

## Building a Scarab 350 Trimaran

This boat was designed to be built using flat panels. In either foam laminated panels or plywood.

1. The build time is less. Panels are lofted, cut out and joined on the frame.
2. Frame can be simpler. Panels are rigid enough to hold the shape.
3. If the panels are accurately joined there is less time spent long-boarding the boat.
4. The only area that needs to be bogged is between the tapes not the entire hull.

### PLYWOOD

This boat was designed to be built using 4mm and 10mm for the centreboard and rudder blade.

### FOAM

Foam provides good heat and sound insulation. Attaching fittings to a foam boat can be a bit tricky. The foam must be removed where bolts pass through

and replaced with strong filler to prevent crushing the foam, this can be achieved by drilling the bolt hole in the appropriate place and using a bent nail or similar to dig out the foam. Any exposed foam at the edge of the bulkheads in the main hull is removed to about 10mm and backfilled with filler.

We used woven mat 200gsm approx. to cover the 10mm foam (Klegecell).

## RESIN

Epoxy resin is used to build plywood hulls. It can also be used with foam panels.

We use polyester resin to laminate our panels. It is less expensive and there is no problem with shrinkage in cold weather.

## FILLERS

Resin and hardener (or catalyst with polyester) should be mixed thoroughly before adding any filler.

Fillers can be added to resin to use for either gluing applications where strength is needed or for fairing areas before painting. Material suppliers offer filler for particular purposes when you buy the resin or you can make your own.

We make our own fillers using different combinations depending on the job. If you want to make your own you will need to experiment with combinations until you feel comfortable with the result.

We use Q cells for any areas that need to be sanded later. Strong glue can be made using aerosil mixed with cotton fibres.

## **LAMINATING THE PANELS.**

### **PLYWOOD**

Marine plywood (4mm) is cut to the full length of the hull panels and joined with a butt-strap across the whole width. Scraps of plywood can be used to support the panel. The plywood does not need to be covered with glass.

## FOAM

We construct our panels by joining the foam sheets together the full length of the boat and then cover with glass. This method works well and calculation of soak coat recommended by the manufacturer of the foam and the theoretical amount of resin needed to laminate the glass are well within accepted levels.

We use LSE (low styrene emission) resin and the smell of polyester resin is minimal. So it shouldn't annoy the neighbours.

The foam is cut to the desired length and the edges to be joined glued together. We use resin mixed with aerosil. The foam is held in place with drywall (gyprock) screws. We place a piece of plastic under the joint to protect the table underneath and prevent our panel becoming a permanent part of the table. Once the resin sets (usually about 2 hours) the screws are removed. You can fill the screw holes with filler or leave them to fill with resin as you laminate the foam. If you don't fill the holes the resin will pass through the holes leaving a blob of resin underneath. This is easy to remove with a small grinder with a sanding disc.



Lay the glass over the length and smooth. Cut peel ply in short lengths (about a metre in the beginning). Mix the resin and pour it over a section of the foam (about a metre to begin). Allow gravity to help saturate the glass and soak the foam. Using a metal drywall spatula (10 inch wide works well) spread the resin and work it into the glass. When you are satisfied the glass is saturated and there are no air bubbles, add the peel ply. Work the peel ply until there are no air bubbles or

excess resin. Sometimes a small amount of resin poured over the peel ply makes it easier to work the air bubbles out. Finish one area then move on to the next until all the foam is covered with peel ply.

The time to build the full length panels is approx. 10% of the total build-time of the hulls but once the panels are cut out they are very quick to set up on the building frame and are very stiff.

Most of our customers build their boats using plywood but that is beginning to change. I can only think it is the rising price of plywood and epoxy resin.

We use polyester resin on our boats, partly for the cost and partly for the safety reasons. Many people find they develop an allergy to epoxy resin over time.

