Almost everything we produce now has remote access built in," says John Allen of Quantum. "With the client's permission, of course, we can download data onto a protected server, or we can dial in to monitor what's happening in real time and figure out what the problem is."

### CONNECTIVITY

Most equipment manufacturers are developing control software that can link with other systems and components, such as rudders and thrusters. Humphree in Sweden has developed fins that link electronically with its interceptor trim tabs so they can work in tandem to also control pitching. CMC partnered with the French company Sirehna to develop the Argo system that integrates fin control with its steering and thruster systems.

### FOCUS ON REFIT

The refit market is an important one as the growing fleet of ageing yachts starts to strip out old stabiliser technology and replace it with new. The 70-metre Benetti motor yacht *Freedom*, for example, will be the first to feature Quantum's prototype Dyna-Foil system when she emerges from her year-long refit in the US. DMS Holland has also launched DMS Universal, a digital stabilisation control system that can replace any outdated or defective control systems when the hardware components are still in good working order. The system was retrofitted to three superyachts in 2019.

### NOISE REDUCTION

Significant improvements in noise reduction have been made across the board, especially at anchor when stabiliser noise is most noticeable. Some of these improvements are the result of better installation practices to reduce structure-borne noise, but others are the result of more advanced technology. Naiad has a Quiet Powerpack option for yachts, while VEEM has reduced noise levels of all four models in its range of gyro stabilisers. In 2018 the VEEM VG260SD unit received a special mention in the DAME Design Awards for superior roll attenuation performance and setting a new benchmark in low noise emissions.

### SMALL IS BEAUTIFUL

Stabilisation is fast trickling down from superyachts to smaller vessels. Seakeeper is due to launch the Seakeeper 1, its smallest gyro stabiliser to date, and last year CMC unveiled its Waveless product, an ultra-compact stabiliser fin system suitable for boats under 15 metres in length. "Motion control is evolving and diversifying," says Alessandro Cappiello, CEO and founder of CMC Marine. "Whereas once it was the preserve of a certain size of yacht, expectations are filtering down to the smaller boats, but owners still want stabilisation both at rest and under way. These products are now becoming like consumer goods aimed directly at the end-users."

### BEYOND ROLL

At the 2019 Monaco Yacht Show, Naiad Dynamics jointly announced with Hull Vane the Dynamic Hull Vane, an actively controlled version of the patented fixed Hull Vane that targets fast displacement vessels. CFD simulations show that the active Hull Vane can reduce pitching by 20-40%, double that of the fixed one. "The ship feels as if it has active suspension: less pitching, less vertical acceleration and less slamming," says Bruno Bouckaert, Hull Vane sales director. ♦



QUANTUM

CMC MARINE

SEAKEEPER

CLOCKWISE FROM LEFT:  
a cut-out of a Seakeeper gyro  
stabiliser; the 54m Mangusta  
Gransport *El Leon* carries CMC  
electric fin stabilisers (above).

60m *Spectre* is the first  
monohull superyacht to  
be fitted with a ride control  
system by Naiad for  
damping roll and pitch.

A render showing  
the two active stabiliser  
fins amidships  
and two active  
canards forward.

Dynamics was the first to take a holistic approach by combining conventional fins with other appendages such as T-Foils, trim tabs, canards and interceptors. Naiad relies on simulation programs, tank test data and CFD analysis to predict Motion Sickness Incidence (MSI) and specify the most suitable combination of control devices.

One recent example is 69-metre *Spectre*. Delivered by Benetti in late 2018, it is the first monohull superyacht to be fitted with a ride control system by Naiad to improve both comfort and performance. Working closely with naval architect Frank Mulder, Naiad ran simulations using different configurations at various speeds, wave heights and headings to find the best combination of appendages for *Spectre*. The results showed that having two active stabiliser fins amidships, two active interceptors mounted under the transom, and two active canards forward provided the most effective roll and pitch damping, as well as optimising the trim of the yacht. In fact, pitching was reduced by up to 47% in head seas and rolling by nearly 90% at the worst case heading of 75 degrees.

"The idea of total ride control is slowly gaining traction in the superyacht industry," says John Venables, Naiad CEO. "No matter the hull type or shape, if designers and naval

architects come to us early enough in the design phase, we can always enhance the seakeeping and make the overall experience more comfortable for the owner. I call it the 'comfort imperative', because if the owner isn't comfortable, his yacht investment makes no sense."

Like Naiad, Quantum Marine has pioneered stabilisation solutions in the military, commercial and yachting sectors. The market leader for fin stabilisers on yachts over 55 metres and best known for its patented Zero Speed and XT (extendable) fin units, Quantum is also the developer behind the MAGLift rotor (originally devised for smaller boats but was also fitted to 162-metre *Eclipse*) and the more recent Dyna-Foil system.

"What we see trending right now is the combination of fins and rotors," says John Allen, President of Quantum Marine. "The advantage of the MAGLift rotor is that it performs best at zero speed and at speeds of 6 or 7 knots, unlike fins that are less effective at slow speed. The rotors peak at about 12 knots, after which they retract into the hull and the fins take over. The combination basically provides the best of both worlds to broaden the performance."

Before being unveiled in 2017, the retractable Dyna-Foil underwent extensive third-party model testing by MARIN (Marine Research Institute Netherlands). While the concept is relatively simple, its implementation and optimisation are complex as both the angle of attack and the swing speed at anchor are variables that need to be controlled to provide optimal stabilisation. Underway the foil is deployed at 90 degrees to the hull centreline and lift is generated much like traditional fins by articulating the foil to change the angle of attack through the water.

The AntiRoll All-In-One system is a stabiliser innovation still under development by relative newcomer DMS Holland. Aimed at yachts up to 30 metres, at anchor the fins mounted on the transom make a paddling motion, while at cruising speed they function much like traditional fins. What's new is that it takes the concept a step further by having the foils tuck under the transom to double as trim tabs at high speed.

One of the biggest variables in any stabilisation decision is the owner's expectations. It doesn't help that there is currently no industry standard available for assessing motion comfort aboard large yachts. After all, we react to the same stimuli in different ways and accelerations that might not bother a seasoned sailor can send a less experienced guest running for the nearest dayhead.

The problem is being addressed by the International Organisation for Standardisation (ISO) and a working group led by MARIN is finalising a report to be published shortly that aims to provide a comfort criterion with a numerical value that also takes into account human variations.

"The stabiliser suppliers make different claims about how their systems increase onboard comfort, but the general public don't know how to quantify this effect," says Enrico Della Valentina, who is heading up the ISO working group. "Naval architects and other specialists know how to do that, but there is not a uniform way of doing so. The new ISO standard will make this assessment more easily understandable by presenting the results in a 5-star system, whereby the higher the number of stars, the greater the comfort."