Western Reserve Model Yacht Club
AMYA #255

Soling 1 Meter Suggested Building Procedure 5/09

thanks for input from:
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The purpose of this document is to provide the builder with ideas for enhancing the basic boat, building it stronger, and building it more accurately than just building a "toy". The objective is to build a strong, reliable boat that can be used for years with only minor maintenance and checking periodically.

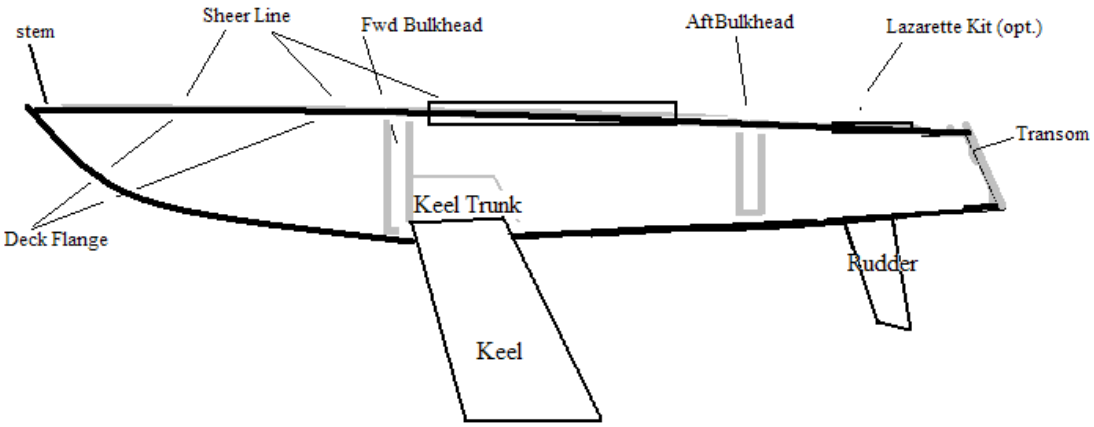
It IS possible to overbuild the boat, ending up with a far more expensive boat than is necessary, which we will try to avoid. But, there are certain things that can be done to add strength, and add to the convenience and enjoyment of sailing the boat.

Building Jigs are mainly to assure proper alignment of the rudder and keel, and the rudder and keel to the centerline of the boat. The product of the jig is only as good as the jig itself, so you would have to spend a lot of time building a perfect jig. The time and trouble to build your own jig is probably not worth the effort for just one or two boats. You can build a Soling accurately, if you understand the importance of building the boat straight, then take the care to do so.

You WILL need a stand …so build a simple stand, first. Victor Model Products has a simple stand kit ("Large Stand") at $24.

There are also a FEW of the old type of canvas and wood campstools available at reasonable prices (and a few at unreasonable prices), or from garage sales. You would cut the canvas to allow the keel to fit through the seat.

Parts of the Soling 1 Meter Hull



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

X		X		X	
	Exacto Knife		**Fine-Mesh fiberglass cloth** (or carbon fiber tape)		**Paint or varnish** to finish the spars
	Needlenose pliers		**Disposable epoxy brush** (metal-handled paint brush)		Methyl Ethyl Ketone (MEK)- from a paint store
	Thin CA Glue		**Wet/Dry Sandpaper- 220, 600, 1000, and 1500 grit**		MeasuringTape- 12 ft. or longer, metric/ English if possible.
	Thickened CA Glue		**Paint-** either Krylon 5-Ball Aerosol, with Krylon primer; or Krylon Fusion (no primer). If brushing- regular enamel paint (like Rust-O-Leum enamel).		Clothes Pins or small clamps
	Body Filler- Bondo type or Squadron waterproof		**Large thick rubber bands** (used for model planes)		Paint Thinner (Mineral Spirits)
	3/16" solid brass rod OR (5/32" solid brass rod for a Victor-built rudder)		Saw- (Atlas model RR saw, or any small saw for cutting wood)		Lacquer thinner (or acetone)
	Velcro- sticky back type		6-1/2 lbs. #9 or #6 **lead shot** (unless buying a pre-made keel)		Scissors Pencil
	3/32 aircraft plywood- 1- 8 X 10" sheet		Flexible plastic ruler- clear if possible		Small paint brush (that you won't mind ruining)
	3/16" square basswood- 1 stick		Motor tool, helpful, though a drill motor could be used		
	Slow-Setting Epoxy- 24 hr., such as WEST # 105 resin and #206 or #209 Hardener.		Drill motor, 1/16", 3/32", 1/8", 3/16", 11/64", 13/64", 9/32" drill bits, cutoff wheel		

Can be added later, or now:

Convenience: Victor Boom Vang Kit (or make a screw-type vang and gooseneck combination)

Victor Lazarette kit

Adhesives:

MEK
Thin CA
Thick CA

MEK, and PVC Cleaner are "plastic welder" types of products- and work by melting the mating surfaces of the plastic together. These thin products will "wick" through the tight joints of polystyrene, "welding" them together and sealing in the process.

The downsides- Almost any of these products can also cause the plastic to ripple. Though the ripples can be fixed by filling, **the best advice is to use solvents as sparingly as you assemble**. You can always then go back and "flow" the chemical around to seal the hull/deck joint by quickly moving and rolling the boat around letting the chemical flow to all areas.

Secondly- these chemicals all will etch the surface of the plastic if dripped. (So will CA).

Now on to the building: (This procedure is for a standard, flanged deck vs. flangeless boat.)

First, read through the Instructions that came with your kit. At each step- read the Kit instructions, then this procedure before doing the step.

I. Locate and mark the centerlines of the boat and place the interior bulkheads. (Kit Pg 6)

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

Centerlines

A. **Hull Centerline: Mark a centerline on the inside of the HULL** from just ahead of the keel spar cutout to the stern. Any flexible straight edge will do. Assume the keel cutout and rudder posthole are centered, use your flexible ruler to draw a line on the INSIDE of the hull, from the outsides of the two openings; then draw again from the opposite side. The two lines will be slightly curved and separated. Average the two lines to find and draw the centerline.

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

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

   i. Trial-fit the deck. It will not be easy to snap the deck over the hull, but it does fit. Rubber-band the hull-deck assembly together and push the hull **tight** forward in the deck **tight** to the stem. Push HARD. Adjust rubber bands so they hold the assembly together in position.

ii. Draw a line on the floor 100 mm from a wall (a wall with no trim molding).

iii. Inverting the hull, place it stem-first/ deck down against the wall.

