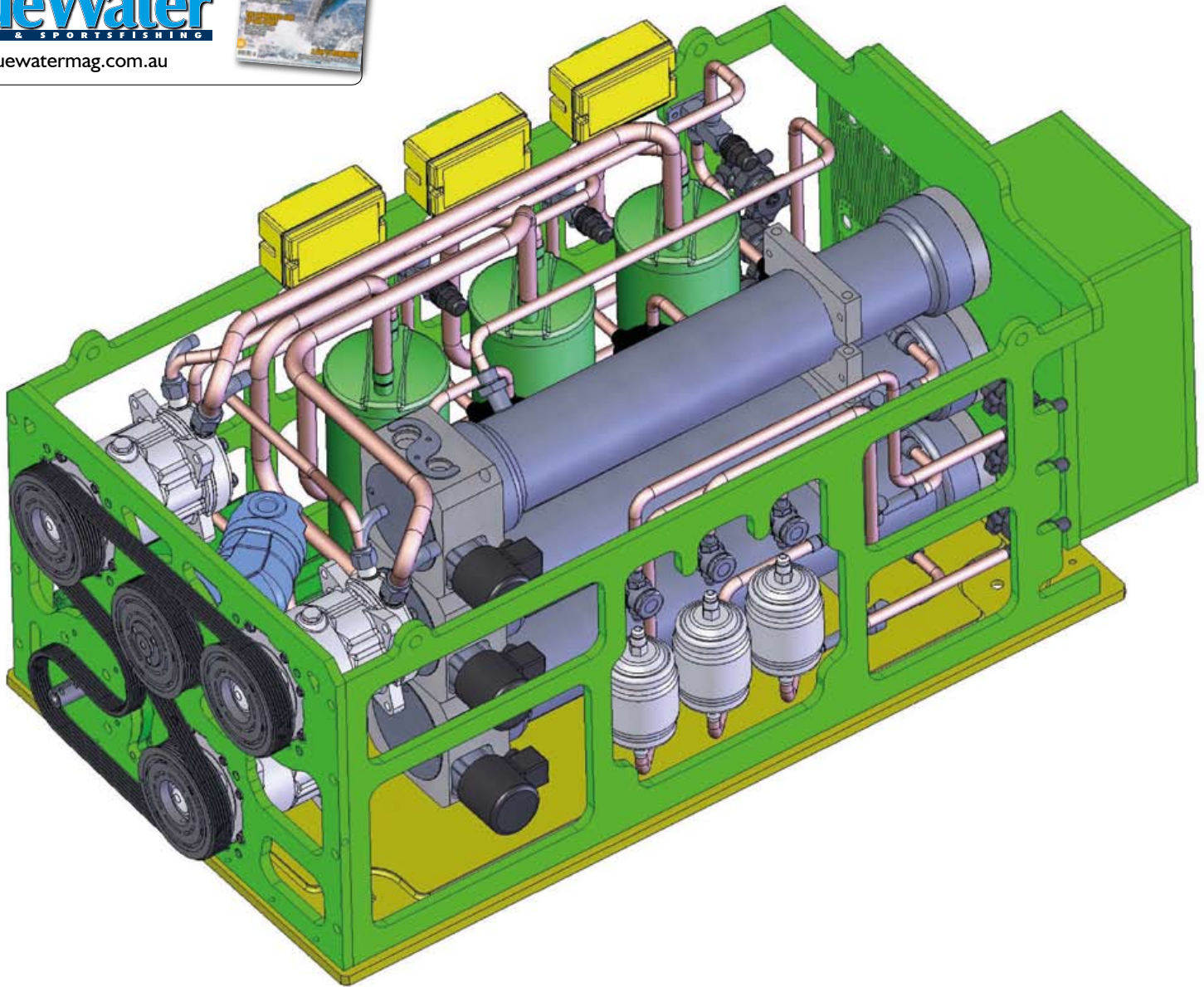


This article is provided courtesy of
BlueWater Boats & Sportsfishing magazine.
It originally appeared in Issue 86, 2011

BlueWater
BOATS & SPORTSFISHING

www.bluewatermag.com.au



Paul Jindra's revolutionary Energy Conversions system

Renowned Australian custom gameboat designer and builder David Pleysier reveals his long quest for a revolutionary system to power onboard machinery. Finally he discovers the breakthrough in Jindra Energy Conversion's Combi VI unit. This single device incorporates air-conditioning and refrigeration compressors, high-pressure pumps for both the desalinator and deck wash, and a cruise alternator, plus more.

