

Understand Boat Balance & Performance



w/o Trim Tabs

22 Searay V8 I/O Accelerating to Plane



with Smart Tabs



Family Sport & Fishing Boats



Yacht Tenders

Nauticus
incorporated

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Quick Facts & Misconceptions

Facts: The Market - How Big

All Power Boats (USA)	12,500,000
Power Boats 22 feet and Up	4,200,000
With Trim Tabs (70%) - Served Market	<u>2,940,000</u>
Available Market	
Helm Controlled Trim Tabs (30%)	1,260,000
Power Boats under 22 feet	8,300,000
With Trim Tabs (7%) - Served Market	<u>581,000</u>
Available Market	
SMART TABS (93%)	<u>7,719,000</u>

Misconceptions: About Small Boat Performance

#1 Dealer Statement: "Our Boats Don't Need Trim Tabs!"

Q: What does that mean?????

A: The Dealer performance criteria is set too low! They feel that if the boat eventually planes that's good enough. and trim tabs are only used to help the boat plane. The bar needs to be set higher. Boat performance should include all handling characteristics, such as ride, tracking, porpoising, chine walk, and ride and handling And, Now more than ever before better efficiency (MPG).

A: Small boats generally have a much higher power to weight ratio. Usually about two to three times the HP to weigh ratio of it's larger cousins. This allows them to plane, but can induce other handling problems

Q: Why don't boat builders install or offer trim tabs on smaller boats? (Some are now using Smart Tabs.)

A: The most obvious answer is that the cost of helm controlled trim tabs are too high for the lower priced boats.

A: The less obvious answer is the potential for misuse of helm controlled trim tabs on small, light, fast sport boats. Accidental deployment at higher speed is dangerous.

Q: What about changing the prop?

A: This is like down shifting to second gear. It may help the boat climb the hill to plane easier, but it increases RPMs at all speed levels and uses more fuel. The real answer is to eliminate the hill (Trim Tabs).

#2 Statement: "With Tilt & Trim on the motor, trim tabs are not necessary"

Q: Is the "Tilt & Trim" as efficient as trim tabs for planing

A: No! Using the propeller to adjust boat attitude is not an efficient use of prop thrust.

Q: Why is Tilt & Trim offered on nearly all small power boats?

A: It is marginally effective, cheaper than helm controlled trim tabs, and minimizes the risk of radical changes in boat attitude while underway.

