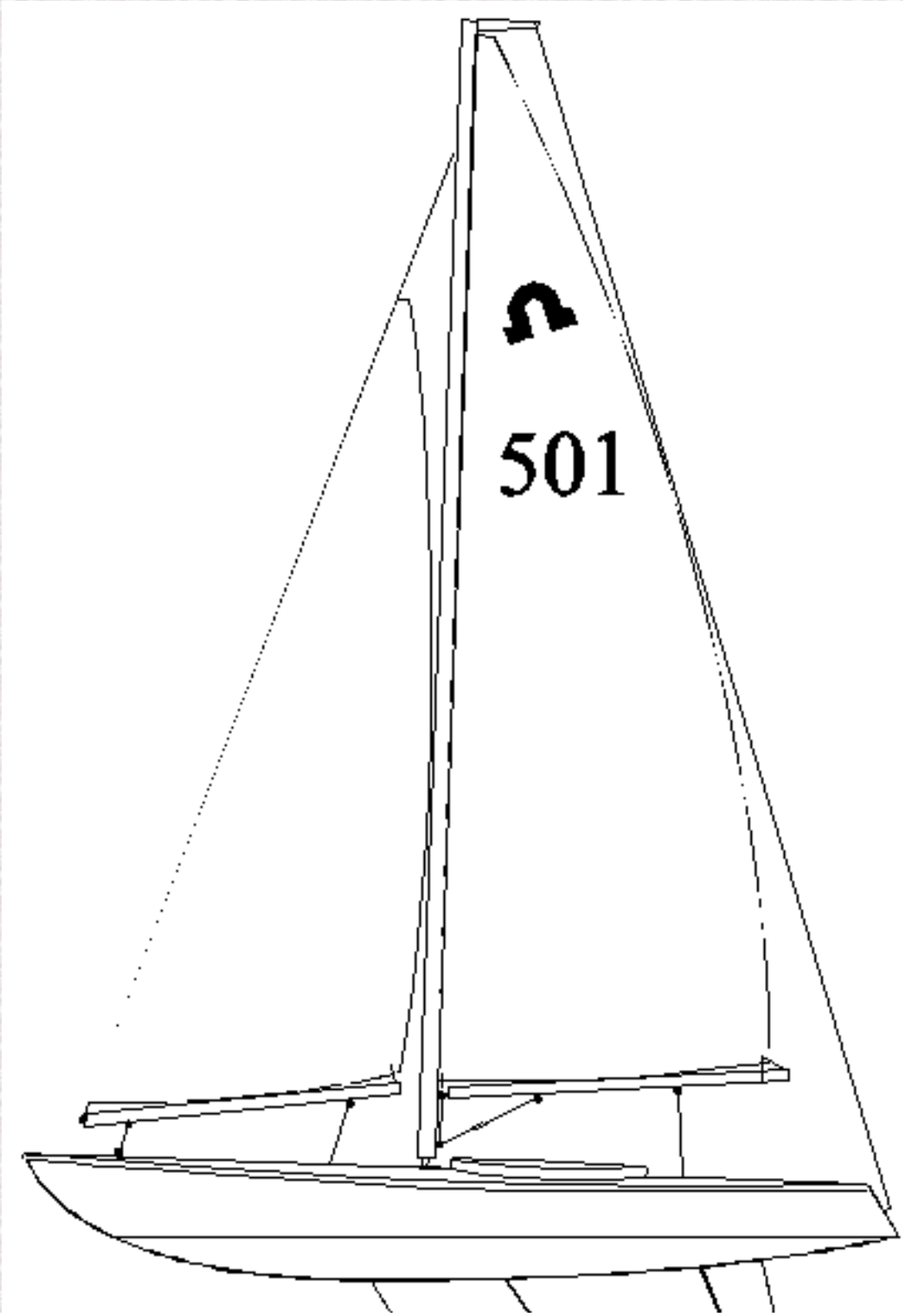
The Soling One Meter Resource Center

Last update: ***March 02, 2003***

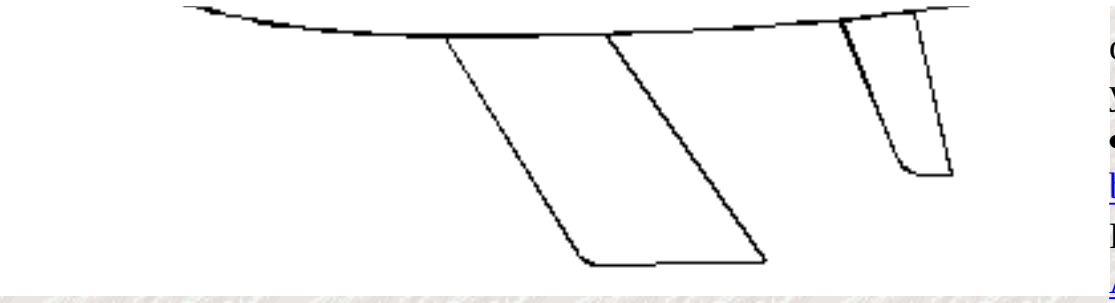
Welcome to the on-line home of the Soling One Meter!



The Soling One Meter is a low-cost, entry-level model sailboat designed for radio controlled sail racing. It is recognized by the American Model Yachting Association (AMYA) as one of the largest model yacht classes in the country. This extremely low cost kit-based model is a pleasure to sail. As a one-design, it is an ideal introduction to model yachting for new skippers, yet it provides close competition for the best of veterans as well. Since its introduction as an officially recognized class in 1993, the Soling One Meter has zoomed in population to become the most popular class in the AMYA.

This site is dedicated toward providing the best information on the Soling One Meter class. Here's what you can get:

- The AMYA S1M Class page governing the class.
- Building tips to help you build your Soling One Meter right!
- Tuning tips to help you



optimize the performance of your boat.

- Download the revised Soling building jig drawings in Adobe PDF format (you need the free Adobe Acrobat Reader to view/print). [Please contact me if you have problems with this file.]
- Learn about upcoming Soling One Meter regattas
- Link to the AMYA web site

It's all just a click away.

Soling One Meter Sources

The Soling One Meter is a one-design class and is only manufactured by one company. The company is Victor Model Products, 12260 Woodruff Avenue, Downey, CA 90241, 310-803-1897.

More Hints and Tips

There are many pictures and tips in the Soling One Meter Yahoo Discussion Group
at http://groups.yahoo.com/group/solingonemeter/
and
http://photos.groups.yahoo.com/group/solingonemeter/

Upcoming Regattas

See the AMYA Regatta Schedule.

This page maintained for the Soling One Meter Class by the AMYA Webmaster

Soling Building Tips

Last Updated: March 02, 2003

This document is always under construction. It was started by Jack Gregory and is currently maintained by the AMYA webmaster. Feedback, contributions of pictures and text, and encouragement is always welcome.

[News Flash: It has been reported that some of the new removable keels have been stripping their mounts and removing themselves to the bottom of the pond. Before installing a removable keel, be certain the screw is not tightened so much it splits the wood. Victor has gone to plywood for the keel spar for this reason. 27-Feb-1998 JGG]

For a nice brief on strengthening the forestay screw-eye mount, see Soling Eyes

Contents

There are many pictures and tips in the Soling One Meter Yahoo Discussion Group
at http://groups.yahoo.com/group/solingonemeter/
and
http://photos.groups.yahoo.com/group/solingonemeter/

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1. Background

The Victor Soling 1M was first sold in 1985. Since that time, more than 5,000 Solings have been sold.

