Nauticus incorporated

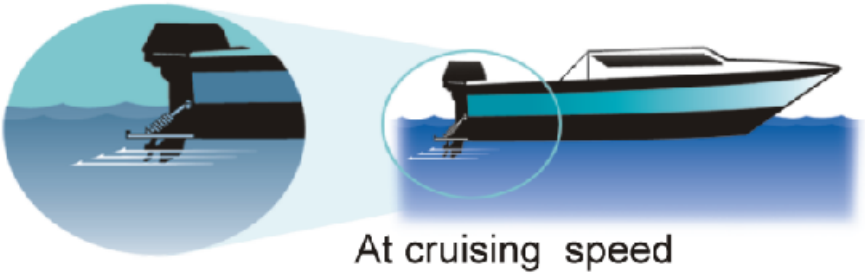
SMART TABS™

Understanding Boat Balance & Performance

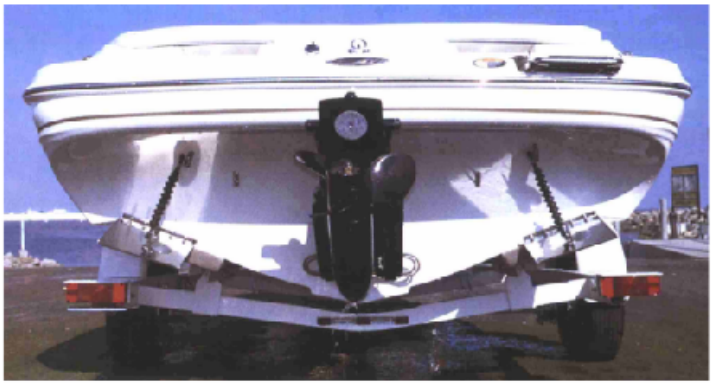
Using Trim Tabs on Small Craft

As the boat speed increases or decreases the trim plates automatically react.

Reduce BOW RISE & "ON PLANE" Speed 30% or more



At cruising speed the trim plates are up.



Family Bow Rider

Yacht Tenders

Tech Info Call: 800-233-0194

8080 Snowville Rd, Brecksville, Ohio 4414 . Tel: # 440-746-1290 Fax: # 440-746-1291

Understanding Boat Balance & Performance
Index

Quick Facts & Misconceptions

Facts: The Market - How Big Is The Available After-market

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

Misconceptions: About Small Boat Performance

#1 Statement: The Checks in the Mail and "Our Boats Don't Need Trim Tabs!"

Q: Why-

A: Because they plane easily!

The attitude is that if the boat planes it's OK, and trim tabs are only used to help the boat plane. With enough horse power you can get an elephant to plane, but elephants rarely make good boats. Judging boat performance should include all handling characteristics, such as ride, tracking, porpoising, chine walk, and steering.

Q. Why do they plane so easy when compared to bigger boats.

A. Small boats generally have a much higher power to weight ratio. Power to weight ratio on a 20' bow rider is 1 hp / 12.5 lb., the 30' sedan with twins is 1 / 25 lb.

Q: Why are Hydrofoils sales at 200,000 units per year if small boats plane easily?

A: Statement #1 is incorrect.

Q: Why don't boat builders install or offer trim tabs on smaller boats?

A: The most Obvious Answer is that the cost of helm controlled trim tabs is 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 boats. Accidental deployment at higher speed is dangerous.

#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.

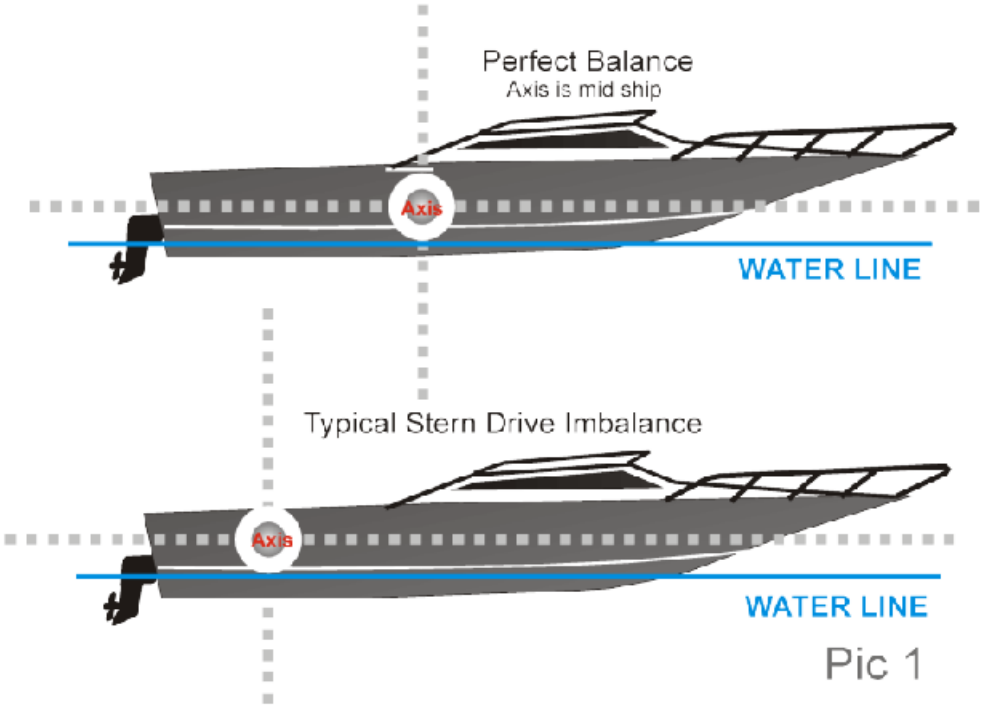
Q: Why is Tilt & Trim offered on nearly all small power boats?

