Western Reserve Model Yacht Club
AMYA #255
2/2024

Soling 1 Meter Suggested Building Procedure For Victor Model Products' Soling 1M Yachts

(revisions from 2/15 in BLUE)

See also: "Electronics and Batteries", and "Finishing your Soling One Meter"

Victor went out of the market in 2018, but there are hundreds of unbuilt kits available from owners, Clubs and other sources. The purpose of this document is to provide the builder of a Victor Kit with ideas for enhancing the basic, building it stronger, and building it more accurately than simply putting it together. This document contains the process for building and rigging only- painting and electronics, and gear are covered separately. (IF you do not have a set of Victor Instructions (Assembly Manual) they can be downloaded FREE from the AMYA website: https://www.theamya.org/BoatClassDetail.asp?BCID=14

THE AFTERMARKET: As the Soling 1 Meter has become a very competitive Class, there are aftermarket parts available that are very appealing- but remember- this is a one-design boat, and nothing can be done to make the boat FASTER than the Kit-built boat. So- this procedure will use Kit parts with a few exceptions, since most everything can be added later as budget allows.

So- if you are going to buy (a) aftermarket sails, (b) a spruce mast and booms, (c) an aluminum mast crane, (d) aftermarket stranded wire, etc. etc,. etc., anyway- locate a Victor "Lower Boat Kit" or an unbuilt full boat kit. Beware: the polystyrene plastic used to mold Solings is susceptible to damage ("drying out") from storage in places like garages or attics that get hot in warm weather. This makes boats easier to be holed or cracked and needing repairs than newer material.

There are several ways to do each procedure, but we will recommend only the one we think is easiest, strongest, and most cost-effective, based on our club's experience as a club building (so far) 30 Soling One Meters over five years.

Time: The procedures below should take something like 40- 60 hours. That sounds like a LOT- and it is. An experienced builder can probably build one in 30 hours, doing all or most of the steps outlined here. If you build it strong, it should last 5 – 10 years, so it is worth the extra time to do it right. The "new" Solings from 3DRC Boats and/or Vac-U-Boat are also made of polystyrene plastic and would still be damaged by storage in hot places. BUT, they will also be at least 2 years or more newer. Also- the new Soling kits are MUCH faster and easier to assemble- cutting the build in half or to as short as 5-12 hours.

You WILL need a stand …so build or buy a simple stand, first. You can make a stand of your own design, forming a scissors-like stand (similar to a camp stool). You can use ½" PVC piping for your stand, or wood. Ropes or webbing are used to make a cradle between the frames. 3DRC Boats also sells a folding carry stand that supports the boat well, and is easier to carry around.

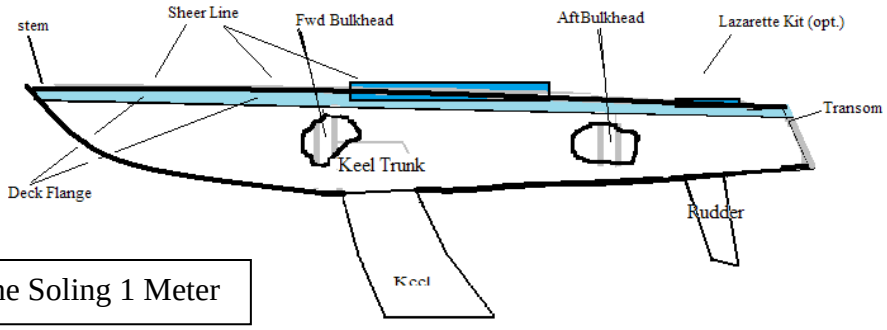

Fig 1- Parts of the Soling 1 Meter

Supplies Needed: (Bold generally available at Hobby Shop)

☑		☑		☑	
	Exacto Knife		**1/4" square basswood- 1 stick**		**Paint, stain or varnish** to finish the spars
	Needlenose pliers		**Paint-** see the "Finishing Your Soling" download on types of paint		**MeasuringTape-** 6 ft. or longer,
	Large Channelock-type pliers for wire crimping		**Fine-Mesh fiberglass cloth**		A **dressmaker's tape** (cloth) is also very useful.
	Wire cutters or side-cut pliers		**Disposable epoxy brush** (metal-handled paint brush)		Drill motor, 1/16", 3/32", 1/8", 3/16", 11/64", 13/64", 9/32" drill bits
	Motor tool, helpful, though a drill motor could be used		**Wet/Dry Sandpaper- 220, 600, 1000, and 1500 grit**		**CA Glue products**: Thin, and Thickened, plus CA DeBonder, CA Accelerator
	Cutoff wheel		Self-Adhesive **Velcro**		**Clothes Pins or small clamps**
	Flexible plastic ruler- clear if possible		**Isopropyl alcohol** (to use as a cleaner for epoxy.		Paint Thinner (Mineral Spirits)
	Body Filler- Bondo type or Squadron waterproof		**Saw-** (Atlas model saw, or any small saw for cutting wood). Miter box helpful.		**Pint Epoxy or polyester resin.** (see text- "Adhesives, pg 3)
	Small paint brush (that you won't mind ruining)		**6-1/4 lbs. #9 or #8 lead shot** (unless buying a pre-made keel)- new OR reclaimed shot are both fine		**Large thick rubber bands (used for model planes)**
	4" Strip of 1/8" aluminum		**For the bulkhead doubler 3/32"- 1/8" plywood- 4 x 6" sheet (see page 7)**		**Extra piece 1/2" basswood** 15" long X 1" wide
	3/16" square basswood- 1 stick		(2) 1 X 3" boards- 4' long For Alignment Jig (2) c-clamps (1) level		**1/16" music wire**- 36" - 48"

Adhesives:

Thin and Thickened CA- Hobby-grade CA at the hobby shop is higher quality than the "instant glue" or "super glues" you buy at convenience, or grocery stores. Victor recommends "Super Jet", which is a specific brand, but any good CA product will work fine. The "Gorilla Glue" CA's come in a bottle with a lid that seems to clog less- helping with a problem common to most CA's. CA's cure "instantly" in the presence of water- hence they instantly bond skin. For wood-to-plastic and wood-to-wood joints.

Epoxy vs. Polyester resin?? Epoxy- epoxy is a 2-part adhesive, that instead of "drying" like most glues, "cures" though a chemical reaction. You can use epoxy and hardener to mix with the #8- #9 lead shot ballast for the keel,

We use **WEST #105 Epoxy Resin**, plus **WEST #206** Slow Hardener for filling the keel and for filling the rudder.

Our recommendation: if 3 - 4 are building a Soling, split 2 quarts of WEST epoxy- 4 Keels and 4 rudders take about ½ gallon of resin and a suitable amount of hardener. If you are building 5 or 6 boats at once, get a gallon of #105 Resin and suitable amount of Hardener. WEST # 105 Resin and two cans of #206 Slow Hardener. (#205 Hardener is also OK- but will generate more heat than #206.)

Buy the WEST System mini- pump set (about $18) for precise proportioning and foolproof results, OR mix your epoxy according to directions by weight, using a digital scale. WEST products are available from marine stores, or online. The downside: a quart of WEST #105 and one of the hardeners (#205 or #206), plus a set of pumps, will set you back about $85- so, share the cost (a quart will do about 3 boats at $30/ boat).

Recommended: Alternative epoxies: Casting epoxy resins are a lower-cost and acceptable alternative to WEST resins. They are NOT adhesives- but good for filling keels. They cure faster (most have a work time in 30-minute ranges), but generate less heat than do the other epoxies. From Amazon:

NASUBI 68oz (34 oz each resin and hardener) Clear Epoxy Resin -High Gloss Resin Epoxy for Craft, Wood, Table Top Coating, Molds, Jewelry Making, No Bubbles, No Odor, Non Yellowing 2 Part Resin Casting Kit

If you are building your first Soling, given the difficulty of obtaining lead shot in certain areas, as well as the mess and bother of pouring your own keel and rudder, and only one is building- save some grief and buy a finished keel from 3DRC Boats. A 7 pound keel is recommended. **https://3drcboats.com/**.

Not recommended: Polyester resin as recommended by Victor. **Polyester resin,** used with a hardener, also cures using a chemical reaction**, is significantly lower-cost than epoxy, and is perfectly acceptable for filling the keel and rudder. However, polyester will <u>not</u> bond wood together well, and generates even more heat during cure than does epoxy.** Follow the recommendations in this document regarding cooling - immerse the keel shell in water as you fill it, especially using polyester resin.

<u>Plastic-to-plastic and hull to deck bonding</u>:

MEK: Victor traditionally has recommended using Methyl-Ethyl-Ketone (MEK) to "weld" styrene plastic parts together. But, if you apply too much MEK (easy to do) it creates unsightly ripples in the boat.

You can actually use **CA** for bonding internal plastic parts. We have used it successfully for bonding the bulkheads and transom in place as well as in wood-to-plastic joining.

We recommend **Liquid Nails Polyurethane Construction Adhesive** for bonding the deck to hull**.** This is a strong adhesive, one-part, and easy to use. It will not damage the plastic surfaces of the boat. It also is an effective sealant. You will need a caulk gun applicator.

Liquid Nails Polyurethane Construction Adhesive (Prod No. LN-950),	Similar product to 3M 5200. Will bond "anything to anything". **WRMYC Recommendation**	They say for all applications indoors and out. In 14 oz. caulk gun size tube only- will bond 3 – 4 boats. Tan in color- so plan to paint the boat after using. Cure- 8 – 12 hours

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Now on to the building: This procedure is for a **standard, flanged deck** vs. flangeless boat.
At each step- read the Kit Assembly Manual covering that portion, then read our procedure.