AUTHOR: DAVID PLEYSIER
PHOTOGRAPHY: PAUL JINDRA; WARREN STEPTOE; TIM SIMPSON
ILLUSTRATIONS: PAUL JINDRA

Jindra Energy Conversions (JEC) first came to my attention during a search for components to incorporate into my XP-29 project to enable single-engine, fixed-propeller boats to be directionally controlled while travelling in reverse. JEC is renowned for specialising in high-quality marine components for electrical and hydraulic applications, and I have known Paul Jindra, CEO, for many years. In that period I had numerous informative discussions with him regarding the application of energy conversion units.

Our projects were similar in that both systems require reasonably constant speeds to maintain optimum functionality – a requirement, extremely hard to achieve, when mounted in any particular position to a main engine with rpm variations between 850-3800. This shared challenge saw us working together on a project recently, and prompted me to share the experience in this article.

SEARCH BEGAN WITH PANNAWONICA

My quest for the ultimate energy conversion system began in the early '70s when I was selected by the late Sir Garrick Agnew to construct his 52-foot gamefishing vessel *Pannawonica*, launched in 1971. Garrick, who received his knighthood in 1983, was fervent about weight. As a consequence, he was on a continuous search for support systems that would minimise the weight of his boat.

One unit of particular interest was an evaporative water desalinator operated by a hot-water pump and a cold-seawater pump, both of which were driven by one of the main engines. There was also a small electric motor in the evaporation chamber.

The unit worked quite well while at cruising speed, but as the boat spent most of the day trolling for marlin, the majority of water was made during the trip home, which was not long enough to fill the water tank. This resulted in poor performance due to decreased hot-water flow to the evaporative chamber. It was at this time we realised the necessity to produce something with more constant speed.

Another issue was the 32-Volt DC electric refrigeration unit with a water-cooled condenser, only large enough to service the custom-built, galley fridge/freezer. On deck were two large iceboxes, which were quite



common in the early 1970s – no problem if bulk ice was available on a daily basis. As this boat did an annual run from Fremantle, in the south of Western Australia, to Cairns, spending up to six weeks or more fishing for giant black marlin, it soon became problematic to preserve baitfish and frozen food for the crew.

It was decided to install an engine and electric-powered refrigeration system to service the iceboxes, which enabled them, with the use

of eutectic tanks, to become freezers. The electric system was incorporated for marina use while the boat was in port.

To obtain the necessary result, due to engine-speed variations, an open-unit refrigeration compressor was used with a seawater condenser. This was driven from the main engine PTO (power take-off) through a lay-shaft fitted with an electric clutch to facilitate temperature cycling. The same applied to the electric motor, but only one seawater pump was

Above: Building Sir Garrick Agnew's *Pannawonica* in the early 1970s led David Pleysier to search for an energy conversion system like the one finally delivered by Jindra's Combi VI unit.

Paul Jindra with his Combi VI energy conversion unit.



“No increase in fuel consumption from the propulsion engine when the Combi is deployed.”

used for cooling (the details described are kept as simple as possible for the purpose of this article). This system worked quite well for a couple of seasons, but was not without fault. With the issue of the desalinator unresolved, it was decided to install a hydraulic system in an attempt to control the speed of the various systems.

This consisted of two constant output pumps, one on each engine, as Sir Garrick did not want to risk losing all systems due to one engine failing. A bilge pump, desalinator pumps and compressor were fitted with hydraulic motors. Control valves were fitted to manage the exact speed of each unit. Although the system’s designers assured us from the beginning that no water-cooled heat exchanger would be required (as the flow rate would be

very small), upon system start-up it soon overheated. This in turn required the fitting of a titanium heat-exchanger, which proved to be the number one mistake. This device was sharing one of the main engine’s cooling systems, and we were very dependent on one engine never failing.

This system worked successfully for a number of years, but resulted in multiple ruptures of high-pressure hoses, making us aware of the dangers involved in the way the system was designed and installed. This resulted in the system being completely removed during *Pannawonica’s* 1977 re-fit.

SECOND TRY

Prior to this refit, we completed the construction of *Seastrike* with the installation of an improved version of the engine and electric system. This was then duplicated and mounted in *Pannawonica* with positive results. In fact, it was still performing satisfactory when I relocated from Perth to Brisbane in 1983.