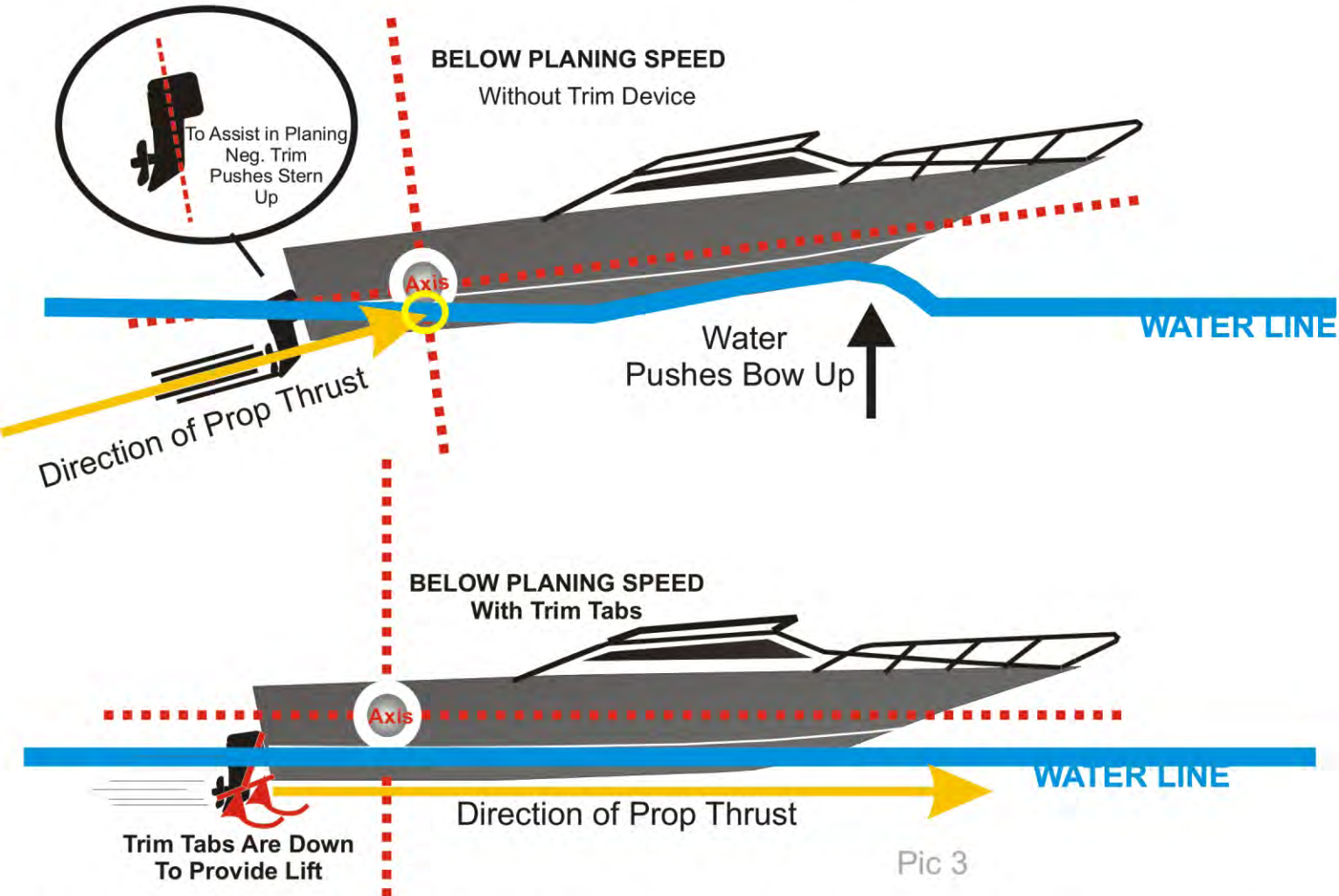
Common Remedies for Poor Performance - Propellers and Hydrofoils

The Two most common remedies are specialty or lower pitch props, and hydrofoils. Both sell in relative high volume which emphasizes to the need for planing and performance assistance on small boats.

Propeller:

If the standard propeller allows the WOT (wide open throttle) RPM's to be within the recommended operating limits of the engine, then a prop change could be a compromise to the overall performance.

Reducing the pitch will improve low end thrust (much like down shifting a car into second gear), but sacrifice both top end performance and fuel economy since the engine runs faster than necessary at all speeds (MPH).

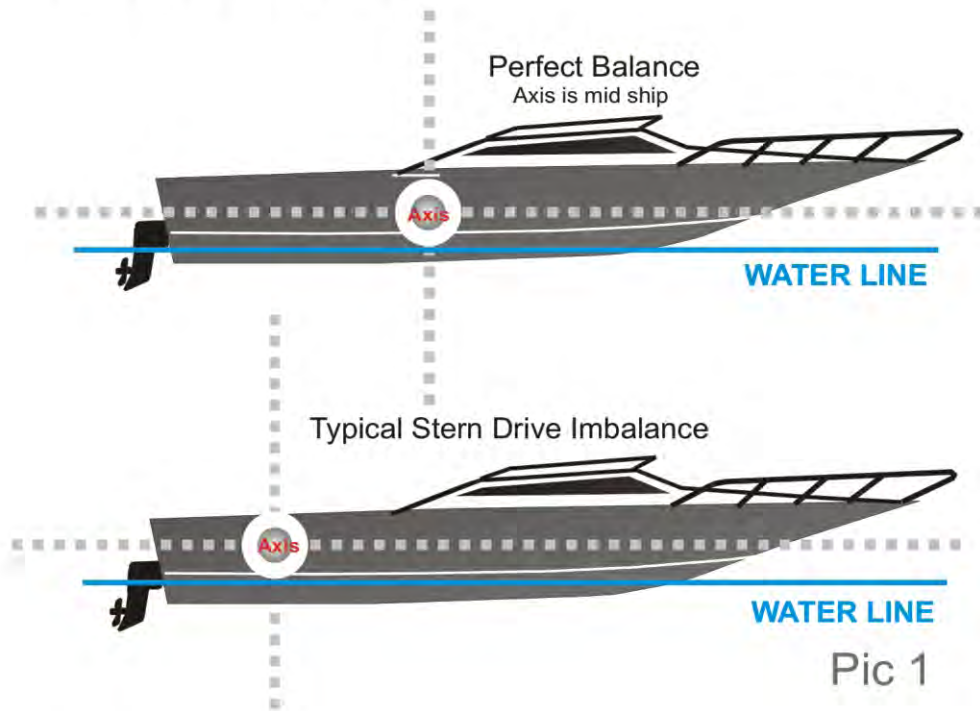


Eliminating the "hill" is the best answer! All of the thrust is now used to "propel" the boat forward.

