Western Reserve Model Yacht Club

AMYA #255

Soling 1 Meter Suggested Building Procedure 12/11 (revisions from 3/11 in blue)
See also: "Electronics and Batteries", and "Finishing your Soling One Meter"

The purpose of this document is to provide the builder with ideas for enhancing the basic Victor Soling One Meter kit, building it stronger, and building it more accurately than just building a "toy". This document contains the process for building and rigging only- painting and electronics gear are covered separately.

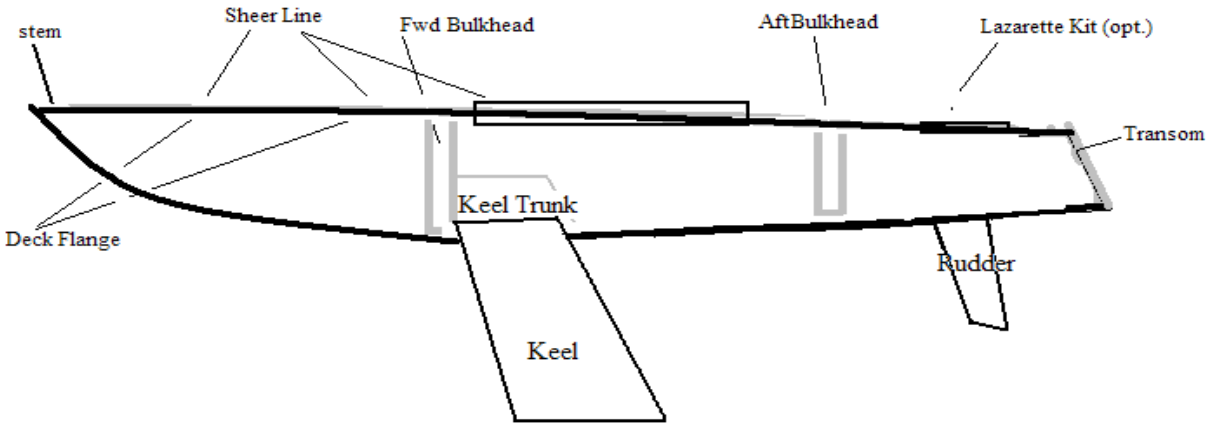
There are several ways to do each procedure (many are available on the Internet), but we will recommend only the one we think is easiest, strongest, and most cost-effective, based on our personal experience as a club building (so far) 25 Soling One Meters over three years as a group.

There are really only a few areas where we believe deviation from the Victor Assembly Manual makes a difference:

1. The use of measured centerlines and checking all precut holes for accurate placement.
2. Strengthening: the forward bulkhead, around the keel trunk, and rudder block.
3. Precise, yet easy alignment of the keel and rudder.
4. Use of the keel location to determine forward bulkhead location (vs. a standard measurement).

You WILL need a stand …so build or buy a simple stand, first. Victor Model Products has a simple stand kit ("Large Stand") at $24, or you can make a stand of you own design.

Parts of the Soling 1 Meter



Fore End MidShips Aft end

Supplies Needed: (**Bold** generally available at Hobby Shop)

B= supplies WRMYC HAS at the Build Session for participants to use.
Some may involve a shared cost. (such as lead and epoxy). You do not need to purchase these separately if you are attending the WRMYC Build Sessions.

	Exacto Knife		**3/16" square basswood- 1 stick**		**Paint or varnish** to finish the spars
	Needlenose pliers		**3/32 or 1/8" aircraft plywood-** 1- 8 X 10" sheet	B	Methyl Ethyl Ketone (MEK)- from a paint store
B	**Large Channelock-type pliers for crimping**		**Fine-Mesh fiberglass cloth**		MeasuringTape- 6 ft. or longer, A dressmaker's tape (cloth) is also very useful.
	Wire cutters or side-cut pliers		**Disposable epoxy brush** (metal-handled paint brush)	B	Drill motor, 1/16", 3/32", 1/8", 3/16", 11/64", 13/64", 9/32" drill bits, cutoff wheel
	Thin CA Glue		**Wet/Dry Sandpaper- 220, 600, 1000, and 1500 grit**	B	**Motor tool**, helpful, though a drill motor could be used
	Thickened CA Glue	B	**Large thick rubber bands (used for model planes)**		Scissors Pencil
	CA Glue: **- DeBonder** **- Accelerator**		**Self-Adhesive Velcro**		Paint Thinner (Mineral Spirits)
	Body Filler- Bondo type or Squadron waterproof	B	**Saw-** (Atlas model saw, or any small saw for cutting wood). Miter box helpful.	B	**Slow-Setting Epoxy**- 24 hr., such as WEST # 105 resin and #206 or #209 Hardener.
	5/32" solid brass rod to replace the Victor shaft/tube.	B	6-1/4 lbs. #9 or #8 lead shot (unless buying a pre-made keel)- new OR reclaimed shot are both fine		Lacquer thinner
	Small paint brush (that you won't mind ruining)	B	Flexible plastic ruler- clear if possible		Isopropyl alcohol (use as a cleaner when pouring epoxy- and for cleaning surfaces before painting.)
	3/16" square basswood- 1 stick		Clothes Pins or small clamps		**Paint-** see the text on types of paint

Can be added later, or now:

- **Victor Boom Vang Kit (or make a screw-type vang and gooseneck combination)**
- **Victor Lazarette kit (recommended- main advantage- access to rudder area.)**

See the last page of this procedure for a list of all equipment needed to build and sail the Soling One Meter.

Adhesives:

Thin and Thickened CA- used for wood-to-plastic and wood-to-wood joints. Hobby-grade CA at the hobby shop is different and higher quality than the "instant glue" or "super glues" you buy at convenience, grocery or even hardware stores. CAs cure "instantly" in the presence of water- hence they instantly bond skin. **Be careful**- especially with kids and CA's. The "**CA Accelerator**" is a material that sets CA very quickly. **CA De-Bonder** is to break apart a bond or remove CA smudges- and is marginally effective.

Epoxy- use epoxy and hardener, mix with the #8- #9 lead shot ballast for the keel, and for general bonding of wood. We use **WEST #105 Epoxy Resin**, plus **# 205** Hardener**. (This hardener will cause significant heat generation during cure- so follow the recommendations in this document regarding cooling when pouring your keel and rudder. However, rather than buy TWO types of hardener- buy the 205 and follow the water-immersion cooling procedures for your rudder and keel.)** WEST products are available from marine stores, or online.

Buy the mini- pump set (about $15) for precise proportioning and foolproof results, OR mix your epoxy according to directions by weight, using a digital scale.

We recommend **3M 5200 Fast-Cure Adhesive** for bonding plastic-to-plastic**.** This is a strong adhesive, one-part, and available in **fast cure** (full cure 24 hours) and regular (7 days) at marine outlets or online. About $14 per tube.

Boat weight:

Sailors sometimes are obsessive about the weight of their model yacht.

Actual testing was done on International One Metre models, by noted R/C sailing expert **Lester Gilbert** (http://onemetre.net/Build/Accel/Accel2.htm) and his conclusion: *..a minimum weight IOM pitted against an ... IOM (seriously overweight by half a pound- 6%), ... have them tack 10 times up the beat, such that on each tack they lose half their speed and must accelerate again, with a wind speed of 2 m/s,(5 MPH) then the heavier yacht will be a mere 20 cm or 8 inches behind.* After ten tacks. Ten tacks would be more than a full leg of the average race. 8 inches, that's it.

R/C Model Yachts are keelboats. Their speed is limited by their waterline length, and they cannot plane. Weight matters.

But strength REALLY matters. If your boat is under-built, in a blow it could easily lose its rig. In 2010, I built a boat with a balsa jib boom. First big regatta- snap! I spent SIX heats while I chased wood at a Home Depot in a strange city, cut it, installed it, etc. It WAS light however. So, we will just try and build a Soling that comes in under about 10.5 lbs., and doesn't break.

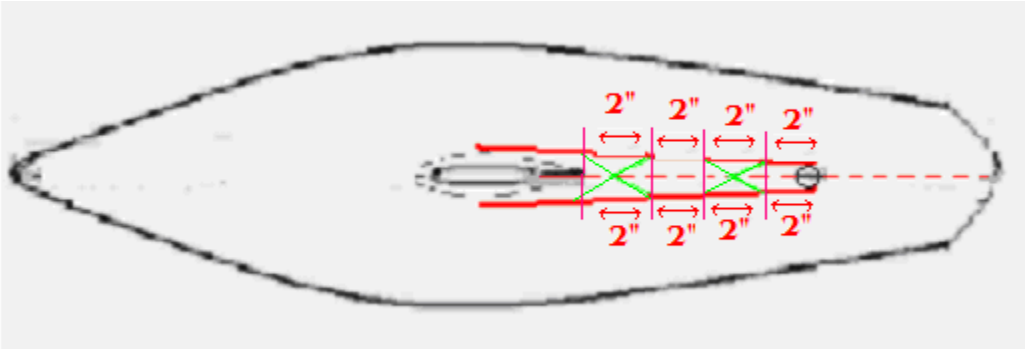
Some weight saving ideas that don't compromise strength:
- Use aluminum spreaders and aluminum mast crane - Use balsa for the bracing under the deck- balsa weighs 33% less than hardwoods (NOT for the backing pieces with screws in them though) - replace the rudder rod with a carbon fiber tube, stronger and stiffer, as well as lighter. – fill the rudder with epoxy thickened using microballoons instead of pure epoxy - consider digital servos (see the page on electronics) -use carbon fiber strip instead of wood for your sail arm Use line for a vang instead of metal - drill lightening holes in your radio board -instead of a lazarette kit, use a piece of styrene covering a square 3 X 3" hole, fastened using #2 aluminum screws - Replace brass screws with aluminum screws

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 this procedure.