During the period 1977-1983 there was a tremendous improvement in air-cooled technology. This made it possible to successfully utilise air-cooled, sealed refrigeration units in boats – subject, of course, to a good air supply. Also popular were the high-speed, engine-driven air-conditioning compressors. These were relatively easy to install, with a seawater condenser usually plumbed into the engine-cooling salt-water circuit.

As technology evolved, gamefishing boats were fast becoming highly sophisticated fishing machines, with air-conditioning, multiple refrigerator/freezers, desalinators, high-pressure deckwash pumps, power steering, auto-pilots and cruise alternators. All of these systems usually require access to engine PTOs to drive them, which is not an easy task and often not possible without the use of lay shafts.

ENTER PAUL JINDRA

Let’s fast forward to the present day and to Paul’s Jindra Energy Conversions (JEC).

After assuring me of the availability of a suitable system for my XP-29 prototype, our conversation became focused on his latest development: the Combi VI.

This unit combines everything we thought was necessary in a device such as this during the 1970s, with the bonus of many additional extras

we hadn’t considered! Hydraulically driven – at controlled speeds – it consists of one single unit, and can basically be installed anywhere within the engine room. The only part fitted to the engine PTO (gearbox-end or flywheel) is the hydraulic pump. The system incorporates air-conditioning and refrigeration compressors, high-pressure pumps for both the desalinator and deckwash, and a cruise alternator.

Should a back-up unit be more desirable, it can be fixed either in tandem or with a pump connected to the second engine. It can also be extended to incorporate a ‘Get Home System’ for single-engine installations, stabilisers and many other hydraulically driven systems. Once a suitably sized generator is installed, the entire system can operate on an electric/hydraulic basis.

NOW IN USE

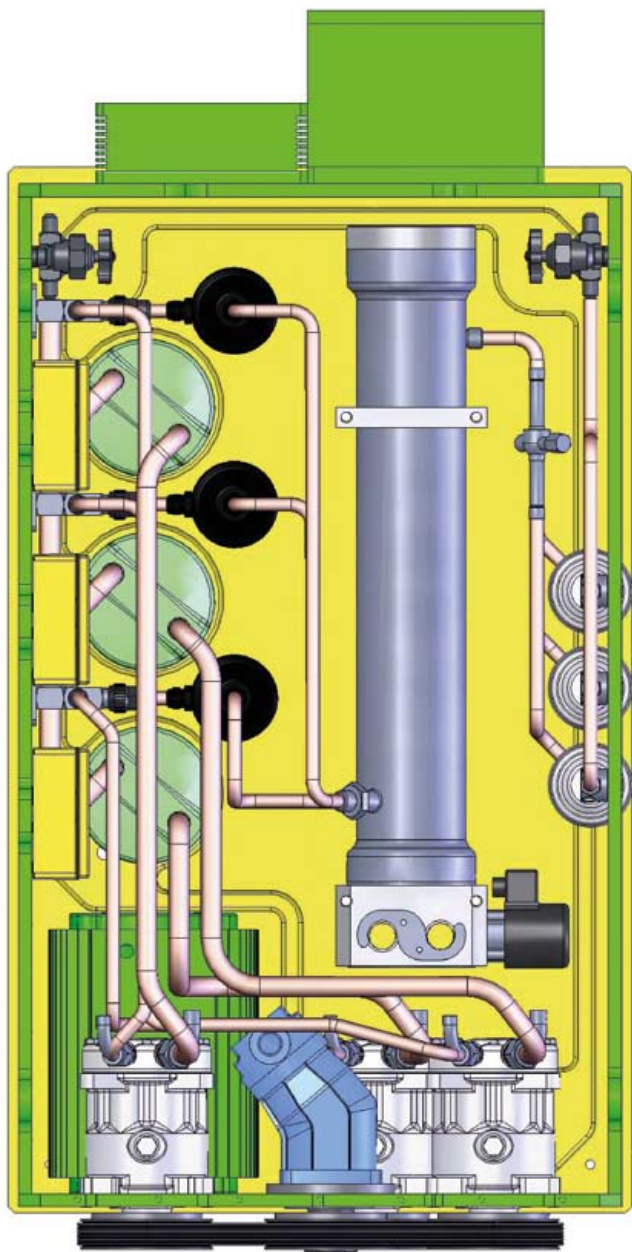
A number of these units have already been installed in gamefishing boats. In February this year, Paul invited me to evaluate the installation and operation of his Combi VI aboard the charter gameboat *Kekōa*, which is a custom-built O’Brien 56 Sportfisherman commissioned a little over a year ago. Top honours go to Capt Luke Fallon, as the boat was in immaculate condition, especially the engine room.

