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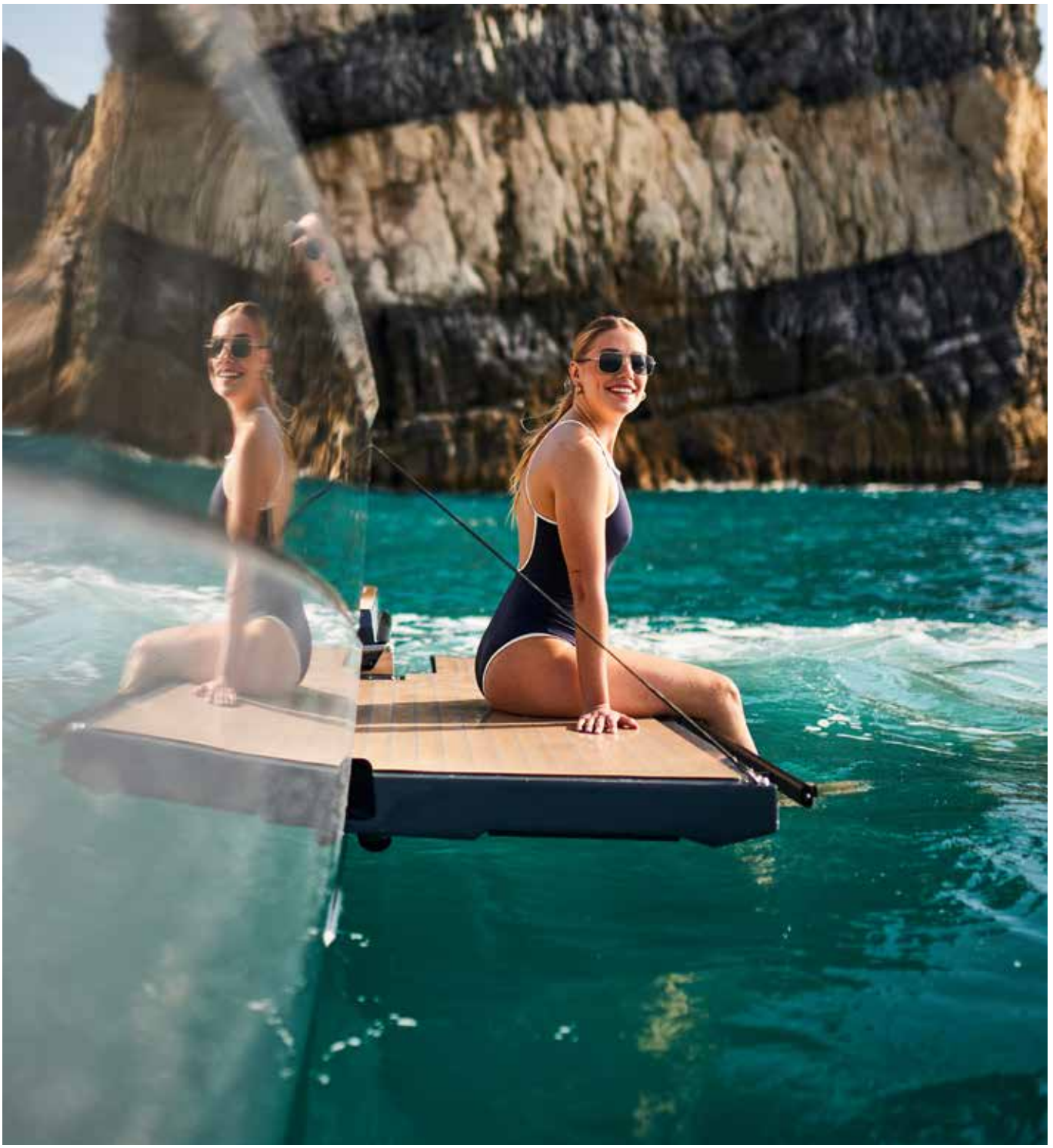

VIRTUES OF THE V10 T-TOP AUSSIE HYBRID POWER HOW TO CATCH KINGIES
THAI ISLAND CRUISING SPEEDBOAT STEERING SYSTEMS JETSKIING IN SURF

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SMOOTH TURNS

Expert insight into the types of steering systems on outboard-powered speedboats and how they work.