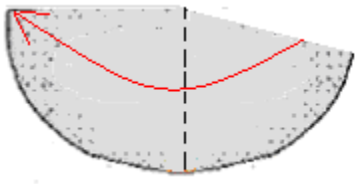
I. Locate and mark the centerlines of the boat and the interior bulkheads.

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

A. **Hull Centerline: Mark a centerline on the inside of the HULL** from just ahead of the keel spar cutout to the stern. Use your flexible ruler to draw a line connecting one side of the two openings; then draw again from the opposite side. Measure equal distances up each line, at four points, cross the lines making an "X"- the center of the X will be the centerline. Draw a line to connect the two points to create your centerline.



B. **Mark a vertical centerline on both bulkheads.** Trace the outline of the two bulkheads on paper. Cut out the outlined paper shapes. Fold the papers in half, and then use the papers to locate and draw a line vertically on the fold. Use this template to transfer the centerlines from the paper to both sides and inside the bulkheads.



C. **Mark the hull for length and keel position.**

i. Trial-fit the deck. Rubber-band the hull-deck assembly together and push the hull **tight** forward in the deck **tight** to the stem.

ii. Use a yardstick or tape, on the outside bottom of the hull:

a. Make all measurements, and mark the outside 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).

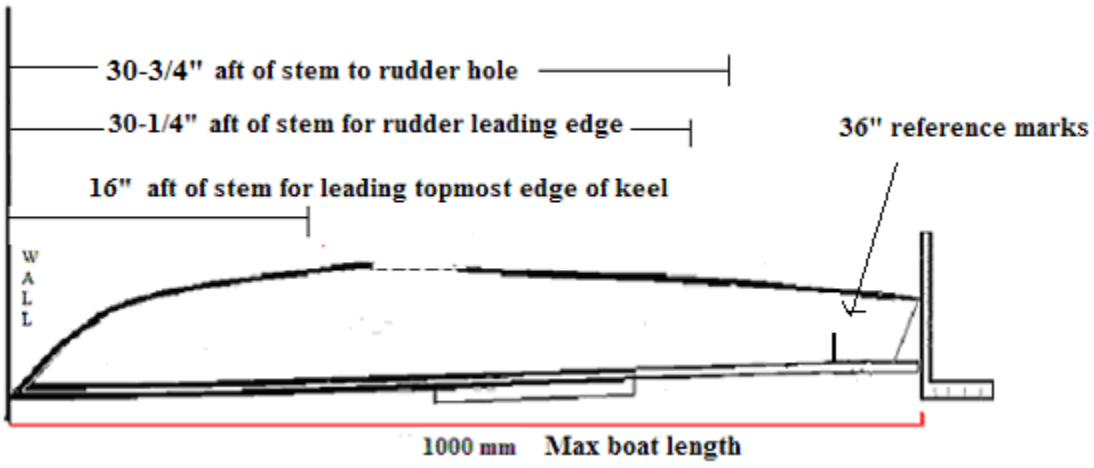
b. Stern Limit (length): Measure and mark **1000 mm from the wall** to find the end-point of STERN LIMIT location on the outside (bottom) of the hull. (It may be that your hull is cut exactly at 1000 mm- but check.)

c. Make a mark **16" aft of the stem**. This is max forward position of the keel.

d. Measure **31-3/4" aft of the stem-** this is the plan location of the rudder shaft. If the pre-drilled hole is ¼" or more off, OR if it is all off-center, mark a new location for a rudder shaft hole in the correct location.

e. Remove the deck. Duplicate the outside stern limit mark on the inside of the hull at the centerline.

f. Put the boat upright in your stand. Make up a string with a loop for a pencil- tape the string to the center of the bow. Using the string equally on both sides of the boat, **mark two** reference marks- **points on the hull sheer lines (port and starboard), of identical length from the stem, about 35- 36" aft of the stem**. .



II. Bulkheads

A 2010 Rule Change allows the boat to be built without using the bulkheads. The main advantage of removing the bulkheads is easier access forward and aft, plus the ability to locate things like battery packs farther forward for weight distribution reasons. **But**- the bulkheads, once glued to the hull, add considerable strength to the boat, at no cost (included in the kit), and weigh a minimal amount. We will be installing both bulkheads in the WRMYC procedure.

Bulletproofing:

There are considerable forces working as the boat is carried around and as it sails. They are mainly (a) the mast pushing down on the deck under rig tension, (b) the twisting effect of the hull as the boat sails, and (most damaging) (c) the flexing effect of the keel and keel trunk as you carry the boat around or (even) while it sits in a stand. These forces can eventually cause the hull to crack and break around the center. Poorly built boats can even DROP their keel, taking on water through the hole and sink! Also, a boat that flexes is also not as quick to accelerate as a rigid ("stiff") boat.

We are going to build the boat STRONG in the middle. We will use a plywood "Doubler" on the forward bulkhead, fiberglass reinforcing of the center floor of the hull, and a good tie-in of the keel trunk to the bulkhead. We will try to make the center of the boat a solid unit.

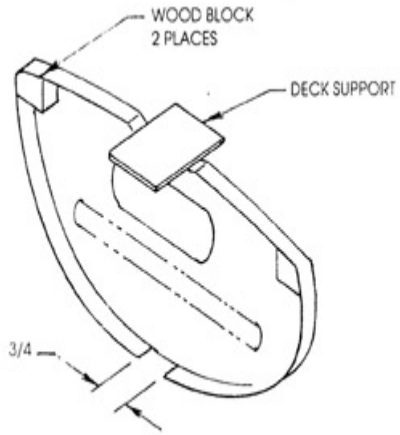
A. TIP: **Cutting plastic:**
The easy way to cut styrene- scribe it using a NEW #11 Exacto or other razor knife. Scribe where you want to cut, go over it a second time, then use a needlenose plier to begin to "tear" it along the scribed line.

(See the Assembly Manual Pg 5)

B. (Using an X-Acto Knife, OR a pair of cutting pliers) Cut a ¾" wide "notch" centered in the lower flange of the forward bulkhead- scribe and remove the notch.

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

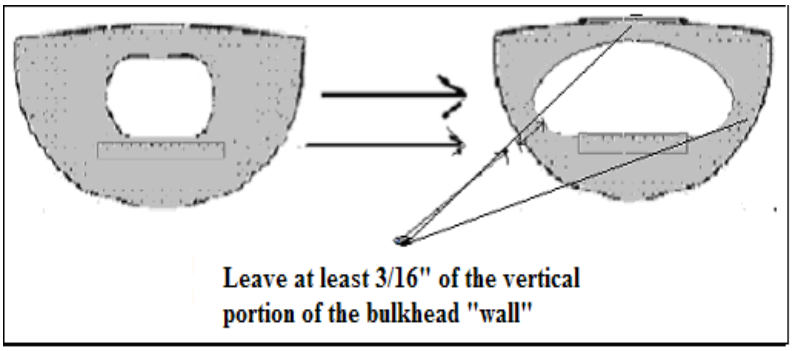
D. Rough the outside of the flanges of the bulkhead using 80-grit sandpaper.



(Pic from Victor Assembly Manual)

E. **Forward Bulkhead:** A **plywood "doubler"** using a piece of 3/32 or 1/8" aircraft plywood, cut to the inside size and shape of the bulkhead, and CA'd in place, greatly increases the strength of the boat without adding a lot of weight.

Trace the shape of the bulkhead on to your plywood, use a jigsaw (or better- a bandsaw) to cut out the doubler. Unless you have a way to plunge-cut, you will have to make a cut through the outside of the doubler; make this cut on what will be the BOTTOM of the bulkhead doubler; there will be far more glue and strengthening there later to re-join the wood securely.



Once you have the doubler cut out, and fitted into the bulkhead, remove the plastic from the bulkhead in the center for easier hand access, leaving minimum 3/16" of the vertical bulkhead, all around and inward from the flange. You probably want to cut above the horizontal strengthener near the bottom of the bulkhead- it adds strength, and you will never need to get your hand that low in the boat anyway.

Mark the bulkhead (minimum 3/16") inward from the flange on all sides, as a cut line. Go slowly and carefully.

More important than the strength of the bulkhead itself is the strength and method of tying the bulkhead to the center structure of the hull. More on that later.

Aft Bulkhead- no doubler. Just cut out the aft bulkhead open to 3/16" from the edges.

Epoxy vs. Polyester resin?? The Victor Assembly Manual recommends the use of polyester resin for filling the rudder and the keel. Polyester is readily available, and low cost. Polyester resin is OK, but it has a couple of downsides- it generates intense heat when curing and can warp the plastic. It has no "technology" like the WEST System.

Epoxy has better adhesive properties- it bonds to most materials far better than polyester resin. It especially bonds wood to wood far more effectively than almost any other glue. Second, using WEST System, or SYSTEM 2 epoxies, there are various hardeners available, and slow hardeners will produce far less heat during the curing process than polyester. WEST has three catalysts that cure at different rates, different available fillers with different properties, and a lot of online technology. You can make the stuff walk and talk. Our recommendation: buy the epoxy- a quart of resin and a suitable size can of hardener will do.

III. Keel and Keel Trunk

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

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

C. **Carefully assemble the keel halves** –

1. Glue a piece of coarse sandpaper to a flat surface, like your bench top, or a piece of plywood. Using this flat sanding surface, sand all edges of the keel trunk and the bottom edge flat. Waterproof the keel trunk using CA (as per the Victor instructions).