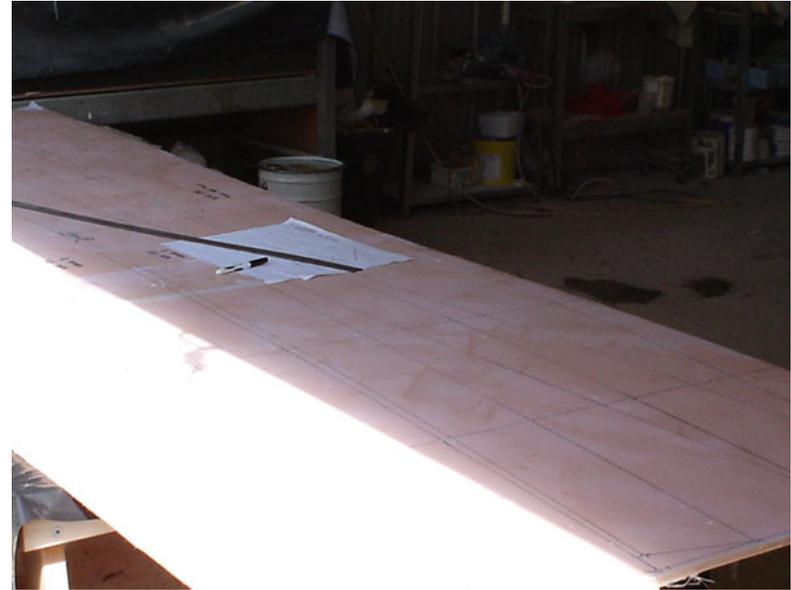


## LOFTING

To loft the boat panels a straight line is drawn on the edge of the fabricated panel or plywood and marked at 500mm intervals. A square can be used to draw lines perpendicular to the base line. Mark the dimensions given on the plans along the perpendicular lines.

Panel pins or dry wall screw are attached at the marks and a flexible baton is bent to create a smooth line. The baton can be made from a narrow piece of plywood the length of the overall panel. (We use an old sail batten. Draw the lines onto the peel ply. The panels are cut out using a jigsaw.

The bulkheads were drawn up from the dimensions on the plans.



## SETTING UP THE BUILDING FRAME FOR MAIN HULL

This building frame was built using plywood.

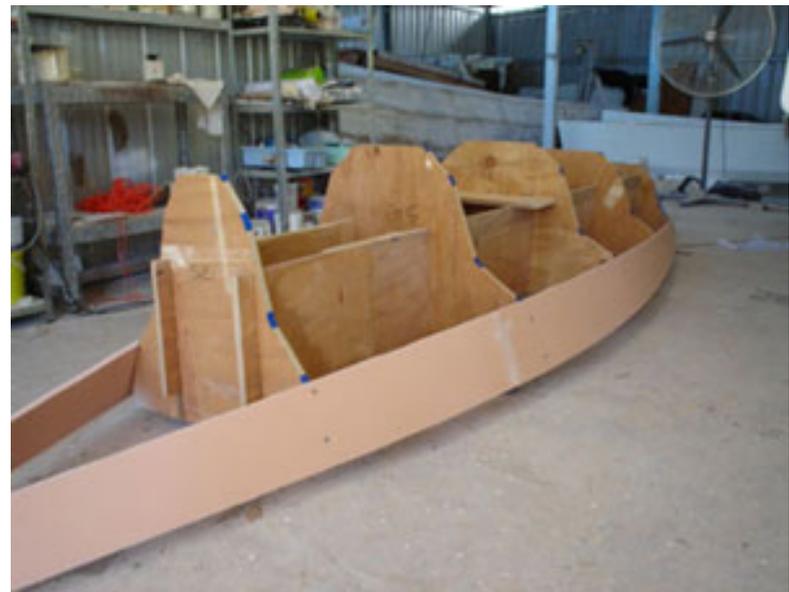
The building frame longitudinals and bulkheads have slots and fit together egg crate fashion.



## ATTACHING THE PANELS TO THE BUILDING FRAME.

The cut panels are attached to the building frame (drywall screws for foam and staples for plywood).

If you mark the position of the bulkheads on the inside it will help position the permanent bulkheads.





All the panels are added.

It is important to ensure the chines are fair at this time. The chines were filled and sanded and then taped. If you use strips of peel ply the weave will be filled with resin making it easier to finish with minimum sanding.



The hull was turned and the chines taped. A quick neat technique is to use a wet fillet. The bog is applied in a rough fillet and the glass tape is applied over the wet fillet. Using a compactor, squeeze out air bubbles and shape the fillet wiping off any excess filler.

The all the bulkheads were taped to the hull using wet fillets



A plywood stinger to strengthen the deck was added between bulkhead no.2 and no.4.



