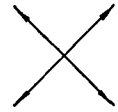
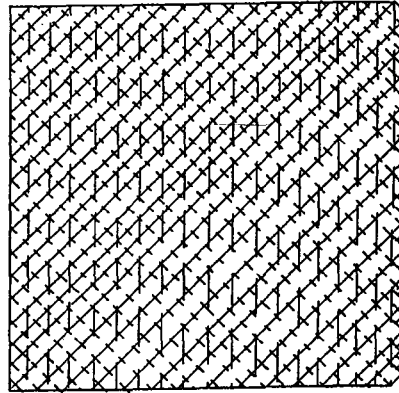


3. Biaxial Cloth

This is a special form of bi-directional cloth in which two separate layers of "uni" are laid at 45° to the longitudinal axis, and at 90° to each other-- they are stitched with a light thread rather than woven. This cloth has less drapeability than either "bid" or "uni", but on large, comparatively flat or single curvature surfaces, such as the wing, the work involved in skinning is considerably reduced. This cloth is only used for wing skins.



Always store glass cloth in a clean, dry place.

7. WINGS

Overview

This chapter will take you through the building of the wings, including fitting inserts for the flap hinges and for pins which will be later screwed into the wing root. You will also fit the aileron bellcrank brackets to the spar.

Each wing is made in two basic stages. Attachment and layup of the leading edge to the spar then, subsequently the trailing edge. Please note that these instructions include cloth cutting dimensions and quantities for the building of *one wing* at a time.

The metal parts supplied have been punched or nibbled out and require their edges to be smoothed off with a file. Take care that no scratches are left on the metal's surface or edges as these could lead to cracking after a while in service. If you have to do any marking on aluminium parts don't use a scribe or even a lead pencil. Carbon from pencils has been known to lead to cracks developing!

Some parts may have a protective coating of plastic on them which needs removal before installation.

Items that get painted when the aircraft is sprayed include W18, FL1, FL2 and FL3.

Items that should *not* be painted are A2, FL7, FL9, FL10, FL12, OR6, OR7, W17, W22 and W23.

It is advisable to protect your metal parts from corrosion. Anodising is suitable for light alloy parts as is painting them with Zinc Chromate. If you decide to anodise, specify you want the parts chromic anodised to DEF STAN 24-03 (sealed). Don't use sulphuric or hard anodising.

Remember, keeping your working area clean and tidy especially just before layup will give you the best chance of making a neat job of your aircraft components. Lets get stuck in.

Preparation

Step 1

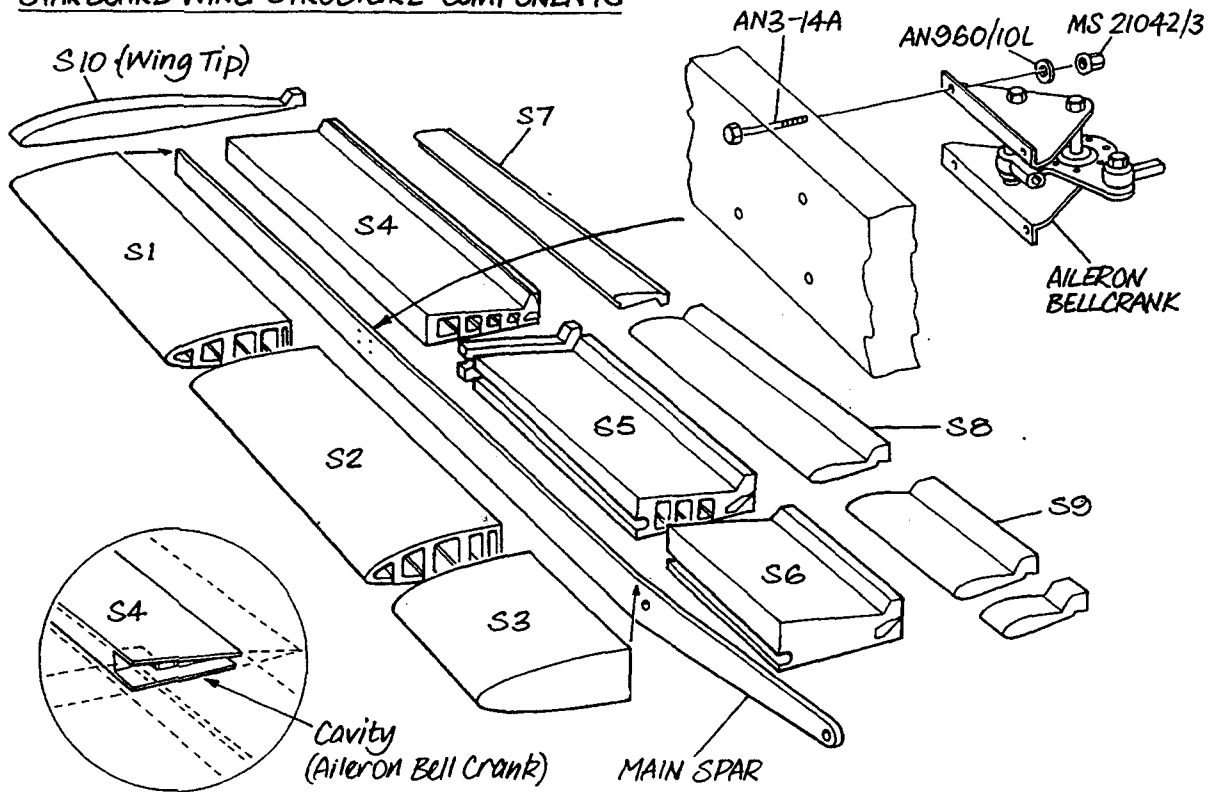
Spar

First of all decide which spar will be for which wing, port or starboard, and label them including which way is up and which is the forward or rear face.

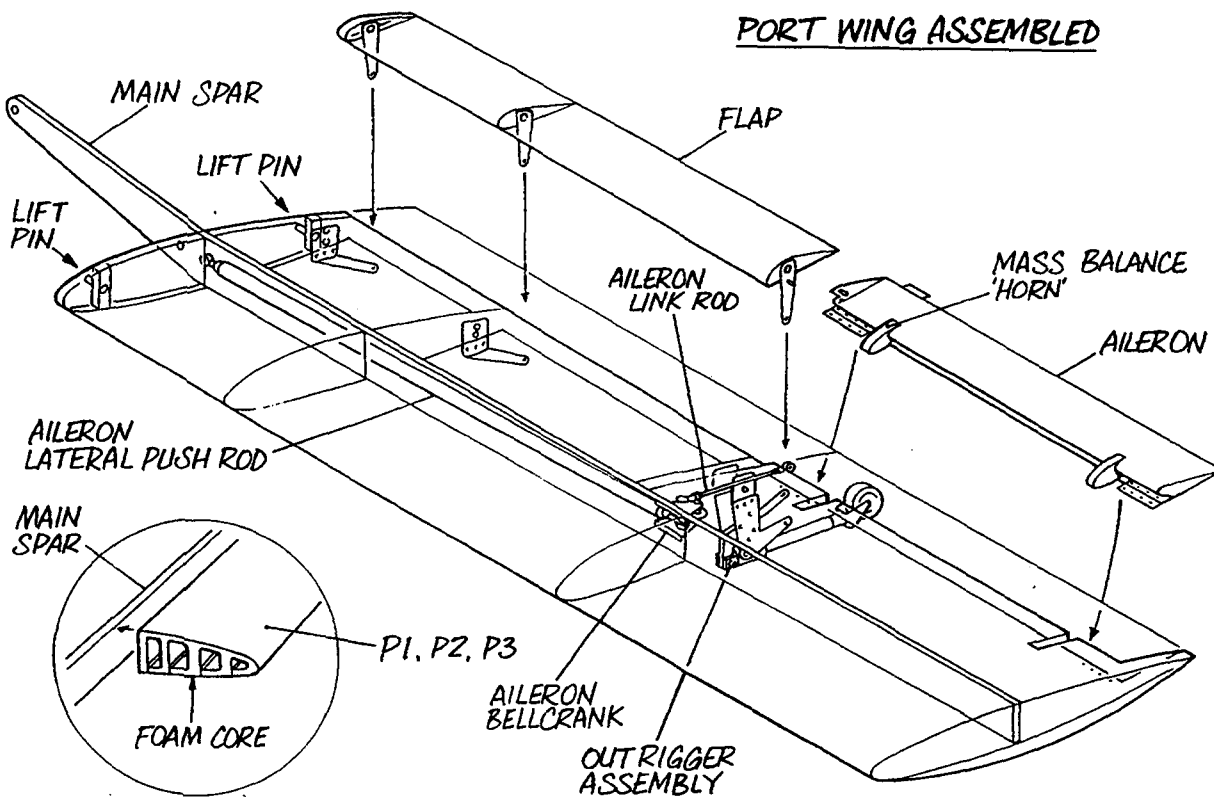
Note: *The wing's dihedral is set by the kink in the spar.*

See the illustrations of the component parts and completed wing overleaf.

STARBOARD WING STRUCTURE COMPONENTS



PORT WING ASSEMBLED



Sand the spar's unmoulded edges to form a radiused corner similar to that of the moulded side. It is permissible to increase the size of the radii slightly on the edges where the wing structure will be to make it easier for the cloth to go around onto the shear web. Don't overdo it here, though. The aim is to enable the foam cores to sit flat on the unmoulded side of the spar. Scuff sand the spar sides and edges with 60 grit paper to prepare it for bonding to within about 5cm (2") of the metal bush.

Make up the aileron bellcrank bracket assembly (part nos. W11, W12, W13, W14 and W15 as in figures 1 & 2). If you intend to paint these parts, do this before assembly.

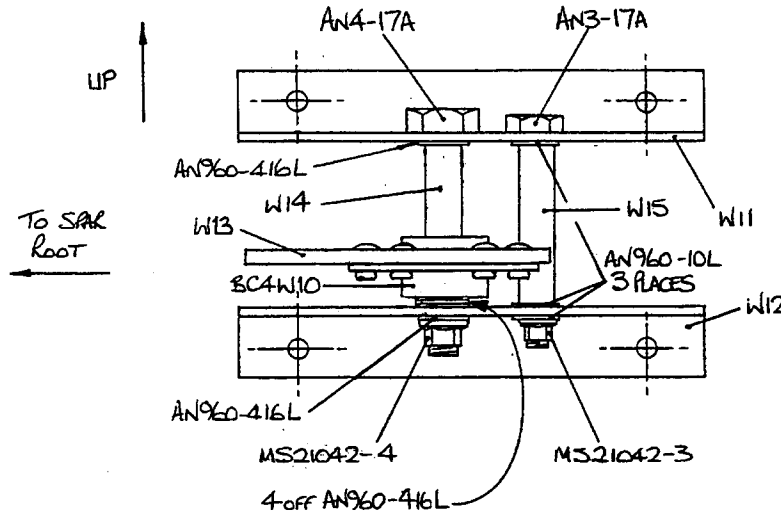


Fig 1. Bracket assembly looking at T.E. as installed (stbd).

Initially attach a BC4W10 bearing to a W13 bellcrank with six AN470AD4-7 rivets noting that these sub-assemblies are handed port and starboard.

Now attach the bracket assembly to the rear face of the spar with four AN3-14A bolts, smearing wet floc onto their shanks to bond them in place, MS21042-3 nuts and AN960-10L washers. See figure 2.

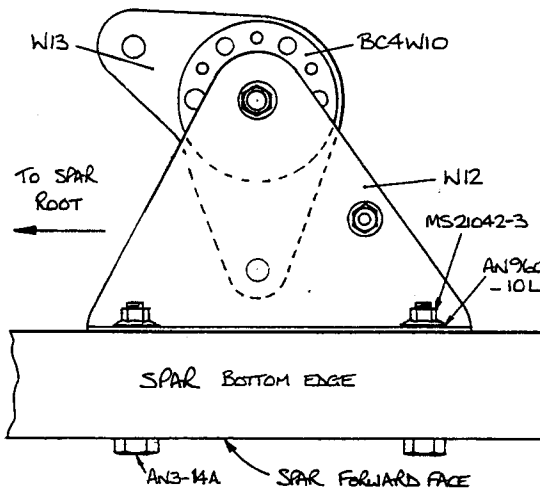


Fig 2. Bellcrank bearing assembled on spar (stbd)

This is a convenient time to attach the two rod-ends to the bellcrank. Fasten them according to figure 3.

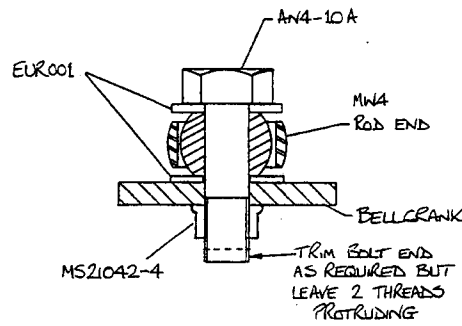


Fig 3. Attachment of rod-end to bellcrank.

Cover the bellcrank assembly with plastic to protect it from splashes of resin during the leading edge layup.

Step 2

A simple 'jig' needs to be made on which to place the spar for the leading edge layup. Four pieces of wood 7.5cm x 7.5cm x 60cm long (3" x 3" x 24") are all that are required for this 'jig'. (We said it was simple.)

Decide where you want to do your wing leading edge layup then clear the area on the floor of your workshop. You will need to have room to walk right around the spar when it's jugged onto the wood.

Figure 4 indicates where the wood supports want to be relative to the spar. Make sure that you miss the aileron bellcrank assembly of course.