Stern Loaded Boats Have Performance Deficiencies

Balance

Placing the engine toward the back of the boat, or an outboard motor on the transom creates imbalance. Balance is the key to the overall performance of any planning hull power boat. Similar an airplane moving through the air, boats operate in a liquid constantly rotating on an **AXIS**. Controlling and maintaining balance is essential to all aspects of performance from acceleration and top speed to ride and handling.



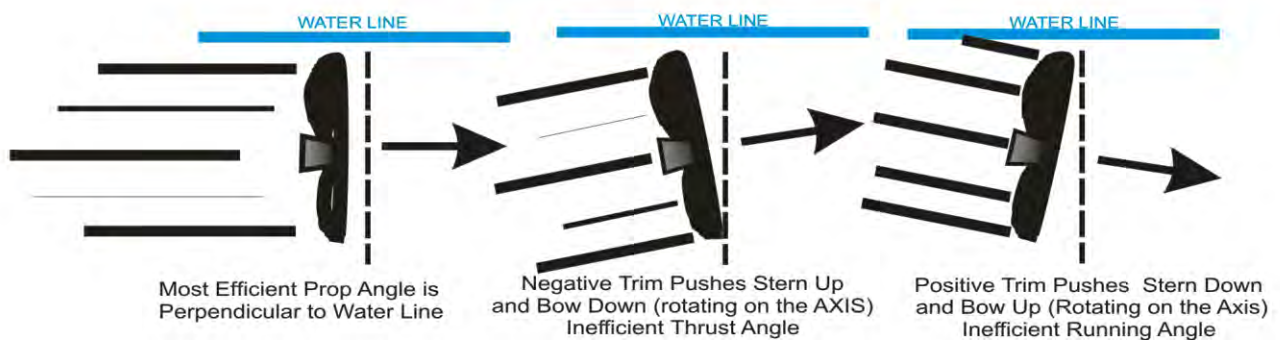
Planing & Porpoising

The two most common problems addressed by small boat owners are planing and porpoising. Both are a balance problem inherent to small power boats.

In the absence of affordable and safe trim tabs, both consumers and manufacturers moved to other remedies since the power tilt and trim left a void in performance.

The effect of power tilt and trim during acceleration to plane and porpoising is noticeable, but inefficient because the prop loses some thrust when trimmed beyond perpendicular. The sooner the boat achieves enough speed (water pressure on the hull), the sooner it will plane. Negative Trim on the prop is a compromise between maximum forward thrust to achieve speed, and pushing the stern up to correct the high bow rise or reduce the porpoising. Props should be used for propulsion!