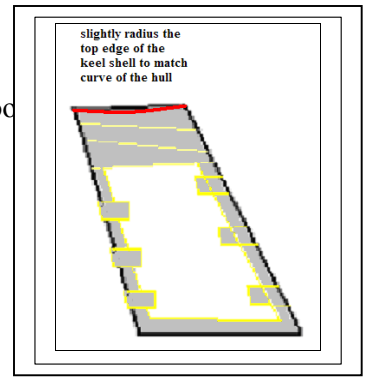
2. Thoroughly sand the INSIDES of both keel halves, using 80 to 120 grit paper. This will enhance the epoxy/ keel bond and make less likely any separation of the keel halves later.

3. Use masking tape to hold the keel halves tight together. Visually make sure you have a tight joint between the keel halves. 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.

4. Run Thickened CA down the inside edge of the keel, and rotate the keel assembly slowly so that the CA runs all around the inside edges of the keel. Use a fair amount of CA here. It should flow all around the keel. **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.

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.

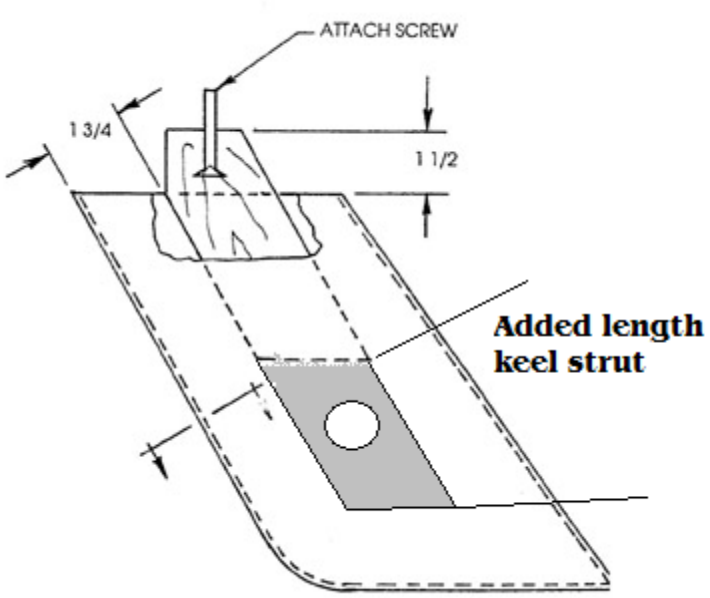
6. Mark the position of the keel screw on the side of the keel trunk so you will have a reference point to drill your hole for the screw after you install the wo top piece of the trunk.



7. 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.

8. 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.

9. **A stronger Keel Strut**: for a stronger and more reliable assembly, cut a new keel strut from 5/16" aircraft ply. The non-kit strut should be about twice as long as the original, follow the same basic shape. Drill a ¾" hole (OR two 3/8" holes) in the bottom portion of the strut. This will add strength to the keel, and most importantly, allow epoxy to flow through the strut at you pour the keel- locking the lead mass, and therefore the keel in place and to the hull. (See pic next page)



V. Rudder and Rudder Support

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. Tape the halves together, and follow the procedure you used for the keel (III D above) to glue the rudder shell together.

B. The Victor rudder is a weak point, primarily because of the supplied rudder tube. As you carry the boat around, the rudder is flexed then eventually breaks the rudder tube/ shaft.

We recommend using a **solid 5/32" brass rod** and replacing the Victor-supplied tube entirely. If not, at least put a solid brass rod (3/32") or epoxy a nail into the Victor-supplied tube.

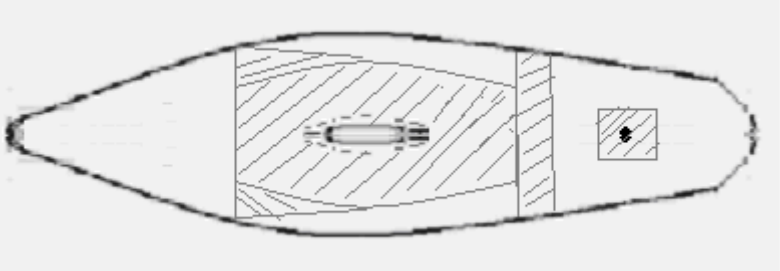
C. Bend the rudder shaft per the Assembly Manual. Place the rudder shaft inside the rudder shell, located fore and aft so that the **forward** edge of the rudder blade is exactly 30-3/4" aft of the stem. CA the rudder shaft in place inside the rudder.

D. Mix up a batch of epoxy- approx. 4 ounces. We recommend thinning the epoxy with alcohol- less than 5% alcohol to catalyzed epoxy- to make it pour easier. Fill your rudder with epoxy. You will likely get some shrinkage, so you can top it off later after curing.

E. If you are using a nail in the standard rudder tube- epoxy that in now. Make sure it is ALL THE WAY down to the bend in the rudder tube.

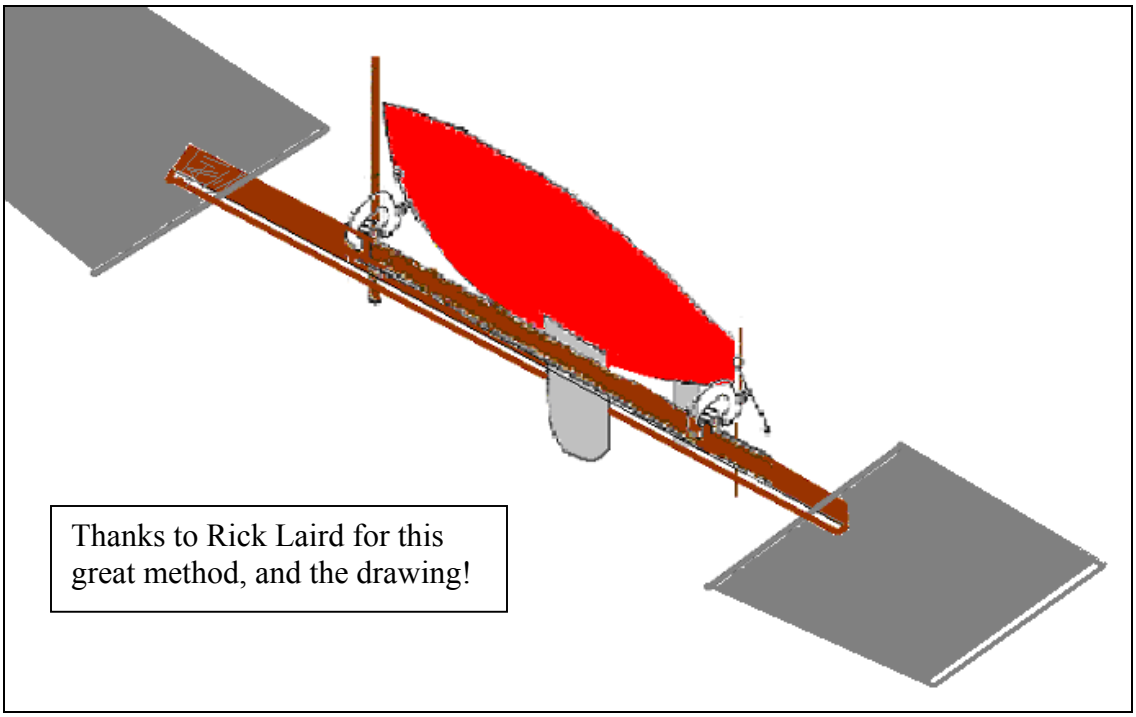
F. Allow the rudder to sit vertically overnight to fully harden. You can lightly mount the rudder shaft in a vice to hold the rudder assembly vertical during curing. (Don't squeeze or damage the rudder shaft with the vise!)

VI. Sand the inside of the hull with 220 grit wet and dry paper, from about 17" aft of the stem, to about 22" aft of the stem, about 2"below the sheers. The purpose is to rough up the area to aid in adhesion of the epoxy/ fiberglass reinforcing and the area of the bulkheads themselves. Sand also around the area where the rudder block will be mounted.



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

A. Make a "jig" to align the keel. (The alignment of the rudder is done later.) Using two 1"X 3 " X 48" boards and rubber bands or clamps to clamp one board either side of a 1" vertical board at the bow, and a thin dowel (I use a bamboo cooking skewer) at the stern. It needs to be small diameter to allow the boards to join at the center. (See the drawing.)



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

B. With the hull in your stand, mount the keel shell/ spar through the hull into the keel trunk, Add the wing nut. Slide the keel forward or back until the upper front corner of the keel is at the 16" mark aft of the stem. Loosely tighten the keel bolt with the wing nut. You may find that the keel spar is such a tight fit that no fastener is needed for this step. If so- great.

C. Place the jig with the keel clamped between the long boards, and tighten the clamps snug.

D. Place the whole assembly between two surfaces, like two tables, or chairs. IF you can level these surfaces, especially side to side- do so.

E. **The forward vertical of the jig should line up on center at the stem, and the rear dowel on center at the transom.** Move the keel trunk/ keel assembly and twist the keel, and hull until everything lines up. You will likely find that twisting the hull is needed here, in order to get both vertical components of the jig to line up on the hull centerlines.

F. Tighten the wing nut firmly, to lock the rudder and keel in place. Remove the jig. Move the boat to your stand.

G. **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.

- As a check- eyeball the keel to verify it lines up perfectly on the centerline of the hull and hangs perpendicular to the hull. You can use a square on the table below the stand.

H. Take your time, you may have to go back to the jig if everything isn't aligned and/or if the keel is not vertical.

I. Again- carefully check to see:
- that the keel is hanging vertically with the hull level side-to-side
- that the keel lines up with the centerline of the hull.
- tighten the keel nut and the rudder horn to hold everything in place.
- 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!) Mis-aligned bulkheads will twist the hull. If that is the case, we hope you just "tacked" them. Remove the bulkheads. If you glued the in using CA, use your CA De-Bonder. 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. Use a file to file the edges of the keel spar (either forward or aft edges) to get the keel aligned. Keep working at this until you get a good keel alignment.