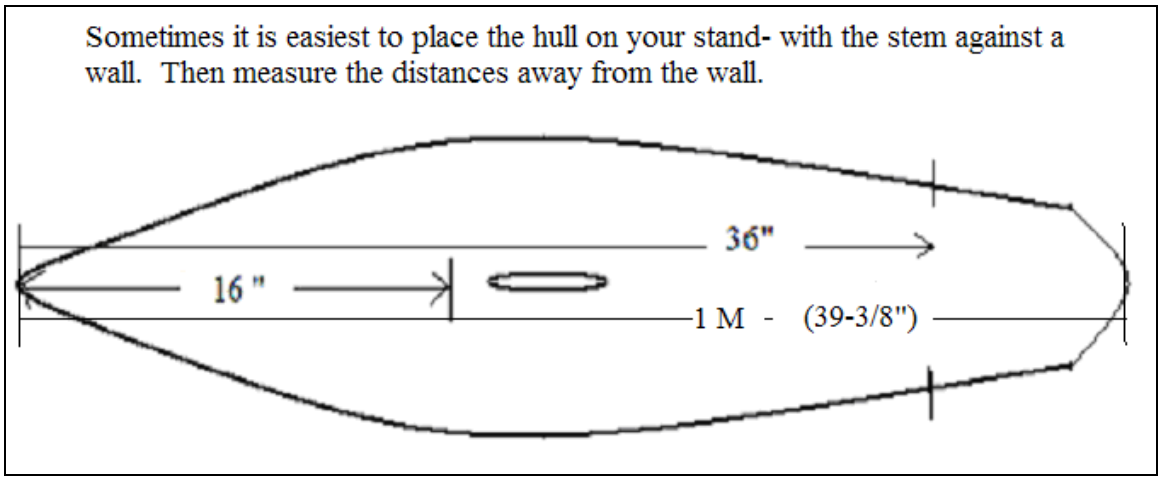
a. Use a square (the square end of a ruler, or a real t-square will do) Mark a point on the hull at your 100 mm point. This mark is your STERN LIMIT location on the outside (bottom) of the hull. (It may be that your hull is cut exactly at 100 mm- but check.)

b. Then, on the outside of the hull and with a rule level (90 degrees to the wall-- NOT along the curve of the hull) measure **16" aft of the stem and make a mark on the outside, ahead of the keel slot.** This is the point marking the nominal position for the forward edge of the keel.

c. Holding the hull up to a bright light, duplicate the outside stern limit mark on the inside of the hull at the centerline.

d. Remove the deck.

e. Put the boat in your stand, and mark two points on the hull sheer lines (port and starboard) 36" aft of the stem. These will be reference points as you align the upper end of the transom. (Instruction 6 below.)

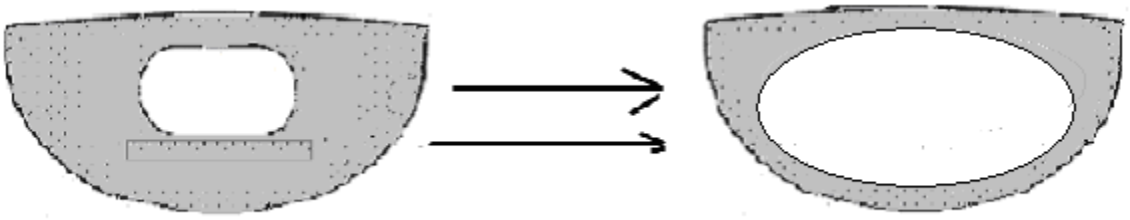


II. Bulkheads

Many builders enlarge the access holes in the forward and aft bulkheads, to allow for easier access to the front and aft of the boat. If you intend to reinforce the forward bulkhead as in this procedure, you can cut out as much of the plastic bulkhead as you like, both fore and aft. Keep at least the flanges intact.

See drawings next page.

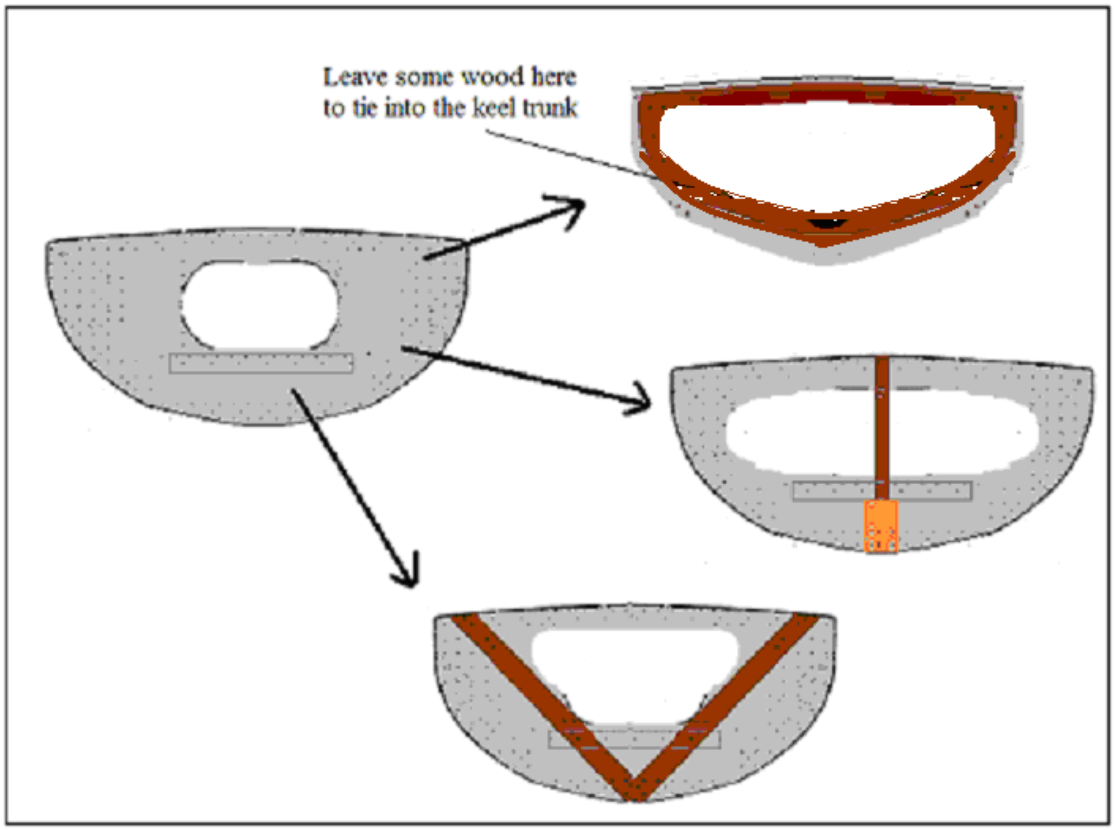
You can cut a LOT of the rear bulkhead away, as it is far less critical to the boat's stiffness or strength. This will make it lighter, help the balance, and make it easier to get into the rear compartment if needed. Rear bulkhead only:



Bulletproofing: Forward Bulkhead support: a plywood "doubler" is a great way to add a more substantial place to tie the keel trunk to the forward bulkhead, strengthening the boat in the face of the twisting of the heavy keel.

Using a piece of 3/32 aircraft plywood, trace the outline of the forward bulkhead on paper, then cut the paper out about 1/16" smaller on all dimensions. Remove most of the plastic from the bulkhead, and the wood from the doubler in the center of the bulkhead for easier hand access.

An easier to make, but far less convenient (for access forward) alternative is vertical or angled pieces of wood as struts from the sides of the keel trunk to the top underside of the bulkhead. This is also your only alternative to strengthen the bulkhead AFTER the boat has been assembled.