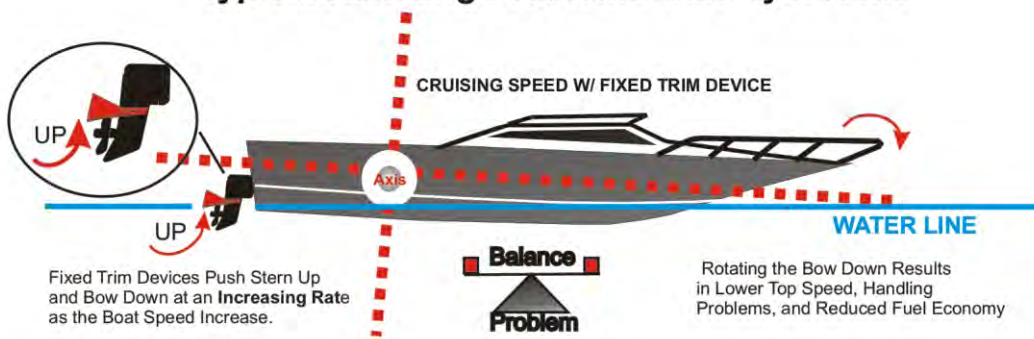
Tilt Trim and Prop Angle



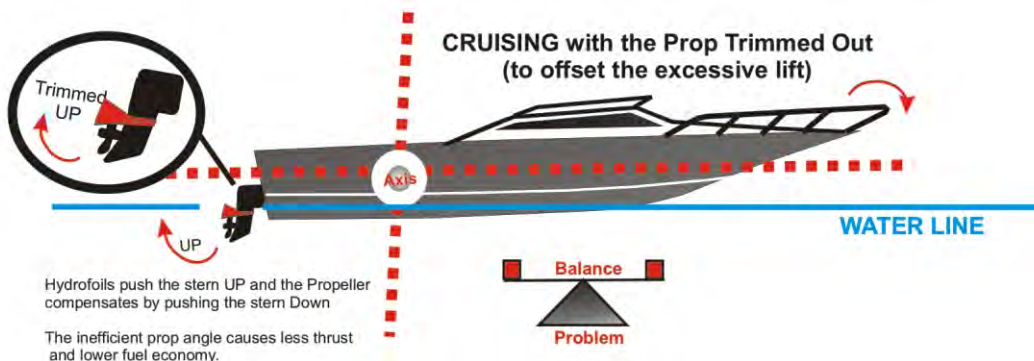
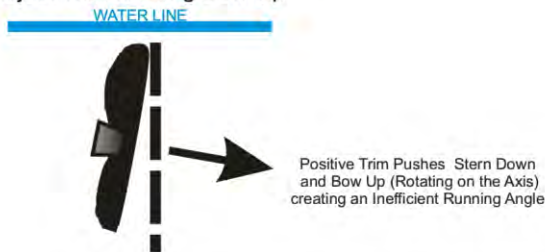
Hydrofoils

Foils add some additional lift to aid in planing, but sacrifice top speed, handling, and fuel economy in the higher speeds when they provide excessive lift. Because they are rigid and wing shaped the lift increases as the boat speed increases. The result is too much lift at cruising speeds and an up driving the bow down into the water. The result is poor handling (especially in turns), a propensity to listing (especially to Port), and a loss of top speed and fuel economy.

Typical Handling Problems with Hydrofoils



Corrective Action "Adjust Trim to Bring Bow Up"



Reduced Fuel Efficiency & Speed

Positive Trim Pushes Stern Down and Bow Up (Rotating on the Axis) Creating an Inefficient Running Angle

Trim Tabs

The traditional hydraulic or electric trim tabs have been used on larger cruising boats (26 +) for many years as means of assisting the boat to plane, and adjusting attitude port to starboard.

