

Composite Keel

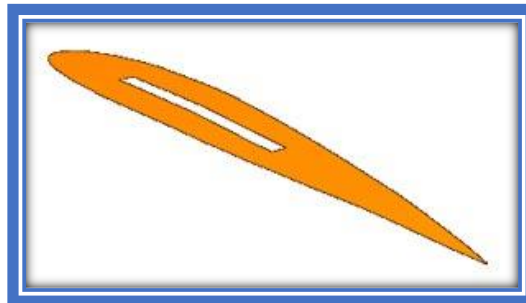
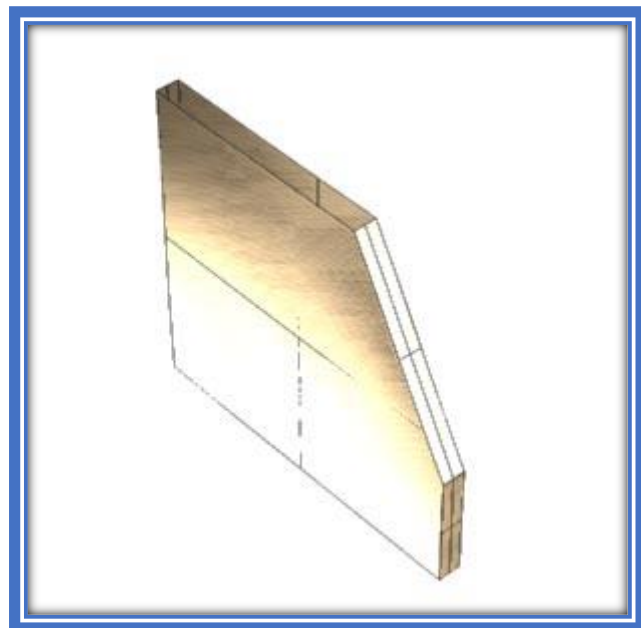
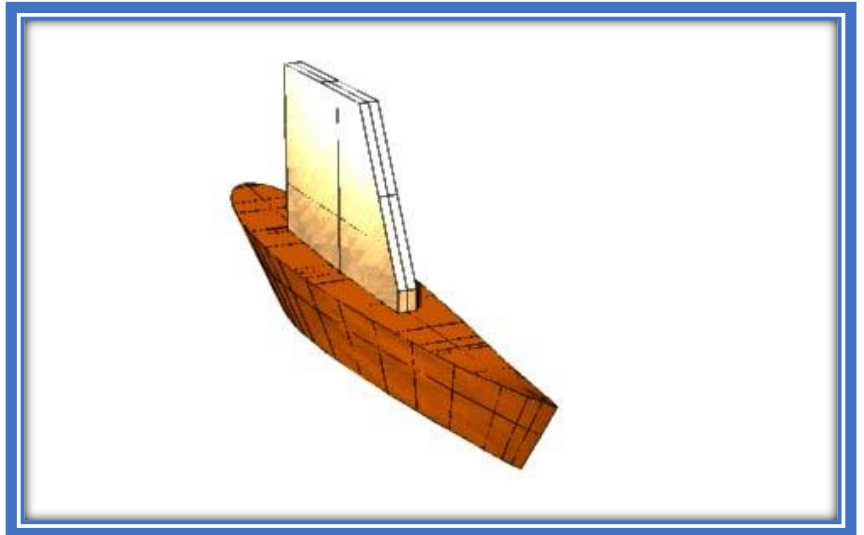
In this tutorial, we will show the construction principle and building sequence of a typical centerboard keel to that will be bolted to a composite (stitch and glue) sailboat hull. Some of our larger designs feature integral composite keels with internal ballast but the keel described below is to be bolted on the hull just like a cast lead or welded steel keel.

Keels are often a major hurdle for an amateur boat builder. Castings are difficult to realize and standard keels rarely fit and are expensive to ship. One solution is a welded steel keel and we propose them for some of our boats but if you are not a welder, why not build a keel from the same materials than the boat? Many high-performance deep bulb keels used on ocean racers are made from composite materials. Some keel shapes like centerboard keels are well suited to composite construction: they are basically a box filled with lead. If the builder can put together a whole hull, the composite keel will be very easy to build. We take some shortcuts in this tutorial and do not show fasteners, dimensions or scantlings. All that information is listed on the optional keel plans.

In our tutorial, the pictures are based on the Vagabond Plus centerboard keel, but this type of keel is also available for the Serpentaire. The plans for each of these boats are now supplied with three keel options: a welded steel deep fin type keel, a welded steel centerboard keel and a composite centerboard keel shown in these pages.

First, we will build and cut some parts off the boat. We start with the CB trunk. This is a simple box, 50 mm (2") wide inside. Dimensions on the plans. Epoxy coat and paint the inside before assembly. The plans show a very easy CB trunk building method.