By Scott Cumming
Photography: Scott Cumming and supplied

This article explores the types of steering systems found in high-performance boats, with a focus on single-outboard-powered monohulls or modified vee-hull boats – think Labsport, Bullets, Haines SO, Force and similar.

These types of performance boats share some common characteristics: they're relatively lightweight, have a high horsepower-to-weight ratio, and rely to varying degrees on some amount of 'lift' – that is, as speed increases, the hull lifts progressively out of the water, which reduces drag and therefore increases speed.

Because of this, the steering system becomes an important part of controlling the vessel, as opposed to just choosing the direction you wish to travel.

Boats of this style have a huge following and countless examples are being driven by enthusiasts on any given weekend. That said, a good degree of caution and the right experience when operating fast boats is paramount.

UNDERPINNING MECHANICS

Fast monohull outboard-powered boats feature a hull specifically designed to allow the boat to achieve high speeds – speeds at which the steering system becomes necessary to control the dynamics of the boat.

A commonly found feature is a 'running plank', a flat section at the bottom of the hull's vee to increase hydrodynamic lift and to some extent improve handling.

In most cases, they're powered by a single outboard with a propeller that's usually right-hand rotation – this means the outboard will typically want to turn the vessel to the right, so part of the steering system's job is to counteract the outboard's force.

Up to a certain point, these boats gain a top-speed benefit from raising the engine height on the transom to reduce drag. This 'surfaces' the propeller, which means that some of the propeller blades are in the water and some out. As the propeller rotates, the forces involved will typically increase the force that causes the outboard to turn or pull to the right.

SAFETY FACTORS

Importantly, control or the ability to properly handle a performance boat is a key factor in choosing the right steering system.

Equally important is avoiding failure in steering systems. Any failure resulting in the steering no longer connected to, or controlling, the outboard will cause the boat to suddenly turn to the right. At speed and under power, this

Above: The 1750 Bullet No Fear *competing in the 2016 Southern 80 waterski race on the Murray River.*

can be extremely violent and can cause serious injury or worse to occupants, and major damage to the boat.

Another dynamic these boats typically encounter that affects handling is 'chine walking' – the boat oscillates, or rolls, from one side to the other at speed. Depending on the speed and the type of boat, this can start to amplify if not corrected via steering inputs. If left unchecked, it can lead to total loss of control and an accident.

To put it simply, you can't just point this type of boat in the direction you want to go, push the throttle down and expect it to be solid as a rock – this is why the steering system and gaining the skills to drive it safely are so important.

The best steering setup available won't make the driver an expert performance-boat handler, but it will offer the ability to control the vessel adequately with the right experience and technique.

Here's another factor: the faster a monohull drives, the more the hull will be up on top of the water, and controlling it essentially becomes a balancing act, with wind, waves and boat wakes all factoring in. Along with the trim of the outboard (which is a subject unto its own) the steering is key to being able to orchestrate this balancing act.

STEERING SYSTEM TYPES

The most generic steering system on outboard-powered boats is a cable 'push-pull' or teleflex type. This is a relatively simple single- or dual-cable system with a rotary drum or a rack-and-pinion setup behind the dash. They're used in low-horsepower, moderate-speed installations, so we won't go into detail in this article.

The cable outrigger type is probably still the most common type of system found on high-performance or racing monohull boats.

The hydraulic type is generally an off-the-shelf system that's found on many vessels as standard. These can be straight hydraulic or power-assisted hydraulic.

A variation that takes the hydraulic system further sees the hydraulic ram or rams attached to outriggers mounted to the side of the outboard on custom brackets. It still uses many off-the-shelf parts but is set-up for performance use.