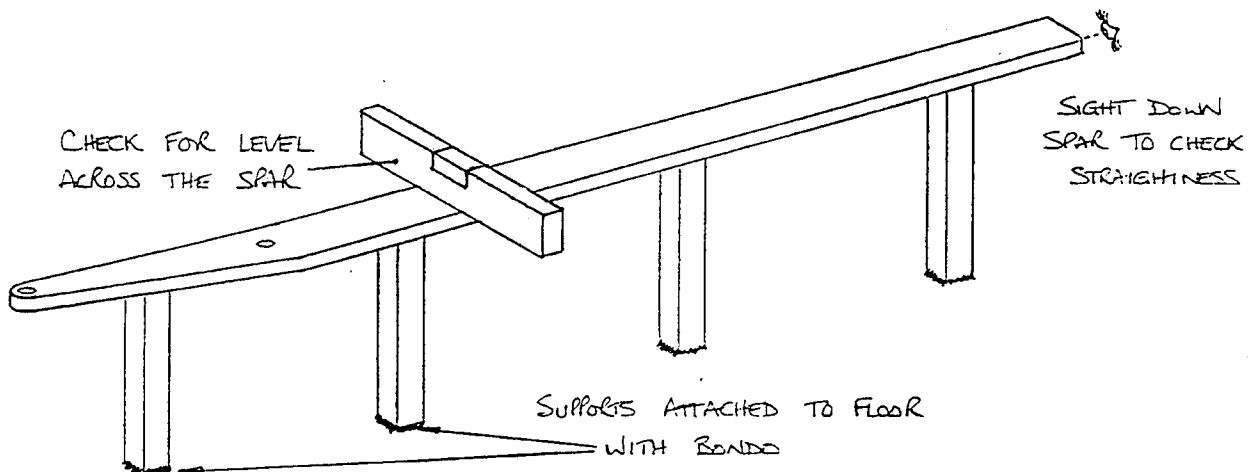


Fig 4. Supports for spar (port spar shown).

As the kink at the end of the spar means that one of the supports will have to be slightly out of line with the others double check that its position coincides with the spar you want to build on. The two spars are identical so if you want to build the port wing then the spar's moulded side (shiny side) should be uppermost. This side can be identified by its radiused edges.

Initially bond the two end supports on the floor with bondo first and, when secure, pull a string across them to make sure when you fix down the two supports between them all tops are at the same height.

Put blobs of bondo on the tops of the wooden supports and squidge the spar down onto them making sure that it is level laterally and straight. Check for level in various places along the spar's length, using the moulded side, to ensure also there is no twist. See figure 4.

Step 3

Mark a line on the spar 95mm (3.75") away from the centre of the metal insert as in figure 5.

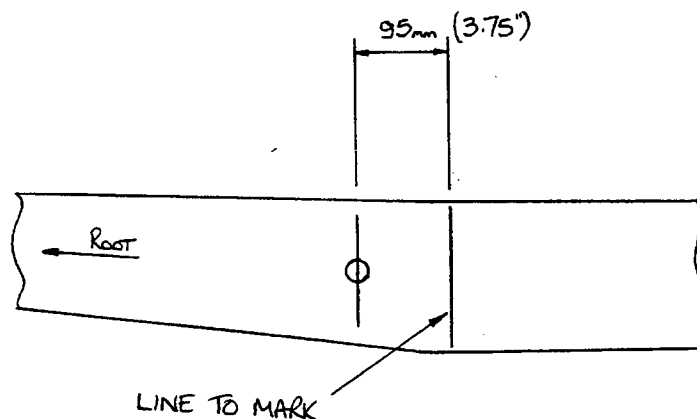


Fig 5. Marking spar for root core position.

Set the No. 3 core onto the spar to act as a guide when marking this line which will be used as an aid in locating the core during bonding.

Step 4

Foam Cores

Each wing is made up with seven main foam cores, the flaps have two and the aileron is in one piece, see figure 6.

Each core has been identified with a number marked on one of the jig blocks, and a P or S indicating port or starboard.

Clear your bench and place each of the leading edge foam cores (1, 2 & 3), for the wing you want to build, in their jig blocks so their bottom surfaces (with all the slots) are uppermost.

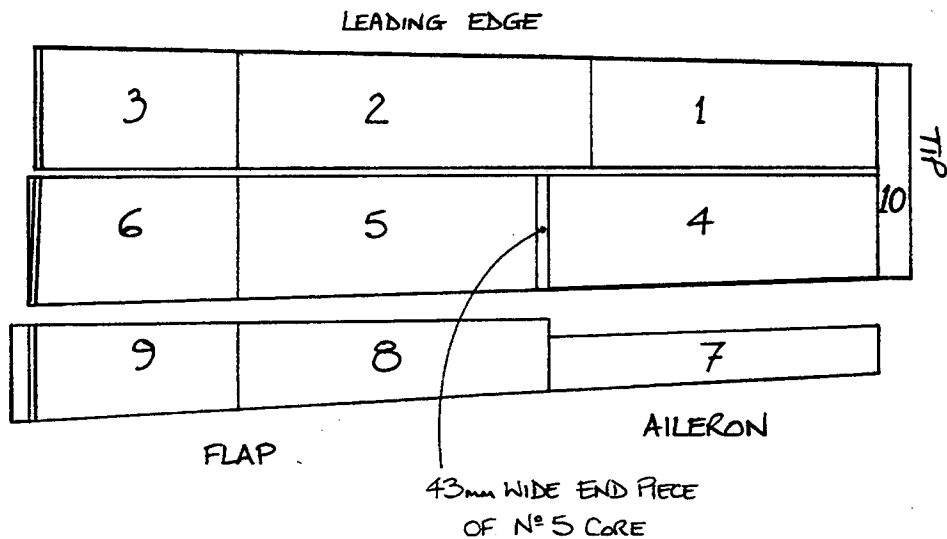


Fig 6. Foam core locations (starboard wing shown).

Remove the lightening hole cores but save them. You'll need bits of them to bond back in place at various stages of the build. To avoid confusion later it may be an idea to identify each of these cores in some way or another.

If the jig blocks are bowed, rapid epoxy bond them to a flat bench to make sure they stay flat and if your cores refuse to sit snugly in them bond them in place using *small* blobs of rapid epoxy. Once you are happy that the cores are straight and true, scrape some rapid epoxy into the slots, much as you did with the fin and tailplanes, to hold the profile shape. Two or three blobs per slot should suffice.

Set all three foam leading edge cores onto the spar in their relevant positions and check that they all line up reasonably with one another. You may notice the cores overhang the spar's end by a few centimeters. This is correct. So is the spanwise twist which is built in to the wing for 1.5° of tip washout.

You'll need to locally hollow out the foam on the spar face of the middle core to allow clearance for the aileron bellcrank bolt heads.

It's a good idea to G-clamp a straight piece of wood across the spar against your marked line so the root core can be located against it. See figure 7.

Use a piece of wood under the clamp's screw to spread the load onto the spar underneath.

To stop the cores moving about when you come to bond them to the spar, glue some mixing sticks to the spar edges to act as guides between which the cores can sit. Don't position them too close to where the foam joints will be as they'll only get in the way. A hot glue gun is ideal for this sort of thing.

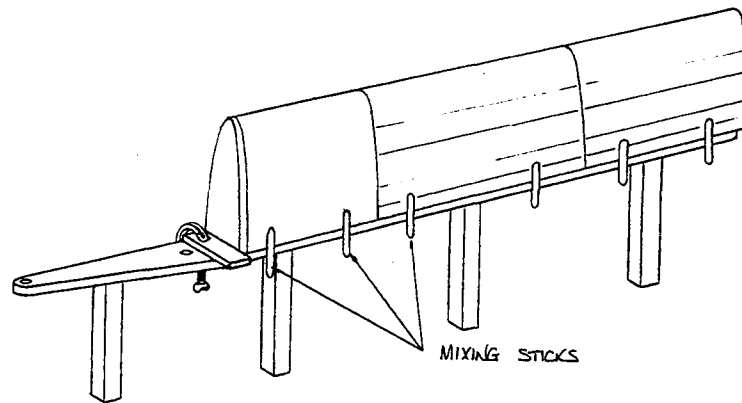


Fig 7. Leading edge cores in position on spar.

On the outboard end of the root core (No 3) and the inboard end of the tip core (No 1) sand a small rebate, about 1.5mm (1/16") deep and 25mm (1") wide, as in figure 8 to allow for ribs of 2 plies of 'bid'.

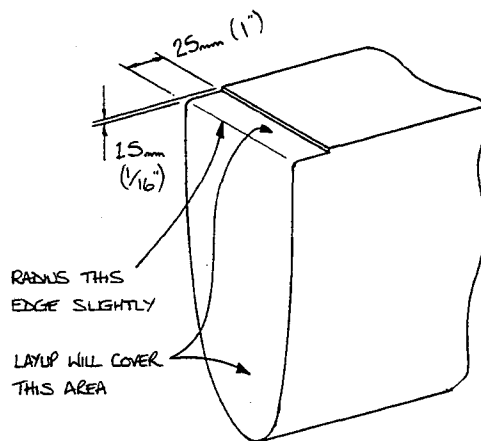


Fig 8. Extent of ribs.

The inboard end of the tip core, where the rebate is, now needs its lightening holes plugged to give something for the rib that will be laid up here something to lay against. Find the relevant core plugs and cut 2-3cm (1") from the end of each then rapid epoxy them in place ensuring they are flush.

You'll notice that the starboard cores have an extra lightening hole. This is because the starboard spar is further aft than the port spar to allow them to overlap.

Attach the narrow end piece temporarily to the No. 3 root core. The short lines marked on this end piece will be used to accurately position the core to the spar so don't obscure them.

Pierce the walls of the lightening holes of the cores by running a hot welding rod, or similar, from the flat trailing edge through to the leading edge chamber so that air can vent between chambers. Do this in several places avoiding the lightening hole plugs.

Step 5

Leading edge ribs layups.

Cut 4 pieces of 'bid' at +/- 45° 55cm x 15cm (22" x 6").

Dry micro fill any gaps and dings then micro slurry the core end adjacent to the rebate and the rebate area itself. Now paint epoxy over the slurred area and layup 2 plies of 'bid' at +/- 45°, one at a time, onto the core side and into the rebate squeegeeing and scissor trimming as close to the foam edges as you can. It's better for the glasscloth to be short of the rebate step than for it to be proud of the core's flat spar surface.

Sand the ribs down to fair in with the wing's profile and dig out a small triangle of foam beside the rib so that a flox joint between the rib and the skin can be made. Chamfer the mid-core (no. 2) edges so that there will be a similar trough on the other side of the rib when the cores are all joined together as shown in figure 9.

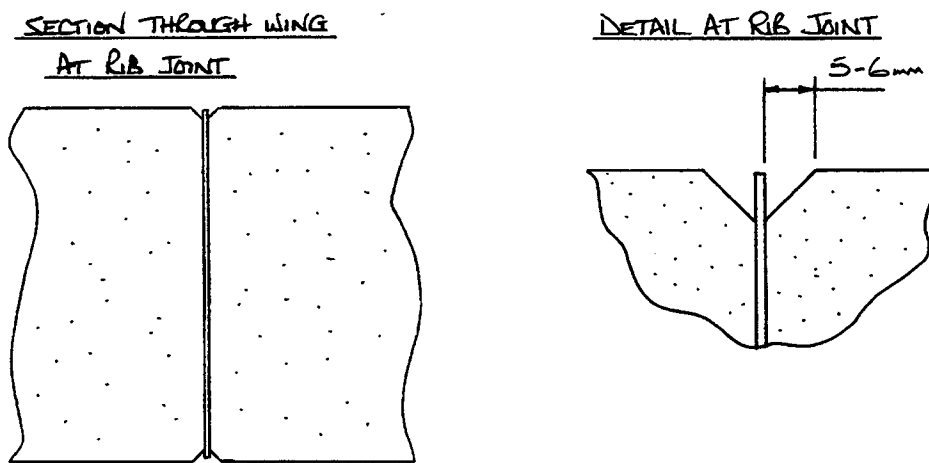


Fig 9. Channels for flox joints.

Step 6

Bonding L.E. cores to the spar.

Firstly, pierce the outboard core's rib with a small drill through each of the lightening hole plugs, making sure you go right through the foam plug as well, to allow air to vent through.

Scuff sand all over the rib layup with 60 grit paper in preparation for bonding.

Start this bonding process by firstly applying dry micro to the *root* foam core's spar edge (flat surface) keeping the micro away from the sides and the rib flange to avoid it oozing out. Apply flox to the rib flange itself.

Adding blobs of rapid epoxy at the corners can be useful to hold the core whilst the micro hardens.

Position the core, complete with the narrow piece, onto the spar next to your guide, pushing it down, giving the micro time to squidge down, and checking that the marked lines are set vertical by placing a level against them. See figure 10.

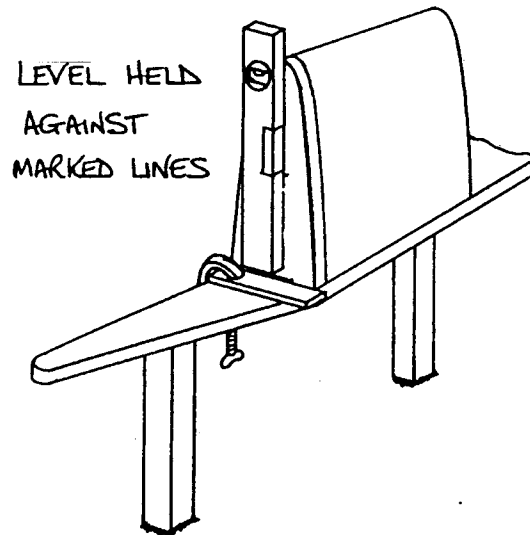


Fig 10. Bonding root core to spar.

Next apply some flox to the aileron bellcrank bracket bolt heads to pot them securely in place.

Trowel dry micro onto the lightening hole walls, but not the edges, of the mid no. 2 core, and to the spar face also as before. See figure 11.

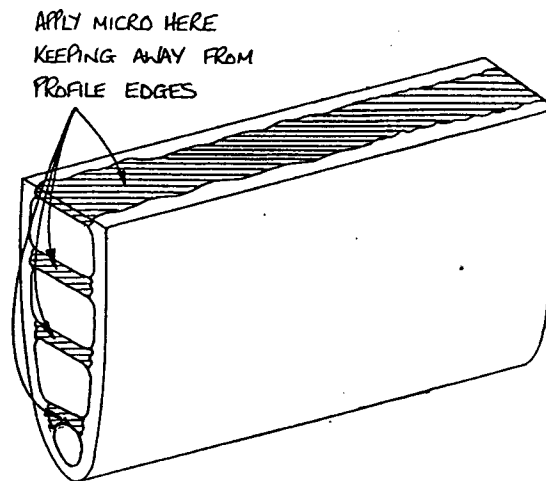


Fig 11. Applying dry micro for bonding.

Place the core onto the spar and squidge it down ensuring it lines up with the root piece. See figure 12.

