CLUB MARINE

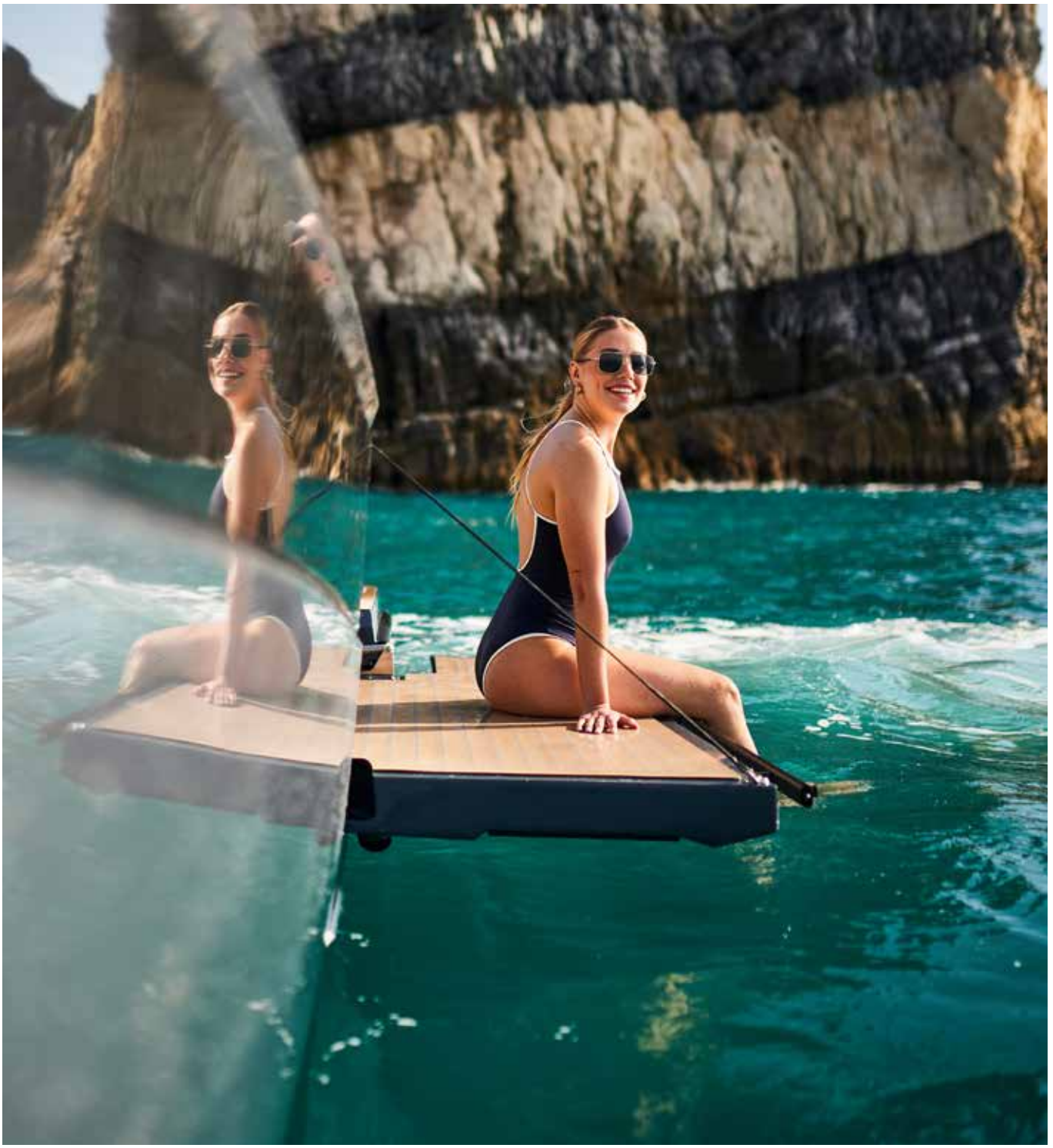
Vol. 39 No. 3

June-July 2024

AUSTRALASIA'S LEADING MARINE LIFESTYLE MAGAZINE

CLUB MARINE

Vol. 39 No. 3



VIRTUES OF THE V10 T-TOP AUSSIE HYBRID POWER HOW TO CATCH KINGIES
THAI ISLAND CRUISING SPEEDBOAT STEERING SYSTEMS JETSKIING IN SURF

Print Post Approval 100008056.