III. Hull reinforcement

Bulletproofing: Hull- the hull is a 1/16" thick molding of polystyrene. Over time as you are carrying the boat, the polystyrene around the keel can form flex cracks that open up-leaking or even dropping the keel and keel trunk. One solution is to simply run epoxy into the area around the keel trunk. Another is to reinforce the center of the boat using fine-mesh fiberglass cloth and epoxy, or carbon fiber tape and epoxy. The addition of the fiberglass cloth (or the carbon fiber) strengthens significantly better than epoxy alone.

A. Locate the Forward Bulkhead position

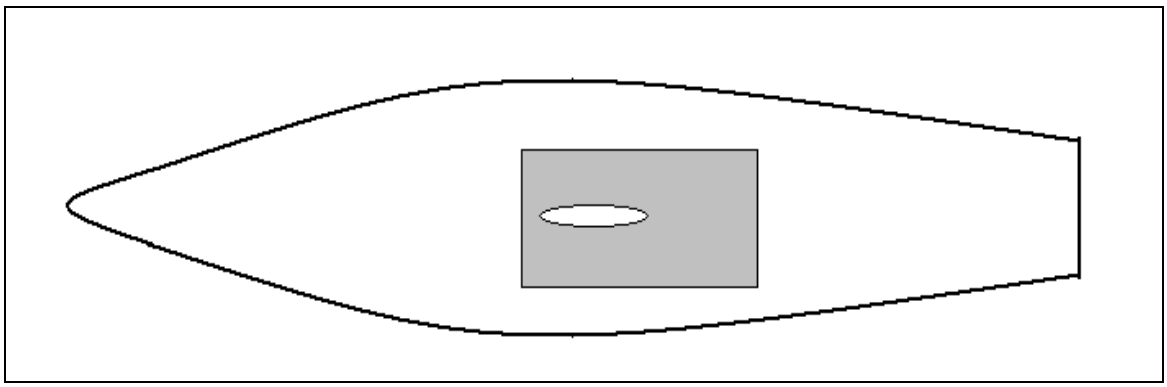
1. Put the stem (with deck in place) against a wall. Measure and mark the point 16" aft of the stem (keel location point farthest forward with the deck in place). See # 8, this procedure.

2. Mark this position INSIDE the hull. This is the approximate location of the forward bulkhead.

B. Cut 2-3 layers of fiberglass cloth in 2" X 5" rectangles to fit the area. You can cover the hole for the keel, then re-open it later using a Dremel motor tool, or you can use separate sheets of glass cloth on each side. OR

C. Cut (using scissors) 6 or so strips of carbon fiber tape (take care to use masking tape to hold the tape strands together).

D. Sand the inside center of the hull thoroughly, using 100-grit sandpaper. Sand from the keel-forward mark on the hull to 3" or so behind the keel slot, up to 1" short of the sheerlines.



E. Wipe the area with acetone or lacquer thinner. (DO NOT soak, just wipe.)

Reinforcing using Fiberglass:

F. Lay the first layer of fiberglass cloth into the bottom of the hull (DRY). Position it ½" or so aft of the mark you made at 16" aft of the stem.

G. Wet out the first layer of fiberglass cloth using a steel epoxy or junk paint brush, dipped in epoxy catalyzed using slow catalyst (like WEST #105 Resin and #206 or #209 Hardener). The slow hardener is to minimize heat.

H. Follow with the second and third layers. Allow to cure 24 hours before further work on the hull.

Reinforcing using carbon fiber:

I. Tape the first strip of fiber tape into the bottom of the hull (DRY). Position it ½" or so aft of the mark you made at 16" aft of the stem and 1/8" outside of the keel slot.

J. Wet out the first fiber tape using a steel epoxy or junk paint brush, dipped in epoxy catalyzed using slow catalyst (like WEST #105 Resin and #206 or #209 Hardener). The slow hardener is to minimize heat.

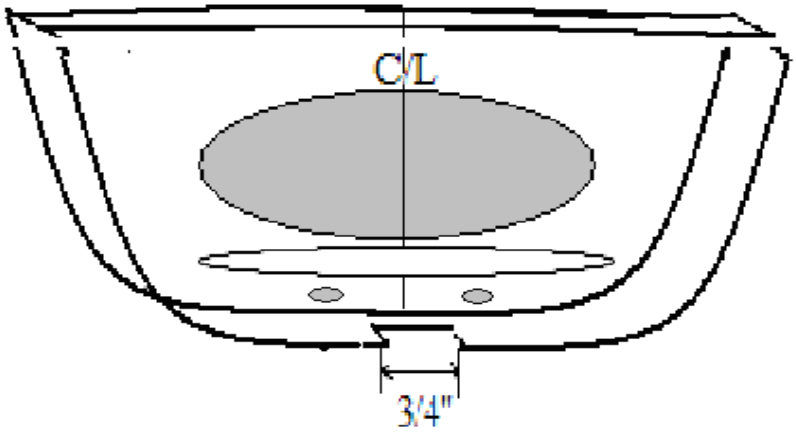
K. Continue as you install 4 pieces of tape- 2 per side, tapes spaced about 1" apart. Save 2 strips for later (these will be placed AFTER the keel trunk and former are installed.)

VI. Locating the bulkheads and building the keel --- Use of one of the following methods ensures you will get accurately located bulkheads and a proper hull to deck fit, and keel trunk to bulkhead joint.

A. Note: Do NOT glue anything in place until instructed to do so. Mark everything first. Read the Victor Instructions.

B. Locating the bulkheads --- recommended method- locate the bulkhead based on keel position: **NOTE: using this method,** the keel position determines the location of the keel trunk, and the location of the keel trunk determines the location of the forward bulkhead.

1. Scribe (using an X-Acto Knife, OR a pair of cutting pliers) and cut a ¾" notch in the lower flange of the forward bulkhead.
2. 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 larger 3/16" center limber hole in the aft bulkhead.



C. **Carefully assemble the keel spar and the keel halves** -do NOT add the epoxy and lead shot yet- save that for last. Allow the glue to set overnight. You should build the hull and rig, then weigh them, and weight your keel to bring the total up to the minimum 10 lbs. (See pg. 3 Victor Instructions)

D. **Build the keel trunk**. (per Victor Instructions)

E. Insert the keel spar through the hull so that the keel spar is in position in the keel trunk. Finger tighten the wing nut, loose enough that the keel assembly will slide fore and aft. It can be loose, and you will tighten it in position later.

F. Sliding the keel forward, locate it where the front edge of the keel is at the 16" aft – of-stem point.

G. Use your eye to get the keel close to straight. Tighten the wing nut snug. (You are finding the fore/aft point for the keel trunk and bulkheads in this step.)

H. Draw lines inside the hull around the keel trunk with the keel at this point. This will be the approximate final location of the keel trunk and keel.

I. Place the hull in your stand.

Do not glue the keel trunk in place just yet.

J. At this point you have not aligned the keel, so the keel trunk will need to be able to move and twist from this temporary position.

K. With the keel trunk holding the keel in place 16" aft of the stem, position the forward bulkhead tight against the keel trunk- with the keel trunk in the ¾" notch- BULKHEAD FLANGE facing aft, toward the hatch opening.