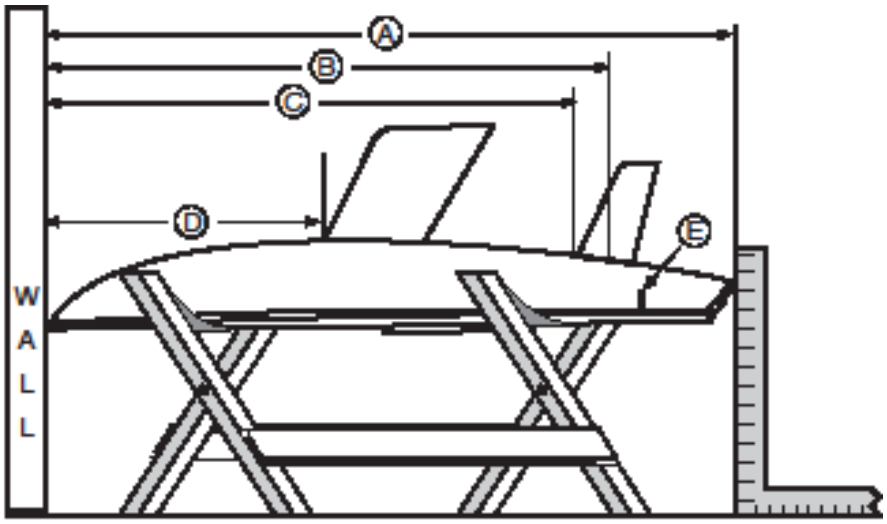
I. Mark the hull for length and keel position. See Figure 2.

(Note: Use **pencil.** Ballpoint, markers, and felt-tips will eventually bleed through styrene plastic.)

A. Trial-fit the deck. Rubber-band the hull-deck assembly together and push the hull **tight** forward in the deck **tight** to the stem. It may help to heat the stem area of the deck and hull using a hair dryer, then push the hull into the deck to better shape it, and get a tighter fit.

B. Place the hull/ deck assembly upside down on a stand, with the stem firm against a wall.

C. Use a yardstick/ or tape, on the outside bottom of the hull: with the deck on the hull, and a rule (level 90 degrees to the wall-- NOT along the curve of the hull).



Ⓐ 1000 mm (or 39-3/8") Maximum Length
Ⓑ 31-3/4" To Aft of Rudder Hole
Ⓒ 30-1/4" To Leading Edge of Rudder
Ⓓ 16" To Leading Edge of Keel
Ⓔ 36" Reference Marks

Fig 2

Model Yachting
Drawing by Jim Linville

Marks to be made on the hull: (pencil)

1. Stern Limit (length): Measure and mark **39-3/8" from the wall** to find the end-point or STERN LIMIT location on the outside (bottom) of the hull. (It may be that your hull is cut exactly at 39-3/8"- but check.)
2. **Keel forward position**: Make a mark **16" aft of the stem**. This is design forward position of the keel.
3. **Rudder shaft location**: Measure **31-3/4" aft of the stem-** this is the design location of the rudder shaft. If the pre-drilled hole is off-center, simply drill a 3/16" hole in the right place; tape it over on the outside the hull. Then as you fill in your transom you'll fill the extra hole.
4. **Reference Marks:** These are used for "squaring" parts as you install them. **Mark two** reference points on the hull, **identical length from the stem, about 36" aft of the stem** on both Port and Starboard side. The exact dimension is not critical, just so both sides are the same.

II. Centerlines- Locate and mark the centerlines of the boat and the interior bulkheads.

A. **Hull Centerline: Mark a centerline on the inside of the HULL** from just ahead of the keel spar cutout to the stern. This can be done several ways. DO NOT ASSUME that the rudder hole OR the keel opening are centered. **For a diagram of these procedures, see III F, page 7.**

- allow a small (1/16 or 1/8") drill bit to roll to the center of the boat in the bow and just aft of the keel slot.

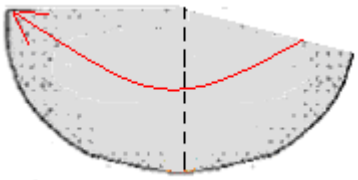
NOTE: the keel slot and/ or rudder hole are not always perfectly centered from Victor. Check YOUR centerlines, and if your measurements appear to be right go with those.

Roll the boat slightly to find the centers. Do not count on leveling the boat in your stand using a level across the top of the hull (sheerline)- the sheerlines of the Victor hull are not the same height! (You will trim them later.)

B. **Mark a second vertical centerline on both bulkheads.**
- Trace the outline of the two bulkheads on paper (place the bulkheads flange side down on the paper).
- Cut out the outlined paper shapes. Fold the papers in half, and then draw a line along the fold. Use this template to transfer the centerlines to **both sides and inside** the bulkheads.

See Figure 3. The larger of the two bulkheads is the forward one, and the smaller is the aft bulkhead.

Fig 3



C. **Temporarily attach the bulkheads, centered, to the hull.**

1. On the inside of the sheerlines, on the top, measure and mark 2 sets of points:
   a. One set of two- port and starboard- 18" forward of your reference marks, and…
   b. …two more just aft of the mainsheet exit dimple- 12" aft of your forward marks (a. above).

These are the approximate locations of the forward and aft bulkheads.

2. Also mark these bulkhead location points to the outside of the deck flange in pencil.

3. Be sure the **forward bulkhead** is placed correctly- with the "open"- flanges side facing AFT.
   a. Align the forward bulkhead at the marks on the hull at the top corners of the bulkhead (BOTH sides- equal distance forward of your reference mark), so the bulkhead is square to the deck. Once located, use tape (no glue) to hold the bulkhead in place, on the centerline and square to the line of the boat.

4. Next use the same process to adhere the **aft bulkhead** to the deck- with the "open"- flanges side facing FORWARD.
   a. Align the aft bulkhead at the marks on the hull at the top corners of the aft bulkhead (BOTH sides- 12" aft of your forward bulkhead again so the bulkhead is square to the deck. Once located, use tape to hold the bulkhead in place, on the centerline and square to the line of the boat.

5. Snap the deck to the hull, then sighting through the open transom, double check that both bulkheads are centered- and the "gap" between the hull and the top of the bulkheads against port and starboard deck should be about the same.
   a. If it does not appear that both bulkheads are centered, wiggle things around a bit until both bulkheads are square and centered in place.

6. Look through the hatch opening, and verify that the centerlines of both bulkheads, and those on the hull, match. Draw lines on the hull at both bulkheads so you can re-set them later. Remove the deck and bulkheads from the hull.

III. Bulkheads and under-deck reinforcement at the mast

A. Extend your centerline on the forward bulkhead up the plastic. Cut a ¾" wide "notch" centered in the lower flange of the forward bulkhead- scribe and remove the notch. See Figure 6 and the tip below.

TIP: **Cutting plastic:**
The easy way to cut styrene- **scribe it** using a NEW Exacto or other razor knife. Scribe where you want to cut, go over it a second time, then use a needle nose pliers to begin to "tear" it along the scribed line.

B. Bulkhead reinforcement: We install a 1/4" thick . "beam" in the upper inner section of the forward bulkhead. This stiffens the bulkhead, and spreads the rig load evenly, and also prevents the deck from collapsing under the mast. The beam is mounted on the aft, upper inside, under the flange of the bulkhead, shaped to fit tightly, and using CA.

1. Cut and shape a "beam" out of basswood, or thicker (1/4") ply to fit under the upper bulkhead flange.
2. Cut two right angle supports again out of basswood or ply, to mount under the flange- one ahead of and one aft of the bulkhead. See the illustration.
3. Use CA to attach the styrene mast support supplied by Victor, then CA the two right angle supports to the bulkhead, beam, and styrene.

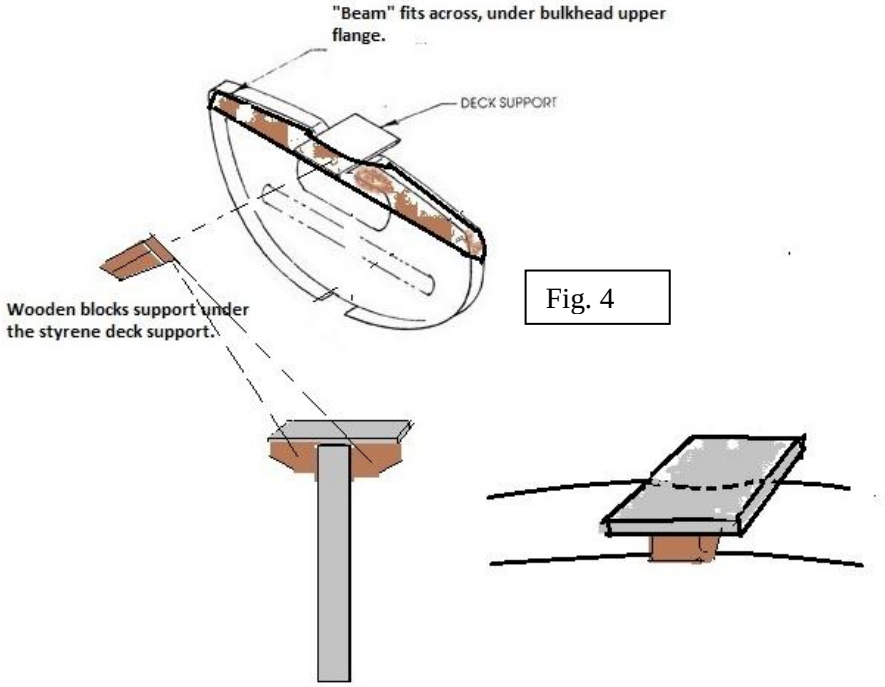
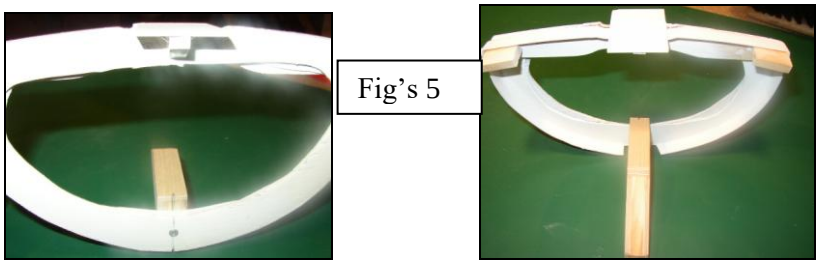