VII. Position the forward bulkhead:

A. With the hull in your stand, and keel trunk holding the keel in place with the forward point of the keel 16" aft of the stem, position the forward bulkhead tight against the keel trunk- and BULKHEAD FLANGE facing aft, toward the hatch opening.

1. Measure forward from your 36" reference lines to the outside tops of the bulkhead to be sure the bulkhead is square. Mark the position of the forward bulkhead upper corners.
2. Clamp the bulkhead in place. **Take your time here, to get the bulkhead perfectly located, square and vertical.**
3. Draw lines around the bulkhead, showing its location.

<u>Do not glue the keel trunk OR bulkhead in place just yet</u>.

VIII. Tacking the keel trunk

A. **Once you are sure that everything is located properly**, Use a toothpick to **tack bond the KEEL TRUNK** in place with 1-2 drops of thickened **CA** at the front and at the back of the trunk. Thickened CA does not "wick" as much as the standard thin CA- so it is less likely to run through the keel trunk/strut, locking the keel in now.

> Be careful here- a keel 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 from the trunk. Dry all CA from the keel trunk.

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

D. Some will ignore the rudder at this point, just visually verifying that the rudder hole is centered- the rudder shaft will likely have to be "tweaked" later to make the rudder vertical. Or, you can use the "jig" to align the rudder now. If so- install your rudder. Using the rudder actuating horn, install the rudder, then bend the rudder slightly until it, too, is perfectly straight and aligned with the hull centerline, and with the keel.

E. Re-level the hull in your stand, and…triple check:
- that the boat is level,
- that keel lines up vertically
- that the rudder hangs vertically and lines up with the centerline/ keel
- and that the keel in not twisted off to port or starboard.

F. **Carefully remove the keel,** and using thickened CA and Accelerator- permanently bond the keel trunk into the hull where it is tacked.

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

A. Measure and draw a centerline on the wood former.
B. Use a round or flat file to cut two limber holes- one on each side- about 5/16" off center- of the Former so water can pass through it.
C. Install the Former directly behind and connected to the keel case, making sure it is centered and square (measure forward from your 36" reference points). To get a good bond, use a weight on the former- flex the hull to the former then bond using thickened CA, and CA Accelerator.

X. Hull reinforcement

Bulletproofing: 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.

A. Reinforcing using fiberglass cloth: This step should be done after the keel trunk is and Former are located and glued in place. So- you should have at this point aligned the keel and rudder, and have a final location for the keel case, then CA'd the case and the Former in place.

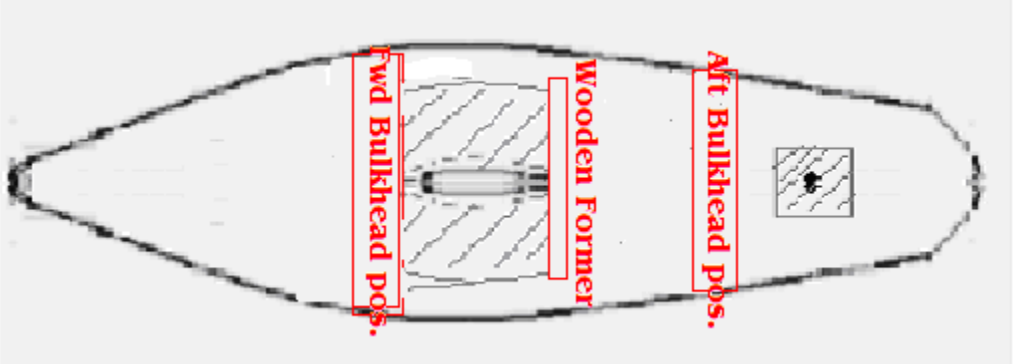
1. You are going to place two squares of fiberglass cloth into the bilge, and epoxy them to the hull and up the sides of the keel case. **These should extend part way up the sides – about 1"- up the keel case.**

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 or wooden ruler and Xacto knife to cut 4 pieces.). Lay the first layer of fiberglass cloth into the bottom of the hull (DRY).

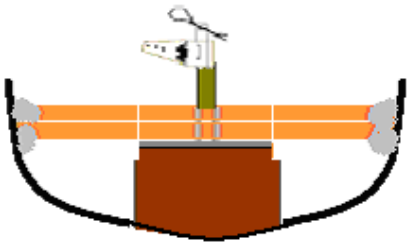
3. Position it overlapping the bulkhead flange. It should not extend any farther aft than to the "former".

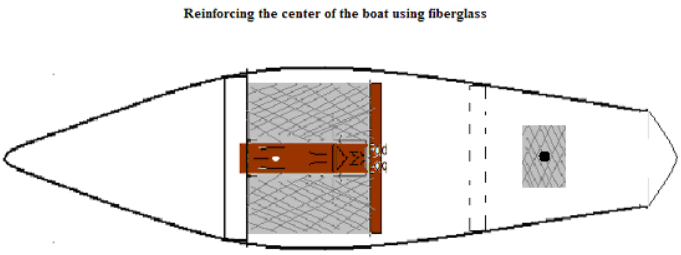
4. Position the fiberglass so it extends about ¼- halfway up the sides of the keel trunk. Starting at the joint of the keel trunk to the hull, "wet out" the fiberglass cloth using catalyzed epoxy, and a steel (or junk) paintbrush. Brush all air pockets out of the cloth. Add a second layer over the first.

5. Wipe off any drips or epoxy that gets beyond the edges of the cloth with alcohol. Set the hull aside so the epoxy can cure for 24 hours.



XI. Install the rudder block and rudderpost wood supports.





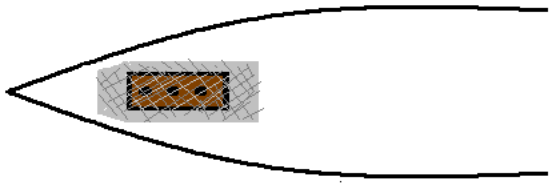
Reinforce under the rudder block area around the rudder shaft hole, using 2 layers of 3 X 3" fiberglass cloth. (Alternatively- you can use pieces of plywood, or ¼" square sticks crossed to the hull.)

XII. The Deck:

A. Glue wood pieces on the underside of the deck at the dimples where the jib and mainsheet exits will be.

B. Jib mounts at the stem: Bulletproofing: Rough the area under the deck, at the three dimples at the front of the deck, with 80-100-grit sandpaper on the underside of the deck, and aft of the stem. Use CA to glue the wood reinforcing block per the Victor Instructions.

C. Lay 2 layers of fiberglass wetted with catalyzed epoxy over the wood block jibstay reinforcer. This will prevent the wood block from coming loose after the boat is built- replacing it once the boat is assembled is difficult!!



XIII. Install the Bulkheads:

A. Fit the Forward Bulkhead :

1. Sand the forward bulkhead flange all around and the area it will mate to the hull.

2. **Square the bulkhead-** Verify the Bulkhead is 90^{o} to your centerline, by measuring from the stem to either side of the forward bulkhead (or from your reference marks forward.) Adjust the position of the bulkhead slightly until:

   - the position of the bulkhead is square, at right angles to the centerline and;
   - the centerlines on the bulkhead match those on the hull.

3. Mark the location of the top corners of the bulkhead on the hull. Use tape or clamps to hold the bulkhead in place. **Re-check** the position of the bulkhead to be sure it is square, and that the centerlines on the bulkhead match those on the hull.

4. Snap the deck in place. Make sure the hull is pushed well forward into the stem.

5. Sighting through the open transom of the hull with the deck in place, check the top corners of the bulkhead for fit with the top edge of the hull (sheer line). The **EDGES of the HULL (sheerlines) should be between 1/16 inch and 1/8 inch <u>BELOW</u> the top corners of the bulkhead,** (the bulkhead should be ABOVE the hull sheerlines) and the bulkheads should appear "square". <u>(The bulkhead tops will be higher than the hull sheer lines by 1/16" – 1/8", and, may not be even.)</u>

Small adjustments to the height of the bulkhead, for fit and alignment, may be made by tilting the BOTTOM of the bulkhead fore and aft. **But, keep** the **<u>top</u> flange of the bulkhead taped/aligned with your deck marks.** When satisfied with the fit, mark the final location for the bottom of the bulkhead.

B. Glue the Bulkheads to the hull:

1. This is critical- Be sure to recheck the centerlines on the hull and the bulkheads, and your measurements forward of the 36" reference marks on the hull to be sure BOTH bulkheads are square.

2. Tack glue about 1" below the tops of the bulkheads. Use a drop or two of CA- it will not get a permanent instant bond on styrene to styrene applications.

3. Pivot the bulkhead to verify that the slot you cut in the bottom flange of the bulkhead will easily fit the keel trunk in its final position. If it will not- gently pry off the tack points, and re-position the bulkhead. NOTE: DO NOT glue the bulkhead to the keel trunk at this time.

4. Once properly located, and using MEK or one of the alternate adhesives this time, permanently glue the forward bulkhead in place where you marked the location. Leave the top 1" on each side unbonded to the hull until later.

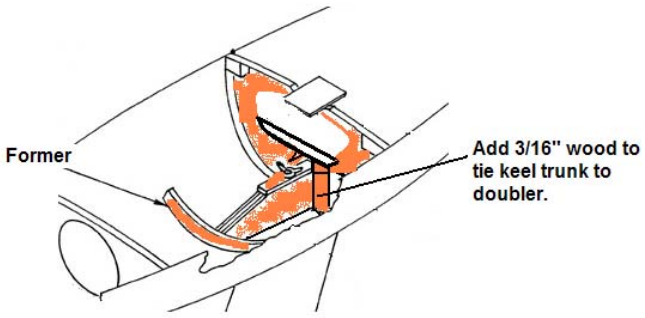
   (NOTE- any glue or chemical designed for polystyrene- MEK, Testor's Plastic Glue, can warp or wrinkle the hull, if you use too much. Shoe Goo, 3M 5200 will not do this.)

