Soling Building Tips II

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Introduction

The following are some lessons learned and experience gained in building a Soling kit. The plan developed is based on the issues discussed on the various Internet sites devoted to the Soling. Many of the solutions presented are not new just collected into one document.

Bear in mind that these are somewhat arm chair quarterbacking as my boat has not been finished and sailed.

The issues and problems with building and sailing the Soling kit are well defined in http:/www.ultranet.com/~jgg/s1mbuild.thm (Ref 1) and Yahoo/clubs/soling.

The only problem area that I have to add is the fit of the two main bulkheads. Installing bulkheads flush with the hull top /deck results in gaps to the lower hull on the centerline. Pushing them down into the hull results in hull distortion that is a bigger problem. Additional structure is therefore needed to ensure a continuous bulkhead to hull/deck interface.

Keel alignment/Building Jig

The requirements for keel alignment are clearly set out in Ref 1. There has been a lot of discussion on the need for the jig and the alternatives in the Yahoo Soling Club.

I decided to make a jig. Used foam board for the 4 station frames. Foam board (available from OfficeMax or other stationary store) has the advantage that it is rigid yet you can cut it easily with a knife. I took 4 hours and $5.00 to build.

Lessons learned were to apply center line marks on all surfaces front and back Also to have large cut outs for sighting and checking alignment during build.

My problems started when I came to use the jig.

1.0 Hull cut outs in the jig frames does not match the hull shape.
2.0 During installation of the keel the hull is to be lifted up off the holding points. (At this point what is the contribution of the fixture?)
3.0 The notches in frame 16 and the sliding bar are the critical alignment feature. However they are fighting the slot in the hull, which also aligns the keel. It is poor practice to have two types of locator schemes controlling one feature. Something has to give.

The hull slot looks to be well aligned to the hull centerline. It is probably consistent and accurate and can be used for alignment as it is put in by Victor tooling during hull fabrication. The sliding bar control in the fixture is therefore an un-necessary feature.

4.0 It is important to go back and decide the characteristics we are trying to control. The key feature is to ensure that keel is not rotated about a vertical centerline relative to hull. That is hull and keel centerlines are parallel in plan view. Miss alignment here will result in added drag, steering problems and different performance on each tack.
Angling of the keel to the hull in the front /rear view is less of a problem. Will slightly change the righting moment on each tack. Full size yachts move the keel laterally underway to increase righting moment so it cannot be a big issue.

After reviewing the subject the process I used was (Figure 1):

1 Use the hull slot to align the keel to the hull at the hull joint. Add some loose shot in keel to ensure the keel hangs vertically.
2 Mount the hull in the Victor holding cradle or make a simple hull holding fixture.
3 Add a bob weight at the bow and stern. Bob weights to end below keel and have slightly different lengths so that they can be lined up together to provide a reference line. Bob weights to be attached to a single line run over the bow and through steering hole to provide a longitudinal centerline sighting line.
An alternative if the holding fixture gets in the way and you cannot see to align the two bob weights is to add 2 additional lines. 1 in front, and 1 behind the keel location. Tape to the hull and use centerline chine for center.
4. Use plumb lines to verify keel alignment and set up.

I found this method to be simple and accurate. Alignment adjustments are small. Keel alignment was maintained after adhesives had set. Biggest problem I had was focusing on plumb bob lines. (Age related more than anything). Recommend thick black thread is used to improve visibility.

There is a need for a fixture to hold the hull during build. However this can be simplified to the equivalent of frames 18 and 30 of the building jig. Construction can also be simplified to foam board as desired.

P.S This is not a new approach. I found it in a 1976 English text on model yacht building. It is probably well known and used by experienced builders.

Fig 1 also includes a set up for mast alignment from the same source that I thought was interesting.

Hull reinforcement

After studying the durability issues listed in ref 1, the discussions in the Yahoo Soling club and studying the hardware I came to the conclusion that in addition to just providing additional

strength for durability the performance could be enhanced through the incorporation of increased stiffness to provide a rigid hull that would minimize flexing under sailing loads. Vibration of the steering rudder and keel will result in spongy steering. It will also slow the vehicle down, as vibration takes energy, which must result in a reduced force driving the boat forward.

If you want to experience the effects of increased stiffness from an automotive perspective I suggest a test drive in a Ford Focus. High body stiffness in this car results in a number of noticeable performance improvements. I suspect a similar approach will increase yacht performance. The issue is not just having a structure that will not crack or break but to minimize deflections under operational loads. This will result in increased performance.