Fig. 4



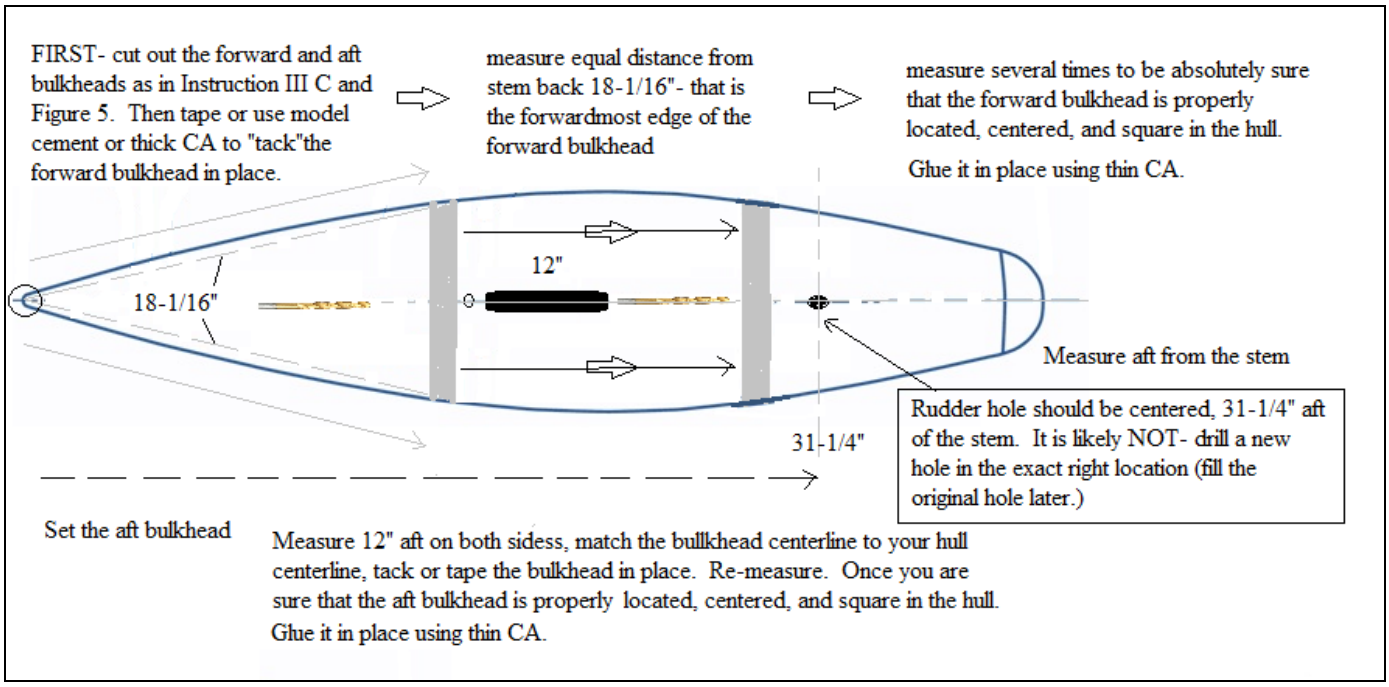
Fig's 5

Figures 5a and b- Looking at both sides of the forward bulkhead. (Here, the builder used a small screw to locate and hold the keel trunk in place.) Note the strengthening of the bulkhead under the mast and the wood blocks at the chainplates. The wood reinforcement has been painted white in these pictures.

C. Drill two 3/16" limber holes (drain holes) - one on each side of the notch on the forward bulkhead, each about 5/16" outside the notch, and Drill one 3/16" center limber hole centered in the aft bulkhead.

D. SAND: For better adhesion of the bulkheads, hull and deck. use 80-grit paper and sand:
1. the inside flange of the deck,
2. the outside flanges of BOTH bulkheads, including the top flange,
3. the center 5" or so inside of the hull from about 17" aft of the stem, to the rudder hole.
4. and the underside of the deck corresponding to the approximate bulkhead locations.

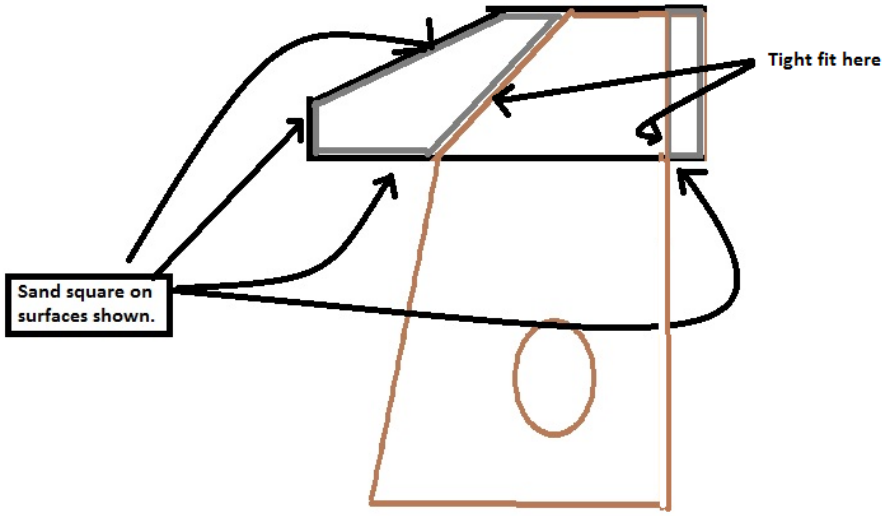
E. Getting everything centered and square:



IV. Keel Trunk

F. **Assemble the keel trunk,** per the Victor Assembly Manual Pg 4. **Leave the top piece off the trunk for now.**

We recommend assembling one side of the keel trunk with the keel spar laying in it for fit. Be careful that you do not glue the spar to the trunk!! Then, add the second side and CA in place. Finally, use a belt or disc sander or a piece of plywood with sandpaper glued on it, to sand the edges flat and square for a tight fit to the hull.

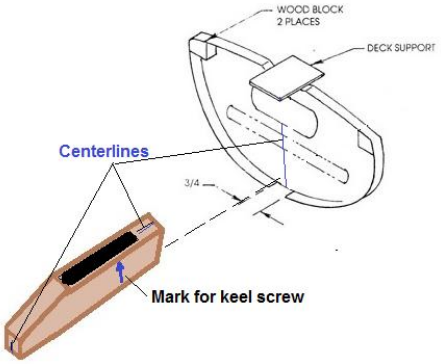


G. After a few minutes- wipe any excess CA from the keel trunk. MAKE SURE there is no wet CA in the trunk!

H. Measure and draw a vertical centerline on the forward edge and in the small vertical aft edge of your assembled keel trunk.

1. Test fit the keel trunk/ forward bulkhead assembly into the hull. Make sure the keel trunk fits tightly on the hull (over the keel slot) and that the bulkhead is centered on the centerline of the hull.

Fig. 6



V. Keel: Carefully assemble your keel shell halves

A. Glue a piece of coarse sandpaper to a flat surface, like your bench top, or a piece of plywood. Using this flat sanding surface and a tape "handle" on the keel halves, sand all edges of the keel trunk and the bottom edge flat. **Do not over do this- making a keel too thin will result n a keel that does not meet the Class Rules as to keel thickness!! All you are doing is making the halves of the keel shell mate for gluing together.**

B. Using CA (as per the Victor instructions), wood stain or boiled linseed oil, waterproof the keel trunk parts inside and out.

C. Thoroughly sand the INSIDES of both keel halves, using 80 to 120 grit paper. This will enhance the epoxy/ keel bond and make less likely any separation of the keel halves later.

D. Tape the keel halves together.

1. Visually make sure you have a tight joint of the keel halves. Use masking tape to hold the keel halves tight together. If the halves do not mate tightly- re-sand until they do. There is a fair amount of pressure on the keel joint as you pour and stir the epoxy/ lead shot mix- so tape the halves together well.

2. Run thickened CA down the inside edge of the keel, and rotate the keel assembly slowly so the CA runs all around inside the edges. The CA will run ou the opposite side IF/AS you get thorough coverage of the keel joint.

