

SMOOTH OPERATORS

THOSE WITH A THIRST FOR PERFORMANCE ARE NOW LOOKING AT THE LATEST RETRACTABLE PROPULSION SYSTEMS TO ELIMINATE DRAG BELOW THE WATERLINE. MIKE OWEN INVESTIGATES

Designers, engineers and builders develop and adopt new materials to shave weight and strengthen structures, and strive for a better understanding of dynamic flows and sailing efficiency, all in the pursuit of performance. Then what do we do? We hang a whacking great propeller on the end of a shaft sticking through the yacht's bottom into the sea. However optimised this appendage may be, it inevitably induces performance-sapping drag. No wonder those who can afford it are looking into retractable propulsion systems, folding the prop and drive back inside the hull to leave a smooth, porpoise-like underbody.

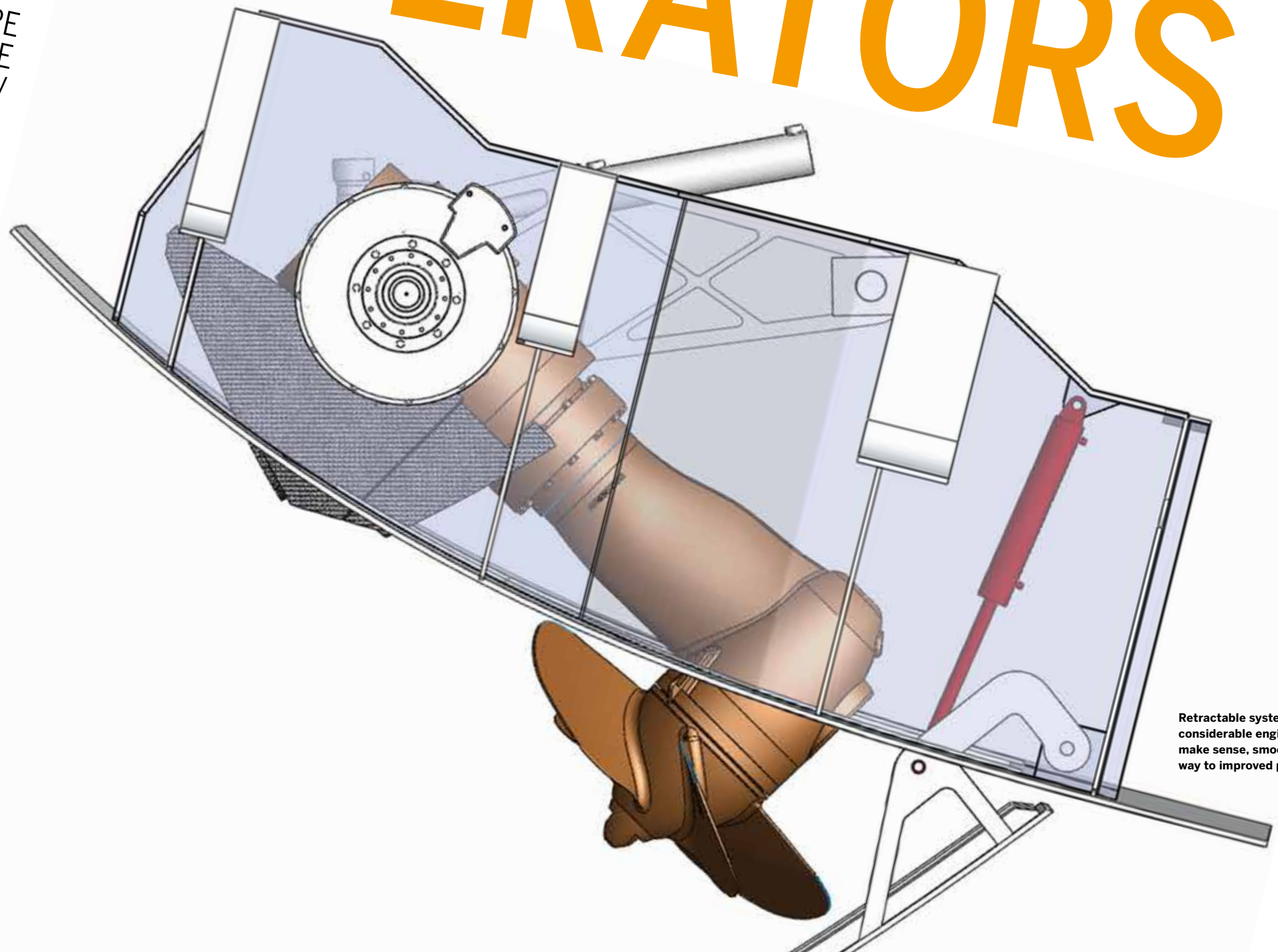
In such arrangements the drive train folds into an integral, sealed wetbox or cassette inside the engine room, lowering and lifting through opening panels that close flush with the hull, usually operated by hydraulics. With the prop tucked away, clearly the benefit is reduced drag not just for straight-line speed, but for acceleration in manoeuvres too.