A concerted effort to make the Victor Soling 1M an AMYA recognized class began in early 1993. The effort was the outcome of a search for a "club boat" by the Minuteman Model Yacht Club in Needham,

Massachusetts. The Minuteman club had determined it needed a low-cost, entry-level RC yacht to attract new members. Since none existed within the AMYA system at that time, the search was broadened to include non-AMYA boats, with the proviso that the club pursue acceptance of the selection after it was made.

Based on many favorable comments from Stowe, Vermont and other sites, the Victor Soling 1M was selected. At the time, the AMYA process required 20 AMYA members to sign up for the class to have it be recognized. Once that occurred, the AMYA president would appoint the initial class secretary. Art Jacobsen of Avon, Massachusetts agreed to become the initial class secretary. All that was required was a set of class specifications.

In order to create a set of class specifications, a technical committee was formed based on names provided by Curt Wright of Stowe. During the winter and spring of 1993, a series of proposals and updates were hashed about by the technical committee. The committee was fortunate that there had been informal sets of rules that had been in use for some time. The resulting rule set was finalized in June 1993. The current rules can be found on the web, and are not included here because they are subject to tweaking over time.

The philosophy of the Soling One Meter class is to provide a low-cost one-design model suitable for introducing newcomers to the hobby, as well as provide enough performance to keep long-time model sailors interested. These goals were met admirably by the Victor product, and the class has become one of the largest classes in the AMYA in just one year, with large fleets in New England and Florida.

This is eventually intended to be a book-length document that is profusely illustrated. It is intended that it will be sold by the Soling One Meter class association as a way to encourage the development of the class as well as cover expenses. Anyone who can help in this endeavor is encouraged to send me text and graphics in electronic form. If you have a pet building trick, tuning note, or other Soling-specific comment, I would love to have it included.

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2. Building for Performance

The Soling One Meter sails very well when built properly. Because it is so often used in one-design competition, it is critical to build it correctly, as every flaw will turn into a disadvantage on the water. The beginning skipper generally has difficulty in appreciating the relative merits of building decisions. This section is an effort to bring that skipper up to speed.

A word of caution, though. Nothing you can build in the boat will make it win. A good skipper can win with a poorly built boat, and a poor skipper will lose with a rule-breaker. Even tuning (setting the sails to the conditions) is more important than building. If your boat loses its first 10 races, don't despair. Eventually you will see improvement, and after that, you will probably be the one telling the beginners that it isn't their boat!

Weight Distribution

The most important factor in one-design racing yachts is weight distribution. The primary goal is to have all the weight as low as possible. Two boats with the same mass will perform differently if one has a lower center-of-gravity (CG). The lower CG will keep the boat more upright in a given condition. A more upright stance presents more sail area to the wind, and provides more resistance to gusts.

A secondary goal is to have all the weight near the center of the boat. A boat with its mass concentrated at the center will provide less resistance to turning, making it more maneuverable. But it is also more easily turned by the waves, and requires closer attention to steering.

Fore-and-aft weight distribution affects how the boat sits on the water. The Soling One Meter is sitting correctly if the bottom of the transom just breaks the surface. You can often adjust the waterline slightly by placement of batteries. In the standard setup, the batteries seem to be best placed in front of the forward bulkhead.

The plans call for 6-1/2 pounds of lead shot. Many builders are using 6-1/4 pounds because the shot comes in 25 lb bags, and they can get 4 boats worth out of them. The AMYA rules require the boat to be at least 10 pounds ready-to-sail. Experience has shown that a moderate amount of strengthening inside the hull, a 6-1/4 pound load of shot, and a Futaba radio installation with Airtronics winch will bring a boat to about 9-3/4 pounds. The remainder usually is made up by adding lead inside the hull, which is not as ideal as in the keel. The drawback to putting the lead in the keel is that it can never be taken out or moved. Sometimes having a little lead to put in the hull is a good thing.

You should not be too casual with the weight. Many people have done the above and came out with a 10-1/4 pound boat. That is a perfectly reasonable outcome, but it is not as light as allowed. You should always strive for that minimum weight. Otherwise you will always be blaming it on your "bad thumb" days. Even painting the hull weighs something.

Alignment

Because of the method of construction, the Soling One Meter can be built incorrectly by misaligning the keel to the hull. Great care should be taken to ensure that both have the same center plane. This means not only do the fore and aft points of the keel have to lie on the hull centerline, but the bottom trailing tip of the keel must be directly under the hull centerline as well. You can't do this by balancing everything on the workbench! You need a jig or alignment tool. See the construction details that follow for ideas. Note that some clubs may have jigs you can use.

Another important area of alignment is the rudder. It should lie in the center plane as well. The details are mentioned in the appropriate construction section.

Durability

The one real problem with the Soling One Meter kit is that if built to the Victor plans, the boat will not last very long in heavy use. This is particularly the case with boats built by builders without a lot of experience in the materials and adhesives involved. There are 5 areas that should be beefed up:

1. The mast step. If built according to the plans, the mast step will push the deck down just behind the forward bulkhead.

2. The keel-box forward bulkhead joint. Constant flexing of the hull in use and in transport will break this joint.

3. The screw eyes. The side stay screw-eyes often aren't long enough to get a good bite into the blocks. They will pull out. Nearly all of the other screw-eye attachments are too weak, and need to be replaced or strengthened in some way.

4. The Hull-deck joint. This joint is hard to build water tight and strong.

5. The rudder block to hull joint. Another area of constant flexing that fatigues the plastic.

Ideas on strengthening each of these areas are covered in the relevant construction sections. When in doubt, add a bit more strength; the weight increase will be small, and the benefits will be large.

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3. A Non-Trivial Project

Building the Soling One Meter is a non-trivial project. There is much work to be done, and there are long periods of waiting involved. A project plan which allows other work to continue while some sub-assemblies are curing or drying is important if time is a factor.

Expect to spend at least 30 hours in construction if this is your first Soling. This 30 hours does not include several 24 hour periods between gluing an assembly and use of that assembly. In calendar time, there is probably at least a week or two of sequential drying stages, especially if you plan on doing a nice finish job. We recommend the following order of the major operations:

1. Cradle or Jig
2. Keel and Rudder
3. Keel to Hull
4. Internal Framing
5. Electronics installation and checkout

6. Deck to Hull
7. Rigging
8. Finishing

There are many minor subassemblies and time consuming work that can go on while these major steps are in process. In particular, note that all wood parts should be painted or varnished, sometimes with several coats. The entire rig (mast, booms, sails, and all the wire and fittings) can and should be worked from the beginning, during curing waits.

Materials

The materials selection in the Victor kit is based on economy, not by durability or weight considerations. You can improve a few parts at some additional cost. In general, if you are reading these words, you are probably serious enough to spend a bit more to ensure your boat lasts a bit longer and doesn't have a built-in disadvantage.

Although the Soling kit is very complete, you are required to obtain a few items: the radio, the lead ballast, and glues and paints. The selection of a radio is covered in a later section. The lead should be #8 or #9 lead shot. The rules require lead shot, and #9 is about the smallest that can be obtained and still be called "shot".

