

# **G48** Outboard Tunnel Hull



For Gas or electric ~Length- 48 inches ~Beam- 18 inches

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Version 1.0

The G48 was designed from our very popular G30 Outboard Tunnel Hull. In fact, it is fundamentally just a scaled up version.

The G48 was designed to be very easy to build, be easy to setup and run well. This unsinkable boat uses a large outdrive for gas engines. You can also run it as an electric on 8/10/12 cells. Using our exclusive ZippCut foam cutter, you can have the boat ready for waterproofing in a very short time. The only way to do this is to read and understand this entire manual.

If you follow and understand the instructions, you will be rewarded with a straight, true, good looking hull. If not, well, we do sell replacement parts...

This is a big boat. This is a heavy boat. This is a fast boat.

Please be careful while operating it, and don't take any chances when people are around.

That said, we assume no liability for damages or other loss in the use of this product, as we have no control over the construction or end use of this product.

Before we begin, let's talk about construction.

The most innovative and important part of this design is the foam core sponsons.

The concept of WOF (Wood Over Foam) construction was brought to the model boating world by the great Jerry Dunlap. We take this a few steps further.

Our sponson sheeting serves as templates and sheeting.

During foam cutting, we will use the top sheet in a different position to cut the foam.

Speaking of cutting foam, the two biggest tips are to be 100% sure you are making a right and left, and always squeeze those templates!

Please follow these instructions EXACTLY, and you won't have any issues.

Don't glue anything until told to do so. We will be using some parts as templates on both sides.

The very first cuts you will make are critical. They must be aligned perfectly, or the boat won't come out correctly. If you are not sure of the next step, or are having trouble with your kit, please contact us and we will help. We want you to have a great time building and running your G48, and will do everything we can to help.

Please read this entire manual completely before you begin construction, as this will help you understand what you are doing and avoid mistakes. Spare parts are available.

Note that this boat went through several revisions while this manual was being written. Some images may differ slightly from the final production version. In those cases, study the process, not the image.

Revision history: V1- First release (this version)

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## **Important Things**

We want you to be 100% successful the first time. Here are some points worth knowing in detail.

1. Foam cutting.

This is a very straightforward project. Almost too easy. It is very easy to make a critical mistake. Please follow the instructions to the letter, and squeeze those templates! This boat is big, and using the foam cutter with a 2S battery is slow. You can use a 3S battery to speed things up.

Note that the cutting wire life will be reduced with a 3S battery.

2. Flatness.

The sponson insides need to be flat. If they are not, they won't fit against the center section very well. This just makes the job harder and adds weight with more filler.

Please don't use clamps when gluing the insides in place. Use tape and weights on a flat surface. This will save you work in the long run.

3. Crowning.

Crowning occurs when you wrap tape around the ply sheeting while gluing it to the foam. This can be avoided 100% by using the included long strips of wood while taping. Taping over the strip serves to press the sheeting against the foam in the center, preventing crowning.



4. Sealing.

It is critical that the inside and outside of the boat be 100% waterproof. If not, water will seep into the structure and make trouble.

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Titebond III and epoxy are waterproof, so water intrusion is mainly cosmetic. Once it starts, though, it's tough to stop.

We recommend epoxy finishing resin for sealing.

You can also use West systems epoxy, MAS epoxy, System 3 epoxy, or any other laminating or finishing epoxy. Stay away

from 5, 15 or 30 minute epoxy, as these are tough to finish.

Also, don't thin or reduce the epoxy. This weakens and softens it.

Don't use polyester (fiberglass) resin. It will react if applied over any epoxy joints.

We use the wipe off/ scrape method outlined in the finishing section.

#### **Required to build:**

Titebond wood glue 30 minute epoxy or T88 Epoxy Epoxy finishing resin Sandpaper (80, 180, 220, 400, 600, 1000 grit) Clamps, paper clamps Good masking tape Drill with bits 1/4-20 Tap Allen wrenches Small socket set or wrenches Utility knife blades (for scraping sealer) Primer, paint and clear coat

**Required to run:** 

Gas engine or electric motor Gas size lower unit Muffler or tuned pipe for outboard Fuel system Steering servos or system Standard throttle servo Steering rods Flexible throttle pushrod Carb cover 6.6 volt 5000 mah LiFe Receiver battery Receiver switch Transmitter/receiver

Glue choices:

We like to use **Titebond** on all parts of the fuselage and nose blocks. The only time you should use Titebond is for raw wood to wood joints. No good for foam, or wood that has been sealed.

Everything else should be **slow setting epoxy**. The slower the better. We like T88 epoxy from System Three. It gives almost an hour of working time, and on a big boat like this, that matters. Anytime you are dealing with wood that has been sealed, or foam, this is the stuff to use.

Finally, we use **epoxy finishing resin** to seal everything.

This is important as it not only water proofs the wood, but it also adds a lot of strength by creating little glue fillets in all corners. Thin sealers like varnish won't do this. One coat, allowed to dry followed by a second coat will seal everything well.

### Let's Begin

#### Fuselage

As you remove parts from the sheet, sand off the little bumps left by the holding tabs. They can interfere with the fit in some cases.

Build the fuselage flat on your building board. Use waxed paper to prevent the fuselage from sticking to the bench.

You can practice by assembling everything without glue. We like to do the following in one glue session. We used Titebond III glue for the entire fuselage. You can also use epoxy.

Glue bulkhead 1, 2, 4 and 5C to the tunnel floor. Use a square on these bulkheads



Glue the center section (radio box) sides in place. Be sure that the etched lines are on the inside. The center section sides fit into slots in the floor, as well as tabs in the bulkheads. Glue both ply sides, snapping all tabs in place and checking that everything is fully seated.