They appeared initially in the Volvo Ocean Race. The Dutch firm Amartech was among the first to come up with a system for the 2005/06 entrant *ABN Amro One*, an early VO70, which went on to win. Around this time McConaghy Boats in Australia also started development of a similar retractable propulsion system for its grand-prix raceboats.

In principle, both essentially adapted the conventional drive train, hinging the propeller shaft at the gearbox end and encasing the shaft within a formed fin for torsional strength when lowered.

Since then a company from The Netherlands, Ship Motion, emerged with an evolved V-bracket format and OYS (Ocean Yacht Systems) from the UK with 360° rotating pod-drives. This year builders Vitters and Baltic have each launched their own individual version of a direct drive pod which, in layman's terms, resembles a swing-arm, rotating saildrive. For its latest launch Baltic worked with Hundested and Vitters with Hydrosta.

The logic is impeccable. As Adam Batemen, the skipper of the 46m/150ft performance cruiser *Unfurled*, recently launched from Vitters with a twin pod-drive, says: "It makes a huge difference not dragging two propellers around the place, and in our case that's not dragging two



Retractable systems take considerable engineering, but make sense, smoothing the way to improved performance

“It makes a huge difference not dragging propellers around the place, and in our case that’s not dragging two propellers around”

propellers around. The boat just feels freed up, sails like a dinghy, 290 tons, but we get up on a wave and just go.” He describes it as much like an aircraft with its wheels lifted, much more efficient.

McConaghy, like Amartech, came into this sector through its search for performance, equipping its fleet right down to 12m/40ft. Standard tooling for small units includes a thrust bearing, carbon fibre wetbox and leg, manual up/down control with push button option, propeller shaft bearings, propeller and anode, and the box empties most water out to prevent carrying dead weight around. The price starts at around US\$20,000.

For many race clients the unit would be used mostly for motoring in and out of harbour rather than endless days under engine, but the bigger, more costly custom-built drives are designed for wider application and are suitable for yachts up to around 30m/100ft.

McConaghy’s record-breaking 30m *Leopard 3* is a good example. Built for transoceanic racing, regatta sailing and charter, she has MCA classification so reliability under motor is vital. “It was a no-brainer,” says *Leopard*’s skipper Chris Sherlock. “We had to have a retractable train drive. They’ve moved on somewhat since we installed ours in 2006, but it is a fantastic system, never had any problems. Very reliable.”

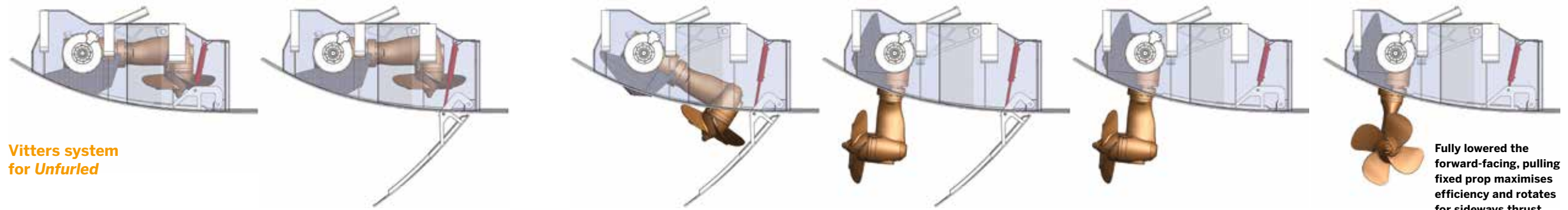
Co-owner of McConaghy Jono Morris explains: “Obviously the emphasis has always been on light weight for this style of boat, so everything was pre-preg and carbon, but the prop shafts were pretty much conventional Aquamet [stainless steel]. We looked at different options such as carbon shafts, but at the end of the day it was all about keeping these units small and compact, and going to carbon shafts just increases the diameter, which has an ongoing effect on overall weight, etc. So we kept to relatively conventional materials.”