L. **Square the bulkhead-**

1. Verify the Bulkhead is 90^{o} to your centerline, by measuring from the stem to either side of the forward bulkhead. Adjust the position of the bulkhead slightly until:

    - a measurement from the bow to the bulkhead at the sheer line is equal on each side;
    - the position of the bulkhead is square, at right angles to the centerline and;
    - the centerlines on the bulkhead match those on the hull.

2. Mark the location of the top corners of the bulkhead on the hull. Use clamps or clothespins 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.

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

4. 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 BELOW the top corners of the bulkhead,** (the bulkhead should be ABOVE the hull sheerlines) and the bulkheads should appear "square". (The

bulkhead tops will be higher than the hull sheer lines by 1/16" – 1/8", and, may not be even.)

Small adjustments to the height of the bulkhead for fit to get the 1/8 – 1/16" clearance may be made by tilting the BOTTOM of the bulkhead fore and aft. **But, keep** the **top flange of the bulkhead clamped/aligned with your deck transfer marks (the location of the bottom of the bulkheads is not as critical.)** When satisfied with the fit, mark the final location for the bottom of the bulkhead. Do NOT glue.

M. Remove the deck, and repeat the process for locating the rear bulkhead. Be sure to reverse the flange on the aft bulkhead so the flange faces forward to the main hatch opening. Again- sight through the aft end of the hull to check deck to rear bulkhead fit.

N. Glue the Bulkheads: Remove the keel, and keel trunk.

1. **This is critical**- Be sure to recheck the centerlines on the hull and the bulkheads, and your measurements aft of the stem (or forward of the 36" marks on the hull) to ensure BOTH bulkheads are square.

2. Tack glue about 1" below the tops of the bulkheads. Use 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. you still have NOT glued the keel trunk.**

4. Once properly located, and using MEK this time, permanently glue the bulkheads in place where you marked the locations. (NOTE- any glue or chemical designed for polystyrene can warp or wrinkle the hull, if you use too much.) **NOTE: DO NOT glue the bulkhead to the keel trunk at this time. you still have NOT glued the keel trunk.**

5. Use two small clamps (or clothespins) near the top of each bulkhead to hold them in place while the glue fully cures.

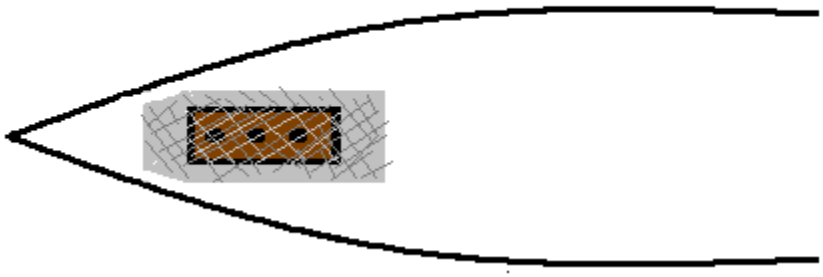
6. Install the wood block reinforcers, using CA, under the forward bulkhead, and the deck support per Victor Instructions.

NOTE: DO NOT glue the bulkhead to the keel trunk at this time.

VII. The Stem:

A. Bulletproofing: Rough the area under the deck, at the three dimples at the front of the deck, with 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.

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



C. Stem Fittings:
Below are full-size pictures of alternative stem fittings: (L to R)

The kit eye-screws, 2-56 stainless eyebolt (sold by Midwest Yacht Fittings and others), w/ washer and top washer, larger brass eye-screws bought at a hardware store.

D. Install stem fittings now, before you fit the deck.

1. Going to fittings made of thicker wire is the only way of actually having stronger fittings. Not that the standard fittings are not strong enough- they are- but they can sometimes back or strip out. **Materials**: **stainless** not actually stronger than the standard carbon steel in the kit, but it is much more corrosion resistant. If you sail in salt water- SS is the way to go. BUT- stainless stretches, and the nuts seem to loosen, you retighten, and they stretch and loosen again. The solution: never overtighten screws- be careful to just tension them. Then use a second nut as a jam nut.

2. If you are using self-tapping screws be sure to set them in CA, or in epoxy.

3. If using eyebolts and nuts,
- **i.** be sure to use washers under the nut as well as under the eye.
- **ii.** Drill holes (3/32") at each dimple.
- **iii.** Countersink the reinforcing block for the 2-56 nut (7/32").

iv. Install the eyebolts to pull the nuts squarely into the block.

v. Remove the eyebolt, then, CA the hex nut into the reinforcing block (or use epoxy, being careful not to get glue in the threads). You do not want to have to rethread a hex nut to the screw after assembly, having to reach forward to the stem.

VIII. Temporarily install the radio, servo tray and battery mounts.

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

A. Interior arrangement:

This is done many ways.

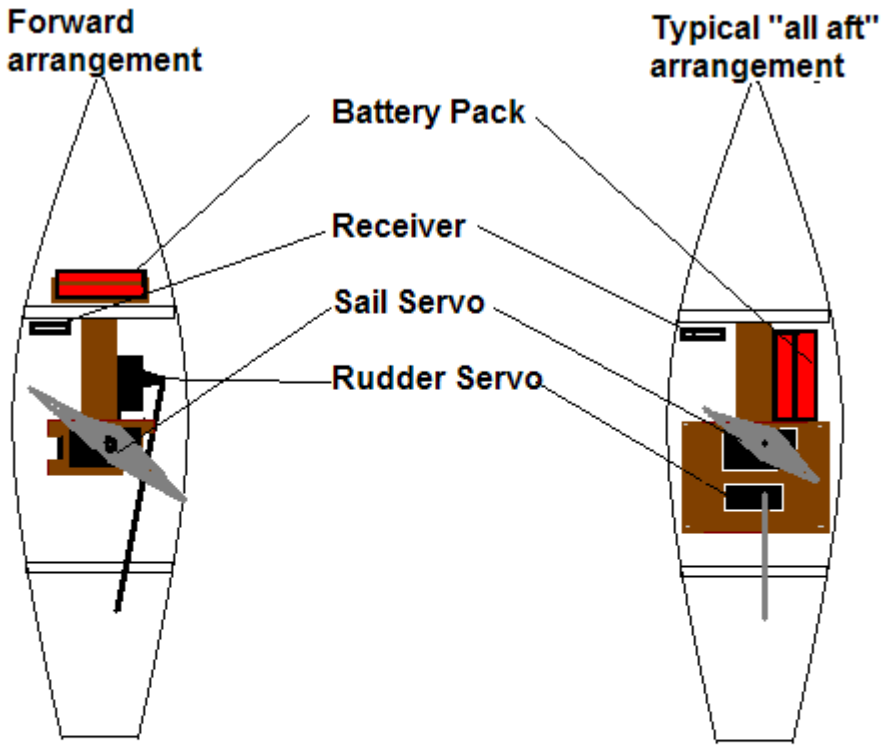
1. **Victor** uses a radio board, with holes cut out to recess/fit the two servos, a 4-cell AA plastic battery box, and an ON/OFF switch. All mount aft of the keel trunk. The radio board screws to the Former (in the kit), and a second Former serves as a rear mount for the radio board. This locates the weight of the batteries, the servos, and the servo board all aft of the keel.

