
23M. Bonding on fuselage top moulding - mono

The bonding of the top moulding to the rest of the fuselage will make the structure complete and extremely stiff in torsion. Although the forward fuselage is already stiff with the cockpit module bonded in, it would be inadvisable to add the lift pin sockets, flap control system, or engine to the lower fuselage before the top is added, as you may find things have moved slightly afterwards.

Before the top moulding is bonded in place, however, there are several tasks that can be carried out now which will save working in awkward places (i.e. the inside of the rear fuselage) unnecessarily.

Trim servo wiring and antenna cable

The extension cable for the trim servo should be added to the wires coming out of it. Fasten the cable to the fuselage side (the port side may be easiest for running the wires into the back of the panel). Cable tie bases, bonded to the fuselage side will enable easy attachment. A hole will be required through the baggage bay bulkhead for the wiring to pass through. Allow also for any antenna cables you may wish to install. Arrange the wiring, etc. to run underneath the door surround in the cockpit area.

The most convenient place for the VHF radio antenna, a simple dipole made from copper tape, is on the inside surface of the rear, port side flange of the fin's rudder shroud. Instead of installing the cable in the fuselage, though, it may be easier to make up the antenna assembly on the bench beforehand and then thread the cable through from the rear of the fuselage. However, making provision for mounting the cable within the rear fuselage at this stage is a good idea.

Cockpit frames

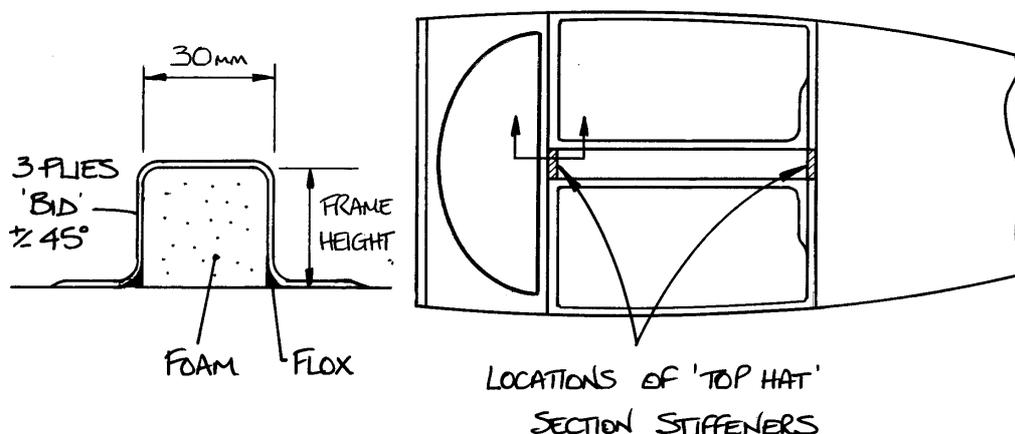


Fig 1. Section of 'top hat' section stiffener and locations.



To provide extra strength and stiffness in the cockpit area the frames formed by the front and rear of the door apertures must be joined. To achieve this, 'top hat' section stiffeners will span the gap between them giving a continuous path for loads to follow.

Cut and carve pieces of scrap foam to fit between the door apertures as detailed in figure 3. Thoroughly scuff sand the area around where they will fit and squidge them in position with floc, then immediately layup three plies of 'bid' at $\pm 45^\circ$ to cover the foam and run on to the surrounding structure by approximately 3 cm (1-1/4"). Cover with peel ply and, having made sure the moulding is properly supported and not twisted, allow to cure before disturbing.

Ceiling panel

Although not essential, a panel spanning the area in between the door apertures can be a useful and tidy addition. Sockets for headsets, for example, can be fitted in this panel, keeping leads away from controls, etc. You will need access to the bolts of the door hinges that would be covered by the panel; strategically placed holes will allow this.