A: It is marginally effective, cheaper than helm controlled trim tabs, and it is safer.

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.



Pic 1

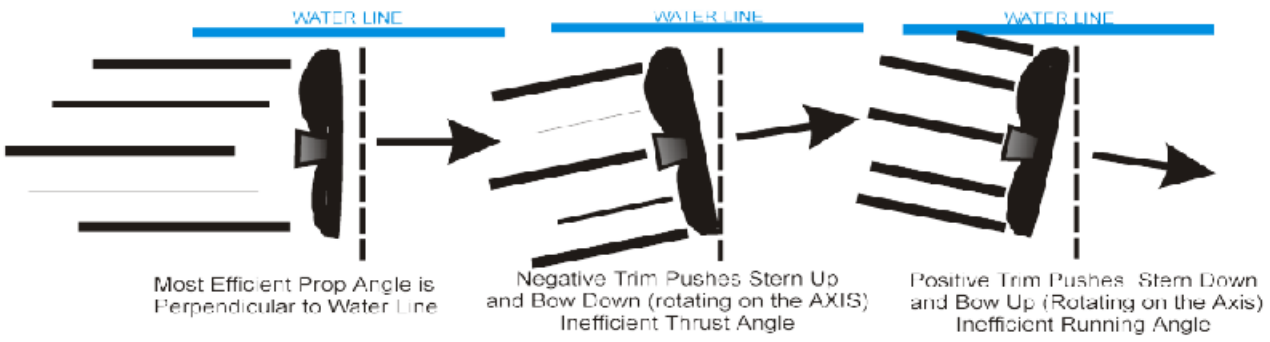
Planing & Porpoisiing

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 looses 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

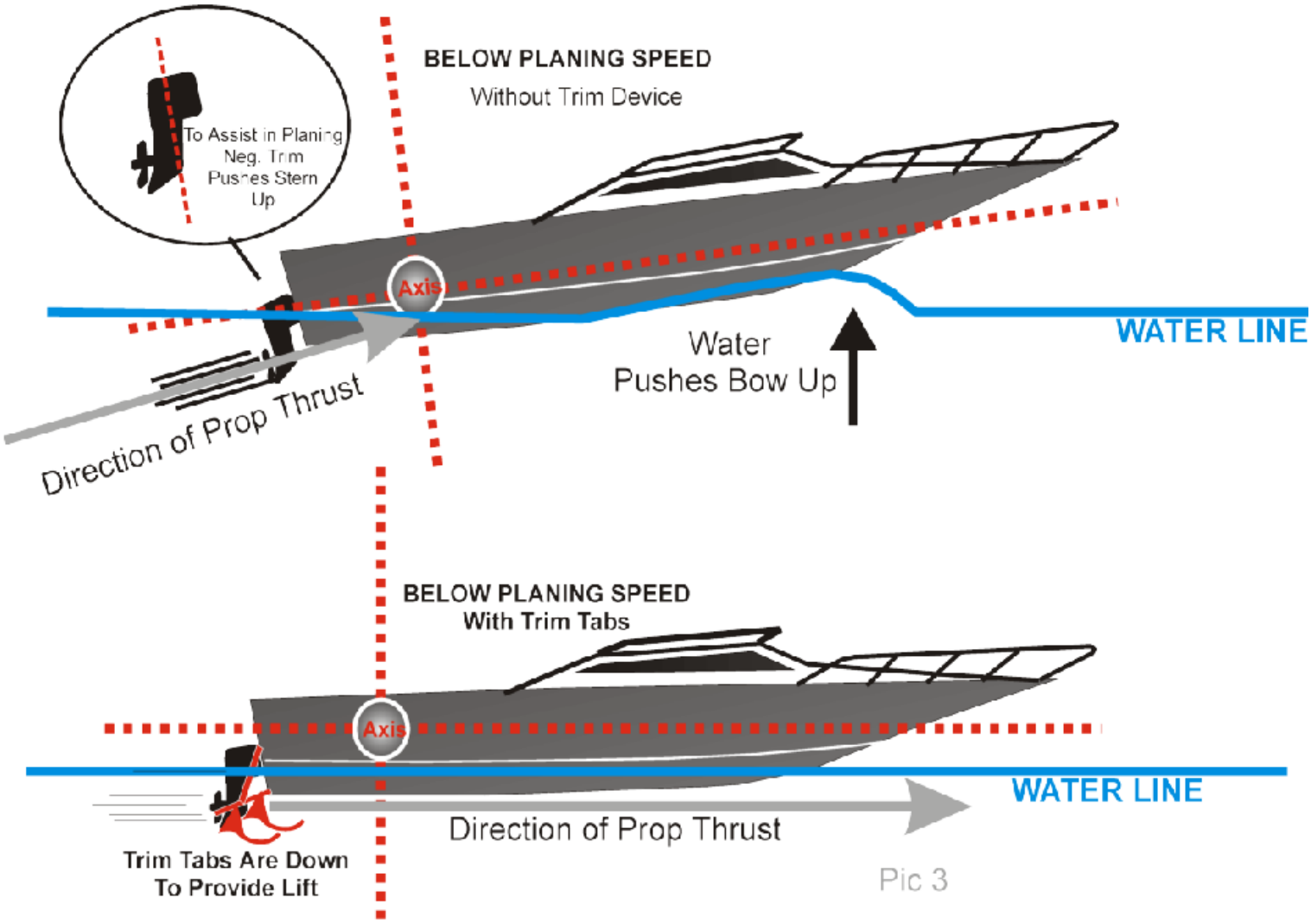


Common Remedies - Propellers and Hydrofoils

The two most common remedies are specialty Props and Hydrofoils, and both sell in enough volume to point to a need for planing assistance on small boats.