3. **Spray CA Accelerator** into the keel, and tilt the keel assembly so that the accelerator runs all around the inside perimeter of the keel. There will be a "crackling" sound AND heat generated as the CA cures.

4. Use coarse sandpaper to radius the top edge of the keel assembly to match the curve of the hull, for a better fit of the keel to the hull.

5. Mark the keel 1-3/4" back from the top forward corner; this will be the forward position of the keel spar in the keel. The top of the spar needs to be parallel to the top of the keel shell.

6. Mark the position of the keel screw on the side of the keel trunk so you will have a reference point to drill your hole for the screw after you install the wooden top piece of the trunk.

7. Mask the keel especially around the top (at least 2"), so you won't get CA or epoxy on the outside of the keel shell.

8. CA the Keel Spar in place per the Assembly Manual.

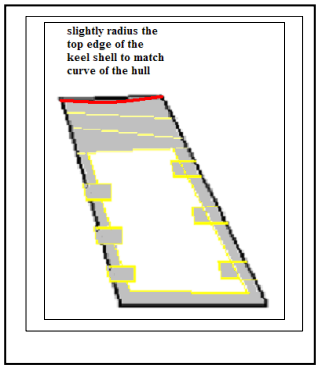


Fig. 7

VI. Rudder –

A. Use your sanding board to sand the facing edges of the Victor rudder halves, as you did the keel, and as in the Assembly Manual.

B. Tape the halves together, and follow the procedure you used for the keel (V- C above) to glue the rudder shell together.

C. File a "flat" on the top front of the rudder shaft, as a place for the set screw to "bite".

D. Place the rudder shaft inside the rudder shell, per the Assembly Manual. CA the rudder shaft in place inside the rudder.

E. Mix up a batch of epoxy (or polyester) resin- approx. 3 ounces for the rudder. You can thin the epoxy with (less than 5%) alcohol to catalyzed epoxy- to make it pour easier for the keel and rudder. Fill your rudder with resin. You will top it off later after curing.

F. Allow the rudder to sit vertically overnight to fully harden. You can lightly mount the rudder shaft in a vise to hold the rudder assembly vertical during curing.

VII. Align the keel, then install the Keel Trunk. Take your time on this!!!

You are going to level the boat in a "jig", then position the keel and rudder fore and aft as well as aligned vertically before tack-gluing the keel trunk in place. This will properly locate the keel 16" aft of the stem, and the bulkhead accordingly.

A. (If you haven't already) sand (using 80 grit) the forward and aft bulkhead flanges all around and the area it will mate to the hull.

B. (Saving your centerlines!) Sand the whole inside of the hull area from approximately the forward bulkhead to the former and around the rudder hole.

C. Make a "jig" to align the hull, keel and rudder.

   i. Using two 1"X 3" X 48" boards…
   ii. Add rubber bands or clamps to clamp one board either side of two 1" vertical sticks (I use a bamboo cooking skewers) at the bow, and at the stern. These vertical sticks need to be small diameter (up to 3/16") to allow the boards to join at the center. (Figure 13)
   iii. Place your jig between two stable surfaces- sawhorses, tables, or chairs.

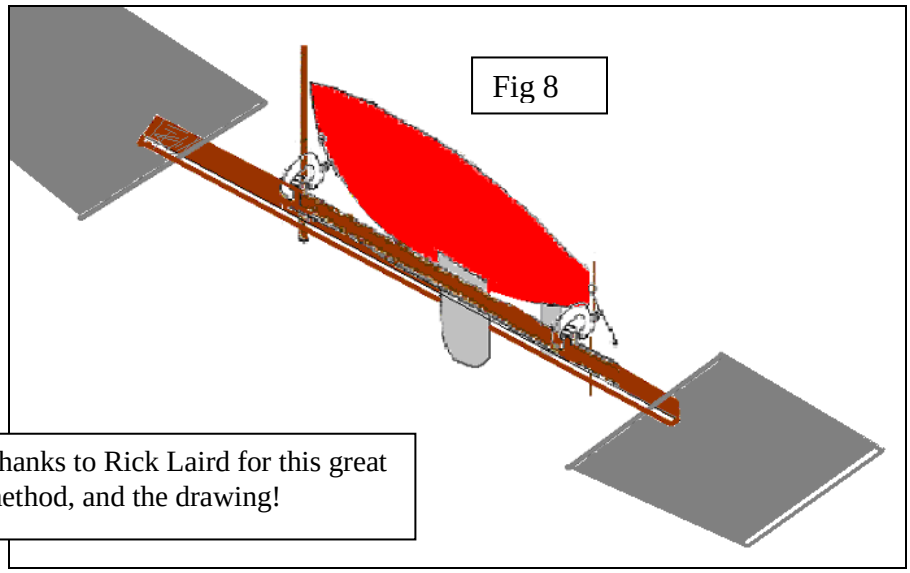


Fig 8

Thanks to Rick Laird for this great method, and the drawing!

D. Since you have not glued the top plate on the keel trunk, drill a (3/16") hole for the keel screw in the top plate at the place you marked, OR use an oversize flat washer to assemble the keel trunk/ keel into the hull. The keel trunk will hold the keel in position without gluing as you twist and align the boat in the jig.

E. With the keel and trunk loose in place, and holding the hull in your hands, slide the keel forward and back until the **upper front corner of the keel is at the hull mark 16" aft** of the stem. Gently lock the keel trunk in position using the wing nut.

F. Place the keel and hull in the jig, with the keel clamped between the boards.

G. Next add the rudder. If you haven't already, sand the rudder block to fit the hull as in the Assembly Manual. CA the rudder log (rudder tube) through the rudder block projecting about 1/16" through the hull. Then use the rudder arm (tiller) to hold the rudder in place.

H. Tighten the clamps of the jig snug, holding the keel, keel trunk, rudder and rudder block in place. See Figure 13.

I. **Loosen the wing nut holding the keel, then level the boat laterally (side to side) on your stand;** place a level across the **front** of the hatch opening. Adjust the boat side to side until the hull shows level in the stand.

J. **With the nut holding the keel loose,** twist the keel and hull until everything lines up. **It likely will not align on the first try.** You will find that repositioning the hull is needed here, in order to get both all components to line up on the hull centerlines.

i. The vertical forward stick of the jig should line up on centerline at the stem.
ii. The vertical aft stick aligned on centerline at the transom.
iii. The Keel trunk centerlines
iv. The forward Bulkhead centerline
…should all align on center.

The rudder block will position so that the rudder is properly aligned- it may not be a perfect fit (based on how accurately you sanded it), but you will fill in using thickened CA. What is important is that the rudder is aligned vertically.

K. Once everything lines up, tighten the wing nut firmly, to lock the keel trunk in place.
Do not glue the keel trunk, bulkhead OR rudder block in place just yet.

L. Remove the boat from the Jig. Again- carefully check to see:
- that the keel is hanging vertically
- that the keel lines up with the centerline of the hull.
- pickup the hull- the keel should match exactly with your centerlines.
- verify that the forward corner of the keel is at your mark 16" aft of the stem. It should be within 1/8".

What if the keel is NOT aligned? Not to worry- take it all apart, and do it again. You will likely find that the hull is somehow twisted (especially if you jumped the gun and have already glued in the bulkheads!) Misaligned bulkheads will twist the hull. If that is the case, we hope you just "tacked" them. Remove the bulkheads. If you glued them in using CA, use your CA De-Bonder sparingly- it will etch the plastic. If you used MEK or Testors glue, carefully try and peel away the bulkhead.

If you can't remove the bulkhead- and you can't remove the trunk- live with it: figure out which way the keel needs to twist in order to line up on centerline properly. You can file the edges of the keel spar (either forward or aft opposite edges) to get the keel aligned. Keep working at this until you get a good keel alignment.

M. Re-install the hull in the jig. You may have to tweak the rudder slightly to be sure it is perfectly straight and aligned with the hull centerline, and with the keel.

VIII. Tacking the keel trunk, forward bulkhead and rudder block

A. **Once you are sure that everything is located properly**, Use a drop of thickened CA on a toothpick to **tack bond the KEEL TRUNK** at the back and front of the trunk. **Thickened CA does not "wick"** as much as the standard thin CA- so it is less likely to run through the parts and bond things prematurely.

Be careful here- a keel permanently bonded to the boat at this point (with no ballast) would be a real problem. (If somehow you inadvertently lock the trunk and keel strut together- use some CA Debonder, and tap it out with a hammer. And good luck.)

B. Remove the keel and top piece from the trunk. Dry all CA from inside the trunk.

C. Re-install the keel in the trunk for a final visual alignment check. Look it all over again, to be sure everything lines up.

D. Place the forward bulkhead against the keel trunk, and measure the distance from the forward bulkhead to your reference lines to be sure the bulkhead is "square" in the boat.

(The forward Bulkhead may/ may NOT be located at your previous measured position 18" aft of the stem. That step was merely to determine where you should sand the hull. You are now final- positioning the bulkhead based on the keel position instead of using any standard dimension.)

E. With the hull in the jig, and the rudder through the rudder log, apply a layer of thickened CA to the rudder block, and glue it in place.

IX. Bond the Forward Bulkhead to the keel trunk, and the trunk to the hull.:

1. Place the deck on the hull. Use rubber bands to hold the deck in place pushed hard forward.

2. **LOOK** from behind the boat through the transom at the forward Bulkhead. You will be able to clearly see the "fit" of the forward bulkhead to the deck. The bulkhead should fit squarely- you should see pretty close to 100% contact all around the bulkhead at the hull and the deck, with small (1/16" or so) gaps at the top corners of the bulkhead.