There is a lot going on, and there are tabs and slots everywhere.

Try not to get any glue fillets on the outside of these sides, as it will interfere with the installation of A thru D.

Make sure that all tabs are fully seated and that the bottom meets the floor. Wipe away excess glue.



Tape the bulkheads at 1 and 2 so that the sides are tight against the bulkheads at the radio box.

Glue in 5B and 5A in front of 5C.



Glue 5D to the back of 5C.



Add both transom braces and clamp the crap out of everything.



We used the included square to protect the transom during clamping.



Add bulkheads 3, locking them into the sides. Both bulkhead 3 parts should have the number facing out as shown. Be sure that they are fully seated and square. Allow to cure.



Glue the two 1/8 fuselage sides to the floor. These have 3 holes for dowels. Use a square to make sure that the sides are 90 degrees to the bench.

Be sure that the notches are fully seated in the bulkheads you glued, as well as in the floor.



Tape these tightly to the bottom and bulkheads. Be sure that there are no gaps anywhere. Double check. You can clamp at bulkheads 3 and 4.



It wouldn't hurt to hold a long straightedge against the sides to get an idea how flat they are. Try to correct anything you find, as these should be as flat and straight as possible. The sponsons will get glued directly to these sides. Chek again to be sure that they are square, and not leaning in or out.

#### Glue in A, B, C and D.

They go against the center section on the outside, and provide a gluing surface for the top deck sheeting. Letters go forward as shown. You may have to sand or bevel these to fit over any glue bumps or fillets.



Do it, as these must be fitted correctly or the top won't fit. They should all sit flush with the top of all bulkheads. Repeat on the other side. Don't glue the top decks on yet. You need two coats of sealer inside the fuselage and on the bottom of the decks.

Use masking tape to cover the two slots in the front of the fuselage floor. They are for the stumble blocks that will be added later. We don't want any glue or sealer to get in these slots. Do both sides.



Glue the pine nose block in place. Clamp, and be sure that it is tight against bulkhead 1. Wipe away any excess glue and allow to cure.



Laminate the cowl mounts together. The front mounts are kind of square, and the rears are round. Glue 3 round rear mounts together, and repeat for the other 3. Clamp until cured.



Glue 4 front mounts together, with the tabbed mounts on one end. Stack the 2 tabbed parts with the non-tabbed part on the side. Clamp until cured, and set all aside until later.



Remove the radio box lid and sand the little bumps off. Glue the radio box lips to the bottom of the radio box top. Use only a very small bead of glue and attach one end, the center pieces, then the other end. Use the etched lines as a guide. Clamp with paper clamps and allow to cure. Do not glue to the boat yet. We want to end up with a nice lip all around. This prevents the lid from falling in...





Glue in both forward cowl mounts. These go in the slots on the front of bulkhead 1. These should be flush on the outside. Allow to cure.



Glue the basswood triangles to the forward cowl mounts and allow to cure.



#### **Interior Sealing**

Wood boats need two coats of epoxy resin to all exposed wood, inside and out. Use only epoxy resin. We recommend our epoxy finishing resin. You can also use West Systems, MAS epoxy or Z Poxy finishing resin. Do not thin the sealer.

Here is the sealing method we use: We will be sealing: Fuselage insides One side of both cross grain decks. Radio box top and lid

Mix about 4 ounces of epoxy sealer. Brush on a coat of epoxy to the inside of the fuselage on either side. Get epoxy everywhere.

Get under the A thru D pieces and inside the holes in the bulkheads.

Don't coat the inside of the radio box yet. We are mainly concerned with the inside of the fuselage that will be covered by the decks. Only coat the inside now. Don't do the outside of anything yet. Work quickly if the temperature is above 70.

Don't forget to seal the radio box top and lid. Coat one side of each cross grain deck piece.

Once you have a good coat of epoxy on the inside, wipe off everything. Wipe off as much epoxy from the surface as you can. Easier to wipe off that epoxy now. Wipe off so that the surface is no longer glossy. Use a Q-tip to get into the recesses if needed.

If you have any sealer left, you can start sealing inside the center section. Start at the transom. Don't seal the radio box area yet. We need to get the servo mounts glued first.



Wipe off any epoxy from the tops of the bulkheads and sides where the decks will go. Allow to cure overnight. Scrape the sealer on the decks with a utility knife blade, or sand with 120 grit. Repeat the exact same procedure for the second coat. Wipe off only areas that get glued (top of fuselage and radio box lid). Don't wipe off the second coat of epoxy on the deck or inside this time.

It is a good idea to let the epoxy pool at the transom to bottom joint. This area takes a tremendous strain, and needs all the help it can get. We tip the nose up slightly and all the sealer to cure.



You should have two full coats of sealer on the fuselage inside (at least where the decks go), as well as the deck undersides and the radio box top underside.

The epoxy sealer prevents water intrusion, but more importantly, adds a lot of strength. It does this by creating "fillets" at every joint, making them very strong.

While the sealer is curing, let's get these gigantic sponsons done.

The number one mistake people make is to end up with two right (or left) sponsons. Make 100% sure that you understand right, left as well as up and down when it comes to the sponsons.

Remember, the tops are curved front to back. The bottom is almost straight.

We recommend that you hold both sponsons together before you start gluing any sheeting. This will help verify that you are doing the right thing.



#### **Sponsons**

The foam blanks may have two smooth sides and two rough sides. We will work with smooth sides. Lay one of the foam blanks on the bench with a smooth side up. Measure 1 inch from the bottom edge.



Use the included square to draw a line down the end of the block. The line should go all the way from the bench to the top of the block as shown. Be sure that the square is flat against the bench. This is important.