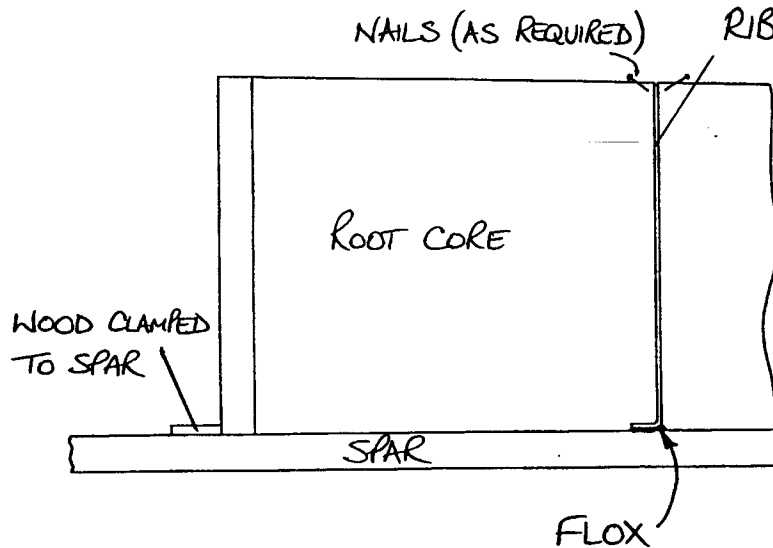


Fig 12. Leading edge core on spar.

Finally repeat the process with the tip core, adding flox to the rib flange, checking that the *marked lines are vertical* and that all the cores line up. If necessary push sharp nails through the leading edge joints to ensure they stay lined up with each other and allow to cure.

Cut a piece of scrap foam to be the same section as the spar and long enough to extend the spar to the end of the leading edge tip core and dry micro bond it in place.

Step 7

Pitot system

The pitot tube is to be mounted to the underside of the wing, and exploded and sectional views of the assembly are provided at page 7 - 33.

It would be logical to mount it on the port wing as the pitot lines would be shorter since the airspeed indicator (ASI) is mounted in the port side of the instrument panel; however it may be mounted to the starboard wing if so desired.

The pitot tube itself is to be far enough outboard so as not to be affected by propeller slipstream, even with the aircraft in a full sideslip. To avoid accidental damage caused by admirers walking around your aircraft, the pitot tube should not extend forward of the wing leading edge.

The pitot line will run from the pitot tube, which will be at approximately mid span in the leading edge, to the wing root. From the wing root, this pitot line will have to be connected to the pitot line running to the ASI to enable rigging and de-rigging.

Pitot tube

The pitot tube is to be mounted on a disc of glassfibre, so first layup 3 plies of biaxial cloth on some plastic sheeting which has been smoothed out on a flat surface.

After full cure, cut out a disc with a 2 1/8" hole saw (this size is chosen as you will need it later in the fuselage construction) so that the disc has a 1/4" hole in its centre.

Bend a short length of the ductile stainless steel tubing through 90°, one straight portion being about 5cm long, and the other being 10cm long. Don't use too tight a bend or you will kink the tube.

Cut a piece of 25mm (1") wooden dowel to about 20mm (3/4") length, and drill a 1/4" hole through its centre. Counterbore one end with a slightly larger drill, 10mm (3/8") maximum diameter, to about 5mm (1/4") depth. This will allow the adhesive in to grip the pitot tube better when it's all bonded together.

Scuff sand the pitot tube on the portion where it will be bonded into the dowel, and then mix a small quantity of epoxy and floc. With the smooth side of the glassfibre disc down, insert the pitot tube so that the external part is about 5 cm (2") from the disc and parallel to it, and then bond the dowel onto the disc and tube. Fill the counterbore also with floc and allow to cure undisturbed.

Preparation

Root Core

A hole of at least 13mm (1/2") diameter needs to be cut through the root leading edge core so that at the outboard end it emerges into the third lightening hole back from the leading edge at the root of the middle core. This position avoids the strong areas of the root rib which will be adjacent to the spar and the lift pin reinforcement plates.

Using a heated metal rod or a tube with a serrated end, cut a hole through the root core at approximately mid thickness.

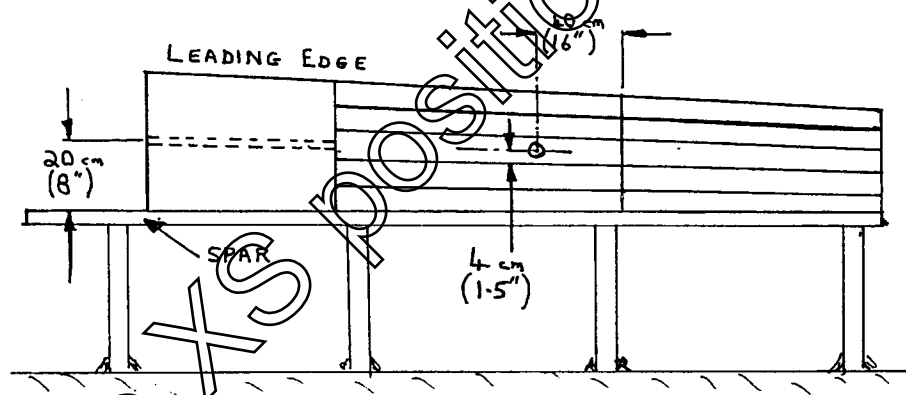


Fig 13. Pitot positioning

Mid core

The pitot tube emerges from the wing underside in the mid core section.

To mark the centre of where the pitot is to be, measure forward from the 3rd lightening hole slot back from the leading edge as shown in figure 13. Using the 2 1/8" dia. hole saw drill out the foam into the lightening hole centred on your marks. Next, make a disc of 3mm plywood to fit into the hole you have just made, and bond it into the hole so that it sits about 2mm (3/32") below the surface.

Step 8

Leading edge skin layup.

Preparation.

Carefully sand the foam flashing off the leading edge and ensure no foam chippings are left around to contaminate the layup.

Cut pieces of cloth to the following dimensions:

1 off 'biaxial' - 3.5m (138") long x full width. (skin)

1 off 'uni' - 1m (40") long. (skin root)

2 off 'bid' - 30cm x 120cm (12" x 48") at +/- 45°. (root reinforcement).

Cut also several pieces of peel ply.

Apply peel ply to the narrow root core, stopping it short of the spar, using pins or double sided tape to hold it place.

Mark the foam surface with a couple of lines running at +/-45° to the spar to aid orientation of the cloth during layup.

Step 9

Skin Layup

This layup is probably the longest single layup to do on your Europa. It's recommended that two people carry out the work as the epoxy's working life is limited.

Dry micro fill any dings in the foam and the gap between the cores and spar being *very careful* not to get any on the spar itself. Now micro slurry the whole surface but avoid getting micro onto your ribs, spar or peel ply.

Mix up some floc and fill the grooves at the ribs.

Paint the foam and spar edge with pure epoxy.

Lay the biaxial cloth along the leading edge ensuring that the longitudinal axis of the cloth (marked by stitch lines) lies parallel to the leading edge of the wing. See figure 14.

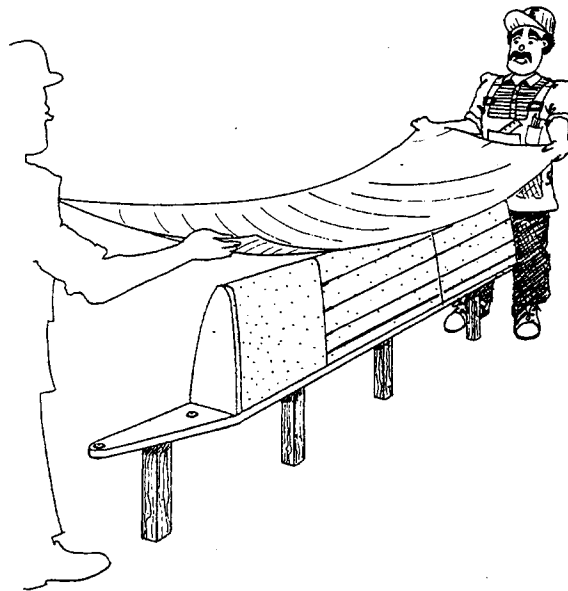


Fig 14. Laying on biaxial cloth on leading edge.

Trim the cloth to end at the back of the spar. Trim the rest of the edges to within 1cm (1/2") of the foam. Squeegee and wet out the whole surface. Take care not to cause indentations at the flox joints.

A 'bid' bracket will be added to connect the skins to the back of the spar, but instead of trying to work upside down now they are to be added after turning the wing over.

Push the skin into the recess where the pitot tube's base plate is to fit, making sure that bubbles don't form in the corners. Double check this area before you leave the layup to cure.

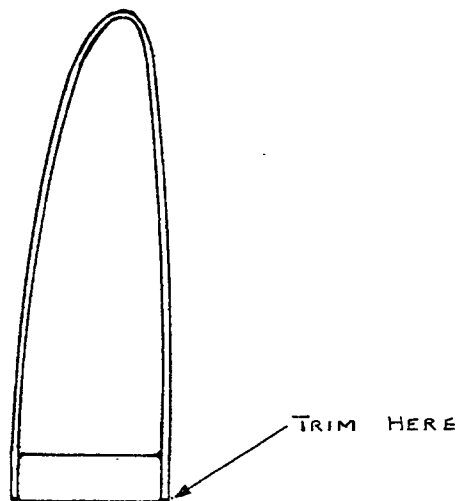


Fig 15. Typical section through leading edge.

Now lay the 1m (40") length of 'uni' to cover the top surface of the root from the spar, around the leading edge and trim to 15cm (6") back on the under surface. This ply has its fibres orientated spanwise. See figure 16.

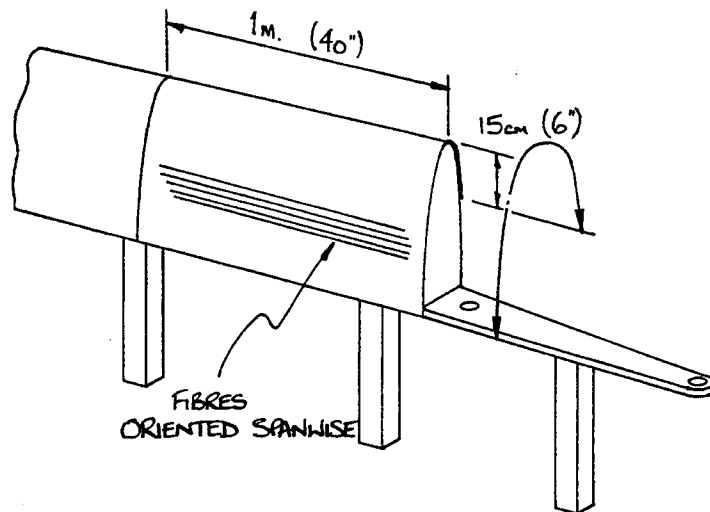


Fig 16. Wing leading edge top surface reinforcement.

The final plies to be applied are the two pieces of 'bid' cloth which cover from the root to 30cm (12") outboard at +/- 45°. See figure 17.

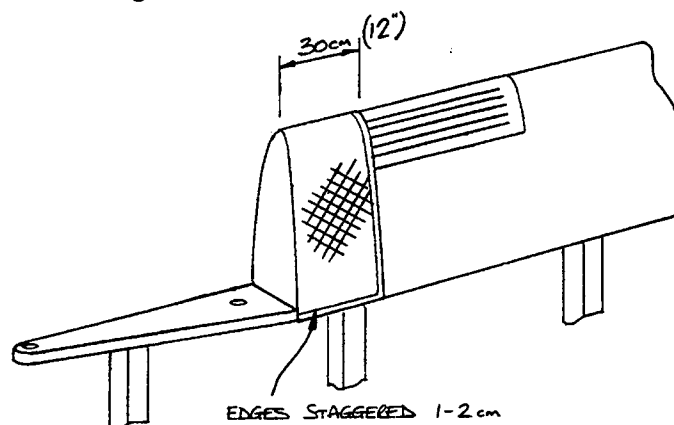


Fig 17. Leading edge root reinforcement layers.

Note: These last three plies will be neater if you stagger the outboard and spar edges of the 'bid' plies by about 1-2 cm (1/2" - 3/4").

Peel ply all the fibre ends, also over the spar edge and towards the leading edge to a width of about 5cm (2") altogether.

Knife trim the edges when the layup has sufficiently cured and sand them back to the foam after full cure.

You have now completed the biggest layup on your Europa and you'll be happy to know that all subsequent skin layups on the wing take half as long as the one you've just done.

Pitot

On the wing which will take the pitot cut the centre of the plywood disc for the pitot mount out to a diameter of 30mm (1 1/4"). Position two MS21047-3 anchor nuts on the flange to act as a drill guide, and drill through the rivet holes and through the plywood with a 3.3mm drill, then drill a 5mm hole between them where the AN525-10R8 attaching bolts will need to go through. Countersink the rivet holes in the glassfibre with a drill for the rivet heads, and rivet the two anchor nuts in place using TLPK424BS pop rivets. If you want more access, you can open up the large hole by filing away the flanges each side of the anchor nuts to make it oval shaped.

Drill 4.8 mm holes for the two fasteners in the pitot mounting plate, making sure that the pitot is pointing at 90° to the spar, then fish out the tubing and trim it or pull it through so that about 7-8cm (3") protrudes from the hole. Connect the tubing to the pitot tube and wire lock it in place. Don't over tighten the wire or you could cut through the tubing.

Whilst you have the four supports in place it may save time to get the second wing to this stage before continuing with the trailing edge. Just re-site the support at the spar's root end first.

Note: If you decide to do one wing at a time just go straight to step 10 and you'll be referred back to here at the appropriate stage

Before removing the spar and leading edge from the supports cut two pieces of 12mm (1/2") plywood or similar to approximately 60cm x 20cm (24" x 8").

Place one piece on the spar against the root leading edge section and mark the profile onto the wood. Do similarly at the tip, lining the board up with the spar front face. Cut out the profiles then slot the boards over the leading edge about 30cm (12") in from each end using bondo to secure them, making sure that the tops are level with the spar See Figure 18.