On the Soling bulkhead 18 is cut away for access and bulkheads do not fit well. It is essential that structural additions restore strength and have a continuous attachment to the hull. Also the area forward of Bulkhead 18 must be stiffened to prevent failures.

The hull reinforcement plan I developed is shown in Fig 2, 3 and 4. The most important initial step is to draw the centerline along the inside of the hull using the steering hole, keel cutout, and centerline chine for set up. This forms an alignment reference for all future operations.

1. The first step is the gluing of the keel box. My suggestion is to first install the two bulkheads (18 and 30). This stiffens the hull and reduces the number of floating parts to be handled and adjusted. Position Bulkhead (Blkd) 18 to give a 16" +/- ¼ distance bow to front of keel. Install bulkheads flush with the top of the hull /deck line even if this leaves gaps blkd to hull at the lower centerline. This approach minimizes local hull distortions that could be an issue when the boat is finished. Align the keel and attach box with glue at positions (1) and (2) only (see sketch 2). Keel box is now rigidly fixed in place. If you try to glue along the sides of the box at this stage you run the risk that there will be gaps and the adhesive will run and permanently attach the keel.

2. Remove keel and install strips A and B. I used these parts to provide larger bonded surfaces, take up gaps and minimize bending /tension in the glue joints. Install standard kit supplied brace at the rear of the keel box.

3. Add a ply web and spruce cap to the front of blkd 18 (Parts E and F). Web material must be glued to the lower hull to restore bulkhead attachment. Bulkheads must be attached to hull/deck all the way around the perimeter to allow them to function and redistribute keel loads into the structure. I also added some local spacers to attach the blkd flanges to the lower hull (see sketch 2).

   Note that drainage holes should be provided in all reinforcements to allow any water inside the hull to drain to the center section.

4. Add a ply web and spruce cap on the hull centerline (parts C and D) butting up to blkd 18. Cut a square hole in web/blkd 18 to pass the cap and join on to the top of the keel box as shown in Section BB.

The effect of additions 3 and 4 above is to distribute keel-bending loads into the hull and eliminate reported hull cracking forward of the keel.

5. Add a ply web and cap strip at the rear of the keel box (Parts G and H) (approx 2.25 inches rear of blkd 18). Web must attach to hull along it length. Also attach to keel box.

   The goal of this extra bulkhead and reinforcing the existing bulkhead (Items 3 and 5 above) is to provide a very stiff structure that will distribute keel lateral bending loads into the hull. Provides increased stiffness and distributes loads to eliminate hull cracking

6. Complete reinforcement of Blkd 18 by adding a mast support I to transfer mast compression loads into the keel box. Cut away the bulkhead on the right hand side for access as recommended by Ref 1. Reinforce and restore bulkhead strength with parts J and Q. Q is particularly important to eliminate deck flexibility in the completed boat.

7. Reinforce Blkd 30 with an additional web to complete the joining of the lower blkd to the hull. I also added some spacers to stabilize the lower blkd flange. Again ensure you provide a centerline drain hole.

8. Add a ply web and cap to the steering block/tube (Parts L and K) Goal here is to distribute lateral steering loads out into the hull. This will both minimize local stresses at current transitions and provide a rigid structure with more responsive steering.

9. Add a stern brace (Part P) at the stern to take the backstay loads.

10. Eyebolts With all the correspondance in the chat groups relative to eyebolt pull out I don't have to say to use the threaded eyebolts with nuts available at most model aircraft stores.

11. To join the deck I added ¼ x 1/8 balsa strips around the top edge of the hull (fig 4). Positioned them so that they were flush or slightly raised from the edge. Lightly sanded to provide a surface to match the deck. Goal is to provide a larger joining surface between deck and hull where adhesive will say in place until parts are mated. Applied liberal slow cure cyanoacrylic adhesive and plastic cement on bulkheads Added deck. Held down with rubber bands and elastic straps. Went around the exposed flange edge with plastic cement and made sure I had a continuous sealing fillet. Looks good

12. Templates for the additional parts are shown in fig 4. If you want to use I recommend that you make paper templates to verify shapes before you cut material.

13. Finally seal the wood parts. I used a liberal coat of model aircraft dope to seal and covered with a coat of spray paint if required.