If you decide to fit a ceiling panel it's probably easiest to do it now while you can work on it without standing on your head. 3 mm plywood would be a suitable material for this panel.

Access panels

Access panels at the rear of the fuselage will make maintenance tasks on the various assemblies on and around the rear bulkhead and the tailwheel spring easier. The positions for these panels and a smaller viewing hole are shown in figure 2. The method of construction is described below.

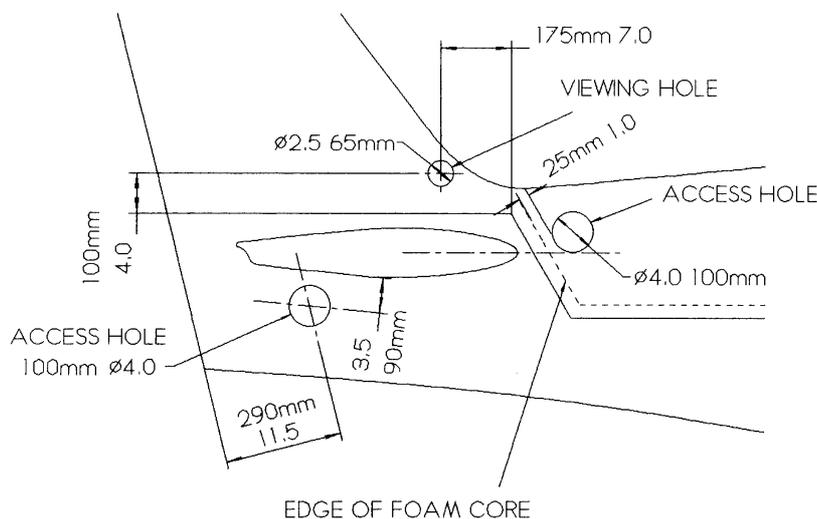


Fig 2. Positions of access and viewing panels.

If you are right handed it would be most sensible to fit the access panels and the viewing panel to the starboard side. Variations on hole positions from those shown must be approved by Europa.

To make the access panels and the reinforcements around the holes, the following technique should be employed. Dimensions given are for the main access holes. For the viewing hole in the base of the fin all dimensions except the flange width should be reduced by 38 mm (1.5").

Access panels

1. Cover the area where the access panel will be with plastic sheet to act as a release film. Lay-up a "splash" (a thin glassfibre moulding), to be used as a mould to make the panel from, onto the release film - (figure 3).

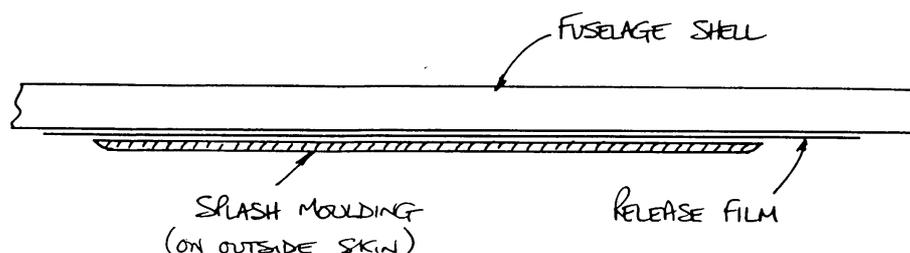


Fig 3. Lay-up of 'splash'

2. Cut a hole through the fuselage shell 25 mm (1") larger than the desired access hole. The maximum diameter for the access hole should be kept to 100 mm (4") - (figure 4).

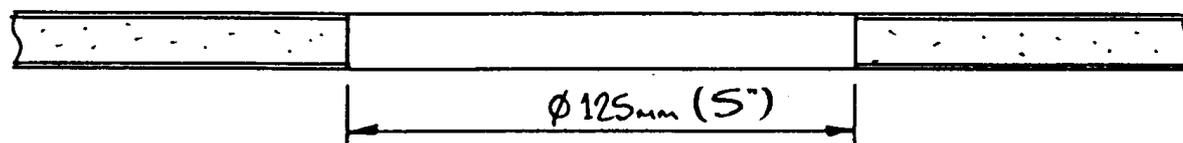


Fig 4. Hole cut out

3. Cut the foam core and inside skin back 10 - 15 mm (0.4 - 0.6") from the hole's edge, then chamfer them back at about 45° - (figure 5).