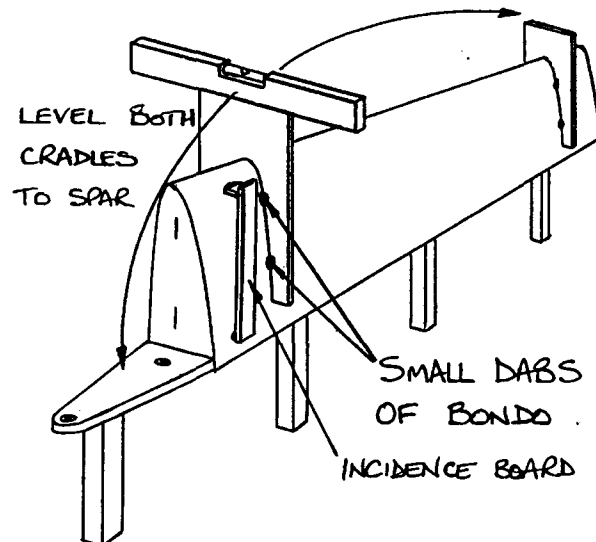


Fig 18. Setting on leading edge cradles.

Incidence board

To enable the wings to be easily set up with the fuselage an incidence board is to be fitted. This will be removed after the wing lift sockets have been installed onto the fuselage sides.

The incidence board must be parallel to the reference lines on the root core foam.

Make the board from a piece of wood about 5cm (2") wide and 50cm (20") long and, using bondo, attach it to the top of the wing about 20cm (8") from the root, orientated chordwise and parallel to the reference lines. You'll need a short support block at the leading edge. Refer to figure 18

.Crack the wing off the four supports with a sharp tap with your hand. Don't use any thing hard otherwise you could damage the structure internally. Invert the wing and stand it on the cradles then, making sure the spar is level laterally, fix the cradles to the floor with bondo.

Spar-skin 'bid' brackets

Remove the peel ply all along the spar and scuff sand the spar rear face. Two plies of 'bid' will wrap around the corners of the spar, joining the top and bottom skins to the spar, outboard as far as the aileron bellcrank. From this point to the tip only one ply is required.

Cut pieces of 'bid' at +/- 45° 5 - 6cm wide (2 - 2 1/2"), and don't cut the ends square. The easiest way to apply these plies is to wet them out on plastic sheeting before positioning them onto the wing. This holds the fibres together until the cloth is in position.

Butt adjacent plies together to avoid a thickness build-up but, where two plies are required, ensure the top ply's butt joint is in a different location to the one underneath.

Remove any plastic and cover the entire layup with peel ply then allow to cure.

Step 10

Trailing edge cores preparation.

When you first have a look at the trailing edge cores you'll find a triangular sectioned strip of foam which has been pre-cut from both number 4 tip core trailing edge support blocks. *Don't throw these away*, you'll need them later on so keep them in a safe place.

There are a few small layups which need to be done to the trailing edge foam cores before they are attached to the spar and you can do these all together or separately as you wish.

The flap hinge plates, W18, will be bonded in place with ribs which you will layup. Also a cavity needs to be made and laid up in which the aileron bellcrank will be housed. There is also a quick layup to be done in the root core push-rod channel.

Before we go further though, making sure the cores are sitting snugly in their jig blocks and are not bowed, apply rapid epoxy to the slots as usual and then referring to figure 19 plug up the middle and tip cores' lightening holes with the relevant pieces of hole core cut down to about 2-3cm (1") in length. Use rapid epoxy to hold them in place.

If you feel you have to dispose of the lightening hole cores be sure to save the rearmost one from the trailing edge tip core as parts of this are to be used later to plug holes in the aileron mass balance channels.

The tip core need not have its tip plugged as a separate tip block will be added later and its root should have the core plugs set 3.5cm (1 3/8") in, except the core plug nearest the spar face which should be set 12cm (4 3/4") in towards the tip. These plugs then form walls of the aileron bellcrank housing and push-rod channel.

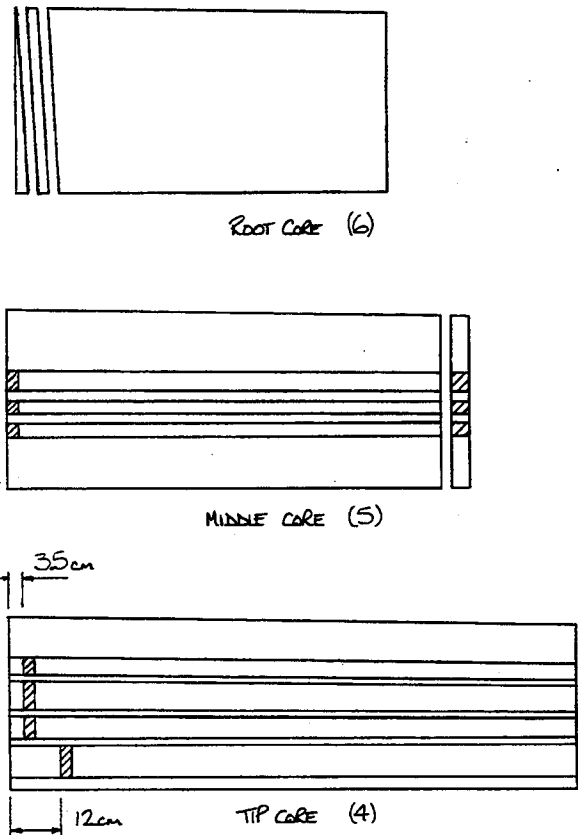


Fig 19. Sections through trailing edge cores.

The 43mm (1.7") wide core can have its lightening hole cores bonded in place complete. The remainder of the plugs should be flush to the ends of the cores. (All this shouldn't be as confusing as it seems if you have the parts in front of you, honest.)

The remaining lightening hole plugs may be discarded, except for the tip core's rearmost one, remember, as parts of it will be used to blank off the sides of the aileron mass balance channels.

For pressure relief, pierce the walls of the lightening holes of each core, as you did with the leading edge cores, and make sure that the open aileron lateral push-rod channel in the spar edge of both No.5 and No.6 cores has a hole leading to the first lightening hole.

Step 11

Aileron bellcrank housing and link-rod channel.

Take the No. 4 tip core and cut out the walls of the lightening holes to the depth of the plugs you bonded in place and to the width of these plugs to make a channel (see figure 20).

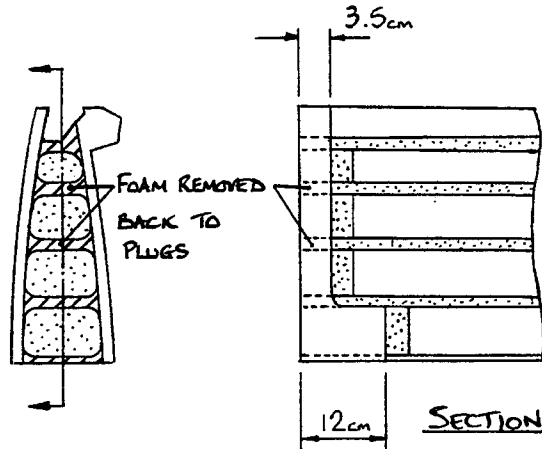


Fig 20. Root end of No.4 T.E. tip core.

Round off the square corner to allow for a 'bid' cloth layup. See figure 21.

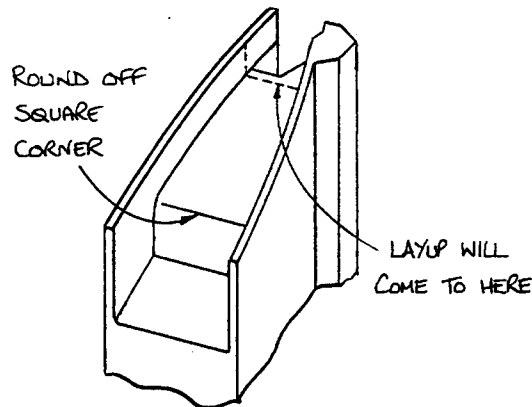


Fig 21. Aileron bellcrank housing / link rod channel.

Lateral push-rod channel.

Now take the No. 6 root core and sit it on its trailing edge to give access to the aileron's lateral push-rod channel. See figure 22.

By the way, the reason that the port wing's channel is deeper than the starboard's is due to the port wing spar being further forward and the aileron lateral push-rods emerging from the fuselage at the same fuselage station as each other.

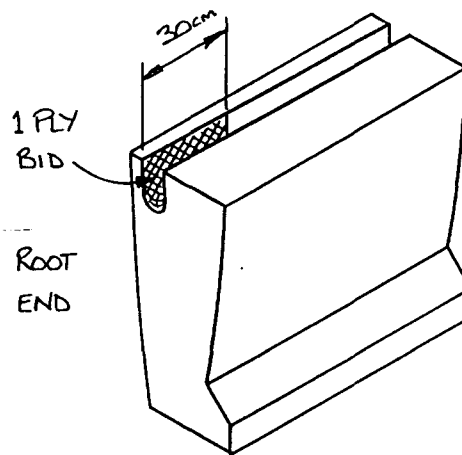


Fig 22. T.E. No.6 root core.

Step 12

Cut pieces of 'bid' at +/- 45° to the following dimensions:

1 off 60cm x 20cm (24" x 8") - (Aileron bellcrank housing/link-rod channel).

Either 1 off 20cm x 30cm (8" x 12") - (Port wing aileron lateral push-rod channel).

Or 1 off 15cm x 30cm (6" x 12") - (Starboard wing aileron lateral push-rod channel).

Micro slurry the aileron bellcrank housing/ link-rod channel in the No. 4 tip core and also the first 30cm (12") from the inboard end of the aileron's lateral push-rod channel in the No. 6 root core then lay in one ply of cloth to cover these areas. Trim the cloth in the No. 4 core to be about 1cm (1/2") short of the aileron close-out channel (ref. figure 21) Use offcuts to cover the sides of the bellcrank housing which will have been left exposed, overlapping any joins and wetting the cloth out thoroughly.

When the layups have cured, trim the excess cloth back to the foam in all areas and double check your vent holes have been left uncovered in the root core. Drill a small vent hole through the layup of the bellcrank housing making sure you enter one of the lightening holes.

Step 13

Jigging for the trailing edge layup

If you decided to make each complete wing one at a time now is the time to jig the spar up to bond on the trailing edge blocks. Refer back to step 8 for instructions on jigging up then come back here to carry on.

Step 14

Preparing for rib layups.

As you did for the leading edge, (ref. figure 5), mark a centre line on the spar at the kink but this time mark a line at 90° to it 70mm (2.75") from the centre of the hole of the metal bush. This dimension takes into account the wedge shaped piece of foam at the root. Clamp a strip of wood lined up on the line's inboard side as a guide for the foam core.

Four of the W18 plates will be installed in each wing and are bonded in at the same time as the ribs you're about to lay up.

The trailing edge cores which the ribs are attached to are the root (no. 6), middle (no. 5) and the 43mm (1.7") outboard piece. This narrow piece will have a flap hinge plate on each side of it which must be set so they are 44.5mm (1.75") apart so you'll need a block of wood or similar of this thickness which can be placed between the plates during cure.

The root and middle cores will have the flap plates attached to their inboard ends. At the root end of these two cores sand a rebate on the spar face, similar to the ones you did on the leading edge cores (ref. figure 8), 1.5mm (1/16") deep and 25mm (1") wide.

Mark a line all around the end of the 43mm core 3mm (1/8") back from the spar face and sand this much off. This is to allow for the plies from both ribs, which will be laid on it, to have their ends overlap on the spar face. Don't forget to round off the edges where the rib layups will go.

Mask the plates as in figure 23 to act as a reference line and save cleaning epoxy off them up after layup.

To give a better key to the W18 flap plates when bonded into the wings scuff sand the unmasked portion with 60 grit paper.

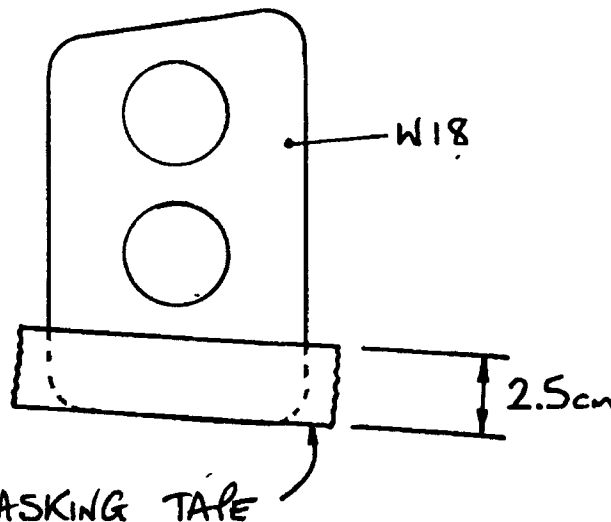


Fig 23. W18 flap plate.

Cut also a 5-6mm (1/4") triangular channel in the foam around the root core's aileron push-rod hole layup for a flox corner.

Step 15

Rib layups.

Cut pieces of 'bid' at $\pm 45^\circ$ as follows:

4 off 25cm x 18cm (10" x 7") - 1 ply/rib.

12 off 45cm x 18cm (18" x 7") - 3 plies/rib.

The ribs to be laid up on core nos. 5 & 6 are identical so just one will be described here. The ribs which will be laid up on the 43mm piece are similar to the others but, instead of their ends wrapping round into a rebate, they are overlapped sequentially onto the spar face. Each rib is comprised of four plies of 'bid' cloth with the W18 plate set between the middle two plies with flox. The third ply to be applied is not full length.

On the root core only fill the trough around the aileron's lateral push-rod hole with flox. Micro fill any gaps between the cores and lightening hole plugs where the layup will go then micro slurry the surface. Layup the first two full length plies, wetting out and trimming each, as indicated in figure 24, wrapping the ends into the rebate on the spar face.

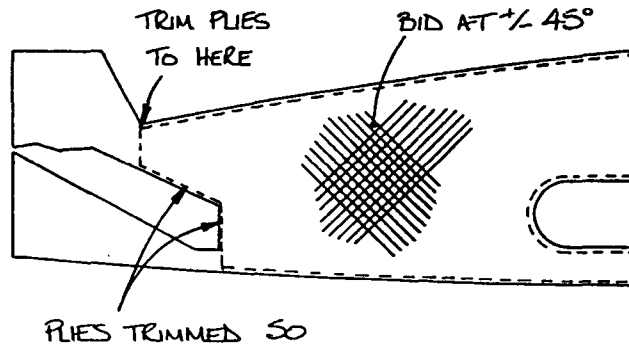


Fig 24. First 2 plies of rib layup.