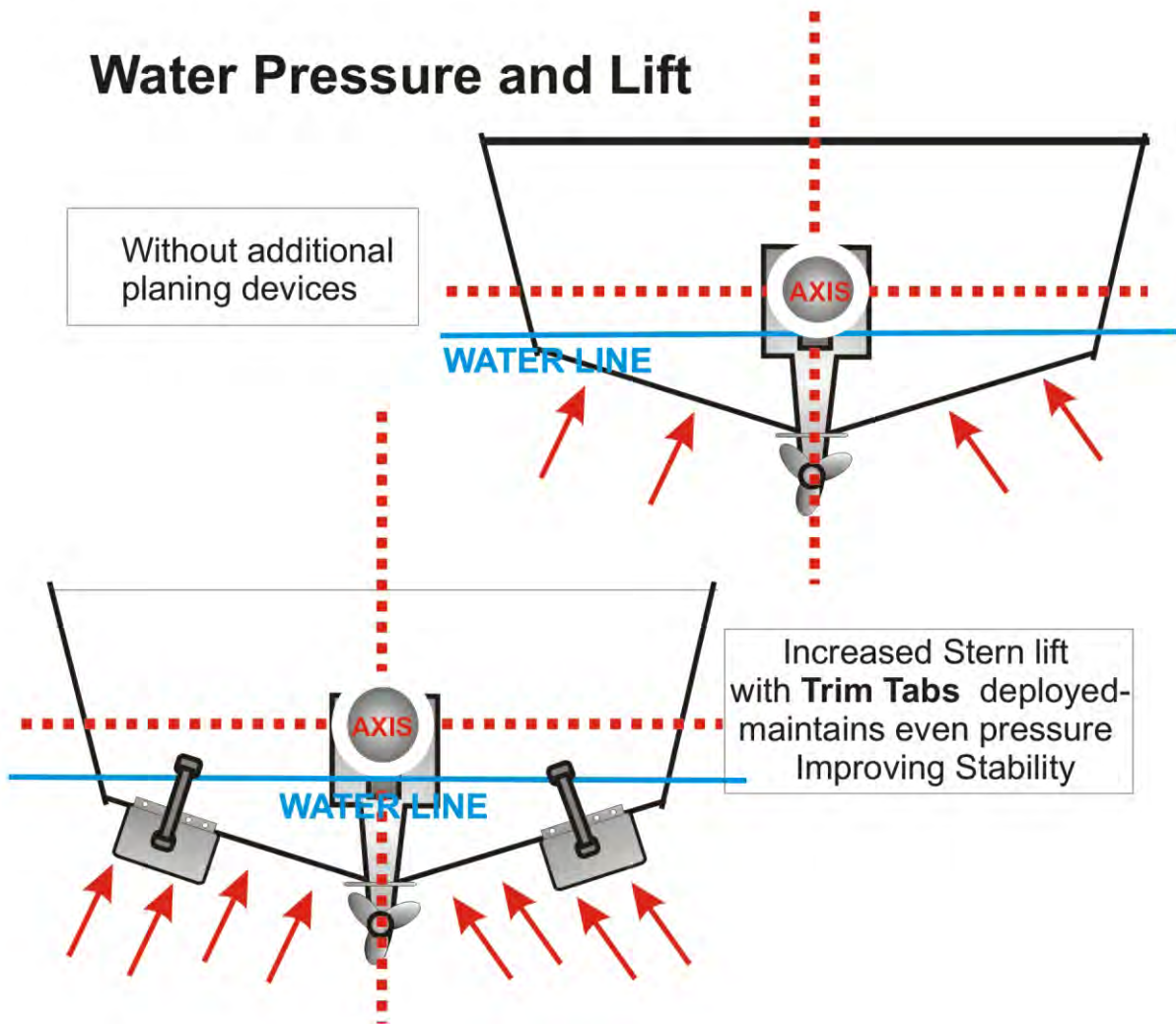
Like flaps on airplane wings, *trim tabs adjust the hull design* to compensate for changing conditions such as boat speed, waves, weight and or load, wind, etc.

Since the boat is operating in a liquid, it is constantly rotating on an axis (balance point). By adjusting trim tab position while the boat is underway, the water pressure on the trim plates adjusts the boat attitude.

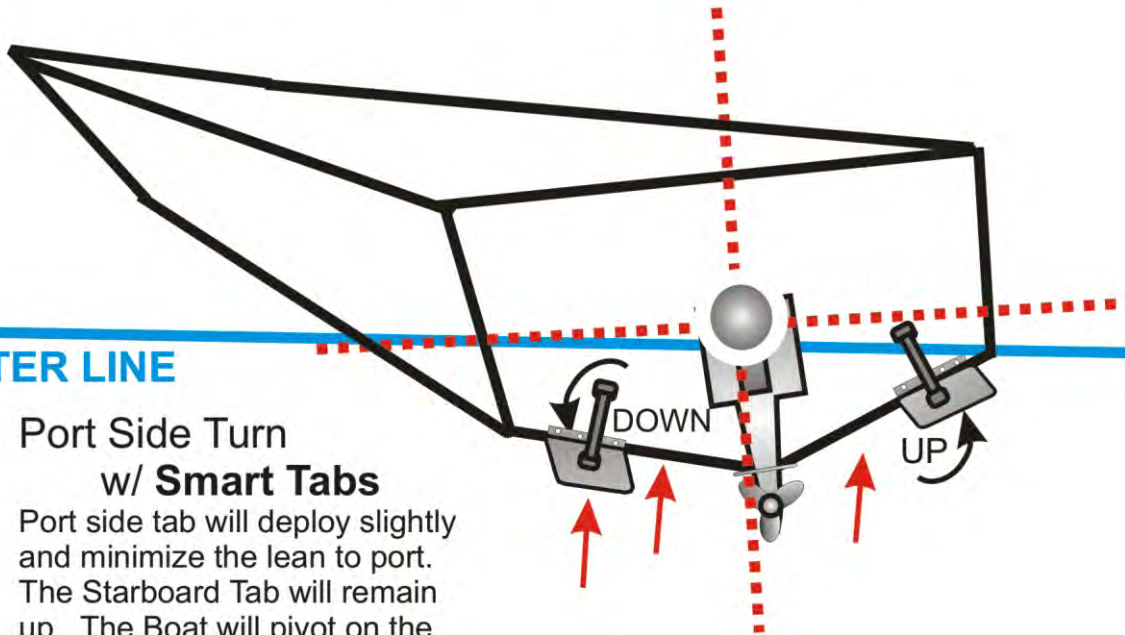
As with airplanes, boat hulls are designed for specific functions. For example, in order to carry large loads a barge is appropriate. To pull skiers you would want a Master Craft ski boat. Neither is an appropriate design for the others function. By making a section of the hull adjustable, the design itself changes and the efficient window of operation gets much larger.