SILENT **KNIGHT**

Driven to reduce the running costs and emissions of motor cruisers, Aussie engineers have pioneered a hybrid propulsion system for an evergreen Steber.

By Mark Rothfield

you can indeed teach an older hull new tricks

Ask boatbuilder Alan Steber whether his 4380 hull runs trim tabs and there's a good chance you'll score a backhanded slap on the bicep, as I did. It speaks volumes for the pride that Alan holds in the design efficiency of this evergreen, bluewater workhorse.

No, it doesn't need assistance to perform. Yet nowadays you can't really say the same for the combustion engines propelling it, which is an increasing concern as folk pay more heed to environmental vulnerabilities and future responsibilities.

Fortunately, an engineering team from NSW's Hunter Region has shown that you can indeed teach an older hull new tricks. Together with Alan Steber, they've spent six years researching, developing and perfecting a hybrid electric drive system that could revolutionise new installations and repowers in the future.

Above: The recreational flybridge version of the Steber 4380 hull shows its efficiency on glassy waters.

Below: Twin 640hp Caterpillar diesels filled the engineroom prior to making way for modern electric plants and battery sytems.

Like many grand design projects, this one began with very different intentions. Steber simply wanted to build a commercial vessel that could operate in stealth mode, allowing police to sneak up on crooks at night – and allow maritime inspectors or marine parks service vessels to conduct operations too – and for marine rescue crews to better hear cries and whistles for help. That's difficult to do with two thumping diesels, which meant exploring electric options.

TAKING CONTROL

First stop was Ampcontrol, an engineering firm based near Newcastle. They, in turn, contacted the University of Newcastle, and a triumvirate was formed.

"We took Alan up on the challenge," explains Ampcontrol Engineering Manager Steve Mitchell. "We secured a couple of small government grants, then initially conducted modelling to look at return-on-investment based on different battery sizes, different engines and different operating conditions.

"On the basis of those findings, Alan built a very rudimentary 22ft (6.7m) hull and we fitted

go from dawn till dusk purely with whisper-quiet, effective, emission-free operation

a Cummins diesel generator and some clever power electronics that we developed with the University of Newcastle. It ran an 80kW electric motor, plus we had 38kWh of lithium ion phosphate battery power.

"When we demonstrated it on the river at Taree, it went wonderfully; attracted quite a bit of media and political interest."

Using a modified 4380 hull, the new 40 Hybrid is conceptually similar to the 22 but has twin electric motors spinning shafts, with up to 600kW at its disposal. Its 150kWh battery bank has three times the capacity of a Tesla Model 3.

The hybrid's system then allows for three performance modes – full electric (up to 300kW), full diesel generator (up to 300kW), and combined generator/electric (up to 600kW).

Above: One of two electric motors in the Hybrid, with associated wiring and cooling. The adjacent black boxes contain the battery bank, keeping weight central.

Below: Located aft and on the centreline, the 300kW diesel generator feeds power directly to the motors, not the shafts.

Under electric-only drive, the system provides speeds of four knots (7.4km/h) for around 12 hours, eight knots (14.8km/h) for three hours, or 30-minute sprints at about 20 knots (37km/h). Having the 300kW generator overcomes any range anxiety as it can power the electric motors and/or recharge the battery.

That's not to suggest the genset is connected to the shafts. Rather, it is a series hybrid configuration, allowing the generator to supply electrical power straight to the battery's DC bus.

The gen-electric mode affords the benefit of instant torque from take-off, no gearbox crunch or turbo lag, and greatly reduced vibration. We saw top speeds of around 26 knots (48km/h) on Newcastle Harbour.

"If you're out wining and dining with friends, you could go from dawn till dusk purely with whisper-quiet, effective, emission-free operation as an electric vessel running on battery," adds Mitchell. "But if you need to go faster or further, you're only limited by the size of the fuel tank, the same as with conventional diesel-driven configurations."

Afterwards, the 40-footer can be plugged in and recharged at a dock using standard three-phase power outlets via a 60kW onboard charger; there's no requirement for marinas to install dedicated charging infrastructure. Alternatively, the boat can be recharged by its own generator.

KEEPING COOL

Electric motors have relatively few moving parts but operate at high rpm, making cooling imperative. In this case, Ampcontrol's team has tapped into the infinite supply of cold seawater surrounding the hull, sending the water through a glycol-filled heat exchanger.