Repeat on the other end. Be sure to measure from the same edge. Bring your marks around the corner so you can see them. Grab both Insides (marked IN). Note that one side is curved and one almost straight. The curved side is the top.

On the side marked with IN, put a piece of masking tape over the slots near the front of the inside.

This is needed to prevent glue from getting in the slots that are used later.

Tape each one. Be sure to do both pieces on the marked side. Use regular masking tape. We only used the blue low tack for the pictures.



Pin both insides (IN) to each side of **one** foam block. Line up the back so that they are even with the foam. Line up the bottoms of (IN) on your marks on both ends.

Be sure that both parts are perfectly aligned with each other. Look at both ends and double check.



They must be perfectly aligned with each other. This is absolutely critical, so take the time to get it right.



You can tightly tape the rear, to help hold in place.

Wiggle the pins slightly, to make the pin holes a little bigger the first time you push them thru the wood. Don't make the holes too big, as we need them to help with alignment.



#### **Foam Cutting**

Be sure to squeeze the templates together while cutting. If you don't squeeze them pretty hard, the template can be pushed down by the cutting wire. If this happens, the boat will be ruined. Don't allow the templates to move, even a tiny bit. The best way to do this is by, you guessed it, SQUEEZE THOSE TEMPLATES!

Cut the foam on the top or bottom. Flip it over. Cut the other side. Be sure to squeeze... Hold the cutting wire against the wood. Use just enough pressure to keep the hot wire in contact with the wood templates. Better to not press hard enough, than to press too hard. You don't want those templates to move even a tiny bit.

Plunge the wire about an inch from the end and down to the wood. Start to follow the wood all the way to the other end. Take it slow, and let the wire do all the work.

When you reach the end, slow down and try to have the wire exit both sides at the same time.

It takes a little practice, so take your time and understand what you are trying to accomplish.

Trim the little bit that you left when you started the cut.

Use a few light swipes of a sanding block to smooth the surfaces you cut and eliminate any bumps if needed.

#### Repeat this same procedure on the other foam block. Don't glue anything yet.

Remember, the <u>curved part of the sponson is the top</u>. The bottom is almost straight.

Next, we will make these into right and left sides. It is very important that we make these mirror images of each other. If not, you get to buy a new kit and do it again!

Honestly, take your time here and understand where you want to end up.



#### **Sponson Insides**

Lay out both foam blanks so that they are mirror images of each other. In this case we have bottom to bottom. This is the most critical step in sponson assembly. Be certain that you have them as mirror images.



Mark each foam blank and its respective wood inside. It doesn't matter how you mark it, as long as each mate matches.



Glue an Inside (IN) in place on the sponson. Try to do this on a very flat surface.

To glue the sponson sheeting in place, we like to use T88 epoxy. Just use a scrap of thin ply or an old credit card as a squeegee, and put a thin coat on the foam and plywood. Work quickly. Use pins and tape to hold in place.





Clean out any glue from the round holes. There should be zero glue in the forward slots, as you applied masking tape on the glue side of the wood. Right?

Put some waxed paper down and set the sponson on the waxed paper, inside down on a very flat surface, until cured. Put some weights on the sponson to keep it flat.

We do this so that the sponson inside will be straight and true. Everything else is based on the inside, so take the time and do this right. Check that the inside has not moved. Do the other side the same way. Allow to cure for at least 12 hours.

Let's get the decks glued on

Scrape the bottom of these decks so that the epoxy is smooth. Sand the top of the fuselage where the decks will go. Check the fit all around. Sand the edge or end of each deck to "fit" them. Try for no gap at all. A little is okay. Mark each deck so you know where it goes.



When you are satisfied that they fit everywhere, glue them down.

Use 30 minute epoxy, and don't be stingy. Clamp and weight the deck in place and wipe away excess epoxy.

Work quickly. Use tape and clamps. Be sure the deck is pushed up against the pine nose. Check back periodically to be sure the deck has not creped outward. Wipe away any epoxy that has oozed out. Decks should be tight against the pine nose.



Repeat on the other side. Allow to cure.

Sand off the deck overhangs on the side and rear. Round the pine nose. Leave the bottom flat. You only have to round the front of the decks.

You can leave the pine square in the center. The cowling will cover this.



Back to the sponsons...

Pin **both** tops (T) to one sponson. Pin so that the etched line is even with the edge of the plywood inside. There will be an overhang on this edge while cutting. Line up the back ends flush with the foam. It may help to use tape on the ends, to hold the tops in place.

Cut the excess foam off... Squeeze.

Now, very important, flip both tops over, align and pin to the other foam blank, except this side will be **a mirror image** of the other.

Double and triple check this before you cut. Both tops will be curved and both bottoms will be almost straight.

When you are positive that you have both a right and left side, go ahead and cut.

Now that you have two sponsons, this is starting to look like something. And look at what a good job you did with following instructions and all!

Since you are a foam cutting pro now, the rest will be easier.

#### **Sponson Outsides**

You can now glue the outsides (O) in place. This is also curved on **top**, and the pointy goes forward. Line them up so that they are even at the ends of the **top** (curved) part of the sponson at the front and rear. See OVERLAY page at the back of this manual.

We like to mark the outline on the foam. That way, we only put epoxy where it is needed.





Pin, tape and weight the outside until cured.

Do the other side. MAKE SURE that you put the curved part at the TOP of the sponson. Remember, the top is curved and the sponson bottom is almost straight.

Allow to cure.

Once everything cures, let's finish up these sponsons!

ZippCut the top and bottom of each sponson. No need to squeeze anymore since the templates are glued in place now. Sand the top and bottom of each sponson so that the inside and outside sheets are beveled. We used 80 grit paper on a block for this. We want a flat, smooth surface for the sheeting to bond.