In short, every boat is designed to be most efficient under specific conditions (speed, water, load capacity, etc.) The ability to modify the hull simply allows the boat to operate more efficiently over a broader range of conditions.

Water Pressure and Lift



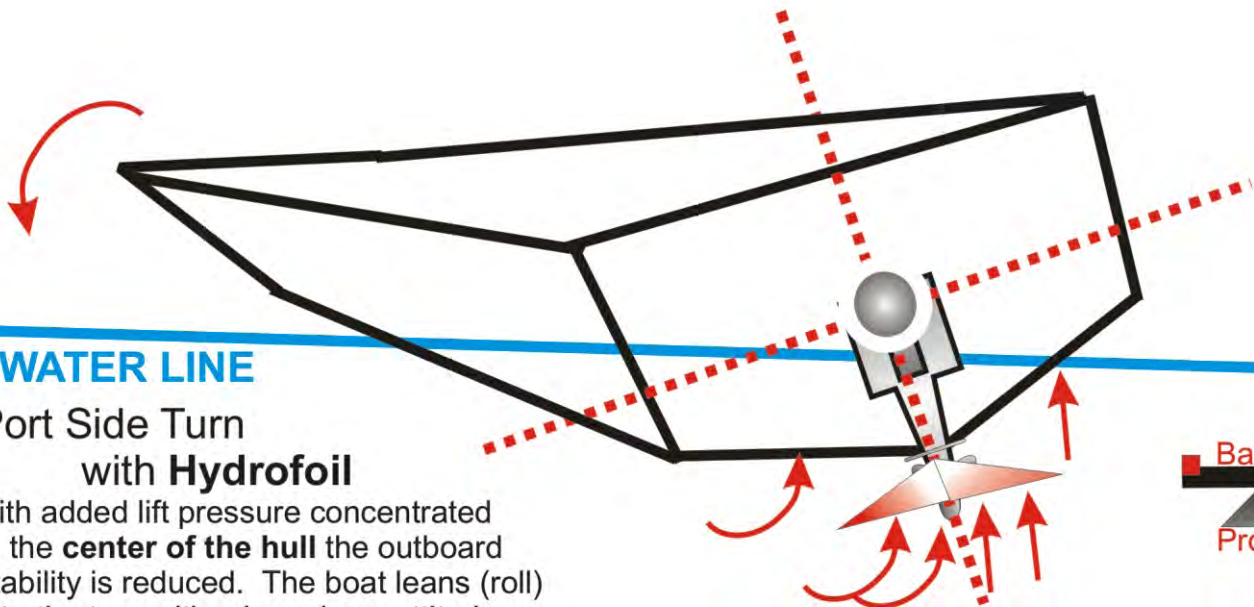
Handling and Turns at Cruising Speeds



WATER LINE

Port Side Turn w/ **Smart Tabs**

Port side tab will deploy slightly and minimize the lean to port. The Starboard Tab will remain up. The Boat will pivot on the port side tab to create a more positive turn (eliminate sliding).



WATER LINE

Port Side Turn with **Hydrofoil**

with added lift pressure concentrated in the **center of the hull** the outboard stability is reduced. The boat leans (roll) into the turn with a bow down attitude.