5. Wrap a rubber band around the hull at the bulkheads, and use two small clamps (or clothespins) near the top of each bulkhead to hold them in place while the glue fully cures. This may be as long as 7 days (3M 5200), or as short as seconds (MEK).

6. Install wood block chain plate reinforcers, using CA, under the forward bulkhead, and the deck support per Victor Instructions. Locate these as far "out" near the hull sheer as possible. Mark the position of these on the OUTSIDE SIDES of the hull in pencil for future reference.

7. Bond the Keel Trunk to the Forward Bulkhead using CA.

Tie the forward end of the keel trunk into the forward bulkhead using CA, and add 3/16" wood to the sides of the keel trunk at the bulkhead. You want a solid assembly joining the keel trunk to the forward bulkhead. (See diagram.)



C. Aft Bulkhead :

1. Remove the deck, and repeat the process for locating the aft bulkhead. (Generally it is 12" aft of the forward bulkhead.) Make sure your sheet exit reinforcer does not interfere with the aft bulkhead and impede the fit of the deck.

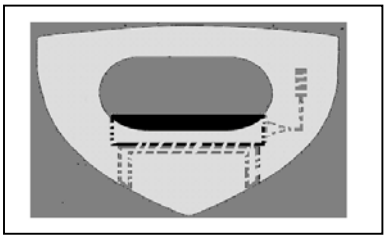
2. Sand the aft bulkhead flange all around and the area it will mate to the hull.

3. Be sure to reverse the flange on the aft bulkhead so the flange faces forward to the main hatch opening. Measure forward from your reference line to make the bulkhead square in the boat.

4. Again- rubber band on the deck, and sight through the aft end of the hull to check deck to rear bulkhead fit. Bond the aft bulkhead in place, leaving the top 1" on each side un-bonded to the hull until later.

NOTE: here you may see that the port (left) side sheerline is higher than the starboard sheerline, by about 1/8" at the aft bulkhead. This can be trimmed later.

XIV. Battery shelf: many want the battery pack ahead of the forward bulkhead, for better fore and aft weight distribution.



A. Build a simple battery shelf -a piece of wood that extends to both sides of the hull.

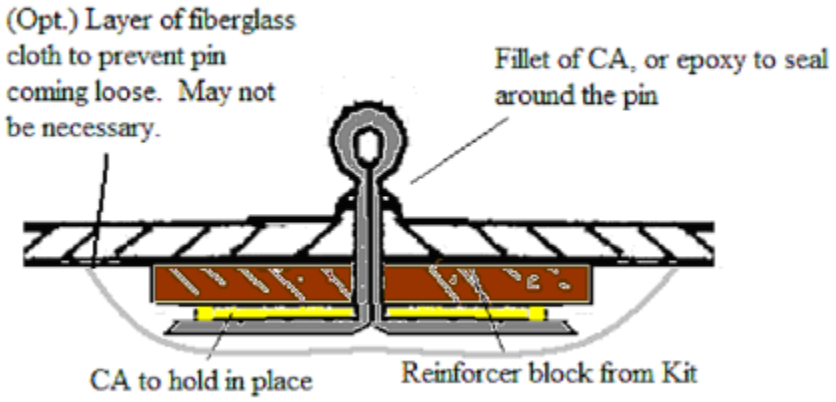
Use Velcro to hold the battery pack in place.

XV. Stem and shroud fittings (chainplates):

A. Install stem (jib club mount) fittings now, before you fit the deck. (Not chainplates for shrouds, yet.)

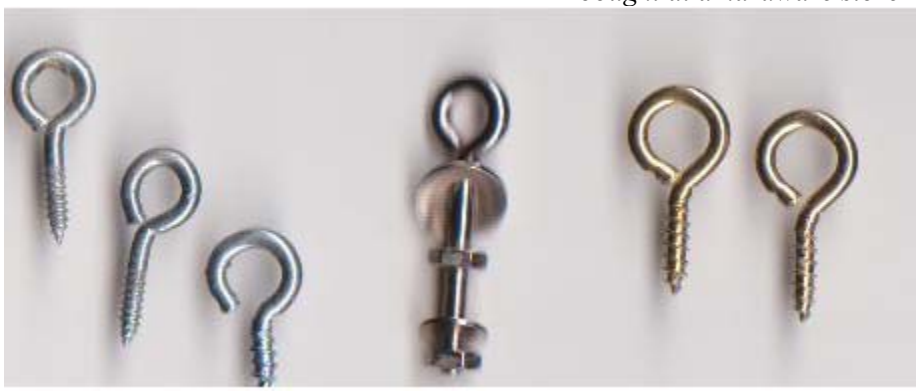
We recommend 3/32" or 1/8" X 1 brass or stainless cotter pins, inserted through the deck and bent, then glued in place, as chainplates. These have the advantage of being strong, inexpensive, light, and will never come unscrewed. You'll need hooks on the shrouds instead of eyes. These are commonly available at good hardware stores in either SS or brass.

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



Below are full-size pictures of alternative fittings: (L to R)

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



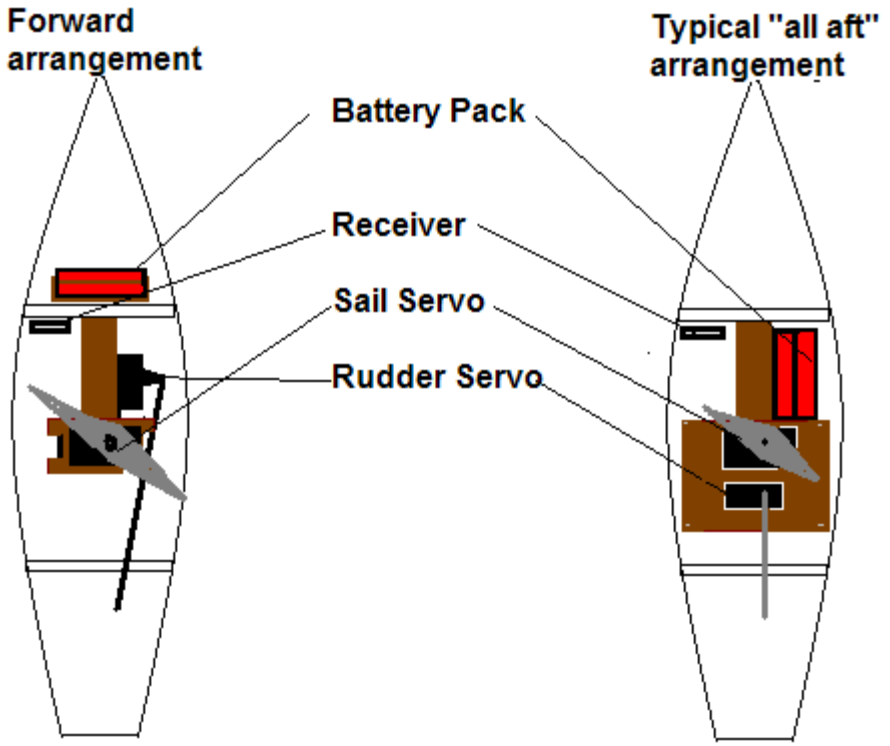
1. If using eyebolts and nuts, you do not want to have the nut fall off:

Be sure to use washers under the nut as well as under the eye.

- **i.** Drill holes (3/32") at each dimple.
- **ii.** Countersink the reinforcing block for the 2-56 nut (7/32").
- **iii.** Install the eyebolts to pull the nuts squarely into the block.
- iv. Remove the eyebolt, then, being careful not to get glue in the nut, CA or use epoxy to glue the hex nut into the reinforcing block.

XVI. Temporarily install the radio, servo tray 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:

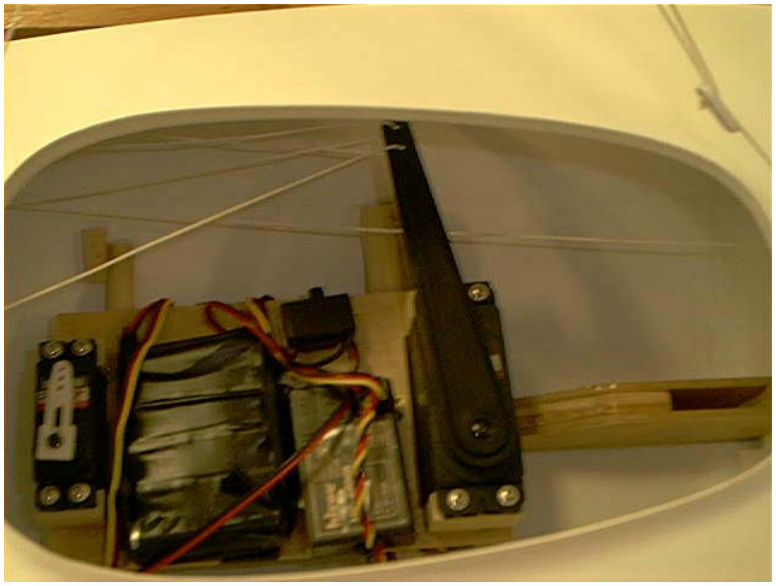


B. **The objective** - keep the weight of these components forward, keeping the transom out of the water for better boat balance.