Several kinds of glues are required. A good marine epoxy is a must. The enormous amount epoxy required (the keel and rudder are literally filled with it) means a substantial investment must be made in epoxy. We can highly recommend West System epoxy.

While the West System epoxy can be used for typical gluing tasks, the slow-cure type recommended for the keel is thin and runs excessively. For wood-wood and wood-styrene bonds, we can recommend a typical hobby store 15- or 30-minute epoxy. Avoid 5-minute epoxies; they tend to be more brittle and prone to impact failure, especially in the wood-to-styrene joints required all over the Soling. You thought RC sail racing is a gentle hobby without impacts? Ha!

For styrene-to-styrene bonds, we recommend liquid plastic cement, such as that sold by Testors. The tube-type styrene cement will work, but it tends to be stringy and it is definitely difficult to apply in the minute amounts required for good joints. Styrene cements are really solvents that weld the plastic together. They do not bridge gaps or form strong fillets, so the thicker tube cement is only a problem.

CA glues can be used for many bonds. Typically, it is applied after parts are mated, and "wicks in" to the bonded area. The standard version of these glues is very thin, and dries very fast. Thicker versions exist that can bridge small gaps. CA bonds are very strong if the parts being glued make perfect contact over a large surface area. Be sure to have a bottle of the de-bonder handy whenever working with CA. It is very common to glue one's fingers together -- and don't try to get them apart without a de-bonder! CA glues don't last long after being opened, and are very prone to contamination. Water vapor alone will gum up a

bottle in a month. They are also relatively expensive.

There are other adhesives that have proved successful, and it is worth experimenting. The non-drying silicone adhesives that come in tubes for a caulking gun are light and bond well to the styrene. Their principal benefit is that they span huge gaps -- like those you will inevitable find in the fit of your vacuum-formed parts. There are probably other interesting compounds out there, and you can buy loads of them for the price of one 3/4 ounce CA bottle.

Tools and Techniques

The most important tool required is some kind of cradle or jig. This is covered in the next section.

The most important general technique required for a good strong boat is making good strong bonds between wood and styrene. CA can be used, or epoxy can be used. Both are very different kinds of glue, and require different surfaces for a good bond. Epoxy requires some surface roughness to grab onto. Bare wood is fine as is, but the plastic needs to be roughed before bonding. Use some 100-150 grit sandpaper and really work it over the area to be glued. It helps to mark the area with pencil during a test-fit. You then know where to rough, and you have a good measure on how much roughing has been done when the pencil marks disappear.

Keel Jig

By far the most import tool required for building good Solings is a cradle or jig that allows you to properly align the keel with the hull when gluing them together. Since this is one tool that no first-time builder will have, it makes sense to discuss it at some length.

The keel needs to be aligned in yaw and roll. Yaw refers to a rotation about the vertical axis. Needless to say, the keel centerline should be aligned with the hull centerline. Failure to do this results in a boat that disagrees with itself about which way it is going -- not a good idea. Roll refers to rotation about the front-to-rear axis. The keel needs to be aligned so that its vertical axis is perpendicular to the water plane. Actually, it is so heavy it will do this anyway -- but the trick is to have the mast perpendicular to the water plane as well! Because of the hydrodynamics of the situation, and the fact that the hull has a nearly circular cross section, roll alignment is less critical than yaw.

If you are building a Soling in an area where there are already several, and possibly a club racing them regularly, you might be able to borrow a jig from someone else. In fact, it is a good idea for a club that intends to have a Soling fleet to build a club-owned jig or two that serves both builders and measurers. Using a good jig removes so much of the anxiety of getting it all straight that building becomes fun, like it should be.

Another consideration in the jig is what you are going to do about a cradle. A cradle is the thing you take to the pond to prop the boat on when it isn't in the water. A cradle can be made to serve as a building jig

very easily, but you have to plan for it.

There are 2 kinds of jigs. One is a "T-bar" which is used to align the keel box relative to the hull. This type is shown in Figure ?. This assumes that your keel spar (the piece of wood that gets trapped in the keel when building) is square to the keel itself. The T-bar should be built very accurately, since any error built in will get replicated in all boats made from it. If you borrow a T-bar from someone else, check it for squareness before committing your boat to it.

The problem with the T-bar is that the keel spar may not be square with the keel. The cradle jig ensures that the actual keel and hull are square by using them directly. A cradle jig is just a cradle with provisions for holding the keel and hull in place while the epoxy cures. An elaborate jig is shown in Figure ?. It can serve as a complete building and measuring center. Note that there is almost as much work in the jig as the boat, so it doesn't make much sense to build such a jig if you are only going to be building one boat. [May 2, 1997: a PDF file containing the building jig drawing is available here. To view or print it, you will need the Adobe Acrobat Viewer, which is free.]

To control yaw, three points must be captured on the keel: the front top, the rear bottom, and the rear top. These are all practically knife-edge points. These points must all lie on the center plane. The hull must then be placed over the keel such that the bow center and lower transom center are in this plane as well. Without a third point on the hull, it is not possible to control roll accurately, but some kind of clamping arrangement that keeps the port and starboard gunwhales at the same level is enough. Since the mast is usually rigged such that the top is the same distance from the side-stay anchors on deck, ensuring that the deck is level relative to the keel will keep everything straight.

Cradle

When out of the water, most keel boats won't stand up by themselves. You will need some kind of cradle. If you decided to make a jig-style cradle as described in the previous section, you are all set. Otherwise, read on.

A sling type cradle is simplest. A couple of cloth straps across a double X-frame structure provides a foldable cradle that is very stable if the stance is wide enough. However, the Soling should not hang from its hull too long. The styrene hull is very thin, and the deck opening weakens the center. The keel base should carry most of the weight. This means sizing the cradle so that the keel touches the ground (ugh), or adding some parts for it to rest on.

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4. Hull Preparation

The hull preparations can begin at any time and happen in parallel with work on the keel and rudder, the

sails, and the spars. Since the hull interior is where most of the variations from the kit plans are found (and permitted), we will spend some considerable space discussing building options.

Marking

The first thing to do with the hull is find the centerline, and mark it in pencil. Take your time and do it right. Use string to ensure that the centerline is the same distance from either sheer line (the deck edge of the hull). Near the ends, mark the centerline on the inside as well.

Despite inaccuracies in other parts of the kit, you can usually trust that the sheer curves are at the same height. These are cut at the factory on a surface plate, with the hull inverted on a form. There have been reports of uneven sheers. Check, check, check. The transom cut is much less controlled, which is why it is often asymmetric.

Find the bottom center of the bulkheads and mark them on the flange and front face so you will be able to see them when installing them. Then mark the inside of the hull in those places that take the bulkheads, and test fit everything many times. Remember that the only way to get a good joint is a tight fit. If you don't have one, the joint will probably break, no matter what adhesive is used.

Now is the time to start planning any additional reinforcing or radio installation details. Before you glue anything other than the transom, you should have the interior completely thought out, including the details about where the rudder linkage will be, where the radio antenna will feed, where the dead-ends of the sheets will go, and so on.

Because radios, servo sizes, batteries, and winches vary, there is no one way to setup the internals. Even servo travel direction will affect the layout (unless servo reversing is available).

