

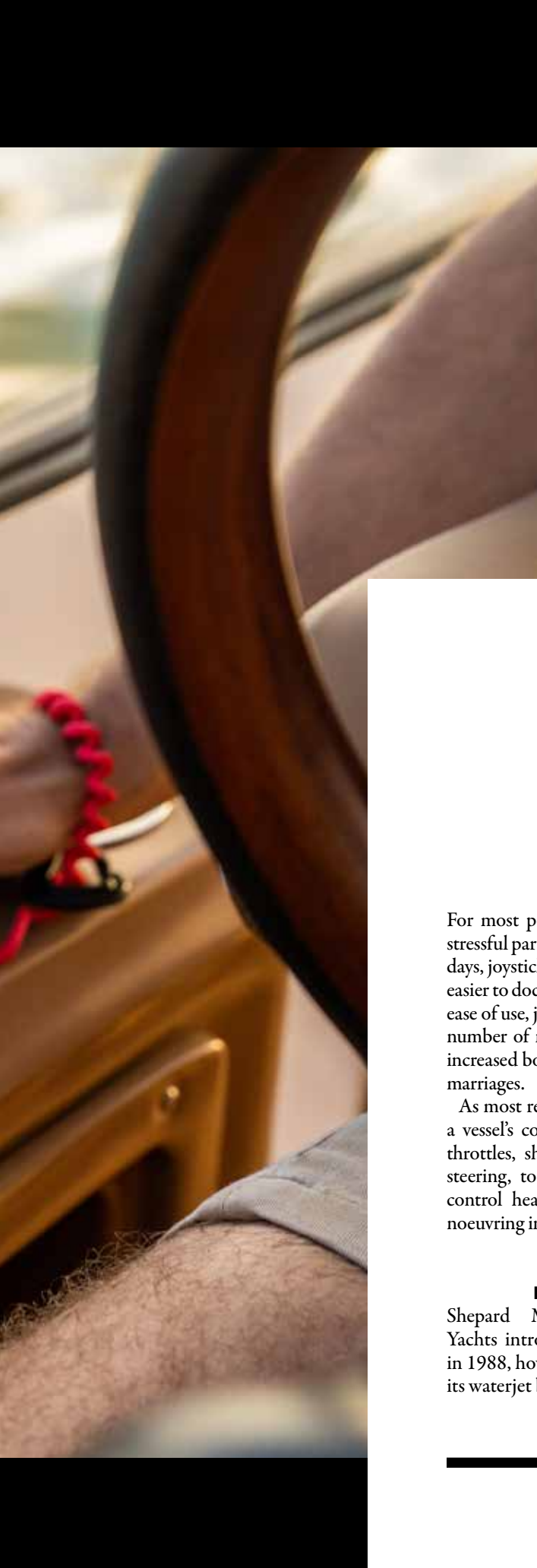
# OH THE JOY (STICK)

*Joysticks are now available for most boats, including those with single engines, but the devil is in the details*

BY PETER A. ROBSON



*Mercury Single engine joystick system.*



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For most people, docking is the most stressful part of boating. However, these days, joystick steering has made it much easier to dock like a pro. Because of their ease of use, joysticks have also brought a number of new boaters into the sport, increased boat sales—and saved a lot of marriages.

As most readers know, joysticks allow a vessel's controls, which may include throttles, shift controls, thrusters and steering, to be controlled by a single control head that allows precise manoeuvring in any direction.

## BACKGROUND

Shepard McKenney of Hinckley Yachts introduced a joystick solution in 1988, however, it was exclusively for its waterjet boats. In 2006, Volvo Penta

was the first to offer a commercially available turnkey joystick solution to the mass market. It was soon adopted by many of the leading boat brands across the globe.

In 2008, Cummins-MerCruiser came out with their version of pod drives: Zeus. Soon after, joysticks were being developed for single and multiple outboards, shaft drive vessels and most recently, for sailboats, jet boats and wake boats. Today, almost any type of vessel with any configuration of propulsion, can be controlled by a joystick. Nearly all are installed at the boat builder level, though some can be retrofitted.

## THE PLAYERS

SeaStar Solutions (Dometic) was the first company to offer joystick steering for outboards with their Optimus 360 system introduced in 2012. Initially, it was offered for mechanically controlled shift and throttle, and later for electronically controlled engines.

Mercury now offers joystick piloting for single-engine pontoon boats, utilizing the outboard and deployable thrusters at the bow and stern. They have also integrated thrusters into their existing joystick control system. The system uses “closed loop yaw” logic which cancels out yaw when joysticking, eliminating the need for the user to have to twist the joystick to maintain heading due to wind or waves

Volvo has released a joystick docking system for single diesel Aquamatic ›

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sterndrive installations. It integrates steering, bow thruster, gear and engine speed into a single joystick control. The company is the first in the industry to integrate steering of a diesel sterndrive with the control of the bow thruster on a single engine installation.