CABLE OUTRIGGER SYSTEMS

Cable outrigger systems are arguably the most direct, providing the most feeling and feedback in high-performance, fast outboard-powered boats. They're an entirely mechanical system that requires physical effort to steer – although, this varies a lot depending on the boat setup. That said, Formula One outboard racing boats run this style of steering for good reason.

the steering system becomes necessary to control the dynamics of the boat

Below: 1800 Bullet waterski race boat Spinal Tap *in action.*

Formula One outboard racing boats run this style of steering for good reason

A typical cable outrigger system comprises:

- A steering column, which connects the steering wheel to the steering drum via a steering shaft.
- A wire cable that attaches to the steering drum firstly in a slot then wraps around the steering drum in opposing directions, then is routed back to the outboard. The cable is the only link between the outboard and the steering wheel and must be inspected regularly and replaced by a specialist at least once a year.
- A series of (usually four) pulleys inside the boat, two pulleys where the cable exits the deck in the outboard well. Then usually two more pulleys attached to the steering 'wings', and finally the cable attaches to anchor points on the vessel itself all serving the purpose of guiding the wire cable from steering drum to outboard. The pulleys need to be specific to the application.
- Steering wings – these are metal brackets bolted directly to the sides of the outboard.
- Shackles – fittings that attach the pulleys to the steering wings. Must be specific for application, correct geometry and, importantly, have a safety retainer.
- Cable clamps – anchor the cable back to anchor points in the outboard well, with a minimum of two at each cable end.

Cable outrigger systems can be more physically demanding to steer due to the torque being transmitted to the steering wheel, and to some degree you're counteracting the wheel wanting to turn right.

Driver error can be magnified, too – for example, re-entering the water while still on throttle can pull the steering wheel from your grip. Don't ever let go of or lose grip on the steering wheel when underway, especially when at speed. Be aware that torque or forces from the outboard and propeller are transmitted directly back to the wheel.

Specialist knowledge to set up the system is required and it's important to regularly inspect and maintain all parts and replace any parts or attachment points in the system as required.

Cable outrigger systems are very direct, with essentially no play in the system if rigged correctly. They're much cheaper than custom hydraulic systems and maintenance is relatively inexpensive with the right knowledge.

Key things to be aware of include the tension on the steering cables – there should be no undue amount of play in the system, however the steering cables should not be piano wire tight.

Above: Steering column and drum for cable outrigger steering. Image courtesy Labsport Power boats.

Above right: One side of an outboard with the steering wing (in this case it's blue) bolted to the side, and the shackles attaching the pulleys to the wing in the foreground.

Right: Cable outrigger steering drum – view from under dash.

AUSSIE SPEEDBOATS

Bullet Tunnel Deck

Bullet 1850

BULLET 1750 / 1800 / 1850 WITH V6 TWO-STROKE POWER

Iconic Aussie-built ski/race/performance boats, Bullets are solid performers and capable of big numbers with the right setup. They require a very precise steering setup operated by capable hands. Typically fitted with cable outrigger steering which, when properly installed, is very likely the best choice, especially for those looking to exploit the performance these boats can deliver.

HAINES HUNTER 1600 / 1800 SO

Popular and iconic Aussie-built skiboats spanning a long period of time, solid performer with good rougher water capabilities. 1600 and particularly 1800 are capable of some impressive numbers with the right power and setup, but more typically found in use where the outright speed is less the goal than all-round use.

Depending on setup, an off-the-shelf hydraulic system is likely the best choice for models used mainly for social boating, and probably a given for the 21ft boats.

You'll probably see cable push-pull systems on older examples of the 1600 and 1800 SO, but many are being swapped out

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Haines Hunter 1800 SO

for hydraulic when these are repowered with newer outboards. You may see some examples fitted with cable outrigger steering.

LABSPORT 21 GTR, FORCE 21

Two examples of great performance boats from Australian builders that are for many the go-to options for fast social, ski and race boats. Many are being fitted with hydraulic steering systems.