Sand the back of the sponson so that it is flush and square with the inside and outside, and flat.

Use the supplied 5/16x48 wood strips when taping the top and bottom sheeting in place. If you don't use the strips (or something similar), the sheeting will "crown" or "bow" in the middle. We need the sheeting to remain flat against the foam for gluing.

Glue the bottom (BOTT) in place. Let the bottom overhang 1/8 inch at the rear by aligning the etched line with the back of the foam sponson.

The bottom sheet should be the only one to overhang at the rear.

Allow an even overhang all around the bottom sheet.

Use tape tightly to hold the bottom sheet in place.

You can put a couple of pieces of tape in place to hold the sheeting in the correct position, but most of the tape wraps should be over the square strip to prevent crowning.

Repeat on the other sponson.

Double check that the etched line is at the back edge of the foam, and you have some overhang all around.

Allow to cure.

Glue the sponson rear cap in place, sitting on the bottom sheet. Tape in place. Tape one of the pine nose blocks here to prevent crowning as well.

When cured, sand flush with top and sides.

Be sure to leave the overhang on the bottom sheeting only.

Glue the top in place. Leave an even overhang all around. Tape tightly until cured. Use the wood strip to prevent crowning. Repeat on the other side.

Once cured, sand all sides flush. **Be sure to leave the rear overhang**. Don't round off any corners or edges. All sheeting should be sanded flush, except the bottom. It will have a 1/8 inch overhang at the rear when completed.

At this point, we strongly recommend adding weight to the sponson noses, prior to gluing on the nose block. The boat must balance at 15.5 inches forward of the sponson transoms. With 7-8 pounds of engine and lower unit on the back, we have to counter that weight.

If you use a lightweight muffler, you will need to add 2-3 pounds to the radio box for balance. If you use a tuned pipe, you probably won't be able to add enough weight to the radio box to balance.

However, if you add just 8 ounces of weight to each sponson nose, you won't have to add any weight for a muffler, and maybe just a heavy battery pack for a pipe.

It is completely up to you. We would rather add weight where it is invisible, than to tape on a huge amount of weight on the outside...

We used lead shot and epoxy. Just hollow out the foam from the nose, and pour the lead/epoxy slurry into the cavity. Once cured, sand the nose flat and flush with all sheeting.

Glue the pine nose block in place. When cured, bevel and shape for desired look.

Repeat for the other sponson if you have not already done so.

Trim any excess and sand with 220 on a block. The sponsons are now ready for sealing.

You can round the corners on the outside of the sponson, but leave the inside edges sharp.

You can give them a quick swipe with sandpaper to lightly knock off the sharp edge, but don't round them.

The rear overhang should be sharp, and not rounded in any way.

Basically, any place that touches the water should have a sharp edge.

#### Cowling

The fiberglass has 1/8 ply stiffeners that also double as cutting templates. Follow along and you will have a perfect fit to the fuselage airfoil. Notice that the two cowl stiffeners have small etched marks at one end. These marks should face down when they are glued in place. Don't get any glue on the "X" part that is etched in the wood. We will snap these small tabs off later.

Grab one of the plywood cowl chins and position it for the best fit, flush with the cowl bottom. Mark the location of the notches onto the fiberglass as shown. Bring these marks down inside the cowl. Don't glue it yet.



Align the stiffener so that it is at the front line you marked, and even with the bottom of the raw cowling in the front and rear. If the raw bottom edge is uneven, align with the marked line on the bottom.



Before gluing, sand all around to about 3 inches up into the cowling. Use 220 paper and wipe down with alcohol before gluing.

Use medium CA or epoxy to attach them. Don't put any glue on the small tab under the "X"

Note that CA will give an almost instant bond, so be sure you are lined up before you touch the wood to the cowl.

Clamp in place and allow to cure. Make sure that both ply stiffeners are lined up with your marks at the front, and flush on the bottom. Do both sides the same way.



When cured, break off the little tabs at the rear of the wood stiffener. Cut the curved cowl opening by following the curve of the template (stiffener) with a cutoff wheel in a Dremel.. Trim the back part of the cowling a little long, to allow exact fitting to the length of your fuselage.



Sand the cut edges with 80 then 220. Now look how perfectly that cowl fits!

Laminate both cowl chins together. Allow to cure.

Drill the 4 holes thru the fiberglass, where the cowl mount holes are in the ply stiffener. Try to drill these accurately. Drill from the inside (with an angle attachment) if you can.



Set the cowling in place and check the fit. It should fit perfectly. Mark the location of the 4 holes onto the fuselage center section. The forward holes will be (hopefully) on the forward mounts, and the rear will be on the sides. Carefully drill these thru with a #7 drill.

Glue the rear mounts (round) centered over your holes. Drill thru the rear mounts with the #7 bit.



Tap the holes  $\frac{1}{4}$ -20 and bolt the cowling in place with the supplied  $\frac{1}{4}$ -20x3/4 inch nylon screws.

Flip the center section (with cowl) upside down on the bench and brace it so it won't fall over. Sand a sharp bevel on the front of the plywood chin. It should be sharp around the front, tapering to no bevel at the rear. Sand until the chin fits flush with the front of the cowling.

You can make a "handle" out of tape, to help position the chin.



Adjust the rear of the chin so that it is even with the fuselage floor as shown. You may have to sand the slots in the ply slightly.

Once happy with the fit, glue the chin to the cowling with a few drops of medium CA or epoxy. Keep glue well away from the fuselage. We prefer a removable cowling. The chin doesn't need to be fully glued now, just attached so that we can remove the cowl and epoxy it on the inside.



Once cured, carefully remove the cowling from the fuselage.