Yacht Controller and Dockmate both offer wireless handheld remotes that can be added to almost any existing vessel with any make of equipment.

Glendinning's ProPilot joysticks and Yacht Controller's fixed joystick can also be installed with almost any make of engine, transmission or thruster (including a model for single engine vessels). The same goes for Italy's Xenta.

Companies such as Glendinning, ComfoDrive and Xenta offer joystick steering for sailboats though none are seeing widespread use. Most sailboat owners simply use their single engine and a bow thruster. ZF, however, has a unique steerable (360 degrees) sailboat pod drive that mates with small diesel engines and a bow thruster. Beneteau offers this system on two of their larger sailboat models under the Dock & Go label.

### INSTALLATION

Installation at the boat builder level is easiest with fully electronic systems (helm and engines/transmissions). Then it's just a matter of plugging it all in. Volvo Penta offers the most comprehensive system, supplying complete packages from the props, transmissions, engines, controls, joystick, autopilot, glass cockpit and all the harnesses as a single part number.

Things get a bit more complicated when it comes to older vessels with mechanical (i.e. cable or hydraulic) controls between the helm and the engines. Yacht Controller offers a system called Yacht Controller Mechanically

Actuated Systems (YAMAS) that ties a fixed or wireless remote joystick to fully mechanical controls between the helm and the engine. They do this by installing an electronically controlled actuator box. In other cases, Yacht Controller and other companies such as Glendinning and ZF can replace an older vessel's mechanical controls at the helm with electronic controls. Then, an electronic actuator in the engine room operates short stub cables from there to the engines.

### NETWORKING

At the heart of any joystick system is a network that pieces together the component hardware and software. The challenge is to write algorithms that accurately configure thrust vectors for specific boat brands, so that when the joystick is turned, the boat actually goes in that direction. In addition, the software must be configured for each model and horsepower of engine, transmission and thruster (when fitted) that will be using that particular joystick.

Joystick technology is never really plug and play. For best performance, software parameters must be customized for each vessel. ZF's process is typical, says Keith Stanley, ZF Marine's pleasure craft product line manager. "After installing a joystick system on a vessel, our application engineers execute a series of steps to fine-tune performance at the time of commissioning. They optimize the software parameters based on vessel characteristics, typical sea conditions and captain preference. The application engineers responsible for commissioning joystick systems typically have hundreds if not thousands of parameters they can use to fine tune the performance. This tuning process is particularly important for station keeping, which is typically a balance between smooth engagement

and system authority to ensure optimal performance even in elevated sea conditions."

### WIRELESS REMOTES

Manufacturers of wireless handheld remotes (Yacht Controller and Dockmate) have an additional issue to deal with: communications between the remote transmitter and the onboard receiver that control the joystick. Obviously, if that radio link is broken, then the remote will not function. Yacht Controller and Dockmate avoid interruptions through different protocols. Redundancy is key. For example, Yacht Controller's Maximo and Supremo offer added redundancy and range with over 100 channel combinations via digital dual band radio frequencies.

Both Yacht Controller and Dockmate have alarms to alert the user should communications be lost.

### AUTOPILOTS & STATION KEEPING

One of the attractions of joystick systems is their ability to hold a vessel in position regardless of wind and current. Of course, this requires the system to be interfaced with an autopilot, in most cases two GPS sensors or a combination of GPS/IMU (Inertial Measurement Units) and some form of display. That function is variously called Station Keeping, Dynamic Positioning, Virtual Anchor, Skyhook and so on. In addition to position holding, other standard features include the ability to hold the vessel in position on a certain compass heading and the ability to maintain a specific heading without holding position.

Some joystick manufacturers offer their own branded autopilots (and displays) as part of their options package while others need to be interfaced with third-party autopilots and their



*Yacht Controller (Left) and Dockmate (Right) both offer wireless handheld remotes that can be added to almost any existing vessel with any make of equipment.*



*Dometic was the first company to offer joystick steering for outboards with their Optimus 360 Electric Steering Actuator.*



*Volvo Penta's Assisted Docking for its IPS pod drives can automatically compensate for tide, wind and current when approaching a dock.*



*Fully integrated electric or bolt-on steering is available for several Yamaha outboards.*

displays. Glendinning's ProPosition system is different in that it doesn't require use of an autopilot and only needs a single GPS position sensor to hold a vessel in position.