14. Pouring the keel.
    It would be best not to describe the mess I got into. There has to be a better method. The approach I would like to suggest is:

Pour resin in from the rear opening only. Pour in lead shot from the front opening and do not pull out the tramping tool. Goal is to prevent resin wetting the front area where the shot is being added (or at least delay until bulk of shot is in place). Once this area gets wetted with resin the shot will not fall freely. Other potential helpful ideas

- A second pair of hands during keel fill is essential. Local clean up, application of shot and pushing it down into keel.
- Frequently change the scoop being used to ladle shot. Or clean off any resin between ladles. Once the ladle gets contaminated with resin it tracks back to the bulk shot and which becomes more difficult to handle.
- Don't use a foam cup to mix resin.
- Add a band of masking tape around the top of the keel to provide a tapered lead in for the shot to flow into the keel.

Would be interested in comments on this proposal or solutions others use to fill the keel.

I should also report that I used liquid plastic cement and cyanoacrylic adhesive. However majority of joints involving wood were 2 part epoxy which will increase weight but I am old fashioned and don't trust crazy glue for key joints.

Hope this report is of interest to builders. It addresses the issues discussed in Internet chat groups. As I said at the outset these are the plans of an armchair builder who has not yet put the boat in the water. If you want further information or have comments I can be contacted at adeane@ic.net.