Next, coat the unmasked portion of the W18 plate with wet flox and position it on the layup as in figure 25.

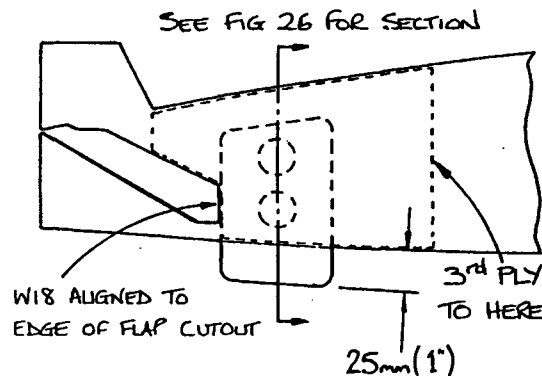


Fig 25. W18 flap position.

Keep an eye on W18's position as you go along with the layup. It's bound to move slightly until you can leave it alone.

Hint: To ensure the W18 plates stay put, stab some strategically placed cocktail sticks through the large holes into the foam.

Apply a skim of flox to the the other surface of W18 and make fillets with flox around the holes and edges of the plates for the next plies of cloth to run down. See figure 26.

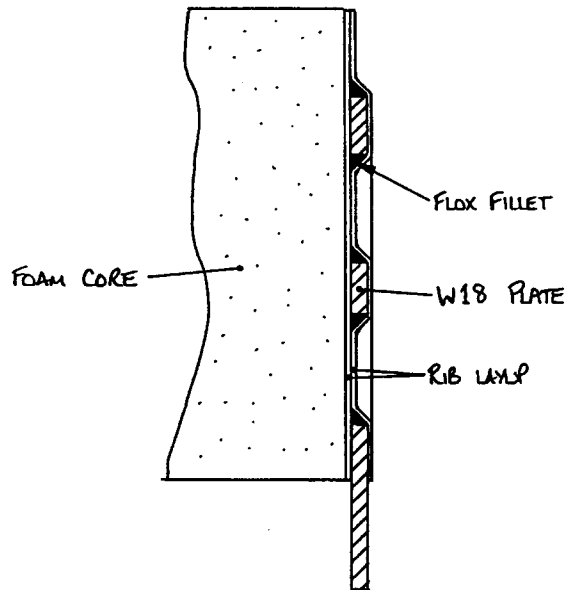


Fig 26. Section through T.E. rib layup (see fig 25.).

Lay on next the local ply of 'bid' (3rd ply), wet it out and trim it then repeat the process with the final (4th) full ply. Trim the layup to the foam edges then peel ply the entire rib. Once again check the plates have not moved then allow to cure.

For the 43mm wide piece the procedure for laying up is the same as described above except that plies should be laid up on alternating sides in turn with their ends interlocking on the spar face.

When the W18 plates have been positioned make sure a 44.5mm wide hard spacer block will fit snugly between them. Add plies locally under the plates if necessary. The outrigger's retraction mechanism fits here so it's important to end up with the correct fit.

Having completed laying up both sides apply peel ply to both ribs and place the assembly on its side, on a flat surface covered with a sheet of plastic to stop it sticking. Put the spacer between the W18 plates and place a small weight on top, supporting the rest of the core so the bottom W18 plate is flat on the bench. Ensure nothing will move then leave to cure.

After cure carefully sand the rib's edges back to the foam.

Step 16**Bonding T.E. cores to the spar.**

Stand the cores on their spar faces on a flat surface and remove foam locally at the areas adjacent to where the W18 flap plates are so they are able to fit nicely together.

Do this even with the 25mm (1") root piece and temporarily attach it in place with rapid epoxy.

The 25mm root piece should then be rapid epoxied back in place, to be used in making a flange, and the wedge shaped piece then rapid epoxied to the the 25mm piece. Always use only small blobs of adhesive as these pieces will be removed later on. The wedge shaped piece is used only for aligning the root core, when bonding it to the spar, as it has the vertical level lines marked on it.

Try the cores on the spar in their relative positions to see if any adjustments are required before bonding them in place. When the trailing edges are bonded to the spar the level lines marked on the root and tip must be in line with those of the leading edge so a straight edge with a cut out in it for the spar will need to be made. Use a piece of faced board, the type commonly used for making shelves with, and make the straight edge according to figure 27.

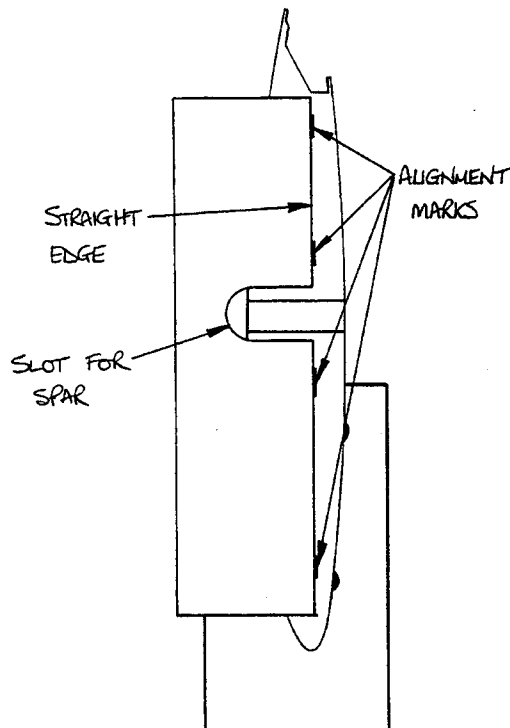


Fig 27. Straight edge for lining up cores.

Step 17

When you are happy that the cores will go together properly scuff sand the spar, where bonding will take place, with 60 grit paper.

Apply floc to the glassfibre in the spar face rebate then trowel some dry micro onto the cores' foam spar face as you did the leading edge, starting with the root core, and squidge them down in position one at a time having applied micro also to the ribs.

Make sure that the reference lines on the root and tip cores are lined up using your straight edge. Ensure also that the middle core pieces line up with the two end ones and take special care that the trailing edge is a straight line by sighting along it. Ensure that the cores won't move then leave to cure.

Step 18

Carefully remove the wing from the floor, but keep the cradles as you'll need them again later. You won't have to set the wing to any level reference during the remainder of the build so there's no need for them to be mounted back in exactly the same place.

Your wing should be stiff enough by this stage but it won't hurt to sight down both leading and trailing edges to ensure all is straight and true.

Set the wing leading edge down in its cradle.

Step 19

Trailing edge bottom skin layup.

Remove the peel ply from the leading edge-spar corner and, if there are any glossy looking areas, lightly sand them with 60 grit paper.

Cut a triangular channel in the foam cores about 5-6mm (1/4") deep either side of each rib for floc joints. *Remember that the 25mm root piece is only there to make a flange on so don't floc this to the rib. As the flange need only be 25mm wide, remove the wedge shaped piece of foam from the root and discard it.*

Cut pieces of cloth to the following dimensions:

1 off 'biaxial' 3.4m (134") long x 63cm (25") wide (this is half the full width - the other half will be used later for the trailing edge top skin layup).

2 off 'bid' at +/- 45° 50cm x 30cm (20" x 12")

and also several pieces of peel ply.

Step 20

Use dry micro to block the lightening hole slots then micro slurry the foam surface but keep micro away from the rib channels as much as possible. Fill the rib channels with flox until they are flush with the foam surface, then paint the surface with neat epoxy.

Lay the ply of biaxial cloth with the selvage edge overlapping the leading edge layup 5cm (2") from the rear face of the spar, carefully cutting slots to allow the W18 plates to go through. See figure 28.

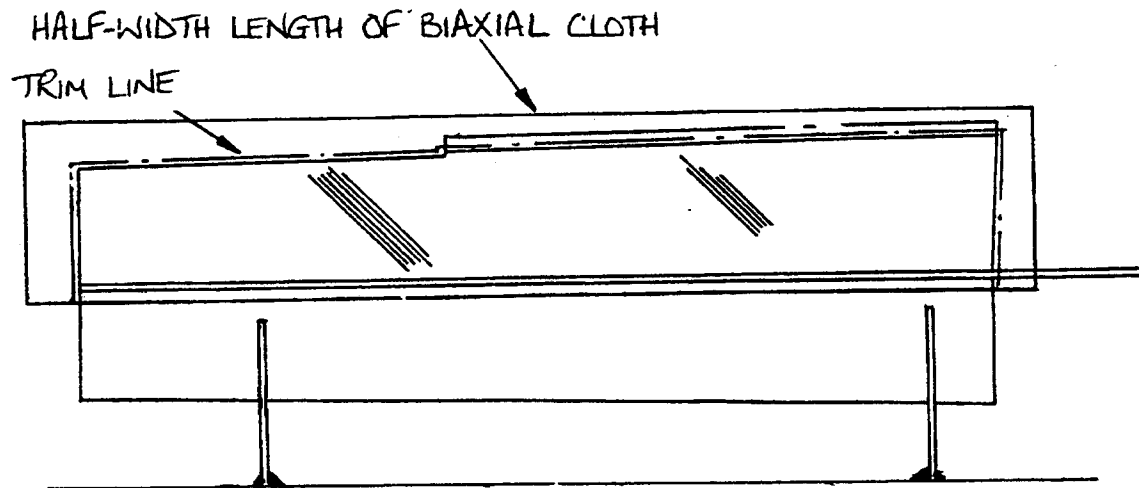


Fig 28. Trailing edge layup.

Trim the edges of the cloth to within 1cm (1/2") of the foam. Squeegee and wet out the cloth taking care not to create indentations in the flox at the joint areas.

Now apply the two plies of 'bid' cloth at the root for the root rib reinforcement. Arrange them so the second ply is trimmed 1-2cm (1/2"-3/4") shorter at the spar and outboard edges than the first to allow for a smooth transition of the edges.

Peel ply all cloth ends and joints then leave to cure, knife trimming when appropriate. After full cure carefully sand the skin back to the foam edges. At the aileron portion of the T.E. this is the defined line for the hinge.

Step 21

Trailing edge close-out.

The next small layups to be done form a close-out all along the trailing edge which will house the flap and aileron leading edges.

Flap close-out

Draw a line on the bottom skin parallel to the rearmost slot which can be seen through the cured skin and 5cm (2") towards the trailing edge all along the flap portion of the wing. As the root core has no slot, extend the line from the mid-core. See figure 29.

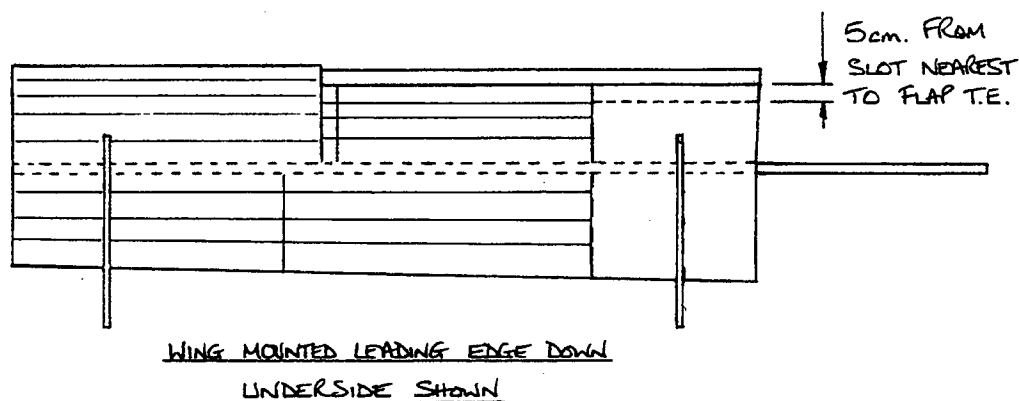


Fig 29. Trim line for flap area of wing T.E.

Using a hack-saw blade cut through the skin and remove this strip of glass fibre and foam from the root up to where the aileron starts.

The final trim line will make this flange even shorter when you come to hang the flaps so you needn't spend time making sure that its straight and accurate at this stage. You are trimming it now just to give yourself access to do the layup.

Remove the foam back to the skin as in figure 30 and prepare this skin for a layup.

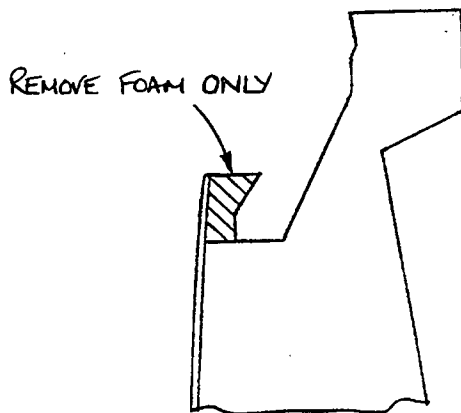


Fig 30. Section through flap area of wing.

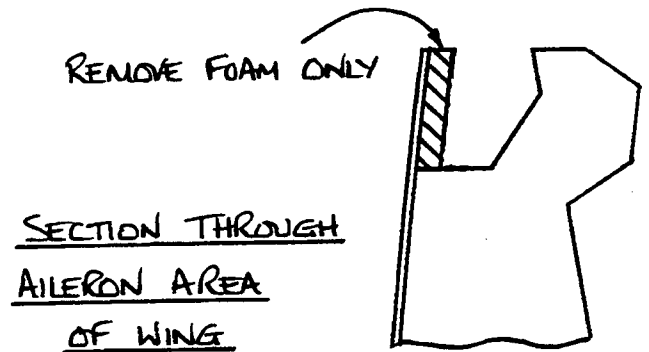


Fig 31. Section through aileron area of wing.

Step 22

Aileron Close-out

It's a little awkward to do but remove the foam all along the aileron close-out as per figure 31.

Once done, get that long triangular sectional strip of foam you've been guarding jealously and try it for size in the position shown in figure 32.

Make sure it sits in place properly as it will be microed in place just before the layup to stiffen the skin as the aileron is hinged from it. Lastly, cut 5-6mm (1/4") deep triangular troughs each side of the ribs to allow for floc joints.