The important thing is to have everything planned out. This will ensure that you have strength where it is needed. So be sure to read this document through before embarking on too much building.

That @#%&! Transom

The transom of the Soling frustrates many a beginning builder. There are two reasons: first, there are no hard points to locate from; second, the transom cut often comes from the factory with significant asymmetry.

The asymmetry is easily fixed. Take a long string and tape one end securely to the center of the bow, on the outside. You will be using this string quite a bit, so do it right. Glue it if you have to. Now find the side of the hull at the transom that is closest to the bow. Using the string as a measure, mark off the same point on the "long" side. We have seen this to be as much as 10mm in front of the transom cut!

The short side and the the mark are what you will align the transom to. Place the transom in position and secure it with a few pieces of tape on the inside. The transom flanges go on the INSIDE. Then take a pencil and trace on the hull around the back of the transom. Remove the transom piece and cut the hull back to this line. Now your hull is at least symmetrical. While doing this, check to see that your hull is going to be 1 meter long. Don't let it be longer, but don't cut off too much, either. Don't forget to have the deck on when measuring overall length.

The transom should be glued with liquid plastic cement. You need to tape it firmly in place on the outside and wick some liquid plastic cement in everywhere you can. Then add a 1/16 inch styrene tube or rod up against the inside of the flange. Cement it in place and use tape to make sure it stays while everything dries.

Near the deck line, the transom seems to want to try to bring the hull in too far. Don't glue too high, just let the top half-inch or so be unattached. When it comes time to put the deck on, we will want to fill the gaps that happen in this area, but for now, don't touch the hull for 24 hours.

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5. Keel and Rudder

The keel and rudder of the Soling are similar in construction. Each is made from two sides of styrene with a post of some kind trapped inside and sticking out the top. Both should be filled with epoxy.

The keel halves should be prepared by first roughening the entire inner surfaces with coarse sandpaper. Then the two halves should be *flat-sanded*.

Flat Sanding

Flat sanding ensures that the two halves will meet throughout their intended region of contact. As received from Victor, the halves are usually pretty close to final shape. To bring them to final shape, tape an entire sheet of 320 or 400 grit wet/dry (the black kind) sandpaper to a flat surface. The tape should cover the edges of the paper. Then make little masking tape "handles" and attach them to the outside of the keel half. Using the handles, push the keel half around on the paper until all edges have been trued. It is best to concentrate on one side at a time, but putting pressure on it as you move the part; the fine grit will prevent you from sanding away too much. Do this to both halves. When flat-sanded correctly, the keel halves will meet at the seam without any gaps.

Keel Assembly

Using the Victor plan, draw a pencil line on the inside of both keel halves where the post leading edge should lie. Then place the post in place with the correct amount appearing beyond the part, and trace the

bottom and back edges onto the keel half. Draw another line on the post itself on where it passes the top of the keel half. Put all these lines on both halves and both sides of the post. These lines will tell you where to rough up the plastic and where to put the epoxy. They also serve as a guide when clamping.

Rough up both halves in the area that the post will contact. Mix up a batch of regular epoxy and attach the keel post to the starboard half of the keel. Use blocks to distribute the clamping force over the entire area. Ensure that the outside block does not extend beyond the bottom of the post. While tightening up on the clamp, ensure that the post is still where the pencil lines say it should be.

After the starboard side has set, you can epoxy the port side to the post. The key here is to line up all of the edges of the two keel halves. To do this, after putting epoxy on the post, place the port keel half over the starboard and use masking tape to attach the two sides to each other. The tape will tend to force the mating edges to align with each other. Then put the blocks and clamp on, and set aside to cure. Don't try to glue the keel edges yet.

After the epoxy is completely cured (overnight, at least), remove the tape along the edges of the two keel halves. Starting at the top front of the keel, brush on a stroke (2 to 3 inches) of liquid cement. Wait 5 seconds, then squeeze the area just wetted together. You should see a slight ejection of melted plastic along the seam. Holding the squeeze, tape over the edge just glued to hold it. Do the same for the next section, and so on, proceeding all the way around the keel. Set the entire assembly aside to dry at least 12 hours.

At this point, you should have a hollow keel assembly that is fairly light. Don't sand, file, or do anything else to the plastic seams. You may even want to leave the tape on. The lead shot and epoxy pour can crack the seam; you don't want to weaken it.

Rudder Assembly

The rudder halves need to be rough-sanded on the inside. Mark on both halves the point at which the rudder post will emerge based on the plans. Then take the rudder post (actually a tube) itself and mark off 2 inches from each end. One of these is the bend point, and the other is the point marking the insertion depth into the rudder. With a light hammer, tap the lower section flat, tapering from full round just above the bend mark to completely flat at the bottom.

Place the post in place against one half without glue, and sandwich it between the other half. Tape the two halves together in a few places to hold pressure on the shaft. Then take liquid cement and, like the keel, do a little bit at a time, taping and clamping with close pins until the entire seam is done. Leave this assembly to dry overnight. The post can be removed after that; it doesn't get glued in until the epoxy is poured, but it is needed to get the proper shape. Again, don't clean up the edges of the rudder until after it is filled with epoxy.

Lead and Epoxy Pour

The West System of epoxy is strongly recommended. Although the expense is staggering, the quality is unsurpassed. Use slow-curing epoxy! In the West brand, use 105 resin with 206 hardener. These are not 1:1 mixes, but 1:5. West even sells nice little pumps to ensure the ratio is exact. I strongly recommend you get them as well as one of the little syringes that allow squirting epoxy into tight places, or, sucking it out. The little pumps and syringes are frills to be sure, but they really make the whole pour process fun.

You can use other epoxies, but the heat released during the keel cure can destroy the parts. Don't underestimate this! You will ruin your keel. With the slow-cure, the keel barely gets warm. If you really want to use normal curing epoxy, you need to take steps to cool the part while curing, either outdoors in winter, or in the refrigerator.

Since the keel and the rudder are the only use of the West epoxy, it helps to do them at the same time. To prepare the parts for the pour, tape wax paper around the openings so that stray spills don't get on the parts. Then prepare a place where the parts can STAND UP while curing. The slow-cure epoxy is fairly thin. It can leak out through cracks and such. Make sure you have wax paper under the parts until cured.

Get the lead shot ready. It should be all weighed and in a suitable pouring container. Get a long shaft ready to do the tamping. This needs to be long enough to reach the bottom of the keel and thin enough to get through the top. Get a flashlight. You use it to look down and see how things are going inside. You don't really want to pick the keel up during the process.

Start by pouring a bunch of epoxy into the keel. Then pour a little bit of shot and tamp it into the epoxy. Don't tamp too hard! You will break the keel seam and epoxy will start pouring out the bottom. This is Not Fun. Try to keep the top of the pour wet; don't pour in so much shot at a time that the shot makes a dry mound inside the keel. This method will reduce the air trapping to a minimum. Keep pouring epoxy and shot until you run out of shot. It should come up to the bottom of the post. As a general rule, put more in front of the post than behind it. I don't know what ideal is, but it seems better to err with having the weight toward the front. Finally fill the keel with epoxy; right to the top. The level will go down after the trapped air rises and leaves, so you will want to fill in the trough the next day. You can use regular epoxy for the top-off job.