Propellers

If the standard propeller allows the WOT (wide open throttle) RPMs to be within the recommended operating limit of the engine, then a prop change could be a compromise to overall performance, especially if the change is simply to a different pitch. Going down in pitch will improve low end thrust, but sacrifice both top end performance and fuel economy since the engine runs faster than necessary.

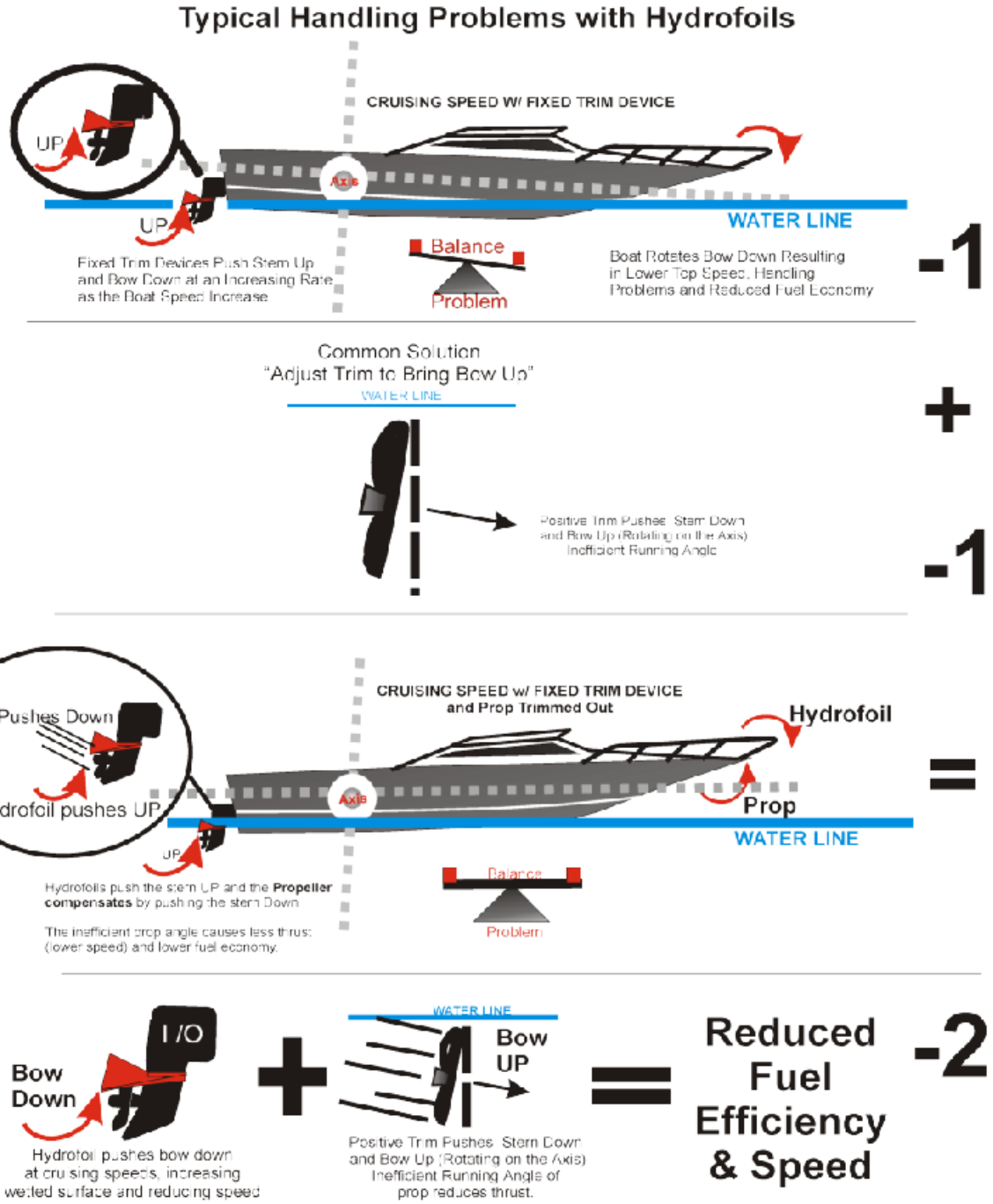


Pic 3

Hydrofoils

Foils add some additional lift to aid in planing. but sacrifice top speed, handling, and fuel economy in the higher rpm range. *Generally the foils are too small to make a major change in low end performance,* and because they are rigid create an increasing amount of lift as the boat speed increases. This excessive stern lift at higher speeds (especially above 30 mph) causes a bow down attitude which results in a reduction of both handling stability and speed. If the boat has "trim & tilt" the bow can be raised by trimming the motor out so that the prop pushes the stern back down and the bow up to a more correct attitude, however this creates an inefficient prop angle and causes a further reduction in economy and speed.

In either case these "fixes" are costly in terms of both overall performance and dollars. The initial cost of hydrofoils are inexpensive but since they sacrifice hull and prop efficiency the cost goes up every time the boat leaves the dock. If a prop is chosen for low end performance (acceleration) it to will also cost more every time it is used.