For the race or dual-duty models, a specific or custom hydraulic system is becoming more common than cable outrigger, particularly with the V8 Mercury or 300R becoming the go-to powerplants. For race or dual-purpose social/race boats, a custom hydraulic system is likely the best choice.

Labsport 21 GTR

you want a very quick reaction from the outboard to your steering input

Above: A custom dual-ram powered hydraulic steering system being serviced.

Above right: Steering wing and shackle.

Right: Helm pump with custom steering column for high-performance hydraulic system.

Also, the tension on the steering cable must stay the same when trimming the outboard through the normal range. If the tension changes to any noticeable degree, there is likely a problem with the geometry of the steering wing or shackles.

When fitting a powered jacking plate, note that there's a specific way to set up the pulleys and anchor points on the transom and jacking plate so that the tension on the steering cable remains unchanged when you raise and lower the jacking plate.

HYDRAULIC OFF-THE-SHELF SYSTEM

Hydraulic steering systems essentially have three main components: a helm pump connected to the steering wheel, a hydraulic ram connected to the steering mechanism on the outboard, and hydraulic lines or hoses that connect the helm pump to the steering ram.

The steering ram, lines and helm pump all contain hydraulic fluid. When you turn the wheel, it pushes or pumps oil and moves the hydraulic ram attached to the outboard.

With each revolution or turn of the steering wheel, the pump displaces a certain volume of oil, which translates into how fast it moves the steering ram at the outboard end of the equation. With high-performance vessels, you want a very quick reaction from the outboard to your steering input.

There are varying sizes of helm pumps in terms of how much oil they move. The higher the volume the helm pump produces, the harder the effort required at the steering wheel becomes. For high-performance outboards, it's worth considering a powered hydraulic system so you can have a large-capacity helm pump while still being able to steer with a reasonable amount of effort.

Hydraulic rams are available in different grades that range up to performance-oriented pro systems for higher horsepower and higher speed boats.

There are limitations in how closely the system can approach zero play or resist a small amount of movement between outboard and wheel, and there's no feedback provided through the steering wheel.

As the system relies on oil to transfer pressure from the steering wheel to the outboard, it's important to monitor the fluid level – if you lose oil, at some point you can lose steering. Air in the system due to a leak or improper maintenance or set-up is another potential issue; it's usually noticeable as an inconsistent or spongy steering feel.

As with all steering systems, regular service by a qualified specialist is important.

HYDRAULIC CUSTOM SYSTEM

High-powered, lightweight, race-oriented monohulls capable of 120km/h or more generally employ tailor-made steering systems.

The differences between a generic and a custom hydraulic system are most obvious in the components at the outboard end. This can be a single side-mounted hydraulic ram or dual mounted hydraulic rams on custom brackets. The helm pump size and power assist are also selected to provide optimum steering and control.

Custom steering systems are typically the most expensive in terms of parts, installation and maintenance, and require specialist knowledge in setting them up.

They're worth it on the right type of boat as they allow the driver to steer and control a heavy and powerful outboard without fighting the torque. Specific custom-made components can achieve the least amount of play at the outboard and give you the most precise and responsive hydraulic system available.

Again, as a hydraulic system, it relies on oil to transfer pressure from the steering wheel to the outboard, so losing oil means a loss in steering ability, while air in the system will give an inconsistent or spongy steering feel. Maintenance and repair by a specialist is a must, and you should regularly check for leaks, loose parts or deteriorating components including the mechanical linkages. CM

This article is by Scott Cumming, a marine surveyor and the Managing Director at Aquamarine Services in Coomera, Qld. With input from: Jason Chiswell, Extreme Marine; Bruce Stubbs, Labsport Power Boats; Nick Binstead, Marine Control Systems; Luke Johnston, Gold Coast Ski Boat Group.

Above far left and left: Steering brackets and ram components for custom/high-performance hydraulic system.

Below: The Superclass 21 Mental.