We should note here that some enterprising builders are not filling the rest of the keel up with solid epoxy, but are using microballoons or some other filler to make the rest of the pour much lighter. You can put more lead in if you do this, but we don't recommend playing too many games like this in your first boat. Championships have been won with boats built to the plan; don't get carried away with lowering the CG.

Now inject the epoxy into the rudder, filling it up. It doesn't get any lead. You don't HAVE to do this. You could just epoxy the post in and make an air-filled rudder by capping the top with some styrene. This will have the effect of moving the CG forward. It may also give you a rudder that floats, which is useful if your setscrew ever lets go.

Wow!

It never ceases to amaze builders how heavy and dense these keels feel the first time they are picked up after curing. You have to take extra care not to drop it. Always carry it with the bottom held deeply into the palm of one hand. It seems silly to have to say this, but dropping and breaking the keel is common enough that it is clearly necessary. It is heavy and sharp enough to go through your foot as well; consider yourself warned.

Something neat to try is to hold the keel up to a bright light, so you can see through it. You will see where the lead shot is and where it isn't. Should have tamped a bit more, eh?

Finishing

When all is cured, it is time for the sandpaper. Use water and wet/dry sandpaper, starting off coarse and going to 400 or 600 grit to finish. If you are going to paint, use 600 grit on all exterior surfaces to get the primer to grab. Don't over-sand the seams, or try to "fair" them. Just make the seam smooth and leave it at that. It is illegal to shape the keel beyond the boundaries of the plastic shell.

The tops of both appendages need to be level. The keel generally comes out a little higher on one side than another if you lined the bottoms up. You need to carefully bring the high side down to the other side. This is tricky with the wooden post in the way, but it is important to get a really strong keel-hull joint. Spend some time on it!

A finished keel weighs about 7 pounds (6-1/4 load).

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6. Hull Internals

We now come to the most important part of the building process. It is where most of the variability is allowed by the rules, and it is where most of the strength is built in. There are many things a Soling hull is trying to package:

1. Mast support
2. Rudder post support
3. Backstay support
4. Forestay support
5. Sidestay supports
6. Sail winch
7. Rudder servo
8. Receiver

9. Batteries
10. Keel support
11. Sheet fairleads
12. Sheet dead ends
13. Power switch

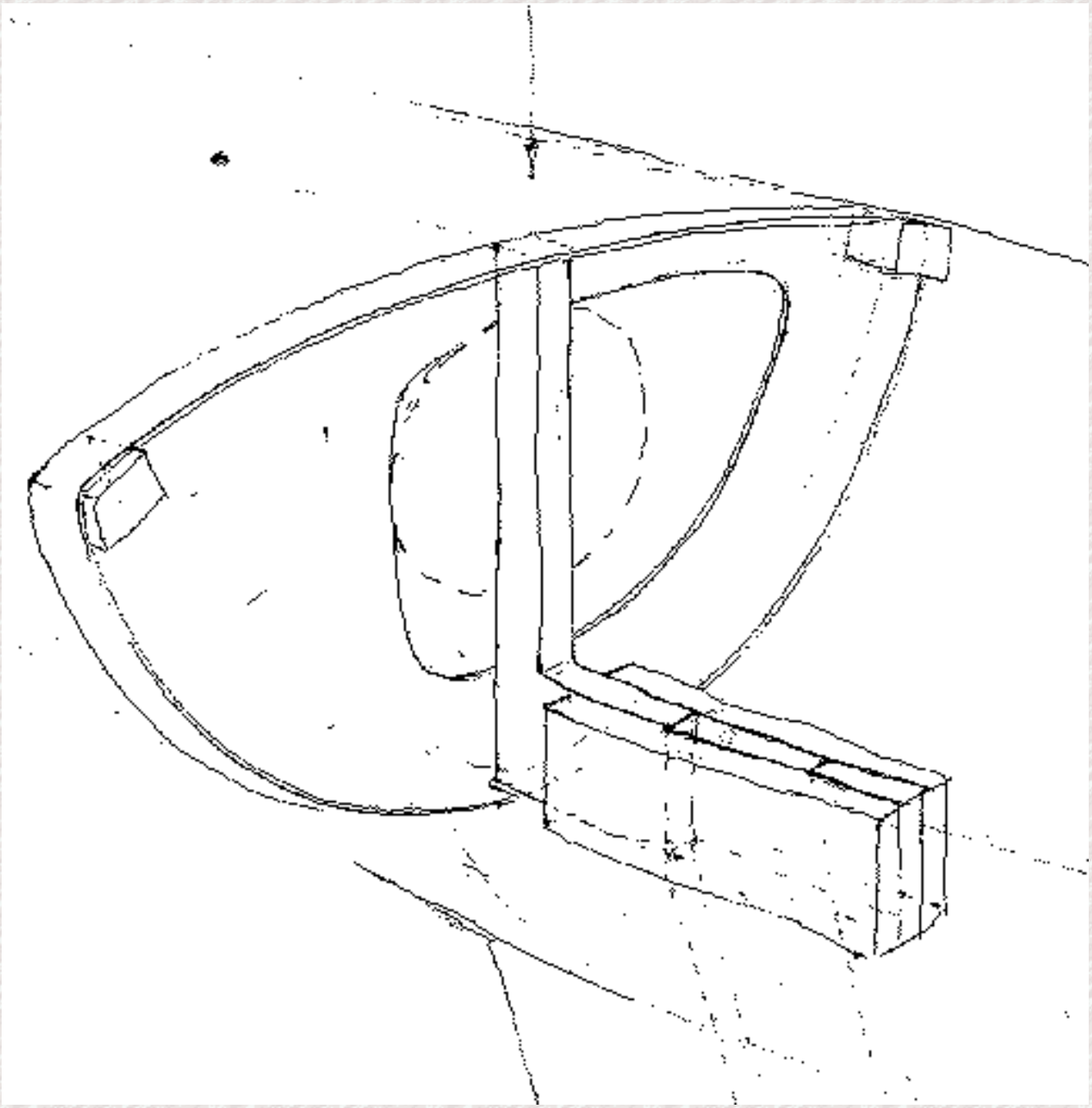
Building provision for all of these into the hull is not too difficult, but it is easy to screw up if you haven't done it before. That is why you are reading this, after all. The next chapter discusses some of the electronic layout provisions. This chapter will cover what we call the standard installation. It is by no means the only one, in fact, it is different from that shown in the Victor plans.

The standard installation packages a swing-arm type winch. This is the easier winch to deal with for beginners, and some experts prefer it as well, though drum winches are very popular in other classes.

The considerations involved in hull internals construction is mainly the support of the winch and rudder servo, and ensuring the mast step is firmly supported, the keel is rock solid, and the side stays are anchored firmly. The backstay and jib swivel actually see very low forces (less than 10 pounds), so they are not specifically strengthened.

1. Mast Step

The current recommendation for this is to support the mast with a "hockey stick" which is just a mast strut that goes from under the bulkhead flange to the keel, just ahead of the keel box. The following sketch shows this feature. The lower part of the stick forms the front inside part of the keel box. The drawing shows the stick probably a little too far ahead; the back of the upper part is probably right at the front edge of the keel box. This sketch shows a few other features as well: the blocks under the side stay screw-eye locations, the cutout of the bulkhead on the starboard side to clear the jib sheet, and the non-cutout on the port side, where the radio receiver is mounted with velcro. Another reason to cut out the bulkhead to starboard is to be able to get a hand up forward, for access to threading sheets or adding trim weights.