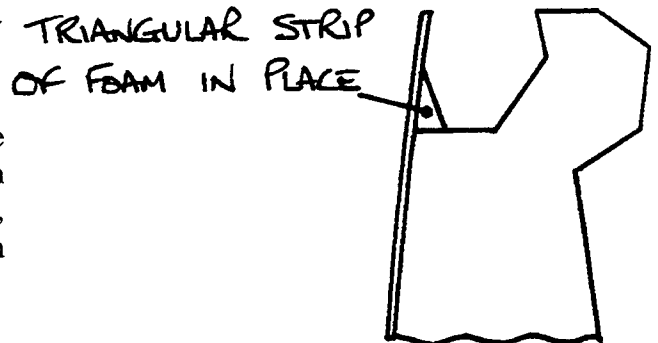


Fig 32. Section through aileron close-out.

Step 23

Close-out layups

The close-outs of both the flap and the aileron will have two plies of 'bid' at +/-45° each, cloth dimensions being:

- 3 off 25cm (10") x full length possible. (Don't cut ends square) Flap close-out.
- 2 off 25cm (10") x full length possible. (Don't cut ends square) Aileron close-out.
- 4 off 20cm x 8cm (8" x 3") Aileron hinge reinforcements.

Start off by filling the rib troughs with flox then attach the triangular strip with dry micro in the position shown in figure 32. Micro slurry all the foam ready for layup making sure that any stray micro is wiped off the glassfibre flange before layup.

Now comes the tricky bit. As you will have discovered, when making the rudder, 'bid' cloth can change shape quite a bit especially when in long strips. If you gently roll the length of cloth up, initially unroll it over the close-out channel in the trailing edge then feed it into place from one end, adjusting the width to suit progressively you will stand a better chance of not losing your patience with this layup. The plies used in the aileron's close-out will have to be stretched a little to cover it without a join so the cloth has been deliberately sized extra wide to accommodate this.

Stipple the epoxy through with a brush to wet out the cloth. Take care not to use too much epoxy though, as it's difficult to get in to remove the excess in the small space that there is. The joint in the cloth necessary in the flap close-out must be an overlap of about 2-3cm (1"). Try to make overlaps in different places on subsequent plies to avoid building up the thickness.

When you get to the area where the close-outs run into the aileron link-rod's channel run the plies down into it to over-lap onto the glassfibre of the channel ensuring no foam is left exposed.

Scissor trim the first ply to limit the excess cloth to no more than 1cm (1/2") to give you better access for laying in subsequent plies. Place the hinge reinforcement plies, 2 at each location, in the aileron's close-out channel, as shown in figure 33, wet them out then scissor trim them. The dimensions are taken from the inboard end of the aileron close-out flange.

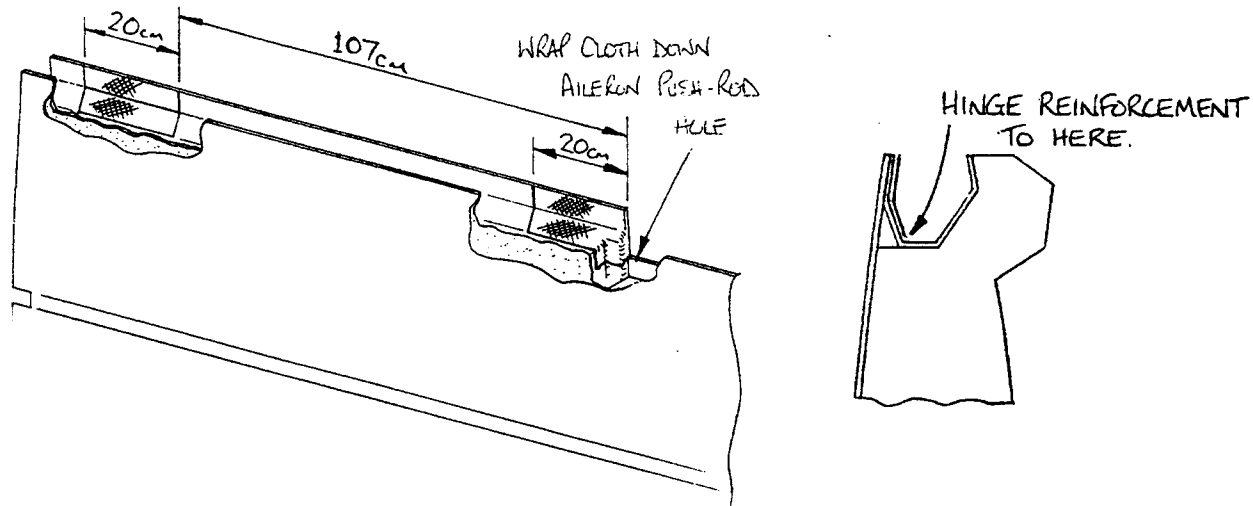


Fig 33. Hinge reinforcement positions.

Now lay in the final ply, scissor trim then leave to cure, knife trimming when appropriate. After full cure trim the fibres' ends back to the foam or to where the bottom skin has been trimmed to.

The layup in the flap close-out covers the area shown in figure 34 and the aileron close-out as in figure 35.

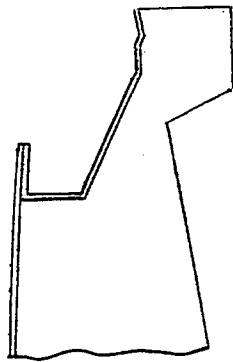


Fig 34. Section through flap close-out.

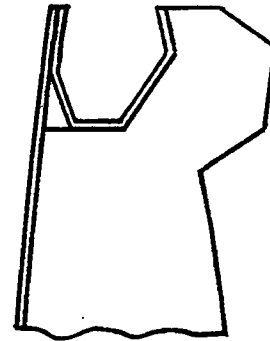


Fig 35. Section through aileron close-out.

Step 24

Trailing edge top skin layup

The next skin layup is essentially a repeat of the under-surface's layup. The only difference is that three plies of 'bid' cloth are to be positioned at the root for the walkway as this is the area that will be stepped on the most.

Preparation.

Hack-saw off and sand down the trailing edge support block to blend the foam surface in with the trailing edge close-out skin as in figures 36 and 37.

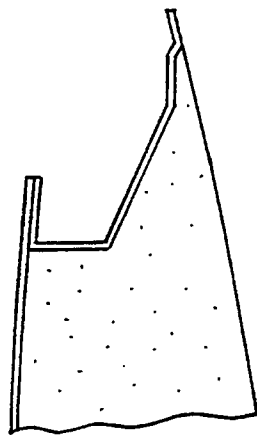


Fig 36. Section at flap close-out.

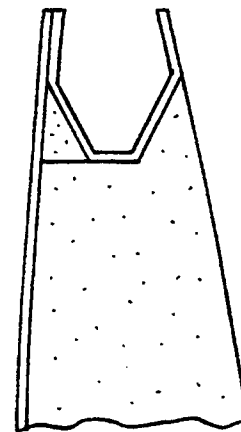


Fig 37. Section at aileron close-out.

Cut pieces of cloth to the following dimensions:

- 1 off 'biaxial' x 3.4m (134") long x 63cm (25") wide (left over from the bottom skin layup).
- 3 off 'bid' 55cm x 30cm (22" x 12").

Cut triangular channels each side of the ribs for flox as before then micro slurry the foam surface and flox fill the channels before painting the entire surface with epoxy. Do remember to take care not to cause indentations at the flox joints.

Apply the biaxial cloth with the selvage edge overlapping the spar by 5cm (2"). Trim the edges to within 1cm (1/2") of the edges. Wet out and squeegee the cloth.

Add the *three* plies of 'bid' cloth at the root as reinforcement for the walkway, staggering their edges by about 1cm (1/2") for a smooth transition.

When all plies are in place, properly wetted out and squeegeed apply peel ply to the 'bid' cloth ends at the spar and outboard edges. Allow to cure, knife trimming when appropriate.

After full cure sand the glass-fibre edges back to the foam and trailing edge line.

Step 25

Root close-out rib.

Sandwiched between plies in the root close-out layups will be three small plates. Part numbers W22 in the leading edge and W23 in the trailing edge.

These will later be drilled and tapped to take the 12mm stainless steel pins which transfer the lift, drag and torsional loads of the wing into the fuselage. Scuff sand these plates and keep them clean and handy for incorporation into the following layups.

Cut pieces of 'bid' cloth at +/- 45° to the following dimensions:

6 off 65cm x 25cm (26" x 10") (3 each full length on L.E. and T.E. ribs).

10 off 35cm x 25cm (14" x 10") (plies to be sandwiched between the W22 and W23 plates),
and several strips of peel ply.

LE plies can be shorter by 4.25cm (1/2 10x10)

Remove the 25mm thick root foam pieces from both the leading and trailing edges and tear away any peel ply from the inside of the resulting flanges.

Remove the peel ply or, if not applied, scuff sand the trailing edge root rib in readiness for laying up.

Make a *small* fillet of dry micro in all the corners, just enough to prevent air bubbles forming under the layup.

Now micro slurry the foam surface of the leading edge in preparation for laying up, taking care to wipe off any that may have strayed onto the glass-fibre flange, then paint the whole area with epoxy.

Lay two plies of 'bid' cloth to cover the whole of the leading edge and trailing edge close-outs' ribs wrapping the cloth around onto the glassfibre skin flanges and also onto the spar. Stagger these plies on the spar so that the first ply runs about 5cm (2") beyond the metal bush and the subsequent two plies are about 25mm (1") shorter each time. Cut a hole in the glassfibre for the bush flange - don't lay-up over it.

Coat one of the W22 (L.E.) or W23 (T.E.) plates with floc and position as in figure 38.

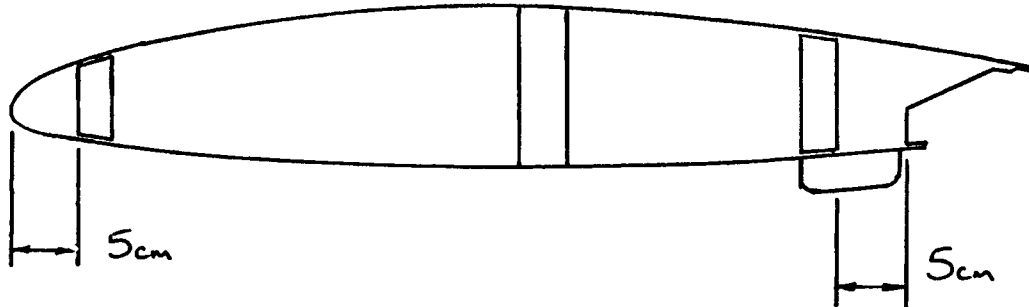


Fig 38. Position of W22 and W23 inserts.

Referring to figures 39 and 40 make a fillet around the edges of the plates with floc for the cloth to run down then apply two shorter plies wetting each out in turn.

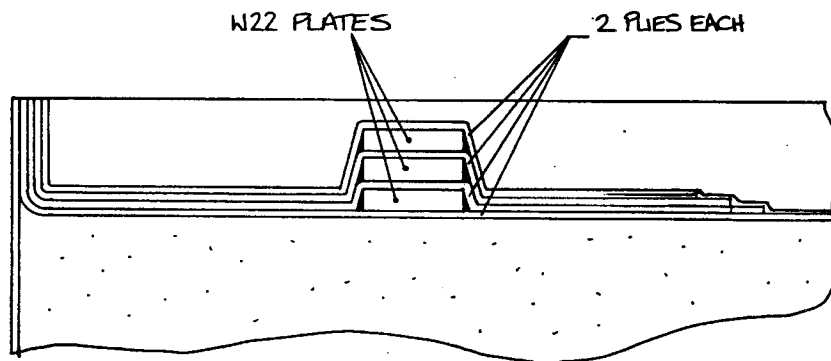


Fig 39. Section through leading edge root rib.

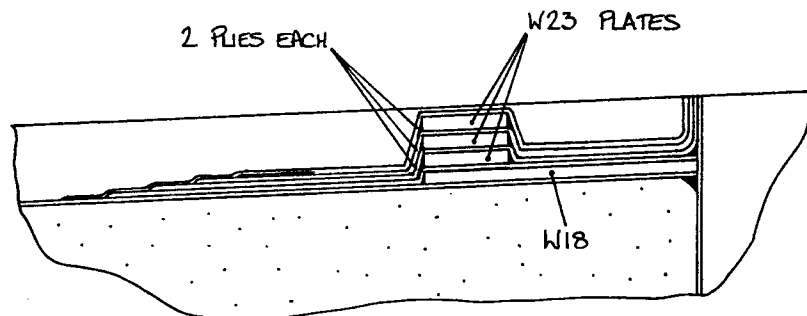


Fig 40. Section through trailing edge root rib.

In the leading edge, these shorter, local plies need to go right onto the leading edge flange and back to approximately 10cm (4") aft of the plates. Stagger the ends of each ply to be about 1-2cm (1/2") shorter than the previous one to give a gentle transition for the final ply to run up.

At the trailing edge get the cloth into the vee between the top skin and close-out flange to about 10cm (4") forward of the plate, again staggering the ply ends.

Attach another plate directly on top of the first one, having smeared flox all over it then make a fillet around its edges before laying on the next two local plies.

Apply the third and final plate on top of the previous one covering it with *one* local ply then one full length ply to finish up with. Make sure that the plates don't move until the layup has cured. If there has been some displacement of the plates during layup carefully reposition them through the laminate before it starts to harden.

Leave to cure, knife trimming and sanding the ends back to the previously cured flanges when appropriate. Also cut open the aileron push-rod hole.

Your wing structure is essentially finished, the tip being the only bit missing but before this is attached you will want the ailerons fitted to ease alignment so these are what to make next.

At this stage you can try the pitot in place in the wing using two AN525-10R8 bolts but it is advisable not to do the final fit until you have finished working with the wing to save damaging it.



Installation of underwing pitot/static

| | |
|-----------------------|----------------------------|
| Classification | Highly recommended |
| Applicability | All pre XS Europa aircraft |
| Compliance | N/A |

Introduction

The static source on the sides of the fuselage, in some aircraft, is subject to instability when operating close to the stall, causing substantial oscillation of the A.S.I. needle.