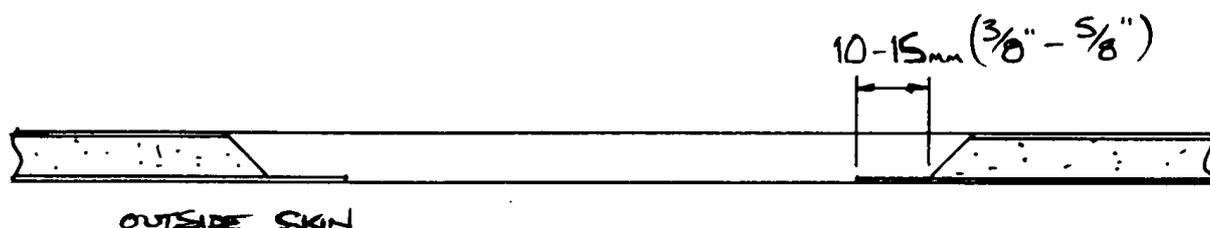


Fig 5. Hole chamfer



4. Make a new panel from 4 plies of 'bid' on the 'splash' mould, and trim to fit the hole.
5. Cover the panel's inside surface with release film or tape, then hold in position in the hole with blobs of rapid epoxy, or hot glue on the outside skin.
6. Lay-up reinforcement plies of 2 plies of 'bid', the second ply being at 45° to the first, around the hole. These plies should lap onto the access panel by about 20 - 30 mm (0.8 - 1.2") and be about 20 cm (8") in diameter - (figure 6). Also layup a further 2 plies of 'bid' as extra flange reinforcement.

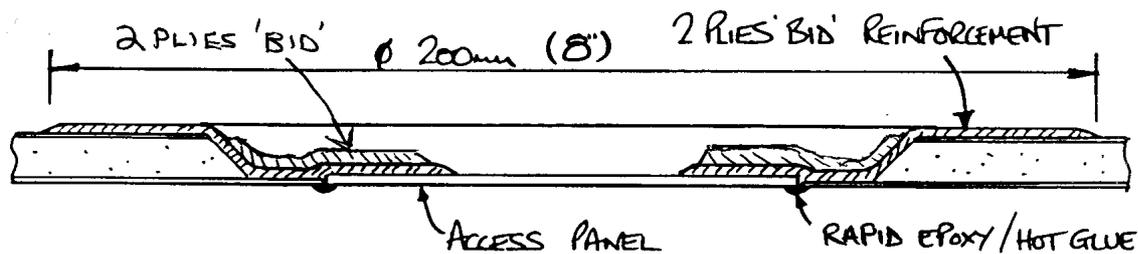


Fig 6. Flange layup.

7. After cure, remove the panel and trim the flange around the hole to about 12 - 13 mm (½") in width - (figure 7).

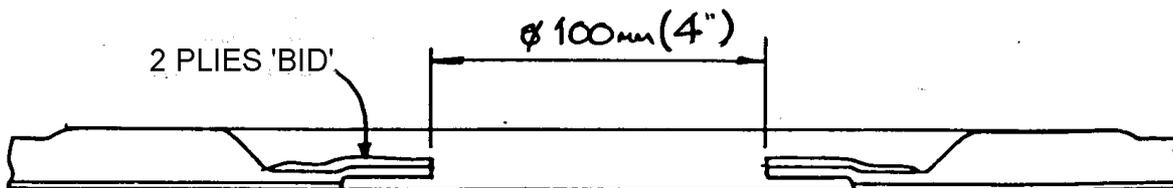


Fig 7. Reinforcement and trimming

8. Attachment of the panel is to be with AN525-10R8 bolts, MS21047-3 anchor nuts which are secured with TAPK33BS rivets.

Four anchor nuts, equally spaced around the access holes, should be installed and three around the viewing hole.