Note that the above drawing does not show the "new" bulkhead style (1997) which has a little "dip" in the center to clear a small mast support block. The presence of this block will certainly help, but in my opinion, will not solve the long term load problems at this position.

<lots more to come>

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7. Electronics Layout

The standard installation places a swing-arm winch as low as possible in the center behind the keel box.

The rudder servo is placed on the starboard (right) side of the keel box. The receiver is attached to the front bulkhead via Velcro on the port side, and the antenna proceeds from it up a hole near the mast step. The switch is on the underside of the deck, on the port side of the hatch opening. The hatch must be lifted to turn the boat on or off. The batteries are wrapped in a condom and Velcro'd to the hull just in front of the front bulkhead.

This arrangement does a number of good things. It maximizes the exposed antenna length, keeps the receiver (which is light) up out of any water, and it keeps the servos low. The switch is also high and out of any water, and still easily accessed through the hatch. The batteries can be moved more forward (on a strip of Velcro), or back to the port side of the keel box to change the weight distribution.

<more to come>

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8. Spars and Rigging

The rig is a very important part of the Soling. Since the sails are flat (unpanelled), the only shape that can be given to them is provided by the tuning features of the rig. It is very important to make sure nothing prevents a full range of sail adjustments. You are not required to use the 2-piece mast as provided in the kit. However, the scarf-jointed kit mast can be made into a winning mast, so don't bemoan the aesthetics of a kit being made to fit a box rather than the other way around.

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9. Finishing It Off

The Soling can be painted or left as is. Painting or marking of some kind is strongly recommended. There are too many white Solings floating around, and you will invariably come out of a dense pack sailing someone else's boat. If you insist on a white boat, or no paint for weight reasons, then do something distinctive, like paint or dye the top of the sails.

See the AMYA Soling 1M photo page for some examples!

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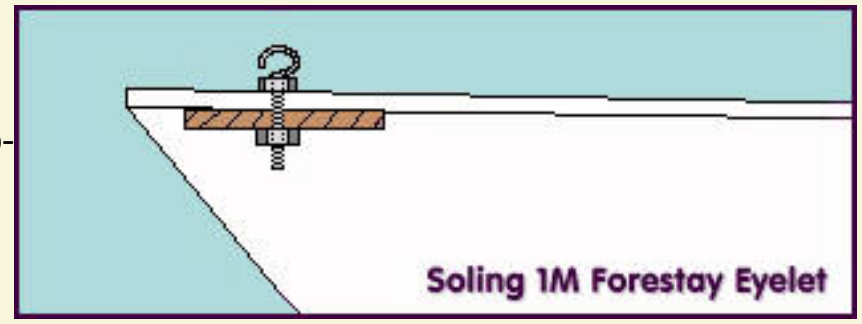
Improved Rigging Attachments For the Soling 1-Meter



The drawing shows how you can improve the strength and dependability of the mast rigging-to-hull attachments. The small wood-screw eyelet that is supplied with the model for attaching the four points on the hull, over time, can pull out. Once that happens, it is difficult to get them to stay again. Epoxy might help, or you can go to a larger eyelet.

The eyelets I used are 1-inch by 4-40 threaded eye bolts, available from model shops (Sullivan No. 549) or hardware stores, either in steel or brass. The ones I got came in a package of four; just right for the forestay, backstay, and two shrouds. Since I used the nut on top of the deck as well as below, I had to purchase an extra four size 4-40 nuts. Having the nut on the top of the deck allows me to tighten them up from the outside, in the unlikely event they come loose.

I used a 1.5 X 2.75-inch piece of 1/4-inch pine under the deck for the forestay, and other spare pieces of the same material for the other points. I put a drop of epoxy on the bottom nuts to keep them from back off.

The probability that the rigging will collapse remains likely, but it certainly won't be because of the hull attachment points!

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Soling Tuning Tips

Last Revised: February 28, 2003

Most of this content was provided by Carl Olbrich. I have added comments in square brackets where I thought it was appropriate. We welcome others to add their comments as well.

[Sailboat tuning ***is*** a science. But practicing it as a science requires very careful measurement and recording, and most of all, some basis for comparison. These are extremely difficult things to do in this hobby, so any tuning advice must be general in nature. Where you find dimensions and other details in the advice that follows, they should be used as a starting point. In all cases, we have tried to indicate how to correct problems. And don't forget the skipper, who must be "tuned" as well. Go sailing!]

Fore & Aft Trim

The Soling One Meter is sitting correctly if the bottom of the transom just DOES NOT break the surface of the water with everything on board. Adjustment of batteries fore and aft can help give you the desired setting. [Alternatively, if your boat was built under 10 pounds, the corrector weight can be moved to adjust the trim.] Batteries can be split into two units by wiring in series. Then store the batteries with velcro on either side of the keel support. They can be mounted outboard as far as possible as the center of gravity of the batteries will still be over the keel and it (CG) will be much harder to move. The batteries can also stored forward of the bulkhead if needed for trim.

[This will be moved to the building section.] The lower the center of gravity the better the boat stands up to the wind. Keep all interior weight as low as possible. Glue a narrow board (part of a paint stick) to the hull from the keel support back. The sail winch and rudder servo can be mounted on a narrow board which can be attached to the paint stick with velcro or small screws. Keep as much weight to the center of the boat (fore & aft) as this will make it more maneuverable. Also balance side to side.

Rudder

Set the rod to the servo in the middle of the holes on the arm. Try out the boat for how much movement the rudder has. Adjust this setting depending on how fast you want your boat to respond. Too fast a response will slow the boat down until you become proficient with the controls. On land stand behind the boat and with the radio control on (lever r/h side and spring loaded) check to see if the rudder is centered and aligned with the keel. Using the small trim tab on the radio, check to see if the trim tab moves the rudder equally on both sides. If not loosen the set screw and adjust the setting. This is critical because eventually you will at least sail to windward just using the small trim tab when boat is properly trimmed.

[Not all skippers sail with the trim lever, but you want to be able to do it.]

Mast

Use second or third hole for mast at base. Generally forward hole is not used. Set mast straight or slightly aft rake. Set this by using the jib headstay bowsie and backstay bowsie.(@45-3/4 inches above deck on the mast, a line to the bow would be approximately 49 inches long) Deck to jib stay eye attachment no more than 45-3/4 inches (including base jack). Jib forward eye at deck can range from 3-5/8 to 4-7/8 inches from bow. The closer to the bow for the eye will give you a bigger pocket between the jib and mainsail. Then with the backstay loose take up slack in the side shrouds by using the base jack. Do not over tighten the jack - snug side shrouds only. Snug back stay tension. Back stay tension effects how the jib boom lifts in a strong breeze due to the jib headstay being forward of the attachment point to the boat. A tight backstay holds the jib boom down and a loose backstay lets the boom lift up spilling wind.

Sail Shape

Jib setting at the the boom should have a generous curve. 1 inch at center of foot. (outhaul tension). Mainsail at the boom should have a generous curve but not quite as much as the jib. (outhaul tension). Reduce the curve in heavy wind. Stretching the sails (jib or main) up toward the top of the mast is not required, they should be snug without wrinkles.