Cut the panel that will become the top of the keel. Expanded plate dimensions are given on the plans. Cut the slot for the CB trunk in that panel. Cut the same slot in the bottom of the hull. Locate the cut from measurements on the plans, starting at mast bulkhead. Drill pilot holes from inside then roll the hull on its side or better 180 degrees, bottom up and cut the slot.

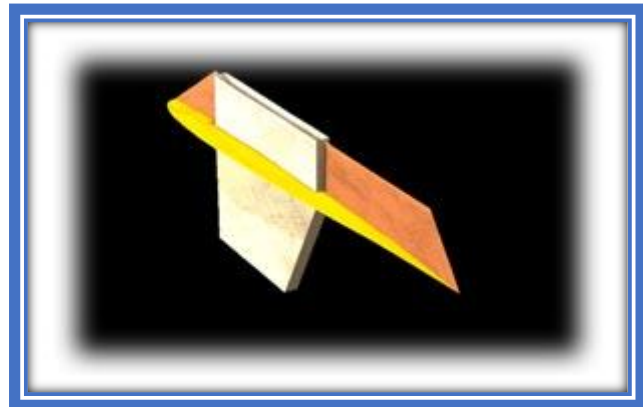
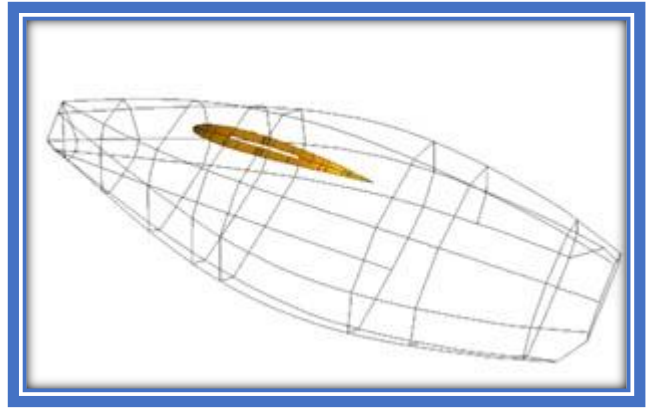


The next step is important: it will bend the top part of the keel to the correct radius and secure the CB trunk in the proper place and alignment. For this step, the hull should be 50 cm (2') above the ground or better, rolled over, bottom side up. Put the CB trunk in the boat and clamp or screw it temporarily to the mast bulkhead at the proper height. From outside, install the keel top panel. Temporarily fasten the panel to the bottom, check alignment and build fillets and seams between the trunk and the keel top panel.

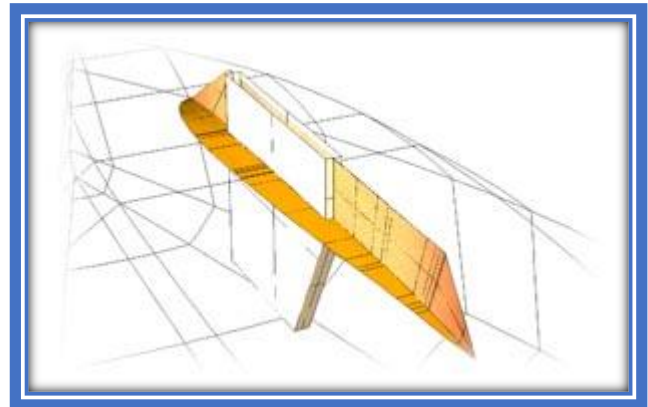
Composite Keel

Install keel stringers. These panels run along the center line and will keep the top keel panel at the proper radius. Build fillets and seams between stringer, trunk and keel panel. At this point, I recommend removing the assembly from the bottom and proceed with the building of the keel on a simple jig. Important: before removing the assembly, locate the holes for the keel bolts in the top panel. Your inside keel frames (floor timbers) should be installed. Drill through them from inside and mark the keel top.

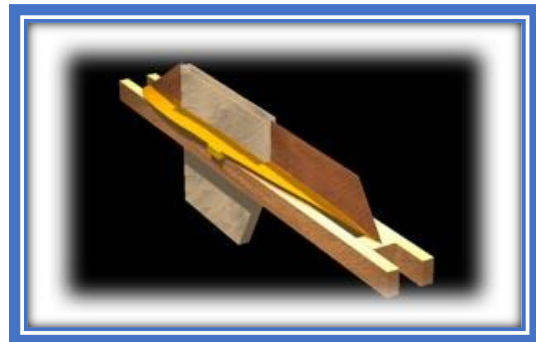
This is how the assembly should look when removed from the hull. The longitudinal stringers will keep the curvature in the top of the keel and insure a nice fit at installation time. Holes for keel bolts are not shown.



Support the assembly on 2x4 raised above the floor by saw horses.



