THE TEST

We used a Bénéteau Océanis 323, kindly lent to us by Sailtime in Lymington. She has a typical fin keel form, but atypically she has a built-in skeg carrying the shaft, rather than the P-bracket or saildrive of most other modern yachts. The skeg protects the shaft and prop from underwater damage, but a downside is increased vibration as the blades of the prop pass through the disturbed waterflow behind the skeg. This is resolved in normal use by fitting a three-bladed prop as standard rather than two, but otherwise did not alter the propulsive element of our test for either two- or three-bladed units.

The engine was a Yanmar YM20, giving 21hp at a maximum 3,600rpm. The gearbox ratio is 2.6:1 in ahead, but somewhat confusingly a higher ratio of 3:1 in reverse. This is a very common engine/gearbox combination, so not an unreasonable test. Yanmar says it gives better thrust in astern, but in practice it meant the folding props were forced to use a compromise pitch. Some of the feathering props were able to set a different astern pitch.

We measured thrust, or 'bollard pull', in ahead and astern, throughout the rev range, using a load cell borrowed from Diverse Yachts, with a remote read-out. We then measured the side-thrust at full power in astern. This enabled us to predict the prop walk created when you go into astern. To put this figure into context, the thrust produced by the worst prop in our test is the same as a 3hp outboard mounted on the transom, driving at right-angles at full throttle. No wonder so many yachts veer off to one side!

On the water, we measured speed through the rev range to maximum. We then carried out a crash stop from 6 knots. We recorded the time it took to bring the boat to rest at full throttle from the moment we engaged reverse gear.

To put these times into context, the distance the boat would travel before stopping would be 12m (39ft) with the best prop tested, but 17.4m (57ft) with the worst.

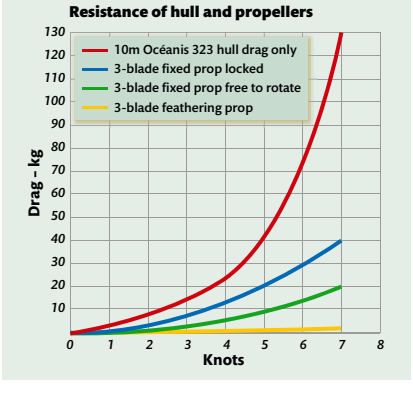
To measure the drag of all 15 propellers precisely enough to compare them with one another, making allowances for different yacht hull forms, we would have had to build a sophisticated testing rig, hire a team of scientists and spend several days in a research laboratory with a very large towing tank. Our objective was just to demonstrate the difference in drag caused by different types of propeller.

We fitted a fixed prop, then a folding one, then a feathering one, to an outboard motor leg mounted on the transom of a lightweight 14ft skiff. We then towed the skiff at speeds up to 7 knots, and measured the difference in drag. We don't claim this gave us the last degree of accuracy, but it was sufficient to compare with published drag figures. We then compared this drag to the hull-only drag of the Océanis 323 – a typical 10m cruising yacht.

Measuring prop walk. INSET: The Océanis 323 has a typical modern hull form

ABOVE: The load cell shackle was crucial for accurate measurement; Emrhys records a 'bollard pull'

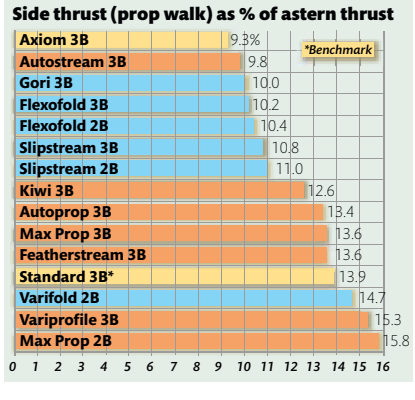
DRAG CURVES



At 5 knots, a fixed three-blade prop with its shaft locked creates almost half as much drag as the entire hull. The drag can be halved by allowing the prop to spin, but the gearbox may suffer. By contrast, the drag of a feathering prop is negligible, and the drag of a folding prop is too small to plot on a graph of this scale.