Sheet Tension - boom alignment

Jib boom should be 10 degrees wider than the mainsail to the centerline of boat. Jib boom should point to the shroud eyes. Mainsail boom should be close to the centerline but don't pull the boom down to kill the leech or completely flatten the sail. Mainsail boom should point to the corner of the intersection where the transom and side meet. Adjust the sheet bowsie on each boom so that the fine adjustment on the radio control is at mid-point on the adjustment with the booms set as suggested. With an Airtronics 94581 winch, the longer arm should be set up for the jib sheet. [Yikes! I have never seen this.] Lay the boat on its side and check to see if the pocket between the jib and the back curve of the mainsail is uniform in clearance from bottom to top.

Boom Vang

In light air the boom vang should be snug but let the boom come up slightly with the sail amidships. In heavy air the boom vang should be looser to permit the boom to lift and spill air.

Other Points

- Mainsail should be loose at the mast , not pinned up against mast.

- Eye hooks on booms for jib and mainsail sheets should be over sheet holes in deck.

The Slot

The space between the aft edge of the jib and the mainsail is called the slot. Moving air through this point makes the sail work.

1. Jib sheet boom angle controls part of it.
2. Backstay tension controls a lot of it.
3. Use only the upper eye hook on the mast (where the jib headstay is attached) don't use the lower eye hook to pull up the sail as it kills the pocket.

[The slot cannot be properly check with the boat lying on its side, because the sails are responding to gravity, not wind. If you can set it up on a stand with a slight heel, you will be able to see how backstay tension affects the slot. I use as little backstay tension as possible, because it seems that the Soling "likes to breathe", which means it sails better when its slot is more open. Don't attempt to get a nice, thin slot like an America's Cup boat. It won't work, and besides, you don't have an overlapping jib.]

[More on Jib/Main Tuning

Pay attention to when your jib luffs relative to your main. You want the main to get "light" first. That will allow you to point as high as possible. Another thing that helps pointing, but seems to hurt everything else, is backstay tension. A higher backstay tension will straighten the forestay, but it will also close the slot. It is a delicate balancing act to find the right compromise. The simplest way to adjust when the jib or main luffs is to adjust the sheet lengths. This is why I recommend running the "dead ends" of the sheets out on deck, for easy adjustment.

When you win a race, don't make any changes in your rig. Wait until you lose to start messing around. I have seen too many winners de-tune their rig right after a win. If it ain't broke, ...]

Troubleshooting

[**Problem**: Boat consistently loses races.
Solution: Replace skipper with one with more experience. Alternatively, have existing skipper sail more often. These boats are close enough in performance that the skipper is 95% of the sailing equation. Don't underestimate the value of thumb time.]

Problem: Boat rounds up to windward on both tacks. Constant rudder is required to hold course.
Solution: This is called "weather helm". It means the center of the forces on the sails is too far aft, and the boat is acting like a weather vane. Some tendency for weather helm is natural in heavy air; don't be

concerned about yaw during gusts. Adjust for the average conditions. Some skippers like having some weather helm; it helps them follow lifts. Don't overdo this, however. There are several solutions to this problem:

1. Rake the mast forward by lengthening the backstay and shortening the forestay. Make sure you have the adjustability on these lines to do this.
2. Change the relative position of the main and jib. For weather helm, either make the jib sheet a little shorter, or make the main sheet a little longer.
3. Loosen the vang on the main boom, increasing the twist and dumping more air out. This solution should generally be a last resort in heavy air.

Problem: Boat falls off to leeward on both tacks.
Solution: This is called "lee helm". It means the center of the forces on the sails is too far forward. Do the opposite of the weather helm case above. Some tendency for lee helm is natural in very light air; don't make adjustments for it unless you are sure it is correctible.

[Problem: Boat rounds up to windward on one tack, and falls off on the other.
Solution: This could be any one of several things, or combinations of things. Go about checking them methodically, constantly re-testing to see if you are making progress.

1. Check the rudder for centering. Sometimes your trim lever can get moved inadvertently. The best test is to remove the rig and push the boat across a pool or other calm surface. If it turns at all, you have a problem. Adjust the trim. If it will only go straight with significant rudder trim, the keel could be on crooked, or there is some other asymmetry, like a leaf stuck on one side (it happens!).
2. Check the mast for port/starboard leaning. There could be some damage that has gone undetected, like a screw-eye partially pulled out.
3. Make sure the keel hangs down in the same plane as the mast, and the deck is level. This problem can't really be corrected, so hope that you don't find anything!

A properly tuned Soling should hold its course sailing to windward in a moderate breeze with no rudder input at all.]