Mix up some 30 minute epoxy (or finishing epoxy) with filler, until is has the consistency of toothpaste. We use about 1 ounce of epoxy for this.

Use your finger to spread this paste inside the nose of the cowling, and work it in well. There should be a nice fillet from the ply chin to the fiberglass. Do the nose well. Make large fillets as shown. Image below is inside the cowl chin.



Work some paste into the outside of the chin to glass joint. The transparent cowl makes it easy to see any voids that should be filled. Pack the paste into these areas. Also make a small fillet on the front of the ply stiffeners.



![](_page_31_Picture_0.jpeg)

When cured, trim and sand the front flush with the chin. Round the corners to eliminate the sharp edges. Also mark and trim the rear of the cowl. We like to leave the top full length, and trim from the back of the ply stiffeners to the top. It gives the cowl a raked look.

If you are using a tuned pipe, you may have to further trim the cowl for pipe clearance.

![](_page_31_Picture_4.jpeg)

Seal the cowl chin (inside and out), as well as the plywood stiffeners. Be sure to get plenty of epoxy on the top of the stiffeners, to create a glue fillet all along the top, to add strength. Wipe off and allow to cure. Seal again, but don't wipe off this coat. Cowling is now ready for paint prep (unless you have to trim it for a pipe).

![](_page_32_Picture_1.jpeg)

We are so close to having a whole boat! Let's get it done.

Sand the sponson insides and sand the fuselage outsides until they are flat and smooth. Use a <sup>1</sup>/<sub>4</sub> drill bit to clean out all of the dowel holes if needed. Don't drill into the foam.

Sand a point on one end of each dowel.

![](_page_32_Picture_5.jpeg)

Use 30 minute epoxy or T88 to glue ONE sponson in place.

Temporarily put the front and rear dowel in place and test fit one sponson. Don't let the dowels fall into the fuselage. You will have a lifetime rattle inside the boat...

Trace around the fuselage side, onto the sponson inside. This will serve as a glue guide. Don't put glue outside of this line. Repeat on the other sponson.

Put a temporary piece of masking tape over the slots in the sponson inside. We don't want any glue in here.

![](_page_33_Picture_4.jpeg)

Be sure to coat the entire face of the fuselage side with epoxy. Get epoxy on all three dowels. Wipe away excess epoxy. Do not allow any epoxy into the slots on the sponson inside. We used masking tape over them. We wiped all traces of epoxy from the area, and removed the protective tape before the epoxy cured.

Tightly tape the sponson in place and allow to cure, wiping away excess epoxy as you go. When cured, glue the other sponson in place the same way.

If the sponson fit isn't perfect, clamp the front and leave any gap at the rear. Fill the gap at the rear (after curing). Do it this way so that if the sponsons are not parallel with each other, they have toe in. Toe in=okay. Toe out=bad.

![](_page_33_Picture_8.jpeg)

![](_page_34_Picture_0.jpeg)

#### Anti-Stumble blocks

Glue the 1/8 stumble block outsides into the tunnel floor as shown. Use a square to make them 90 degrees to the floor.

![](_page_35_Picture_2.jpeg)

Glue the 1/8 ply (cross grain) stumble block bottom into the slots on the sponson inside, as well as into the notches on the outside piece.

Sand a bevel at the front of this so that it fits properly, and is a thin edge. Repeat on the other side.

![](_page_35_Picture_5.jpeg)

![](_page_35_Picture_6.jpeg)

![](_page_36_Picture_0.jpeg)

#### Setup

Drill out the holes in the transom if using a Lawless lower unit.

If not, you will need to clamp your lower unit in place so that the center of adjustment puts the prop shaft centerline ½ inch above the sponsons.

You can use the included propshaft gauge held against the tunnel floor, to sight the shaft depth and angle.

#### **Engine or Motor**

Install the lower unit with either gas engine or electric motor to the transom with the 8-32 screws and washers. Set the engine so that the **propshaft center line** is 1/2 inch above the sponson bottoms and perfectly level.

Use the included setup gauge.

Hole it against the tunnel floor (under the boat), and sight along the drive. The shaft centerline should be parallel with the bottom of this gauge.

#### Radio

We recommend one of two steering setups:

Robot servo- GoBilda Stingray 3 (1050 oz) (Servo City) with GoBilda 1121 3 hole U Channel split in half (Servo City) Or

Dual servos- Two of the HV2060MG servos ganged together (Amazon)

#### GoBilda Robot Servo Setup

Cut the U-channel mount in half, right down the middle. Use a band saw, hack saw or Dremel. Bolt each channel piece to the servo using the outer slots as shown. You want to end up with a mounting shoulder on each side.

![](_page_37_Picture_5.jpeg)

![](_page_37_Picture_6.jpeg)

#### Servo Installation

You will need to have your servos before we can glue the radio box top in place. It is much easier to get to things now, before the top is in place.

We have provided mounting plates for both the Servo City GoBILDA Robot servo, as well for dual servos. Pick the plates that fit your servo setup and laminate them together with Titebond or epoxy to make the radio tray.

There are etched lines inside the radio box that are gluing guides for the hardwood rails. The top line is for the GoBILDA Robot servo. The bottom line is for dual servos. The hardwood rails get glued so that the line is at the top of the hardwood rail.

Dry fit your servos before you glue anything, and make sure you have at least 1/16 inch clearance under the servo bottoms.

Epoxy the hardwood rails in place on your line. Allow to cure.

![](_page_38_Picture_0.jpeg)

Seal the hardwood rails and the servo tray with epoxy finishing resin. Allow to cure, scrape and seal again.

![](_page_38_Picture_2.jpeg)

When cured, put the tray back in place, against the rear of the radio box and drill 3/32 holes in 4 places for the servo tray screws. Bolt the servo tray in place with 4 #6 sheet metal screws and washers.