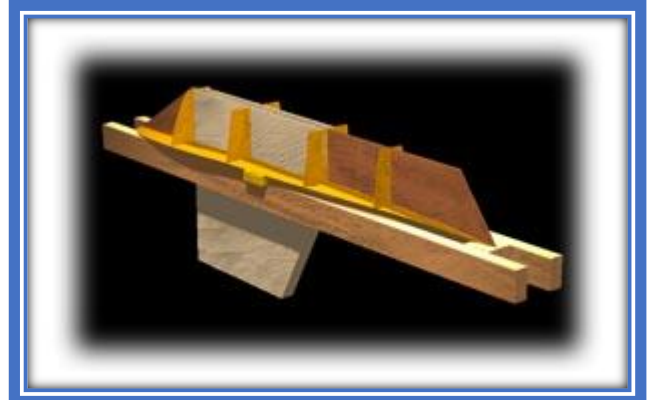
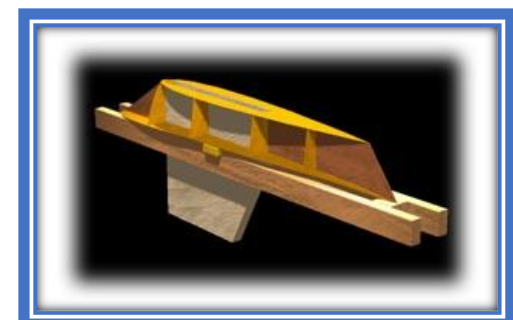
On the jig, install the frames. These are the transversal parts. Stringers and frames become a stiff monocoque (egg crate) structure.



Install the keel sole plate Build all the seams: fiberglass lamination specifications are given on the plans. The strength of the structure comes from these fiberglass beams. More will be added after installation of the lower part of the planking.

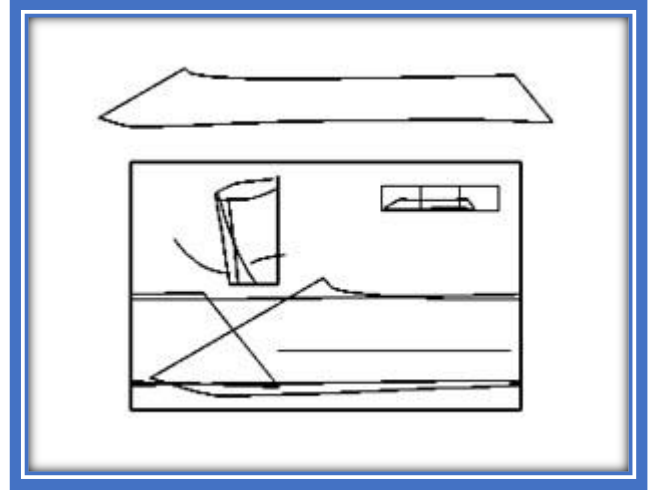
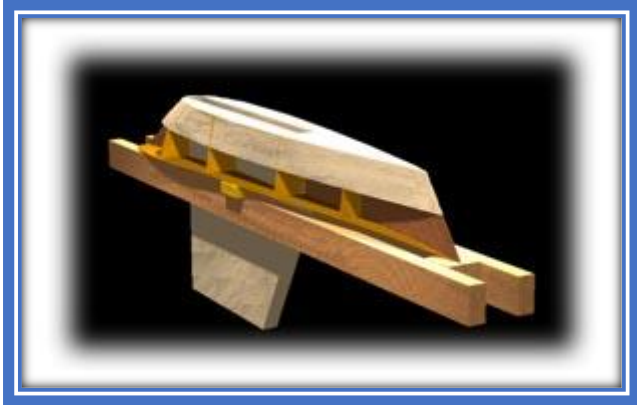
Cut the side panels from the expanded plate dimensions given on the plans. The sketch on the left shows the full-size pattern sheet supplied with the plans. Check against the keel assembly. There are several ways to shape the keel planking: - with two panels, one on each side or better: - slide a PVC pipe diameter 2" on the forward stringer by cutting a slot in the pipe. You may have to cut

1/2" (12mm) from the forward edge of that stringer. Drape the two side panels around the keel framing and cut the forward edge where it is tangent to the pipe. This will produce a nice round leading edge.



Composite Keel

When you are satisfied with the fairness of the sides, remove them and cut them in two lengthwise. Install the lower half, the one on the sole side, against the framing as in the picture and build some outside fiberglass seams between sole and side.



Flip the keel over and build seams inside between side panels and framing. Install the keel bolts. Do not forget the backing plates and star washers. Use extra-long bolts, you can always cut them later. Install your lead ingots in the lower part of the keel. Ideally, you should have poured the lead in a shape that fits the keel as tightly as possible but if you use brick type ingots, fill all remaining spaces with lead shot. Cast some resin around the lead. Add more lead ingots above until you reach the specified weight. If necessary, drill holes in the keel top, in one or more compartments, to fill later with lead shot.

Drape the upper half of the side panel around the structure. Fiberglass the outside as specified on the plans. Fill all remaining space with A&B foam poured through the holes in the top (not shown). The keel is complete and ready to be bolted to the hull. After installation, fiberglass seams will be built on the inside around the trunk.