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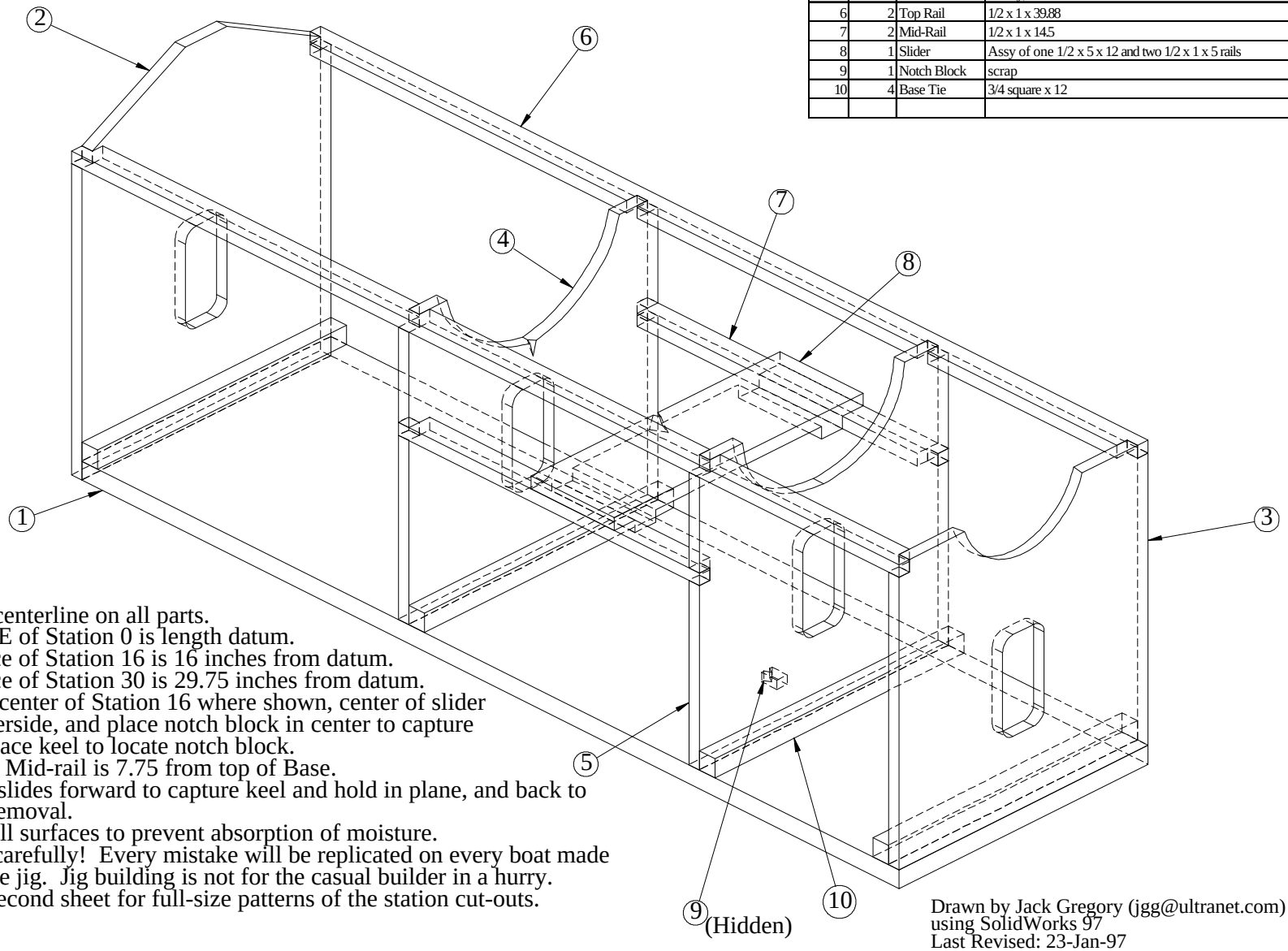
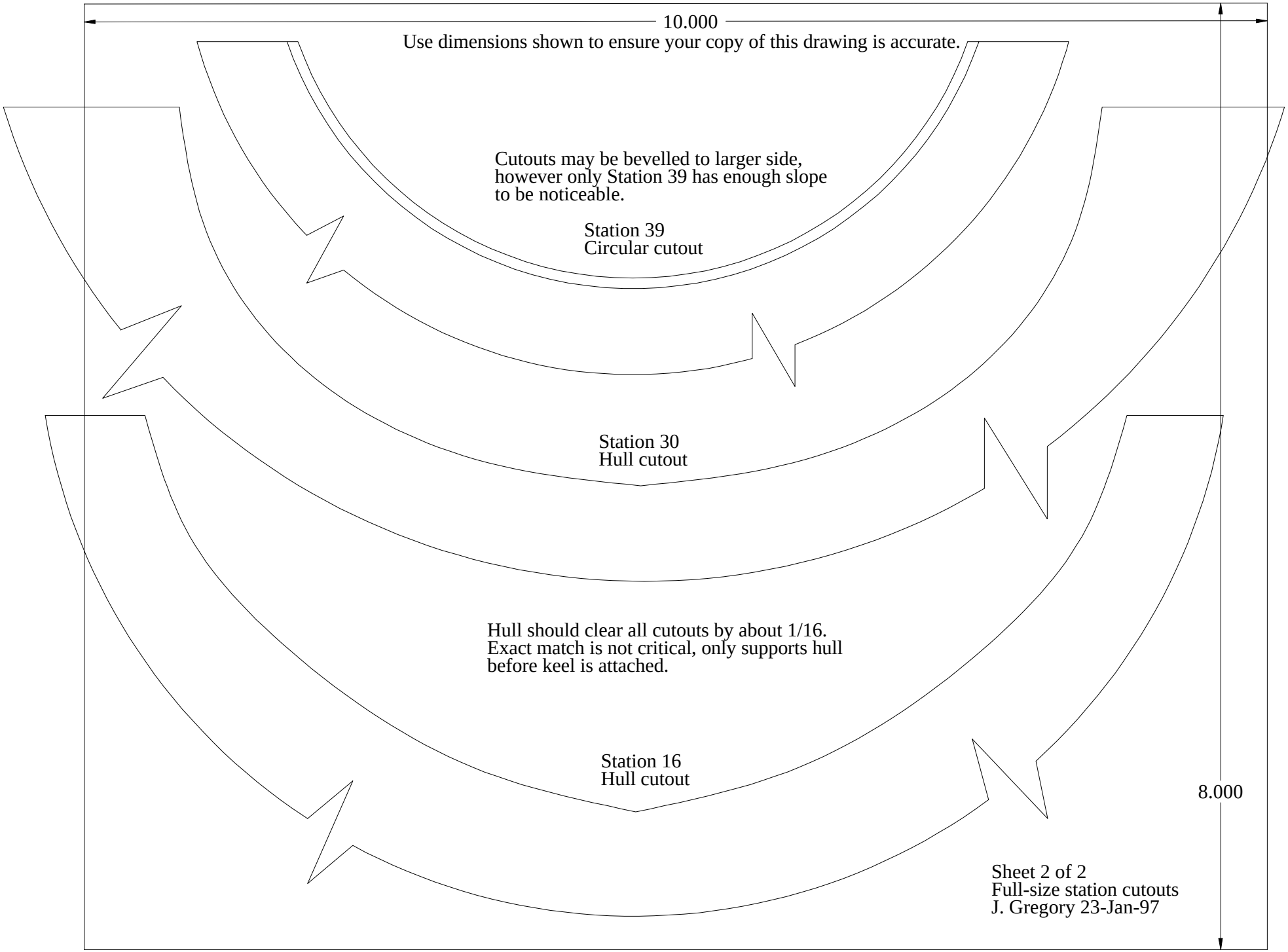
Soling One Meter Building Jig

ITEM	QTY.	PART	DESCRIPTION
1	1	Base	3/4 Ply, 12 x 39.38 (1 m)
2	1	Station 0	1/2 Ply, 15 x 12
3	1	Station 39	1/2 Ply, 12 x 12
4	1	Station 16	1/2 Ply, 12 x 12
5	1	Station 30	1/2 Ply, 12 x 12
6	2	Top Rail	1/2 x 1 x 39.88
7	2	Mid-Rail	1/2 x 1 x 14.5
8	1	Slider	Assy of one 1/2 x 5 x 12 and two 1/2 x 1 x 5 rails
9	1	Notch Block	scrap
10	4	Base Tie	3/4 square x 12



1. Draw centerline on all parts.
2. INSIDE of Station 0 is length datum.
3. Aft face of Station 16 is 16 inches from datum.
4. Aft face of Station 30 is 29.75 inches from datum.
5. Notch center of Station 16 where shown, center of slider on underside, and place notch block in center to capture keel. Place keel to locate notch block.
6. Top of Mid-rail is 7.75 from top of Base.
7. Slider slides forward to capture keel and hold in plane, and back to allow removal.
8. Paint all surfaces to prevent absorption of moisture.
9. Build carefully! Every mistake will be replicated on every boat made from the jig. Jig building is not for the casual builder in a hurry.
10. See second sheet for full-size patterns of the station cut-outs.

Drawn by Jack Gregory (jgg@ultranet.com)
using SolidWorks 97
Last Revised: 23-Jan-97


10.000
Use dimensions shown to ensure your copy of this drawing is accurate.
Cutouts may be bevelled to larger side,
however only Station 39 has enough slope
to be noticeable.
Station 39
Circular cutout
Station 30
Hull cutout
Hull should clear all cutouts by about 1/16.
Exact match is not critical, only supports hull
before keel is attached.
Station 16
Hull cutout
8.000
Sheet 2 of 2
Full-size station cutouts
J. Gregory 23-Jan-97