Europa Aircraft have carried out flight testing to determine an optimum position for the pitot/static under the wing. This Modification describes the installation of a pitot/static unit suitable for underwing fitting to Europa aircraft having foam filled wings. Pitot/static units fitted in accordance with this Modification will have pitot/static errors within the limits imposed by JAR VLA.

Action

1. Mark a position on the under surface of the port wing 13" outboard of the flap/aileron interface, and 12" aft of the rear face of the spar.
2. With a 45 mm (1 3/4") diameter hole saw carefully cut through the wing skin and foam.
3. Cut the plywood supplied to make a disc with an outside diameter of 45 mm (1 3/4") and trim to fit in the hole cut in the wing. Cut out an oval hole as shown in figure 1. Drill through the plywood 2 holes 4.8 mm diameter 1" apart, countersink the holes, and fit the two MS21047-3 anchor nuts, using TLPK424BS pop rivets.

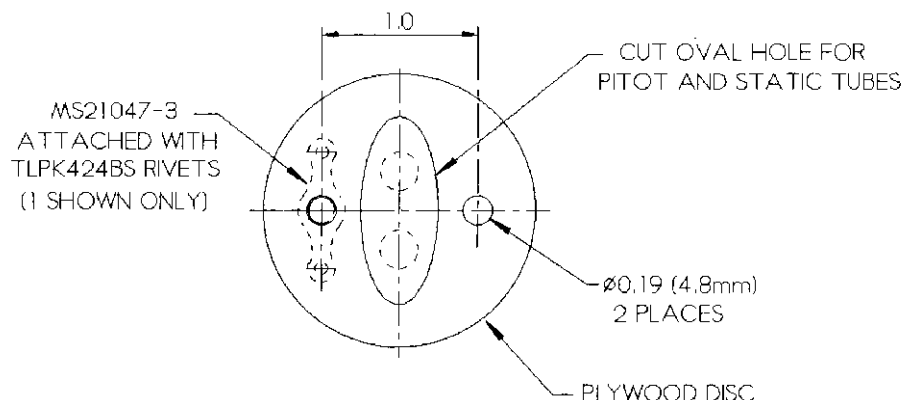


Fig 1. Pitot/static mounting block.

4. Pass the plywood disc over the free ends of the tubing, and floc it into position so that it is 1.5 mm (1/16") below the wing surface.
5. Scuff sand 4 cm (1 5/8") around the hole, removing any paint completely, and layup two layers of 'bid' over the plywood disc lapping 3 and 2 cm (1 1/2" and 1") onto the wing skin. Make a fillet of floc around the edge of the hole first to eliminate air bubbles. Peel ply and leave to cure.
6. Drill a 12 mm (1/2") diameter hole starting at the front of the flap outboard close out as far forward as possible and as low as possible, and aimed directly at the hole cut in the wing skin. This will break out into the same lightening hole as the one cut in the wing skin. You will need to disconnect the outrigger mechanism push-rod OR5 to pivot the flap out of the way
7. Feed two lengths of the 3 mm x 6 mm PVC through the hole and fish the ends out leaving about 5 cm (2") free for later fitting to the pitot/static unit. Run the tubes along the front lower edge of the wing trailing edge close out, securing them at intervals with scraps of 'bid'. Pass the tubes over the top of the spar and fix them to the root rib with a scrap of 'bid', leaving about 30 cm (12") of slack.
8. Fit one tube with a plug fitting (PMC 22-02) and the other with a socket fitting (PMC 17-02). This allows them to be fitted together with the wing derigged, and avoids confusion as to which is pitot or static.
9. Fit the two tubes onto the pitot/static assembly and clamp them in place with wire, being careful not to over tighten the wire or you could cut through the tubing.
10. Fit the pitot/static assembly to its mounting with the AN525-10R8 bolts.
11. Drill two 1/4" holes through the fuselage side near the bottom of the area covered by the wing and just forward of the spar cutout. Feed two lengths of the 3 mm x 6 mm tubing through these and lead them along the door reveal to the instrument panel area. The "T" pieces and union fittings are provided for instrument fitting. Fit the outer ends of the tubing with the quick release fittings PMC 22-02 and PMC 17-02, ensuring that the static ports of the instruments match the static vent and vice versa.

Mass Balance box Cutouts

Step 15

Wing cut-outs

Before you can re-install the ailerons onto the wings, cutouts in the wing's bottom surface are required.

To ensure sufficient aileron travel, the cut-out in the wing will be made and laid up before the mass balance arms are permanently fixed with glassfibre.

Line the aileron up with the wing and mark the *bottom skin* with the outline of the mass balance horns with a clearance of 5mm (3/16") all around.

Cut away the bottom skin to your lines, removing also the portion of the rear close-out. Dig the foam out down to the underside of the top skin, taking care not to cut or score the skin itself. Try the aileron in place ensuring that you have the 5mm clearance all around the mass balance horn throughout the aileron's full movement.

Step 16

Wing cut-out layup

With the aileron removed once more, fill the exposed lightening holes with scraps of foam approx 2-3cm (1") long and glue them in with rapid epoxy. Use portions of the lightening hole's core if you still have it.

Layup the entire exposed area, including the inside of the top skin, with two plies of 'bid' at +/-45° making flox corners at the skin junctions.

You will have to manipulate the cloth around the corners as you stipple it in adding epoxy as required. Try not to get too much resin into this layup as it is almost impossible to get it out again due to the restricted space.

After cure, trim and sand the excess flush with the skin.

Check that the aileron can travel 22° down minimum (20° will be required after layup). This can be measured as shown in figure 25. When carrying out this check, tighten fully at least one screw in each hinge.

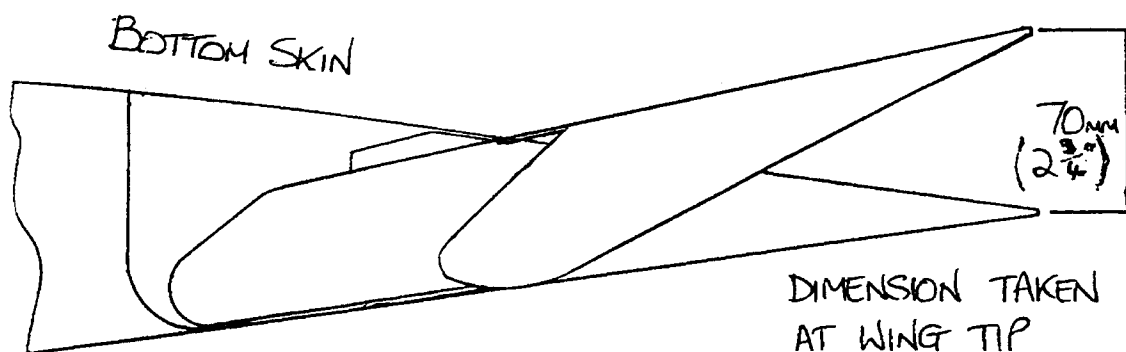


Fig 25. Checking for sufficient down aileron travel.

Check that the the aileron can pivot 23.5° up with clearance - if there is inadequate clearance trim the upper skin flange as necessary - if you trim it to contact at 25° up this will give an appropriate clearance at 23.5°.

If either of the arms strikes the top skin before the check dimension is obtained, move the weight and trim the foam as required. Trim off the excess lead to blend it in to the foam arm. Finally, bond the weight to the foam arm using rapid epoxy.

Aileron Bellcrank Access Hole

Aileron Bellcrank Access Hole

You've probably been wondering how to get access to the aileron bellcrank, buried in the wing, for attachment of the push-rods. Well, find a sharp knife as you'll soon be cutting into your lovingly laid up bottom skin to make a hole. There are many ways you can gain access to the aileron bellcrank for inspection and servicing and the following instructions describe only one of them. A clear window is used in this method so visual checks can be made without removal of a panel. Of course, once you have cut the access hole and sealed the exposed foam edges with floc, a simple cover could be made using a thin sheet of light alloy painted white and attached to the skin with silicone. The panel can be prised off every year for the inspection and simply re-attached with fresh silicone afterwards.

Step 21

Marking Out

Referring to figure 30 which shows how the access window will look when installed, mark the outline of the aileron bellcrank housing onto the underside of the wing. Sticking masking tape on the skin in the relevant positions first may help you get clear lines.

Use the spar and the 43mm wide trailing edge core, which you can see through the skin, to reference dimensions from.

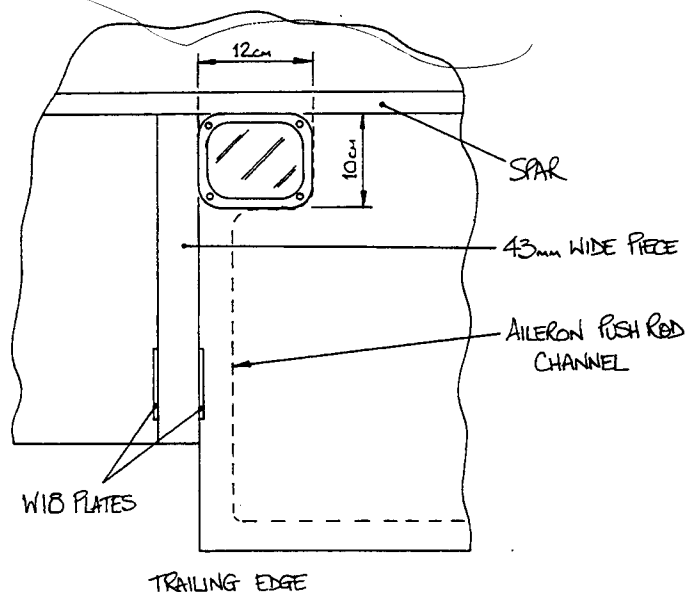


Fig 30. Partial view of wing bottom surface.

With the housing size and position established mark lines now to make a rectangle 1cm (1/2") smaller in both length and width. Finally, mark radii of about 2.5cm (1") at each corner. This outlines your aileron bellcrank access hole.

Step 22

Cutting the hole

The surest way of cutting the hole out, and finding out if you're definitely in the correct place before opening it out to full size, is to initially use a hole-saw in your drill to cut out a central hole then, using a hacksaw and file, cut to the final size.

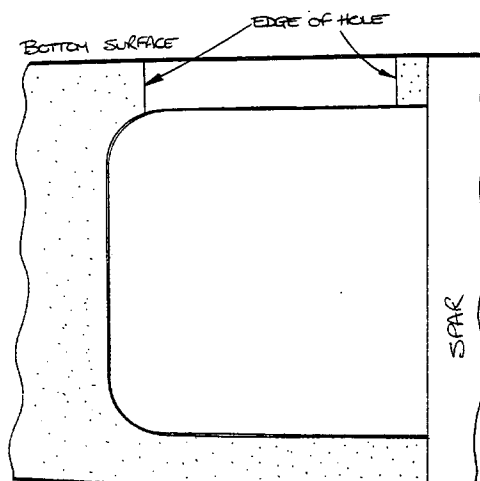


Fig 31. Section through bellcrank housing with hole

Step 23**Access window**

To make each access window you will need a piece of perspex or lexan 12cm x 10cm (4 ¾" x 4") (not supplied). The thickness is not critical but 3mm (1/8") is about ideal. Cut the window to size and round off each corner to a 2.5cm (1") radius. See figure 32. This shape should match the marking on your wing. Be careful when cutting or filing perspex as it can easily crack, especially if cold.

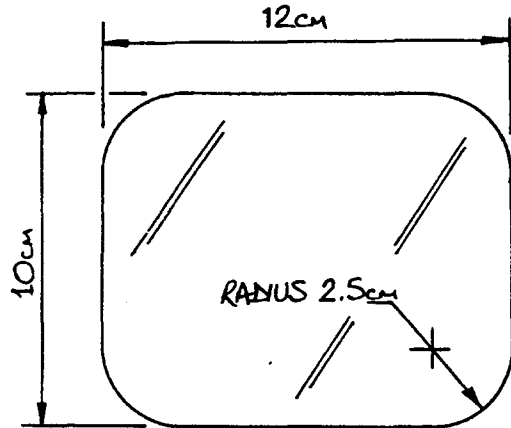


Fig 32. Section through bellcrank housing.

Step 24**Mounting flange**

The flange will match the size of the bellcrank housing, 12cm x 10cm (4 ¾" x 4"). Use your access window as a template and mark out the flange's outline and position. The apparent mis-matching of corner radii allows sufficient room for an MS21047-3 anchor nut to be positioned at each corner. With a sharp blade carefully cut along your marked line to just cut through the skin and, by sliding the blade underneath the skin, remove the flange. See figure 33.

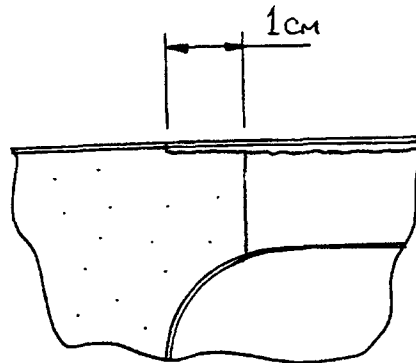


Fig 33. Part section of hole with flange removed.

Scuff sand one side of the flange for bonding then layup 2 plies of 'bid' onto it, all over, just to thicken it up. This ensures that countersunk holes can be made, for anchor nut rivets, without fear of going right through.

Sand the foam around the hole sufficiently deep until the thickened flange and the perspex window can be put in place and be flush with the wing's skin. See figure 34.

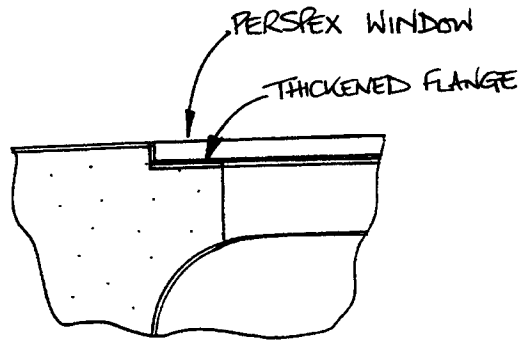


Fig 34. Checking for flange depth.

Step 25

Attaching the anchor nuts

With the window matched up with the flange mark the hole centres for anchor nuts at each corner and drill through both window and flange with a 5mm drill. See figure 35.