Trim Tab

Function:

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.

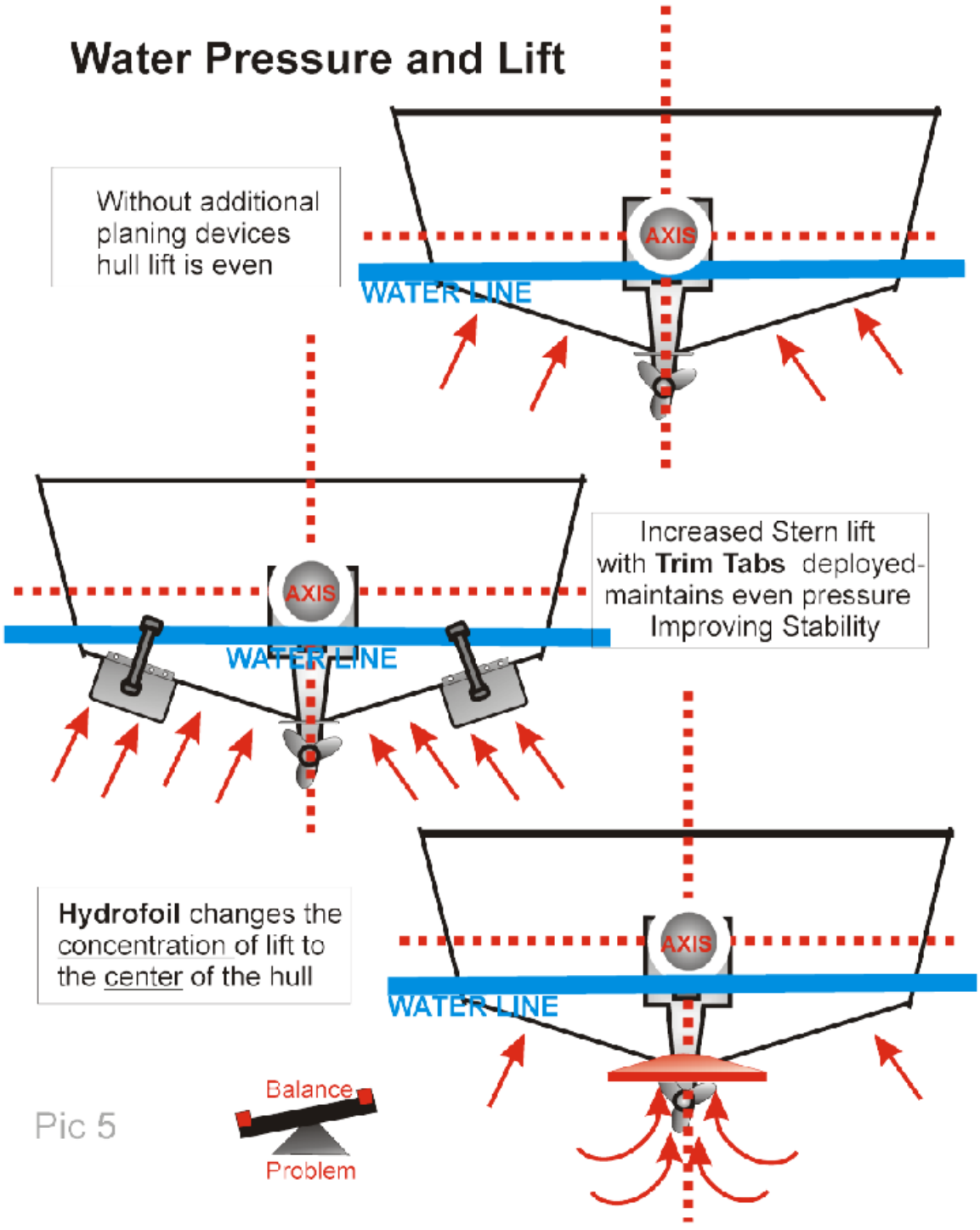
Since the boat is operating in a liquid, it is constantly rotating on an axis (balance point). By adjusting trim tab position while the boat is underway, the water pressure on the trim plates adjusts the boat attitude.

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.