2. Others like the weight of these components forward to improve boat balance, keeping the transom from being below water, causing a suction effect at the transom.

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

4. Actual mounts for the servos can be blocks, formers, anything that secures the servos in the right location.

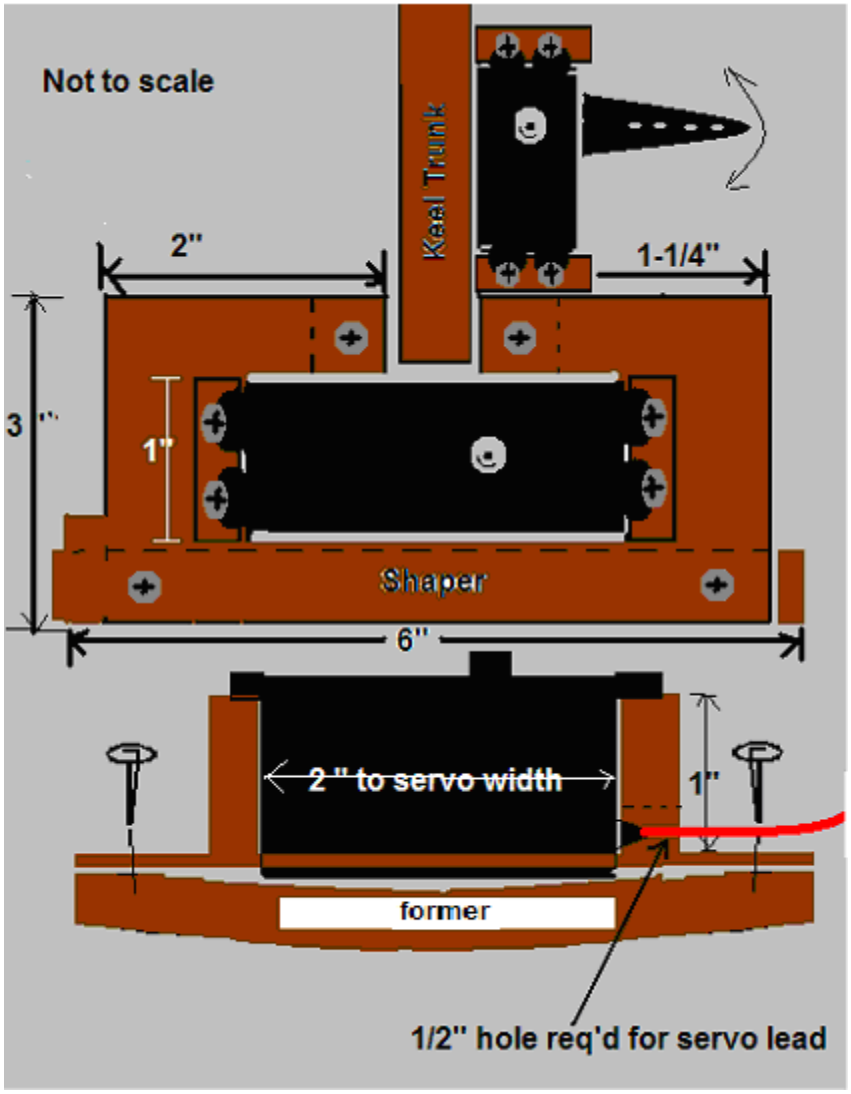
    a. Some add formers as mounts.
    b. Some make small wooden blocks, shaped to fit the curve of the hull, and bonded to the hull. The radio board is screwed to the blocks.
    c. I like to use "Servo Sled" – a frame that allows me to mount the electronics significantly forward. See below.



I use a "Servo Sled" for the sail servo- an H-shaped plywood piece that mounts to the "former" and the keel trunk. Note battery pack mounted on "table".

Victor supplies and recommends a simple plywood board w/ holes cut out for the Sail Servo, and aft for the rudder servo. Both work. I simply like the weight forward.

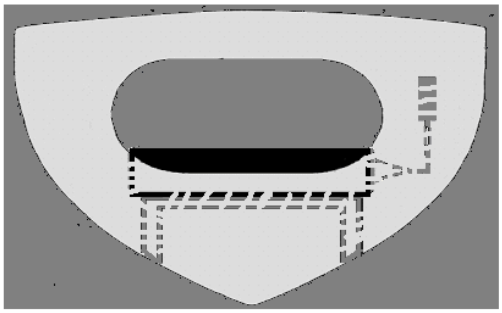
Servo Sled: This allows the servos to be mounted as far forward as possible for weight and balance. The servo sled screws to small basswood blocks glued to either side of the keel trunk (which act as keel trunk supports), and to the Former (moved aft from its aft of the Keel Trunk normal position). The sled can be made from 3/32" ply, or 1 X 3/32" sticks simply glued together to the shape and size.



B. Battery shelf or table: On factory boats, Victor locates the batteries on the servo board beside the keel trunk. But, many want the battery pack ahead of the forward bulkhead, for better fore and aft weight distribution.

1. I use a small battery shelf or board located just ahead of the forward bulkhead for the battery pack. This locates the batteries forward for better fore/aft trim, plus the batteries are up off the floor of the hull to keep them drier. It can be mounted fore and aft, or crosswise as shown.

2. The shelf is made out of three pieces of scrap wood, waterproofed w/thin CA, and is glued to the hull and the forward bulkhead. Use Velcro to hold the battery pack in place.



IX. Now the transom: Note: the aft end of the hull as delivered from the factory is NOT usually cut square, and often the sheerlines are also different heights. So as part of transom installation, you will be cutting part of the hull off the boat at the transom, and adjusting the sheerline(s).

A. Using CA- glue the wood reinforcing block from the kit to the vertical inside surface of the transom. (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 1 meter stern limit mark when fully pressed down inside the hull. The top upper corners of the port and starboard side of the transom of the transom should be between 37.5" and 38" aft of the stem. and the (Measure equal distances from your 36" marks on each sheerline [1.D.iii above] to ensure the transom is square.)

C. Small adjustments may be made by tilting the lower end of the transom fore or aft. The shear line may need to be sanded down on both sides if the hull side sits too high (the transom needs to fit just like the other bulkheads- about 1/8" to 1/16" higher than the hull sheerline).

D. The transom should be in the right position with the bottom centered, just <u>inside</u> 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 at an angle of approx. 30 degrees tilt. Be sure the flange on the transom faces forward. toward the hatch opening.

F. Measure aft from your 36" marks (done in Section I) to ensure the tops of the transom are 90 degrees to the centerline. Apply a single drop of CA at the center bottom of the transom to locate it. Later, you will permanently bond it using MEK.

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.

CAUTION: After marking the transom location, before gluing the transom, re-measure the boat length against a wall with the deck in place and the boat is inverted to be sure the boat will be NO LONGER than 1 meter, (39 3/8 inches). You may be as much as ¼ inch shorter.

H. **Now** glue the transom into the hull aligning it with your hull marks, the centerline of the hull and bulkhead centerline and the stern limit. Hold in place with small clamps (clothespins) while the glue sets.