C. Both servos need to be mounted off the floor, so any water that enters the boat is less likely to cause servo damage.

D. Installation of the electronics:

1. (in the kit) **Victor** supplies a plywood radio board with small blocks to be CA'd for mounting two servos. The radio board then screws to a piece of wood which serves as a rear mount for the radio board, across the Former. Victor and many Soling builders use a double-arm sail control arm (unlike the picture below with a single arm).

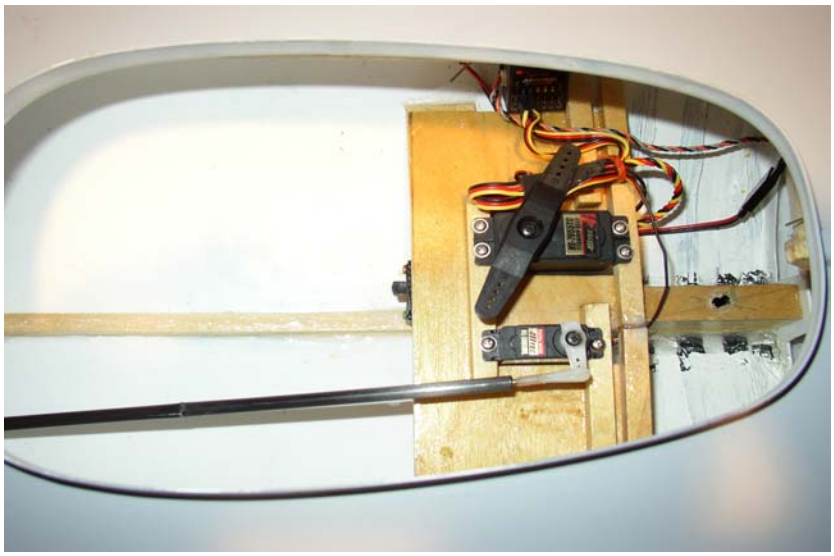


Note (in this Victor-built boat) the batteries are well behind the keel trunk. Compare to other pictures with the battery pack ahead of the bulkhead, and the rudder servo mounted to one side of the keel trunk.

(We don't feel the keel trunk is adequately supported in this picture. We would add supports on either side of the trunk.)

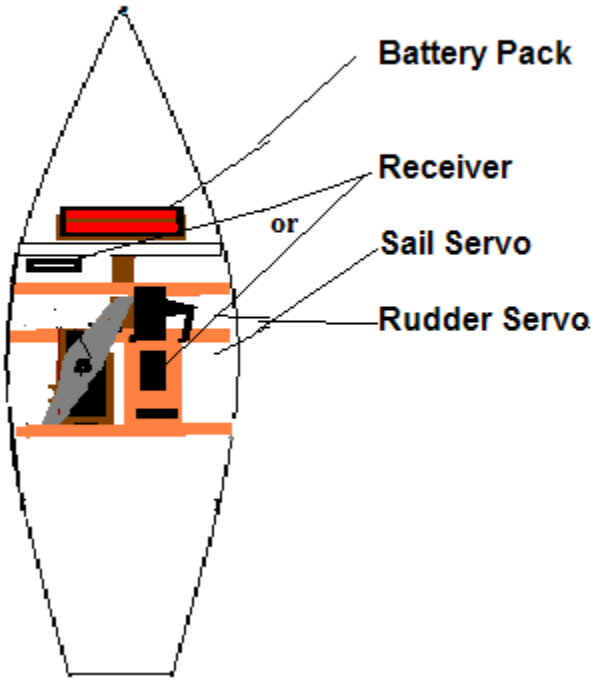
E. If using the plywood radio board, don't just glue supports to the plywood. Cut holes to recess/fit the two servos, then glue ¼" hardwood wood square to act as a servo mount. This method has the advantage of supporting the servos' twisting motion using the plywood board, not only the servo mounts. This is an especially good idea when using digital servos w/ high torques.

In the picture, the radio board is moved forward as far as possible. (Below, the plastic sail servo arm is used as a mount for the carbon fiber arm to be eventually installed.) The sail servo here is the digital HiTec HS-7955TG and the rudder is another digital- HS-5085 MG.



The rudder control rod here (not hooked yet to the rudder arm) is a carbon fiber tube (tail boom from a model helicopter) with fittings CA's into the ends. Strong, light and stiff.

F. **Another alternative**: use ¼" square cross pieces that mount the servos, and provide added support for the keel trunk. This is easier than fiberglass cloth or carbon fiber to do- the only disadvantage is that hull reinforcement is vital- a HARD hit might push one of the mounting sticks through the hull.



B. Sail Control Arm:

You can use a single OR a double arm. The single arm is available commercially with the HiTec 815 Servo, (or separately as Hitec # 56361). The Double Arm is slightly more likely to tangle but splits the lines in half rather than having both sheets at one end of the same arm.

Your Sail Arm can be made of any one of many materials, including aluminum, plywood, plastic, Lexan, Plexiglass, etc. **I use Carbon Fiber strip (Midwest 5743).** It is easy to work with, and not expensive. Cut it with a hacksaw. A double-ended arm should be about 7" long, with about 4" on one side and 3" on the other (so you can make 5-6 arms from a single Midwest piece).

For sheet pivots on the sail control arm, you can drill holes and chamfer the edges, install screw-eyes, install eyelets in the ends of the sail arm (like the ones used for sheet exits with the Kit), or even use miniature ball-bearing blocks. Probably for your first Soling, just drill and chamfer holes in the arm- add blocks later.

	Total Length:	Main side	Jib Side
Standard servos of up to about 150 oz. in of torque, 120-140 degree travel	7"	4"	3"
200 +/ w/180 degree travel	5-1/2"	3"	2-1/2"

The offset longer side sheets the mainsheet- this way, the booms will stay closer to parallel as they ease out. The perfect amount of offset varies with each boat- but drill a few holes on the jibsheet side to experiment.

XVII Lazarette:

Now is a good time to install your lazarette, if you want one. Follow the Victor instructions.

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 corner. (This varies from the Victor Instructions. Screwing the backstay eye to the vertical surface -instead of the deck is stronger, plus it gets 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 100 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 using MEK or another adhesive.

G. The important part of fitting the transom is to ensure it is fully pressed into the hull and the top of the transom will fit inside the DECK flanges. If the transom does not fit perfectly, you can fill the gaps later.

H. Once you have located the transom in the right position, hold in place with small clamps (clothespins) and tack the upper transom in place with CA. Later you will permanently bond it and fill it.

XIX. Check the sheerline: The shear line may need to be sanded or trimmed down if one of the hull sides sits too high. Sighting through the open transom the bulkhead edges should be about 1/16- 1/8" higher than the hull sheerline. It may also be fine as is.

If you have an overly high sheerline where the hull extends to the top of the bulkhead, cut with scissors, or scribe a line and break away the plastic above the line to trim the high sheerline to the same level as the low side. Sand smooth.

Finally use 5200 adhesive to set the transom.

XX. Install the under-deck fittings and reinforcements prior to installing the deck. Use CA with Accelerator to bond blocks of wood to the hull.

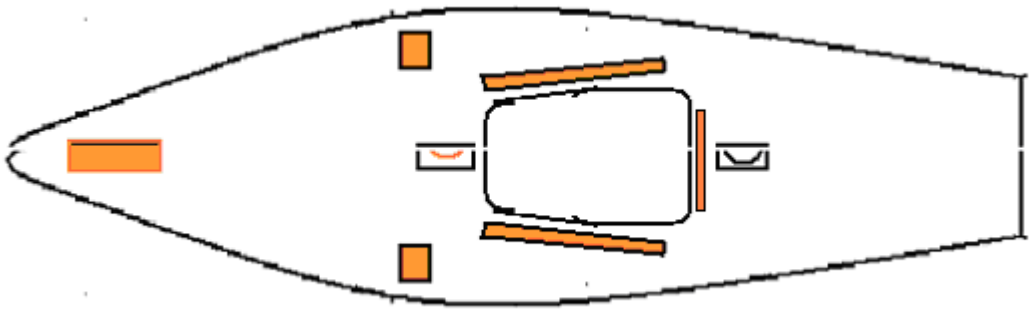
A. Install: the deck sheet exits. The eyelets provided by Victor allow water to get inside the hull when sailing in high winds. To **add height and lessen the amount of water entering the hull**, make "taller" sheet exits out of:

- commercially-available aluminum parts
- 3/8" nylon hex bolts,
- 3/4" wooden balls cut in half (available from a craft store)
- screen door rollers glued to the deck

- 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.

B. Install **underside deck bracing** for chain plates if not already done.

C. Install underside reinforcement on each side of the main hatch opening using 1/4" square wood, if desired. (Strengthens hatch opening for the inevitable time you lift the boat by the hatch opening.)



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;
- The hull solidly reinforced around the keel trunk.
- 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 sheerlines should match.
- Your transom is 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.

XXI. Deck- Now install the deck.

A. Installing the deck:

1. Test fit the deck on the hull for all around fit. The deck should almost "snap" into place.
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.
3. Pencil a line all around the deck flange. Pencil a line marking the position of the chainplate (marking the the forward bulkhead OUTSIDE of the hull.
4. Remove the deck and sand where the bulkheads are to rest, so you get good adhesion.

B. Deck installation is really quite simple.

1. Installing with other adhesives (than MEK)- the MEK "ripples" and deforms the plastic, even when carefully used. **We like 3M 5200 because it gives a lot of working time, wipes off easily, and does no damage to the plastic.**

a. Invert the deck, laying flat on a 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. Use heavy-duty rubber bands to hold the deck to the hull while the adhesive sets.

Then cleanup first with a dry cloth or paper, then alcohol.