Trim Tabs Improve Handling and Stability

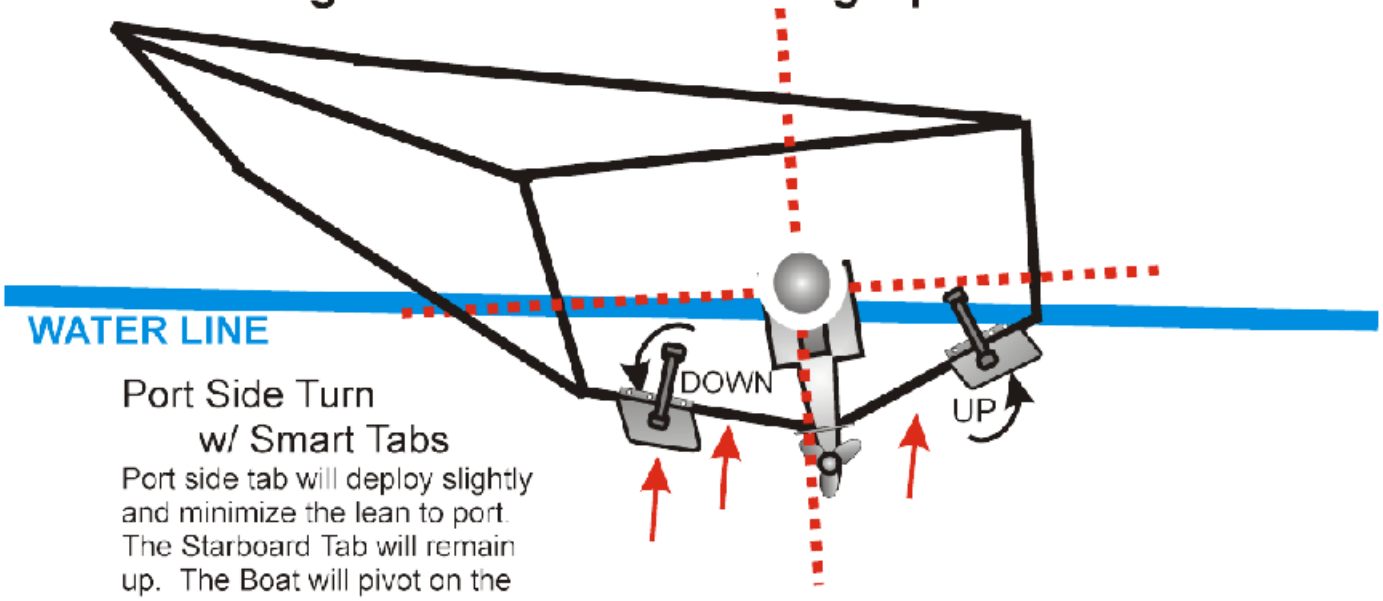
At cruising speeds trim tabs will not only improve the stern lift but add to the stability of the boat. The mounting location of the tabs should be as far to port and starboard as possible staying just inside the chine. These additional and adjustable running surfaces provide attitude control in all directions.



Pic 5

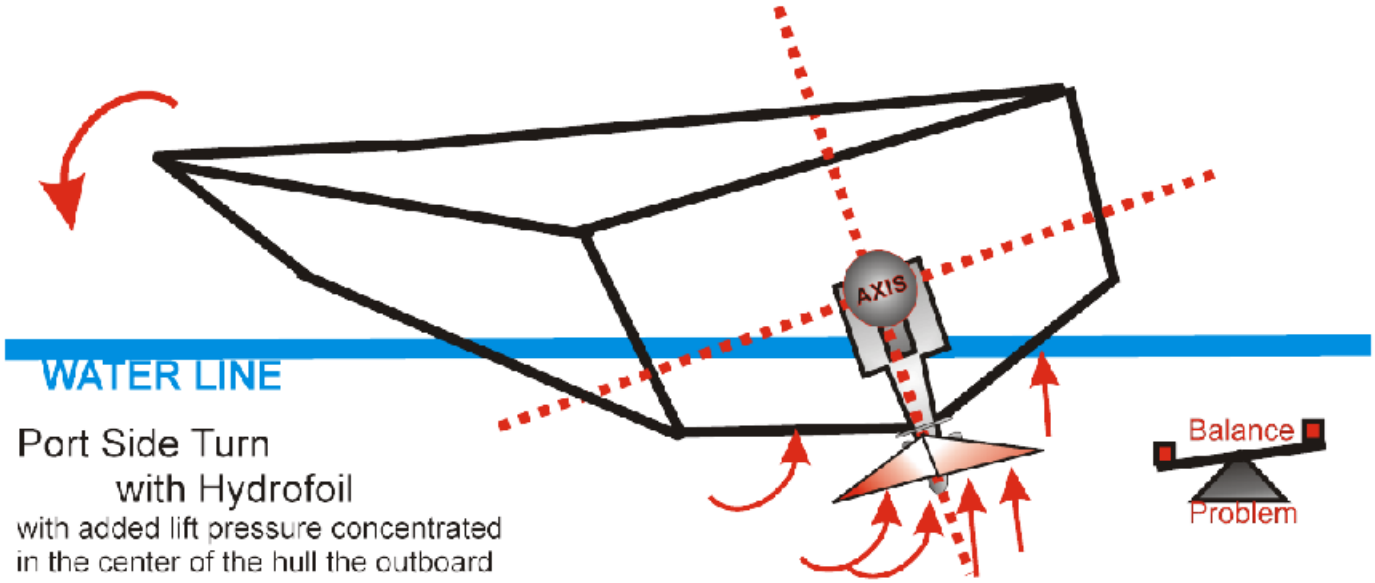
By contrast the hydrofoil can significantly and adversely affect the port to starboard stability. The hydrofoil is mounted to the anti ventilation (cavitation) plate which concentrates the additional lift in the center of the boat. Lifting any boat from the center will cause a port to starboard balance problem, and in the case of a "V" bottom hull the effect is similar to a "teeter totter".

Handling and Turns at Cruising Speeds



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).



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.

Boat reacts more dramatically in turns as it leans harder with the excess Lift pitching the bow down, and rolling it to the inside of the turn.

Helm Controlled Trim Tabs

Widely Accepted on Larger (Destination) Boats

It is accepted that trim tabs are a huge advantage on larger cruising boats, which we refer to as "Destination" boats. The primary advantages are allowing the boat to plane easier, and controlling port to starboard attitude.

These "Destination" boats leave the port, set a course, "trim out", and cruise in the same direction for an *hour* to their next port. Helm controlled trim tabs are perfect for this application.

Not well Suited for Smaller "Sport" Boats

Inconvenient
High Cost
Safety Risk

The boats in this "Sport" category are family bow riders, fishing boats, bass boats, lake runabouts, etc. Helm controlled trim tabs on these boats can be an advantage, but the use of the boat can make the use of trim tabs cumbersome. For example, the family bow rider seldom cruises in the same direction for more than a few minutes let alone an hour, and each time the direction is changed the trim should be adjusted.