I. After the glue sets, trim the aft end of the hull slightly longer than the transom to provide a lip for body filler after the deck is installed. The excess length will be sanded off during final finish.

J. Using a cloth tape measure, measure the distance from the hull (outside) centerline at equal points aft of the stem, up to the sheerlines. If there is a significant difference one side to the other, use scissors to trim the high sheerline to the same level as the low side. (Usually the Port (left) sheerline will be as much as 1/8" too high.)

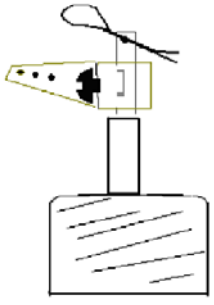
X. Install the rudderpost wood support per the instructions.

Many builders add two pieces or aircraft ply side to side sanded to fit the shape of the hull as additional rudder block support.

Bulletproofing: The 3/16" tubular brass kit rudder post is prone to breakage from bending. Either add a 5/32" solid brass rod placed and glued (epoxy or CA) down the center of the standard rudder tube, (or build the rudder post with a solid 3/16" solid brass rod in the first place).

Also, file or grind a flat at the top of the rudder shaft, 90 degrees to the direction of travel on the front of the rudder shaft, for the set screw in the rudder arm to lock to. (see diagram)

Finally- some builders drill a hole in the top if the rudder shaft and insert a 1/16" cotter pin. This makes it impossible to lose your rudder in the event your set screw ever loosens.



XI. Align the keel, install the Keel Trunk and bracing. Take your time on this step!!! Place the hull in your cradle. You are now ready to align, and finally install the keel trunk and bracing.

A. Place the keel up into the hull and slide the keel trunk on the keel spar from above (inside the hull). Loosely attach the keel wing nut to hold the assembly together, so it can be pivoted and moved fore and aft.

B. **Level the boat laterally (side to side) on your stand;** place a small level across the hull sheer lines at the forward bulkhead, above the keel trunk. Adjust the boat side to side until the hull is level in the stand. Using masking tape **suspend strings** with weights (like fishing sinkers) from the bow and stern to hang as plumb lines.

C. **Sighting using the plumb lines** align the keel and trunk vertically and laterally with the boat centerline. Use the strings suspended from the bow and stern as sight guides and re-position until you are sure the keel aligns fore and aft with the centerlines. Double check the boat is level, the strings line up with the keel vertically, and that the keel in not twisted off to port or starboard.

D. Once you are certain that you have the boat level, and that the keel is straight, **Tack bond the KEEL TRUNK** in place with CA/super glue. **Careful: DO NOT bond the keel spar into the trunk.** Double check the boat is level, the strings line up with the keel vertically, and that the rudder lines up with the centerline/ keel, and that the keel in not twisted off to port or starboard.

E. **Install your rudder.** Recheck, and re-level as in (b.). Using the plumb lines, bend the rudder slightly until it, too, is perfectly straight and aligned with the plumb lines, and with the keel.

F. **Remove the keel.** If by chance you (like 100s of people before you) have inadvertently bonded the keel to the keel trunk, put rags under the keel, and use a small hammer to tap lightly down on the keel screw, and then with more authority in an attempt to break the keel shoe loose from the keel trunk. Be careful here- a permanently-mounted keel (if it is straight) is great compared to attempting to loosen excess CA and beating the whole bottom of the boat out.

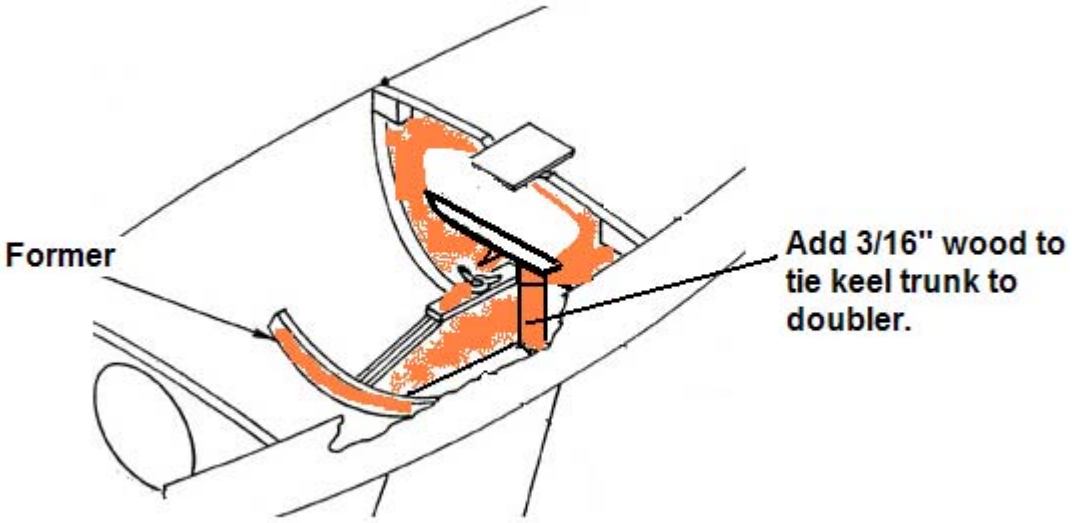
G. **Install the keel trunk**.

1. Note on adhesives: CA bonds wood to styrene well. CA will not bond as effectively to epoxy.

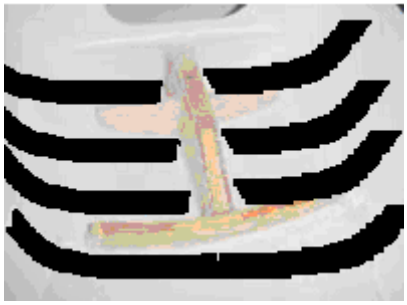
    i. If you reinforced the hull using epoxy/fiberglass “patch” you will have to bond the keel trunk, the former, and any bracing using epoxy.

    ii. If you plan to reinforce by adding epoxy using the drip method, you can bond in the keel trunk and former using CA per the Victor Instructions.

2. **(at last) Fully bond the keel trunk and bracing in place**. Tie the forward end of the keel box into the forward bulkhead using CA, and adding 3/16" stripwood to the sides of the keel trunk at the bulkhead. You want a solid assembly around the keel trunk/forward bulkhead. See diagram.

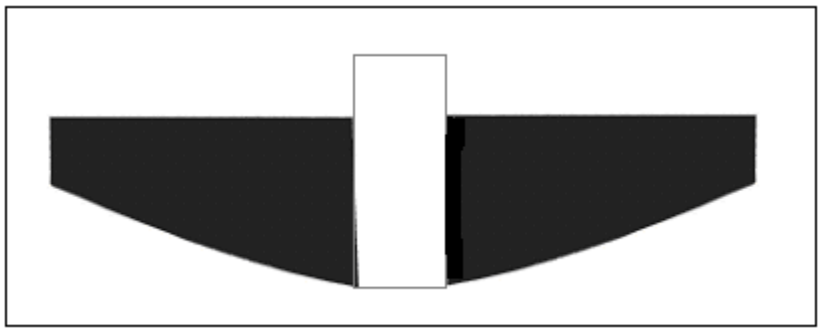


3. Add any trunk bracing, again using CA.
4. Place your final 2 carbon fiber tapes, ½" or so aft of the former, if you are using them, using epoxy. See rough drawing below:



"Knees" for keel trunk reinforcement (full-size pattern)- also mount points for the servo sled.