Paul drove from Melbourne with his testing equipment a couple of days earlier to perform the perfunctory annual service of the Combi VI. Upon my arrival, the unit was operating on shore-power with one compressor engaged to operate the air-conditioner.

The Combi VI installed in this case has three independent condenser systems equipped with Sanden heavy-duty compressors. These are designed to operate with 404A gas and are water-cooled and colour-coded. One is set up for air-conditioning and the other two for temperature-adjustable refrigerators or freezers. The air-conditioning unit is equipped with a feature called ‘capacity control’.

A number of evaporators can be connected to the unit, as it will automatically adjust in accordance with the load. The total refrigeration and air-conditioning capacity of one system is 100,000 BTUs, which is sufficient to operate a boat up to 56ft.

The Combi control system can drive up to 25 Combi units in parallel, which gives a total capacity





of 2.5 million BTUs. The system is dual-powered: hydraulically by the propulsion engine, and electrically via shore power or gen-set. The electric motor is a three-phase brushless motor, utilising single-phase power, which is converted to 400V DC, and powers the unit the same way as a three-phase motor.

The brushless DC motor has two functions. One is to power the unit from single phase, and the other to produce single-phase 240V 50Hz AC with 4kW power (like a cruising alternator) when the hydraulic system is deployed. All of the condensers and their compressors are powered by the use of soft starts, so there are no overloads on the gen-set or shore power.

All of this comes with its own frame as a 'plug and play' configuration, remotely controlled with very simple-to-follow instructions and a second-to-none diagnostic monitoring system. The hydraulics have a low oil-pressure shutdown valve, but I feel some sort of warning system should be installed to monitor the oil level in the reservoir tank. This would prevent automatic shutdown due

to the pump on the engine being out of oil.

As a standard configuration, a high-pressure CAT pump is fitted to the system that is used for desalination and deckwash. The desalinating unit is capable of producing 200 litres per hour, and the set pressure is continuously monitored and adjusted without the need to manually set-up the orifice valve. In addition, the unit can be programmed for the number of litres required, and automatically stop once this volume is achieved. Pressure can be adjusted on the deckwash depending on how much is required.

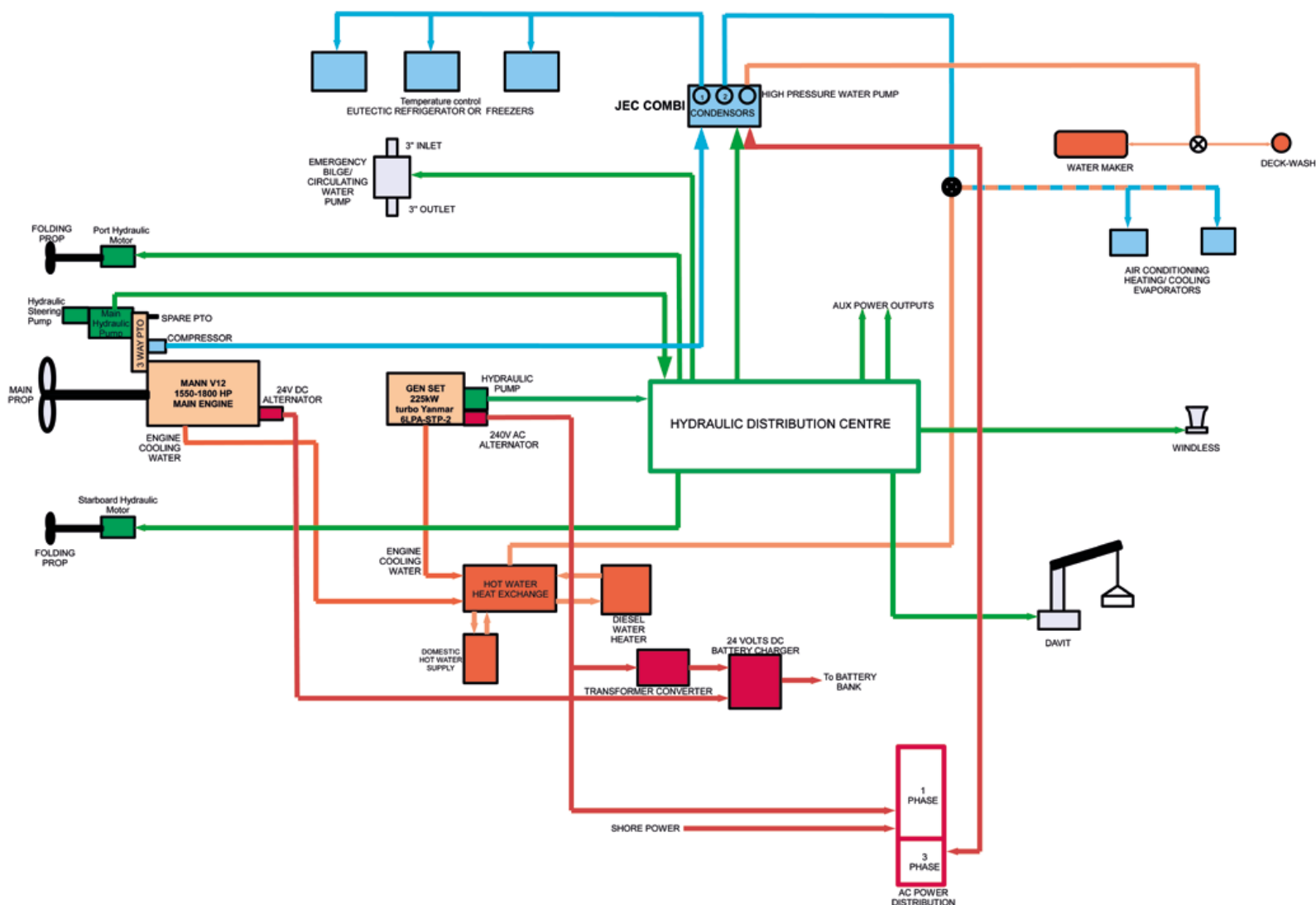
Despite the engine rpm variations (800-2400), the hydraulic system with its electronic and mechanical controls is capable of holding constant rpms on the compressors to within 15rpm. Capt Luke Fallon reports no increase in fuel consumption from the propulsion engine when the Combi is deployed, regardless of the rpm. When the vessel is under way, the gen-set is not utilised. The entire unit is no larger than a 12kVA generator.