![](_page_39_Picture_0.jpeg)

The holes in the radio box are made for a steering arm that measures 3-1/4 inch from hole to hole.

We strongly recommend that you use an arm of this size. If you don't, you will have to move the holes in the bulkhead.

For gas, drill a hole in the rear wall of the radio box (bulkhead 2) for the throttle cable sheath. The cable should end up about 1/8 inch above the servo arm. Use an EZ connector at the servo.

We recommend soldering the ends of the throttle cable for about 1-3 inches.

Just use some flux, heat the cable just enough until solder flows, then quickly wipe off the cable.

The cable should be very stiff on the ends.

For the carburetor, you can use a Lawless throttle clamp, or 3D print your own with our free 3D prints (see Zippkits.com). Either way, you should disconnect the return spring on the throttle shaft. Don't remove it, just unhook the end. This makes it much better for the servo to push the throttle open, and still retains some degree of spring closure.

Sand the outside of the plastic sheath before gluing. Epoxy is best for this.

If using an electric motor, drill a hole for the steering servo wire. We use a 12 inch servo extension glued with silicone sealant. Be sure to hook everything up and test before gluing the servo wire in place.

#### **Pushrods**

You have several choices here. Keep in mind that weight behind the balance point (CG) is bad. We want to minimize the weight we add to the rear of the boat.

With that in mind, we like carbon fiber tubing pushrods. We have a pushrod kit available that includes everything you need. They are very lightweight, and completely adjustable.

Whatever you decide for pushrods, use the included pushrod guides to brace them. Assemble the guides to the guide mounts. Slip them onto each pushrod as shown. Note that the outboard should be adjusted to the running position.

Glue these between the marks etched in the fuselage as shown. Center the pushrod vertically before you do.

Once you are happy with the entire radio installation, remove everything in preparation for sealing. Leave the servo tray in place.

Glue the radio box top in place. Use epoxy or CA.

When cured, brush a coat of 30 minute epoxy inside where the sides and bulkheads meet the radio box top. Flip the boat upside down and allow to cure. This seals the radio box seams and makes it 100% water proof.

#### Sealing

Every part of a wood boat must be 100% waterproof. We do this by using 2 coats of sealer. Before we apply sealer, lets do the seam fillets. This is simply epoxy (finishing epoxy) and filler (micro balloons works best) mixed to the consistency of toothpaste.

This paste is then worked into the corners where the sponsons contact the fuselage (top and bottom), and where the deck meets the sides. Fillets add a lot of strength and prevent water intrusion into sealed cavities.

We use finishing epoxy as it gives you more time to work it.

When done, wipe up any filler that is not in the fillet. Easier to wipe it off now than to sand it later.

![](_page_40_Picture_5.jpeg)

Once the fillets have cured, give the whole boat a quick sanding with 220 paper.

Using epoxy finishing resin, brush a coat on the entire boat. If you have any left, coat the radio box lid too.

Wipe off the outside of everything. Wipe off all epoxy until there is no gloss. Use lint free paper towels from a box. They are much stronger than normal. Don't leave any on the surface, as you will have to sand it later if you do. Wipe off the radio box lid too, if you did that. Allow to cure.

Scrape the sponsons, decks and fuselage with a utility knife blade held straight up. Scrape back and forth. You will find that this is very quick, and gives a smooth finish, ready for the next coat of sealer. Use 220 grit paper to lightly smooth the corners and nose.

You now have a choice for finish. You can brush on a coat of thinned epoxy finishing resin, or spray a clear coat with hardener. Epoxy will turn brown eventually, clear will not.

The method we use is to scrape and sand as above, then spray clear. We like to spray the bottom, let it cure then spray the top. This minimizes overspray and allows you to lay down a nice finish on the top. When spraying clear, spray a light mist coat, and allow to flash for 5-10 minutes. Then spray a medium coat and allow to flash. Finally, spray a wet coat but watch for sags and runs.

Allow to cure until the finish has no odor (1-3 days), then add decals and sand the bottom for running.

#### Painting

We recommend that you at least paint the cowling. If you decide to paint the hull, you can start the process right over the clear coat.

Sand the surface with 400 paper with water. Sand until the gloss is gone and the surface is smooth. Wipe clean and spray with sandable primer. We like white primer as it helps keep colors bright.

Once the primer cures, fill any pin holes or imperfections with spot putty. This is a red putty designed for filling. If you have any cracks or seams that need to be filled, use a structural filler like epoxy and micro balloons. Allow to cure.

![](_page_41_Picture_5.jpeg)

Wet sand the primer and filler with 220 paper on a block and water. It's okay if you sand most of it off. We are just trying to fill the low spots.

Wipe it clean and spray another coat of primer. Allow to cure and fill any remaining holes. Wet sand with 400 and prime again, just enough so that the entire surface has primer.

Allow to cure. Carefully color sand with 600 or 800 wet. Don't sand thru the primer. Careful on the corners.

Wipe this down and spray your color. If you are going with white, you can just spray clear over the white primer. It will look great!

If you are using color, don't use a name brand spray paint. Use the cheapest spray enamel you can find. Ace Hardware, tractor Supply, etc. should have "house" brands. Choose those. The big names tend to react to anything else.

Just spray enough paint to get the shade you want. Don't try to make it pretty or glossy. The clear coat will make it beautiful. Once the paint cures for 3 days or more, very carefully color sand with 1000 paper wet.

Wipe this down and spray clear. It will be the best finish you have ever done...