5. Water-test. (After all adhesives are fully cured- a week later in the case of regular cure 3M 5200) Fill the bathtub with water, and submerge the hull (without the keel) below the deck and transom joints. Mark any leaks with grease pencil, dry the hull thoroughly, and use thickened CA to seal the leaky areas.

Decision: Do you want a fixed keel? Originally, all S1M's were built by permanently fixing the keels in place. In the late 1990's, Victor added a removable keel feature to the Soling One Meter.

A removable keel is useful for shipping the boat. Also, if you are traveling a great distance with the keel in place and the boat in its cradle, it could crack the hull. If, for example, you winter down south, we recommend a removable keel to lessen the chance of damage during the trip.

But, many sailors never remove their keel, plus the procedures outlined here make the hull MUCH stronger. With a removable keel- water is always in the keel trunk, no matter how you seal around the keel. It can eventually rot the wood and rust the keel bolt.

Many builders have returned to fixing their keels in place using epoxy- the boat is less likely to leak, the keel/boat bond is stronger, and no water can get inside the keel case. **A fixed keel is our general recommendation, UNLESS you plan on traveling with the boat.**

XXII. Rig: Complete the rig per Victor's instructions. Upgrades:

A. Reinforce the mast crane using a piece of brass angle. The stock crane will easily bend if you bump against something, or even while sailing in heavy wind. Clean the brass using a wire brush, then with a small torch, solder the angle to the top of the mast crane. Finish by tapering, drilling holes for lightening, and/ or clear coat or paint.

B. Or, make a mast crane from "hardened" aluminum- T6- 6061. It is lighter and will not bend like brass. Obtain from internet ordering, or metal distributor.

C. **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.

D. Use a hammer to deform the threads of the mast jack slightly to form an interference fit that will not loosen as you sail.

E. **Add an easily adjustable boom vang.** These usually include an improved gooseneck. The stock (kit) one is NOT easily adjusted. Victor sells one made of brass (about $18), and an even better unit is the Sails Etc. (about $30).

Standard

Sails; Etc.

F. **Some options** (can be added later):

1. Adjustable shrouds-without removing the rig. Install turnbuckles on the shrouds Adjustable diamonds allows individual adjustment to straighten the mast.

2. This is the arrangement at the deck for either the shrouds OR the diamonds; you probably need a swivel at the other end. The fittings are DuBro model aircraft 4-40, or even 2-56 ball ends, screwing onto eyebolts that have been opened up to a hook configuration. Using stainless eyebolts, this is a pretty corrosion-proof arrangement. An alternative is to open up the eyebolt used in the deck to make it a hook.

3. A double-shroud rig. (E in the diagram on the next page). 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 diamond, and prevents mast bend away from the wind. Theoretically with less wind spilling from the main.

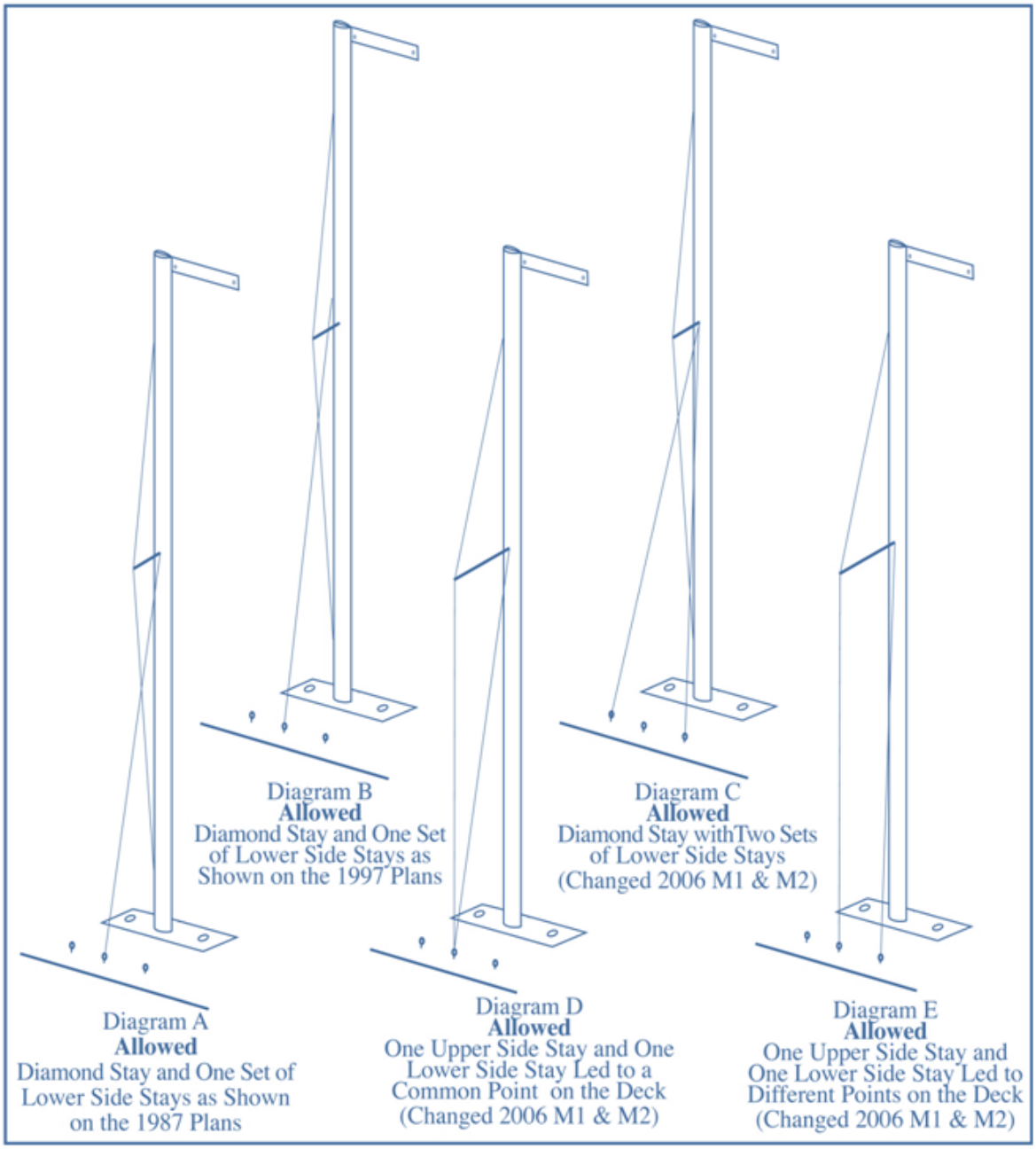


Diagram A
Allowed
Diamond Stay and One Set of Lower Side Stays as Shown on the 1987 Plans

Diagram B
Allowed
Diamond Stay and One Set of Lower Side Stays as Shown on the 1997 Plans

Diagram C
Allowed
Diamond Stay withTwo Sets of Lower Side Stays
(Changed 2006 M1 & M2)

Diagram D
Allowed
One Upper Side Stay and One Lower Side Stay Led to a Common Point on the Deck
(Changed 2006 M1 & M2)

Diagram E
Allowed
One Upper Side Stay and One Lower Side Stay Led to Different Points on the Deck
(Changed 2006 M1 & M2)

G. Some builders upgrade the standard lines from 50# Dacron to 80# test Spectrum fishing or 100# "Tuf Line" line for more durability.

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

I. A great idea I got from **Charlie Mann** in Toronto is to replace bowsies using your spare servo horns. Screw them into the bottom of your booms with a #3 screw, dead-end the line through one of the holes, then turn them to wrap your outhaul lines around them for a precise, easily adjusted outhaul. Tighten the screw to set tension.

XXIII. Sails:

A. Use sail repair tape (nylon or Dacron) to reinforce the corners of the sails. Tape over the grommets. Then use a hot soldering iron to heat the grommets and allow them to bond to the reinforcement.

B. You can use **Sharpie or other permanent marker to mark numbers** on your sails. Careful- it will "run" so do the outline first in ballpoint pen (Press HARD), which tends to stop the bleeding effect.

C. **Mark your sails per the Rules-** the numbers have to be at least 3/8" thick (stroke) and 3" high, and located just below the top "batten" location.

1. Consider marking sail numbers on the jib. It may help the Race Director be able to see your number- and finish you ahead of the boat where he can't see the numbers.
2. If you want to color your sails- use the aerosol fabric paint designed for florists'silk flowers **called Design Master**. Just mask and spray.

XXIV. Fill the Keel (after all finishing, rigging, etc.)

1. I recommend WEST #105 Resin, and an appropriate hardener. I would use #105 resin, and # 205 Hardener- but take precautions and immerse your rudder and keel immediately after or even during filling. WEST website: http://www.westsystem.com

OR- buy a finished Victor Keel, and save the hassle of sourcing lead shot, and the mess of pouring a keel.

2. A pound is 16 oz. (and don't confuse WEIGHT ounces with fluid ounces) Subtracting your boat weight from 10.0 lbs/ 160 oz., determine desired total keel weight. **If you don't have a digital scale or the ability to precisely weigh your boat- assume the finished hull with all the rig and electronics components (inc. battery pack) weighs 4.0 lbs. You will likely come out 3-4 oz. heavier than the 10 lbs. minimum- it's OK.**

3. Weighing: Put all on the boat- including batteries, install servos, mount the rig, including the sails. Don't weigh the keel shell or place it on the scale/ in the boat- you'll weigh is separately as you pour your keel.

4. It's really hard to build a Soling less than about 3.5 lbs.- Victor's boats (with NO reinforcing) are usually about 3.50- 3.75 lbs. plus a keel of 6.5 lbs.- about as light as you'll find.