Additional reasons helm controlled trim tabs are not common on smaller boats are one cost and two safety. The $400-$500 cost is disproportionate to the value of the boat. Safety becomes an issue at higher cruising speeds when accidental misuse drastically changes the boat attitude. If one tab is deployed at cruising speeds on a destination boat it will lean hard, but the family cruiser could throw the passengers in the water.

Nauticus incorporated

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 24' 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 22' it is like 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 course changes would likely dictate continuos trim tab adjustments.

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

2) Cost Vs. Boat Value

The $500.00 cost of helm operated trim tabs on a $50,000. "Destination Boat" is acceptable, but it is disproportionate to the value of a $10,000. to $20,000. "Sport boat".

SMART TABS *Retail prices range from $99. To $199. 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 common to helm controlled trim tabs are replaced by self contained nitrogen gas actuators. Similar to a spring, they hold the trim plate 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. There are 3 basic plate sizes.

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 can be adjusted 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.

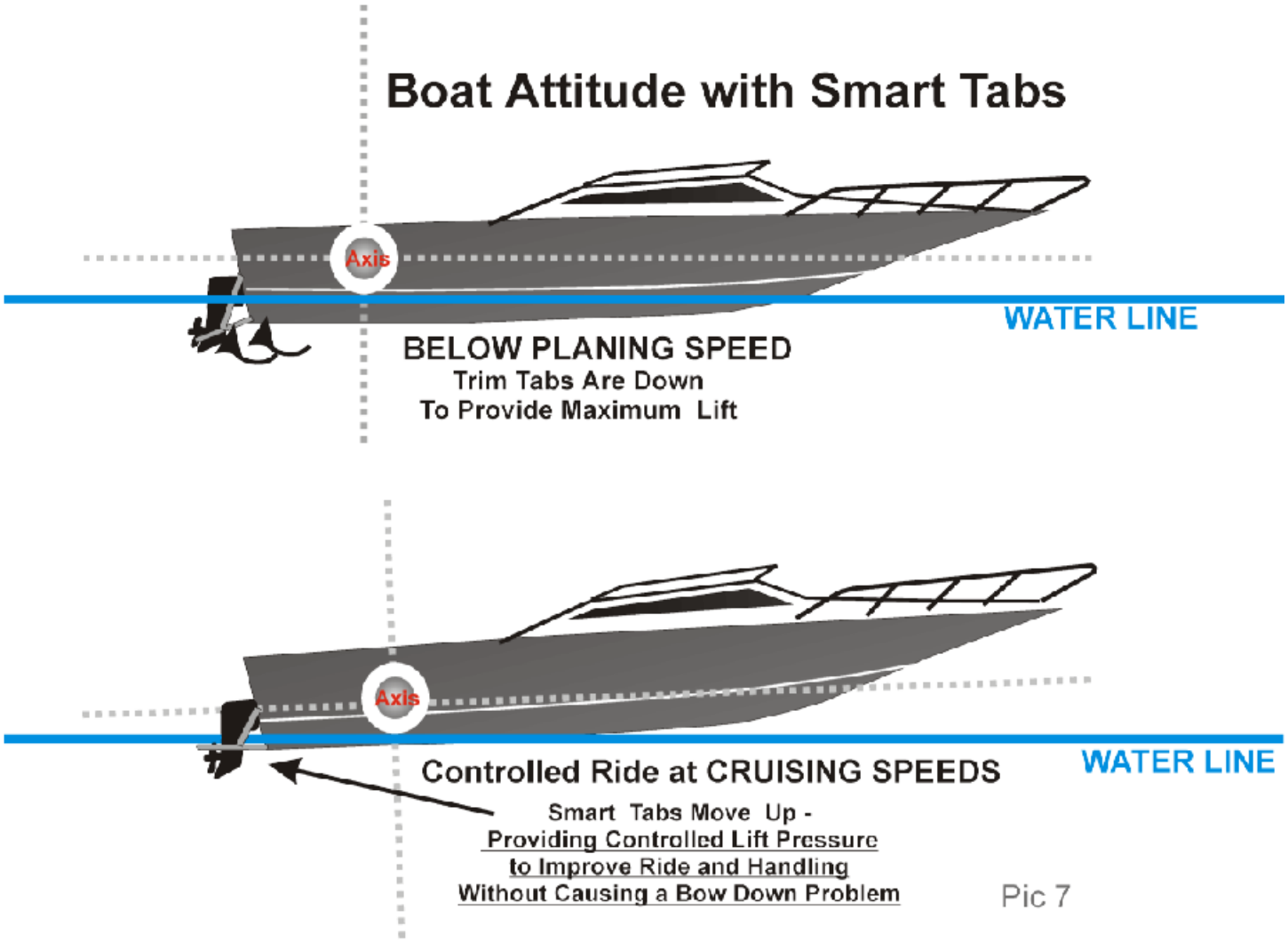
In order to achieve this **SMART TABS** actuators allow some of the gas to bleed to the opposite side of the piston during compression through a very small valve. This increases the resistance load during compression, but allows the actuator to "relax" once compressed.

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 by about 38%.

(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.



Pic 7

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.