Others came out with versions using a folding prop that retracted into a little box. But McConaghy saw that despite taking up more space internally, there were real benefits to a motor with a big fixed prop, and in keeping the



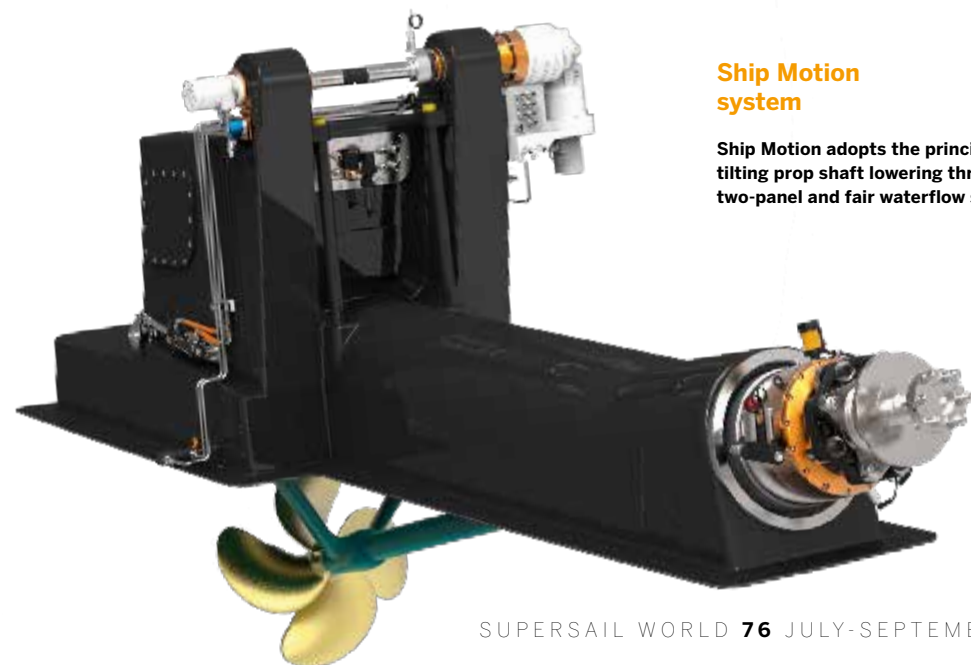
The 46m/150ft *Unfurled* launched by Vitters earlier this year with twin retractable pod-drive

Stuart Pearce Photography



Vitters system for *Unfurled*

Fully lowered the forward-facing, pulling fixed prop maximises efficiency and rotates for sideways thrust



Ship Motion system

Ship Motion adopts the principle of the tilting prop shaft lowering through a two-panel and fair waterflow system



whole system simple to operate rather than fiddling with more complicated options. Morris emphasises: “We also wanted something relatively robust as many of our boats do motor considerable distance on deliveries. Pushing the limits too far comes back and bites everyone.”

Also in the search for light weight, but robust operation, Ship Motion takes a sideways step closer to convention, opting for a V-bracket design and paying attention to a data-intelligent, touchscreen control system that manages gearbox and thrusters, ensuring adequate hydraulic flow.

“We also manage the amount of water in the wetbox,” explains Ship Motion’s co-owner Jan Bruggeman, “with an air-overpressure system that removes most of the water to reduce weight and improve buoyancy. But, for example, when heeling we can let more water back in, otherwise you get air bubbles escaping the wetbox, which can lose you some rudder grip for a short moment. With these kind of things in the system, it is not so much complex as complete.”

Bruggeman came out of Amartech and, along with a team that includes aerospace expertise, has designed and built a system to DNV classification that includes double seals on the opening. For weight saving and anti-corrosion all metal parts are of titanium, and CFD analysis of each project

optimises the shape of the underbody and the hydrodynamic flow to the propeller, which can be of bronze, titanium or carbon fibre.

Under sail the system claims a drag reduction of between 4.6 and 10.2 per cent, depending on conditions and wind angle. As with all these systems, the greater speed gains are to be made offwind, not upwind, but there’s potential to sail higher and tack faster without that sea anchor below the waterline.

The cost is around five times that of a conventional shaft and controlled pitch propeller (CPP), so for a 30m/100ft yacht that’s close to €600,000 and production takes around six months. A big part of the expense is in the control system. There is a lower-cost alternative for yachts below 30m.