#### Sand Bottom

We sand the bottom of the boat for best performance. It's more about the bottom being perfectly smooth than the actual finish, but there is a performance advantage with a sanded bottom vs unsanded. Never wax the bottom of the boat. Use a sanding block with 320 or 400 grit and water. Sand only front to back, and only sand until the gloss is gone. We sand the entire bottom.

Time to reassemble this thing and get it on the water!

#### Assembly

### Install Outboard

Bolt your outboard in place. Use the included depth and angle gauge to set the correct position. The bottom of the gauge should be even with the prop shaft centerline while the top is touching the tunnel.

![](_page_42_Picture_3.jpeg)

#### For dual servos:

Screw the steering servos into the tray. You will need to make an adjustable link rod to tie both servos together. This doubles the output power. If you bought the hardware set from us for dual servos, the parts are included. Cut 1/8 inch off two of the black plastic ball links. Screw the 4-40 rod into one, and screw the other ball link onto that.

![](_page_42_Picture_6.jpeg)

You now have a double ended, adjustable ball link.

Screw the 4 remaining ball links onto the 4, 4-40x12 pushrods. Screw them on until they won't go any more.

Use a paper towel wrapped around a small screwdriver to wipe both ends of the carbon pushrods. Use lacquer thinner or alcohol. Allow to dry.

Use epoxy to glue in the aluminum ferrule. Be sure not to get any glue in any of the holes. Do this with all 4 ferrules. When cured, heat shrink the tubing over the pushrod end. Don't cover the threaded holes. This helps prevent the carbon tube from splitting. Start the two set screws in each ferrule.

![](_page_43_Picture_4.jpeg)

Screw the aluminum pushrod seal bezels to the radio box.

![](_page_43_Picture_6.jpeg)

Bolt a ball link/ pushrod to each servo arm with the pushrods sticking out of the pushrod seal bezels.

Slide the carbon pushrods onto the 4-40 pushrods and lightly tighten the set screws.

Assemble the pushrod guides and slide the assemblies over each pushrod.

Slide in the 4-40 pushrods at the rear or the carbon pushrods. Attach the ball links to your outboard steering arm at the same 3-1/4 distance as the servo. You may need to tap the steering arm 4-40.

Locate the two guide lines etched into the center section sides, and glue the pushrod guides here, adjusting the height so that the pushrod is centered in the nylon guide.

Lightly tighten the set screws. Turn on the radio so that the steering servos are at neutral.

Be sure that both servo arms are 90 degrees to each servo.

Attach one side of the steering link and adjust the other so that the screw drops in with no side pressure. Tighten the screws.

![](_page_44_Picture_8.jpeg)

Check the steering operation. If all is okay, Remove the carbon pushrods from the front 4-40 pushrods and add both rubber seals. These go over the 4-40 rod, and then slip over the aluminum barb of the bezel.

Re-attach the pushrods. Be sure to add the servo arm screws and tighten the pushrod ferrule set screws.

#### For Robot servos:

Screw the Robot servo into the tray with #6 sheet metal screws.

Screw the 4 ball links onto the 4, 4-40x12 pushrods. Screw them on until they won't go any more.

Use a paper towel wrapped around a small screwdriver to wipe both ends of the carbon pushrods. Use lacquer thinner or alcohol. Allow to dry.

Use epoxy to glue in the aluminum ferrule. Be sure not to get any glue in any of the holes.

Do this with all 4 ferrules. When cured, heat shrink the tubing over the pushrod end. Don't cover the threaded holes. This helps prevent the carbon tube from splitting.

![](_page_45_Picture_2.jpeg)

Screw the aluminum pushrod seal bezels to the radio box.

Start the two set screws in each ferrule.

Bolt a ball link/ pushrod to each end of the servo arm with the pushrods sticking out of the pushrod seal bezels.

Slide the carbon pushrods onto the 4-40 pushrods and lightly tighten the set screws.

Assemble the pushrod guides and slide the assemblies over each pushrod.

Slide in the 4-40 pushrods at the rear or the carbon pushrods. Attach the ball links to your outboard steering arm at the same 3-1/4 distance as the servo. You may need to tap the steering arm 4-40.

Locate the two guide lines etched into the center section sides, and glue the pushrod guides here, adjusting the height so that the pushrod is centered in the nylon guide.

![](_page_46_Picture_0.jpeg)

Lightly tighten the set screws. Turn on the radio so that the steering servos are at neutral.

Be sure that the servo arm is 90 degrees to the pushrods

Check the steering operation. If all is okay, Remove the carbon pushrods from the front 4-40 pushrods and add both rubber seals. These go over the 4-40 rod, and then slip over the aluminum barb of the bezel.

Re-attach the pushrods. Be sure to tighten the pushrod ferrule set screws.

#### Throttle

Screw the throttle servo in place. Use an EZ connector on the throttle arm. The throttle cable and sheath should already be done.

![](_page_46_Picture_7.jpeg)

Attach the cable clamp to the engine and clamp the cable in place. Before you do, slip it thru the left pushrod guide. This keeps it out of the way.

We used one of our 3412 throttle arms attached to the throttle shaft. We recommend that you unhook the throttle spring, and allow it to hook in one of the holes in the throttle arm.

This gives you a little bit of spring return, and allows the cable to push the throttle open without issue.

![](_page_47_Picture_3.jpeg)

We solder the threaded adapter on to the cable, and extend the solder about an inch back from the brass threaded adapter for stiffness. We also like to use our 3573 Sullivan 2-56 ball link here.

Attach everything, and lightly tighten the EZ connector at the servo. Adjust your servo travel so that the throttle is at a fast idle with the trigger in neutral, and full throttle just touches the stop. Allow just enough "brake" (push trigger forward) to close the throttle completely.

Once you confirm that you get full throttle and full closure, tighten the EZ connector screw. We like to use a set screw (provided with our EZ connectors), as they won't interfere with the radio box lid.