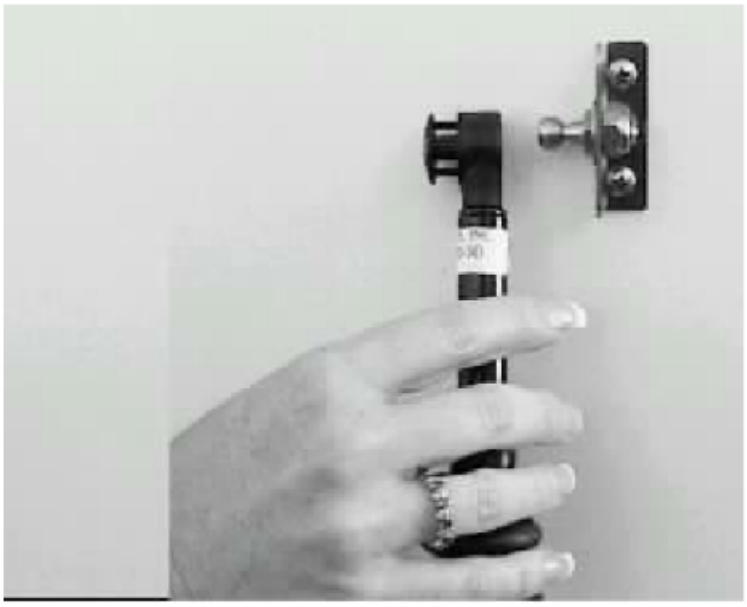
Here is what you get! (From low speed to wide open throttle)

1) Low speed (5 mph) wander is significantly reduced.
2) Bow rise before planing is reduced to 50% or less. (sit and see over the bow @ 10 mph)
3) The minimum plane speed is reduced 35% or more. (pull Tubes at 15 mph)
4) *Improve acceleration (i.e.: 0 to 30 mph) by 10% or more*
5) More speed at every RPM level (result is more MPG)
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*

Tech Tips and Frequently Asked Questions

System Adjustments:
Both the Transom Bracket and the Plate Bracket have elongated slots so that the system can be "fine tuned" for each application. This is typically a one time adjustment!

Transom Bracket -
This slot allows for adjustments to the plate angle at rest (25 degrees down). It is seldom necessary to make this adjustment.