Soling Keel Alignment

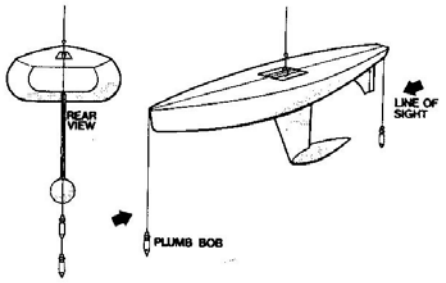


Fig. 124 Aligning fin and skeg

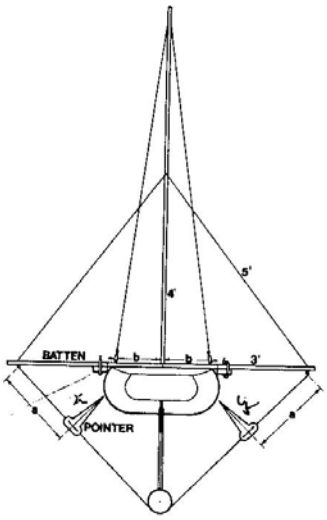


Fig. 123 Checking mast

Fig 1

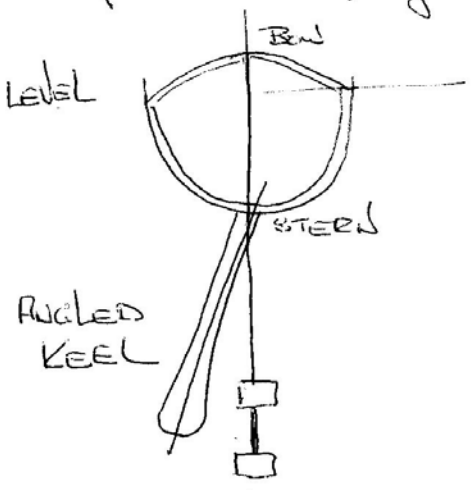
REF

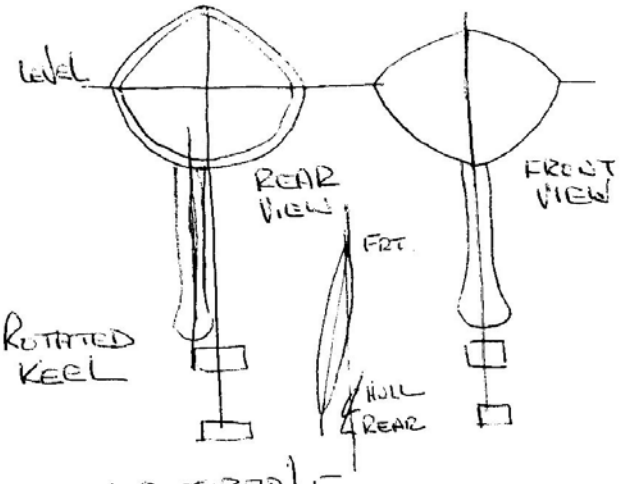
MODEL RACING YACHT CONSTRUCTION

BY R GRIFFIN

MAP TECH PUBS 1976

SHIM UNTIL $x = y$

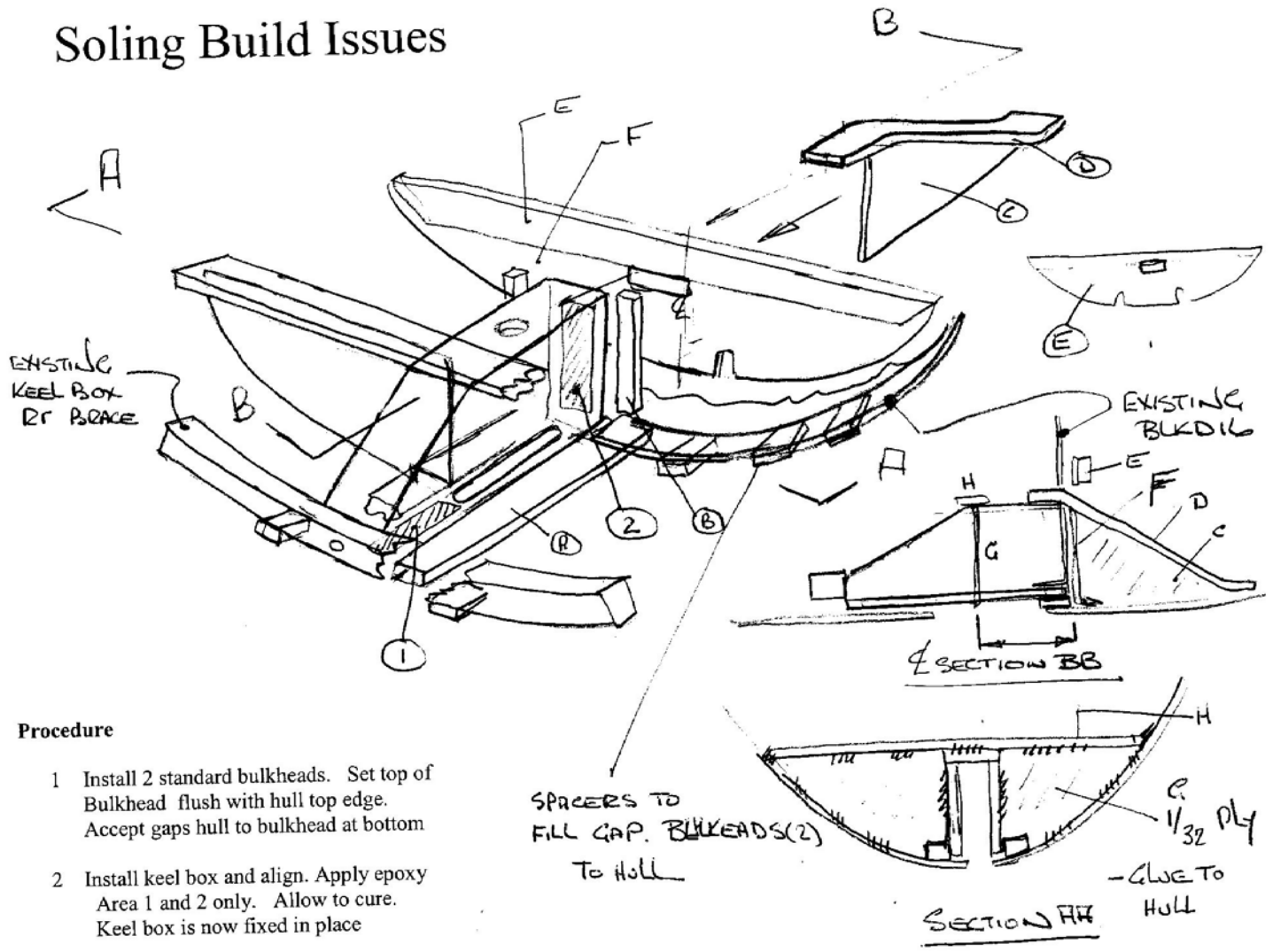




UNDESIRABLE

AID48167 JAN02

Soling Build Issues



Procedure

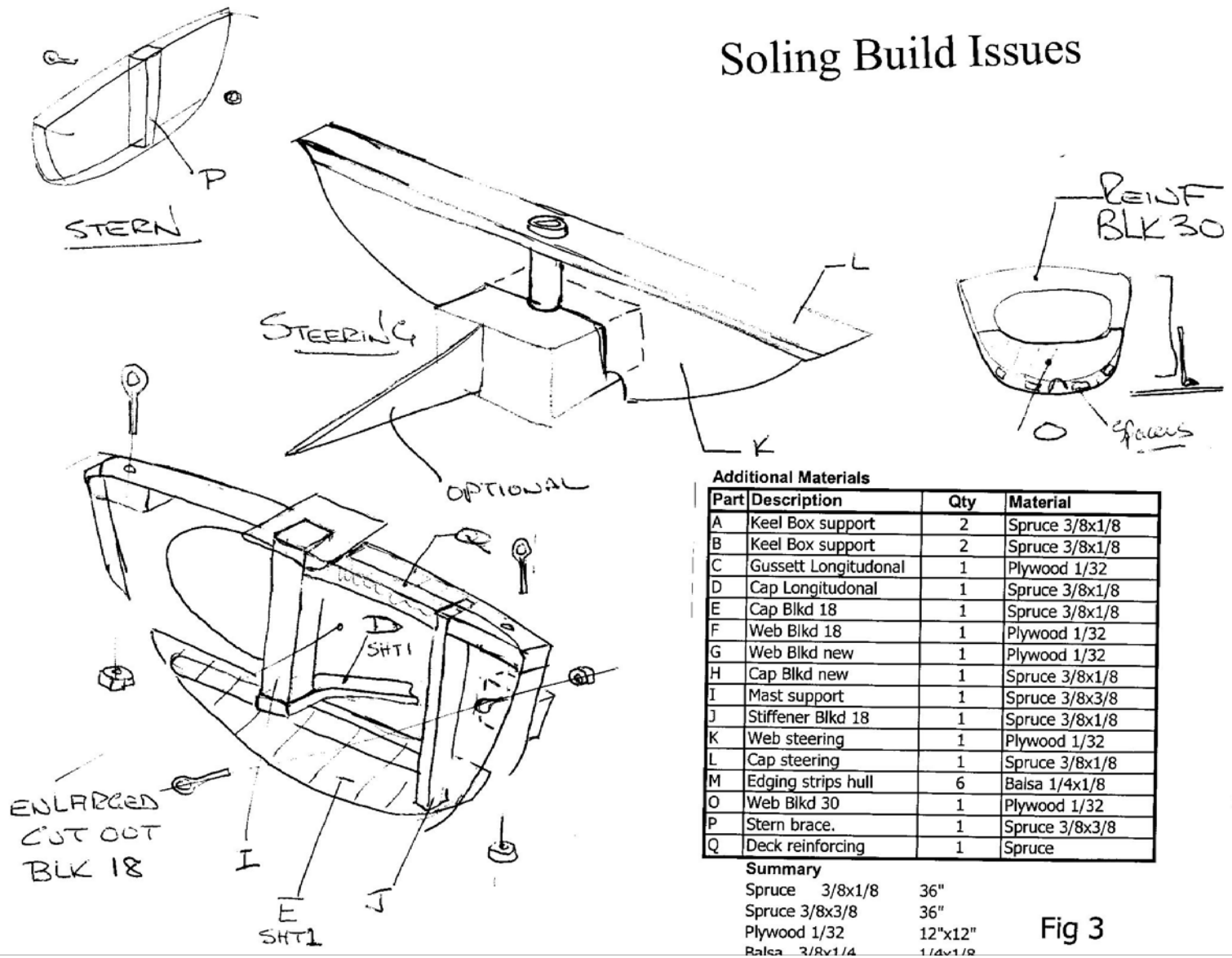
1 Install 2 standard bulkheads. Set top of Bulkhead flush with hull top edge. Accept gaps hull to bulkhead at bottom

2 Install keel box and align. Apply epoxy Area 1 and 2 only. Allow to cure. Keel box is now fixed in place

3 Remove keel and add stiffening structure Starting with Parts A and B.

Fig 2

Soling Build Issues



Additional Materials

Part	Description	Qty	Material
A	Keel Box support	2	Spruce 3/8x1/8
B	Keel Box support	2	Spruce 3/8x1/8
C	Gussett Longitudonal	1	Plywood 1/32
D	Cap Longitudonal	1	Spruce 3/8x1/8
E	Cap Blkd 18	1	Spruce 3/8x1/8
F	Web Blkd 18	1	Plywood 1/32
G	Web Blkd new	1	Plywood 1/32
H	Cap Blkd new	1	Spruce 3/8x1/8
I	Mast support	1	Spruce 3/8x3/8
J	Stiffener Blkd 18	1	Spruce 3/8x1/8
K	Web steering	1	Plywood 1/32
L	Cap steering	1	Spruce 3/8x1/8
M	Edging strips hull	6	Balsa 1/4x1/8
O	Web Blkd 30	1	Plywood 1/32
P	Stern brace.	1	Spruce 3/8x3/8
Q	Deck reinforcing	1	Spruce