Ship Motion’s first installation was quite a test. This was not a new build, but part of the extensive 2012 refit of the high-profile superyacht *Visione*, Baltic Yachts’ 45m/147ft lightweight flyer from 2003. She was back at Baltic for a considerable amount of work, all running in parallel. The installation finished well, and the smooth bottom contributes to *Visione*’s planing speeds now exceeding 30 knots. A further Baltic commission followed, the 33m/108ft *WinWin*, delivered in 2015.

The latest Baltic launch, though, drew the builder into new territory:



Baltic Yachts' *WinWin* has retractable propulsion by Ship Motion that has contributed to her race-winning performance

development of its own system in conjunction with drive specialists Hundested. This is a rotating pod with CPP rather than a shaft and fixed prop. Still known only as the Baltic 130 Custom at the time of writing, the unnamed Reichel Pugh design was nearing handover.

Baltic CEO Henry Hawkins explains: "We still work very closely with Ship Motion, but we wanted to allow ourselves different technical solutions. With this, for example, as the CPP can turn $\pm 90^\circ$ for side thrust, we do away with a conventional stern thruster. With the massive power of the main engine and associated power take-off good for bow thruster hydraulics, we don't need a generator running for hydraulic power when docking, and so the size of the hydraulic unit reduces, too."

This helps counter the inevitable space claimed by the wetbox. The Baltic system, which is available to other constructors through Hundested, can be deployed at up to 12 knots through the water and, with the CPP, full ahead to full astern can be achieved in just three or four seconds.

The Vitters/Hydrosta system installed in the new *Unfurled* is outwardly similar, yet has distinct differences. She has a fixed prop instead of a CPP and the installation is lateral, with the legs or pods swinging down from the side towards the centreline.

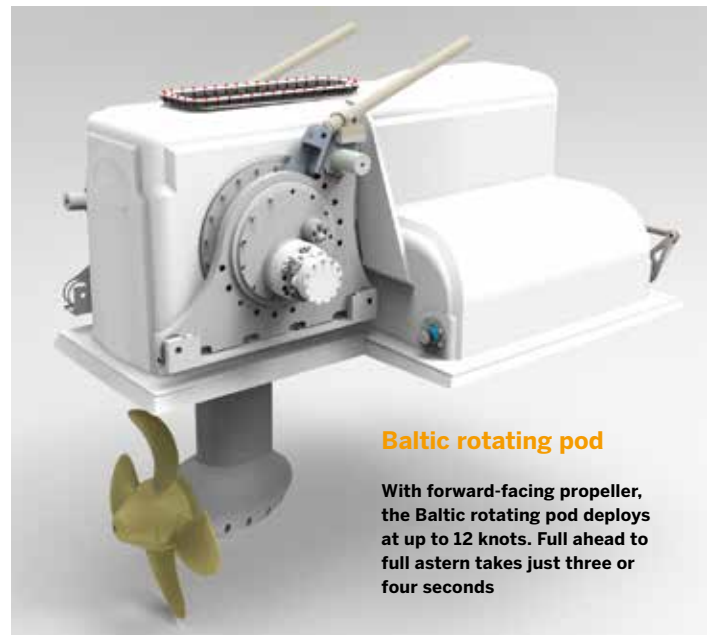
Both *Unfurled* and the mighty, feather-light Baltic *Hetairos* have twin pods. The latter is in refit in Vitters, where they will be replacing the original OYS pods with Vitters' own. For weight saving, *Hetairos* has titanium legs and a pressure system to rid the wetbox of water, while *Unfurled* sails with water in the box and bronze aluminium legs.

Joint MD Louis Hamming explains the idea behind a lateral mounting: "First, longitudinally you want the length of hole as small as possible. Big holes in hulls devastate construction people! Then there's the configuration of the engine room. Because both boats have the lifting keel box in this space as well as generators and engines, if we had made it longitudinal we would have come into the interior. So this had to be athwartships and that made the construction team happier."

It takes around 90 seconds to raise and lower the unit and, for manoeuvring, again the rotating main drives are used instead of a stern thruster and the selected drive takes just three seconds to spin 90° from ahead to side-thrust; the other then drives fore and aft.

As *Unfurled*'s skipper Adam Bateman describes, it's a novel operation: "As they're pretty much midships, you sort of pivot around the keel so when you start thrusting the whole boat parallels sideways, and then, in a way, you use the bow thruster as your rudder."

The greater speed gains are offwind, not upwind but there's potential to sail higher and tack faster



Baltic rotating pod

With forward-facing propeller, the Baltic rotating pod deploys at up to 12 knots. Full ahead to full astern takes just three or four seconds