![](_page_48_Picture_0.jpeg)

![](_page_48_Picture_1.jpeg)

#### Water Cooling

For gas, water cooling is contained to the engine. If you use a muffler, only one water pickup is needed for the cylinder head. If you use a tuned pipe, use a second pickup for the header flange.

For electric, you need to cool the motor and ESC. Two water pickups should be used. One for the motor and one for the ESC.

![](_page_49_Picture_3.jpeg)

#### Shaft Oiler

We recommend the use of a shaft oiler for the Lawless drive. There are not many options available for an oiler. We made one using our T Bar and oiler cup. Our mix is 50% STP oil treatment and 50% Marvel Mystery Oil (red). You should also use a shortened flex shaft and a ball thrust bearing if you want your flex shafts to survive.

#### Don't Lose your Cowling

Don't forget to add some floatation to the cowling. Fiberglass does not float. At all. Don't ask... Twice. A piece of split pool noodle glued in with silicone RTV works well.

#### **Propeller Choice**

Propeller: If using a Zenoah with a muffler, use a small prop. Our 463 2 blade works well. With a tuned pipe, try our 7016 3 blade.

#### **Battery**

We recommend running as much voltage as your receiver and servos can handle, up to 7.4 volts. We use a LiFe battery that is 6.6 volts and 5000 mah. This works well, and gives us some needed nose weight.

### **Building Tips**

How to stay out of trouble:

First, there are some areas where you don't want any glue or sealer during assembly. This boat has a few places that have tiny slots that are used in assembly, and it you fill them up with epoxy, it will be impossible to open them up again. You can still build the boat, but you will have to remove some building tabs and make other minor modifications. Plus, you lose the self-jigging feature of the part.

Do yourself a big favor and keep epoxy out of the slots...

There are several ways to do this;

You can simply tape over the slots with masking tape. This works fine on the interior, but you don't want any masking tape permanently attached to the outside.

You can seal near the slots, and use your finger or a Q-tip to work the sealer up to the slots.

The best way is to not seal close to the slots, and give the area 2 coats of sealer after the hull is finished, and those slots are used.

Second, take your time. Understand exactly what you will do, and how, before you do it. If you think ahead, your chances of getting in trouble are greatly reduced. This works in all aspects of life as well...

Third, take the time to "blueprint" the bottom. This is done by simply checking the last 16 inches of both sponson bottoms for flatness. There should not be any hook (concave) or rocker (convex) in the bottom. Check it with a straight edge ruler. If you find any, either fill them or block sand them flat.

This makes the boat run true, and makes you look like a better driver!

Finally, enjoy what you are doing! If you start to get worked up or confused, stop and walk away for a while. Things are always easier when you come back.

If you are having trouble, or just don't understand something, contact us. We will do whatever it takes for you to have a positive experience and a great running boat!

Add weight to the sponson tips before you finish them. 8 ounces in each sponson works well. You will regret it later if you have to add 4 pounds to the radio box to get the boat to balance.

#### **Setup Tips**

Set the boat up as recommended with the balance point at 15.5 inches forward of the back of the sponsons.

Use the recommended prop for first runs

Set the propshaft centerline 1/2 inch above the bottom of the sponsons. Use the included setup gauge. If the nose rides too low, you can tilt the prop so that it is higher in the back for a positive angle. This is a sensitive adjustment, so a little goes a long way.

Another adjustment is the depth. Deeper makes the boat looser on the water and higher makes the boat tight to the water.

Angle adjustment: Controls the nose height when running.

Depth adjustment: Controls the height of the whole boat on the water.

The reason why these adjustments work so well is that the prop always wants to ride at the water surface and be level. It will climb to the surface and level out, taking the entire boat with it.

Another way to think about it is to imagine the lower unit being fixed in a vise, and you are adjusting the boat depth and angle.

Balance is not critical, but will influence turns and when the boat blows off the water. CG too far forward will keep the boat from blowing off, and the turns will be better, but the boat will be slower.

The key is to find the correct combination of angle, depth and balance point for your boat. That is a big part of the fun and pride!

That said, we currently like to run the lower unit with no negative or positive angle. Shaft centerline 1/2 inch above the sponson bottom and CG 15.5 inches forward.

Keep in mind that propellers will have a strong influence to setup. Some props lift a lot more and require a totally different setup.

We urge you to start out as we recommend. You will have a great running hull, and more importantly, a good baseline to improve on.

## **Driving Tips**

When turning, start wide, and tighten the turn as you get more comfortable with the boat. As you go faster, it helps to "set" the boat in the turns. To set, let off the throttle slightly as you begin your turn. As the boat begins to come around, gradually go back to full throttle.

You will notice that the boat will "lay down" and turn nicely if you set it. You can control how tightly the boat turns with throttle.

If it gets windy, the large side area of the boat will help and hurt. It will help the boat turn at one end, and prevent it from turning at the other. You can use throttle and "set" to overcome this, or at least minimize its effect.

#### **Electric Setup**

Use a 56mm motor, like a 5694 with an appropriate KV for your batteries.

We like to use a 1000kv motor on 8S.

You really need about 10,000 mah total, so in this case, use two 8S, 5000 batteries in parallel, or you can use four 4S, 5000 packs in a 2S/2P setup.

With electric, we recommend a 3/16 prop shaft, as most suitable props will be in 3/16 bore. In the case above, we would recommend that you start with a 60mm 3 blade, like a 6014/3.

Whatever you do, start with a smaller prop. It won't hurt anything. Just one size too big can cost you hundreds of dollars in an electric boat.

Gas or electric, have fun!

Thank you so much for buying this kit. If you need anything, please contact us. Support@zippkits.com