Trial fit of the top moulding

First of all, position the top moulding in place on the bottom moulding and identify areas which may need adjusting to enable the desired fit to be achieved. The front flange of the top moulding sits in front of the firewall. Areas to expect attention are the firewall and the area of the top moulding in which it comes into contact, the pitch stop assembly height, and the rear bulkhead. It is preferable to have a slight gap between bulkheads and the fuselage inside skin as opposed to them being in contact, making small adjustments difficult. A 2-3 mm gap is ideal.

Correct positioning can be guided by the lining up of the rear flanges, the joggle joint and the rear face of the front flange in contact with the firewall. Figure 8 shows how this particular joint will be.

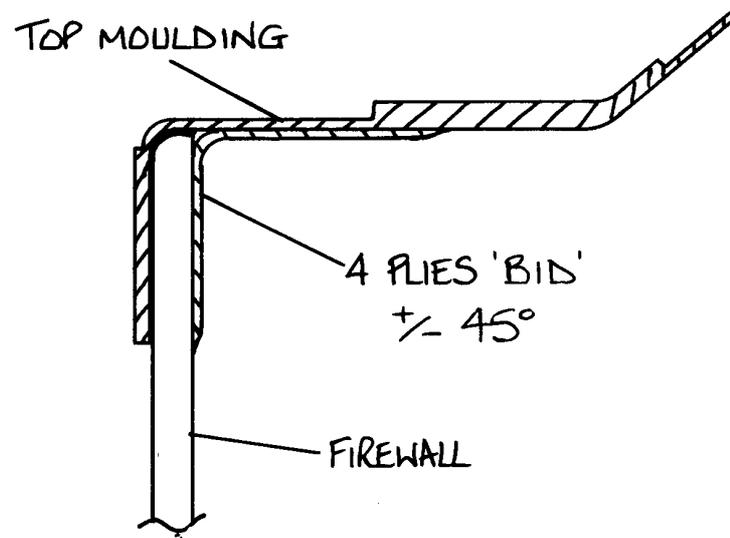


Fig 8. Joint between firewall and fuselage top moulding.

With the top moulding in the correct place drill four or five holes through the joggle flanges along each side of both top and bottom mouldings with a $\frac{1}{8}$ " drill and insert a Cleco in each hole to hold the two mouldings together. Ensure the tailplane torque tube is still level with the forward part of the fuselage.

When you are satisfied you have the correct fit mark the top moulding where the two bulkheads at the pitch control stop uprights will be, then remove it in preparation for bonding.



Fin sternpost

The fin sternpost is a separate moulding which will eventually be bonded to the trailing edges of both the top and bottom halves of the fuselage. At this stage it will only be clecoed in place so that the tailwheel spring mounting pad can be installed.

Position the moulding so that its trailing edge lines up with the trailing edges of the fuselage bottom moulding. If the fuselage top and bottom halves do not match exactly at the trailing edge then they will need to be trimmed as appropriate to get a straight line from top to bottom.

Drill a series of 1/8" holes through both the fuselage rear flange and the sternpost moulding and cleco the two parts together. Use at least 6 clecos in the lower moulding to make sure that the sternpost remains secure once the top moulding has been removed.

Now remove the top half fuselage - this will give good access for the installation of the front mounting pad for the tailwheel spring.

You will probably need to keep in position the spacer you have installed forward of the tailplane fairing, to prevent the torque tube from becoming stiff to operate, until after the top moulding has been bonded in place. This can be fitted permanently if so desired.