### RECENT ADVANCEMENTS

Joystick functionality is increasing every year. One company ahead of the curve is Yamaha. They offer several unique modes. Spiral allows operators to circle out in ever-expanding spirals around a fixed point (for fishers trying to pinpoint hot spots). Zig Zag works well for covering ground when trolling. Drift Point Track allows the vessel to follow a predetermined GPS track while maintaining a specific compass heading (good for drift fishers). Waypoint Arrival is another handy feature. When approaching your final waypoint, you can either have the boat do nothing and continue on its way, or you can have it automatically decelerate as it approaches the final waypoint. Upon arrival, it will prompt the operator to shift to neutral, at which time the system automatically enters into one of three preprogrammed modes. Lateral Assist, a recent addition, is designed to better compensate automatically for wind and current to help maintain heading and direction when moving laterally in joystick mode. Also new are Williamson Turn (to bring the vessel back to a point previously passed) and Pattern Search features.

As David Meeler, Yamaha's new product integration manager put it: "All of these functions are part of the Helm Master EX system, for single to quad outboards, which includes its own dedicated GPS and heading sensors."

ZF offers what it calls Controlled Drift, which maintains heading but applies a braking function to control the speed of the drift. ▶





*ZF has a unique steerable (360 degrees) sailboat pod drive that mates with small diesel engines and a bow thruster.*

### THRUSTER ISSUES

For single or multiple engine shaft drive vessels to achieve full joystick functionality, they require either a single bow thruster or a combination of bow and stern thrusters. These are generally third-party thrusters, either proportional (hydraulic, electric or retractable), or in some cases, single speed electric thrusters. The important issue here is that the thruster(s) have sufficient power to do the job. An underpowered thruster will likely mean that the system will lag in sideways operations and/or struggle against wind and current.

The issue with electric thrusters is their operational time is limited by the motor's thermal capacity. Simply put, once they overheat, they shut down. This is more the case with single-speed electric thrusters as they are either off or full-on. Thermal shutdown is less of a concern with proportional thrusters as they are not always working at full speed, just what's required at the moment. Fortunately, joysticks are typically only used when leaving or approaching a dock, so most don't get heavy use for extended periods of

time—except when operating in the various station-keeping modes. While hydraulic thrusters are all proportional, the downside is that hydraulic lines need to be run throughout the vessel.

### ELECTRONIC STEERING

Recent innovations in fully electric steering (at the engine) have brought a range of advantages to boat builders and boaters alike. With outboard powered vessels, pod drives, stern drives (and some jet and surface piercing drives), being able to steer the drive motors is integral to the joystick function. The rudders on shaft drive vessels are usually not tied to the joystick (Volvo Penta is the only exception I could find).

In the past, hydraulic cylinders were the standard method of steering these vessels. Today though, electric steering is becoming the norm and has many advantages. Most notably, they eliminate the need for hydraulic fluid, hoses and pumps.

Dometic's Optimus Electric Steering Actuator uses inverted planetary roller screw technology to control the move-

ment of the steering cylinder. According to Brian Dudra, vice president/general manager of Dometic Vancouver, roller screws have several significant advantages. "Due to an increased number of contact points, roller screws have two to three times the dynamic load capacity as well as a higher tolerance to shock loads. The nature of this design results in increased durability and repeatability." Dometic's steering actuator is an integrated unit that mounts on most common outboard engines used today.

Fully integrated electric or bolt-on steering is available for several Yamaha outboards. One of the benefits of electric steering, according to Yamaha's David Meeler, is that electric steering only draws battery power when the unit is actually steering. "When a boater is fishing and has the motor idling, that means more amps for other systems on the boat instead of the six to 10 amps that the hydraulic pump constantly draws." Installation is also quicker as it only requires a connection to the starter battery and then a single wire that runs from the helm to the engine.


Other benefits include quicker and more accurate steering; adjustable lock-to-lock steering (for example, at slow speeds lock-to-lock might be four turns while at speed it might be eight turns because you don't want overly sensitive steering at high speeds); and, steering friction can also be altered as needed, depending on conditions.

### THE FUTURE

So, what will be the next big thing for joysticks? Well, it might be autonomous docking systems.

In 2021, Volvo Penta introduced what it calls Assisted Docking for its IPS pod drives. The award-winning system won't dock the boat, but it will automatically compensate for tide, wind and current when approaching a dock. It incorporates a human-machine interface said to provide a smoother docking experience.

Mercury is also continuing to pursue that avenue. They recently demonstrated an advanced autonomous boat. Rob Hackbarth is Mercury's category director for controls and rigging. He explained, "The prototype vessel was capable of autonomously sensing and avoiding in-water obstacles during operation, then docking without the need for on-shore or on-dock sensors. The concept vessel addresses docking and navigating congested marinas, two high-stress aspects of boating."

**IN THE END**, all the companies we talked to stressed that the goal of joysticks is to bring more people into boating that might not otherwise be there. Joysticks make it so much easier to overcome the fear of docking, especially as the systems work so well. That ease of operation has led to more and more people getting into boating. As Dometic's Brian Dudra noted, "Delivering a fun, stress-free experience will be key to keeping [people] in our sport long-term." 

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