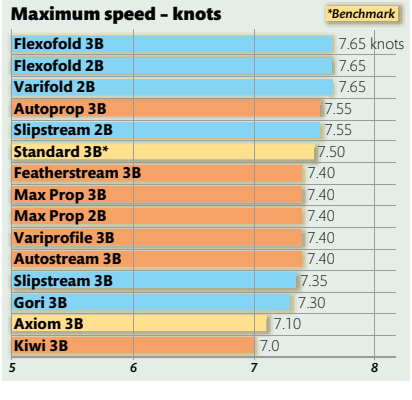
The hull resistance curve for the Océanis 323 was calculated for *YM* by the Wolfson Unit, at the University of Southampton, using data from the Delft University Systematic Series. The propeller drag curves are based on data from SSPA Maritime Consulting, using Volvo S-drives. This data was verified by *YM*'s on-the-water drag test.

PROP WALK



All but three of the propellers on test produced less prop walk than the standard fixed prop. The fixed Axiom and feathering Autostream were the best performers, but nearly all the folding props fared better than the rest of the feathering propellers.

MAXIMUM SPEED



There was more than half a knot of difference between the best-performing props and the worst. Four folding propellers and one feathering prop managed to prove the claim of better performance than a standard fixed prop, but nine of them fell slightly short.

Interestingly, some of the best performers were two-bladed props, which are widely assumed to perform worse than three-blade versions.

Drag test rig: the props were mounted on a lightweight skiff

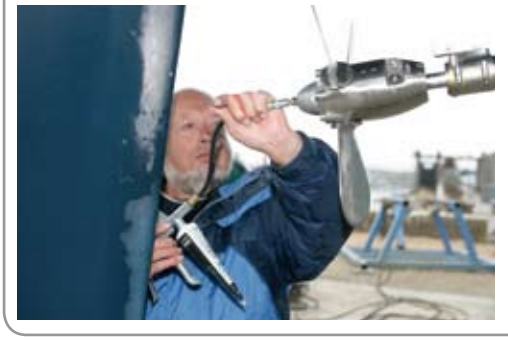
PROP TIPS

FITTING

Some of the props on test are very simple to install, others are very complicated. However, while they all have instructions for DIY fitting, unless you're very confident in your own skills, a piece of equipment as vital as a propeller ought to be professionally installed, both for safety and peace of mind. For our test, we had every prop fitted by the manufacturer's representative, so there was no question about the installation, and they also observed all our tests and measurements.

MATERIALS

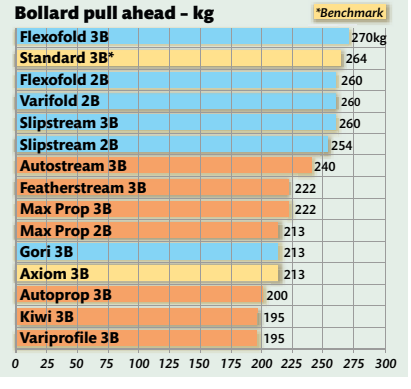
Propellers have been bronze almost since they were invented. Strong, resistant to salt-water corrosion and easy to cast with a low melting point. Stainless steel has been making an appearance recently. Even stronger, it allows thinner blades, which are more efficient. It is even more corrosion resistant, and also harder, so less vulnerable to impact damage. However, its higher melting point means it's more difficult and expensive to cast and machine. The Kiwi prop has plastic blades, even more resistant to corrosion and easier to cast.



MAINTENANCE

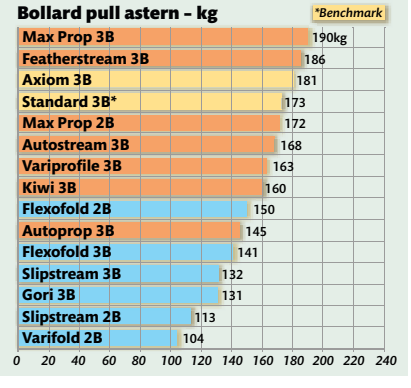
Whatever prop you have, it should be checked every time the boat is lifted, for wear, corrosion and movement. Folding and feathering props do require more maintenance than fixed ones. Some bosses are packed with grease, which should be repacked annually. Some have nylon shims or bearings, which should be checked regularly, especially in silted waters. Most props have an anode, which should be checked and replaced if necessary.