Overall, I was most impressed



by the quality of workmanship, engineering and electronic remote-monitoring systems. I can see a great future for this type of system in boats, particularly when you add additional items like power steering, trim-tabs, anchor winch, davit and stabilisers. Any of these devices can be operated by multiple pumps driven from one engine PTO, if so desired. To find out more about the potential for Paul's system in your boat, visit: www.energyconversions.com.au, or call Paul on +61 3 8872 6555.

Above: This JEC Combi VI unit sits snugly in the engine room of the O'Brien 56 Sportfisherman *Kekōa* (shown at top).



Paul Jindra's energy conversion system enabled David Pleyzier to complete plans for the propulsion and steering system that he was developing. David's 'Get Home System' uses the boat's generator to power two supplementary hydraulic motors that can be used for manoeuvring or to get you home if your main engine fails – as outlined in the diagram above.

GET HOME SYSTEM

In my opinion, the most interesting development to come from Paul's success is that his Combi VI unit has allowed me to continue development of the 'Get Home System' incorporating my XP-29 propulsion and steering system. This is a back-up drive system, powered by your vessel's generator, that will get you home if your main engine fails.

The 'Get Home System' is a revolutionary propulsion concept for sportfishing boats that consists of a hull designed with a single main-propulsion engine (the most efficient and economical arrangement) incorporating my new XP-29 propulsion and steering system. This main drive unit will be flanked with additional port and starboard shafts fitted with

folding propellers or retractable pods driven by hydraulic motors, and powered by the vessel's generator.

This system provides the benefits of maximum thrust with minimum weight, reduced engine bulk, substantially increased fuel efficiency, a backup power system (hydraulically driven from the generator) and yet retains all the manoeuvrability of a traditional twin-engine installation. When trolling, the main engine can be shut down and the boat run and manoeuvred with just the two small flanking hydraulic motors driven by the generator. This would be extremely economical.

The speed of the port and starboard hydraulic motors is controlled remotely (see schematic layout) and would provide estimated

speeds of 8-10 knots (without losing any of the refrigeration or air-conditioning functions).

Having been involved in sportfishing boat design and construction all my working life, I now believe the stage is set for the development of single-engine powered sportfishing vessels, incorporating the 'Get Home System'. These would save the owners thousands of dollars in annual operating expenses, without losing the vessel's required manoeuvrability. The system is not limited to sportfishing vessels; cruising yachts will also greatly benefit.

This revolutionary sportfishing propulsion and steering system will be explained in more detail in an upcoming edition of *BlueWater*. Stay tuned. 🚤