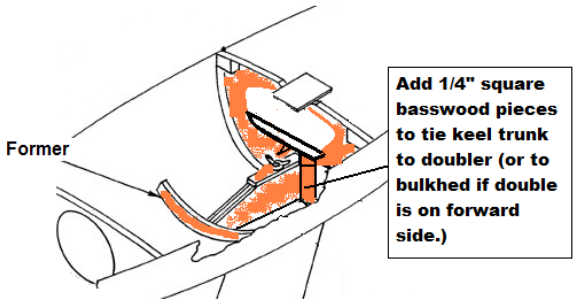
3. Remove the deck.

4. Bond the forward Bulkhead to the Keel Trunk using CA. Leave the top 1-1/2" on each side un-bonded to the hull until later.

5. Bond the keel trunk in place using CA.

6. Add 3/16- 1/4" basswood sticks to the sides of the keel trunk at the bulkhead. You want a solid assembly joining the keel trunk to the forward bulkhead. (See Figure 18.)

Fig 9



X. **Tack the Aft Bulkhead**

A. Remove the deck, and repeat the process (above) for locating the aft bulkhead (generally it is 12" aft of the forward bulkhead).

B. Be sure to reverse the flange on the aft bulkhead so the flange faces forward to the main hatch opening.

C. Slide the bulkhead into position through the hatch, with the bulkhead immediately aft of the hatch opening. Mark the position of the flange at the center of the aft bulkhead on the hull.

D. Once centered, **tack-bond the aft Bulkhead ONLY at the center** using a drop of thick CA.

E. Remove the deck. Measure forward from your reference lines to make the aft Bulkhead square in the boat- tack in place using a drop of thickened CA on each side.

Check - Snap the deck back in place and use rubber bands to hold it on the hull.

- **Sight through the transom again, this time looking at both bulkheads for fit to the deck.**
- **Remove the deck, and re-measure both Bulkheads from your reference lines, to be sure they are "square" in the boat.**

F. Bond the aft Bulkhead in place, using thin CA, again leaving the top 1- 1-2" un-bonded at the sheerline.

Wrap several rubber bands around the hull especially at the bulkheads, to hold them in place while the glue on both bulkheads fully cures (24 hrs.).

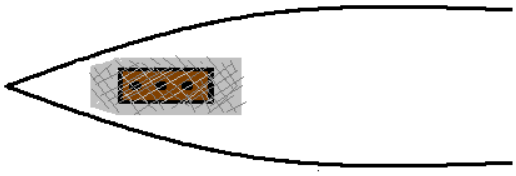
XI. Deck Reinforcement

A. Install wood block reinforcers from the Kit to the deck, under the chainplates, using CA. The wood blocks go under the upper flange of the forward bulkhead, per Victor Instructions. Locate these as far "out" near the hull sheer as possible.

B. Snap the deck in place, and drill pilot holes for the shroud attachments at the chainplates. The size of the pilot holes varies with the size of fittings you plan on using for chainplates- see section XV below. IF using cotter pins, the pilot holes need to allow the pins to drop in place. If using a threaded fastener- the pilot is the size of the "root"- 1/16" pilot is adequate for most threaded fasteners.

C. Use CA to glue the various wood reinforcing blocks to the foredeck and side deck, per the Victor Instructions, **then cover with fiberglass cloth. (Fig 10) These include** the wood pieces on the underside of the deck at the dimples where the jib and mainsheet exits will be, and the wood piece under the jib swivel mounting point.

Fig 10

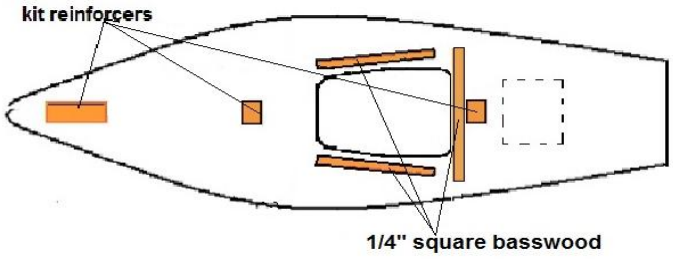


D. Use CA to glue basswood reinforcement as per Fig. 11 (you can also use balsa for lighter weight, water damage is unlikely to the balsa wood under the deck)- these will lessen the chance of breaking the deck from lifting the boat improperly using the hatch opening (it happens!) NEVER use balsa where a screw has to be set.

E. Optional: Use a piece of 1/4" basswood to make a mainsheet reinforcement. Sand the upper edge of the mainsheet reinforcer to fit the curve of the deck aft of the hatch. If left straight it will crack the deck at the ends. Be sure your aft mainsheet exit reinforcer does not interfere with the aft bulkhead and impede the fit of the deck.

See Figure 11.

Fig 11



XII. Hull reinforcement

Bulletproofing the Hull- Over time as you are carrying the boat, the polystyrene hull around the keel can form flex cracks that open up- leaking or even eventually dropping the keel and keel trunk. The solution is to reinforce the center of the boat using fiberglass cloth. We have also used carbon fiber strip, and the results are the same. The fiberglass is easier to work with and less costly.

A. Reinforcing using fiberglass or carbon fiber cloth: This step is easiest after the keel trunk is in. So- you should have at this point aligned the keel and rudder, and have a final location for the keel case, then CA the trunk and the former in place.

1. **SAND**- if you haven't already, using 80- 120 grit sandpaper, rough up ALL areas you are planning to reinforce with fiberglass. If you don't do this, the fiberglass will not stick to the polystyrene plastic and may peel off. You are going to epoxy place two squares of fiberglass cloth into the bilge, and up the sides of the keel case.

2. Cut the fiberglass cloth into four pieces – each approximately 4" X 4" (lay the cloth on a flat cutting board, and use a metal ruler or strip of metal and SHARP Xacto knife to cut 4 pieces.). Lay the first layer of fiberglass cloth into the bottom of the hull (DRY).

3. The fiberglass cloth should not extend any farther aft than 3 – 4" aft of the "former" at the aft of the keel trunk and overlap the bulkhead flange.

4. Position the fiberglass so it extends about 1/2" up the sides of the keel trunk. Starting at the joint of the keel trunk to the hull, "wet out" the fiberglass cloth using catalyzed epoxy, and a steel (or junk) paintbrush. Use a body-putty spreader to brush all air pockets out of the cloth.

5. Wet out a second layer over the first.

6. Wipe off any drips of epoxy that get beyond the edges of the cloth with alcohol.

XIII. Former: The "former" is a main strengthener for the center of the hull.

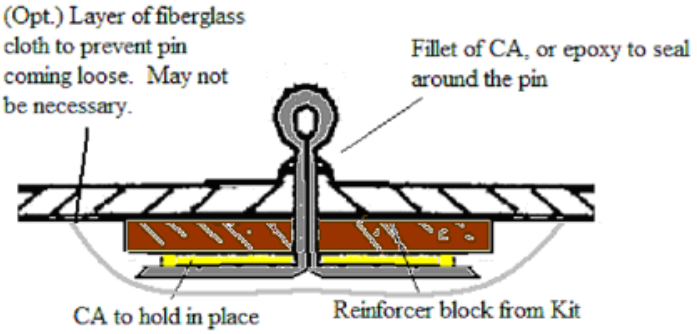
You will have fiberglassed the entire center of the boat around the keel trunk, and under the location of the former. You will have to epoxy the former in place. (CA will not bond properly to the fiberglass cloth used to reinforce the hull.)

A. Measure and draw a centerline on the wood former.
B. Use a saw, or round or flat file to make two limber holes- one on each side- about 1-1/2" off center- of the Former so water can pass under the former.
C. **Using epoxy**, install the Former directly behind and connected to the keel trunk, making sure it is centered and square (measure forward from your 36" reference points).

XIV. Stem and shroud fittings and chainplates:

A. Install stem (jib club mount) fittings now, before you fit the deck.

B. We have found the BEST chainplates and jib pivots are brass or stainless cotter pins, instead of a threaded fastener that might loosen.



3/32 or 1/8 X 1" Cotter Pin Chainplates- brass or stainless

Eye Hooks/screws are easier to install than the cotter pins, so if you are going to use threaded eye hooks we recommend **upsizing the eye screws**, or (better) go to brass screw-hooks, commonly available at good hardware stores in brass (better than brass-plated steel). Also- select the longest eye hook available. This way, you can actually turn the eye hooks to make fine adjustments to center the mast, should the shrouds stretch or somehow not be the same length.

If using threaded eye-bolts, with nuts, you do not want to have the nut fall off- use CA on the threads. If using eyebolts and nuts use washers under the nut as well as under the eye. It is also good practice to CA the nuts to the wood backers underneath, once tightened (before you install your deck).

Below are <u>full-size</u> pictures of alternative chainplate fittings: (L to R) (actual size)

The kit eye-screws *2-56 stainless eyebolt* *longer brass eye-screws bought at a hardware store*

XV. Install the radio board, and battery mounts.

It is much easier to fit the electronics now, before the deck is installed, than reaching through the hatch later.