BOLLARD PULL: AHEAD



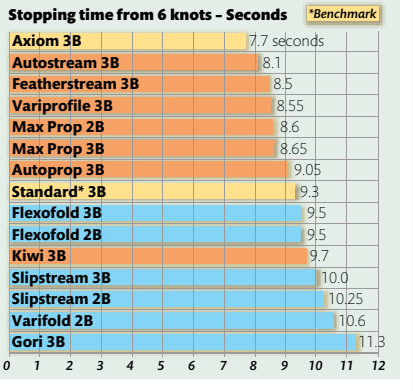
Our bollard pull test shows that the fastest propellers are generally also the most powerful in ahead, and most of the slower ones are among the least powerful. However, only one unit – the three-bladed Flexofold – generated a greater bollard pull than the standard fixed prop. There was a considerable difference in performance – the most powerful props tested produce almost a third more thrust than some of their rivals.

BOLLARD PULL: ASTERN



Three propellers produced a more powerful bollard pull than the standard fixed prop in astern: two folding units and the newly designed Axiom. Nearly all the feathering props performed better in astern than the folding ones – some by a very wide margin. There's a huge difference between the best and worst-performing props – the three-blade Max Prop has almost twice the bollard pull of the two-blade Varifold.

STOPPING TIME



The new-concept Axiom prop excelled in this test, but nearly all the feathering props were better at bringing the boat to a standstill than the standard prop. The difference between the best and worst stoppers was about 3½ seconds or 18ft in distance (39ft being the shortest stop and 57ft the longest) which is over half a boatlength in our 32-footer. It may not sound like much, but in a crunch, it could make all the difference.

CONCLUSION

If you want to add up to a knot to your boatspeed, then fitting a folding or feathering propeller is a must, not just for racing boats. And as our test demonstrates, you can usually still retain the handling and performance under power that you had with a standard fixed-blade prop. In fact, often you'll get better performance.

Five of the tested props gave more speed than the standard prop, with four of them being folding models, and both Flexofolds coming out top. And even though it was only 0.15 knots better, when you look at the hull resistance curve this is a considerable improvement. On the other hand, with astern performance, in general it was the feathering props that came out best, with better bollard pull than the standard, and better stopping times, and the Autostream coming out top. The folding props were generally not as good as the standard, though in the main only by no more than 10%.

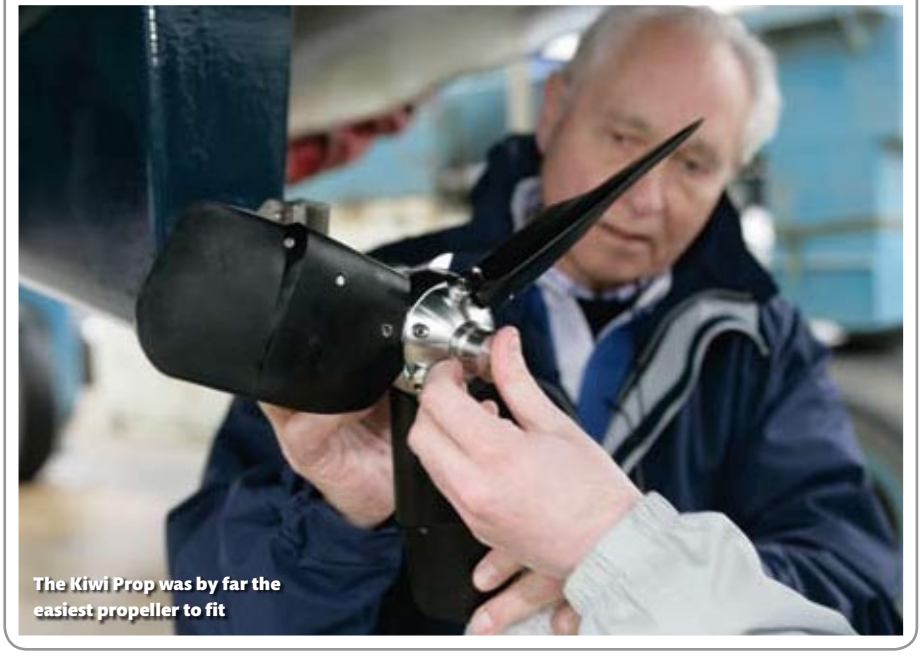
The prop walk figures were most revealing. Ten of our test units gave less prop walk, with generally the folders coming out best, but the top units being the Axiom and Autostream, with 30% less side-thrust than the standard fixed three-blade, a considerable advantage when you have to stop suddenly or back-up in a marina.

