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MOTOR BOAT

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FERRARI OF THE SEA

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JAMES MAY TELLS ALL

Top Gear star relives the race from hell

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Sea Saga 38
Grand Banks 4
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Mochi 64 Flybridg
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The best 3.5m mini RIBs battle it out on the wate

"I BEAT THE CREDIT CRUNCH
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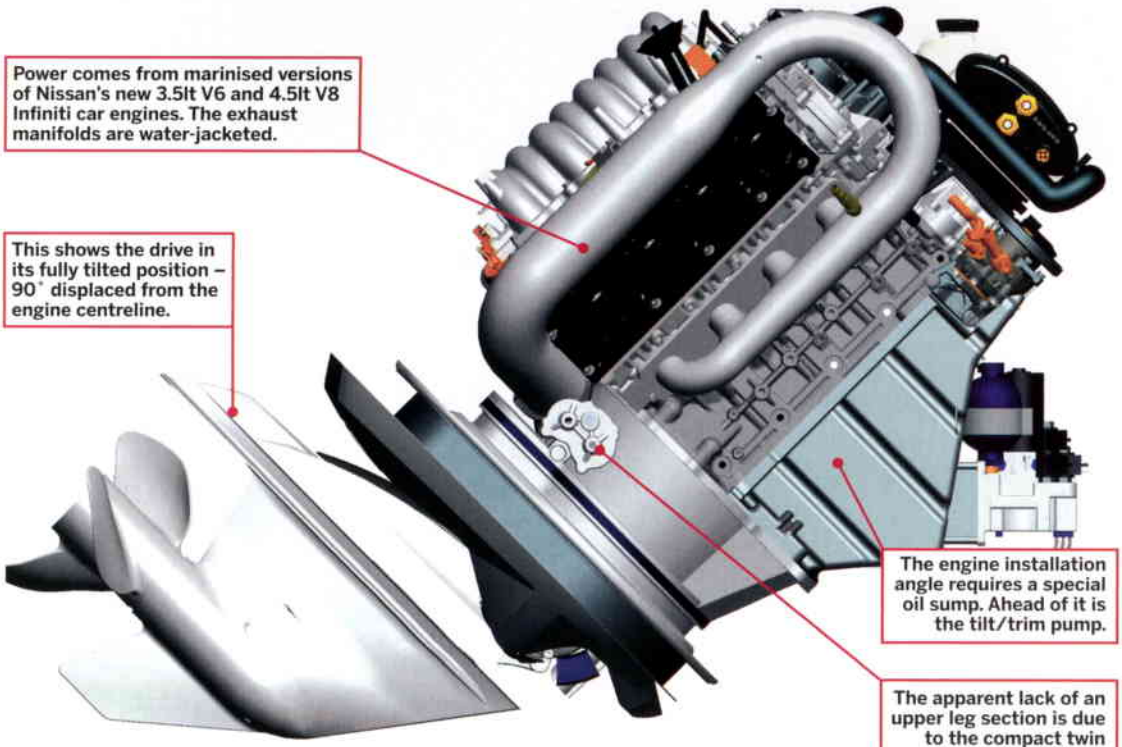
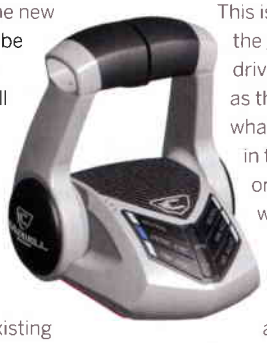


Angle of attack

Axis's surprising sterndrive solution takes up less space and has Nissan's backing

A South African engineer and a British billionaire have joined forces to produce a totally new form of sterndrive transmission that promises greater efficiency and durability. The new Caudwell Axis drive (not to be confused with CMD's Axius joystick control system) still uses an inboard engine linked to an outboard leg but in every other respect it's a totally new concept.



How Axis works

About the only thing the Axis drive shares with an existing sterndrive is that the propeller is mounted at the bottom of a leg that swivels and tilts for steering and trim. But the 'vertical' drive-shaft isn't vertical at all: it runs down at 45° and meshes with the propshaft through a single set of helical gears. The transom is angled at the same 45° and the engine is mounted directly in line with the drive-shaft at the same 45° angle. This puts the front of the power unit somewhat higher than would be the case with a conventional horizontal engine position, but not by a great deal. And it takes up much less space fore and aft.

Steering is achieved by pivoting the drive around the 45° drive-shaft axis. This is difficult to visualise, but the geometry means the drive trims in 'automatically' as the leg is turned – just what's wanted. It also results in the propeller remaining on the boat's centreline, which Caudwell say is superior to the lateral displacement caused by existing sterndrives and outboard motors.

At present, motive power for the Axis drive comes from marinised Nissan Infiniti V6 and V8 engines, which have all the latest electronic bells and whistles including variable valve timing and intake adjustment. The Japanese company were one of handful that were prepared to look at the concept seriously, and are now a full partner in the project. Three versions will be available at 250hp, 300hp and 350hp.

Caudwell have said that a diesel version is on the drawing board, although no engine partnership has yet been agreed on.

The Axis drive is constructed mostly of surgical-grade stainless steel, apart from those mechanical parts for which this material is unsuitable. This eliminates the *bête-noire* of the conventional aluminium sterndrive – susceptibility to rapid corrosion in salt water. It also looks gorgeous.

Particular attention has been paid to details like raw and closed-water systems and design of the control head. Caudwell call the electronic system DCU for Digital Control Unit – which builds on the engine's ECU to provide drive-related facilities such as gear shifting, start-in-gear protection and excess rpm engagement.