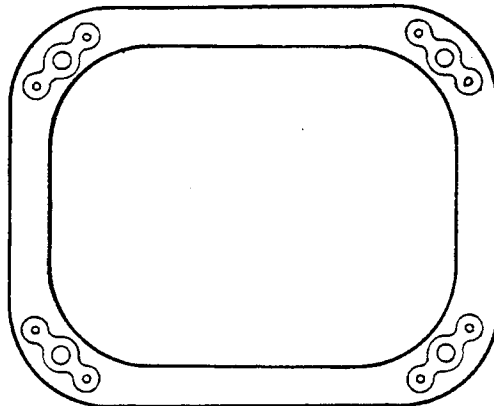


Fig 35. Positions of anchor nuts on flange.

Drill the 3/32" holes for the anchor nuts' rivets (TAPK33BS), holding each anchor nut in position on the flange using one of the AN52510R8 screws to centralise it. Spin a larger drill bit in your fingers to countersink these holes to accept the rivets. Finally, rivet the anchor nuts to the flange.

Step 26

Flange Attachment

Dig out the foam around the access hole locally where the anchor nuts will be to allow the flange to sit properly in place.

Also, dig the foam out as in figure 36 in preparation for filling with flox around the flange. Mix up some flox and bond the flange to the foam making sure you don't allow any to get into the threads of the anchor nuts. Check the flange is to the correct depth before it has cured off.

DIG FOAM FROM UNDER
FLANGE IN SEVERAL
PLACES

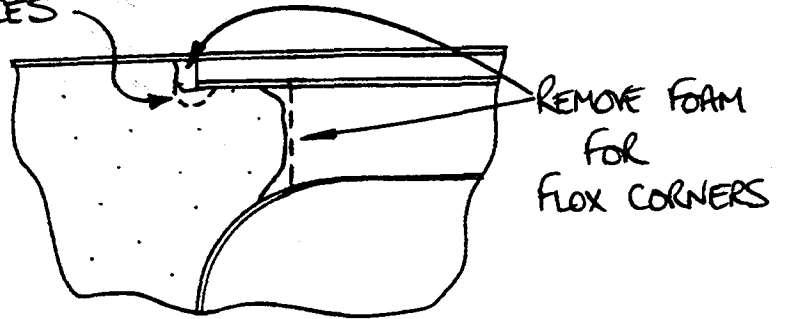


Fig 36. Removal of foam for flox corners.

Fill the cavities, around the edge of and underneath the flange, with flox to make 'flox corners' then leave the whole lot to cure. See figure 37.

After cure smooth off any sharp or rough edges with sand paper. The access window can now be installed.

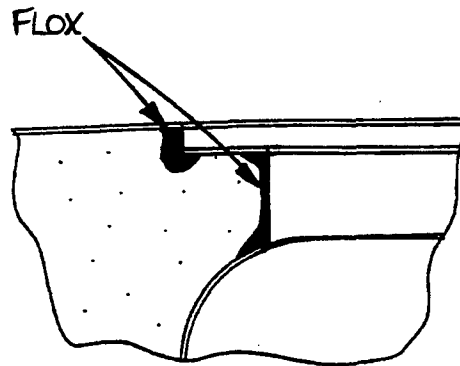


Fig 37. Flox filling foam edges.

Wing Tips

Wing tips

With the ailerons fastened to the wings the tip blocks can be attached, shaped and laid up. The aerofoil section has been pre-cut so only the tip curve and corner radii have to be shaped before layup.

Attaching the block

Both wing tip blocks are identical so either can be used for either wing. Hold the tip block in place on the end of the wing and check that there are no large gaps that would need filling.

If the leading edge and trailing edge cores are not quite in line spanwise then shave some off the wing tip block to compensate. You can afford to lose 10 mm (3/8") from the width of the wing tip block before you will compromise the shape.

Cut a groove in the inboard end of the tip block, long enough to create an air path between the lightening holes adjacent to the spar of the leading and trailing edges.

Set the aileron such that it fairs in with the wing top and bottom surfaces and hold with blobs of hot glue or shims and tape or whatever method you find most simple.

Mix up some dry micro then trowel it on to the exposed foam of the wing tip (no core plugs are required to be inserted). Squidge the tip block onto the wing's end and hold in place, lined up with the aileron, with strips of tape and allow it to cure.

Step 18

Cutting the tip shape

After cure, the shape of the tip curve can be marked on the tip block's top and bottom surfaces according to the co-ordinates overleaf. This shape mimics the wing's top surface. See figure 26.

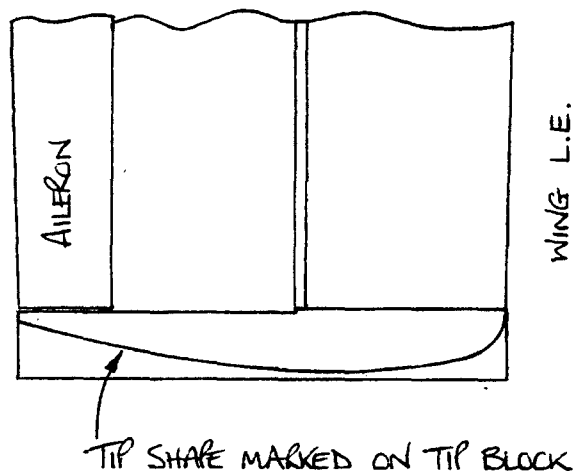


Fig 26. Plan view of wing tip.

Chord position from L.E. (mm) Position from wing end (mm)

| | | |
|------|-----|-----|
| L.E. | 26 | |
| | 10 | 43 |
| | 20 | 50 |
| | 30 | 55 |
| | 40 | 59 |
| | 50 | 63 |
| | 60 | 66 |
| | 70 | 69 |
| | 80 | 71 |
| | 90 | 74 |
| | 100 | 76 |
| | 150 | 85 |
| | 200 | 92 |
| | 300 | 101 |
| | 400 | 105 |
| | 500 | 103 |
| | 600 | 94 |
| | 700 | 80 |
| | 800 | 63 |
| | 900 | 47 |
| T.E. | | 26 |

Carefully cut the tip curve with a hacksaw blade, watching both top and bottom lines to ensure the blade doesn't run off. To finish shaping the tip block use a sanding block with about 60 grit paper to round off the edges. The size of radius you make is up to you.

Leave the trailing edge support block intact at this stage.

When you are happy with the shape of your tip set the wing bottom side up ready for layup. Either remove the aileron or mask it up before layup. Scuff sand the first 3-4cm of the glassfibre skins of the wing tip in preparation for layup.

Step 19

First layup

This first layup will go around 2/3 of the way to the top surface.

Cut pieces of bid at +/- 45° to the following dimensions:

2 off 100cm x 23cm (40" x 9")
and several pieces of peel ply.

Micro slurry the foam, paint the foam surface and the first 3-4 cm (1 1/2") of the wing skin with epoxy then lay on the first ply to overlap the skin by 3-4 cm (1 1/2") and scissor trim it to 2/3 of the way around. In general terms the cloth doesn't go around onto the top surface. Pull the cloth as necessary to wrap it around the leading edge.

Wet the first ply out and squeegee it thoroughly then lay on the next ply, arranging it to be about 1 cm (1/2") short of the first all around to make a gradual transition. Wet this ply out, squeegee it and peel ply the fibre ends all around before leaving to cure.

After full cure, remove the peel ply, trim the trailing edge and cut off the trailing edge support block, sanding it down to fair in to the trailing edge flange. See figure 27.

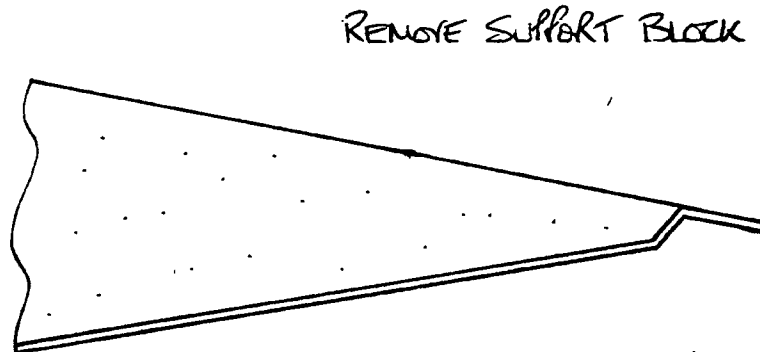


Fig 27. Section through tip at trailing edge.

Step 20

Second layup

This layup covers the remaining core and laps onto the existing skin.

Cut pieces of 'bid' at +/- 45° to the following dimensions

2 off 100cm x 20cm (40" x 8")
and a few pieces of peel ply.

Apply micro slurry to the foam and then paint the foam area with epoxy including about 2-3 cm (1") of the adjacent glass fibre.

Lay the first ply on the foam, scissor trimming to overlap onto the glassfibre skins by about 2-3 cm (1"), except at the trailing edge which will overhang by about 1 cm (1/2"), then wet it out and squeegee it thoroughly.

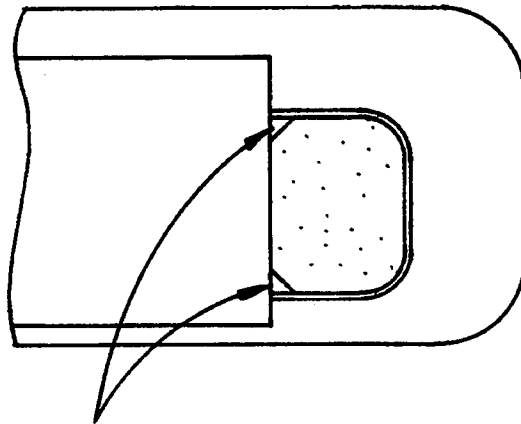
Wrap around the leading edge with this and the next ply to end up with all four plies over the corner for resistance against damage to this vulnerable area.

The second ply to go on should be trimmed to be about 1 cm (1/2") shorter than the first one except at the trailing edge which overhangs as does the first.

After wetting out and squeegeeing apply peel ply to the fibres' ends then leave to cure.

After cure, trim the trailing edge and remove the peel ply.

To finish off with, remove the aileron, if you haven't already, then dig out a triangular sectioned shape of foam at the exposed trailing edge inboard side of the tip in preparation for a flox corner. See figure 28.



REMOVE FOAM FOR FLOX CORNERS.

Fig 28. Section through tip trailing edge looking forwards.

Cut two pieces of 'bid' at +/- 45° sufficiently large to cover the foam and lap onto the trailing edge close-out by about 1 cm (1/2").

Scuff sand the trailing edge close-out adjacent to the tip in preparation for bonding.

Mix up sufficient flox to fill the prepared channels and apply it, micro slurry the foam, then position the two plies of 'bid', wetting them out one at a time then leave to cure.

Trim the edges then replace the aileron, sanding its end if necessary to regain the clearance between it and the tip.

Wing root fairings

The gap between the wing root and the fuselage skin is to be filled with a radiused flange or fairing. The fairing becomes part of the wing which further adds to the wing root stiffness and can assist in passing forward and aft wing loads into the fuselage.

Step 9

With the wings properly rigged apply layers of tape or a piece of card to the fuselage sides, where the root fairing will be, to a thickness of about 2mm. Cover this with plastic tape to provide a release as you will be laying glass fibre directly onto it. Mark the fuselage sides to indicate the pip pin positions as they will become hidden by the fairings.

Step 10

Cut to shape blocks of foam to fit between the wing root flange and the fuselage side and bond them to the wing root flange with rapid epoxy, putting any adhesive on the flange underside as you will be sanding the foam away on the outer surface. See figure 6.

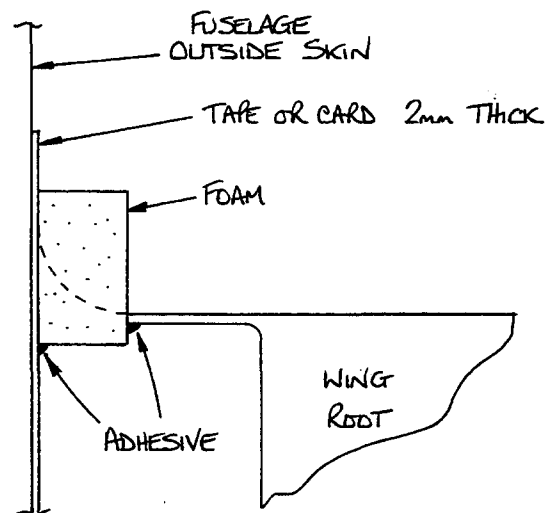


Fig 6. Foam blocks in place ready for shaping root fairings.

With the foam blocks in place and secure, shape them to blend the wing skin to the fuselage side. There is no specific radius to make here, just a pleasing shape.

Step 11

Scuff sand the wing skin at the root and layup onto the foam, lapping about 2-3 cm onto the wing skin, using 2 plies of 'bid' at +/- 45° and leave to cure.

Step 12

Root Fairing

After cure, cut a hole through the fairing to extract the pip pins and remove the wings. Remove the foam from behind the 2 ply layup then trim the edges. Clean away any remains of the rapid epoxy and scuff sand the inside surface of the wing root flanges. Layup 2 plies of 'bid' at +/- 45° from the underside of the root flange and onto the fairing. Apply flox where the two parts of the fairing go each side of the wing root flange. See figure 7.

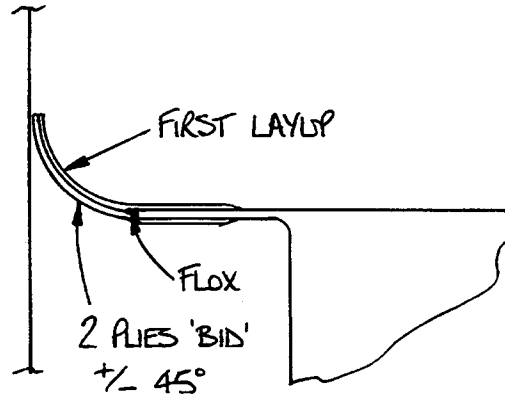


Fig 7. Section through wing root flange.

After cure, trim the layup and the wings are ready for finishing.

With the wings rigged, any gap between the fuselage and wing fairing should be sealed by applying silicone to the fairing having applied a suitable release agent to the fuselage side first. Leave the wings rigged until the silicone has set. **Note:** *Do this after painting otherwise areas that have been in contact with the silicone will not allow paint to adhere.*

See also...