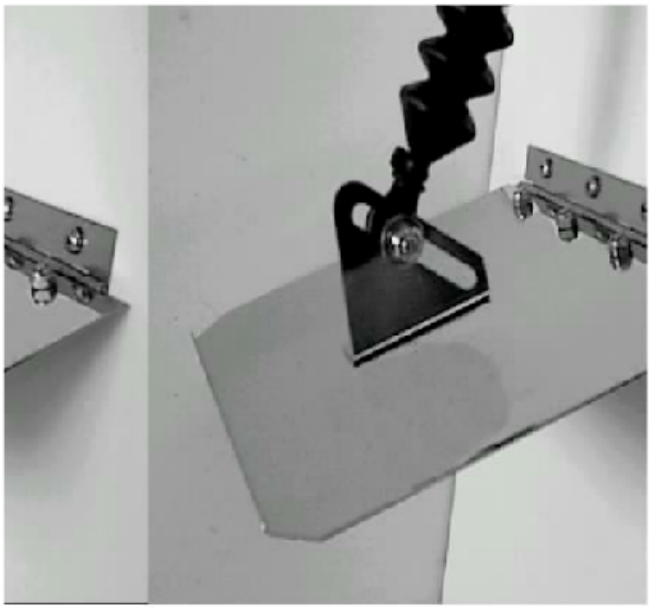


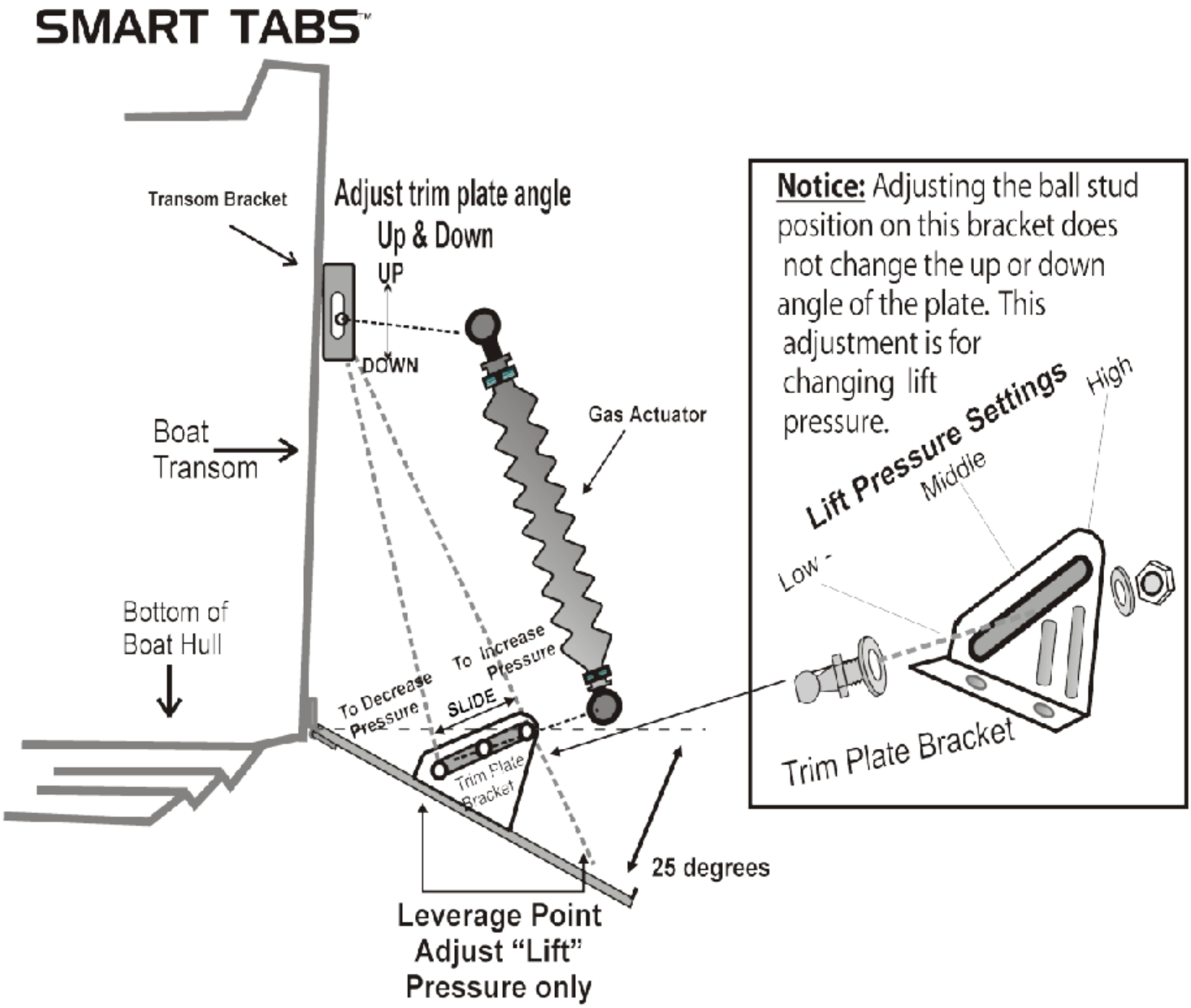
Plate Bracket -
The long slot in this bracket allows the lift pressure to be altered approximately 38%. By moving the attachment point of the actuator along the slot mechanical advantage of the plate changes making it easier or harder to lift the plate (compress the actuator). By making the plate harder to lift it stays down longer and lifts the stern with more force, and vice versa.

Too little pressure (lift) will cause sluggish low end performance, and too much pressure (lift will cause a bow down attitude at cruising speeds and slower top speed.

How to know what is best -

Set the adjustments in the center as the instruction indicate. Run the boat up to the maximum top speed. If the speed is slower than before the installation of **SMART TABS**, reduce the pressure by moving the attachment point down the slot closer to the plate. The boat should run 2 to 4 mph faster with the trim tabs.

NOTE: THIS ADJUSTMENT WILL NOT CHANGE THE STARTING ANGLE (25 degrees) OF THE PLATE



SMART TABS
APPLICATION CHART

Revised 05/03

Select Your Boat Type	Select Your Boat Length	Select Your Motor size	Select Your Motor type	SMART TAB MODEL #	$
☐ 	☑ 10', 11' 12'	☐ 8 to 18 HP	☐ 2 or 4 Stroke →	ST780-20	$99.99
		☐ 20 to 25 HP	☐ 2 or 4 Stroke →	ST780-30	
☐ 	☐ 13',14', 15"	☐ 30 to 40 HP	☐ 2 Stroke →	ST980-30	$149.99
☐	☐ 12',13', 14'	☐ 40 to 60 HP	☐ 4 Stroke →	ST980-40	
☐	☐ 14', 15',16'	☐ 60 to 80 HP	☐ 2 Stroke →		
☐ 	☐ 15',16,17"+	☐ 60 to 100 HP	☐ 4 Stroke →	ST1290-60	$199.99
☐	☐ 16', 17',18'+	☐ 60 to150 HP	☐ 2 Stroke →		
☐	☐ 17',18',19' +	☐ 150 to 240 HP	☐ 2 or 4 Stroke →	ST1290-80	

Note: Inboard engines and Jet drives are same as 4 stroke outboards.

Note: Inboard engines and Jet drives are same as 4 stroke outboards.

Technical Assistance
Customer advise and technical service is provided from 8:00 AM to 5:00 PM Monday - Friday

CALL 800 - 233 - 0194 OR 440-746-1290

WARRANTY: 5 year / 2 year

Nauticus

Nauticus, Inc. Warrants to the retail purchaser of this product that it is free from defects in material and/or workmanship for a period of Five (5) years on all metal components & Two (2) years for rubber boot covers and gas actuators, from the date of purchase

www.NauticusInc.com *Satisfaction Guaranteed*

SMART TABS TECH LINE 800-233-0194

Editors Test- "Real Do-It-This Weekend" Miracle ..."Better Speed! Handling! Holes hot! " (Feb 2002)

Editors Test - **Acceleration "a 10 % improvement"- Bow Angle during Hole shot a " 70% improvement". Ride & Handling - " there is little question that Smart Tabs make the ride more comfortable**

Editors Test - "Planes almost instantly" "noticeably smoother ride", "a 3 to 4 mph increase in top end" (April 2002)

International Magazine Tests

(New Zealand) Editors Test
"From a standing start ... it leaps onto plane" - "a noticeable difference in the way the Aquapro rode"- "Smart Tabs scored top marks ... boat being more level in turns" - "Top Speed improved .. because of better trim" Jan. 2003

POWERBOAT Magazine (Australia) Editors Test
"with a blustery wind creating substantial the GPS recorded top speed of 31.5 knots, and improvement over the non tab 28 knots" - At top speed, turns proved smooth, tight and effortless" Jan 2001