Caudwell have also taken a leaf out of the modern marine engine book in terms of servicing and diagnostics. By inserting a memory stick into a USB port in the control head, a complete runtime history can be downloaded and examined on any PC. In the event of a snag, the built-in diagnostics will not only identify the problem but provide possible solutions.

The gearbox consists of two parallel cross-shafts connected by gears at both ends to provide the necessary reduction gearing. A pinion on the short engine output shaft drives the first shaft, which includes the hydraulically operated multi-plate clutch working on a spiral spline. The second cross-shaft drives the leg output shaft via another pinion gear. Because the leg steers on the drive-shaft axis and tilts and trims on the second cross-shaft axis, all angular changes are taken care of by the meshing of the gears, eliminating the need for a universal joint. Detail design and production engineering of the transmission was conducted by the UK motor racing gearbox specialist X-Trac, and Cosworth are involved in modifying the engine supercharger.

Will it fly?

One can't fail to be impressed with the ingenuity and determination of the two men behind the drive, Mike Beachy


This shows the drives in their normal down position. Engine installation is compact but with excellent service access.


John Caudwell: small and specialist.

Head and John Caudwell, and their uncompromising approach to engineering quality. But sadly, such noble sentiments are no guarantee of commercial success.

Fortunately, both men are totally realistic on this score. "We don't see ourselves as a threat to the likes of Mercury or Volvo Penta," says Caudwell. "We want to be a small, specialist, high-quality niche player. We will support those boat companies for whom it is not primarily about price but about quality. Initially, we will be happy to produce 300 to 500 units per year. That said, we think this package is a truly viable alternative to the latest generation of very high-power outboards."

Apart from the technical aspects, there is, of course, the subject of price. Although nothing had been finalised at the time of writing Martin Bizzell, boss of Caudwell's European distributor Golden Arrow Marine, told me that it should be competitive on an hp-for-hp basis with the latest mega outboards such as the Yamaha 350.

One possible drawback is that Axis uses a single propeller at a time when twin counter-rotating props are more or less *de rigueur* for performance applications as they offer lots of blade area while minimising propeller diameter. Another big advantage of counter-rotating props is that there's no torque steer in single-engine applications. However, Caudwell say that thanks to the unusual geometry, the Axis drive is torque neutral and the single propeller can transmit all 350hp of the most powerful version into the water without problems.

The Miami Boat Show in February will be Axis's public launch with demonstration boats available.

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A boat protected by Ultra 10.

Barnacle blaster

Two new systems revive an old approach to antifouling

A hi-tech method of preventing the growth of weed and barnacles on boat hulls that first appeared in the early 1990s is back again. The ultrasonic system makes use of very-high-frequency vibrations radiated through the boat's hull in order to destroy the algae that are the basis of all weed and barnacle fouling. Theoretically, the vibrations count as sound waves but, at betwe en 40kHz and 120kHz, they are above the 20kHz upper limit of the human ear.

Although ultrasonic antifouling systems have had some success in the commercial market, they didn't take off for recreation use because they were simple analog devices that were too power hungry for sailing yachts and vessels that weren't permanently connected to shore power. But now two UK firms have taken advantage of digital technology to address the shortcomings of the original versions and relaunch the concept.

Ultrasonic Antifouling of Poole offer two off-the-shelf models, the Ultra 10 and Ultra 20 systems; the numbers indicating the intended hull length in metres. Ultra 10 uses a single transducer and Ultra 20, two. Ultrasonic can also produce custom installations for complex hull shapes such as catamarans.

Blue & Green Marine produce the Hull Protection System. This was developed for the marine market from the principles employed in ultrasonic cleaning and is another multiple transducer system. Both systems send pulsed (non-continuous) signals to the transducers, reducing power requirement dramatically.

The Hull Protection System transmits for just ten seconds per minute and average current draw is 0.6A per transducer. Utrasonic's Ultra 10 consumes between 0.8A to 1.1A.

Apart from eliminating the hassle and recurring expense of conventional antifouling, the big benefit of an ultrasonic system is that it protects items like cooling water intakes and other inaccessible areas. A good ultrasonic installation should also cover parts that are subject to high abrasion, such as props and rudders. It will be interesting to see if these systems can provide an alternative to traditional scrubbing and painting.

Above right: Blue & Green Marine's Hull Protection Scheme. Right: the Ultra 10.

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30 SECOND BRIEFING: ALUMINIUM ALLOY

- **We all know that aluminium** is light. Size for size, aluminium components are two-thirds the weight of steel but are also about two-thirds as stiff. Even if flexibility is not an issue, aluminium has very poor fatigue performance and will fail rapidly with cyclic flexing. Pure aluminium is therefore unsuitable for most structural applications.
- **Aluminium alloy** is formed by combining it with other elements such as copper, manganese, magnesium, silicon and zinc. The final characteristics of the alloy can thus be tailored to meet specific requirements.
- **Aluminium also has inferior** resistance to heat when compared with iron or steel and will melt before glowing red hot. So aluminium welding is a special skill. The aviation industry prefers adhesive bonding to welding for sheet material while the marine industry prefers riveting for cheapness.
- **Its excellent corrosion** resistance, like stainless steel's, is due to 'passivation': the forming of an impervious skin on the surface when exposed to oxygen. But unlike stainless steel the layer is normally visible as a dull white sheen.
- **Wrought (sheet) aluminium** is designated by a four-digit number, which indicates the alloying elements. There are five marine alloys in common use, which fall into either the 5000 or 6000 series – these are referred to as 'marine grade aluminium' as they have increased resistance to salt water: 5052, 5083, 5086, 6061 and 6063.
- **However, even marine grade** aluminium is extremely susceptible to galvanic and stray current corrosion. These days, sterndrives are usually protected by aluminium alloy anodes that are lower down the galvanic scale than the material used for the legs.