Summary

Spruce 3/8x1/8	36"
Spruce 3/8x3/8	36"
Plywood 1/32	12"x12"
Balsa 3/8x1/4	1/4x1/8

Fig 3

Soling Build Issues

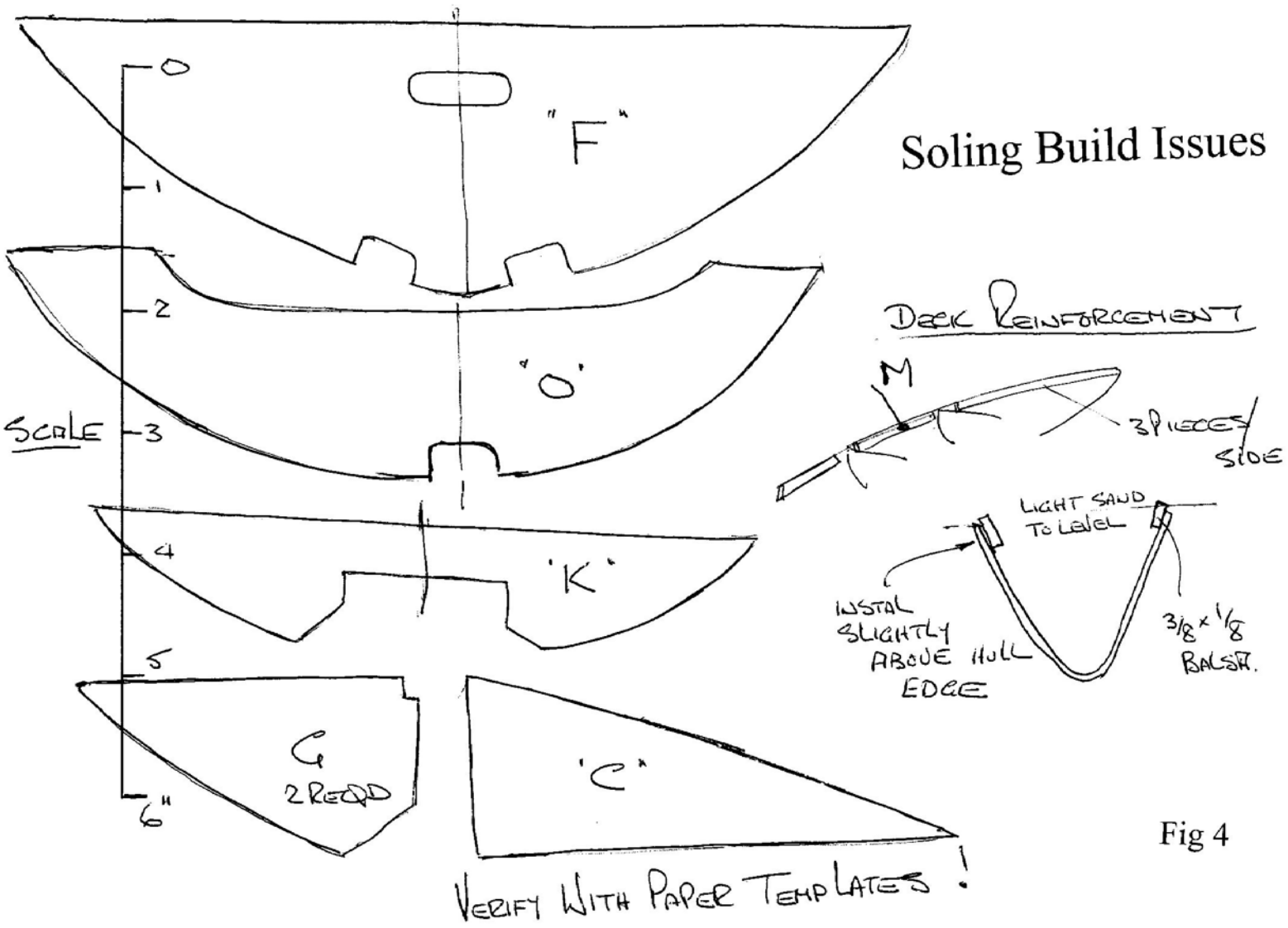


Fig 4