Our test shows that letting your fixed-blade prop spin, if the gearbox manufacturer will allow it, halves the drag. But fitting a folding prop will give at least 95% less drag than a locked, fixed propeller, while a feathering unit will give at least 92% less drag – still an enormous saving.

But these benefits do have a price, literally on your wallet. A 16in fixed three-blade propeller will cost around £300. The cheapest two-blade folding prop will cost at least double, with most of them between £600 and £900. For a three-bladed folding unit, expect to pay between £1,200 and £1,600. With the exception of the £985 Kiwi Prop, feathering props are even more expensive, starting at around £1,200 for a two-blade model, rising to £2,100 for the most expensive three-blade version.

Because of the wide variation in cost, performance and specifications of the units tested, we have not felt it appropriate to recommend a best buy. The tables and curves give you the information you need at a glance, allowing you to make your own decisions as to which is best for you and your boat.

Our test was only able to measure one set of circumstances, and one model of boat. If you have your own experience of props, good or bad, let us know.



The Kiwi Prop was by far the easiest propeller to fit

CRUISING OR RACING?

Some folding prop manufacturers now sell cruising and racing versions of their products. To minimise drag, racing units fold up tightly and create less drag, perhaps gaining an extra tenth of a knot of boatspeed. However, they don't perform as well when the yacht is motoring and can be more reluctant to open when the engine is engaged.

GORI

Gori recommended the15x12in three-blade propeller for our test. Subsequently, they have suggested a 16.5x11in would have given a better performance, as the engine was over-revving with the smaller prop. All manufacturers were given the same information regarding dimensions, specifications and test conditions. Gori says a prop test carried out by French *Voile* magazine, using the 16.5x11in propeller and a similar size engine, produced very different results.

THANKS

Testing 15 props in two days placed big demands on Lymington Yacht Haven's hoist team. Their professionalism, good humour and willingness to help meant the test went without a single hitch. Our thanks go to all at Lymington Yacht Haven for their considerable part in this test's success.

Lymington Yacht Haven
Kings Saltern Road
Lymington, Hampshire SO41 3QD
Tel: 01590 677071

Our thanks go to Sailtime, the sailing membership scheme, for agreeing to let us use its pristine Océanis 323, *Aragorn*, for this test. Not for the first time, Richard and Sue went out of their way to help us get what we needed and once again we're very grateful to them for their help.

Sailtime Lymington
19 Waterford Lane,
Lymington, Hampshire SO41 3PT
Tel: 01590 688 008 or 07809 444480

The load cell used to measure the bollard pulls and prop walk was supplied by Diverse Yacht Services. Diverse has been a major marine player since its foundation in 1982. Then as now, the company supplies and tunes electronics and load cells for the world's leading racing fleets.

Diverse Yacht Services
Uni 12, Port Hamble, Satchell Lane,
Southampton, Hampshire SO31 4QD
Tel: 023 8045 3399

To understand better what happens to feathering and folding props changing from ahead to astern, we needed to watch them do just that. We used a Scubar Pro unit – a waterproof video camera mounted on a pole that displays recordable video on a screen. See *New gear*, p88.

Scubar
Sailmakers Loft, Kings Copse Farm,
Tanhouse Lane, Botley, Hampshire SO30 2SZ
Tel: 023 8045 4484