Tailwheel spring mounting reinforcement

Remove the inside skin and the foam around a diameter of approximately 8 cm (3") centred on the position where the tailspring attachment bolt will pass through the fuselage bottom - this will be 160 mm (6 1/4") forward of the sternpost front face. Take care not to damage the outer skin.

Chamfer the inside skin and foam, and layup 3 plies of 'bid' onto the exposed outer skin and lapping 3 cm (1") onto the surrounding inside skin - see figure 9.

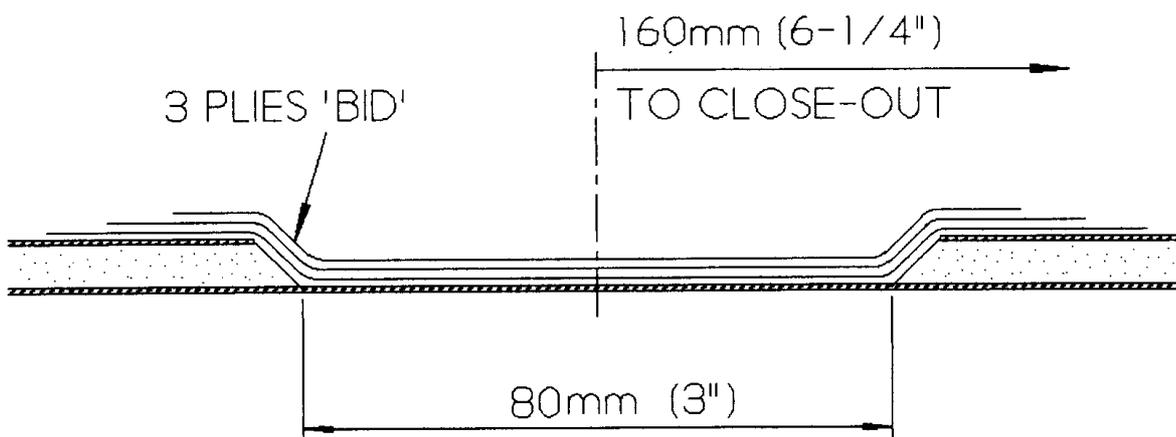


Fig 9. Bottom fuselage reinforcement.

Spring mounting installation

Mark a horizontal line onto the rear face of the sternpost 25 mm (1") up from the outside skin. Drill a 23 mm (7/8") hole centrally onto this line for the tailwheel spring to pass through. The hole should be cut parallel to the rear fuselage bottom, not square to the close-out face.

With the fuselage set level with a spirit level on the door sill, insert the tailwheel spring rod through the hole in the sternpost so that the parallel portion immediately ahead of the bend is in the hole. This should position the hole through the flat end of the spring approximately 160 mm (6 1/4") forward of the sternpost front face.

Measure the vertical distance from the bottom of the extreme rear of the fuselage to the ground. Now adjust the angle of the tailwheel spring so that the bottom of the threaded portion is 235 mm lower than the bottom of the fuselage just measured. See figure 10. Fix the tailwheel spring in this position.