A carlin was added between bulkhead no.8 and no.4.



Supports were added to support the side deck.

If a prodder is desired then it is built at this time. Glass is laminated over a metal tube covered with cardboard or something similar. A stem web and a forestay web are attached.



The assembly is mounted in the nose of the hull and taped in.



Scrap foam or plywood is glued to the inside of the hull to support the deck. Deck is glassed, trimmed and glued to the supports using soft metal.



The aft deck and the side decks are attached. An edge is built using foam between the fore and aft decks.



A mast support tube is made from glass laminated over a metal tube covered with cardboard or similar.



A plywood mast support was added and a hole cut in the hull bottom for the centreboard. The dagger-board case was made of laminated foam and taped to the floor.

A dagger board support was added around the mast support tube and the dagger case.



The inside of the hull was filled ready to paint.

The outside was filled and faired.



## THE FLOATS

The building technique for the floats is the same as the main hull. The same longitudinals are used. The temporary bulkheads are in the same position as the permanent bulkheads so it is a good idea to mark the inside of the panels as they are added. This aids in adding the permanent ones in the right position and saves levelling the bulkheads.



The panels added to the frame and joined with drywall screws (foam) or staples (plywood).

The chines are taped and hull turned over.



All the inside chines are taped using wet fillets.



The float is levelled or you can use the markings that you added when attaching the panels. The bulkheads are added and taped in.



The sloping transom is added and taped to the hull.



Doublers were added around the edge of the float to hold the deck.

The deck is added. Plywood will bend in a fair curve but laminated foam is too stiff to bend. A solution is to score the laminated foam partly through, glue the deck down and add bog in the scores. Trim and sand the joints. Then the deck can be glassed over the edges.



## SANDING AND FILLING

This section shows how we finish boats. There are many other methods you could use. If you already know how to fill and paint a boat you might skip this section.

All of Ray's designs (with the exception of the Avalon 8.2 and the Scarab 12) have chines. The panels are taped together. If you have used peel-ply over the taped chines on the outside then the weave of the glass should be full of resin. If you have made your own panels using peel-ply then the weave should be mostly full of resin as well. If you are building with plywood, add a coat of epoxy resin to all the bare wood and sand.

The best way to a good finish is to apply filler to the depth of the tape with very little filler on the tape itself. We use Q-cells mixed with the resin, either polyester or epoxy. It is easy to apply, easy to sand, can be used beneath the water-line and is inexpensive. We use a drywall tool: a 10" spatula covers a wide area smoothly. We sand the boat using a random orbital sander hooked to a vacuum system to cut down on the dust.

When the boat is sanded you will be able to see through the bog slightly.



## PAINTING

The boat is now ready to be primed. We use Jotun Penguard high build epoxy primer sprayed on with an airless sprayer.



We spray primer twice. After the first coat we sand the boat and fix any imperfections which are only visible after the boat is painted.

Any pin holes which are hard to fill can be filled with Septone blade putty (the putty must be sandwiched between layers of epoxy primer). The boat is sanded and primed again. When the primer hardens the boat is sanded and cleaned thoroughly ready for a finish coat.

We use gravity feed gun with a 1.4mm nozzle and Jotun Imperite, a two part polyurethane. The first coat is a light coat which is allowed to tack off about 15 minutes. This prevents the paint from running. Then spray on two more coats.

If you prefer to paint with a roller or brush follow the directions on the label.



## BUILDING THE CENTREBOARD AND RUDDER

These pictures are of another boat but the technique is the same.

The dagger board and the rudder are made using layers of plywood. Two pieces of 10mm plywood are laminated using a couple of layers of glass cloth and epoxy resin between. When the board is shaped the glass inside gives a sharp finish to the trailing edge directions in the plans.

The boards are shaped a small grinder with a sanding disc. Then the board is cut to shape. A template is included in the plans. After the correct shape was achieved the board was covered with glass cloth and epoxy resin. The board is filled, sanded and painted.





A rudder head is made using a form ply mould. The mould is waxed and layers of glass are wrapped around the mould. Peel ply was used on the outside to minimise the time spent finishing the head. After the mould was removed the rudder head is trimmed to shape and joined to the rudder blade with a stainless pivot pin. The pintles are screwed onto the blade to match the gudgeons on the stern



The tiller is made from laminated hoop pine and varnished.