But not only are the electric motors water-cooled, the batteries and charging system are too. Lithium-ion phosphate batteries are employed for added safety, which Mitchell explained were drop-tested, overcharged, over-discharged, compressed and short-circuit tested to ensure robustness.

Lead-acid batteries are used for starting the diesel and running the control gear, but otherwise the 40 is powered from its lithium bank. An inverter provides 240V as required.

Underway, proprietary software determines how the generator's power output is apportioned between the motors and batteries. As an example, while we were running at eight knots, the gauges showed 50kW to the shafts and 35kW to battery charging. If the batteries are fully charged, then the electrical power is utilised more by the motors.

On a delivery trip from Pittwater to Sydney, the Steber left with 40 per cent battery level and arrived with 80 per cent. Ideally, though, it is more cost effective to plug in and leverage the land-based electricity grid.

COST FACTORS

According to Mitchell, the hybrid system commands a price premium of around 25 to 30

OLD WAYS AND THE NEW WISE

It might surprise some to see 78-year-old Stebercraft International at the vanguard of hybrid technology, given the popular perception (or misconception) that elderly people and venerable companies are wont to lag behind the times.

That's until you realise that wizened boatbuilders like Alan and his dad Bruce have pioneered new technologies continually since day dot. In the marine industry, you either pivot or perish.

A tour of Stebercraft's factory on the NSW Mid-North Coast reveals a mix of time-honoured business practices and cutting-edge innovation. One room houses clip folders containing a paper trail of every commercial vessel ever built there. Another has blueprints for unmanned defence craft and concepts too confidential to mention here.

At the same time, the in-house R&D team is busily experimenting with carbonfibre foils to generate lift, improve planing efficiency and reduce power demands.

"It's not just keeping up with the Joneses, we're getting ahead of the game," says Alan Steber, the general manager. "We're thinking outside the square, because electric boating and sustainable boating are the future."

While the company's commercial vessels are in high demand, Stebercraft continues to offer eight recreational models ranging from 28ft (8.5m) to 65ft (19.8m). The flagship utilises Precision Marine moulds that Steber bought and trucked over from WA. The yard also has ex-Westcoaster moulds that extend to 72ft.

As testament to the construction quality, a 4380 was recently built for a Perth buyer. It was launched, sea trialled then delivered by sea, via the Great Australian Bight, without a hitch.

Displacing 16t with an enclosed flybridge and full fitout, the 4380 runs twin 640hp Caterpillar diesels, although Alan says anything above twin 500hp engines will suffice. As mentioned, the same hull is utilised by the 40 Hybrid, where the 300kW motors equate to approximately 400hp apiece.

The hybrid technology can be applied to all models within Steber's range, and many others.

"Why are we doing all this?" Alan concludes: "Because we love it."

Above: Alan Steber, left, and his father Bruce have adopted countless new technologies in the boating market. They now see a bright future for electric-diesel hybrid propulsion.

Where the concept has huge potential is with repowers

Above: Dashboard screen presents a wealth of information.

Below: Hybrid power helps the environment and running costs.

per cent above a diesel installation. Commercial operators could typically recoup that in three or four years.

A pleasurecraft may take longer but resale values would be substantially enhanced by the silent operation, lack of fumes and reduced engine maintenance – or what Mitchell calls the 'pleasure return on investment'.

Where the concept has huge potential is with repowers. As Alan Steber says, a fibreglass hull can have a 50-year working life, but not so its diesel engines.

"If you've got a vessel that's coming in for a major refit, we like to say that we won't only give it a second life, we could make it better than when it was first born," Mitchell adds. "We could also utilise one of the old diesel engines as the generator and cannibalise the other one for parts."

For weight balance, the batteries are generally housed where diesels would normally go, and the generator where a fuel tank would go. Even the propellers can potentially be salvaged.

After six years, Ampcontrol believes the concept is now market-ready. The 40 Hybrid was revealed at the recent Sanctuary Cove International Boat Show and henceforth it will be available to paying customers.

"I'd suggest that the modest premium is worth it, because it is so much nicer to have this vessel," concludes Steve Mitchell. "It really does tick a lot of boxes for both the pleasurecraft owner and the commercial operator. If I could afford a leisure craft, a decent leisure craft, there's absolutely no way I wouldn't go hybrid." CM