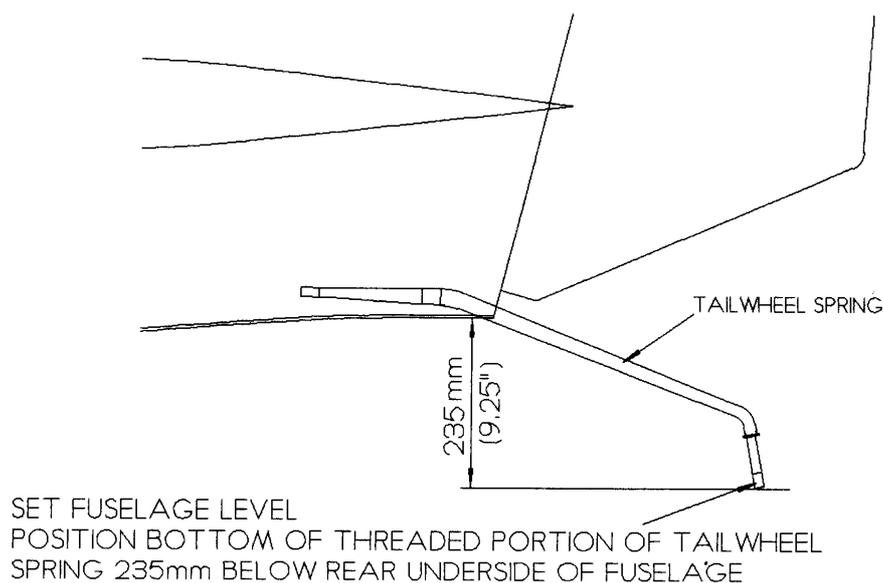


Fig 10. Positioning tailwheel spring.

Measure the gap between the underside of the flat at the forward end of the spring and the floor and take a note of the dimension. Remove the tailwheel spring.

A pad made up from pieces of 3 mm plywood with 2 plies of 'bid' between each is required underneath the flat end of the spring rod. Allowing 3 mm (1/8") for a steel support pad XTW15, which will go on the top of the fibreglass pad, and 3.75 mm (0.15") for each layer of plywood with the two plies of 'bid', prepare the necessary number of layers to fit in the fuselage underneath the spring fixing hole with a further small gap of up to 3 mm (1/8"). This will probably be 5 pieces. A sectional view of the forward fixing point is shown in figure 11.



Note: The flats on the tailwheel spring may not be exactly square to the pivot shaft due to manufacturing tolerances. To accommodate this the pad must be made to fit the tailwheel spring with the pivot shaft vertical with the aircraft.

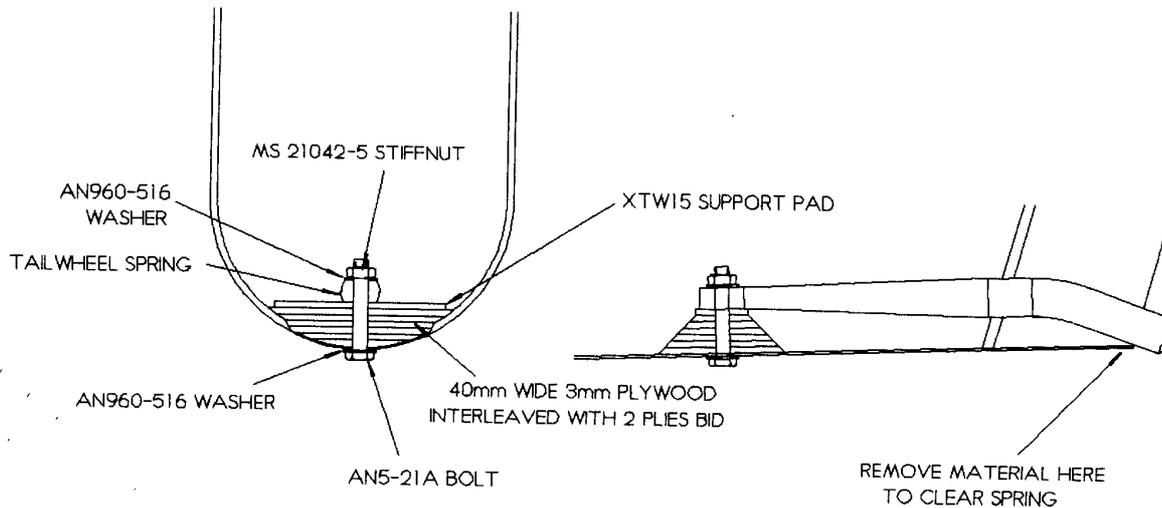


Fig 11. Sectional view of tailwheel spring.

To enable easy laying up of the glassfibre plies between the plywood pad pieces, arrange the pad to be chamfered fore and aft. Each piece should be chamfered as required on the sides also to fit the curve of the fuselage bottom. See figure 5.