A. Interior arrangement:

The objectives – mounting the electronics:

i. Keep the weight of components forward, the transom out of the water for better boat balance.
ii. Center the sail servo as much as possible- this allows a longer sail arm for better travel.
iii. Securely support the sail servo, so the twisting motion of the servo doesn't loosen it.
iv. Mount the servos and receiver clear from the bottom of the boat and any incidental water.
v. Make the radio board removable for maintenance.

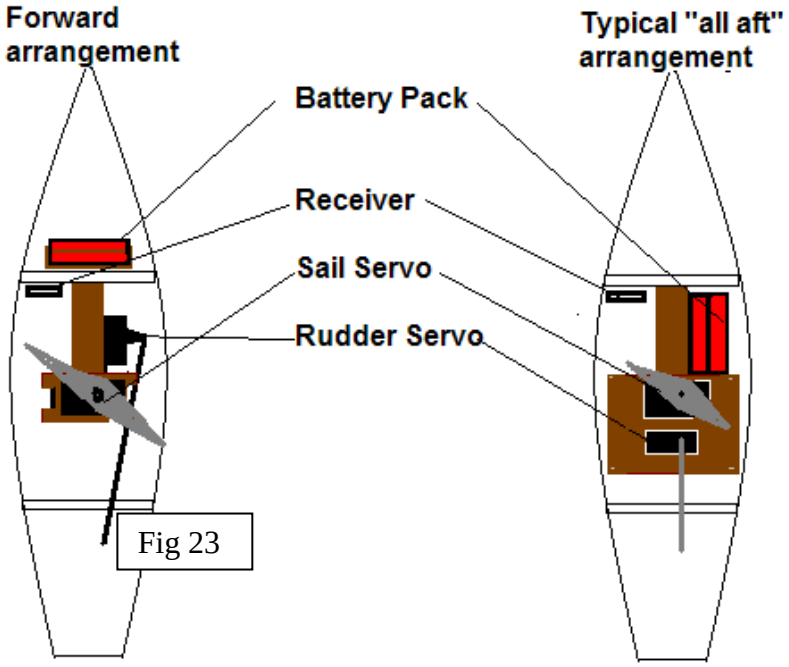


Fig 23

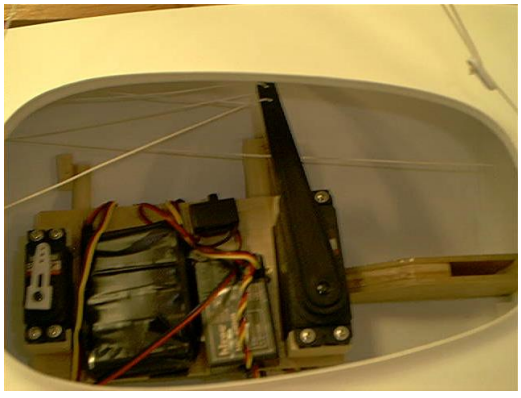
XVI. Installation of the electronics:

A. (in the kit) Victor supplies a plywood radio board, plus 2 wood strips, beveled for making and mounting the radio board.

B. In the illustration (Fig. 23) left side (prev. page) the radio board is moved forward as far as possible, and the rudder servo is mounted beside the keel trunk, with the battery pack mounted ahead of the Bulkhead.

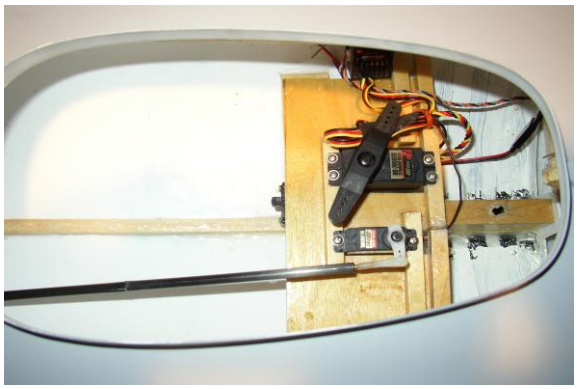
In the photos below- you can see the typical factory-build- with the components mounted pretty well back in the boat.

Fig 24 & 25



In this Victor-built boat the batteries are well behind the keel trunk. Compare to the above picture with the battery pack ahead of the bulkhead, and the rudder servo mounted to one side of the keel trunk.

(The keel trunk is not adequately supported in this picture. We would add supports on either side of the trunk.)



In this picture, everything is moved forward (sail arm is not yet attached to the servo arm). The sail servo here is the digital HiTec HS-7955TG and the rudder servo is another digital- HS-5085 MG- both very small. But analog servos would mount in the same places.

The rudder control rod is a carbon fiber tube with fittings CA'd into the ends (not yet attached). (Hull reinforcement here is carbon fiber tape in place of fiberglass cloth, painted over.)

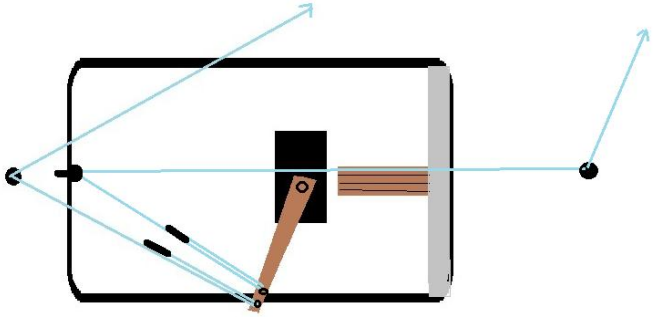
C. **For the radio board, don't just glue servo mounts to the plywood.** Cut holes to recess/fit the two servos, then glue ¼" hardwood wood square wood to act as a servo mount. This method has the advantage of supporting the servos' twisting motion using the plywood board, not only using the servo mounts.

D. **Sail Control Arm:** You can use a single OR a double arm. The single arm is a little more prone to tangling- but it works well.

1. **The single arm** is available commercially with the HiTec 815 Servo, (or separately as Hitec # 56361 OR with the HS-765HB Sail Control Servo).

   Figure 26: (as in the Victor instructions) a single arm arrangement using bowsie for adjustment. With the bowsie set off the sail arm- using a servo of 90 degrees travel (45 each side), a 5" single arm will yield an adequate 7" of travel at 100% torque.

Fig 26



2. A **Double Arm** (Figure 27) splits the lines in half rather than having both sheets at one end of the same arm, reducing travel but is slightly less likely to tangle.

Fig 27

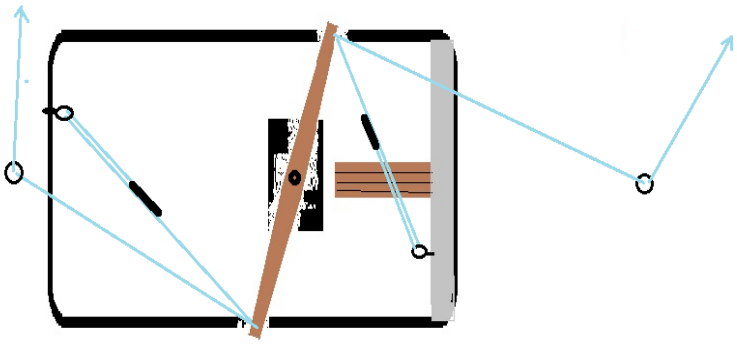


Figure 27: Double arm arrangement using a bowsie for adjustment (NOT dead-ended at the sail arm). This is a 2:1 travel; of each 1" movement of the arm, you get ½" movement at the sail but double the effective torque. So, using a servo of 90 degrees travel (45 each side), a 6" double-ended arm will yield about 4.2" of travel. A 7" arm (3-1/2" per side) yields about 6" of travel. If the servo has 150 oz./in. or torque, effective torque will be 75 oz./in.- this is minimal torque for anything but light winds.

The physics: the shorter the arm, the more applied torque, BUT less travel.

Keep in mind: you do NOT necessarily need to get the booms out 90 degrees to the hull. Your objective is to get the TOP of the 2 sail leeches out 90 degrees- so the booms at about 70 degrees is adequate.

So- what do we use?

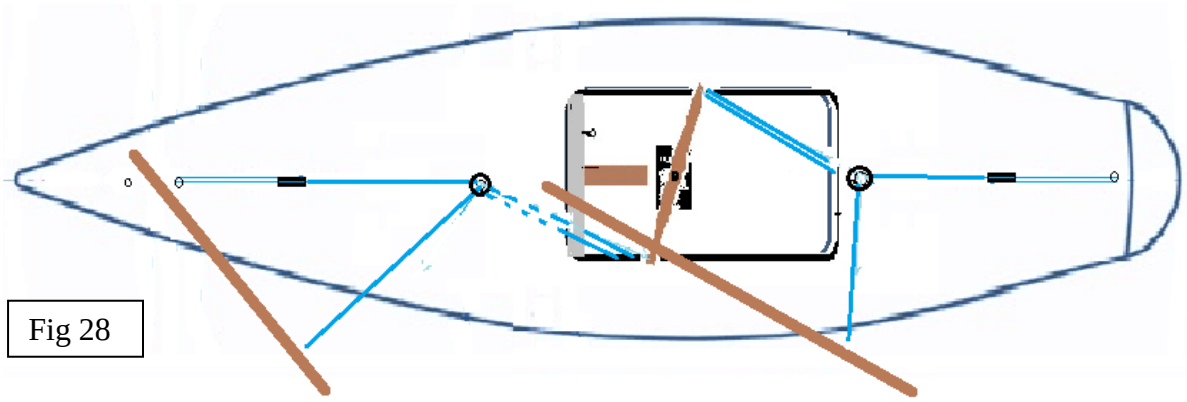


Fig 28

Figure 28: **Recommended setup.** You can also run the sheet dead-end out to the deck, attached at the backstay (mainsheet) and the stem fittings (jibsheet)- this gives easy adjustment using a bowsie without removing the hatch cover. Same travel and torque as Figure 27 example.

Recommendations:
- Use a double arm setup, dead-ended on the deck as in Figure 28.
- The double sail arm needs to be at least 6.5" total length to get enough sail travel. **7"** WILL fit, and if you use the recommended (or stronger) sail servo, you will have enough torque.
- Make the sail arm centered on the servo- you can allow for moving the JIB side by putting in several holes or pivots. This allows you to adjust travel of the jib and main independently.
- Sail servo as centered in the boat as possible- allows a longer arm, for more travel.

F. **Sail Arm:**

i. **Materials:** Your Sail Arm can be made of many materials, including 3/16" plywood, aluminum, thick plastic, Lexan, Plexiglass, etc. or Carbon Fiber (CF) strip (Midwest 5743). CF is easy to find and work with, and not expensive. Cut it with a hacksaw.

ii. **Length:** Making your arm the longest within the confines of the hull will give you maximum travel for the sails.

Our recommendation is a 6.5"- 7" length, carbon fiber or 3/16" ply double arm.

iii. **For sheet pivots on the sail control arm**, you can drill holes and **chamfer the edges** using a larger-diameter drill bit. If you DO just chamfer the edges, use some thin CA, sprayed with

accelerator, to create a wear surface within the chamfer so your sheets last longer. Later- blocks (about $15 each) can be retro-fitted.

iv. For more wear resistance install **screw-eyes, pop-rivets** (remove the "nail") or brass **eyelets** (like the ones used for sheet exits with the Kit) in the ends of the sail arm. Later you can switch to blocks if desired.

G. For the two booms to pay out approximately the same at any sheet setting,

a. Ideally make your attachments on the two booms equal distance from their pivot points.

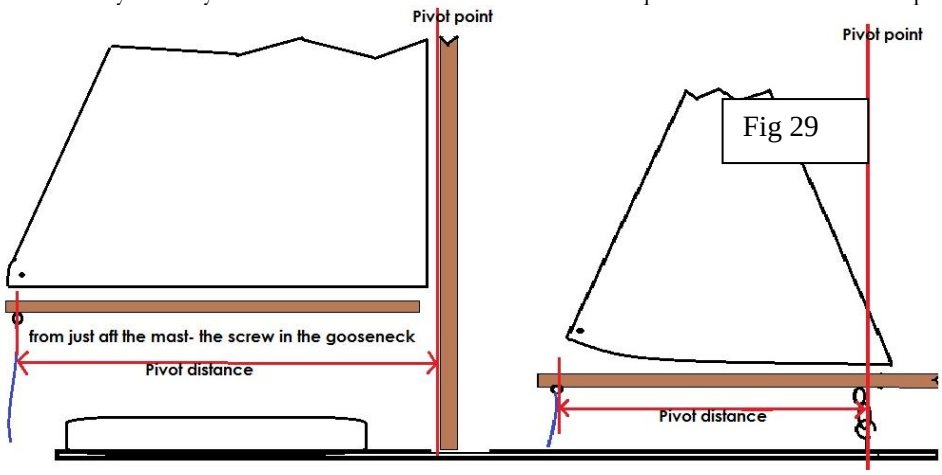


Fig 29

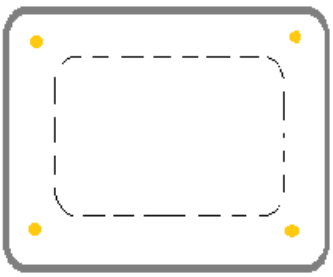
b. Make the jibsheet side of the sail arm with several positions or holes so you can play with the sheeting positions on the sail arm. Usually- making the jib side slightly shorter than the main side will help equalize the sheet travel.

H. **Sail Servo:** The **HiTec 755** ¼-scale servo, on 6V/ 5-cell battery packs, will yield adequate torque (150+ in./oz.). Anything smaller does not provide adequate torque for the sail arm. A HiTec HS-815 is 300+ in./oz. (probably overkill), and provides more rotation than any standard servo- but is much heavier. **Our recommendation is the HiTec HS-755 HB.**

XVII. Lazarette:

Now is a good time to install your lazarette, if you want one. This is useful for making re-attachments to the rudder mechanism, or emergency repairs. You will only have to use it very occasionally- but when you need it, it's a great thing to have- so many never install one. Follow the Victor instructions for the Victor Kit. Or, you can make one using a rectangular piece of polystyrene, screwed at the corners with #1 brass self-tapping screws.

Don't worry about sealing out water- you should never get water over the aft deck.



Per the Class Rules, the lazarette cannot be more than an opening of 9 sq. inches- so 3" X 3".

Cut a 3 X 3" opening (use the scribing technique in Section III), then make a cover slightly larger out of 1/16" styrene. 4 Holes and screws- and viola!- a lazarette.

XVIII. Now the transom: Note: the aft end of the hull as delivered from the factory is NOT usually cut square. So after the transom installation, you will be trimming part of the hull off the boat at the transom.

A. Using CA- glue the wood reinforcing block from the kit **low** to the vertical inside surface of the transom- just up from the bottom center. (This varies from the Victor Instructions. Screwing the backstay eye to the vertical surface of the transom places the backstay farther aft so as to not interfere with the mainsail.)

B. **Test fit the transom** to see if it will line up with the hull/deck marks and the one meter stern limit mark when fully pressed down inside the hull. (Measure equal distances from your 36" reference marks on each sheerline to ensure the tops of the transom are square.) Small adjustments may be made by tilting the lower end of the transom fore or aft.

C. Sand the transom flange all around where it will mate to the hull and deck.

D. The transom should be in the right position with the bottom centered, just inside the 1000 mm. length-point of the boat (leaving a 1/16" or so edge, or "lip" to use for filling).

E. This should be done while holding the transom tilted at an angle of approx. 30 degrees. Be sure the flange on the transom faces forward, toward the hatch opening.

F. Apply a single drop of thin CA at the center bottom of the transom to locate it. Later, you will permanently bond it.

G. The important part of fitting the transom is to ensure it is fully pressed into the hull and centered.

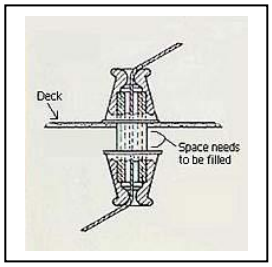
H. Once you have located the transom in the right position, hold in place with small clamps (clothespins) at the top corners and permanently bond it w/ CA.

XIX. Install the sheet exits Use CA with Accelerator to bond (Kit supplied) reinforcing blocks of wood to the underside of the deck at the dimples.

A. Install: the deck sheet exits. The eyelets provided by Victor allow water to get inside the hull when sailing in high winds. To **add height and lessen the amount of water entering the hull**, make "taller" sheet exits out of:
   1 commercially-available aluminum parts (Pekabe #470) See Fig 29 below.
   2 3/8" nylon hex bolts with holes drilled through them/
   3 3/4" wooden balls (available from a craft store) cut in half on a band saw.

- any way to get the sheet exit up out of the water. Class Rules limit the height to maximum **½" above deck**. You should place the same thing on top of, and underneath- the deck. Drill out the holes as large as practical, and chamfer so the sheets will run free.

Fig 29



Before deck installation…

At this point, you should have:

- The keel aligned.
- The rudder aligned.
- The keel trunk bonded to the hull, reinforced, solidly bonded to the forward bulkhead and to the Former;
- The layout and mounting for the servos all figured out, ready to be re-screwed into the hull;
- Your servo mounting and radio mounts all planned, screws set, waterproofed (use CA as Victor suggests, or varnish, linseed oil, etc.)
- Your deck reinforced, and your sheet guides installed.
- Your transom installed
- **(Possible exception**- installing the rudder arm and rudder actuating rod after the deck is installed can be a pain (unless you have a Lazarette). To make this easier, assemble the actuating rod, making sure the adjustable end is FORWARD, attached to the rudder servo (not to the rudder). Attach the actuating rod to the rudder arm, install the rudder, set the rudder arm 90 degrees to the centerline of the hull, and tighten the set screw, install the cotter. Tape off the loose end of the actuating rod to the hull, out of the way.

XX. Deck- Now install the deck.

A. Installing the deck:

1. Test fit the deck on the hull for all around fit. The deck might be resistant to going on- but should go on tightly.
2. Push the hull HARD forward to the stem. Use thick rubber bands to hold the deck to the hull. Look everything over- there should be minimal "gaps" between the deck flange and the hull sheerline.

B. Deck installation is really quite simple. Two sets of hands makes it easier.

1. Installing

a. Invert the deck, laying flat on a (padded and protected) surface.
b. Apply the adhesive inside the deck flange all around.
c. Run a bead of adhesive across the forward and aft bulkheads, and the transom.
d. Snap the hull into the deck, being sure the hull is forced all the way forward, into the stem. Then cleanup around the deck flange, first with a dry cloth or paper towel, then mineral spirits.

Use heavy-duty rubber bands to hold the deck to the hull as the adhesive sets (at least 24 hours).

Decision: Do you want a fixed keel? A removable keel is our general recommendation. It allows easier maintenance, is useful for shipping the boat or for some maintenance procedures.