SMART TABS -

Address the Small Boat Market

There are three (3) factors that should be considered when choosing trim tabs; *the application, the cost, and operating safety.*

1) Application - Sport Boats Vs. Destination Boats

There is a gray area but if the boat is in the 26 and up range it is likely a Destination Boat . As explained earlier this is the boat that cruises from point A to point B for an extended period. The need for adjusting trim is minimized because the course is fixed.

If the boat is under 26 it is likely to be a fishing, water sports, or family lake boat (Sport Boat) where the course is seldom maintained for more than a few minutes. Continuous speed and course changes would likely dictate continuous trim tab adjustments.

SMART TABS automatic operation is ideal for the Sport Boat market.

2) Cost Vs. Boat Value

The \$600.00 cost of helm operated trim tabs on a \$75,000. Destination Boat is acceptable, but it is disproportionate to the value of a \$10,000. to \$25,000. Sport boat .

SMART TABS Retail prices range from \$99. To \$229. Ideally priced for the targeted Market!

3) Operating Safety

The 30 ft. 11,000 lb. sedan that cruises at 22 mph will not react violently to accidental misuse of helm controlled trim tabs. It will lean hard and bow steer, but that is about the extent of the problems.

The 20 ft. V8 powered bow rider that runs 45 mph can easily experience catastrophic reactions to accidental misuse. Considering the typical use of a family sport boat it is easy to understand how a problem could occur. The pilot is watching the tubes, skier, or wake board he is pulling, adjusting speed, looking at traffic and driving.

SMART TABS require nothing of the pilot when in use, They are 100% automatic and active.



Before



After

SMART TABS - Principle of Operation

The hydraulic or electric actuators, tubes, switches, electric wires, pumps, and tubes common to helm controlled trim tabs are replaced by self contained nitrogen gas actuators. Similar to a spring / shock system, they hold the trim plate down at slow speeds, and as the boat speed increases the water pressure exceeds the actuator load pushing the plates up.

As simple as the system seems there are a few tricks .

Proportionate Sizing:

- 1) The plate size is proportionate to the boat hull size.
- 2) The weight of the motor / horse power dictates the actuator load rating. The bigger the motor the higher the load rating.
- 3) Within these parameters the system allows for additional adjustment (fine Tuning) to suite the individual boat. Both load (lift pressure) and plate angle can be adjusted (without any disassembly).

Variable Lift

Ideally the trim tabs should provide the most stern lift at slow speeds, and once the boat is on plane reduce the lift so that the bow is not pushed down.

In order to achieve this **SMART TABS** actuators allow some of the gas to bleed to the opposite side of the piston during compression through a very small valve. This increases the resistance load during compression, but allows the actuator to relax (about 30%) once compressed.

The results are that during acceleration to plane the tabs are held down with more force and provide maximum lift. When the boat achieves planing speed the lifting force is reduced. Conventional torsion or coil springs typically react in the opposite manner. The more they are compressed the higher the resistance load, and the more they lift the stern.

Ride Control

At cruising speeds the actuators act similar to a suspension system on a car. Because they are under pressure even when UP they resist port to starboard roll, as well as bow to stern pitch. Since they operate independently steering and tracking become more precise. Porpoising (common to these boats) is eliminated, as well as chine walking. This active system continuously works to maintain the best balance possible.

Boat Attitude with Smart Tabs



SMART TABS Performance

As one editor put it "it seem too good to be true" (Boating World Magazine). The **SMART TABS** will improve the performance of any outboard or stern drive boat under both low speed and high speed conditions. Independent editorial tests, dealer tests, consumer reports, and OEM evaluations have consistently shown the same positive results.

Here is what you get! **It's Guaranteed Too!**

- 1) Low speed (5 mph) wander is significantly reduced.
- 2) Bow rise before planing is reduced to 50% or more
- 3) The minimum plane speed is reduced 35% or more. (pull Tubes at 15 mph)
- 4) Faster acceleration (i.e.: 0 to 30 mph) by 10% or more
- 5) More speed at every RPM level (result is more fuel economy)
- 6) Eliminate porpoising at any speed without the need to trim the motor.
- 7) Track better, even in quartering seas.
- 8) Turn sharper without prop cavitation and excess loss of speed
- 9) Eliminate chine walking
- 10) **Increase Top Speed by 2 to 4 mph**