Having ensured that the plywood pieces fit in place within the fuselage, and that the tailwheel spring rod fits with the clearance beneath it, prepare the area for bonding.

Apply the plywood pieces with floc, laying up 2 plies of 'bid' over each piece, lapping onto the surrounding fuselage skin by at least 5 cm (2") all around. Leave to cure. You should now have a pad which is approx. 4 mm (0.16") below the bottom of the tailwheel spring.

Reinsert the spring into position, checking that the pivot shaft is vertical.

Make up a mix of Araldite 420 and floc. Making sure that no adhesive gets onto the spring, bond the metal plate XTW15 on top of the support pad, filling the gap with the Redux / floc. Allow to cure fully.

Position the spring rod as before and, holding this position, carefully drill through the pad with a 5/16" drill using the hole in the spring rod as a guide. After cure the spring can be removed.



Preparation for top moulding attachment

Now you should be ready for the steps that will transform what's been looking like a boat into what should start looking like part of an aeroplane.

If, for any reason, you've removed the main pitch push-rod, do be sure to re-install it before the fuselage top moulding is permanently in place. It can be installed later but it's not much fun to do and requires a bit of surgery.

Scuff sand the joint areas of both top and bottom mouldings and also an area at least 5 cm (2") each side of the marked lines where the bulkheads will be. Sand also the bulkheads each side including the firewall and the area where the top of the pitch control stop uprights will be, as mounting brackets will be attached here later.

Bonding and taping

Prepare a mixture of Araldite 420, adding floc to prevent it from running, then apply it to the jointing area of the bottom moulding and the rear bulkhead edges before placing the top moulding in place. Rivet the flanges together using the previously drilled holes to make sure good contact exists between the jointing surfaces. You may have to drill more holes to add rivets in areas if the flange bulges locally. The rivets are only to ensure consolidation of the joints and will be removed after cure. Wipe away any excess adhesive and leave to cure.

Tapes

The joint between the top moulding and the rear of the firewall will require tapes.

Before applying the tapes fill any gaps with floc.

Make the tapes from 4 plies of 'bid' at $\pm 45^\circ$ and 50 mm (2") wide, lapping them evenly on to the top moulding and rear of the firewall.

Pitch control stop upper brackets

This is an awkward job from which you could not be saved as it is obviously necessary to have the top moulding in place to layup mounting brackets for the top of the pitch control stop assembly. You can make life a little bit easier by laying up 4 plies of 'bid' at $\pm 45^\circ$ on sheets of plastic film and trimming them to squares of about 10 cm x 7.5 cm just prior to crawling into the fuselage.

Lay plastic over the tops of the side supports, to prevent them being bonded inadvertently, and hold it down each side with tape. Put the bracket layups in place onto the top of the fuselage and down onto each plastic protected side support. Covering the edges with peel ply should help things stay in place. After cure, remove the peel ply and plastic release film and get ready for the *really* awkward bit.



Drill one hole through both the flange and side support with a 4.8 mm drill to accept an AN3-5A bolt and, using AN970-3 washers as you have at the bottom, fasten it securely with MS21042-3 nuts. You'll need an angle drill or angle chuck for this.

Upper pitch control stop

The pitch control upper stop is to be made from 12 mm plywood (P/N Ply 5) attached, edge on, directly to the fuselage top. Without this stop the mass balance weights would strike the fuselage skin. Similar to the lower stop, the weights should contact the stop approximately half-way along their total length.

Shape the piece of plywood to fit the dorsal inside the fuselage at the appropriate location and adjust its size so that, when the weights are in contact with it, the trailing edge of the tailplanes are at 4° down. Allow for a bead of bath sealing type silicone to be added to the stop to absorb the worst of any hard impact. Bond the stop in place with Redux 420 and flox, holding it in place with the mass balance weights hard up against it until it cures.