5. Weight assumptions:
   a. An empty, painted keel shell, with keel spar, screw, and wing nut: 4.50 – 5.0 oz.
   b. An 8 oz. cup of lead shot weighs approximately 50 oz.
   c. An 8 oz. cup of epoxy weighs approximately 9 oz.
   d. The average boat built using the procedures in this document (standard servos and 6V 5-cell battery pack) comes in at about 4.0 lb. total (hull, rudder, rig, battery pack, servos, receiver, keel shell w/ wing nut). (A 4-cell, 4.8V pack reduces the hull weight by 1 oz.).

6. You will need to add about 6 lbs of shot and epoxy to the keel shell, for a total keel weight of about 100.5 oz./ 6.25 lbs. In rough terms- you will add about 1.5 X 8 oz. cups of lead, and 1-2/3 X 8 oz. cups of epoxy.

Here is a table that might help get you close.

"all up" boat weight less keel: +	Therefore total Keel Weight should be at least:	- Keel Shell incl. spar, screw, wing nut	= Lead + Epoxy weight- Est. total oz.	Est. Lead- oz. By weight 83%	Est. Epoxy- oz. By weight 17%
4.0 lbs. 64.0 oz.	6.0 lbs. 96 oz.	4.5 oz	90	75 oz. 1.5 cups	14.7 oz. 1-2/3 cups

7. Use 8 oz. paper cups, and TWO small funnels- I have a set of nylon funnels with a small 3" one and a 5" one. I use the small one for lead, and the larger one to pour the epoxy.

8. Double-check to see that the keel shell halves are solidly bonded together, and taped. Also tape the upper part of the keel to lessen the chance of dripping epoxy on the shell.

9. The tricky part here is to be sure that the epoxy is thoroughly mixed in with the lead.

10. Pour about 1/4 of the cup full of epoxy into the keel.

11. Pour in about 1/4 of the lead shot. Using a long screwdriver, carefully mix the lead shot and epoxy as it is inside the keel.

12. Repeat this procedure- alternating epoxy then lead, and mixing. If you are filling the keel too fast, start using more lead/less epoxy.

13. **Once all the lead is in the keel lead is used- weigh the keel.** (Wipe it off first using alcohol,) then go balance it on the scale. You should be about at your target weight, or maybe a little under.

a. If you are under weight, add lead to bring it up to about 1 ounce by weight lighter than your target.

b. If you are heavy- tilt the keel over another cup, and use the screwdriver to "pull" some lead out of the keel. You won't have to remove much to make a big difference. Remember that an 8 oz. cup of shot weighs 50 oz.- half the total weight in your keel!!

c. Weigh the keel again and adjust the lead until you are about 5 oz. under target weight.

14. Fill it up with epoxy to within 1/8" or so of the top.

15. Once the keel is up to weight, prop it up in a tub or bucket of water, just in case you get some heat buildup. You can also support the keel on the water after your first lead is added; (it floats up to that point!), and pour epoxy while the keel is in the water. After the keel is filled- wipe it off using paper towels and alcohol. **Put it back in the water to cure.**

Allow the keel to cure for 24 hours before topping off with epoxy or filler.

16. IF somehow you made the keel too heavy, and the finished boat weighs more than you are willing to accept, you can lighten it AFTER CURING by drilling 3/8 holes in the "bulb" part of the keel, and filling them with light filler, and repainting. 10 X 3/8 holes = about ¾ lb.

XXV. **Fixing the Keel** to the boat (if you are making it permanent)

It is best to install the keel using the keel bolt- it ensures better alignment. Leave off the square rubber gasket.

Recheck your keel alignment visually- last chance!

Coat the keel spar with catalyzed epoxy, slide it into the keel trunk, and tighten the keel bolt wing nut. If you want to cut off the wing nut later (after the epoxy cures) for appearance reasons , place polyethelene (dry cleaner bag material) over the bolt, THEN install your wing nut after thoroughly cleaning the threads and/or coating them with Vaseline to avoid gluing the nut.

Clean up the mess using alcohol.

XXVI. Sealing the removable keel

MANY methods have been used to seal the keel from water intrusion.

1. Pack the keel box through the hull opening with Vaseline. Coat the keel spar also with Vaseline, then slide it into the keel trunk, and tighten the keel bolt wing nut.

2. Coat the keel spar with plumber's putty.

3. Apply an o-Ring around the keel spar- you'll have to take the keel to the hardware store to find the right o-ring, that fits the base of the spar.

4. Run a bead of silicone RTV (marine silicone) around the base of the keel. Caution: this is not really a "removable" keel- the silicone is a pretty effective adhesive, and is hard to remove. And, you can't paint it to match the hull- it rejects paint. This method is OK if you really only plan on removing the keel in the event you need to repair something, not if you plan to remove it regularly. We have had people recommend spraying mold release on the area before the silicone for easier removal, but have never tried it.

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

Questions or comments?

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Appendix:

WRMYC New Boat recommendations, with typical prices. (updated 4/11)

Feature/ Item	**Basic- lowest cost**	**Better, easier**	**"best"**
Objective:	Get you sailing	Get you sailing w/ rechargable system. Upgrade radio to a channel-seeking 2.4GHZ radio; make the messy parts of building as convenient as possible. Don't buy something you'll want to re-buy later.	2.4 GHZ "computer" radio- plus features, programmable, greater servo power, usable w/ 10 models All rechargables. Good Peak Charger- AC/DC Upgraded hardware
Victor Soling Boat Kit	Kit- $ 145- $ 180 Avail. internet or retail	Kit- $ 145- $ 180 Avail. internet or retail	Kit- $ 145- $ 180 Avail. internet or retail
Keel	Lead + epoxy- $ 20	Factory-made Keel ($40), and Rudder ($ 8)	Factory-made Keel ($40), and Rudder ($ 8)
Stand	Homemade	Victor Stand Kit- $24	Victor Stand Kit- $24
Radio	Hobby King HK T44 2 gHz or- A radio you have already $0 - $40	Spektrum DX-5e 5-channel/ 1 model 2.4 gHZ radio, w/ receiver $100	Spektrum DX-6i 6-channel/ 10 model programmable 2.4 gHZ radio, w/ receiver $ 200
Steering Servo HiTec (or Futaba)	HiTec HS-322 (S-3301) $12.00	HiTec HS-322 (S-3301) $12.00	HS-322 (S-3301) $12.00
Sail Servos HiTec (or Futaba)	HiTec HS-755 $35 (Futaba S-3802)	HiTec HS-755 $35 (Futaba S-3802)	HiTec HS-815- $ 50 notes- heavier, plus high draw- need GOOD charging system!
(Opt.)	--------	Servo City Servo Stretcher $ 20 Allows servo to turn 180 degrees	(Servo already turns 180 degrees)
Batteries - radio	8 X AA dry cells $10	Use 4 X AA Dry cells- lasts 1/3 a season!- $6	Use 4 X AA Dry cells- lasts 1/3 a season!- $6
Batteries- boat	4 X AA dry cells (4.8V) $6	6V NiMH Battery Pak $ 25	6V NiMH Battery Pak $ 25
Battery Charger	NA	Wall Charger $12	Wall Charger incl. –OR- Battery charger system like the MRC Super Brain 960 Purple "Brain" Charger, plus Leads, etc- $60
Added hardware	----------	Misc. improved hdwre, plus Victor Boom Vang- $25	Sails Etc. Boom Vang- plus Victor Boom Vang- $35
Upgrades:	Rechargable batteries $ 12 Tx, + $25 boat Battery Wall Charger $12	Rechargable batteries $ 12 Tx + $25 boat Battery charger system MRC Super Brain 960 Purple "Brain" Charger, plus Leads, etc- $60	Rechargable batteries $25 boat (Incl w/ DX 6i TX) LED Voltage Indicator - $15
Est. total	**$ 275 + supplies**	**$ 460 + supplies**	**$ 640 + supplies**

Soling Building Package:

1. 1- Thin CA
2. 1- Thickened CA
3. 3M 5200 adhesive sealant- fast dry (marine store)
4. 1- model putty- Squadron Green or White
5. Epoxy- WEST #105 plus #205 Hardener (marine store) IF you are doing your own keel

Recommended From Victor or a stocking hobby store:

Soling 1 Meter Kit

Large Stand Kit

Soling 1 Meter Lazarette Kit	(rudder hatch kit)
Pre-Made Keel	(lead alone will be $20 + epoxy and mess. Also- getting harder to find lead shot. Recommend a pre-made for your first Soling.)
Pre-Made rudder assembly	(ditto on the mess)
Boom Vang upgrade	(more convenient adjustment)

Other:

Improved hardware- refer to WRMYC Building Instructions for suggestions.

Reinforcing material- if you have the epoxy, you can use fiberglass cloth OR carbon fiber to reinforce the floor of the hull around the keel case and under/ around the rudder block.

80# test Dacron braided fishing line OR Spectra 60 lb. (easier to find)- better line than Victor provides.

.023 - .025 stainless steel fishing leader wire if you want to strengthen over the .015 wire in the kit

Soling Builders have found dozens of different ways to make their boats stronger (maybe even stronger than they need to be), more adjustable, etc. For your first build, we recommend only doing the enhancements that can't be added later- mainly structural improvements and mainly under the deck, inside the hull, etc. Later, you can go back and change out some things you want to improve.

For example- bowsies: Victor, in the Kit, provides simple plastic pieces that you drill out to make bowsies. If you drill them using the right drill, they will work, at no extra cost. If you want you can upgrade to commercial bowsies, for about 50 cents each. But, you generally can't find them locally, so you have to order them, pay shipping, raising the cost to (probably) $1 a piece. Wait until someone in your club wants to go together, buy 50 of them, and split the cost. A similar case can be made for almost any upgraded part commonly added to the Victor Soling One Meter.

And… your boat won't be any faster due to these enhancements.