(From "Jaquith" on Yahoo Soling 1 Meter Group)



XII. Install the under-deck fittings and reinforcements prior to installing the deck.

A. Install: the deck sheet exits. To **add height and lessen the amount of water entering the hull**. Some builders use commercially-available aluminum parts, some drill out 5/16" nylon hex bolts, 1" wooden balls cut in half, or use screen door roller hardware- any way to get the sheet exit up out of the water.

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

C. Install underside reinforcement around 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.)

D. Bond mounting rails for servo mounts in place in the hull when you are satisfied with the layout, leaving the servo tray (or sled) to be screwed in after the deck is installed.

E. OR- use CA with Accelerator to bond blocks of wood to the hull.

F. Drill pilot holes, then use #2 tapping screws to screw the servo tray to these blocks, making the tray easy to remove later if needed.

G. Install sheet attachment deadeyes. See Victor Instructions. (Unless you are going to use the outside sheet arrangement. See below.)

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 (unless you are using a Servo Sled);
- The layout and mounting for the servos all figured out, ready to be re-screwed into the hull;
- And the hull solidly reinforced around the keel trunk.

XIII. Now install the deck.

(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.)

A. **Installing the deck:**

i. Test fit the deck on the hull for all around fit. The deck should almost "snap" into place.

ii. 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" in the deck flange even at the stem- a gap of more than (say) 1/32" indicates something is not aligned properly.

iii. Pencil a line across the underside of the deck defining the line of the top of the transom, and down the flanges. Remove the deck and, using scissors, trim the deck to final length along your line.

iv. If you are installing a Lazarette, now is the time to install it.

B. **Deck installation** is really quite simple.

5. Snap the deck in place, 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.

6. Using a small paintbrush and MEK, and holding the deck and hull assembly in one hand, gently squeeze the hull and deck to coax the hull forward for a tight joint at the stem, and tight against the deck flange.

7. Starting **near the bow**, perhaps 1" back from the stem, use a small brush to wick a small amount of MEK into the hull/deck joint. The MEK will wick into the joint and bond almost instantly. **Use MEK sparingly.** (If you are ANY adhesive be very careful that you don't apply too much and wrinkle the plastic.) You are just trying to **tack** the deck to the hull.

8. Work your way down the hull/deck joint from bow to stern at spots 3 or so inches apart. If there appears to be a gap, reach inside the hull through the hatch and add outward pressure to the hull to force it outward against the flange. For hard to reach areas use a small stick or dowel, or wooden spoon.

9. Holding the boat nearly inverted, pour a **thimble full** of MEK inside the hull and QUICKLY rotate the boat around so as to let the MEK run into the hull deck joint all the way around the inside of the deck flange. This will seal the hull to deck joint from the inside. **Pour out any excess MEK immediately.**

10. Paint a small amount of MEK or other cement on the inside of the deck across the tops of both bulkheads and across the transom to bond them to the deck.

11. **Fill, and sand the transom**. See the Victor instructions.

12. **Water-test.** 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 additional MEK to seal the leaky areas.

Finishing your Soling 1 Meter

A. Many builders do NOT paint the deck. The deck is not a perfectly smooth molding, and the imperfections are more visible under paint than if left plain.

B. You can paint the hull color up to or even over the edge of the deck- it will hide some excess glue or other imperfections in the hull/deck joint.

C. Mask, then use a recommended primer and paint to finish the hull. Use the same brands and types of primer and finish paint.

From simplest to most complex…

1. **Simplest:** Of course, leaving the hull and deck "as is" (white styrene) is the easiest route to take. The problem(s) with this are two:

   a. seeing your boat in a crowd of white Solings, and secondly,

   b. there is some theoretical deterioration (drying out) of the unprotected styrene due to the sun's UV rays, and the plastic can become brittle, eventually cracking and failing. Truly, most Solings are not out in the sun enough for UV deterioration to be a problem, but picking your boat out of a crowd can be.

2. **Add Striping**

   Using vinyl tape (automotive pin-striping) to add stripes to the unpainted topsides is an easy way to distinguish your Soling. These are available from auto supply stores, in various colors and widths.

3. Paint stripes on your sails: use a **fabric paint** such as they use for coloring silk flowers- Design-Master.

4. Painting:

The **deck** of the boat has certain imperfections that, if simply painted over, stand out more than leaving the deck unpainted. It can take a lot of work to get the deck smooth enough to really look good under paint.

- So, there are those who like to paint from the waterline, to the deck lip, or slightly overlap on to the deck, but leave the rest of the deck, and the bottom as is. The styrene can be buffed to a high gloss as a last step.
- Another idea- use a flat (like gray primer), or a satin color- it will hide the imperfections better than gloss paint will, and it looks really nice.

A. Preparation for paint:

1. Fill imperfections with automotive Bondo or Squadron Green Putty; any filler.

2. Sanding: The hull has some imperfections that need sanding, whether you are painting or not.

a. Start with 220 or so wet and dry sandpaper, and get the smoothness you
want. Wet and dry paper is best used wet- add a few drops of dishwashing
soap to warm water in a small bucket. Cut the paper into small (3 X 3") pieces for hand sanding; cut into the right size for a sanding block if you are block sanding.

b. If you are staying with the "au naturale" look of an unpainted Soling, start with the 220, progress to 350, then 600 wet and dry sandpaper, and maybe 1000 if you like. Finish it off with Frankie Novak's rubbing compound method (last page).

c. If painting, sand using only the 220 grit, after filling the imperfections.

B. Paint Choices

There are many good paint choices. Always use the same brands of paint and primer, and the same brands in two colors if using two colors. Never mix types, for example lacquer on the deck and enamel on the hull, even if the can says you are able!!

1. Paint Types:

- **Enamel** – low-tech paint getting harder to find in an aerosol, common in pint cans. You thin enamel about 5-10% with acetone and can use it in an airbrush. Enamel has a relatively high gloss. It is soft, and never gets as hard as other paints, making it respond to buffing better, making it scratch easier but also easier to repair through buffing. You can wipe off enamel
painting mistakes using paint thinner/mineral spirits without damaging the polystyrene plastic of the hull and deck.

The solvents in enamel aerosol paints are still "flashing" for up to a week after painting, and the second coat will attack the first coat if you don't do so in the right "window". So, you must recoat enamels **within 1-2 hours** after the first coat, **or wait up to 7 days to recoat.** Read the instructions on the can.

- **Lacquer**: including "acrylics": This is another "old technology" paint. Lacquer dries faster, harder, and glossier than enamel. Thin with lacquer

thinner (**careful**- lacquer thinner contains acetone which will craze the polystyrene. Do not try to wipe off mistakes painting with lacquer- you have to sand mistakes off after the lacquer dries.)

- Can recoat lacquer in minutes, and anytime thereafter.

