PONTOON HYDROFOIL APPLICATIONS INC.

VARA®

FOIL-STRUT-PLATE

VARA® Foil Hydrofoil Kit

INSTRUCTIONAL AND INSTALLATION MANUAL

Patent Pending

Version 1.9

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1. Introduction

Thank you for your purchase. Your new VARA® Foil Hydrofoil System will provide you with a new, exciting, and more "green" efficient way to enjoy your boat for years to come. Welcome to the VARA® Life!

1.1 Overview

There are many benefits of converting your boat to the VARA® Life which include achieving higher cruising and top end speeds, a quieter, drier ride as you push less water and more air, and less wear and tear on the engine as it becomes a more efficient platform with less drag. Boating with a VARA® Foil Hydrofoil System can be done safely, but new owners must be willing to take the time to learn about piloting a boat with an underwater VARA® Foil Hydrofoil System.

The VARA® Foil Hydrofoil System Kit contains four (4) different sets of components:

- VARA® Foil Hydrofoil Extrusion
- VARA® Attach Aluminum Angles
- VARA® Strut System
- VARA® Plate

In very general terms, the effects of mounting a VARA® Foil Hydrofoil System on a boat can be compared to that of how an airplane flies in the air. An airplane uses its wings to produce lift to fly coupled with a horizontal stabilizer located in the tail end which controls the pitch of the aircraft fuselage. The difference in this case is that water is approximately 825 times denser than air. The boat represents the fuselage of the plane with the VARA® Foil Hydrofoil extrusion as your "wing" which is supported using an axial-loaded VARA® Strut system and VARA® Attach aluminum angles.

The VARA® Plate is also a key system component which is mounted on the outboard motor and acts like the horizontal stabilizer on a plane. It helps control the attitude of the bow of the boat using the motor's trim/tilt switch when the wave conditions or weight distribution changes (i.e., passengers move forward or back). Operating a VARA® Foil assembly without a VARA® Plate is hazardous and prohibited and will void all warranties provided by PHA, Inc. No exceptions.

It is highly recommended the installer of the VARA® Foil Hydrofoil System watch the YouTube video which explains the basic theory behind the VARA® Foil technology, Center of Lift, and Center of Gravity to understand more before proceeding.

Link: https://www.youtube.com/watch?v=LUT2by9QhNM

Ensuring all boaters have a safe boating experience is our highest priority.

THE INSTALLER IS RESPONSIBLE FOR PROPER INSTALLATION.
READ THE ENTIRE MANUAL BEFORE PROCEEDING WITH THE INSTALLATION.
THE INSTALLER IS RESPONSIBLE FOR HIS/HER WORK.

Paid marine professionals are available and should be hired to install the product rather than proceeding with an improper installation.

The purpose of these instructions is to assist the VARA® Foil Hydrofoil System installer with step-by-step guide for properly installing a VARA® Foil Hydrofoil System Kit. Development of the VARA® Foil Hydrofoil System components is continually evolving.

DO NOT ASSUME THIS IS THE MOST CURRENT INSTALLATION MANUAL.

Verify the latest version of the Manual on the website at pontoonhydrofoil.com/manuals.

Read the instructions carefully as PHA, Inc. desires HAPPY and SAFE customers.

The intended audience for this manual should understand ALL the basic terms, definitions, tools, and methods described herein. If a step in this manual is not understood, **STOP!** Clarify the install method and procedure by contacting the Support Team at PHA, Inc. by phone, email, or text with the questions or concerns **prior** to moving forward with any additional steps. **WAIT** for written answers before continuing to avoid proceeding with what may be improper and/or create an unsafe boating situation.

Pre-installation checks must be performed to ensure optimal results and may affect the stated product guarantee, if applicable. These include but are not limited to:

1. Check to make sure that the pontoon bottoms are free from growth, barnacles, algae, hairy growth, and all types of parasites. Bottoms should be as clean as from the factory whether painted or not. This will affect VARA® Foil Hydrofoil performance accordingly.
2. The boat should be dry and ready for boating. This includes checking for water inside the pontoon tubes, storage compartments, and all areas or items in boat that may hold water. Extra weight is not only dangerous for the boater but will affect the VARA® Foil performance accordingly.
3. The pontoons should not have large dents or dings which may affect the speed gain warranty.

It is highly recommended the installer watch the help videos posted and available on our YouTube Channel located @pontoonhydrofoil prior to proceeding.

For questions or concerns, contact the PHA, Inc. Support Team before proceeding.

2. Getting Started

2.1 Material and Tool Checklist

A) Examine shipping boxes and document any damage before opening.

B) Open boxes, unwrap, inspect, and document any damaged contents.

C) Verify, document, and inventory all contents. Check that all parts are present and undamaged before starting the installation. Contact PHA, Inc. immediately to report any missing or damaged component. Content list includes:

- VARA® Foil Hydrofoil Kit Installation Manual (1)
- VARA® Foil Hydrofoil Hardware Kit with thread locker (1)
- VARA® Attach Aluminum Angles (2)
- VARA® Struts (2)
- VARA® Foil Hydrofoil Extrusion (1)
- VARA® Plate Installation Manual
- VARA® Plate Hardware Kit with thread locker (1)
- VARA® Plate (1)

D) Gather Minimum Tools Needed:

- Battery Drill with ¼" metal drill bit
- Temporary marker, pencil, pen
- ½ inch wrenches (2)
- 7/16-inch wrenches (2)
- 3' Level
- Tape Measure
- Yardstick for side-to-side measurements
- Small C-clamps (4)

E) Optional Tool Suggestions:

- Use a ratcheting wrench with 7/16" and ½" hex when attaching the VARA® Attach aluminum angles and VARA® Foil Hydrofoil installation steps.
- Using a socket wrench with a 7/16" and ½" sockets may also shorten installation time.
- Use a wrench and nut driver to install box bolts supplied for underskinned boats.

2.2 Cautions, Warnings and Reminders Before Proceeding

A) Each VARA® Foil Hydrofoil Kit is custom built and delivered pre-fit to the measurements provided by the customer following purchase. PHA, Inc. cannot be responsible in the case of inaccurate measurements provided.

B) Wear proper safety gear (i.e., safety goggles) when installing the equipment.

C) Do NOT use electric power tools near the water or in unsafe areas.

D) Check and double check that ALL nuts, bolts and drain plugs are tightened before use or putting boat in water.

E) Do not cross thread screws or bolts.

F) Starting bolts and screws by hand before using a tool for tightening is highly recommended.

G) Do not overtighten bolts and/or nuts.

H) The best rule of thumb is to check side-to-side, up-and-down, and front-to-back mounting measurements before drilling any hole.

I) Check that VARA® Attach Aluminum angle brackets are mounted as mirror images and distances/measurements are the same from port to starboard sides before, during and after installation.

J) The boat must be somewhat level side-to-side and front-to-back for install. Check with level on flat portion of deck, if needed. The closer to level, the better the results achieved.

K) Having too high of “Angle of Attack” (AoA) setting initially will likely cause the hydrofoil to lift the boat too much resulting in the boat “popping” out or “porpoising” before reaching top speed and likely result in poor performance.

J) **As a safety reminder, all passengers are highly advised to remain seated while the boat is in motion to avoid injury.**

USE CAUTION DURING INSTALLATION!

The VARA® Foil Hydrofoil Kit components are metal and may become VERY HOT if exposed to direct sunlight. It is recommended to complete the assembly in a shaded area. Use extreme care when handling.

3. Assembling VARA® Foil Hydrofoil Extrusion and VARA® Struts

Experience Level: Very Easy

Estimated time: 20 minutes

3.1 Hints for Assembly

A) It easier to install the VARA® Struts into the VARA® Foil Extrusion with all parts upside down to visually see the arrows on the matching parts while looking down on them. The VARA® Struts are upside-down when the wider part of the "legs" face downward with the welded 90-degree insertion plate at the top. The VARA® Foil Hydrofoil extrusion section is upside-down when the notches for the struts on the end of hydrofoil face downward and the counter-sunk screw holes are on the top – facing upward.

B) When lining up red/green arrows, the arrows are located on the extrusion inside the bottom end while the arrows on the struts are located on the bottom side of the short insertion plate.

C) The VARA® Foil extrusion is forward when the "Leading" edge (blunt side) faces forward, and the "Trailing" edge (sharp side) faces the rear.

D) The VARA® Struts have slots on the forward strut leg and 5/16 drilled round holes on the back strut leg. When assembling the component, ensure the forward legs of the struts (slotted) match the "Leading" side of the VARA® Foil extrusion.

3.2 Assemble the VARA® Foil Extrusion/VARA® Struts Component

A) Gather the required parts including the VARA® Struts, VARA® Foil Hydrofoil extrusion, #10-24 x 5/8" Stainless Flat Head screws (4), Allen-key wrench (1) and packet of thread locker (1).

B) Line up the two (2) RED arrows on the Port side VARA® Strut with the two (2) RED arrows on the Port side of the VARA® Foil extrusion. Insert and push the strut insertion plate into the VARA® Foil extrusion until the two (2) screw holes located on the bottom line up. See Images #1 and #2.

C) Next, line up the two (2) GREEN arrows on the Starboard side of the VARA® Strut with the two (2) GREEN arrows on the Starboard side of the VARA® Foil extrusion. Insert and push the strut insertion plate into the VARA® Foil extrusion until the two (2) screw holes located on the bottom line up.

See Images 1 through 4 below.

Image 1.

Image 2.

Image 3.

Image 4.

D) Check for proper alignment of all holes. [HINT: Alignment can be confirmed when inserting the 10-24 x 5/8" Allen-head bolts into the holes and hand-tightening by two (2) turns without cross-threading.]

E) After completing the bolt alignment step – remove each bolt and apply a generous amount of thread-locker as directed on manufacturer's separate packaging before restarting making sure ALL threads and bolt heads are covered w/ thread-locker.

Important: Do NOT forget this step!

F) Hand-start bolts and tighten until flush with the bottom side of extrusion using the Allen-key wrench. The VARA® Foil Extrusion / VARA® Strut Assembly is now complete when there is no play between struts and foil. Clean up any excess immediately if needed.

3.3 Perform Measurement Checks

A) Measure the dimension from outside strut-to-outside strut inside the V. This is the maximum width of your assembly. It should match your minimum dimension from inside pontoon tube to inside pontoon tube or inside strake to inside strake. This is the measurement supplied to PHA, Inc. on the post checkout form for your custom build.

Record the measurement here: _____.

B) While under the boat near the trailer axle area, measure the width dimension (side-to-side) between the outermost pontoons.

Record the measurement here _____.

C) The outer dimension of the strut-to-strut width measurement should be within 1/4" of the dimension between the pontoons. If the dimensions are within 1/4" of each other, move on to the next step.

If not, contact the PHA, Inc. Support Team.

4. Installing Your VARA® Attach Aluminum Angles

Experience Level: Moderate

Estimated time: 1.0 hour

The object of the VARA® Attach Aluminum Angles installation step is to locate and install the center of each VARA® Attach aluminum angle along each side of the boat vertically above the inside edge of the outermost pontoons with the Center of Gravity (Cg) mark vertical close to the Cg location measurement from forwardmost part of boat provided by PHA, Inc. with the kit order.

4.1 Important Notes Before Proceeding

A) Inspect the pontoon tubes for any dents or damage.
B) The boat must be within ten (10) degrees side-to-side level for this assembly.
C) Locate and mark all wiring and plumbing lines before drilling or bolting aluminum angles to the deck channels.
D) Do **NOT** drill through wiring, plumbing, or cables, etc.
E) Most kits contain 74” long aluminum angles, however, shorter or longer versions may have been provided based on the specific type of application.
F) The VARA® Attach aluminum angles must be attached to 4-5 crossbeams parallel to and inside each of the outermost pontoon tubes for structural integrity.
G) PHA, Inc. provides the desired location known as the “CG” (CG) location based upon measurements provided by the customer to PHA, Inc. at the time of purchase. The trailing edge of the VARA® Foil mount will start here.
H) The CG location of the VARA® Attach Angles will not always layout evenly between the deck beams of your boat when mounting. This is NOT a problem. You will need to slide the angle location forward (preferred) or back accordingly for an even fit onto the existing deck beams. When required, align the CG location on the angles to **NO MORE THAN 12 inches** from the CG location provided. Contact support if your outside of these parameters.
I) After clamping the VARA® Attach angles to the beams for pre-fit and visual checks, each will be drilled and bolted to the deck beams under the deck.
J) The final attachment should be mounted vertically above AND parallel to the inside most edge of the pontoon tube on each side.
K) **Boats with vertical-sided (straight) pontoons (i.e., JC style) must reverse the aluminum angle for proper fit. Call the PHA, Inc. Support Team for additional instructions.**

4.2 Measuring to Attach the VARA® Attach Angles

A) Remove the VARA® Attach aluminum angles from packaging.

B) Using a tape measure while under the boat, measure from the forwardmost part of the boat (usually but not always the front deck) to the starting mark provided by PHA, Inc. inside the pontoon tubes on both sides. This desired mark is known as the CG location.

C) Place a mark or piece of tape inside both pontoons at these locations. This locates your VARA® Attach angles at "desired" mounting location front to back. Keep in mind that this "desired" location will almost never fall exactly in a place where you structurally span the beams evenly. This is one reason why the angles have pre-drilled holes to allow for adjustments. You have now located your front-to-back "Starting Point" (SP). The CG mark of angles should be as close to CG mark inside toons as possible.

D) It's now time to locate the side-to-side location. Using a level vertically, level up from the inside-most-point of the outside pontoon tubes. Make sure there are no dents or damage in this measurement area (usually created from having inside trailer guides) that may affect the actual measurement.

E) Next, level vertically to the bottom of crossbeams and place a mark on the three (3) beams forward and the two (2) beams behind the SP location. Reminder: The angles are to be bolted to four (4) beams minimum with five (5) being preferred on each side. **NOTE:** This is NOT the final side-to-side location of the VARA® Attach angles as the boat is not perfectly level from side-to-side.

F) Measure from these marks outward to the builder-installed vertical plates that attach each pontoon tube to each beam on each side of the same beam. Determine the average by adding the measurement of side 1 plus the measurement of side 2 then dividing by 2 for the corrected value.

For example, if you measure the forward marked beam from vertical level mark to the vertical plate on the port side and get 7", then measure the mark on the opposite side to vertical plate and get 5", add 7+5=12". Divide this by 2 to average the dimension on that beam. The average in this example case is 6".

In the example shown above, you would measure and place a mark six (6) inches from the vertical plate on each side of the same deck beam. This measurement from mark to mark should add up to the width of your VARA® Foil hydrofoil outside of strut-to-strut measurement in the measurement check in the previous section. This will also center the VARA® Attach angles to your boat.

G) Repeat Step F above for all the beams that the VARA® Attach angles are to be mounted. If all measurements are consistent and the same trend is happening, then you should be able to use just the front and back beams as your marks. This is typical, but you must check YOUR application!

4.3 Attaching the VARA® Attach Aluminum Angles

There are different steps required for attaching VARA® Attach angles based upon boat type. Variations include whether the boat has vertical-sided pontoon tubes or if it is under-skinned or not. Follow the steps below that are appropriate for your specific boat application. **If your boat has vertical-sided (straight) pontoons (i.e., JC style) the aluminum angle must be reversed for a proper fit. Call the PHA, Inc. Support Team for additional instructions at this step.**

If the boat is NOT under-skinned and the C-channel deck beams are visible, continue to Steps 4.3A through 4.3H.

If the boat is under-skinned with thin aluminum or fiberglass sheeting (C-channels or deck beams are NOT visible), SKIP to Steps 4.3I – 4.3O.

CAUTION: Accessing the underside of the under-skinning to install nuts on the back side of the bolts through the deck channels can be difficult. If you cannot access the underside to attach the supplied bolts and lock nuts, we offer a separate stainless steel blind bolt hardware kit for purchase for this type of application. If the fuel line, plumbing, or electrical wiring locations are not known, hire a professional to perform the installation.

For boats with exposed C-channel deck beams, complete Steps 4.3 A-H.

Supplied hardware for this section:

- 1/4-20 x 1” bolts (12)
- Nylon lock nuts (12)

A) Using C-clamps, clamp each VARA® Attach angle at the proper marks with flat edge of angle inboard. The inboard edge will be aligned with the averaged side-to-side marks on beams. The desired CG mark on the angles will fall within 12” of the desired CG location marked on the inside of the pontoon tubes.

B) Double check that your overhang distance of each angle from corresponding beam is the same on each side. This keeps your holes lined up and your VARA® Foil aligned in boat when mounted.

Important:

- After clamping angles in place, measure the distance between the flat faces where the VARA® Strut outboard edges will mount, this should add up to your outside-to-outside VARA® Strut dimension.
- Remember, the angles are mounted with vertical flat edges facing each other toward the centerline, there may be a mark on each angle indicating forward and port/starboard side with a corresponding color. The bolts fasten through the outward facing flange into the deck beams except with vertical wall toons.
- **STOP!** Double check the directions above before drilling.

C) Get the drill ready with 1/4” drill bit.

NOTE: Each VARA® Attach Angle must be drilled and bolted with a single ¼” bolt and locknut at each location where it intersects the deck beams.

D) Remember to check behind each drill location for wires, fuel lines, cables, or any interference before drilling a hole.

E) Drill a hole at each drill point along each angle as close to the vertical C-channel edge as possible leaving just enough room for the locknut.

Important: Do NOT substitute or change the hardware supplied with the kit.

F) Install bolts and nuts then tighten ALL bolts firmly.

G) Double check each bolt/nut for tightness before proceeding.

H) Proceed to Final Attachment of VARA® Foil / VARA® Strut Assembly step.

For boats under-skinned with thin aluminum or fiberglass sheeting and the deck beams are NOT exposed, complete Steps 4.3I – 4.3O.

Supplied hardware for this section include Box Bolts (10).

I) Installation with under skinned boats will usually take 2 people, 1 holding and 1 holding and drilling.

J) Locate each VARA® Attach angle over the marks transferred from the inboard edge of the pontoon tubes with the long flat edge of the angle that has holes inboard. The inboard edge will be aligned with the side-to-side marks on the cross beams and the desired front-to-back location at this point. The CG location mark on the angles should be within 12" of the desired location/measurement on the inside of pontoon tubes.

Important:

- The measurement between marks should match the smallest distance between the outside pontoons sand match the outside dimension from strut-to-strut of outward edges measured at bottom of the V intersection of the VARA® Struts.
- Remember, unless you have vertical wall toons, the angles are mounted with vertical flat edges facing each other toward the centerline, there may be a mark on each angle indicating forward and port/starboard side with a corresponding color. The bolts fasten through the outward facing flange into the deck beams.
- **STOP!** Double check directions above before drilling.

K) Get the drill ready with 1/4" drill bit. NOTE: You now have a choice:
- Either cut the underskinning at the angle attachment locations for a thru bolt install. The advantage is this allows you to drop the underskinning in the future without damaging your Box Bolts. OR
- Mount right over the underskinning where each deck beam intersects the VARA® Attach angle. Each side must be drilled and box-bolted with a single box-bolt with a total of five (5) per side.

- **STOP AGAIN to double check your drill locations.**
- Remember to check behind each drill location for wires, fuel lines, or any other interference before drilling.

L) Drill for each thru-bolt or Box Bolt as supplied.

M) Tighten per manufacturer's instructions using supplied thread-locker.

N) Double check each bolt is tightened to the manufacturer's specifications.

O) Proceed to Final Attachment of VARA® Foil / VARA® Strut Assembly step.

5. Attachment of VARA® Foil / VARA® Strut Assembled Unit

Experience Level: Easy

Estimated time: 20 minutes

The object of this section is to properly attach the VARA® Foil Hydrofoil/ VARA® Strut Assembled Unit to the mounted VARA® Attach aluminum angles at the recommended initial position based on the calculations provided and delivered with the kit. Once attached, it is highly recommended to run the boat with no more than two (2) people onboard to learn how your specific boat responds to the new equipment.

Remember, the position of the VARA® Foil Hydrofoil / VARA® Strut assembled unit is fully adjustable from front-to-back along the VARA® Attach angles (X-Axis), VARA® Foil depth (Y-Axis) and AoA (Z-Axis) by using the forward slots and round holes on each VARA® Strut. NOTE: The amount of adjustability may be limited on underskinned boats as the underskinning will restrict access to the space underneath the decking. Refer to the Section "Understanding Adjustments to Your VARA® Foil Hydrofoil System" of the Manual for more details.

5.1 Easy Install Hacks Before Proceeding to VARA™ Foil Installation

A) The VARA® Foil / VARA® Strut Assembly may be become extremely **HOT** especially if left in the direct sunlight. Use caution when handling.

B) It is best to have two (2) people lift the VARA® Foil / VARA® Strut Assembly during this step to protect the trailer and/or the extrusion from dings, scrapes and damage during install.

C) The proper mounting orientation for the unit is for the "Leading" edge and slots of struts to be toward the front of the boat with the "Trailing" edge and drill holes of struts toward the back of the boat.

D) The recommended height at which to initially mount the assembly to the VARA® Attach angles is in the (2^{nd}) **second** hole from the top and the (2^{nd}) **second** slot from the top which provides a 2-degree AoA. This has been the best starting point setting for all installations to date. Any adjustments to the recommended initial set-up guidelines are done at your own risk. Contact the PHA, Inc. Support Team for more information.

E) During install, it is easiest to insert two (2) aft bolts then loosely apply locknut on back. Swing VARA® Foil upright to check that the Trailing edge location is directly under the CG location starting mark you installed on the inside of toons. If so, install forward bolts in slots with loosely applied locknut.

F) ALL bolts should be assembled with bolt heads inboard with nylon nuts outboard.

5.2 Gather the required hardware and tools

- 1/2" wrenches (2)
- 5/16-18 x 1-1/2” Hex Head Bolts (2)
- 5/16-18 x 1-1/2” Carriage Bolts (2)
- 5/16” nylon locknut (4)

5.3 Attaching the VARA® Foil / VARA® Strut Assembled Unit

Set the previously assembled unit on a piece of carpet or padding behind the boat with the struts up and VARA® Foil extrusion in the front-to-back position.

A) Find the VARA® Foil Hydrofoil location mark that was transferred under the deck in Step 3 of instructions. This mark represents where the back or “Trailing” edge of the VARA® Foil Hydrofoil should be located.

B) While lifting the VARA® Foil / VARA® Strut Assembled Unit, insert a hex head bolt into the 2nd round hole down at the back of the Port side V’d strut to attach it to the mounted VARA® Attach angle. Add a locknut and only hand-tighten at this time to keep the unit from falling.

C) Repeat the above step 5.3C for the Starboard side.

D) Next, install a carriage bolt into the 2nd slot down at the front of the V’d strut to attach it to the Port side mounted VARA® Attach angle. Add the nylon nut and only hand-tighten at this time to keep the unit from falling.

E) Repeat the above step 5.3D for the Starboard side.

F) Check for proper alignment by counting exposed holes on both sides. The “Trailing” edge should be within ½ inch directly under the CG location starting mark. If not, relocate VARA® Foil Hydrofoil Assembly Unit to within ½ inch of the mark provided.

G) Once aligned, tighten ALL bolts.

H) Confirm ALL bolts are tight before moving to the next Section.

6. Final Checks Before Using Your VARA® Foil Hydrofoil System

A) Ensure the VARA® Foil Hydrofoil “Trailing” edge (back edge) is lined up vertically to the CG location mark or measurement provided to the mark on the inside of both pontoons measured from the forward most point of the boat underneath the deck.
B) Ensure ALL hardware, nuts, and bolts are tight on all components prior to use.
C) Check that both VARA® Struts are attached to the VARA® Attach angles with all bolts tightened in the second hole and slot from the top (recommended for the initial set-up which provides two (2) degrees AoA.
D) Watch the video located at https://www.youtube.com/watch?v=LUT2by9QhNM.
E) Mark the VARA® Strut location after bolting to the VARA® Attach aluminum angles in case adjustments are needed.
F) Review the Tables Section provided with this manual to understand the type of information needed during the dial-in and adjustment steps.
G) Inspect and record your original prop specifications (i.e., manufacturer name, year, diameter, pitch, number of blades, material, etc.) in case adjustments are needed.
H) Inspect and record your engine mount bolt hole location in case adjustments are needed.
I) Use Table 2. Record of Changes with Original Prop to record initial data.
J) Use Table 3. Record of Changes with Prop Change to record additional data.
K) Use the “Dial-In and Setup Notes” page to record settings and results.

CAUTION!

As a safety reminder, all passengers and crew should remain seated at all times while the boat is in motion.

7. Understanding Adjustments To VARA® Foil Hydrofoil System

The initial install location may NOT be your final performance position for your specific application. The final position will be based on the results achieved during the "Dial-In" period. As you begin to use the boat and experiment with its new handling capabilities, there are several factors to consider when making the final decision on the preferred mounting location. These factors include such things as how many passengers are most commonly on-board, environmental factors, water conditions, and the most important benefit you desire (i.e., higher speed vs. better ride).

Always operate the boat in a safe manner and BE PATIENT while learning. When you first start using your VARA® Foil Hydrofoil, you are learning how your boat responds to the VARA® Foil Hydrofoil (i.e., travels bow up, bow down, or level thru the speed curve). Making the necessary adjustments during the dial-In period varies for each boat and boat owner. Underskinning on the boat may restrict the amount of adjustability of the X-axis and Z-axis (AoA). To achieve the full range of adjustability on boats with underskinning, some modification of the underskinning material or VARA® Struts may be required. It is recommended to cut a ½ " notch in the underskinning to accept the VARA® Strut legs rather than cutting the VARA® **Struts. Contact the PHA, Inc. Support Team before proceeding or attempting to make any modifications.** Once your VARA® Foil Hydrofoil system is dialed-in, you will notice a totally different pontoon boating experience including faster top end, more efficient cruising speed, smoother/drier ride, less engine wear-and-tear as well as getting better fuel economy.

7.1 Helpful Hints

A) Avoid following in the white-wash wake (aerated water) of other boats and excessive weeds when possible as this reduces performance.

B) When getting started, use the front of the boat to watch the water line while testing. You will feel the difference once the hydrofoil begins to produce lift.

C) The VARA® Foil starts to produce lift at approximately 15-16 MPH. If you are not getting noticeable lift or increase in speed, you may need a prop change. Contact the PHA, Inc. Support Team for assistance.

D) Determining the best cruising speed will be part of the "Dial-In" process. You will notice that as the bow wave moves further aft on the pontoons, the ride gets quieter. This is usually a good indication you have decreased the drag and are at the optimal cruising speed.

E) Practice using the trim/tilt switch to change the pitch of the bow of the boat using the VARA® Plate at various speeds. Using small “bumps” rather than large changes is the best practice under normal operating conditions. The VARA® Foil Hydrofoil will react quickly to small changes, especially at faster speeds.

F) The attitude the boat needs to be synchronized with the VARA® Plate so that each component is doing its part. Ideally, we want 70-80% of the boat’s traveling weight on the VARA® Foil, 10-12% on the VARA® Plate, and the balance on the pontoons. As more passengers are added, this will affect this ratio.

G) Note the following upon starting the process and when making adjustments:

- The sound of the water as the boat begins to lift and come up on plane.
- The location of where the wave begins along the sides of the boat.
- The amount of wake being produced.

7.2. Center of Gravity (CG) Adjustments

The VARA® Foil Hydrofoil used along with the VARA® Attach aluminum angles allows for changes along the X-axis (front to back) to match the boat’s CG. Before making a change, you need to consider your normal everyday traveling conditions/mode (i.e., number of passengers, normal gear on board, amount of fuel, and cooler location). After the initial dial-in period, situations that normally warrant changes include but are not limited to situations such as changing to a different motor, adding a battery or batteries, changes in water conditions/temperature during different seasons, etc.

A) If the bow is riding too high and your VARA® Plate does not bring it back down effectively with the trim/tilt max down, then you may move the location of the VARA® Foil aft. To do this, unbolt the four (4) mounting bolts that attach the VARA® Foil / VARA® Strut Assembled Unit and move it aft along the VARA® Attach aluminum angles and re-bolt ALL bolts. It is recommended to only move it two (2) bolts holes front or back at any one time until the ideal performance is achieved.

B) If the bow is riding to low or the prop is ventilating (too much air) and the VARA® Plate does not bring it up effectively, then you may move your VARA® Foil forward. To do this, unbolt the four (4) mounting bolts that attach the VARA® Foil / VARA® Strut Assembled Unit and move it forward along the VARA® Attach aluminum angles and re-bolt ALL bolts. It is recommended to only move it two (2) bolts holes front or back at any one time until the ideal performance is achieved.

7.3 Angle of Attack (AoA) Adjustments

The VARA® Foil Hydrofoil used with the VARA® Attach angles allows for changes to the Z-axis to achieve the desired AoA which affects the amount of lift achieved.
The VARA® Struts have six (6) sets of holes and slots on each leg. The VARA® Foil is mounted with all four strut bolts located in hole # 2 from top as recommended for the initial install. The VARA® Foil is then set at two (2) degrees AoA. Each difference in the front slot to back hole of struts represents one (1) degree of change.

NOTE: If the boat is underskinned and a larger AoA is needed, modifications may be required as the legs of the VARA® Struts may need to extend farther than the underskinning material will allow. The best method to avoid damage would be to cut a notched opening in the underskinning material to allow for the VARA® Strut legs to pass through to allow for the desired adjustment. Contact the PHA, Inc. Support Team before proceeding or attempting any modifications.

A) Each height change equals one (1) degree difference in the AoA.

B) To decrease the AoA by one (1) degree, lower the front bolt location one each side in the front slot to be one (1) position lower than the back bolt locations. Check that the positions match side to side.

C) To increase the AoA by one (1) degree, raise the front bolt location on each side by one (1) slot higher than the back bolt locations. Check that the positions match side to side.

7.4 VARA® Foil Hydrofoil Depth Adjustments

The VARA® Foil Hydrofoil used with the VARA® Attach aluminum angles allows for changes to the Y-axis to achieve the desired depth. The VARA® Foil Hydrofoil is designed to be positioned between two (2) to six (6) inches below the lowest pontoon but higher than the motor in its trimmed down position.

The position of the VARA® Foil / VARA® Strut Assembled Unit may be adjusted up and down as much as four (4) inches. As mentioned, the initial mount position is the second set of holes/slots from the top.

Several components in VARA® Foil Hydrofoil system generate lift and spread the loads. These include the motor, the VARA® Plate and the VARA® Foil extrusion. As the VARA® Foil Hydrofoil is lowered making it deeper in the water, the engine depth will generally need to follow. There is a balance to the interaction between the VARA® Foil Hydrofoil and the VARA® Plate that will take some time to master. For the gearheads that want every 1/10th of boat speed possible, that is part of the fun!

A) To increase the depth, lower the bolt location in the front slot and back hole remembering to maintain the desired AoA. Check that the positions match side to side.

B) To decrease the depth, raise the bolt location in the front slot and back hole remembering to maintain the desired AoA. Check that the positions match side to side.

8. Troubleshooting and Use of VARA® Foil Hydrofoil System

Always check the VARA® Foil / VARA® Strut Assembled Unit is attached to the VARA® Attach aluminum angles with all bolts tightened in the second holes/slots from the top providing two (2) degrees Angle of Attack (AoA) initially, as recommended.

8.1 The bow lifts too high when increasing speed causing a "popping out" effect and the boat to come back down into the water after hydrofoiling begins.

A) Try repositioning the VARA® Foil / VARA® Strut Assembled Unit further aft until a slight bow-up attitude that is controllable with the VARA® Plate is achieved.

B) Try moving more weight forward (crew, coolers, gear, etc.) forward while keeping it secure forcing the bow down. It is usually easier to learn with more control if you start with weight towards the back.

C) Try decreasing the AoA. Keep in mind that an AoA greater than two (2) degrees makes it more challenging to control when the top end (WOT) speed comes into play. Too much lift too far forward forces the bow up too high when obtaining speed. Remember that the VARA® Foil is always trying to get to path of least resistance, the air at the surface. **Use caution implementing this last option.**

8.2 The stern travels too high pushing/or plowing the bow.

A) Try trimming the motor up in small increments. Slight up bumps to the trim/tilt switch. The bow of the boat should follow. If prop starts to cavitate, or suck air before a bow up response, move to next recommendation. Leaving the motor in the trimmed down position will make the boat perform like a "normal "pontoon boat (slow and noisy).

B) Try moving the VARA® Foil / VARA® Strut Assembly further forward on VARA™ Attach angles until you get a slight bow up attitude when using trim/tilt switch that is still controllable with the VARA® Plate. By controllable we mean bow attitude or pitch should react to VARA® Plate adjustment.

C) Try moving more weight (crew, coolers, gear, etc.) aft while keeping it secure forcing the bow up.

D) Try increasing the AoA. Keep in mind that an AoA set to greater than two (2) degrees makes it more challenging to control when the top end (WOT) speed comes into play. Sometimes too much lift will cause the hydrofoil to porpoise out of the water. Also remember that as we add lift, we add proportional amounts of drag. **Use caution implementing this option.**

8.3 I'm not getting enough lift even while traveling at top end maximum (WOT) speed.

A) Check the inside of your pontoons for water by opening the stern plugs while on trailer or lift and a downgrade aft to drain any existing water. If water is present, check for leaks and repair so that you are not carrying water which slows the boat and is unsafe.

B) Make sure your engine's output is within the manufacturer's published MPH and RPM ranges. A tune-up or prop change may be required.

C) Clean the bottom of the boat to remove any barnacles, growth, weeds, algae, etc.

D) If everything above has been checked, change the AoA by one (1) degree as noted in Section 7.3. Each slot higher in the front equates to one (1) degree which providing positive lift (usually for slower speed boaters with smaller motors). Each slot lower in the front as compared to the back equates to one (1) degree of negative lift (usually for higher speed boaters with larger motors).

8.4 My prop cavitates especially as I approach higher speeds or waves.

A) Make sure your VARA® Foil / VARA® Strut Assembled Unit is mounted far enough forward so that it "forces" more load onto the motor - pushing it downward. It helps to think of your VARA® Foil assembly as a three (3) legged chair with the VARA® Plate as the back end of the chair. The VARA® Struts represent the other two (2) legs. When you change one the other two will change.

B) Make sure as you begin to gain speed that the motor is trimmed all the way down then slowly increase trim to account for needed changes. The VARA® Foil Hydrofoil creates between four (4) and six (6) inches of lift for the boat, with this additional lift the motor is operating at a higher height.

C) The VARA® Plate creates lift and increases propellor efficiency by forming a barrier between the air and the water flow. The VARA® Plate allows you to change the attitude of your bow with the increased area fabricated of rigid materials. Each VARA® Plate creates between 200 and 700 pounds of lift depending on speed. You may need to adjust your engine height into a lower hole, change your prop, or both to achieve the ideal performance with your new equipment. Contact the PHA, Inc. Support Team to discuss your specific application.

8.5 My motor is reaching the rev limiter and/or my RPMs are too high.

CAUTION: THIS MUST BE CORRECTED AS DAMAGE TO YOUR MOTOR COULD RESULT IF YOU CONTINUALLY USE THE BOAT AT THE WRONG HIGH RPM!

A) Changing to a new prop with either more pitch, more blades or both is highly recommended. We have found a 4-blade prop is smoother if you currently run a 3-blade. Generally, we try a 4-blade with same diameter and increase the pitch up to two (2) degrees.

B) Contact your local prop shop or contact the PHA, Inc. Support Team for a recommended prop shop. Most companies allow you to purchase, try, and return props and provide recommendations.

8.6 I installed the VARA® Foil Hydrofoil System and my boat's performance has changed minimally.

A) To date, we have not encountered an application that has not achieved a minimal 25% speed gain as advertised.

B) Check the bottom of the pontoons for parasitic growth. Barnacles, algae, hair, and other growth create drag.

C) Check the pontoons and boat compartments for extraneous water.

D) Your boat may have big bones and a wide girth. These boats are heavier and need more lift before the VARA® Foil begins to work. Try adjusting the AoA as discussed in Section 7.3. Remember each slot we increase in front strut equates to a 1-degree AoA change. Contact PHA, Inc. to discuss the amount of lift each degree of angle change will produce. NOTE: ALL our recorded data to date represents a zero (0) degree AoA to a five (5) degree AoA on ALL applications.

8.7 I am a new user of the VARA® Foil Hydrofoil System and feel like I am not doing a good job of figuring it out.

A) BE PATIENT while learning.

B) Hint: Overloading the boat for the first few times you use your boat with a VARA® Foil Hydrofoil makes for a harder learning curve. Having more than four (4) people on board, traveling with a full tank of gas, many personal belongings, full-size coolers filled with ice and beverages, pontoons that may have water in them, bottom growth on your pontoons, and a prop that may not be set up for your boat or is over-pitched can all hinder the learning progress.

C) We understand that some new users may still find it difficult to navigate through the learning curve. Please feel free to contact the PHA, Inc. Support Team with your questions and concerns.

9. Maintenance and Care

PHA, Inc. highly recommends each boat owner routinely perform maintenance and safety checks on all VARA® Foil Hydrofoil System components – which also includes the VARA® Plate. Contact PHA, Inc. for any replacement parts required.

At a minimum, complete the following items monthly including:

- Ensure all nuts, bolts and washers on each component are intact; replace any missing or damaged parts.
- Inspect all nuts/bolts and washers to ensure they are tight, but not over-tightened. Replace any missing or worn hardware.
- Ensure there are no chips or dents in the VARA® Foil extrusion.
- Check pontoons and all boat compartments for unwanted water.
- Remove plug(s) to drain any unwanted water in pontoons on a regular basis. Replace plugs before launching boat.
- Inspect all pontoons for dents, leaks, and/or cracks. Repair as needed.
- Visually inspect the VARA® Plate for unexpected cracks or dents.
- Manually lift up on the back of the VARA® Plate to ensure it does not move up, down or side-to-side. Tighten bolts or replace as needed.

Tables.

Table 1. PHA, Inc. Support Team and Points of Contact

Contact	Phone	Email	Responsibility
Mike Gable	*727-455-5576*	*mike@pontoonHydrofoil.com*	*Attn: Owner/Inventor*
Tracy Harrison	*850-320-2234*	*tracy@pontoonhydrofoil.com*	*Attn: Billing/Marketing*
Support Team	*727-455-5576*	*support@pontoonhydrofoil.com*	*Attn: Technical Questions*

Table 2. Record of Changes Using Original Prop

Prop Specifications: _____

Date	VARA™ Angle Location Hole Front to Back	VARA™ Strut Location Hole/Slot Height	Motor Hole Location	Maximum Speed MPH	Maximum RPM at WOT Speed
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Table 3. Record of Changes with Prop Change

Prop Specifications: _____

Date	VARA™ Strut Location Hole/Slot Front to Back	VARA™ Strut Location Hole/Slot Height	Motor Hole Location	Maximum Speed MPH	Maximum RPM at WOT Speed
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Dial-in and Set-up Notes