Seal the removable keel using Plumber's Putty, available from the local hardware or "big box" store- the smallest can is a lifetime supply. Put the putty on TOP of the keel spar, and on top of the keel shell, install the keel using the bolt and wing nut. Be sure to use the rubber gasket under the washer between the wing but and top of the keel trunk.

But, many builders fix their keels using epoxy. Use a hobby-grade 2-part 30-minute cure epoxy. It will be thick- so mix it and use an epoxy brush (cheap metal-handled brush from the hobby shop) to brush epoxy all over your keel spar, except at the top. Then install the keel. Add the wing nut and tighten. **Wipe off excess epoxy with alcohol.**

XXI. Rig: Complete the rig per Victor's instructions. (If you choose an aluminum rig- assemble per the manufacturer's instructions.)

A. **Jib club** (jib boom):
Class Rules allow the jib boom to be longer than the Kit boom. It can be up to 15-1/2" long (same length as the main boom). This extra length (a) reduces the tension on the jib leech (back of the sail) and (b) allows full adjustment of the outhaul, both for factors allow for better sail shape. Don't forget to add the loop at the clew (aft corner) of the jib, supporting the boom. The jib pivot point (2" from the forward end of the boom) is an exact measurement without any tolerance- make it exactly 2".

B. **Mast:** the Kit mast will make a straight section of adequate strength and light weight. Don't sand it excessively- you want it to be stiff so as not to depower the sail by bending aft or to the leeward side. Take care as you glue the sections together- we have never seen a mast break at the joint, so the CA-joined mast is plenty strong. (As in the case of aftermarket sails) there are aftermarket spruce masts available- at an added cost of about $ 50.)

C. Replace the mast crane. The stock brass crane can easily bend if you bump against something. **Make an aluminum mast crane** using 3/32" thick T6- 6061 aluminum. It is lighter and will not bend like brass. Obtain from internet ordering, or metal distributor.

D. Some builders upgrade the standard sheets using 50# Braided Dacron, 80# test Spectrum or 100# "Tuf Line" Fishing Line for more durability. The larger diameters are more for use in bowsies than for strength.

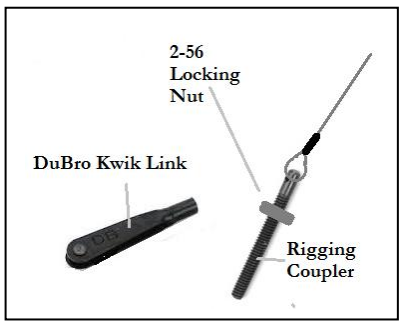
E. Rigging Tip: ALWAYS treat your knots with a drop of CA- ensures they will not come untied.

F. **Be sure to wrap strong fishing line around the base of the mast**, and around the forward end of the mainsail boom, to avoid splitting the wood. Seal it with thin CA.

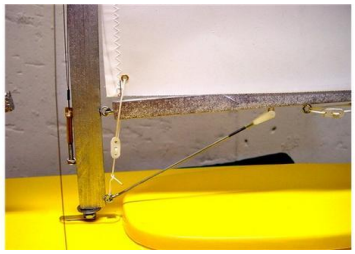
Some options (can be added later):

1. **Shroud adjusters**- the stock Victor setup is to use the threaded screw eyes to make small adjustments in the shrouds and stays. Or you can install turnbuckle-type adjusters to allow precise straightening and positioning of the mast.

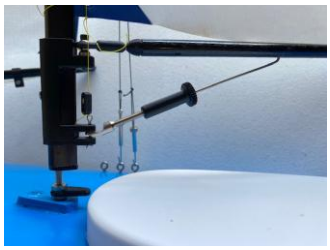
   You can use Pekabe or KDH rigging screws…
   …but a less-costly option is DuBro model aircraft 4-40, or even 2-56 Rigging Couplers and Kwik Link spring clevis'. With the shroud wire threaded through the hole in the Rigging Coupler, and the coupler screwed into a DuBro Kwik-Link, the Kwik Link opens up and attaches to a deck or mast eye screw. The DuBro fittings are available at any hobby shop; the commercial ones online. See pics.



2. **An easily adjustable boom vang.** The stock (kit) one is NOT easily adjusted. A far better vang is the 3DRC Gooseneck/ Vang (for shaped aluminum masts) or Sails Etc. unit with a plastic fitting that screws to the wooden mast; or there are even plans out there to make your own.



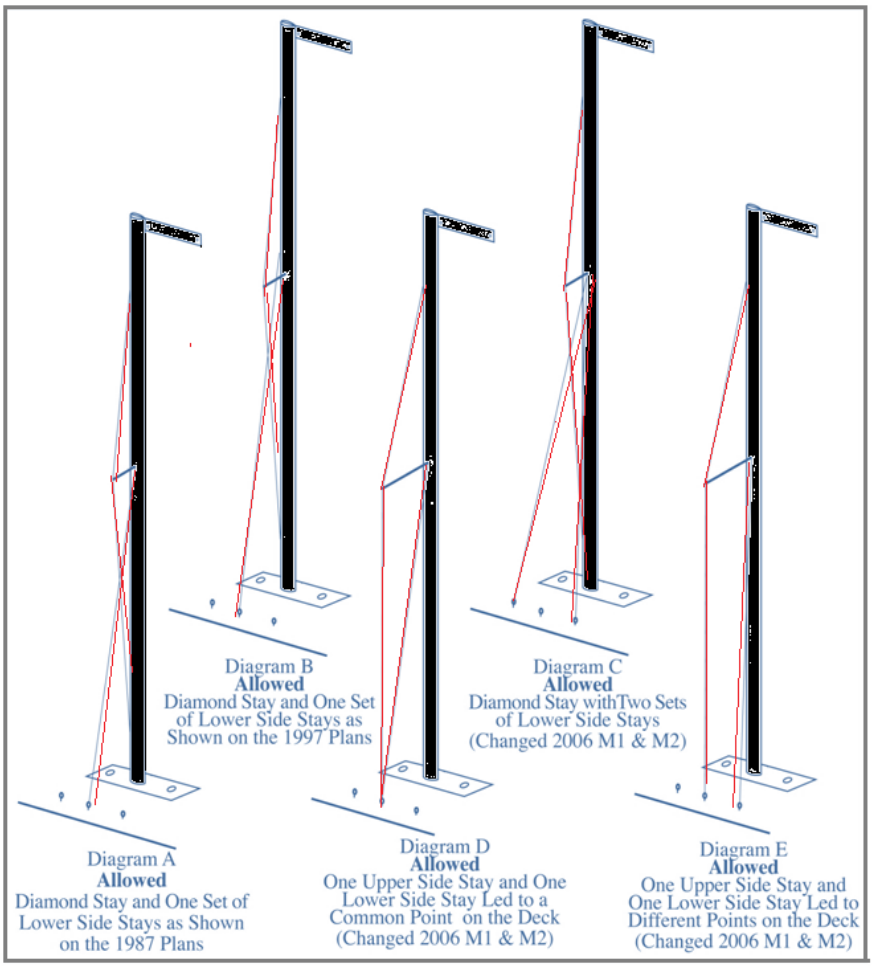
Victor Kit Vang



3DRC

Sails, Etc.

3. A double-shroud rig. (E in the diagram below). Leading the diamond to the deck, with the shroud led to a point aft of where the diamond mounts THEORETICALLY has some advantages. As the rig tensions, the mainsail pivots the mast to windward. The tension on the shroud eases, increasing tension on the stays, and preventing mast bend away from the wind. Less wind spills from the main. And… if you ever lose a shroud- the rig stays up.



XXII. Sails:

Aftermarket sails: As the Soling 1 Meter has become a significantly more competitive class, and commercial (although "cottage industry") individuals have started selling aftermarket sails. ALL Soling 1 Meter sails are flat, unshaped pieces of woven polyester (Dacron or equivalent) cloth. There are basically two "weights" of sails- know as "Standard Dacron", and lighter ICAREX". You can use one cloth for the jib and a different one for the mainsail. It's easy to make the assumption that aftermarket sails are somehow "faster". Theoretically- they are not- it's just that the "fast" sailors use them.

Aftermarket sails may have better workmanship, have differently reinforced cloth or sewn leeches that might make the sails last longer. They also usually have battens and telltales. Most are $ 120 and up. The Kit sails are no extra cost if you bought a Kit.

Our advice: if you are building a Kit- use the included Victor sails and add reinforcements to the corners. Later, if you want to spend the money- you can change sails.

XXV. Other things you need to do:

A. You need to **register your boat through the AMYA (online).** It will be assigned a hull number, and you will be mailed a permanent sticker for inside the hull, usually mounted ahead of the aft bulkhead on the starboard side. Protect the sticker w/ clear postal packing tape.

B. **Mark your sails with your hull number**: buy vinyl numbers online through AMYA (Ship's Store"), or from a sailmaker. Sail numbers have to be at least 3" high and 3/8" thick (stroke), and located just below the Soling "omega" logo. The **starboard markings go above the port side markings**.

C. If you want to color your sails- "ICAREX" sail material is available in colors, or use the aerosol fabric paint designed for florists' silk flowers called **Design Master**. Just mask and spray. This will make your boat easier to identify on the water. Identifying which boat is yours, and which way you are headed, is a problem when the boat is 50 yards or so away from you.

Have Fun!!!

See also "Finishing Your Soling", and "Electronics and Batteries".

Questions or comments?

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