- **Polyurethanes**: these include Automotive basecoat/clearcoat systems- 2-part paints (plus a reducer for thinning). An example is DuPont Imron. Automotive clearcoats are usually polyurethanes. Polyurethanes are hard as a rock, very glossy, and durable. But, urethanes are generally not recommended for amateur use- they are very hazardous and hard to apply
correctly. We do not recommend them for S1M painting.

  Note: Aerosol urethanes have nowhere near the properties of 2-part polyurethanes, and behave more like lacquers.

- **Epoxies:** similar properties to 2-part polyurethanes, maybe a little better from a safety/inhalation standpoint. Victor uses (after many trials of other products) exclusively Sherwin- Williams 2-part Epoxy Paint (anybody's guess as to which specific one- but George at Victor will probably tell you if you ask), through spray equipment. Probably impractical for amateur use, however. So- really- trying to find/use the S-W epoxy seems futile for the average modeler. (Victor's results are beautiful, however.)

3. **Which paint to use?**

Subjective appraisal

Paint Type	**Gloss**	**Ease of painting**	**Ease of cleanup**	**Notes**
Enamel	6/10	7/10	8/10	Easy to buff, and repair scratches
Lacquer	8/10	7/10	5/10- the solvent damages plastics	High initial gloss, Fumes issue
Polyurethane	9/10	2/10	2/10	Don't try this unless you are experienced!
Epoxy	8/10	2/10	2/10	HARD to buff, and repair scratches

Brands:

If you are using aerosol cans, most Soling builders use one of the following (in order of seeming popularity- not a scientific poll):

i. **Krylon 5-Ball**: (left picture, below) Krylon (Sherwin- Williams) calls this an "acrylic lacquerized enamel". This is really a modification of an enamel, adding some acrylics and lacquer solvents to get a paint that has many of the good points of both enamels and lacquers. Good, forgiving paint, fast-drying. You can recoat after a few minutes, or any other time (hence the lacquer traits). Multitude of colors available. Use their 5-Ball primer.

ii. **Krylon Fusion:** (right picture, below) a high-solvents acrylic alkyd enamel. This was developed to paint plastics specifically, with only a cleaning. Very high gloss. Fusion is
used without a primer- simply clean the surface by wiping with mineral spirits, dry with a lint-free cloth, Make SURE the mineral spirits are totally dry before painting!! Then paint. The enamel rules apply here- second coats within an hour or wait a week.

iii. **Painter's Touch** (by Rust-Oleum): Some Soling builders swear that this is THE paint. The manufacturer calls this a "modified alkyd" – a rather meaningless description of a basic paint. It is a low-tech acrylic enamel, with some solvents (toluene, acetone, benzene) to aid in adhesion to many materials. I think this is lower in solids than Rustoleum Rust Protective Enamel, or it may just be the same paint in a different package at a lower price point. Second coats within an hour or 24 hours later. Another fast-drying medium gloss paint. Good stuff.

iv. **Rust-Oleum Rust Protective Enamel** is their standard aerosol (more expensive) paint, which has a higher solids content, and many colors, and…

v. **Rust-Oleum Paint for Plastic** (like Krylon Fusion) in just 11 colors. The instructions on the Paint for Plastic say you can recoat within 24 hours- when using the Fusion you must wait 7 days.

Hint: when using an aerosol paint, place the can in warm (not hot) water for 12- 15 minutes in advance of use. The warmth causes the paint to spray in a finer mist, for a smoother result.

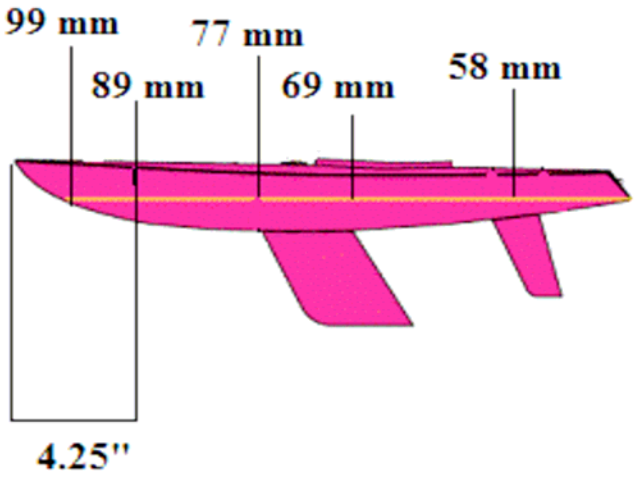
5. Another method: Foam brushes!! This is really easy, and can give a good result. Most aerosol can paints rarely give a perfect finish, and can be hard to use for the novice. You can get a good result using cheap foam paint applicators, and Rust-oleum enamel (available in pint cans- plenty for two boats). THIN the paint 5%- 10% with acetone. (Clean up with mineral spirits.)

Then, follow the rubbing out process below.

Waterline drawing - here are the numbers: courtesy Frankie Novak

Horizontal reference point Vertical measurement from deck "turn" to waterline

1. 2-1/8" from the stem 99 millimeters
2. 4.25 " from the stem 89 mm.
3. Front of Keel 77 mm.
4. Rear of Keel 69 mm.
5. Rudder Log (Shaft) 58 mm
6. Bottom of Transom at underside



Finishing after painting: The Ten Minute Transformation

Courtesy Frankie Novak

If you have rough areas, finish sand with 600- then 1000, and finally 1500 grit wet/dry sandpaper.

Use a little bit of DuPont #7 Rubbing Compound to rub out the finish paint. It shouldn't take more than a few rubs to produce a spectacular shine. Wipe clean and follow up with Polishing Compound, the same way. Finally do some brisk buffing with Turtlewax Swirl Remover. Use dish water soap and clean water to remove the residues. Wipe clean with paper towels. NO WAX PLEASE! (wax is slow) Behold your WORK OF ART!

XIV. **Rig:** Complete the rig per Victor's instructions.

A. Reinforce the mast crane using a piece of brass angle. The stock crane will bend.
B. Deform the threads of the mast jack slightly to form an interference fit that will not loosen as you sail.

Some options (can be added later):

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

D. 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.

E. Some builders upgrade the standard lines from 50# Dacron to 50# test Spectrum fishing or 60# Dacron line for more durability.

F. Rigging Tips and pointers

a. ALWAYS treat your knots with a drop of CA- ensures they will not come untied.
b. Run your sheets outside on the deck- placing the bowsies on deck (instead of on the booms)- makes for easier adjustment.
c. Both a single-arm and a double-arm sail control are OK- but the single-arm is available for purchase while you have to make the double arm.

XV. 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 reinforment.
B. You can use **Sharpie permanent marker to mark numbers** on your sails. Careful- it will "run" so do the outline first in ballpoint pen, 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.
D. 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!
E. If you want to color your sails- use the aerosol fabric paint designed for florists' silk flowers **called Design Master**. Just mask and paint.

Good Luck!!! Enjoy your Soling 1 Meter!!!

Soling 1 Meter 1961, built by Tom Willings of Florida. This boat is perfectly trimmed, with the main and jib leeches parallel (identical "twist"), and the speed shows it. Note the telltales on the leech of the mainsail- both streaming aft showing that the air is "attached" to the sail through the whole width of the sail. Thanks to Tom and Victor Model Products for the great picture!!!

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Notes: