



Toni Clark practical scale

# Albatros DVa

## Building Manual

Last updated 13.02.2014



About 35 years ago I developed a burning desire to build an Albatros, it's shape, with the long oval fuselage and the characteristic Albatros` tailplane shape, the Vee struts between the wings, and above all that sleek fuselage, it was love at first sight. Many years went by but the desire lingered on in my mind, one evening I was visiting my friend Jörg Vogelsang, he had built an Albatross DVa to a scale of 1:3,5 or so, the first thing I noticed was the fuselage was noticeably compressed in the length, and far too deep at the cockpit, the William Wiley drawings being the cause.

This scale inexactitude apart, Jörg being a real genius had used some extremely neat and clever ideas, Jorg is a walking ideas factory, Jörgs fuselage was plywood covered, so I thought at first glance; it was not, instead it was an epoxy/glass fuselage, the trick was very simple, in Jorgs fuselage the wood grain is moulded into the gel coat. It is then a simple matter to brush black paint onto the fuselage and then wipe it off leaving the grain filled with black, the next step is to use a light yellowish brown transparent Lasur paint and you have a plywood fuselage.

In Jörg's Albatross was another very neat idea, aluminium tubing for wing spars. On the full size Albatross, as well on many other German first world war aircraft, the trailing edge is a strand of wire clipped to the rib ends. Due to the shrinkage of the doped linen covering material, the wire is pulled inwards, giving the well known scalloped trailing edge common to many German World War One aircraft. This scalloping has always given rise to some difficulties with models. Jörg's answer was a single strand of Kevlar roving tacked to the rib ends with cyano. The Kevlar rovings are not tightly drawn but have a slight slack, so that the ProfiCover when shrunk with the electric iron, forms the scalloped trailing edge perfectly.

The GRP leading edges caused my partner a lot of hours on the computer with a 3D construction programme, plus an awful lot of thought and concentration, his head must have steamed. The moulds were then machined on our CNC milling machine. Gerd and I have invested a few thousand hours in our Albatross. The results have exceeded our wildest expectations.

## Before starting with the construction

It is essential that you know which adhesives to use, and which not. The instructions call for Epoxy in many places on the airframe; by Epoxy is meant Araldite 2011, *use this adhesive and nothing else!* For wood parts you can use our Titebond modified PVA wood glue, this like PVA is water based. But has the distinct advantage that you can sand it without it rolling. We have 5 different Cyanoacrylate instant glues, Insta-Cure™ thin and Insta-Cure+™ thick, IC-2000™ is best for the wheel tires, all work well on the fingers. On the Balsa and plywood parts in the wings, rudder and elevators, you can use our Titebond™ wood glue, for tacking use Cyanoacrylate. Do not use any form of 5-20 minute Epoxy glues in your Albatross, unless you wish to see an Albatross break up in the air, quite a few full size machines unfortunately did, due to wing failures, I am fairly certain 5 minute Epoxy was not the reason, more likely cause being wing flutter. The three basic airframe units, fuselage, wings and tailplane, can be built in any sequence you may care to choose. Here as you will see I have started with the fuselage.

Where I have used the words left hand or right hand,

this is always seen from the pilots (in the cockpit) viewpoint.

## FUSELAGE

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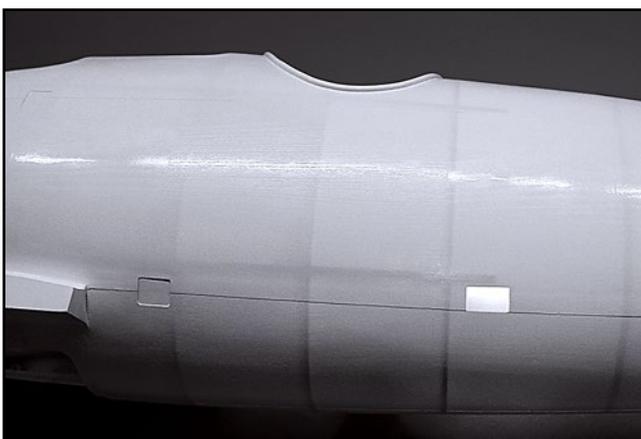
Prepare the Fiberglass fuselage: This sanding work is best done outside the house or workshop, preferably when windy, with you standing upwind of the fuselage. Cut back the laminate over the top of the firewall, flush to the plywood firewall. To do this, mark a line on the outside 50 mm back from front edge, to a point 13 mm above the line ending the wood graining both sides of the fuselage. I found the Dremel metal cutting discs ideal for cutting the glass/epoxy laminate.

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Clean up all the edges of the openings in the fuselage with coarse grit paper and finish with 400 grit.

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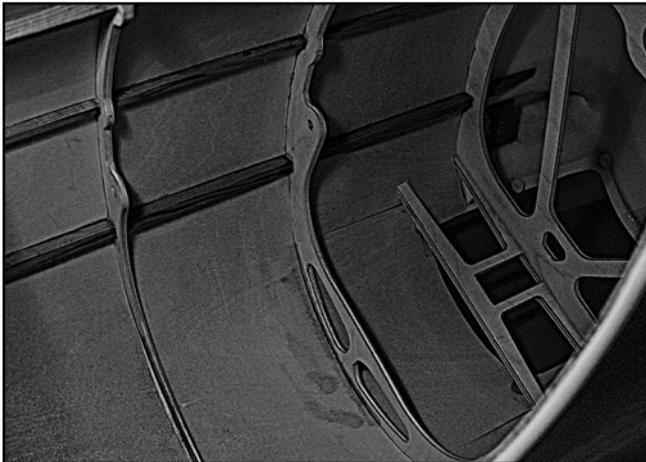
Using a fine point felt tipped pen, mark out the 19 mm high and 32 mm wide foot step opening on the left side only; cut this out and clean up the edges with 400 grit paper.

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The fuselage open end at the tailplane must be sanded, or filed, to a half round section using a 20 mm diameter tool, this to take the elevators leading edges.

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Before cutting these 0,4 mm skinning parts (178) free, mark the backside with a cross for top edge. These parts are removed one at a time from the 0,4 mm plywood sheet and fitted and glued in place. Try fitting the first one into place, shape a little if necessary. Glue into place with thick cyano glue, work crosswise, not lengthwise. It is safer to remove these parts and fit singly. Take care when fitting these parts into place that you do not

press these right into the recesses formed by the stringers and formers, it is highly difficult if not impossible to remove them without damage. Work from the top one side and crosswise through to the top opposite side, working from the tail to the nose. The 0,4 mm skinning parts around the rear edge of the bottom hatch opening must be trimmed a little to fit.

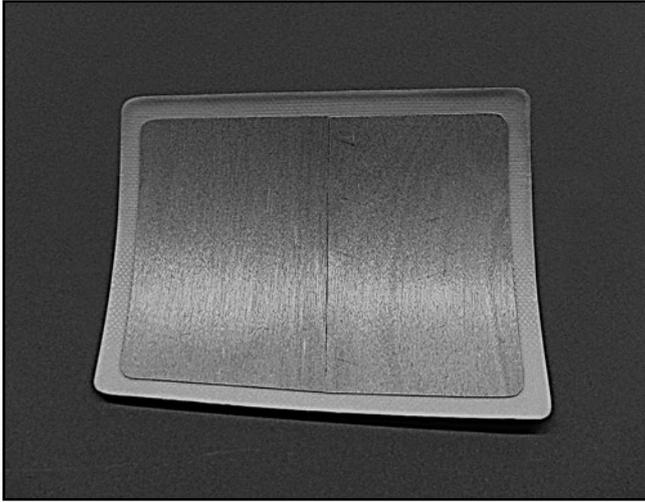
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Clean up the edges of the inspection hatch opening in the bottom of the fuselage. Fit the inspection hatch (13) so that it is flush to the surfaces of the surrounding fuselage by sanding around the edges of the hatch (13). Back into the workshop after blowing out all the glass fiber waste, epoxy six 10 mm dia. 4 mm plywood screw scabs (14) over the opening, three on each side lengthwise - on the fuselage inside of course. There are ten

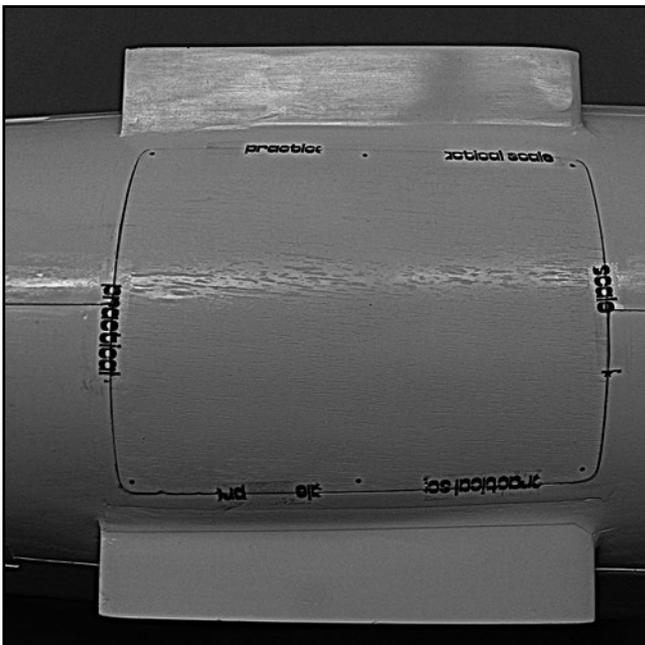
scabs included in the kit, should you prefer to use more of them, feel free to do so.

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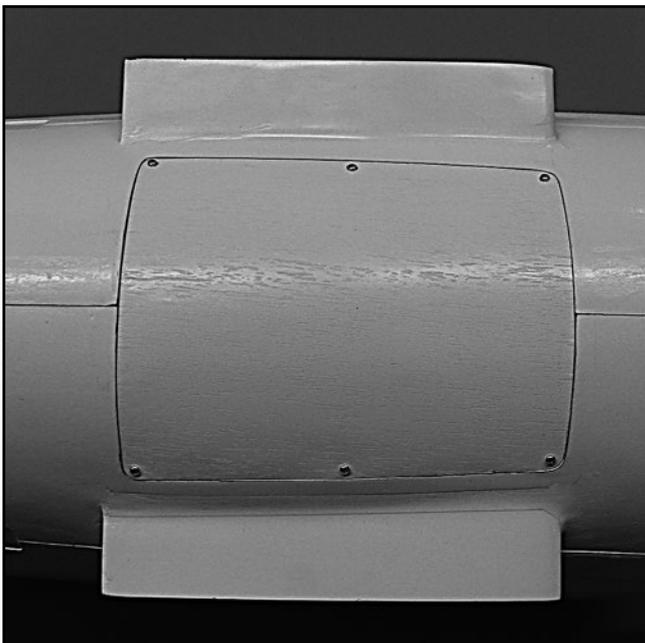
If desired, cover the inspection hatch (13) with 0,4mm plywood. Leave a 10mm wide margin, to make sure that the hatch fits into the fuselage again.

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When the epoxy has thoroughly hardened, mark accurately the position of each screw scab (14) onto the fuselage. Lay the hatch into the opening and tape this down with Sellotape® firmly, drill through the cover, fuselage and screw scabs with a 1,8 mm drill.

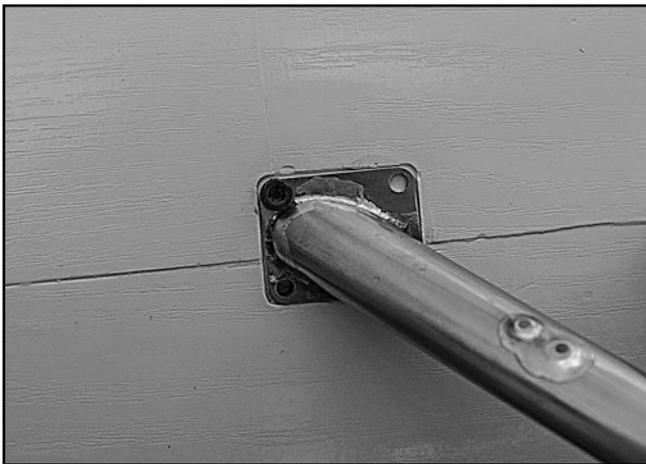
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Use six 2,2x9,5 mm self tapping screws (12) to fix the hatch. Wax the screws before driving these into the scabs (14). It is better to fit the hatch now, it is very difficult to fit after the undercarriage legs are in place, experience shows me this is correct.

- The rest of the work on the fuselage is easier to carry out with the undercarriage and wing center section struts fitted, these formed tube parts are temporarily fixed using M3x8 socket screws (179) and plain hexagon nuts (5). Later, after all painting is finished, and to permanently fix these three parts, you then use the safety nuts (52) with the hexagon headed screws M3x8 (4).
- Fit the two undercarriage legs (2) to the fuselage, but before doing this, lay a couple of layers of soft cloth onto your work bench so as to avoid possible damage to the surfaces of the fuselage.
- Fit a 3 mm spiral metal drill into your electric drill, have ready 12 M3x8 Allen socket screws (179) with normal nuts (5), not safety nuts (52), as you will have to remove these legs later, a small socket spanner also, to fit the M3 nuts (5).
- Before starting to fit the undercarriage legs (2) and the wing struts (3), run the 3 mm drill through each hole in the 8 fixing plates. This is necessary as there is often a very small hook left by the Laser in the holes, if you omit to do this the drill will tend to snatch, this will make it very difficult to drill the respective holes accurately into the fuselage.
- Unless you possess four arms, you will need a helper to hold the undercarriage legs (2) into the recesses moulded into the fuselage. With the end plates accurately held into the recesses, drill just one hole through the end plate on the rear leg, the drill will have to be set at a slow speed as there is a 2 mm thick aluminium sheet behind the recesses. To do this you need a hardwood block, use this to press against the skinning where the holes come through. This will prevent the skinning from breaking out and a untidy hole in the plywood and in your adjacent finger.

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Insert a M3x8 Allen machine screw (179) into the hole and right through into the fuselage, run a plain M3 nut (5) onto this screw and screw down tightly. Next drill a hole in the front leg end plate, fix this with a M3x8 Allen machine screw (179) using a plain nut (5), screw up tight. Check to see that the end plates fit neatly into the moulded in sockets. Use a small socket spanner and Allen key to really tighten these 2 screws down before you drill out

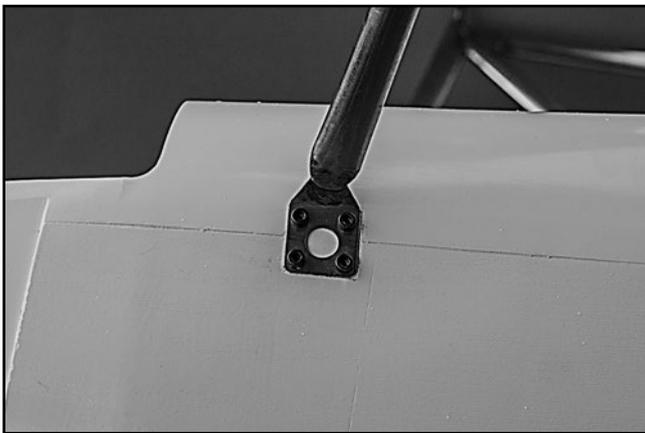
the remaining holes.

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You can now drill out the remaining holes in the end plates front and rear, insert the M3x12 Allen socket screws (179) and fix tightly with the plain M3 nuts (5). Then repeat the whole procedure for the second leg unit.

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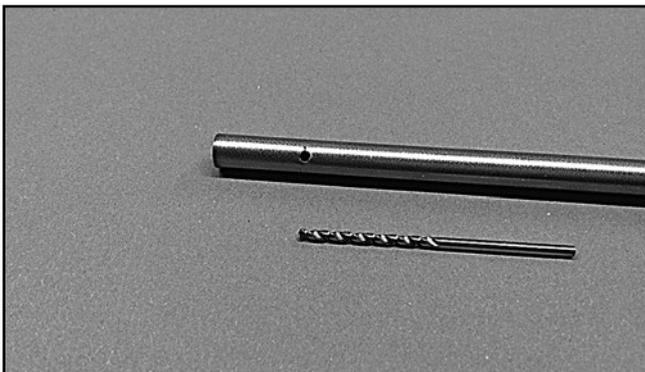
You now use the same process to fit the two fuselage wing struts (3) as you have for the undercarriage legs.

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Tie a piece of string between the wing struts at the top to prevent these spreading when the fuselage is upturned.

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Take the 7 mm diameter tube spreader bar (6) and drill a 2 mm hole through one side only of this tube 18 mm from the end, do not on any account drill through both sides of this tube! Drill a second hole in the other end of the spread-

er bar same for first hole. To start the drill take the edge of a fine file and cut a very small indent in the tube.

- O In case you have not experienced working with stainless steel, you will find this material resists all your efforts to drill holes into it. You must use high quality drills and a low speed, use a high speed and your drill will glow red hot and will only be fit for Balsa wood.

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Place the fuselage upside down on the bench and fit the spreader bar (6) onto the two 6 mm diameter stubs silver soldered into the legs. Pull the legs together so the spreader bar tube (6) is tight against the two legs, using a piece of string tie the legs together.

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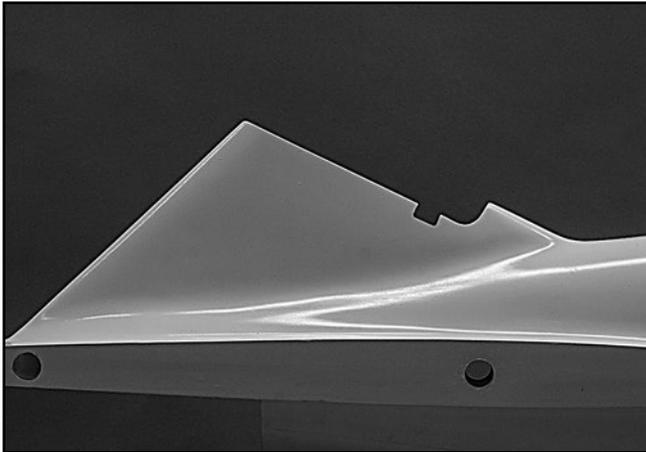
Turn the spreader bar (6) so the holes are uppermost, drill right through the stub and out the other side of the spreader bar, insert a 2 mm split pin (7) into the hole and slightly spread the split pins legs. Drill out the second hole and insert a split pin and slightly spread the split pins legs. Do not bend these split pins legs right over as these must be removed later.

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Tape a piece of masking tape to one undercarriage leg only (2); tape second piece of masking tape to the end of the spreader bar (6) near the tape on the leg; this is to allow you to refit the spreader bar (6) correctly later.

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The hole in the sub fin must be marked to take the Bungee rubber shock cord (69) for the tail skid. Mark a point 111 mm forward from the tip of the sub fin, draw a line across the width and draw a second line 15 mm forwards of the first line. Cut out this slot, which is approx. 8mm wide, in the underside of the sub fin

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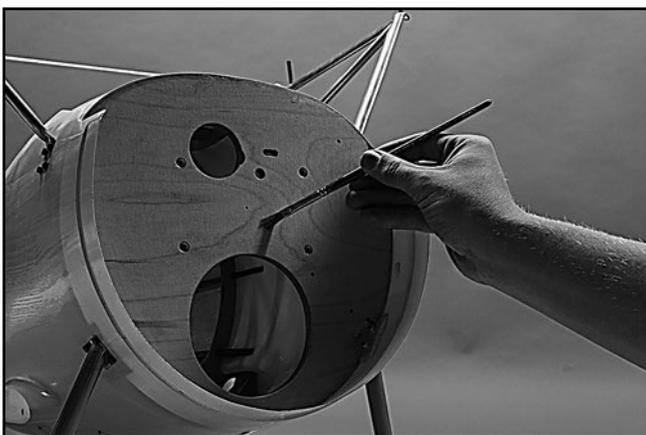
Turn the fuselage upright now most of the work is finished on the underside of the fuselage.

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Slightly colour a small quantity of clear dope with sand colour paint from Revel (Nr.16 Matt), use this to paint over the 0,4 skinning (178) and the formers and stringers. Seal the doped parts with a coat of clear 2K paint.

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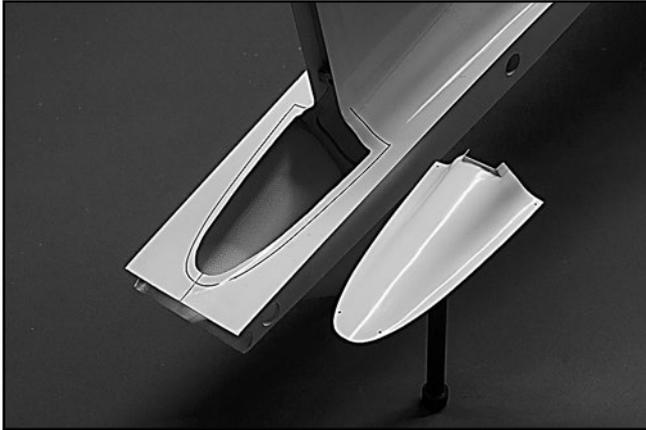


Dope the plywood firewall front and back thoroughly with one coat of clear dope, Dope also the former holding the fuel tank, the rudder servo mount and the stern post. Make sure the edges are thoroughly coated. This doping of the plywood pieces is essential, it will prevent oil soaking into the plywood.

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Next day sand the firewall front carefully to remove all whiskers of wood and give one more coat of dope.

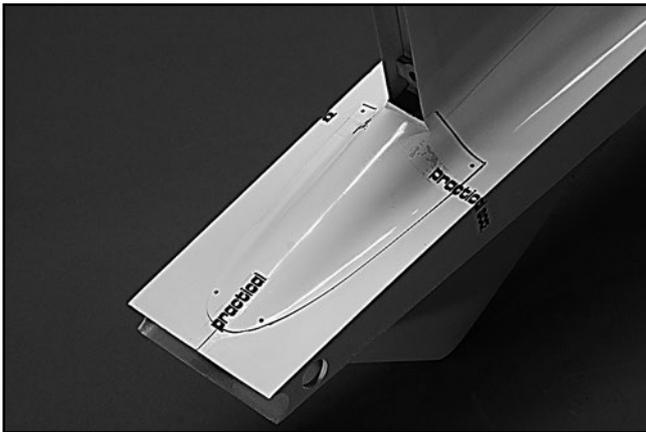
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Lay the rudder horn cover (8) over the fuselage behind the fin, sand carefully so it fits accurately onto the fin, hold the cover in place with Sellotape, with a fine felt tip pen, mark around the edge of the cover onto the fuselage, mark off the four fixing screw holes with the felt tipped pen. These must be 3 mm from edge to center of hole. Remove cover and sand edge of fuselage opening so the cover overlaps 6 mm.

laps 6 mm.

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Drill the four fixing screw holes with a 2 mm drill in the Fiberglass rudder horn cover (8). Lay the cover back over the fuselage and tape in place with Sellotape®, bore the holes through the fuselage using the cover as a drilling jig.

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Mix enough epoxy to complete the work in the next three paragraphs

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Epoxy the four 8 mm dia. 4 mm thick round plywood screw scabs (9) under the fixing screw holes for the rudder horn cover. When the epoxy is fully cured, bore holes into these four screw fixing scabs with a 1,8 mm drill.

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Lightly sand the 6 mm Balsa fin capping rib (70) and epoxy this into the fin with a half millimeter protruding, lay a strip of wood each side of the fin and very lightly clamp these strips onto the fin, leave overnight to allow the epoxy to cure hard.

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Next day sand the rib down until it fits flush to the fuselage. Smear the two rudder hinge sockets (10) with epoxy and insert these into the holes in the rudder sternpost right up to the screw stubs, these stubs being horizontal, leave 24 hours for the epoxy to cure.

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Drill out the two 3,0 mm holes in the glass fiber fin over the hinge sockets (10) screw stubs. I found the Perma-Grit round needle file ideal for this purpose as this file does not skid as a spiral drill will tend to. Screw a socket head grub screw (11) into each screw stub.

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Mark off the 3 mm wide slots in both bottom wing fuselage stubs to take the rigging wire tags (17). Cut the 3 mm slots into the bottom wing fuselage stubs to take the brass rigging wire anchor plates (17). I used the Dremel metal cutting disc that had been worn down to a diameter of 20 mm, then cleaned up the slots with a thin flat file.

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Insert a brass rigging tag (17) from inside the fuselage, into the bottom wing fuselage stub slot and position this accurately over the Beech screw block and hold from outside firmly so that 9mm projects measured on the outside.

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Mark the two screw holes with a fine tip felt pen onto the screw block and then remove the brass rigging tag and drill holes on the markings with a 3,0 mm drill. The Dremel tool just fits inside the fuselage through the bottom hatch for this purpose. Insert the 3,5x13 mm self tapping screws (18) in the holes using wax (candle wax) on the screw threads. Pull the threaded portion of the screw across the wax candle, this

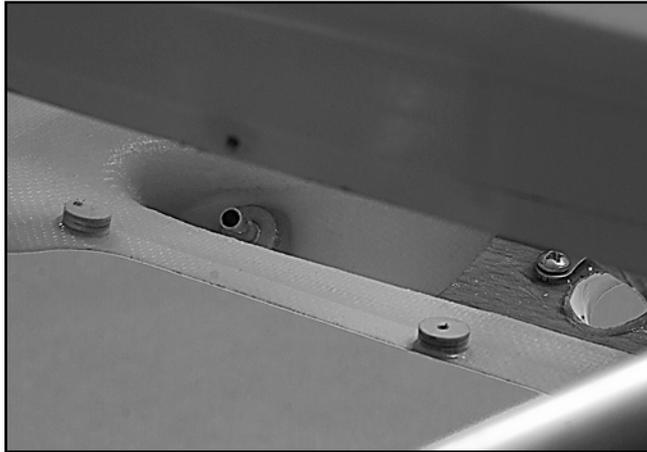
will fill the threads with wax and considerably ease driving the screws in.

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Coat the screw blocks with epoxy; reinsert the brass rigging tags (17), wax the screw threads of two 3,5 x 13 mm self tapping screws (18) and screw these into the screw block. Beechwood is exceedingly tough and tends to split when the screw hole is not big enough.

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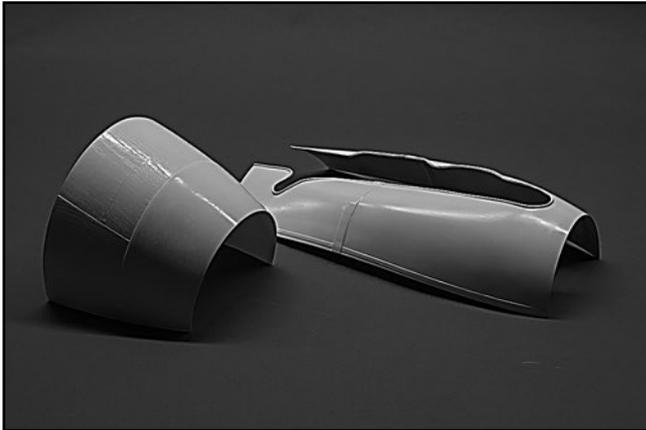


Epoxy the 5x4,2x20mm Brass tubes (19) into the holes in the bottom wing stubs. Adjust the tubes so that they are flush with the outside surface.

## ENGINE COWLING

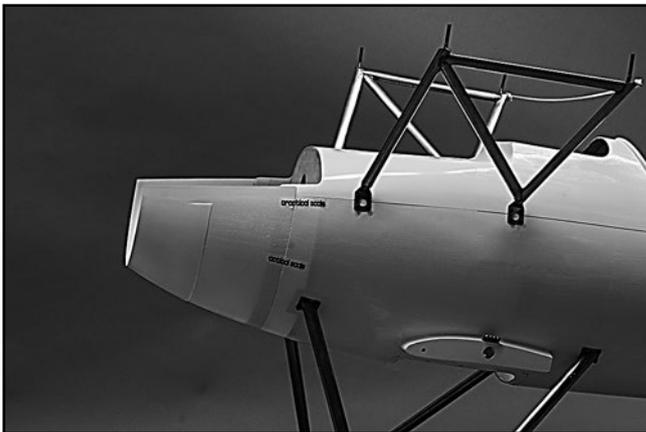
### Bottom cowl

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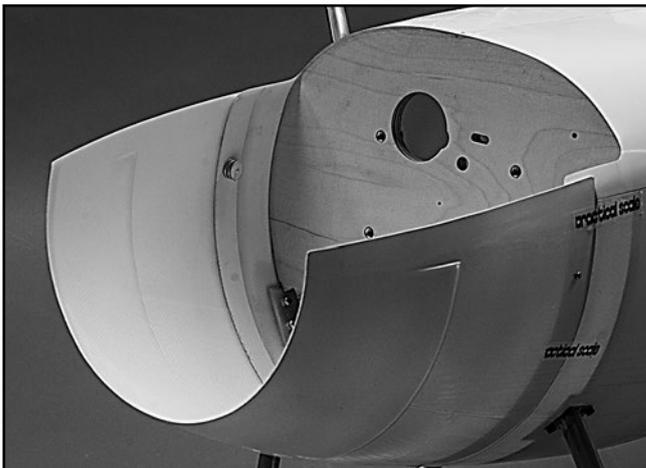
Clean up top cowl (60) and bottom cowl (61) edges only with coarse grit paper (80 grit). On the top cowl the glass fiber must be sanded back to the rounded edge around the cylinders openings. Wash bottom cowl (61) with acetone and then sand over the complete outside surface with 400 grit paper and again wash off with a cloth with acetone.

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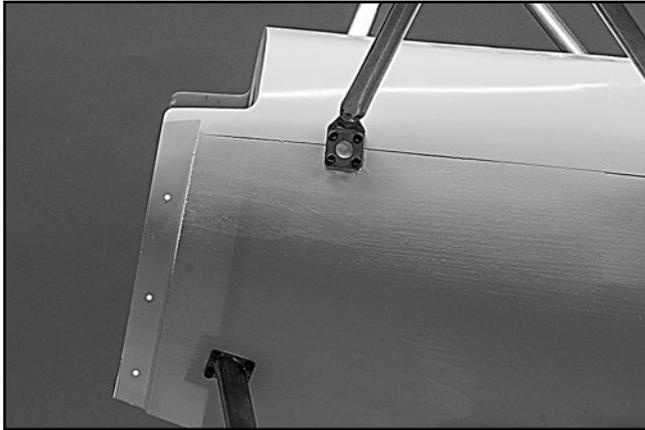
Cut loose thirteen 6,5 mm round screw scabs (62) from the 6 mm plywood sheet. Tape the bottom cowl (61) onto the fuselage securely.

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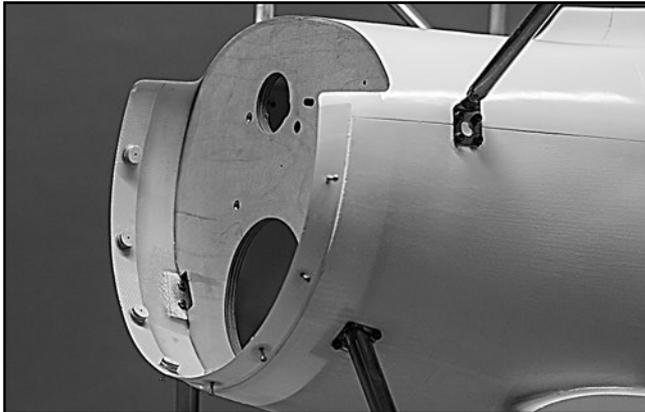
Place a mark 50 mm down from top edge of the bottom cowl (61) both sides, using a 2,0 mm drill, bore right through the cowl and fuselage for these two holes. Using 2 of the 2,2x9,5 mm self tapping screws (12) and two 6,5 mm plywood round pre bored screw scabs (62) dry, fix the bottom cowl to the fuselage.

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Turn the fuselage on its back and mark off position of the 6 remaining screw scabs (62) onto the outside of the bottom cowl. Drill a 2 mm hole for each of these scabs in the cowl and through the fuselage. Remove the bottom cowl from the fuselage. Turn the fuselage upright.

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Apply epoxy to the 8 round screw scabs (62) and drive a 2x2,9 mm screw (12) through the fuselage just a very short way (about 2 turns) into the scabs; do not on any account drive the screws right into the scabs or you will not be able to remove these screws next day. Ensure the scabs are pulled right down onto the Fiberglass cowl so that the epoxy is slightly squeezed out; leave these scabs overnight to

allow epoxy to harden, then remove the screws.

## Top cowl

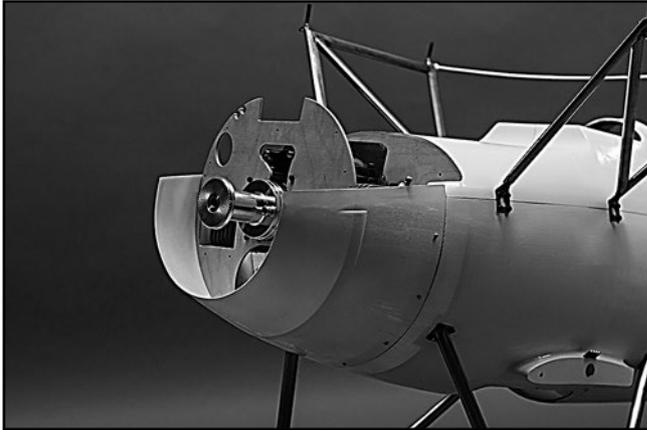
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(60) and bottom (61) cowls.

Place one 16 mm aluminium tube (21) through one of the holes in the tailplane stub and tie a weight onto this tube, this will prevent the fuselage tipping onto it's nose. Fix the engine to the firewall with the four M6x20 (72) Allen socket head screws without the spring washers (73). Fix the 3 mm thick plywood front cowl former (63a or 63b) using the M3x8 (179) to the engine as this will help with aligning the top

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Fit the bottom cowl (61) to the fuselage with the seven 2,2x9,5 mm self tapping screws (12).

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Mark the position of the spark plugs onto the lower cowling. File the cowling until the spark plug connectors fit onto the plugs neatly.

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Remove the spark plugs and lay the top cowl (60) onto the fuselage and mark off the places where the cowl must be slotted to fit over the wing strut fixings, these slots must be 9 mm deep.

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Scissors can be used carefully to cut well inside the vertical markings, the horizontal markings can be cut into the Gelcoat with a pointed knife, break out the waste piece, then the rest can be carefully filed or sanded away.

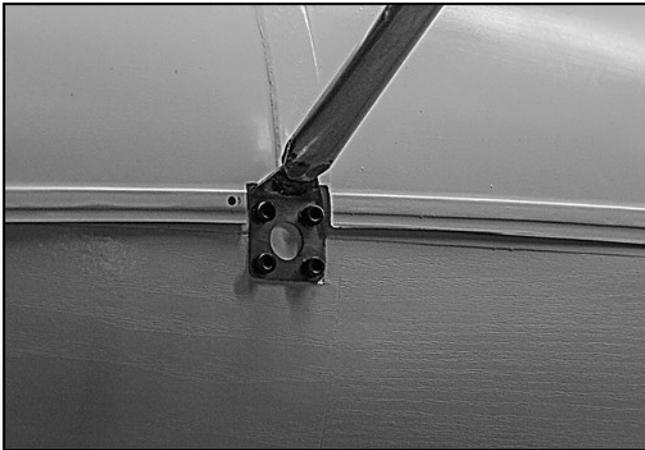
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Fix the Tufnol spinner backplate (220) onto the engine using a small block of wood under the propeller bolt head, this spinner backplate (220) is now used to fit the top cowl (60) accurately so there is an even gap around the spinner backplate (220). Use masking tape both sides to hold the top cowl into place. Check the gap around the spinner backplate (220) to ensure it is equal. If the gap is not equal around

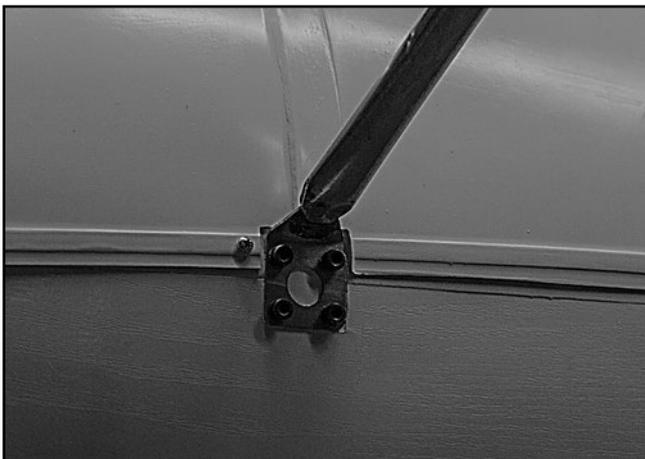
the top cowl you only need to file away a little of the cowl where this fits over the front cabane struts, this has the effect of lowering the top cowl, use the file very carefully and keep checking the gap around the spinner backplate.

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Tape the top cowl (60) securely to the fuselage, then check the gap around the spinner backplate (220), drill a 2.0mm hole through the cowl and fuselage right beside, and in front of the rear wing strut fixing, this hole will go through the aluminium reinforcing plate that is sandwiched between the Fiberglass laminations.

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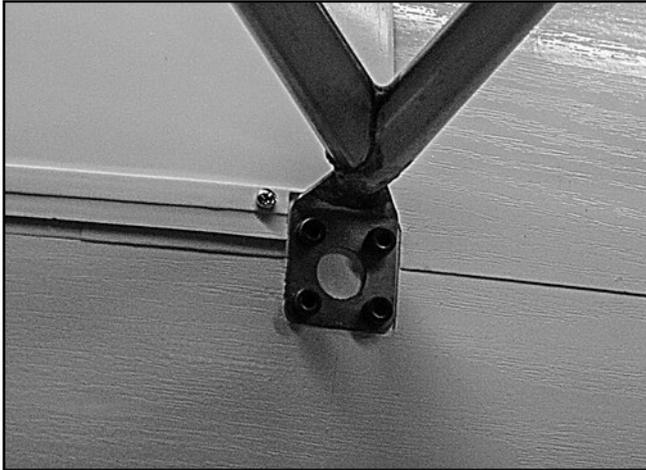


Screw a 2,2x9,5 mm self tapping screw (12) into the hole fixing the cowl firmly in place. Drill a second 2,0 mm screw hole through the other side of the cowl directly opposite this first cowl fixing screw and screw in a 2,2x9,5 mm self tapping screw (12).

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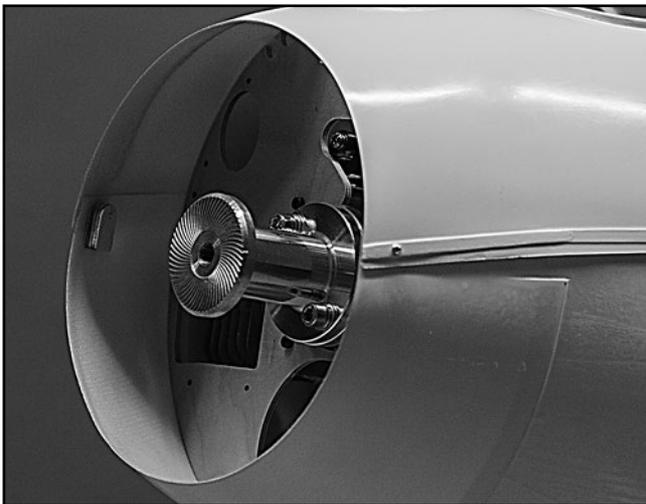
Now look at the gap around the spinner backplate (220) to see if it correctly spaced, you can adjust the top cowl position by loosening the two screws and moving the top cowl (60) a little then using masking tape hold the top cowl (60) in the correct position.

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Drill a 2 mm hole each side of the top wing strut (3) fixing on both sides of the top cowl (60) and drive in a 2,2x 9 mm self tapping screw (12) into each hole. Recheck the gap between the spinner backplate (220) and top cowl (60).

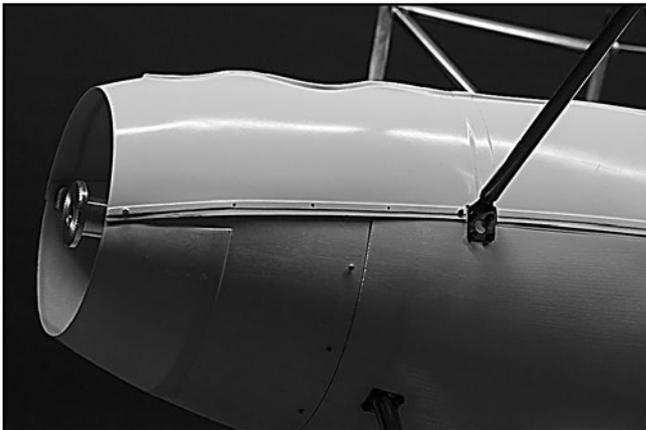
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Hold the top cowl (60) to the bottom cowl (61) at the front both sides, between your fingers and thumbs, to ensure the gap right around the spinner backplate (220) is equal, drill a 2 mm hole through top and bottom cowl 14 mm from front edge on one side. Drive a 2,2x9,5 mm self tapping screw (12) through top and bottom cowl and screw a one of the six longer screw scabs (15) onto the screw. Then screw up tight. Drill 2 mm hole on opposite side same as the first, fixing with a

screw (12) and scab (15).

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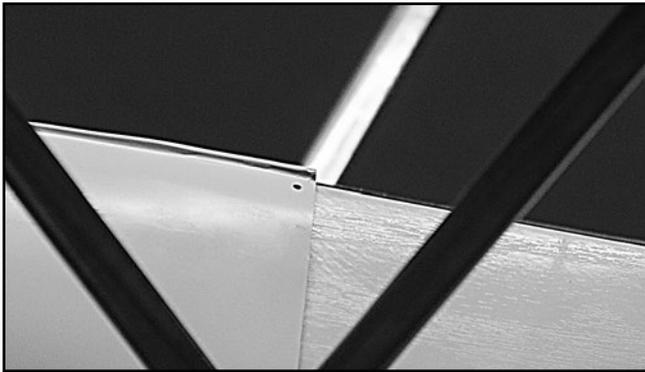
Drill three 2 mm holes through top and bottom cowl between the fire-wall and engine former (63) both sides.

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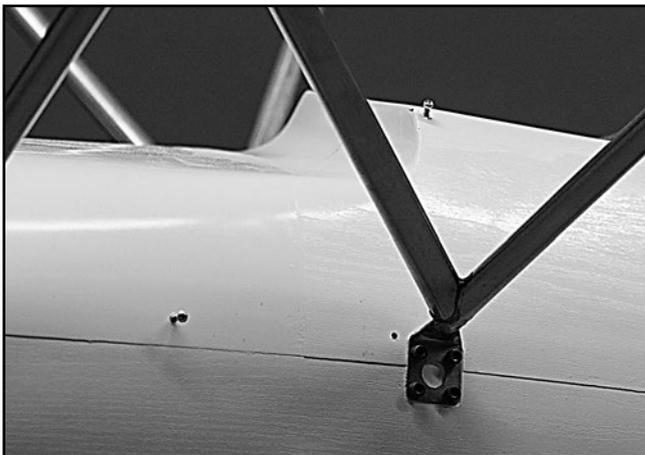
Drill a 2 mm hole half way between the two struts through the top cowl and fuselage both sides. Drill a 2 mm hole through the top cowl on the rear at the front wing strut both sides.

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Drill a 2 mm hole on top of the rear wing struts each side of the Fuselage.

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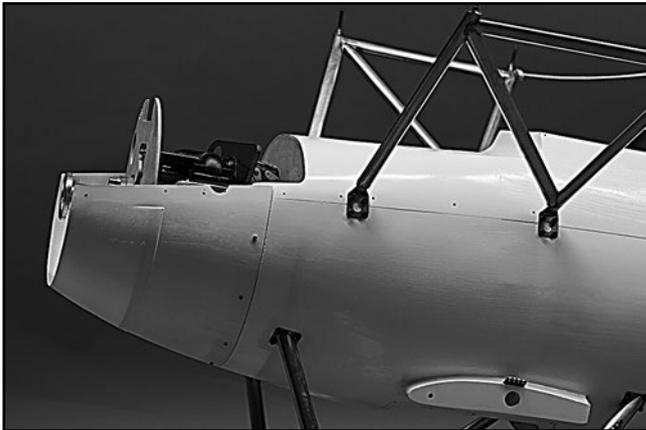
Remove the top cowl and apply epoxy to four round screw scabs (62). These round screw scabs (62) are fitted between the wing strut fixings inside and at the top of the fuselage by the machine guns. Drive the 2,2x9,5 mm self tapping screws (12) through the fuselage and the maximum of two turns into the screw scabs, make sure these scabs (62) are pressed against the fuselage so the epoxy is slightly squeezed out.

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Epoxy the six scabs (15) to the holes in the fuselage bottom cowl flange, remember not to drive the screws in more than two turns or it will be impossible to remove these later.

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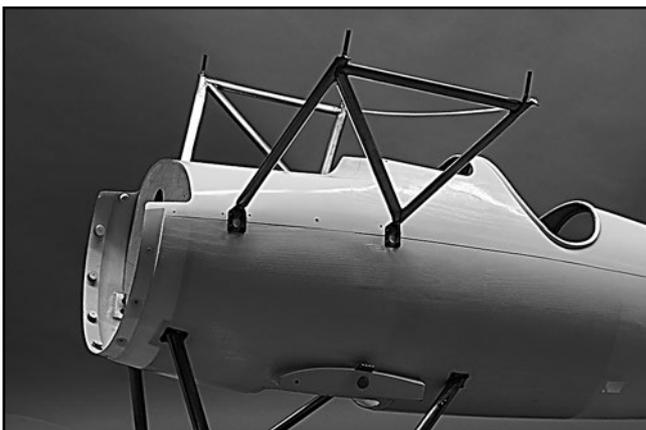
Next day remove all the 2,2x9,5 mm screws (12), you will now have a total of 18 screws (12) fixing the top cowl (60) to the fuselage.

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Attach the spark plugs and the connectors and mark the position on the top cowl. File the cowling until the connectors fit under the top cowling.

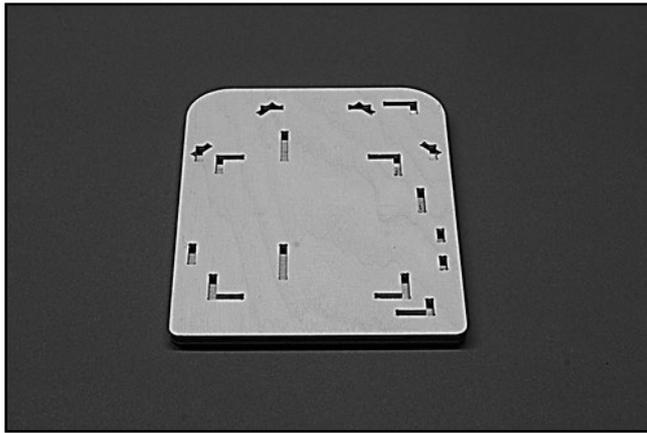
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Remove the cowl, former (63) and the engine from the fuselage.

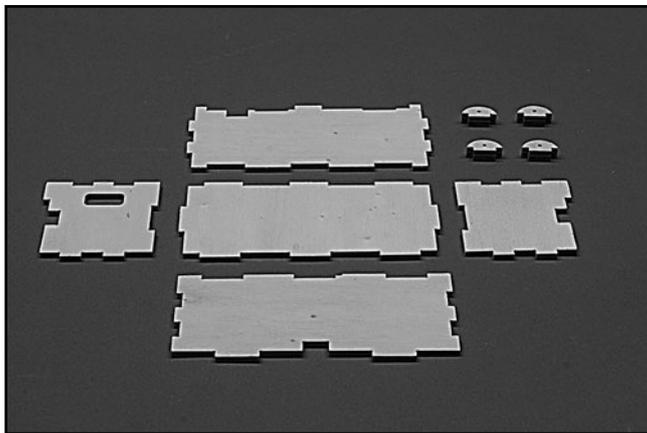
## BATTERY BOX, INTAKE BOX, SILENCER COVER

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To construct these parts you have to use the jig (144).

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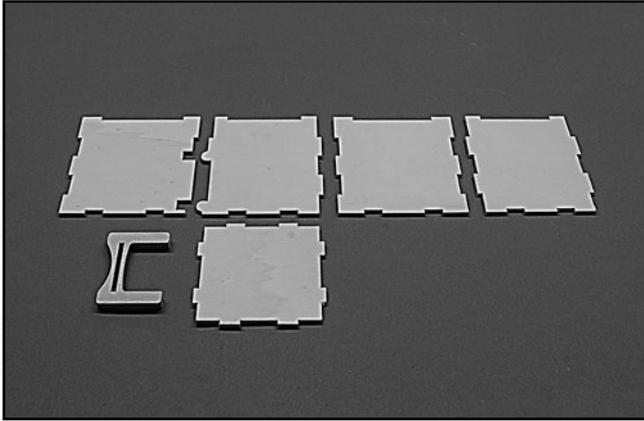
The battery box has five 3 mm Poplar ply parts, (127) (128) (129) (130) (131) and four 6.5 mm Birch plywood mounting lugs (132).

### WARNING:

**LIPO'S MUST BE REMOVED FROM THE MODEL EACH TIME THEY ARE CHARGED !!!**

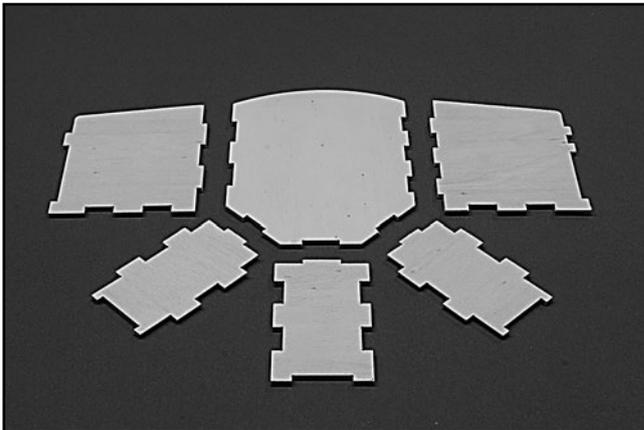
This is of outmost importance and it renders LiPo's extremely impractical for use with the Albatros. A123 or LiFePO4 cells are a lot more safe. Battery weight does not matter as weight in front of the CG is welcome. On our model, we still use the "good old" Ni-Cd's "N1700 SCR" and that is why the battery box is laid out for two 5 cell Ni-Cd batteries and some foam cushioning, but the box will also take two batteries of two LiFePO4 cells each.

O



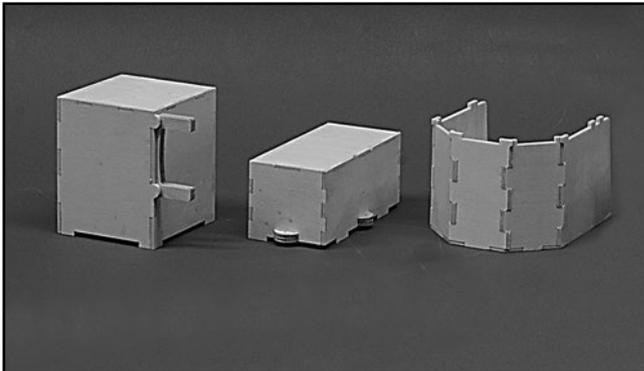
The intake box has five 3 mm Poplar plywood parts (133) (134) (135) (136) (137) plus the 6 mm Birch plywood engine throttle servo carrier (138).

O



The silencer box has six 3 mm Poplar parts (139a) (139b) (140) (141) (142).

O



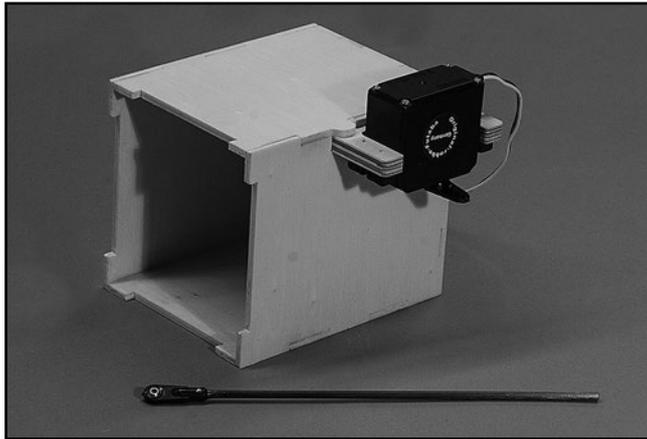
These three box components are glued with PVA. When the PVA has overnight to harden, paint these boxes with dope at least once to fuel proof the wood. After the dope has dried, lightly sand over; now check to see that the tongues on the silencer and intake boxes fit into the slots on the inside of the engine former (63).

O



The battery box fits onto the inside of the engine former and is secured with the four round head 3,5x13 self tapping screws (18) inserted from the front of the firewall. See photoXX for full layout of the rear side of the firewall.

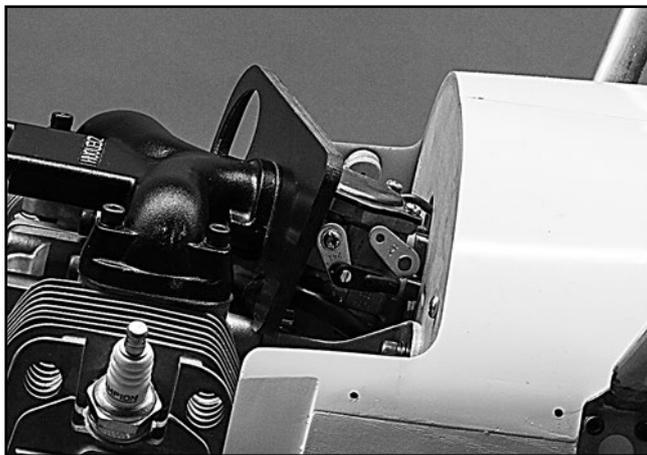
O



The intake box (133) (134) (135) (136) (137) has the throttle servo carrier (138) built into it. Fit the throttle servo onto the carrier with the four screws and rubber grommets supplied with the servo. Make up the throttle pushrod with the 150x3mm carbon fiber rod (151), roughen one end of the rod. Open up the hole in the ball joint (117) with a 3,2mm drill and glue the carbon fiber rod into the balljoint

(117) with epoxy, use a pointed piece of stripwood to work the epoxy into the ball joint and leave for 24 hours to allow the epoxy to harden.

O



Fit a weight to the rear end of the fuselage, then fit the engine onto the firewall with the four M6 socket head screws (72), using a M2 screw (83) nut (57) and washer (59) fit a Nylon ball joint (117) onto the throttle lever after drilling out the ball joint with a 3,2mm drill. Mount the pushrod onto the servohorn in the same manner.

O



Push the intake box into the slots in the rear of the firewall, threading the carbon pushrod through the oval hole in the firewall ensure the intake box is fully inserted into the slots. Lay the carbon rod (151) against the ball joint (117) and mark the carbon rods length with a small file or similar.

O

Remove the intake box from the fuselage and the ball joint (117) from the throttle lever. Cut the carbon fiber rod (151) to length to fit into the ball joint, roughen the ends of the rod.

O



Refit the intake box back into the slots in the firewall, insert epoxy into the ball joint then push the ball joint onto the carbon rod (151), refix the ball joint onto the throttle lever with the M2 screw and nut. Leave for 24 hours to allow the epoxy to harden.

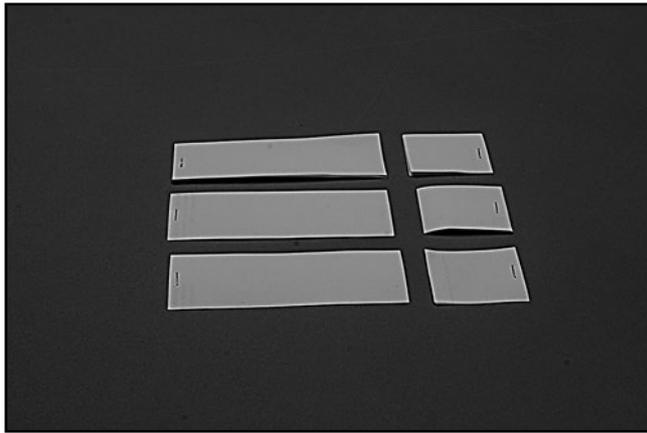
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Disconnect the throttle pushrod (151) from the carburetor, remove the intake box apply glue to the tongues of the intake box and push the tongues into the slots on the firewall, same for the silencer box.

## ENGINE COOLING COWLING

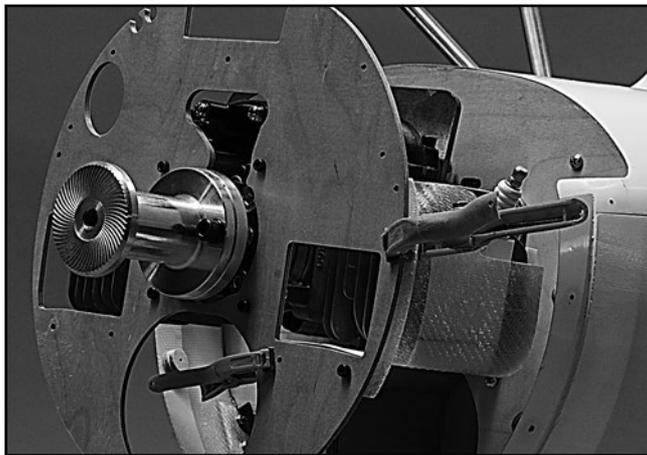
○



shrouds (182L) and (182R).

Fit the engine former (63) with the four M3x8 socket head screws (179) to the Tufnol former carrier. Cut from writing paper six strips 50x210 mm, tack both ends together with glue or a stapler, this makes a 0,6 mm thick distance piece. Cut 60 mm from the paper strip ending with two pieces, the second being 150 mm. These paper strips then form the correct gap between cylinder fins and cooling

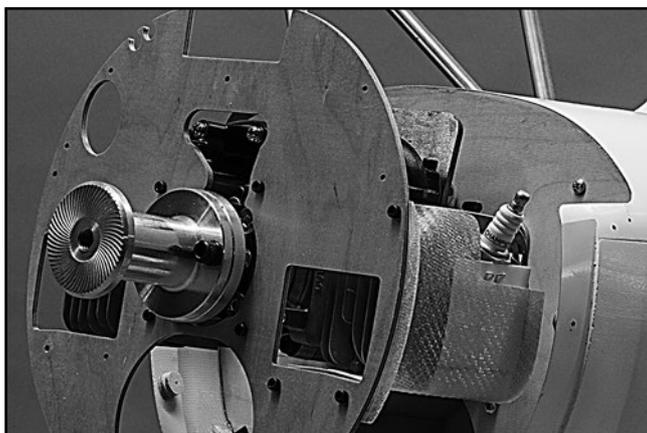
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(179) and fix with a normal hexagon nut (5).

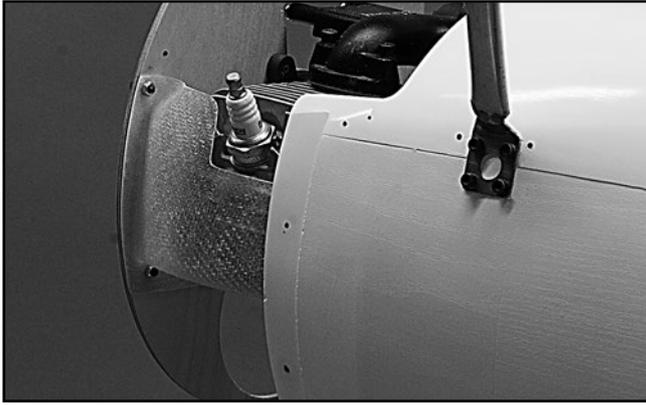
Cut out the two exhaust flange openings in the two shrouds (182L) and (182R). Lay the paper into one shroud (182) as is shown in photoXX and hold the shroud (182) into place with spring clips onto former (63), press the shroud (182) hard against the cylinder fins and head so the gap is no more than the paper thickness, then drill one hole through the shroud from the front of the former (63) with a 3 mm drill. Insert a M3x8 socket head screw

○



Ensure the shroud (182) fits tight against the paper, then drill the other two holes through the shroud. Fix the shroud with the M3x8 socket head screws (179) and plain nuts (5). Ensure the shroud fits tight against the paper.

O

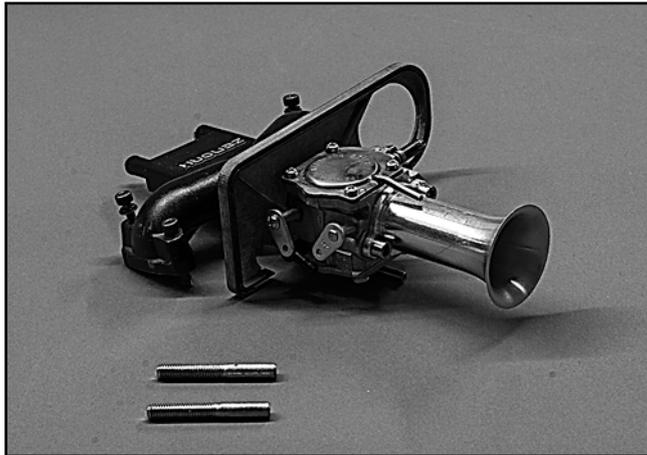


Remove the shroud and sand it until it fits flush to the former (63).

- O Fit second shroud (182) same as the first. Remove the shroud (182) and then refix both shrouds to check the clearance around the exhaust flanges and mark difference if necessary, then cut or file to suit. Remove the four M6x20 Alan cap screws (72) from Engine mount.

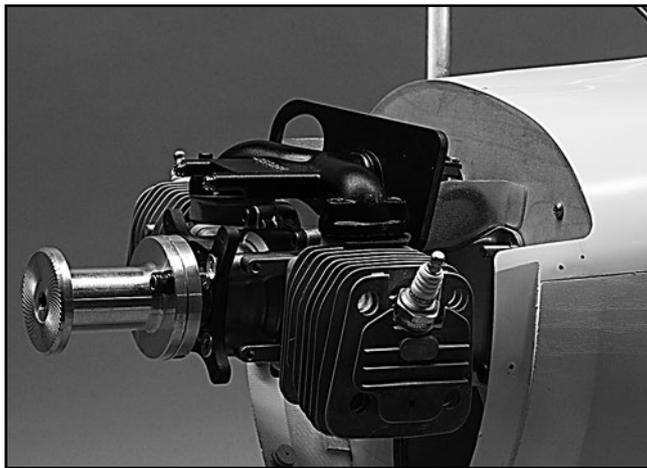
## FITTING THE CARBURETOR COOLING DUCT

○



Cut the heads from the two M6x55 socket screws (77) and screw these into the top two engine mounting holes. Remove the intake manifold from the engine. Take off the carburetor and refit with the intake trumpet and the milled Tufnol spacer/insulator (194) see photo. Note you must fit a gasket each side of the Tufnol insulator.

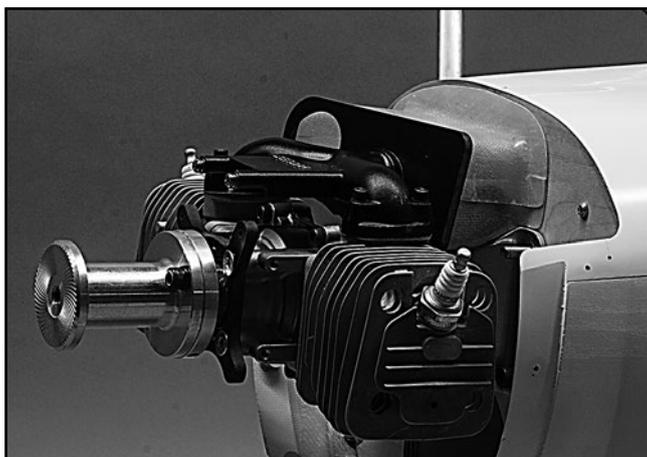
○



Slide the engine over the two headless socket screws (77) and secure the engine with one M6x20 mm fixing screw (72) in the bottom left corner of the engine mount. Push the bottom half of the Fiberglass cooling duct (195) into the space formed by the engine mount. So much for the easy part. Take the intake manifold and thread the intake trumpet into the hole in the firewall, the bottom half of the glass fiber cooling duct (195) must be

fitted into the slot on the insulator (194) so that the intake manifold holes line up over the fixing screw holes in the cylinders.

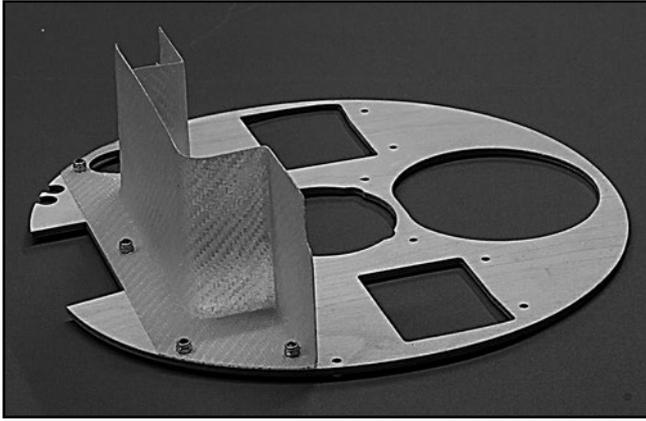
○



Now the top cooling duct (196) has to be fitted, this requires patience, this must be joggled into position, I found that by fitting the left side where you can insert a finger and with the thumb hold the two halves together and so they are both in the slot. Carefully move the other side about and you will find the insulator (194) suddenly clicks into place (with a little pressure from your third hand on the intake manifold). Now fix the intake manifold to the en-

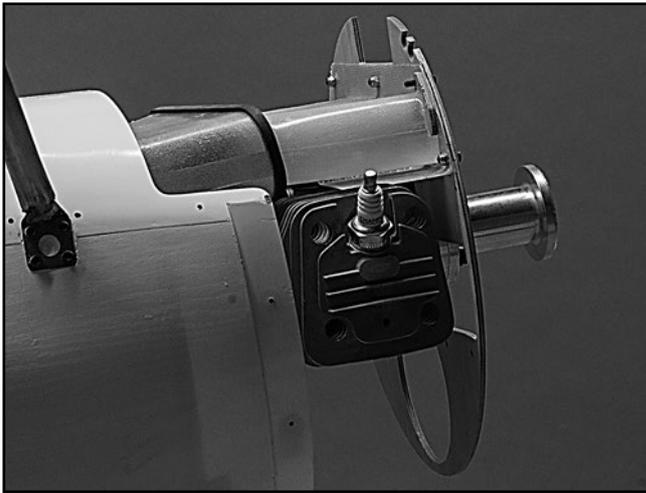
gine.

O



Fit top intake cooling shroud (183) onto the former (63) and hold in place with spring clips, ensure the oval hole for the carburetor cooling duct (184) is correctly placed over the corresponding hole in the former (63). Drill through the shroud from the former (63) and screw the shroud to the former (63) with 5 M3x8mm Allen cap screws (179) and safety nuts (52).

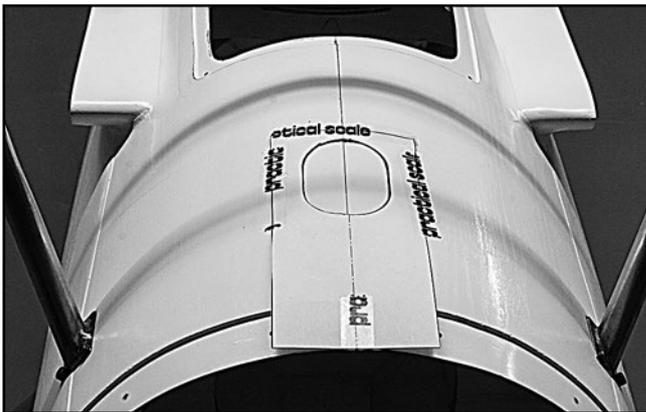
O



Drill two 2mm holes through both sides of the cooling duct and insert a M2,2x9 round head PK screws (12) into each hole screwing the cooling duct assembly firmly onto the firewall. Slide the cooling air tube (192) through the former (63) and into the Tufnol insulator (194). Place the U-brace (193) over the tube (192), note there is only one way to fit this as you will see by the uneven shape, remove the screw (179) and replace with a M3x12 Allen cap screw (181) to hold the

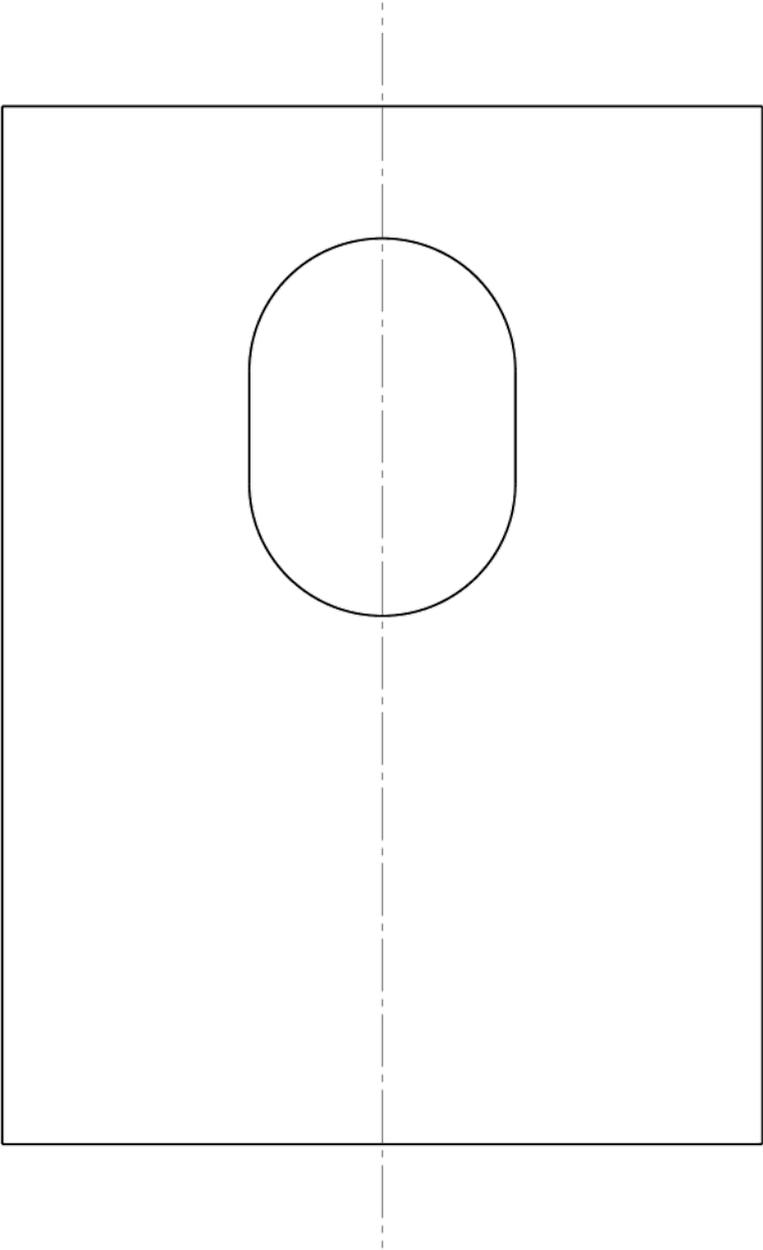
U-brace onto the former (63). Epoxy the U-brace (193) onto the tube (192) taking care to avoid gluing the brace to the former (63).

O



Mark with the help of the template the position of the Muffleroutlet. Tape the template down, when it is flush to the front side of the fuselage.

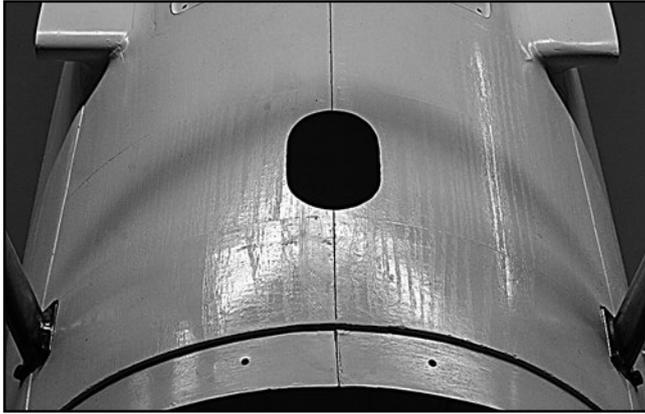
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Template to mark the opening for the Muffleroutlet

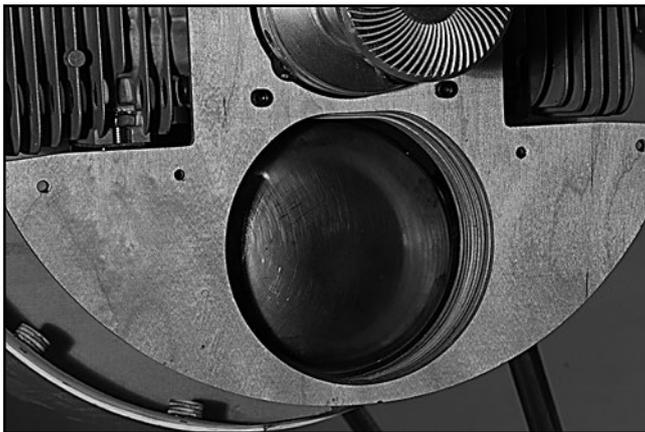


O



Cut the marked opening and file it to shape.

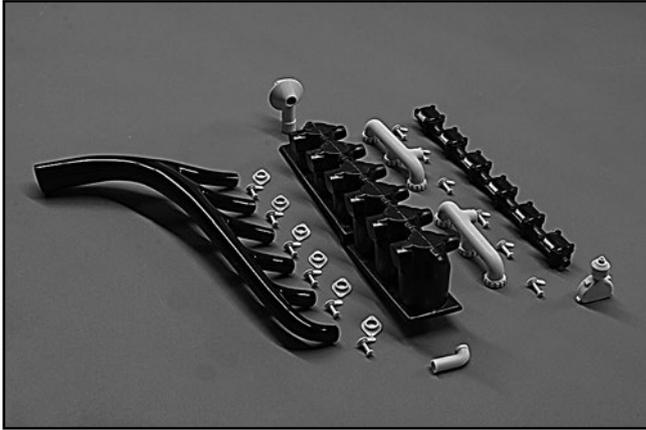
O



Bolt the muffler onto the engine. Clean up the four 6 mm plywood rings (145), these must be glued together on the back of the former (63) so they form a tunnel leading the air over the muffler. Note the flat side is at the top and these rings must not contact the muffler, but have an equal distance to the muffler of 2-3 mm.

## SIMULATED ENGINE

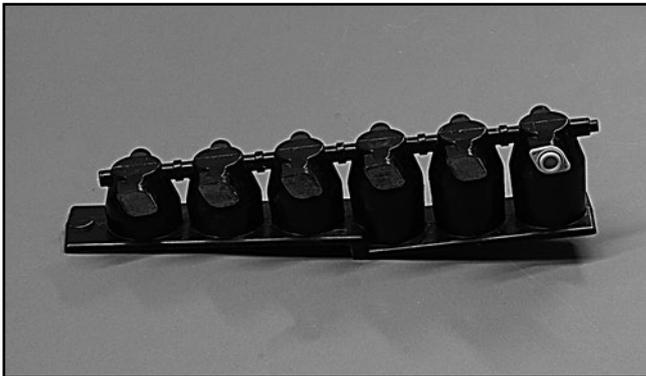
O



The engine components must be first glued together with Epoxy and Cyano glue and then painted. Important! Before starting assembly, all surfaces must be degreased, to do this use Acetone with a small stiff brush. Release agent is used to allow the removal of all the simulated engine parts from their respective moulds without damage; you have to ensure that you have removed all traces of the release

agent before starting assembly, or you will surely find that the engine will come apart and the paint will flake off when fitted to the model.

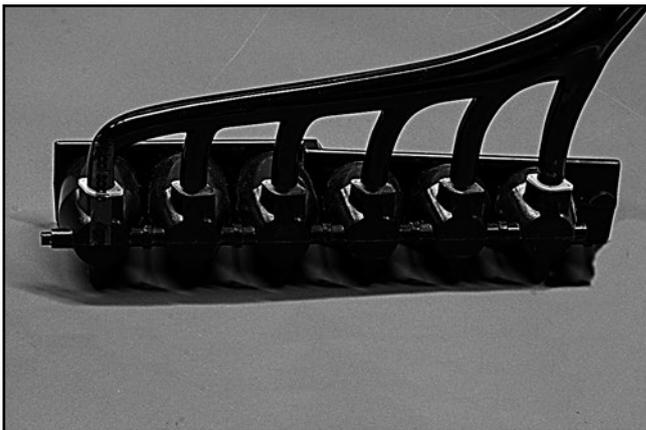
O



Start with the cylinder bank (80), use a 280 grit paper to sand over the glued surfaces on the exhaust stubs on the cylinders and the backs of the six small exhaust flanges (81), mix a small amount of epoxy and place a drop onto the middle of the cylinder exhaust flanges of the first and last flange only. Press a flange (81) onto the front cylinder exhaust stub and

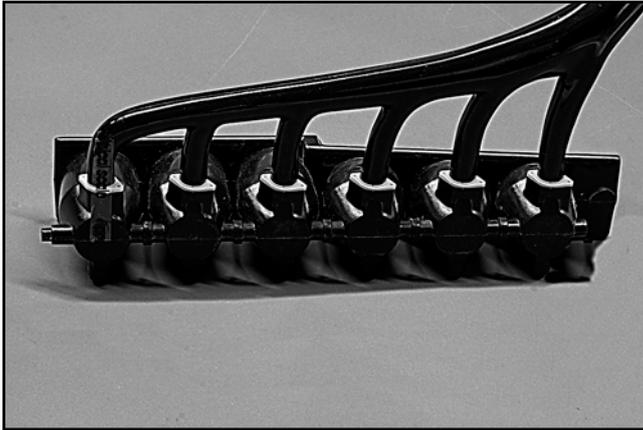
slide the loose flange around to evenly distribute the epoxy.

O



Glue the second flange to the rear cylinder exhaust stub, fit the exhaust pipes (82) over the two flanges (81) and hold the exhaust pipe (82) in position with Sello-tape®; refer to photo'xx, align both flanges (81) as accurately as possible, lay the cylinders down with the exhaust uppermost and leave overnight for the epoxy to cure hard.

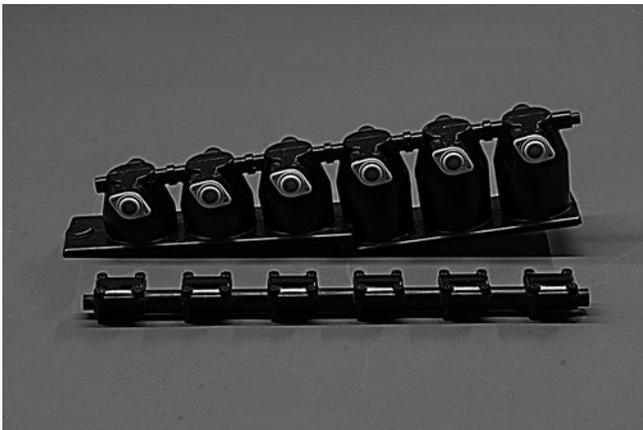
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Remove the exhaust pipe (82) and Epoxy the four remaining small exhaust flanges (81) onto the cylinders exhaust stubs, accurately align these flanges. Have ready Sellotape and place the exhaust pipe (82) onto the flanges (81) using Sellotape to hold the exhaust pipe onto the flanges (81) tightly. Lay the cylinders down with exhaust (82) uppermost, check to see that the alignment of the four

flanges (81) is accurate and leave overnight to allow the epoxy to cure hard.

O



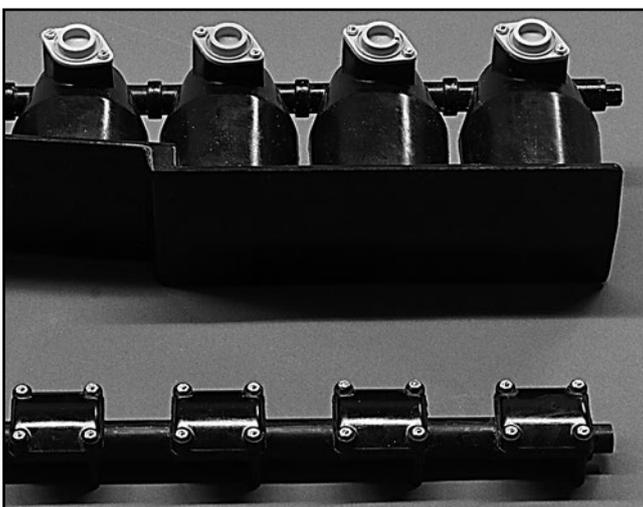
Use a 2mm twist drill to bore out the 12 holes in the six exhaust flanges (81) and the 24 screw holes in the six rocker boxes.

O



Take 36 M2x12 cheese head screws (83) and 36 M2 nuts (57), screw the nuts (57) onto the ends of the screws (83) so that the screw just pokes through, cut the screws in halves.

O



Mix a small amount of Epoxy and have a pointed piece of Balsa, and dip the point into the Epoxy and carefully work the Epoxy into the screw holes, you need only a small amount of Epoxy, push the screws (83) into the holes slowly on the rocker boxes and exhaust flanges until the nuts (57) comes against the flanges. Leave overnight to allow the Epoxy time to cure hard.

O



Use a hacksaw blade to make little cuts into the exhaust flange spigots (81) to provide a good key for the Epoxy. Wipe off the spigots with Acetone, use the brush to clean the inside of the exhaust pipe tubes with Acetone. Mix Epoxy and using a small shaped stick, apply a very thin smear of Epoxy to the insides of the exhaust pipes (82) and the exhaust flange spigots (81).

O

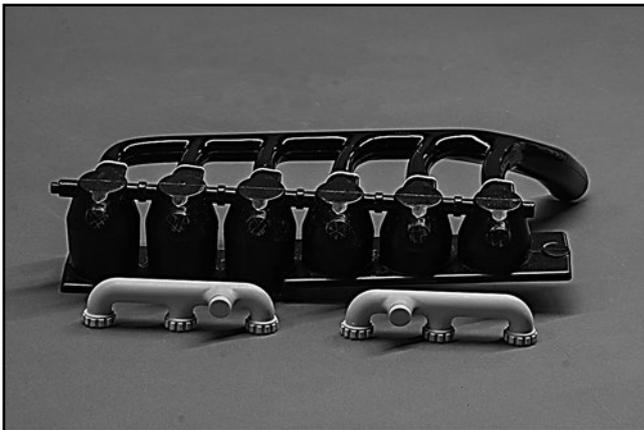


Mix Micro Balloons with the rest of the Epoxy until it is quite thick, smear a little of this Epoxy around the inside lips of the exhaust pipes, fit the exhaust pipes (82) over the flanges (81) and hold exhaust in place with Sellotape®, the thickened epoxy will gradually run down around the spigot but not seep out around the flange due to it being thickened.

O

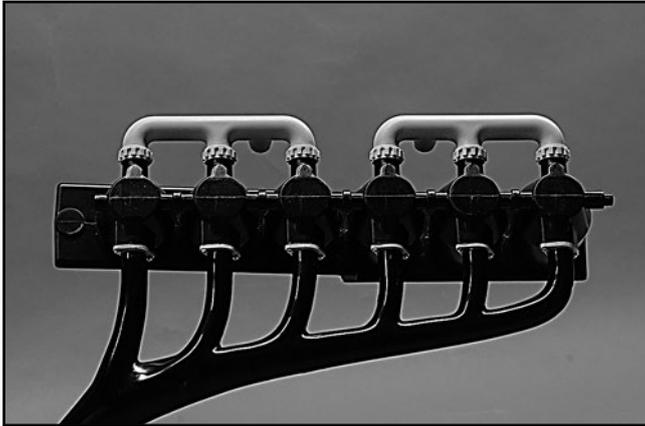
Leave overnight the engine laying on it's intake side and the exhaust pipe vertical to allow the epoxy to cure hard.

O



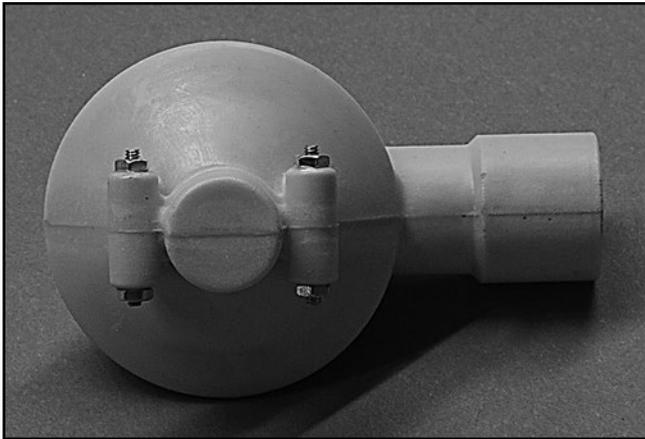
The two inlet pipe manifolds (85) must be made ready by first using the pointed hacksaw blade to scratch around the inside of six crown nuts, use the hacksaw blade to make small cuts around the six inlet stubs on the cylinder bank (80), note that there is a left and a right hand manifold, this is to say the down going stubs are towards the middle and not the outside.

O



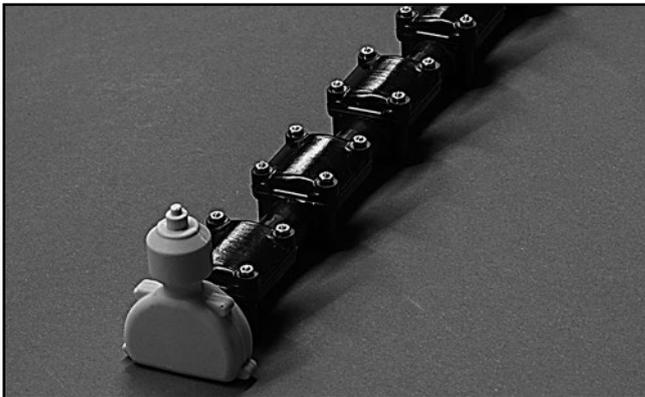
Smear epoxy around the inside of the crown nuts and press the two inlet manifolds (85) onto the cylinder inlet stubs. Lay the whole unit on its side with the two manifolds (85) upwards and leave overnight to allow the epoxy to cure hard.

O



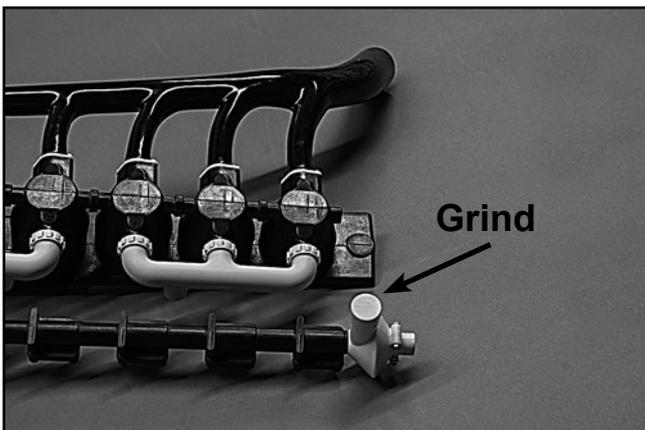
The camshaft drive case (86) must have the two screw holes drilled out and M2 cheese head screws (83) with nuts (57) fitted both sides and epoxied into the holes.

O

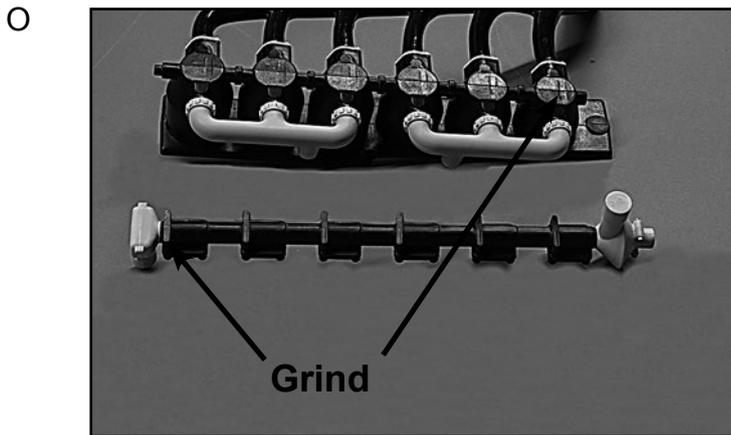


Fit the pump (87) to the camshaft spigot to check for fit, roughen the inside of the hole in the pump and the spigot on the camshaft. Apply a little epoxy to the spigot and inside of the hole and push the pump (87) fully onto the spigot. Ensure the pump is vertical on the camshaft and leave overnight.

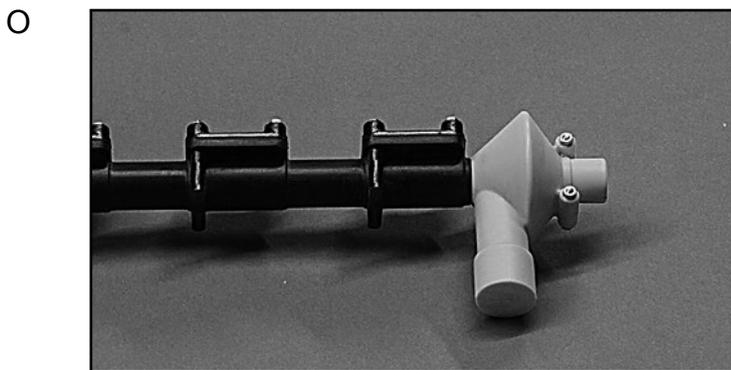
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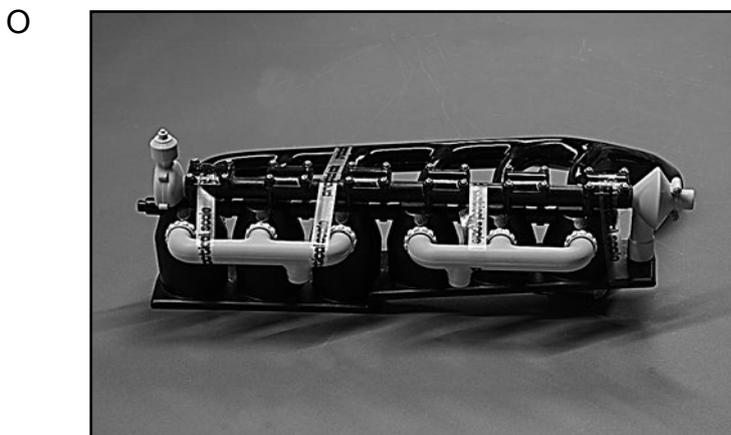
Fit the camshaft drive case (86) to the camshaft spigot, press the camshaft case fully home. Lay the camshaft onto the cylinders and ensure that the camshaft boxes feet all sit directly onto the cylinders, if there is a gap then you will have to sand off a little from the foot of the camshaft drive case (86).



Take a small strip of 240 grit paper and sand the narrow feet of the camshaft boxes and the small indentation on the cylinder heads just enough so only the shiny surface is matted, this to provide a key for the Epoxy. Remove all sanding dust with Acetone and a piece of clean waste cloth, do not use kitchen roll paper.

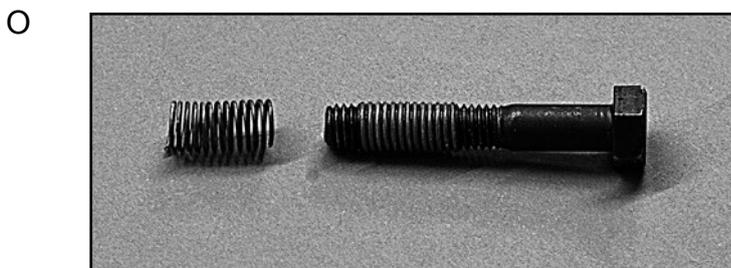


Use the pointed hacksaw blade to roughen the hole in the cooling water pump (87). Use Acetone and a piece of cloth to clean out the holes, lightly smear Epoxy onto the spigot of the camshaft (84) and press the pump (87) onto the spigot.



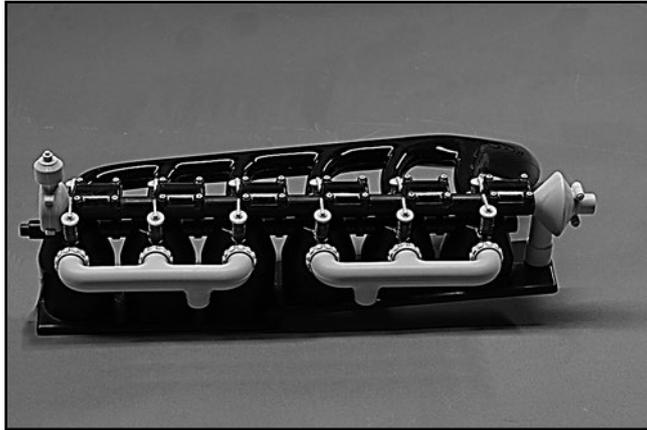
Smear Epoxy along all the six narrow feet of the rocker boxes and the camshaft drive case foot, lay the camshaft unit onto the cylinder bank, press the camshaft unit (84) firmly into place, then carefully lift off to check that the epoxy has covered the cylinder indentations. Add a little more epoxy where necessary and press the camshaft unit (84) into position. Secure camshaft with strips of Sellotape®. Leave

overnight.



Make the 12 spiral valve springs from the 0,8mm soft wire (92) by winding 13 turns onto the M8 bolt (93). Screw out the bolt carefully avoiding any distortion of the spring.

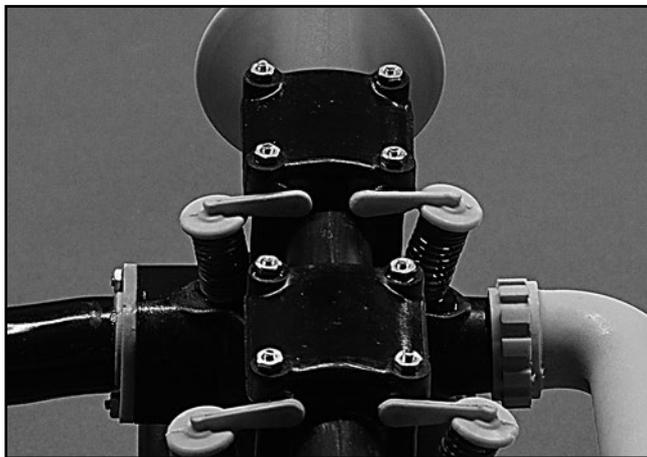
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Use 400 grit paper to sand over the places where the valves (94) seat onto the cylinders, sand the foot of each valve (94) with 400 grit paper, slide a spring over the valve (94) and apply a little epoxy to the foot of the valve (94), place the valve in position on the cylinder and use a small drop of Cyano to fix the arm onto the rocker box, the safest way to use the Cyano is to squirt a small amount onto a piece of glass or

china and transfer the Cyano to the arm with a small screw driver or similar. You need only the smallest drop of Cyano on the arms. Note, the longer valves have to be positioned on the left hand side of the cylinders.

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Please note you must glue the rocker arms and springs so close to the rocker box as possible only on the first cylinder, this is to allow the correct fitting of the two machine guns

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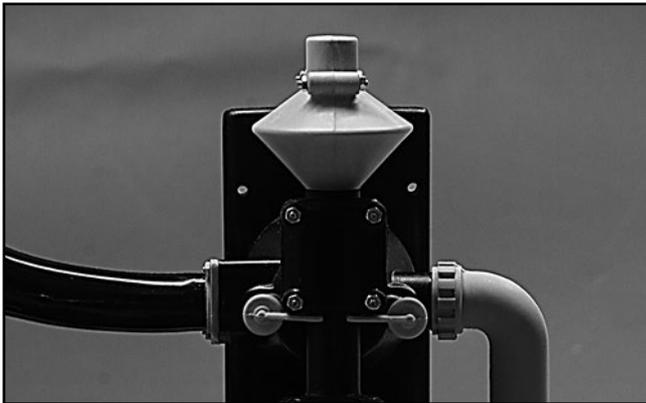
To fix the dummy engine to the fuselage make a line 163 mm back from the firewall on the fuselage topside, this line is directly over the tank cradle base and is the place for the two self tapping 2,9x13 mm screws (149).

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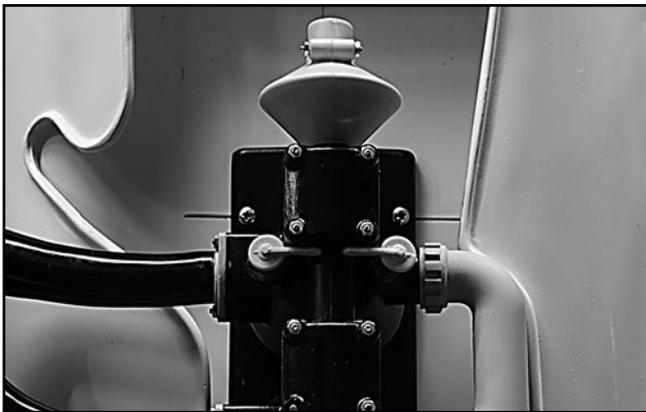
Mark a line over the middle point of the firewall thickness onto the fuselage to mark the position of the front two engine fixing M3x25 (51) Alan cap screws. Make these lines wider than the engine base so you can see these with the engine in place.

O



Lay the dummy engine onto the fuselage and transfer the rear screw mark line onto the engine base and drill a 3 mm hole each side through the engine base only, you need an extra long twist drill for this.

O



Refit the top cowl to the fuselage with the screws (12). Slide the dummy engine into the cowl and place it in the middle of the cowl opening. Hold the Dummy engine in place and use the long 3 mm drill just to mark the rear holes both sides of the dummy engine base. Remove the engine and drill out the two rear screw holes with a 2,5 mm drill. Now fix the dummy engine to the fuselage with the two 2,9x13

self tapping screws (149).

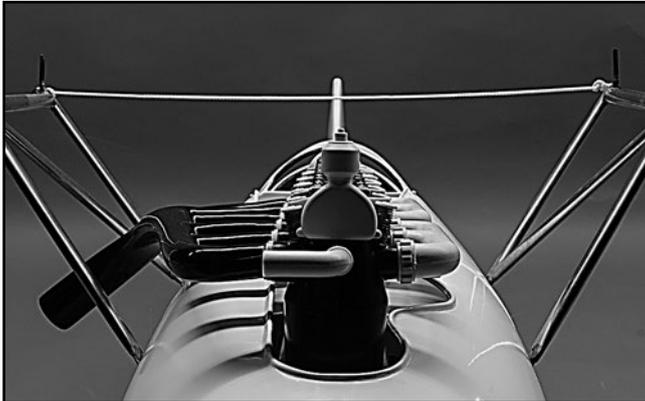
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With the long 3 mm drill, drill a hole each side of the engine base over the line marking the middle of the firewall. Go very careful so as only to drill through the engine base and lightly mark the glass fiber of the fuselage. Remove the dummy engine and drill out the two front screw holes with the 5,2 mm drill. Insert a M3x25 Alan cap screws(51) into two knurled brass bushes (114)

from the blank side,so that the threaded portion is filled with the screws, work epoxy into the holes and slowly push the bushes into the holes in the firewall, wipe off excess epoxy and leave overnight to cure hard

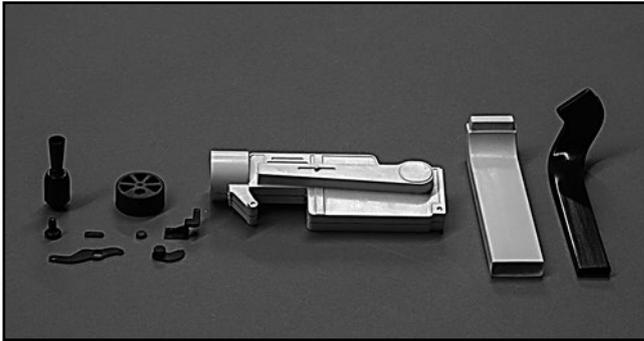
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Now refit the engine using the two 2,9x13 mm self tapping screws (149) and the two Alan cap screws(51). Make certain the engine is correctly placed in relation to the top cowl. Epoxy the water pump bend (88) into place. The bend should face to the right and has to be horizontal aligned.

## SPANDAU MACHINE GUNS

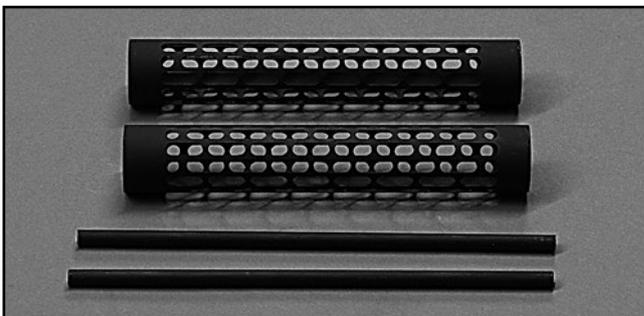
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As with the simulated engine the first and most important job is to remove all traces of release agent from the glass fiber components (95) (96) (97) (99) (100) (101) (104) (105) (106) with a brush with stiff short bristles and Acetone. This cleaning up must be thoroughly carried out or the epoxy adhesive and paint will not adhere to the

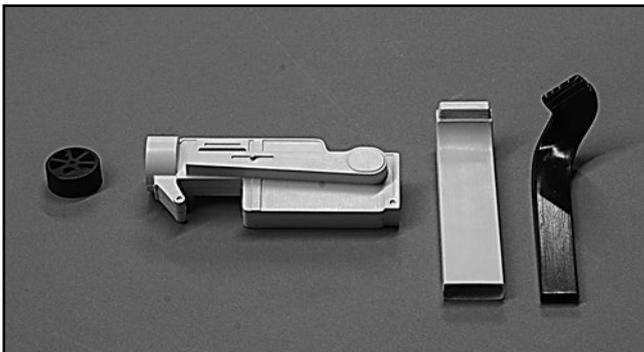
parts.

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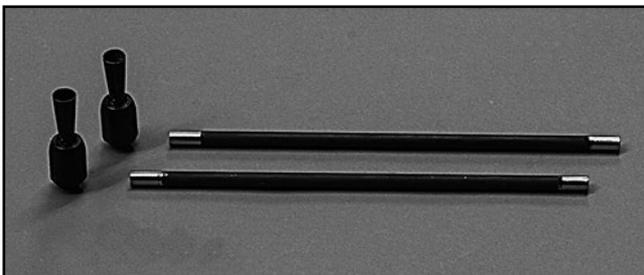
First paint mat black inside the slotted barrel sleeve (97) and gun barrel (101) leave to dry.

O



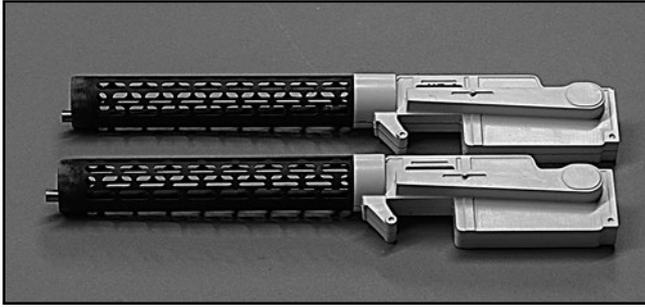
Use a pointed hacksaw blade to roughen inside of the front slotted barrel sleeve end cap (96) and the inside of the round body part (98) that takes the slotted barrel sleeve (97). Use same hacksaw blade to roughen both ammunition inlets and outlets, also roughen the glue surfaces of the four ammunition chutes (99) (100) tongues.

O



Grind or file small grooves outside of both ends of the 6 mm dia stainless gun barrels (101), use a small round file to roughen the inside of the flash dampener (95) hole where the gun barrel (101) fits into it.

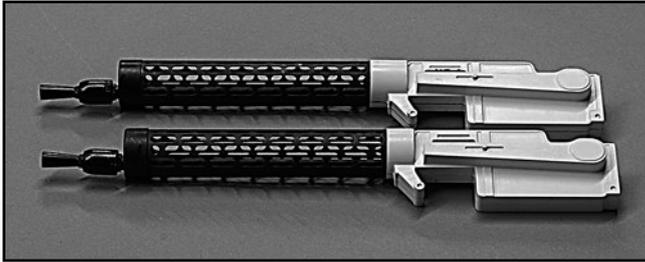
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the bodys (98) with the wide strip between slots right at the bottom.

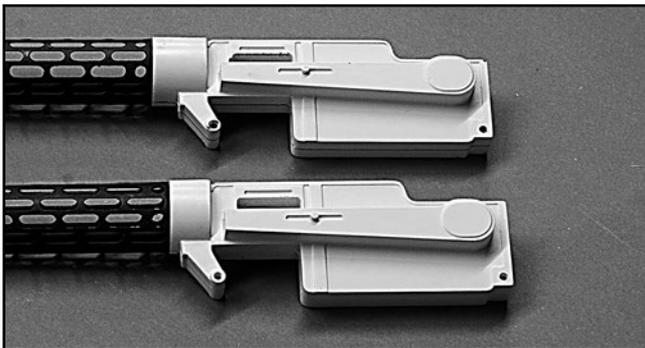
Use 280 grit to lightly sand the ends of the slotted barrel sleeves (97). Mix a small quantity of Araldite 2011 and lightly smear the end of the gun barrels (101) and insert this into the bodys (98); smear a very small amount of epoxy into the round part of the bodys (98) and push the slotted sleeves (97) into

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Very lightly smear epoxy in the slotted sleeve end cap (96) and push this over the barrel (102) and onto the slotted sleeve (97). Lightly smear the end of the barrel (101) with epoxy and slide the flash dampener (95) onto the barrel (101).

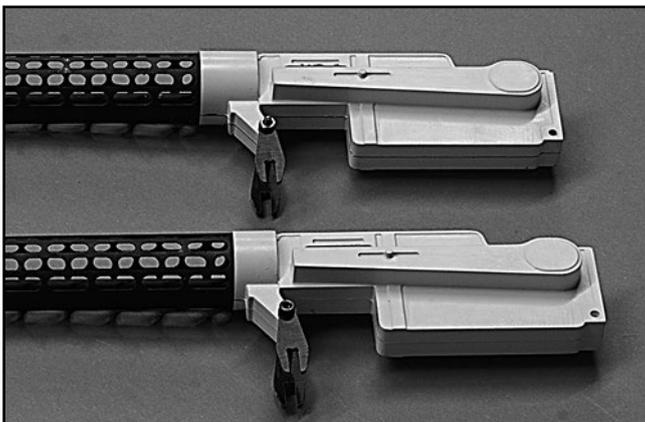
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supports, there is so little material and the drill will easily run out.

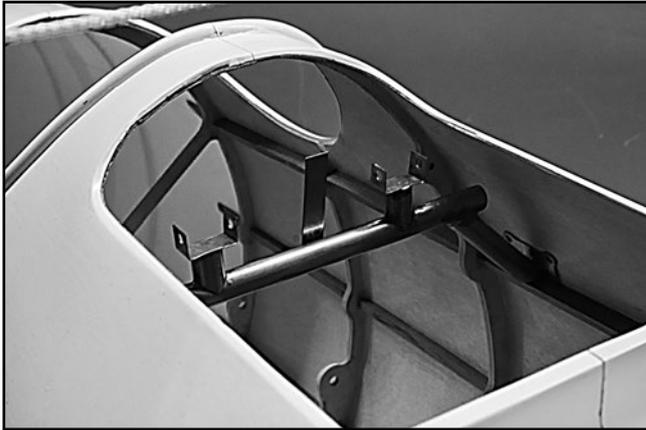
Next day after the epoxy has cured hard use a 3 mm twist drill to bore out the two fixing holes, one in the front support and the other in the rear of the body (98). To bore the holes in the front support and body, it is better if you drill halfway through from each side. You will find it difficult to drill right through from one side only on these front

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Fit the four front support forks (107) onto both MG's with a M3x25 socket head screw (51) with a plain nut. Note these two screw heads (51) must be facing inwards or you will not be able to remove these later when the front forks are epoxied onto the former.

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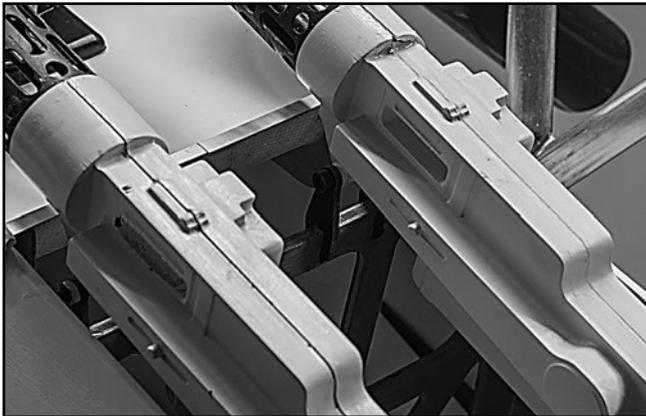
Place the ready made stainless steel tube MG bridge (108) into the fuselage; noting there is a fore and aft side, the aft side is the small flat strip, this faces towards the tail-plane.

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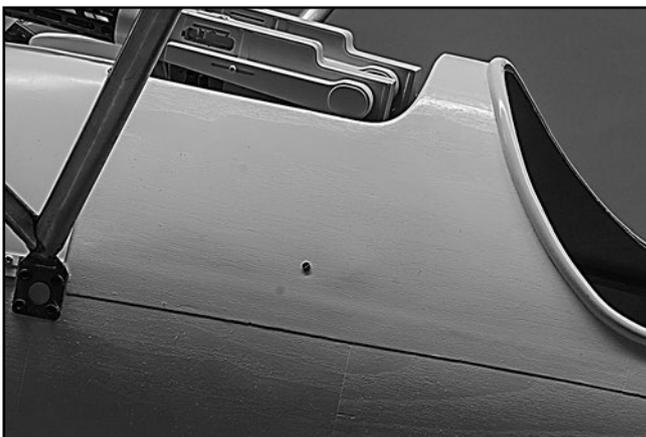
Fit both MG's front forks (107) onto former's edge. Place the MG's into the two forks on the bridge (108). Thread a M3x25 socket head screw (51) through each U-shape rear MG support and adjust both MG's so that they sit equally spaced both sides of the engine.

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Epoxy the four front support forks (107) onto the former (109) and leave overnight to allow Epoxy to cure hard.

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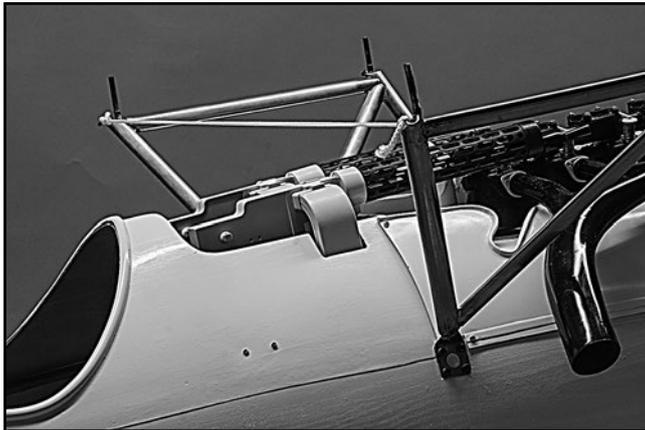
Ensure the machine gun bridge is sitting upright, bore a 2mm hole from the inside of the fuselage through the fixing plate of the machine gun bridge and insert a M2x12 cheese headed screw (83), fit a M2 nut (57) and screw up tight.

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Bore a hole through the opposite side and fit a M2x12 cheese head screw (83). Check to see that the machine gun bridge is sitting accurately then drill out the second holes and insert a M2x12 cheese head screw (83).

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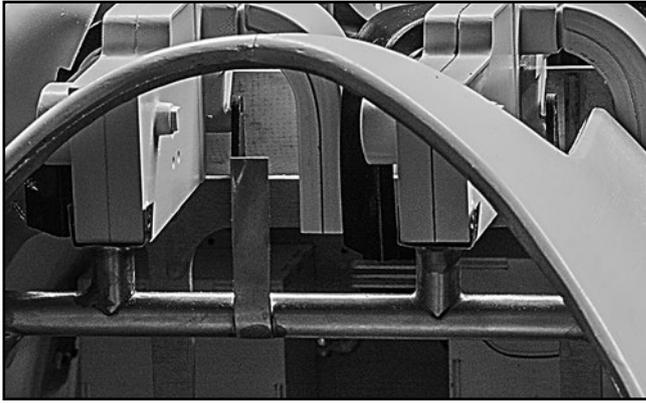
Remove the two MG's. Epoxy the four munition chutes (99) (100) into the slots. Note that the straight chutes (100) are fitted to the right hand side of both MG's. Next day refit the MG's, this requires a cutout each side of the fuselage to take the munition chutes.

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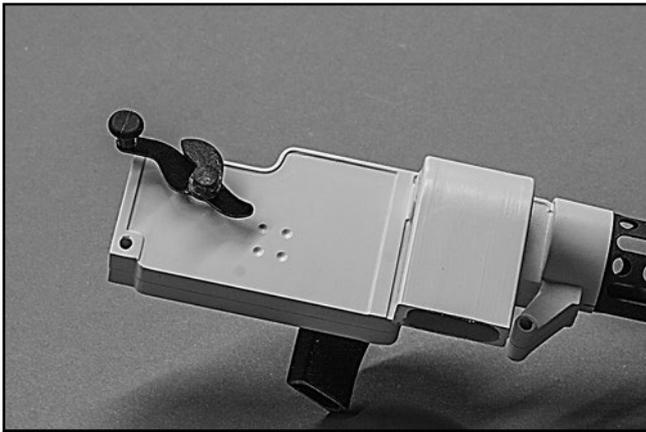
The vacuum formed ammunition chute cover (111) must be trimmed to shape, this is fitted over the left hand side gun only. Tape this into place and with a 1,5 mm drill bore the four fixing holes and screw in the four M2x8 woodscrews (112).

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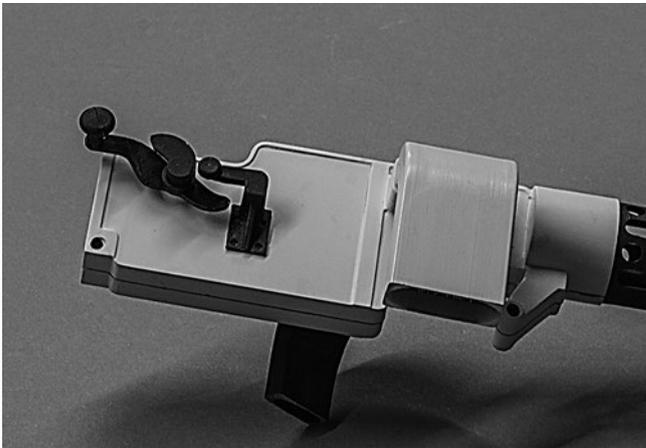
To prepare the installation of the fuel tank, the munition chutes (99) (100) have to be shortened. Mark the length of the chutes by sighting the cutout into the former and remove the MG's out of the fuselage. Cut the chutes with a saw to length and check the result. Remove the MG's from the fuselage.

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Glue the knob (103) with cyano onto the cocking lever (102). Afterward glue the cocking lever (102) onto the MG Body (98). Finally fix the Endstop (106) with cyano onto the the cocking lever.

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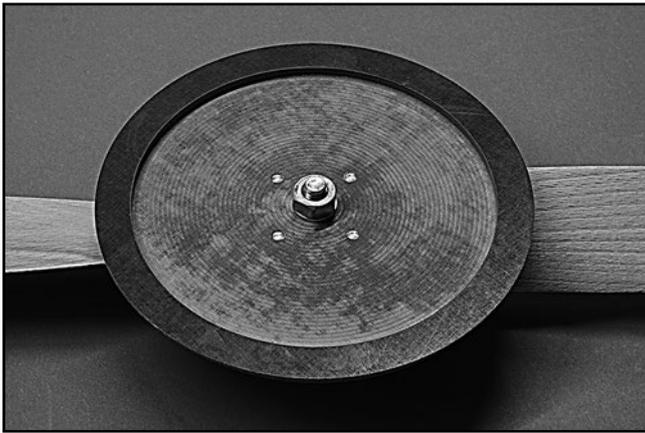


Glue the knob (105) onto the lever (104), in the same manner as before. Fix this unit with cyano right over the marking onto the MG-Body (98).

O Remove the engine and the bridge (108) from the fuselage.

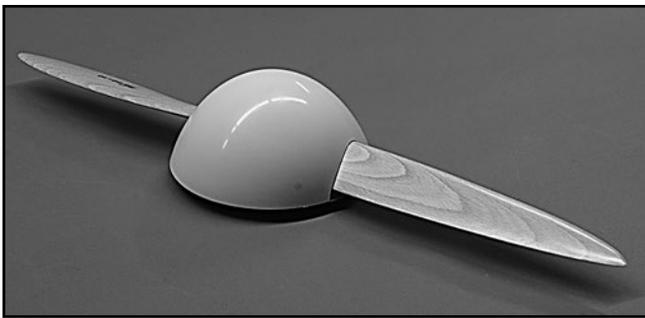
## Spinner

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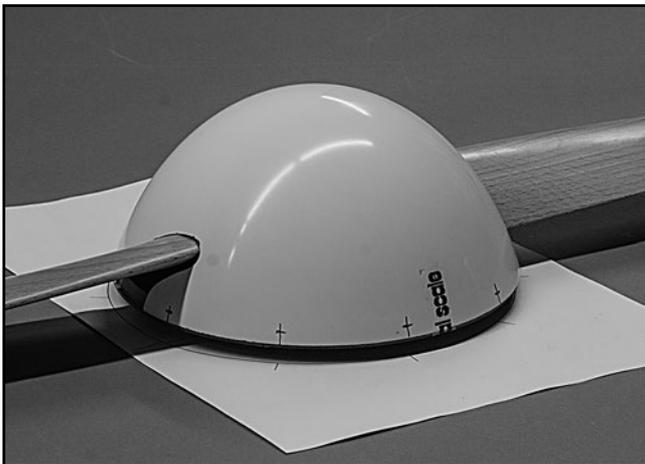
Mount the propeller temporary with a M10 screw, 2 washer and a Nut onto the backplate (220). Make sure that the four holes for the fixing pins (221), align with the template. Afterward drill four 5mm blindholes into the airscrew right deep enough to take the fixing pins (221). Press the fixing pins with the cuck of the box column drill in to the airscrew, until they are flush to the Backplate (220).

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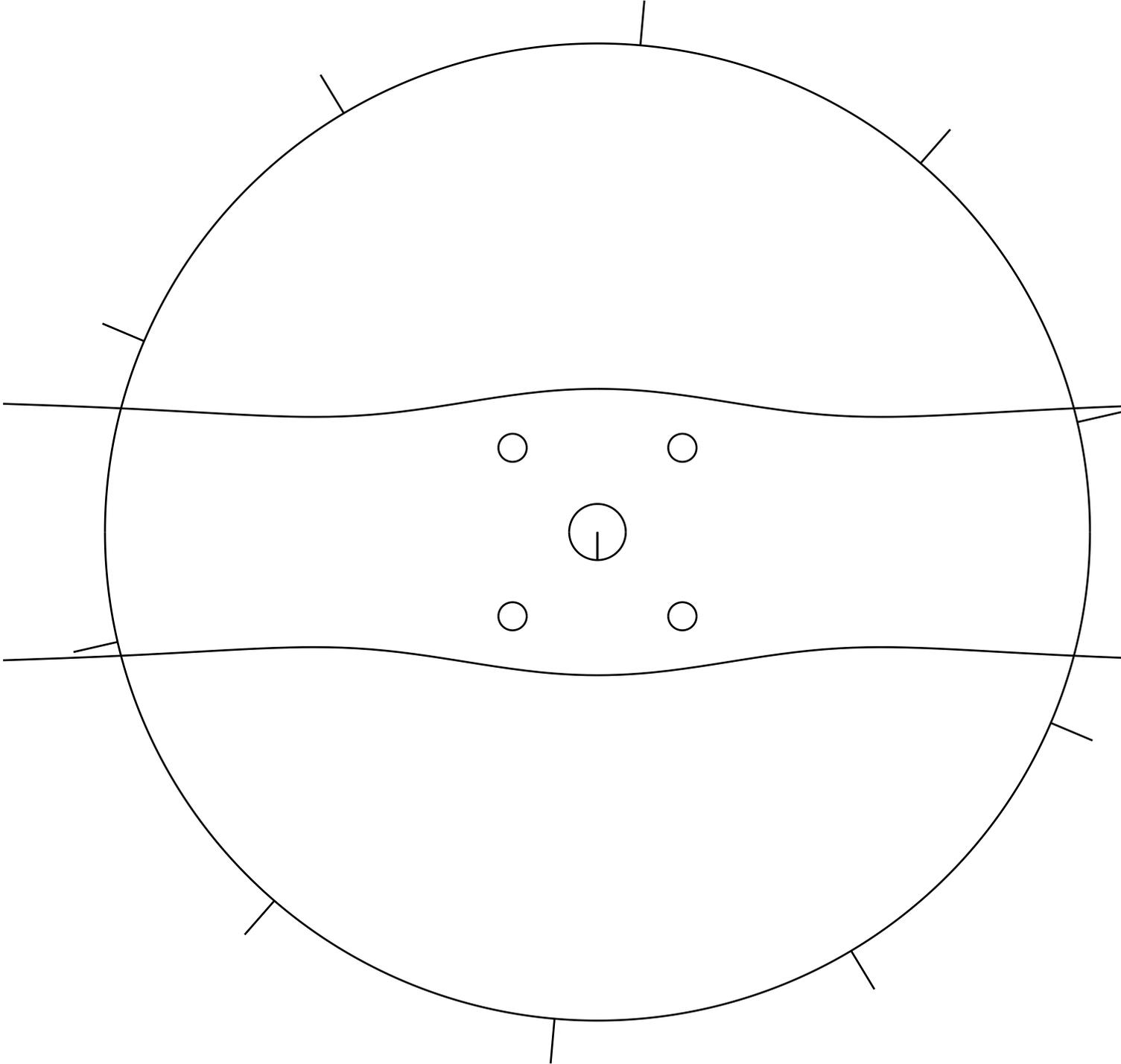
Cut and grind the marked holes for the airscrew into the spinner cap (222) until it fits your airscrew.

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Fix the spinner cap (222) with Selotape onto the backplate (220). Lay the spinner on the template and mark the position of the M3x10 round head sockethead screws (223). They should have an offset from 5mm to the edge of the spinner cap (222).

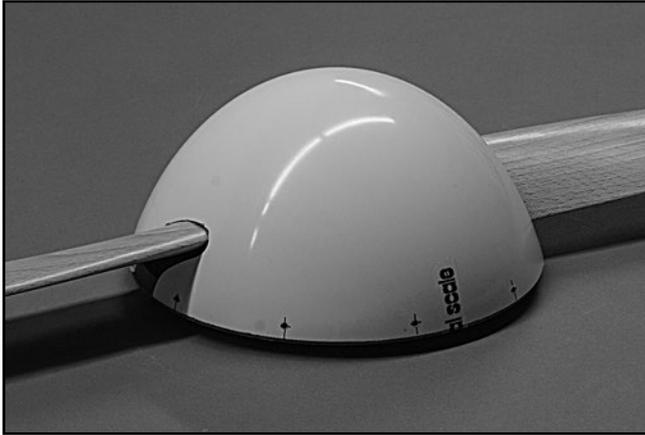




Template to mark the position of the screw holes



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Drill with a 2,5mm drill 12mm deep holes for M3x10 roundhead socket head screws (223). Make sure, that the drilling machine is vertical to the surface of the spinner cap.

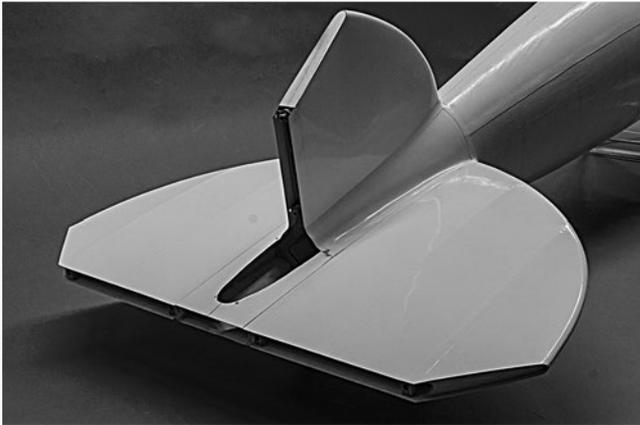
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Remove the spinner cap (222) and widen the 2,5mm holes with a 3,2 mm drill. After that cut the M3 threads into the backplate (220) and fix the cap with the screws (223) onto it.

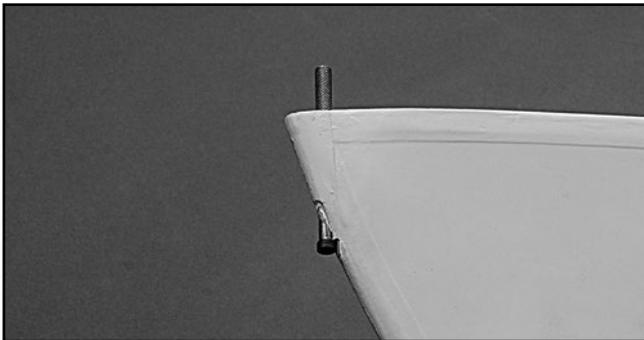
## TAILPLANE

○



Fit both sandwich construction GRP tailplane halves (20) to the fuselage using the 16 mm aluminum tubes (75) (76). Use felt a tip pen for example, and mark on the respective rear phenolic tubes left and right. When making and fitting the elevators this left and right will prevent any mistakes by always fitting the tailplane halves on the correct side of the fuselage.

○



Fit a M3x50 socket head screw (113) into the brass tube at the nose of one of the GRP tailplanes; screw a shortened knurled brass bush (115) onto the projecting screw thread; screw the bush (115) onto the socket head screw (113) with the threaded portion innermost.

- Ensure the bush (115) makes contact with the brass tube, if necessary, clean away any gel coat.

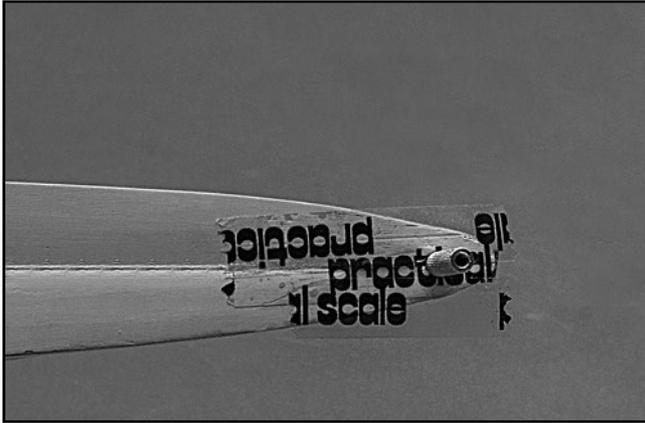
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Insert the two aluminium tubes (75) (76) into the two holes in the fuselage. Insert the two tubes (75) (76) into one tailplane half and carefully push the tailplane half towards the tailplane stub on the fuselage until the shortened brass bush (115) comes against the tailplane stub. Using a fine point felt tip pen to mark the position of the shortened bush (115) onto the tailplane stub.

Remove the tailplane half and drill and file out the hole to take the bush (115).

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the fuselage. This plain portion leads the screw perfectly into the thread without fear of crossing.

Refit tailplane and ensure the shortened brass bush slides into the hole easily. Remove the tailplane from the fuselage, remove brass bush (115) and M3x50 screw (113); cover the nose of the tailplane with Sellotape®, carefully poke a hole through the Sellotape® and insert the screw (113) and screw the bush (115) onto the screw. Note that the plain half of the bush is facing towards the tailplane and not towards

O



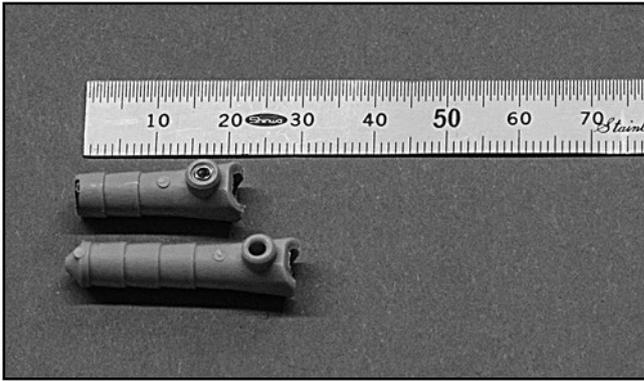
Using a pointed stick, work a little epoxy into the hole, apply epoxy to the shortened bush (115) and push the tailplane onto the fuselage. Repeat procedure with the second bush (115) with the other tailplane half and leave overnight for the epoxy to set hard.

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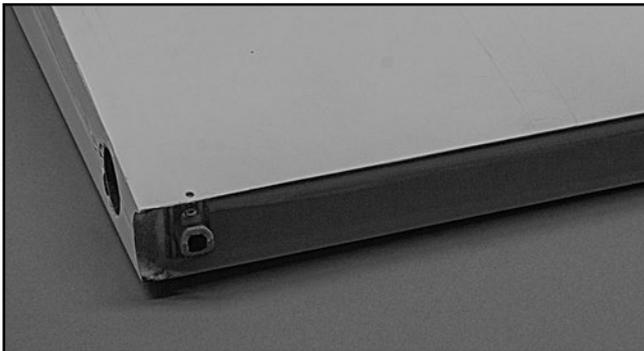
Next day, remove both M3x50 socket screws (113); you need a long thin knife blade to carefully insert between the tailplane and the fuselage between the front tube (75) and the screwed bush. Slide the knife blade carefully towards the bush and this will release the tailplane from the fuselage.

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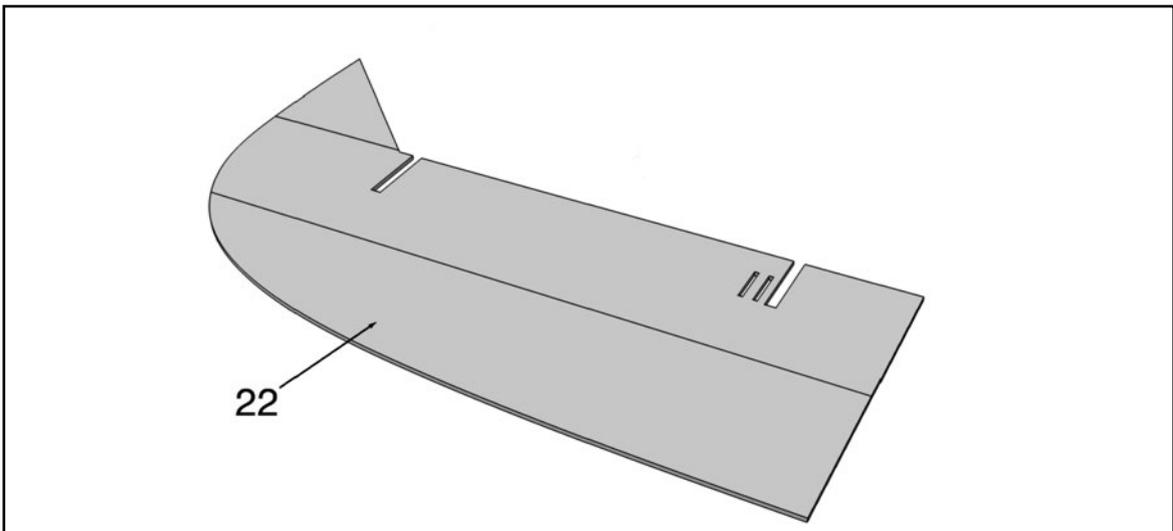
Cut off 11 mm from four hinge sockets (10) so these are then 22 mm long. Using Araldite 2011, epoxy these four hinge sockets (10) with the screw holes facing downwards, into the 9 mm plywood hinge carriers, that are already moulded into the tailplane.

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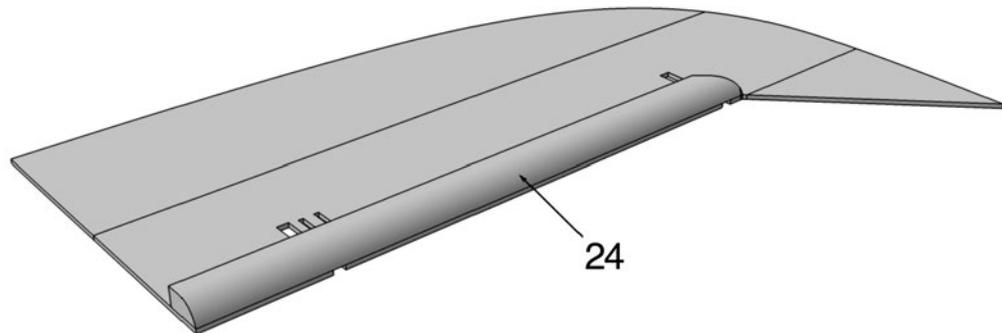
Leave hinge sockets (10) overnight to allow the epoxy time enough to cure hard. Remove both tailplane halves (20) from the fuselage and bore the 2 mm diameter holes through the tailplane halves over the hinge socket screw holes. I found the Perma-Grit round needle file perfect for this job.

O



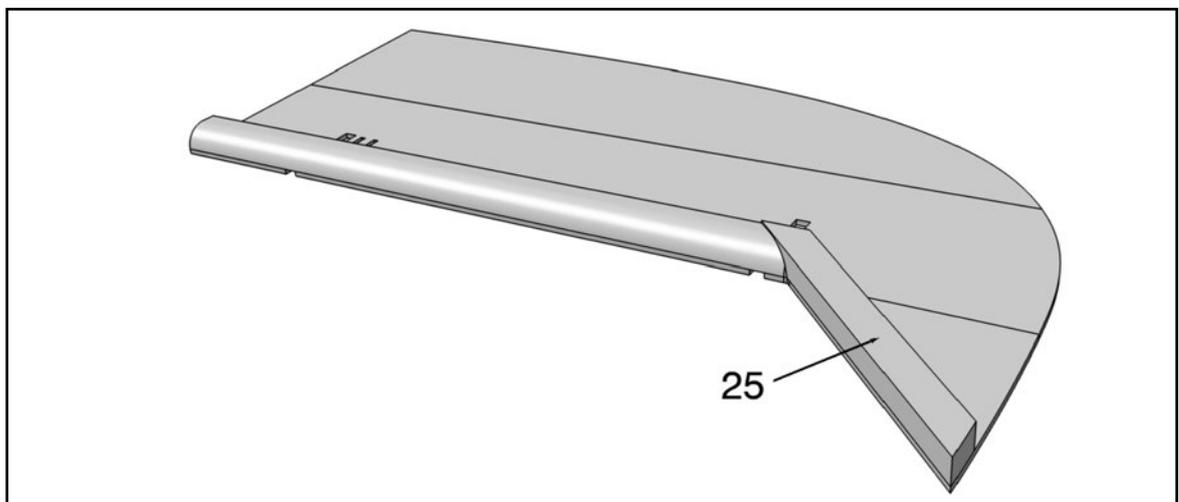
Refit both tailplane halves to the fuselage, lay the two 2 mm Balsa core sheeting (22) against the tailplanes and transfer the position of the hinges onto the core, mark and cut out the 43x5 mm wide slots. Mark for left and right elevator as the position of the hinges may not be identical on both tailplane halves! Mark the position of the ribs onto the Balsa core sheeting.

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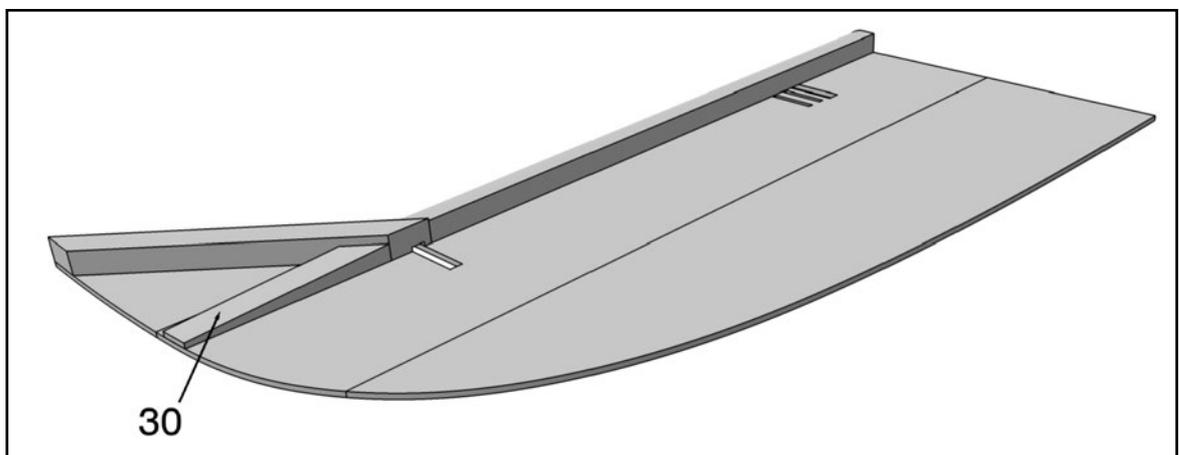
Glue the spindle moulded leading edges (24) first to the top halves of the core sheeting.

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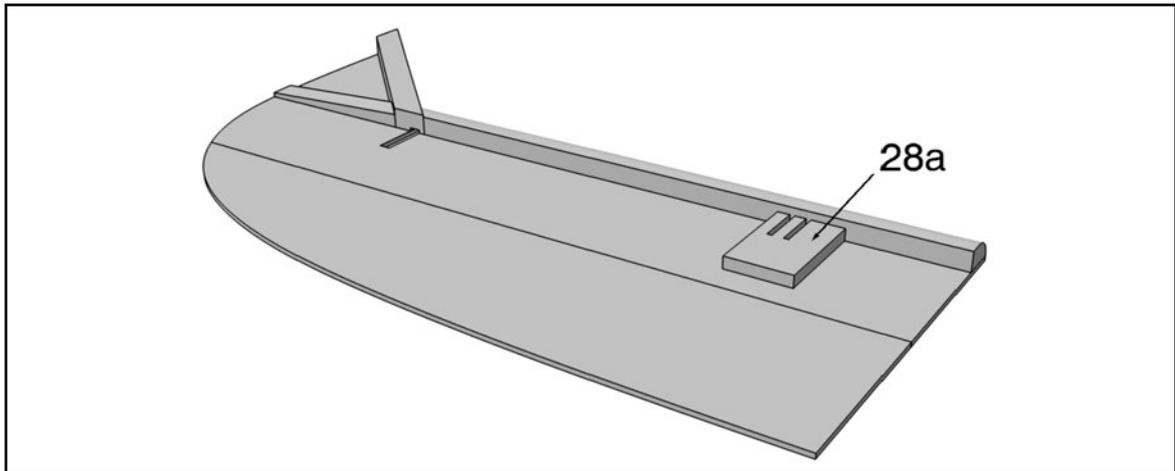
Fit and glue the short pieces of 12 mm x 9 mm leading edges (25) at the horn balance.

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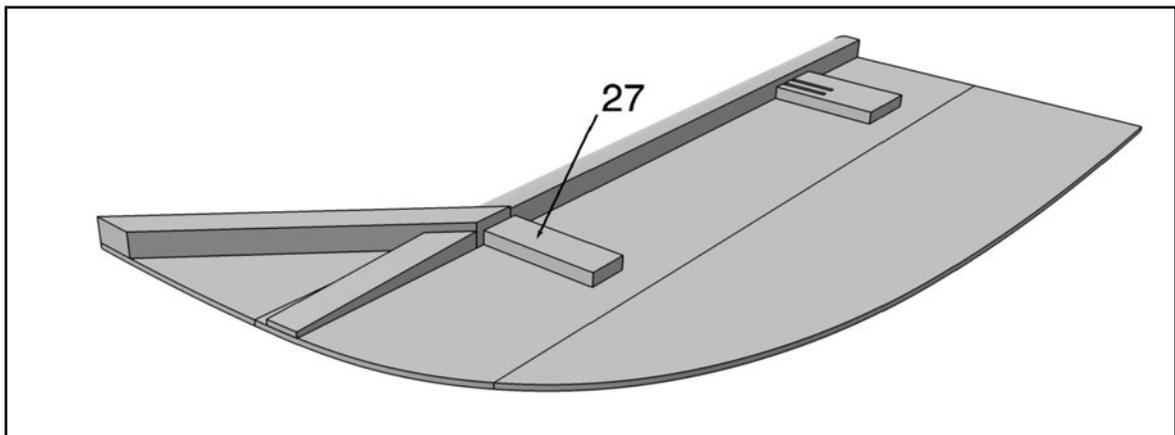
Glue the stiffener (30) to the top halves of the core sheeting.

O



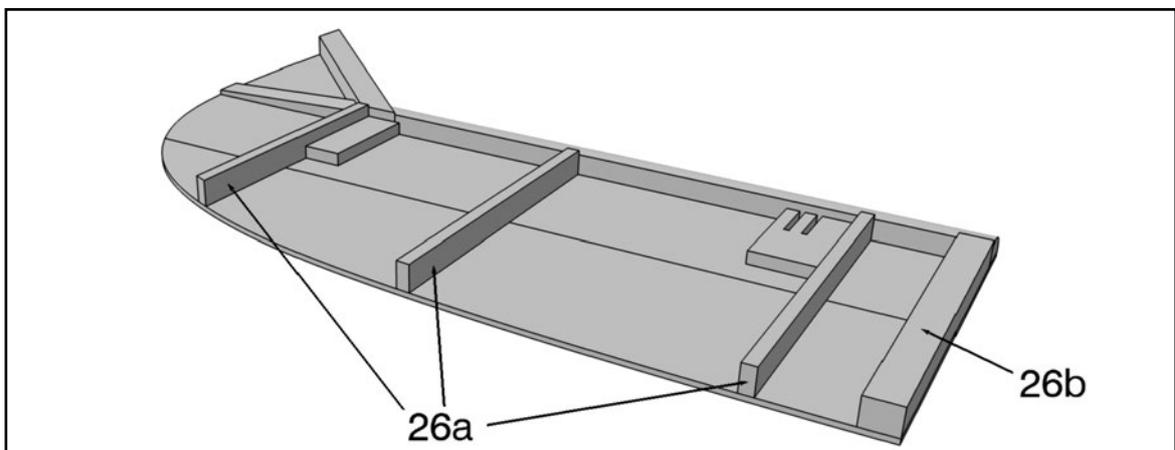
Glue the thin large hinge scabs (28a) exactly over the cutouts for the ruder horns and Robart hinge. **Attention:** there is a thin version (28a) for the upper side and a thick version (28b) that must be placed on the bottom side of the elevator. It is important that the hinge groove in the scab is lined up accurately with the slot in the cores.

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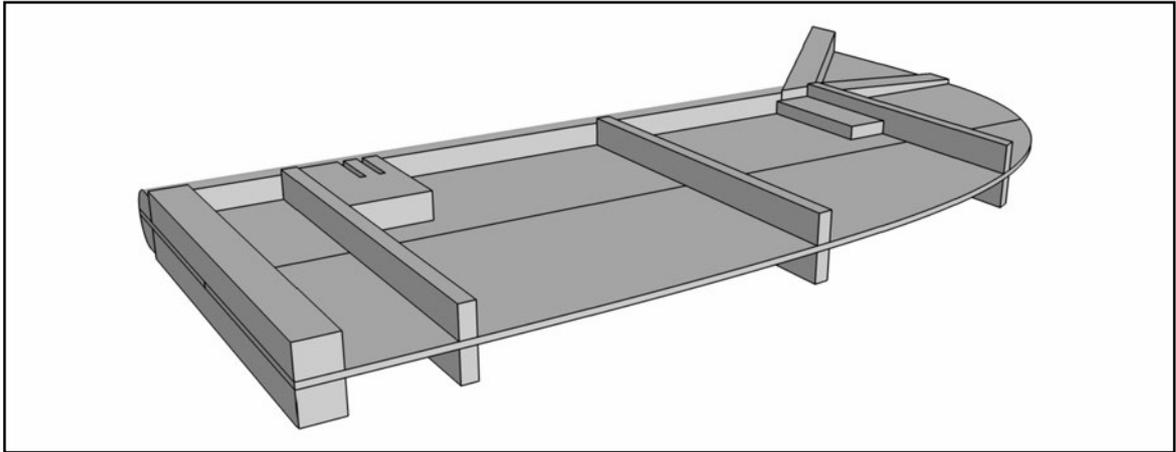
Glue the hinge scabs (27) exactly over the cutouts for the outer Robart hinge.

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Glue the 10x5 mm balsa ribs (26a) and 10x12mm balsa ribs (26b) to the topsides of the tail plane cores.

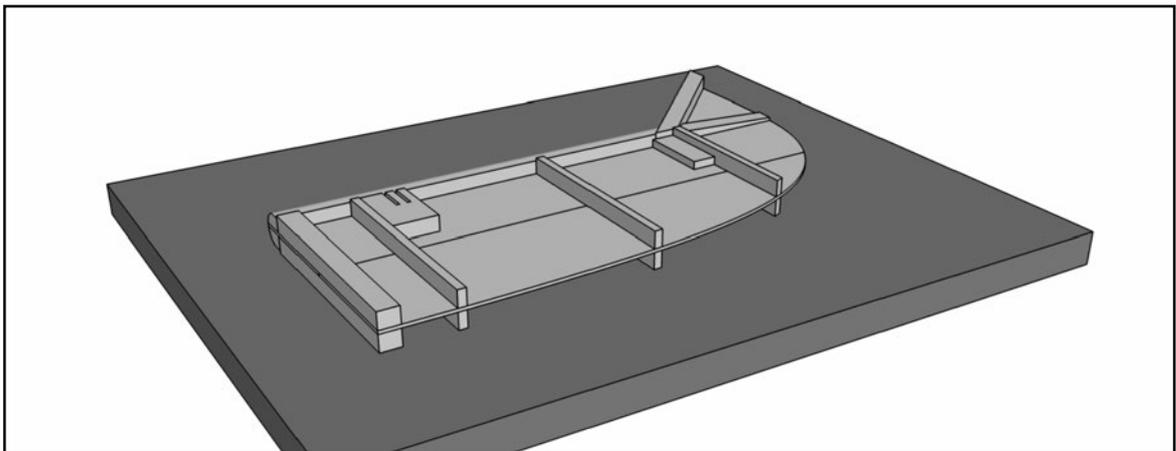
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With the glue dry, remove the elevators from the board, turn them upside down and pin these securely to the board now with the LE and ribs downside. Complete the second side exactly as for the first.

- O Remove the elevators from the board. Run a fillet of PVA glue at the rear end of the scabs to seal the holes, this will prevent epoxy leaking out when installing the hinges later.

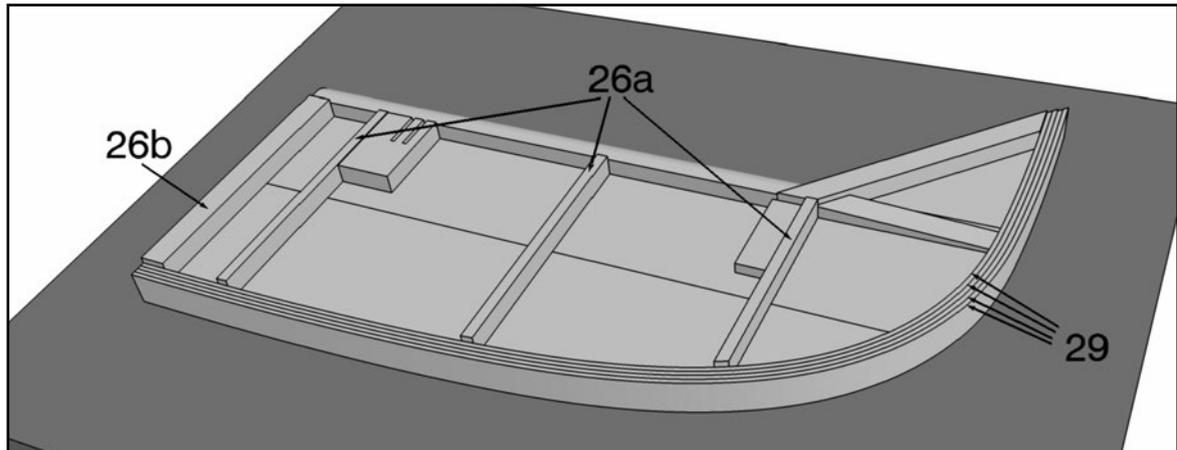
O



Sand off the overhang of the ribs carefully so these are not in anyway rounded, or they will not fit tightly against the laminated trailing edges (29). Pin the elevators securely to the plastic film covered board.

- O Soak the 16 mm x 2 mm trailing edge laminating strips (29) in water for a few minutes. Without removing excess water, apply a fairly thin line of PVA glue along the middle of one strip, lay second strip over, and another line of PVA glue along the middle, a third and fourth strip likewise.
- O Press strips together and the glue will be squeezed out, wipe off excess glue with kitchen roll paper. Have ready zinc plated 2mm panel pins, do not use unplated panel pins as these will quickly rust and leave marks on the Balsa, and these marks will be difficult to remove, also these rust marks will later come through the covering material and paint.

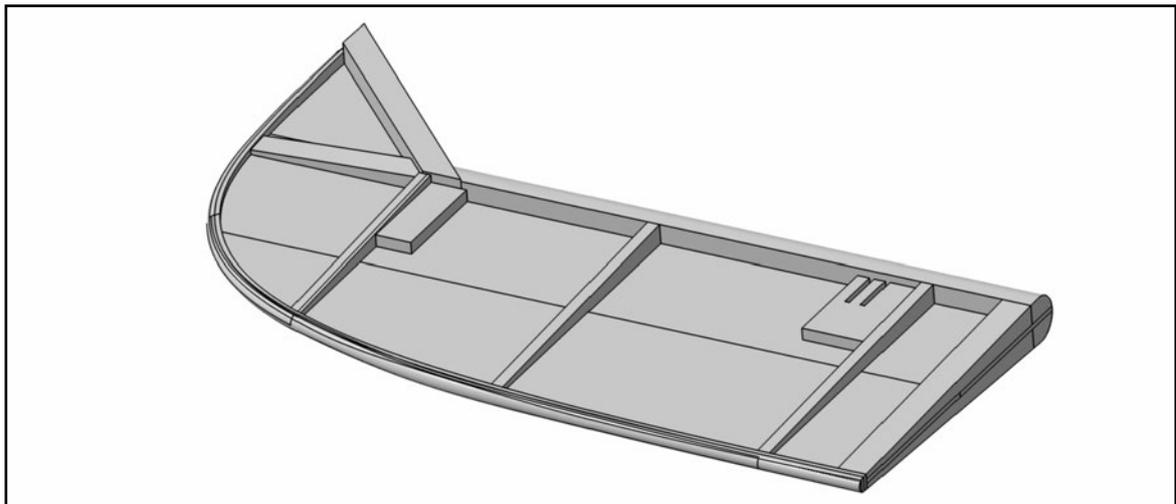
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Apply PVA glue to edges of the cores (22/23/24) as well as the ends of the ribs (26a) (26b). Fix the still wet laminated trailing edge strips (29) to elevators with the panel pins hammered into the board and spaced about 30 mm apart. Leave both elevators for 24 hours to dry out.

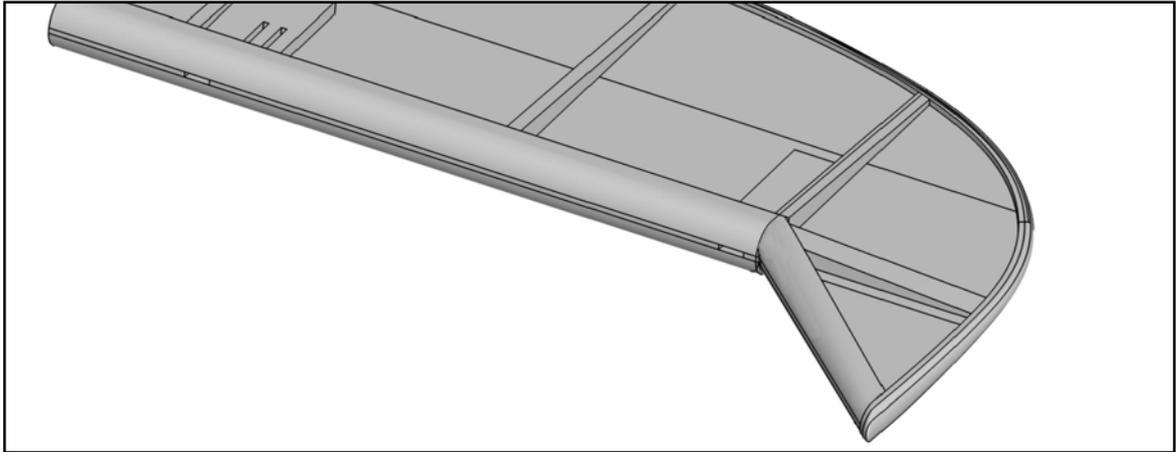
O Now comes the rather more dusty work. After removal of the elevators from the board, cut away the overhang of the laminated trailing edges.

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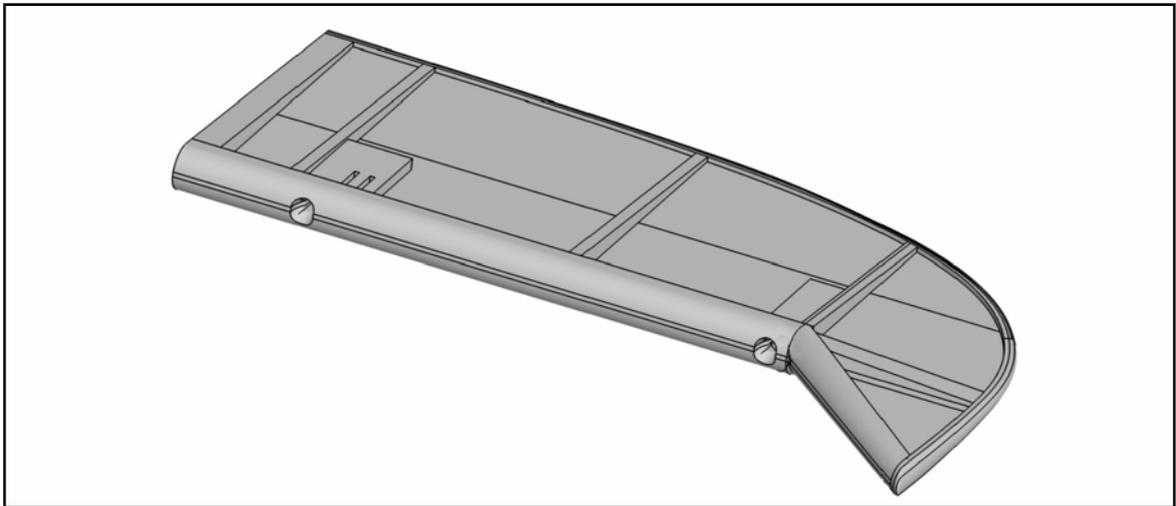
With a small wood chisel trim away the ribs to within 3 mm from the core at the trailing edge end. With the razor plane trim down the laminated trailing edges (29) until 3 mm remains above the core both sides at the trailing edge and fair out to full height at the horn balance tip. Carefully plane down the ribs to a tapered shape. Using a wide sanding block, sand elevators to a straight tapered shape. Round the trailing edge equally from both sides with fairly fine 240 grit paper.

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Round the horn balance leading edge.

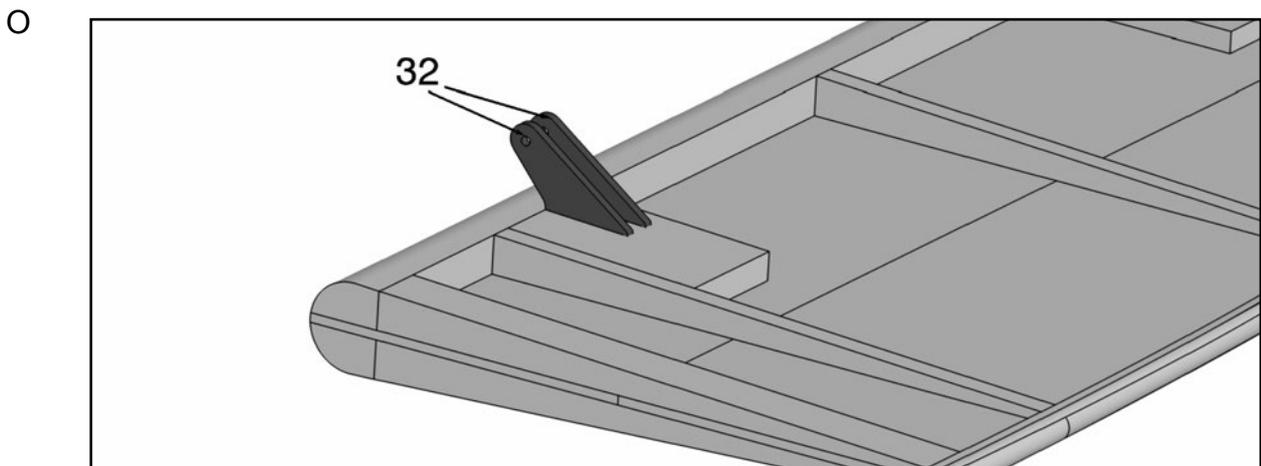
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Next take a pointed round file, I used the Perma-Grit round needle file, #3332 and opened up the two hinge holes in the leading edge (24) enough so you can fit the Robart hinge points (31) into the elevator. You now have to widen these holes so that the elevator can move up and down by 25 to 30 degrees without the hinges coming into contact with the leading edge (24). The Dremel pointed sanding sleeves are ideal for this, these holes must be deep enough so that the hinge pin is at the center of the radius of the leading edge.

- O Cut off 11 mm from one end of each of the four Robart hinges (31), insert these hinges with the shorter ends into the tailplanes hinge sockets and secure the hinges with small socket head grubscrew (11) in the tailplanes.
- O Using Araldite 2011 epoxy the four hinges (31) into the elevator. For safety I put a tiny drop of silicone oil into the knuckle of each hinge, you will of course ensure that no oil gets onto the glue surface of the hinges, also do not forget the shortened ends goes into the tailplane!

- Plug the two tailplane (75) (76) tubes into the fuselage and fit both tailplanes onto these tubes. Fit one of the elevators onto the tailplane. See if it is now possible to fit the second elevator onto the other tailplane, if not you must carefully sand the ends of the elevators so that both fit onto the tailplanes with a gap of 2 mm between both elevators.
- Clean up elevators all round with 400 grit paper. Both elevators can now be covered with ProfiCover. Cover first the undersides to just under halfway around the edges. Use ProfiCover topsides overlapping the underside covering. I prefer to paint the overlap with well thinned down dope, leave this for 24 hours to really dry, then sand overlap with 1,000 grit paper, you can use 800 grit but do not use any coarser grit as this will result in fuzzy edges. Be careful painting the overlap for if you stray onto the open covering with the brush this will tend to show up on the paint finish later. You will find you need to dope the overlap quite a few times so the small step completely disappears.
- Use a fine pointed X-ACTO knife or similar to cut away the ProfiCover over the hinge holes, you can dope the edges a couple of times and leave for 24 hours to dry out, then you can sand off the rough edges formed by the ProfiCover, I used 800 grit paper wrapped around a dowel.



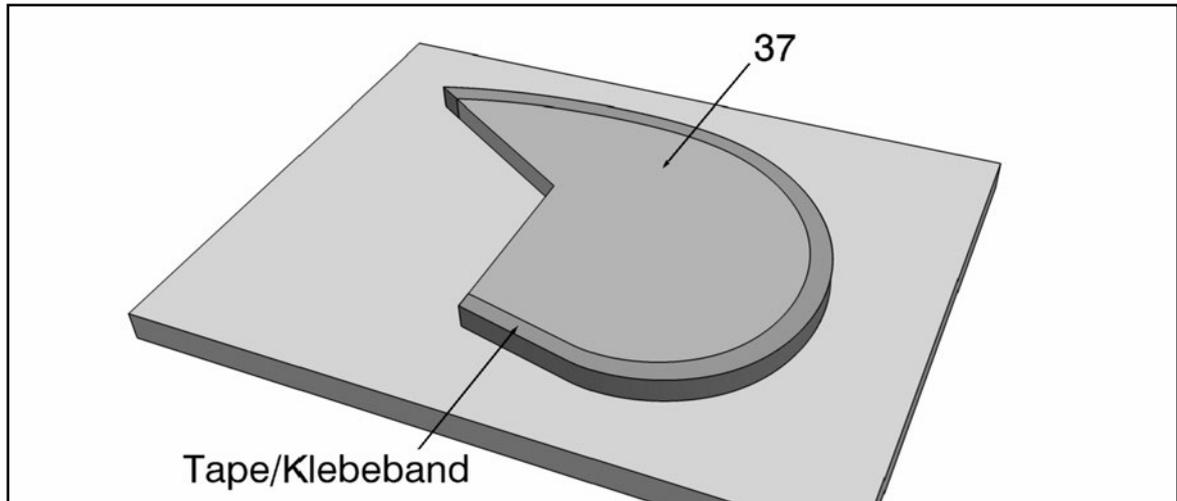
Roughen the four horns (32) over the glued area with coarse grit paper, cut away the ProfiCover from the horn slots in the undersides of the elevators, using Araldite 2011 epoxy, smear a little onto the horns, with small screwdriver blade work the epoxy into the slits, be careful to just insert enough epoxy so that a little is squeezed out. Clean off excess epoxy and leave the two elevators overnight to harden off the epoxy.

- If you wish to simulate rib stitching on the elevators, here is a well tried and simple method, you need masking tape and a hypodermic syringe with a fairly coarse needle.
- First stick a stripe of masking tape both sides of the ribs with a gap of just under a millimeter from edge of the ribs. Mark off short lines with 10 mm gap between them; I found a very fine felt tipped pen ideal.

- Partly fill the syringe with PVA glue, experiment on a piece of dark card making these short extruded strips of glue, you will notice if you go really slow the glue line will be thick, you going faster has the opposite effect. The PVA glue shrinks in size as the fluids evaporate, thereby reducing the size of the stitching somewhat, take a little time over this glue stitching practice, allow the stitching time to dry so you can get feel of how thick to squirt the stitches onto the covering.
- So you are now satisfied with your practice shots? Make the stitching on the underside of one elevator first for safety, if you are not satisfied with the results, then quickly wipe off the PVA with a damp sponge before it has time to dry. With the stitching in place pull off the masking tape and leave the "stitched" elevator to dry overnight. Next day you can finish the topside. Cut strips of ProfiCover 7 mm wide and iron these over the rib stitching, do not pull these ProfiCover strips too tight or they will start to distort and form a curve that is impossible to correct. Please note Pinked (Zigzag) band was never used during the 14/18 war!
- Fit the two servos into the tailplane halves. Note the servo carrier is wider than the servo body; put the servo against the bottom side with a strip of 0,5 mm card or plastic so there is an air gap between servo and the plywood carrier. The servo output arm is towards the tailplane nose.
- Take the two 210 x 3 mm carbon fiber pushrods (116) and four ball joints (117). Drill out the four ball joints (117) with a 3 mm drill.
- Remove the servo output arms, fix a ball joint (117) onto the two servo arms with M2x12 cheese headed screws (83), secure nuts with Loctite, cut off excess screw thread where this exits through the nuts, then refit servo arms. Tape the elevators in a neutral position, fit a ball joint (117) between the rudder horns on both elevators.
- Mark the places for the servo pushrod slots on the undersides of the tailplanes. Take care with cutting these slots as the sandwich laminate is only eighty grams glass cloth. Insert a pushrod into the ball joint on the servo arm, turn the servo arm so that the angle of 90 degrees exists between the servo arm and the pushrod. Lay the pushrod onto the ball joint on the elevator horn and mark the length with a file or similar.
- Cut the pushrod to length and roughen both ends. Remove the servo arm and work epoxy into the ball joint (117) refit servo arm to the servo, insert the pushrod into the ball joint and wipe away any drop of epoxy falling off with short piece of balsa strip. Use medium strength Loctite to secure the output arm screw into the servo. Leave overnight for the epoxy to harden, next day epoxy the pushrod into the balljoint on the elevator horn.

## RUDDER

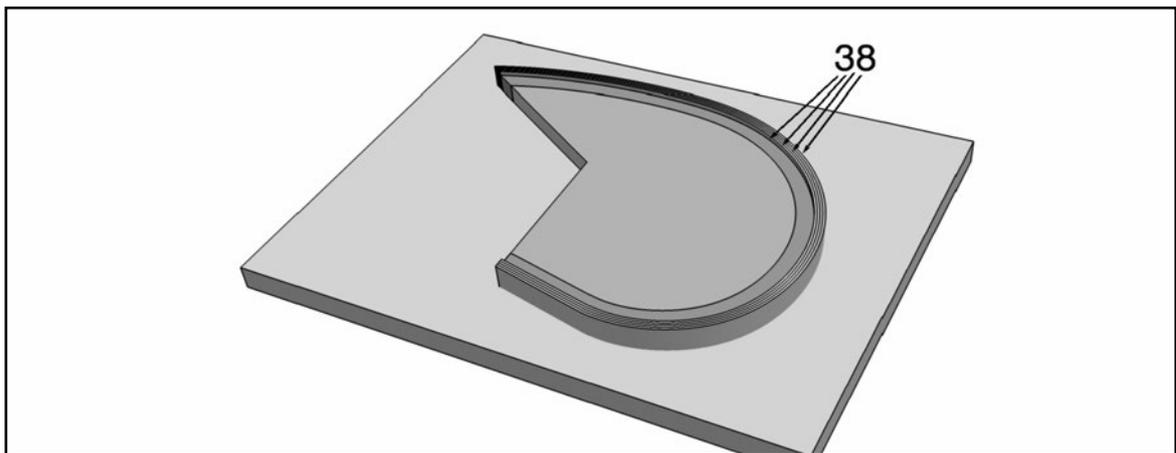
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Cover the edge of the 16 mm thick chipboard template (37) with 50 mm wide tape. Press the tape flat on the edge so no wrinkles are formed, carefully wrap the tape around the edges. Cover a piece of blockboard with plastic film and nail the template to the blockboard.

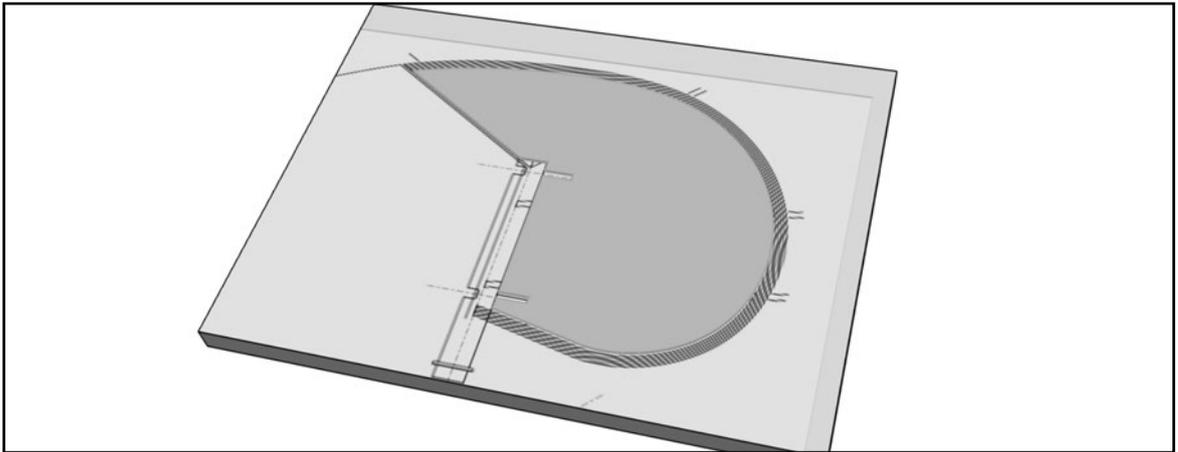
- Soak the four balsa 22x2x730 mm laminating strips (38) in water, do not remove excess water, run a strip of PVA glue along the middle of one strip, lay a second piece over this side and run a line of glue down the middle, same action for third with fourth laid on top, now press the strips together, the now thinned down glue surplus will be squeezed out. Wipe off this excess glue with kitchen roll paper.

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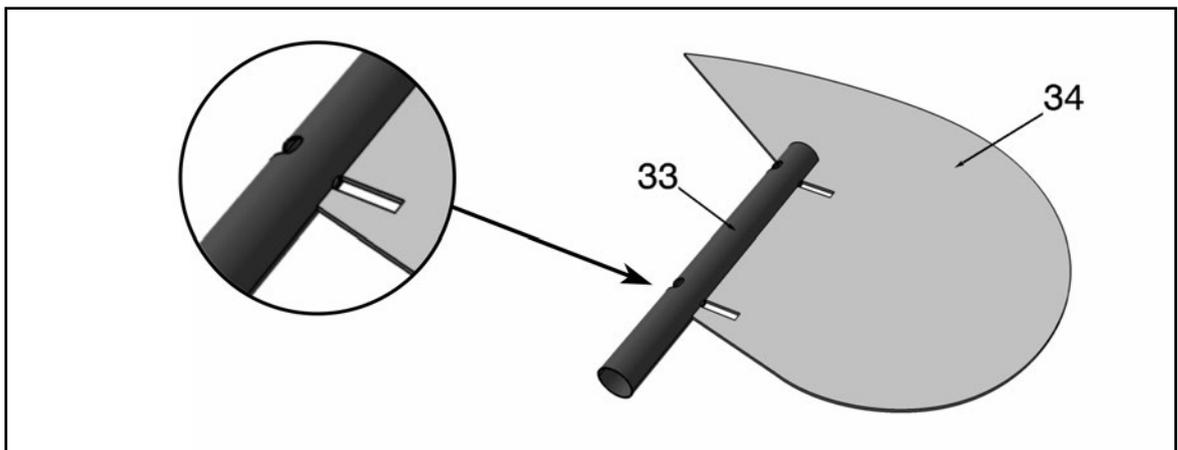
Using zinc plated panel pins fix the laminating strips (38) around the template.

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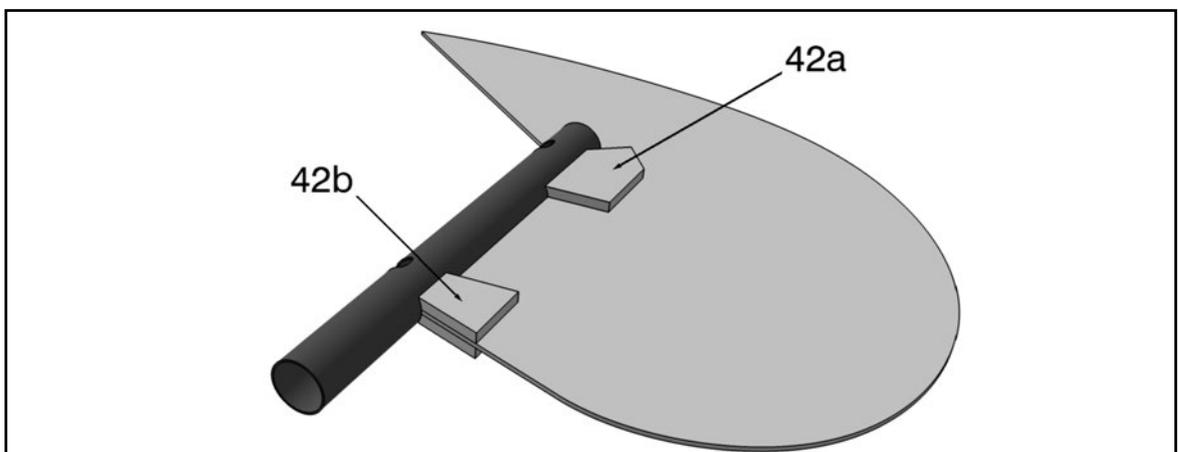
Lay the 2 mm thick rudder core sheet (34) over the plan and mark position of the balsa 10x5 mm ribs (39) both sides, you need only to make a small mark at both ends of the rib positions. Sand off the shiny surface of the rudder post tube (33) where the balsa core makes contact, you need only to sand a strip about 6 mm wide.

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Glue the rudder balsa core (34) accurately to the middle of the rudder post (33), using cyano instant glue. Use the hinge hole for reference.

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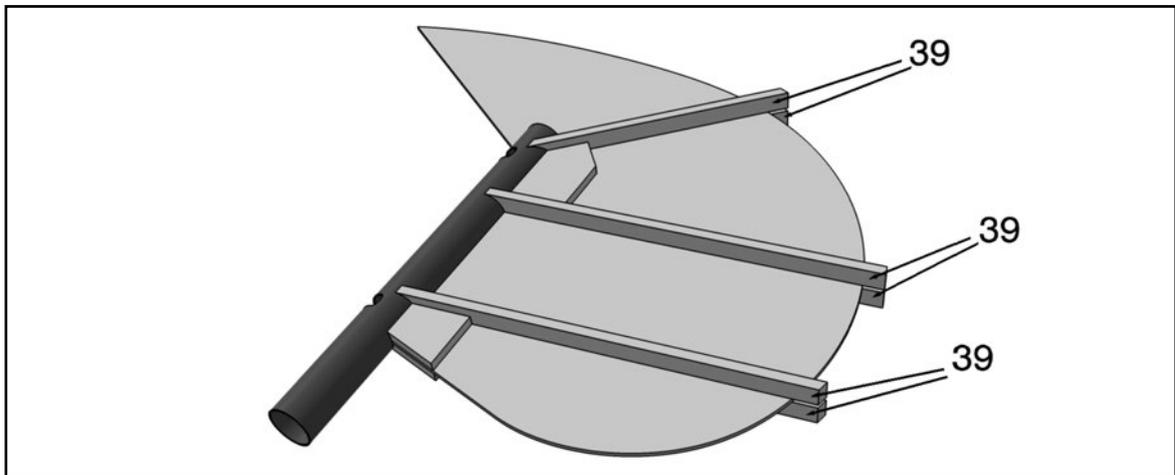


Place the hinge scabs (42a)(42b) over the hinge slots and hold in place with your fingers. Check to see from the other side, whether the scabs are accurately placed,

then fix the scabs with cyano glue. Take care to ensure that 42b aligns with underside of the core as well as the hinge slot is directly over the groove in 42b.

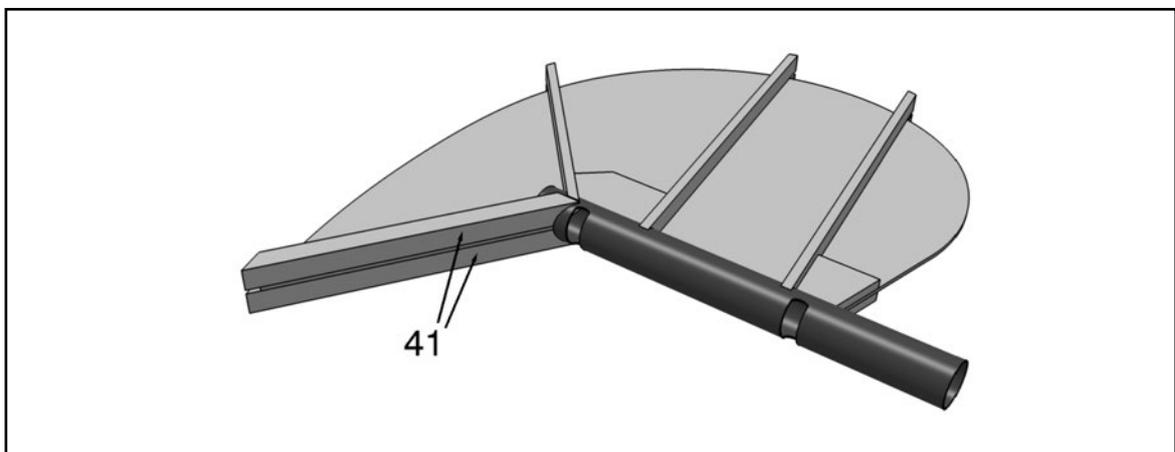
- O Align the scab (42b) on the second side with the edge of the core, at the same time ensuring the hinge groove aligns with the slot in the core.
- O Accurately align the scab (42a) on the second side by sighting over the edge of the core.
- O Cut the six ribs (39) from the 10x5x915 mm Balsa stripwood, cut these ribs with 30 mm to spare to allow for fitting losses.

O



Sand a round edge into the ribs (39) where these fit onto the rudder post (33), using the short piece of phenolic tube (40) with sandingpaper wrapped around it. Glue these ribs to the rudder core topside with PVA. When glue has hardened, cut the ribs (39) to fit the second side.

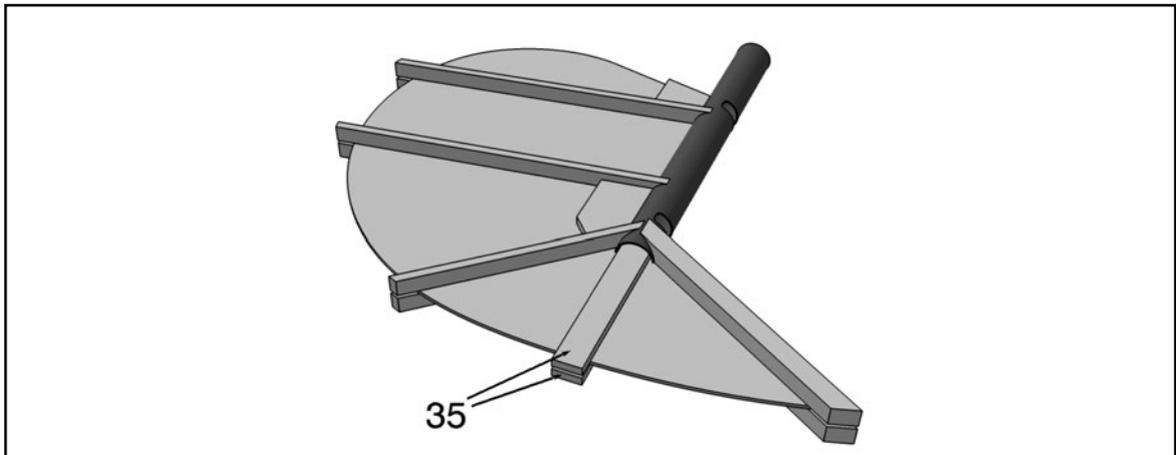
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Cut to length from the 11x11x400 mm Balsa strip wood the two horn balance lead-edges (41), the ends must be carefully shaped to fit over the rudder post (33),

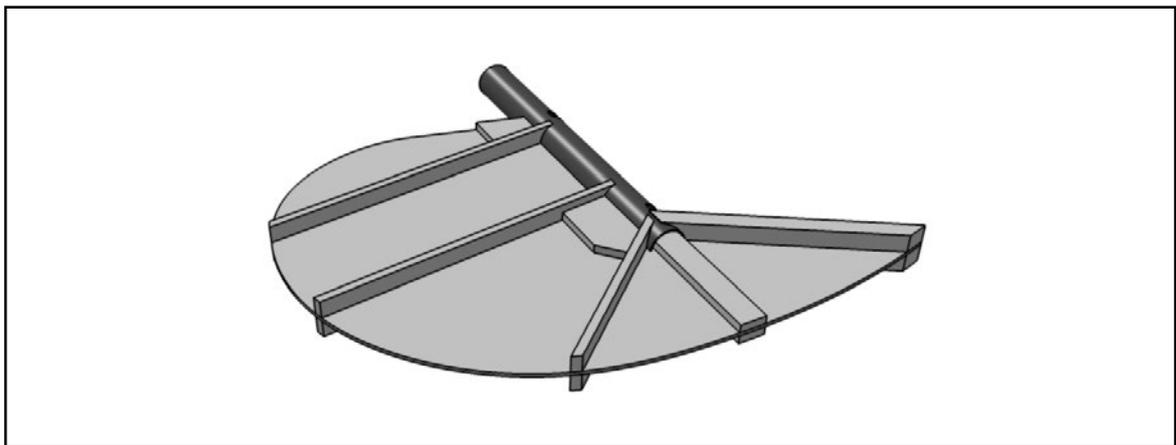
again using the glass paper wrapped phenolic tube (40), glue both these leading-edges (41) onto the rudder horn balance.

O



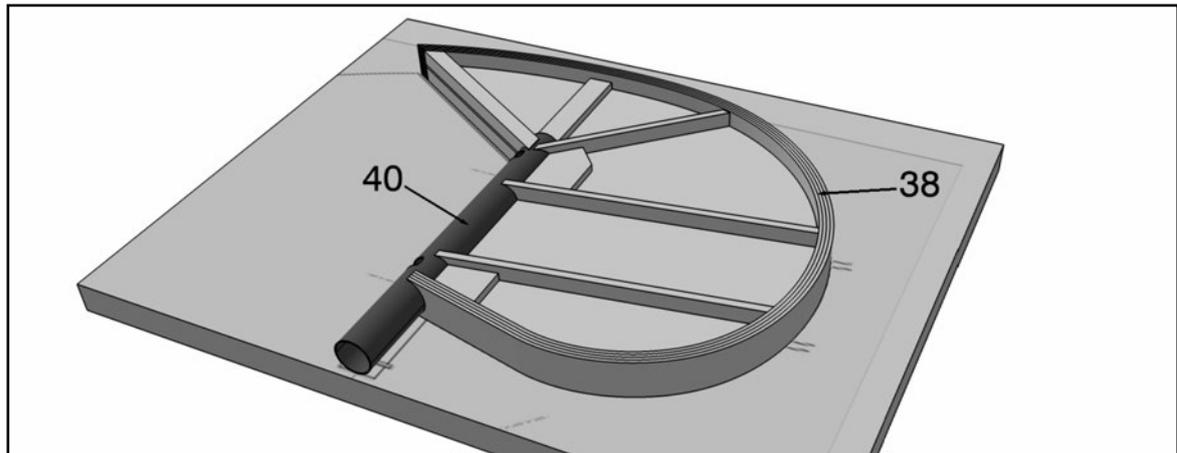
Glue the rudder stiffener (35) into place to reinforce it.

O



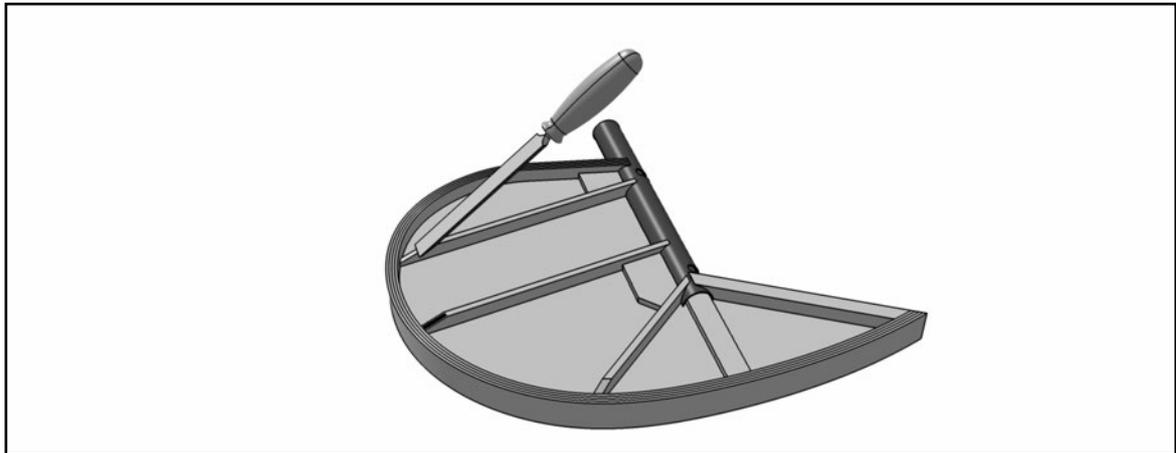
Next day sand edges of stiffener (35), ribs (39) and leadingedges (41) so that they finish flush with the outline of the rudder core, take care not to round the ends of these ribs or the laminated strips will not make full contact with them.

O



Remove the laminated rudder edge (38) from the template (37) and sand the lower end to fit over the rudder post, using the glass paper wrapped phenolic tube (40). Pin the rudder to a plastic film covered building board and fit and glue the laminated edge (38) to the rudder with PVA glue.

O

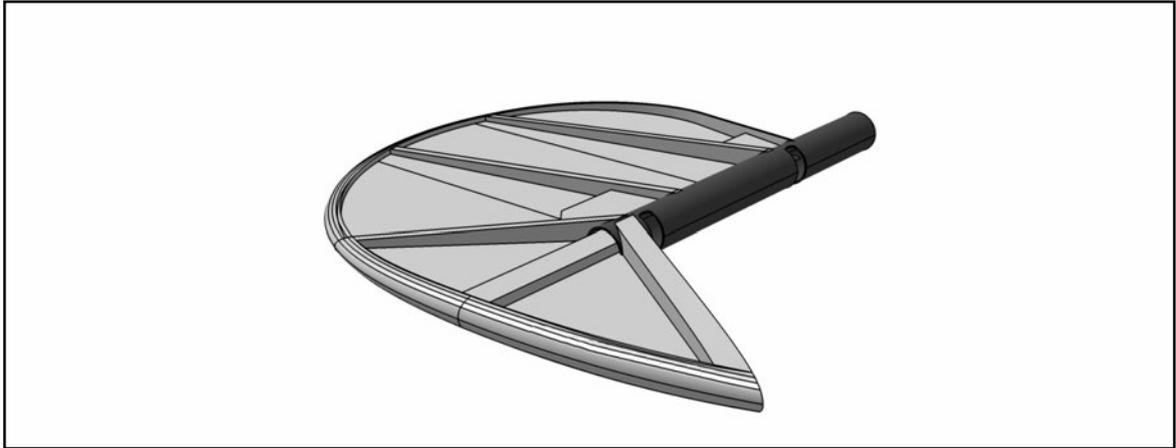


After the PVA glue has had overnight to really harden, remove the rudder from the building board. With a small wood chisel trim away the ribs to within 3 mm from the core at the trailing edge end.

O

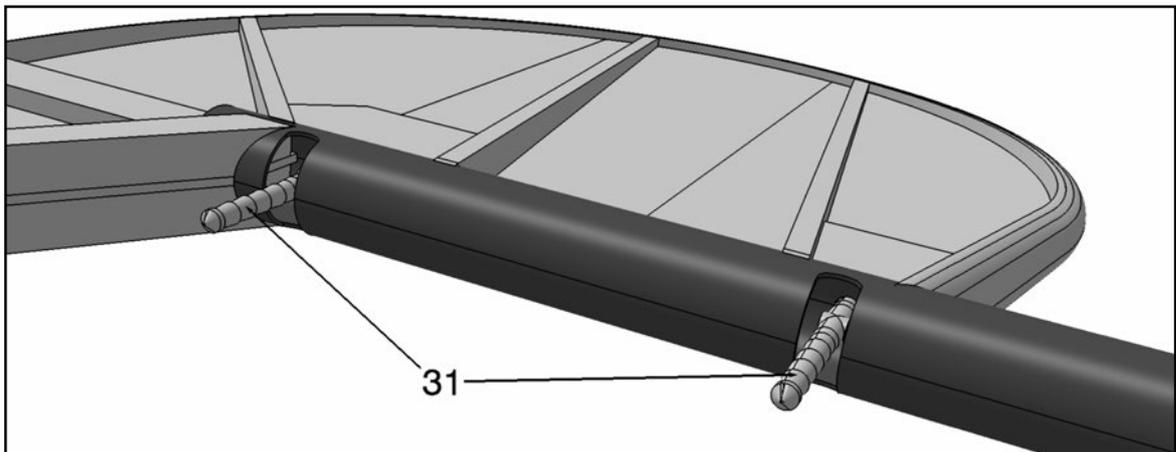
Plane down the laminated trailing edge (38) to within 3 mm from core sheeting between the three ribs, the rest of the laminated trailing edge is tapered outwards towards the rudder post (33) and towards the horn balance leadingedge (41) at the top of the rudder.

O



With a long and wide sanding block, bring the rudder to a straight taper from front to back. Round the trailing edge equally from both sides with fairly fine 240 grit paper.

O

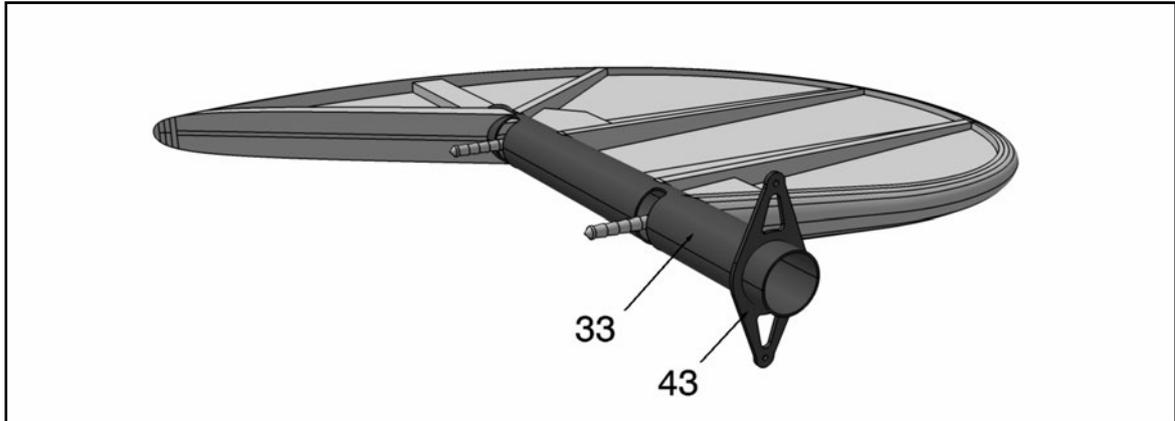


Test insert both hinges (31) into the rudder. Using Araldite Epoxy 2011, glue the two rudder hinges (31) into the rudder, make sure that the hinge knuckle is exactly in the center of the tube and the hinge is moving horizontally. You have to ensure that you do not allow epoxy to enter the hinge knuckle. Leave for 24 hours to cure hard.

- O Fit the rudder accurately onto the fuselage and screw the small socket head grub screws (11) up fairly tight. Now shape the rudder balance horn to fit the rudder fin.
- O Remove the rudder from the fuselage and sand over with 400 grit glass paper. Although it is not necessary, I always like to give the Balsa a coat of clear dope right over, when dope is dry sand off with 400 grit paper and then cover the fin with Proficover.
- O Fit the rudder to the fin temporarily, screw the two grub screws (11) tight enough to hold the rudder into place. Then fit the rudder horn cover (8), by sanding out the round slot to go over the rudder post (33) so there is a gap of 2 mm right around the rudder post. Wax the four 2,2x9,5 mm self tapping screws (12) and fix the cover

with these four screws (12). Remove these cover screws, cover and rudder from the fuselage.

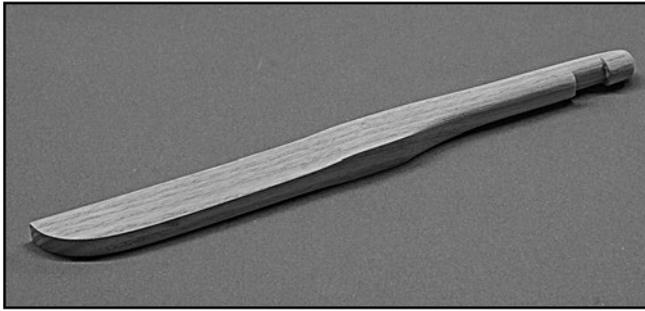
O



Sand around the base of the fin post (33) where the rudder horn (43) is epoxied to the rudder post. Fit the Tufnol rudder horn (43) onto the fin post; fit the rudder to the fin and check to see that the rudder horn is correctly placed so the control wires to the servo, pass through the middle of the oval opening in the rudder fin post, by sighting through the end of the fuselage. Remove the rudder from the fuselage, securely epoxy the rudder horn (43) to the rudder post.

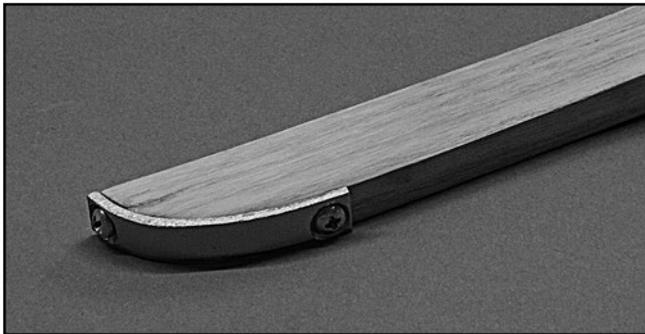
## TAILSKID

○



Carve and sand the Ashwood tailskid (45) arm to a round section, carve out a 15 mm long recess 4 mm deep in the arm to take the rubber cord (16).

○



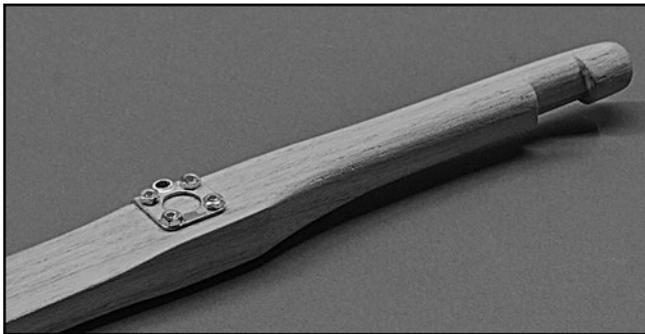
Bend the 8x2x46 mm steel skid shoe (46) to fit the curve at the end of the skid which makes contact with the ground. Drill a 3 mm hole into each end of this shoe and countersink these two holes to take the 2,9x9,5 mm self tapping countersunk headed screws (47). Lay the shoe over the skid and mark the two screw holes position onto the

skid and drill these out with a 1,5 mm drill. Fix the shoe (46) onto the skid with the screws.

○

The 1 mm brass tailskid swivel bearing and yoke (48/49) is ready made and only needs fixing to the underside of the sub fin and to the skid.

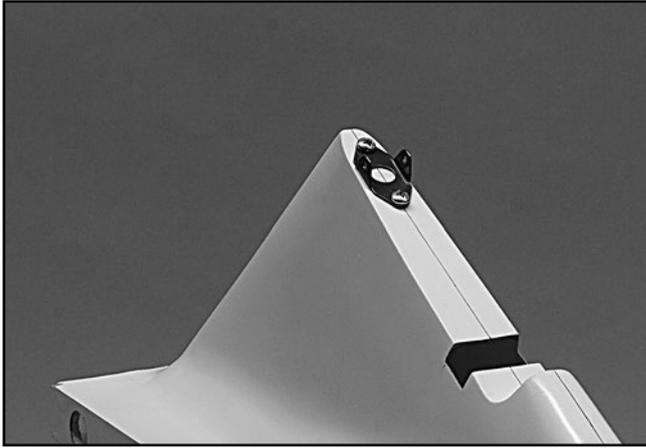
○



The swivel bearing (49) is fitted over the tailskid 120 mm from outer end of the skid. You must file a half round groove into the skid so the swivel bearing sits fully onto the skid. Drill one of the four holes with a 2 mm drill right through the skid, this is best done with a pillar drill. Insert a M2x20 cheese head screw (56) and secure with a M2 nut (57)

drill the remaining three holes and check to see that the M2x12 screws (83) go right through. Finally grind the protruding Screws down.

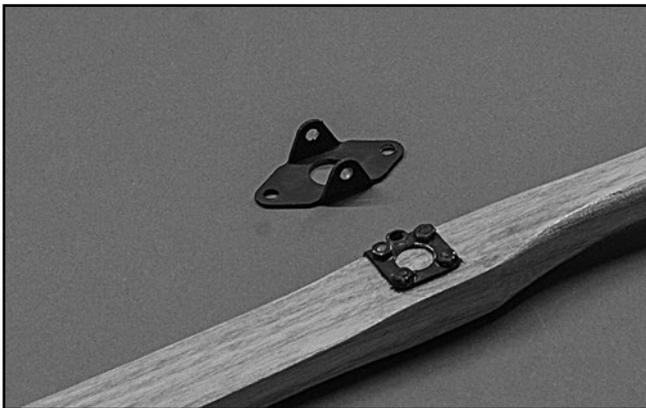
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Fit the yoke (48) to swivel bearing (49) with the M3x25 socket head screw (51) and a M3 saftynut (52). Turn the fuselage upside down and lay the complete skid onto the sub fin and mark the position of the swivel bearing yoke (48) onto the sub fin. Remove the yoke from the skid and use this to mark the two screw holes onto the sub fin. Drill out these holes with a 3 mm drill. Screw the yoke to the sub fin with the two 3,5x13 mm round head self

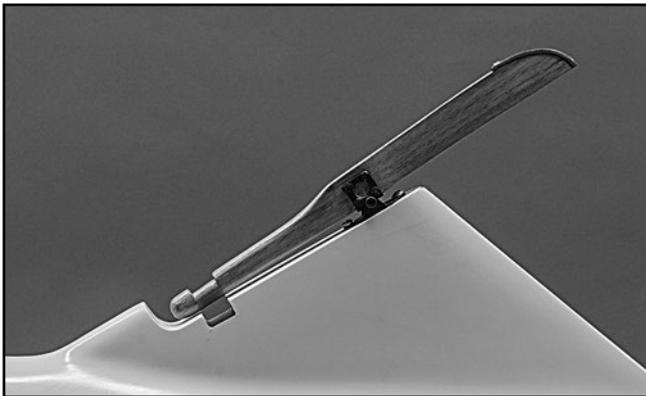
tapping screws (18).

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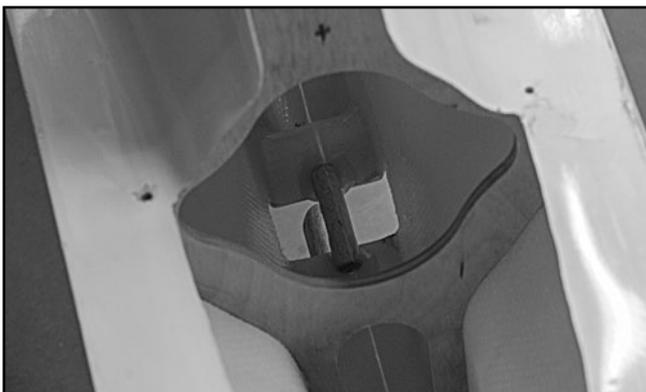
Remove the yoke (48) from the sub fin, this must now be painted mat black along with the swivel bearing (49). Dope the tailskid (45) a few times to protect it against wetness.

O



Using the two 3,5x13 mm self tapping screws (18), fix the yoke onto the sub fin. Place the tailskid into the yoke and insert the M3x25 socket screw (51) and a M3 saftynut (52).

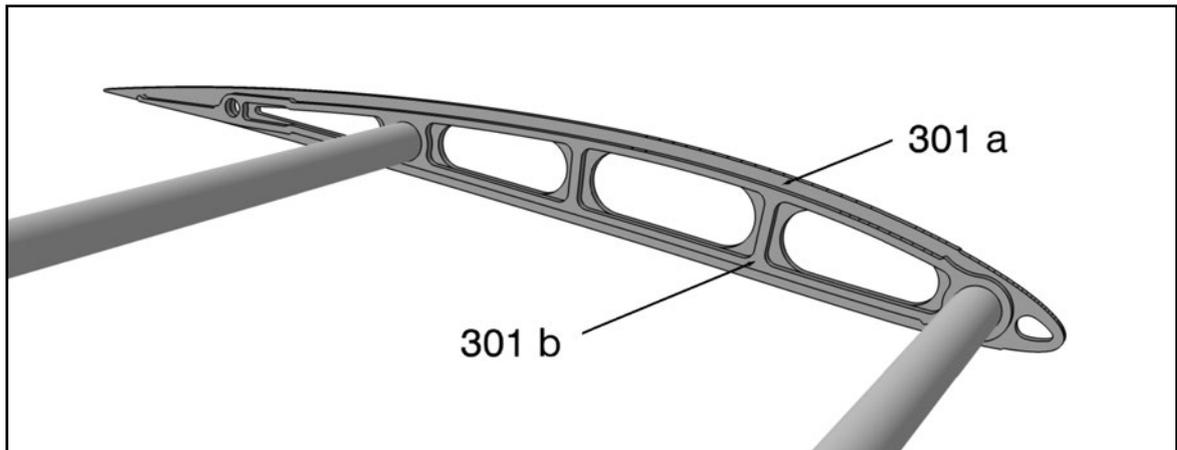
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Stand the fuselage upright onto the table and then epoxy the 6 mm Beech dowel (44) to hold the rubber shock cord (16) into the sub fin and leave overnight for the epoxy to harden.

## TOP WINGS

○

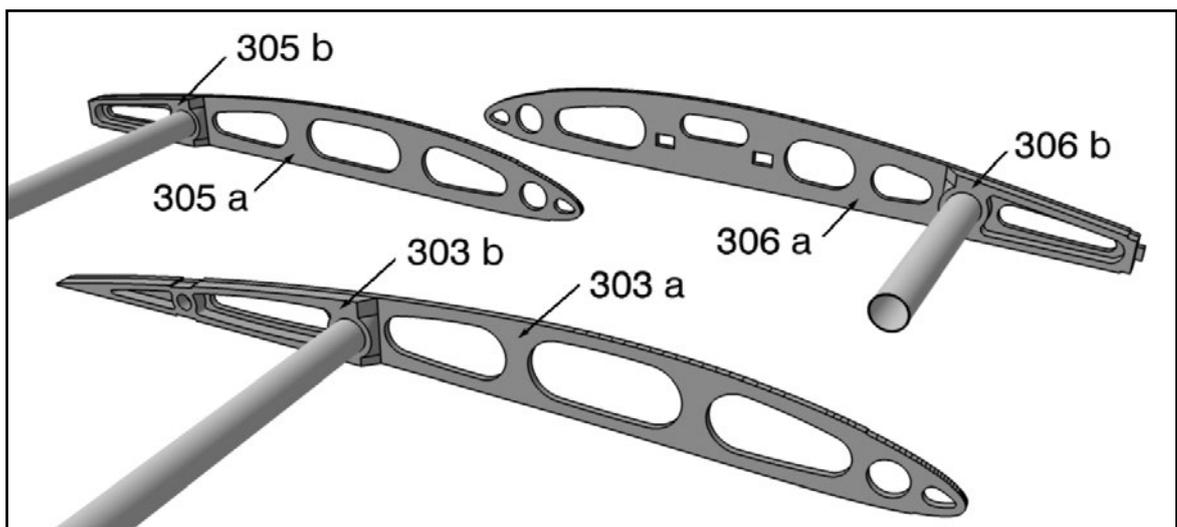


First cut out the two skeletal ribs (301b) and two ribs (301a). Note: the ribs (301a) have smaller lightening cutouts than the standard main ribs (302). (301a) and (301b) must be glued together so that there is a left and a right hand. Apply a thin line of PVA glue around the spar holes, (this PVA then acts as a seal preventing Cyano creeping onto the spar tubes) and press the two ribs (301a) (301b) together, push two spar tubes (325) (326) into the holes and clamp the two rib (301a) (301b) together so that they are flat. Glue the ribs (301a) (301b) together with thin Cyano glue.

○

Take the 6 mm Poplar plywood root rib sheet with the rib doublers (303b) (305b) (306b) and root ribs (300a). Cut out the six doublers (303b) (305b) (306b) and select the three to fit the ribs on the 3 mm Poplar plywood left hand sheet. Remove the retaining stubs and sand off the loose fibers. Mark the three doublers so these correspond with the 3 mm ribs: (303a)+ (303b), (305a)+ (305b), (306a)+ (306b). CHECK THE POSITION OF THE 6 mm DOUBLERS BEFORE GLUING TO THE 3 mm RIBS.

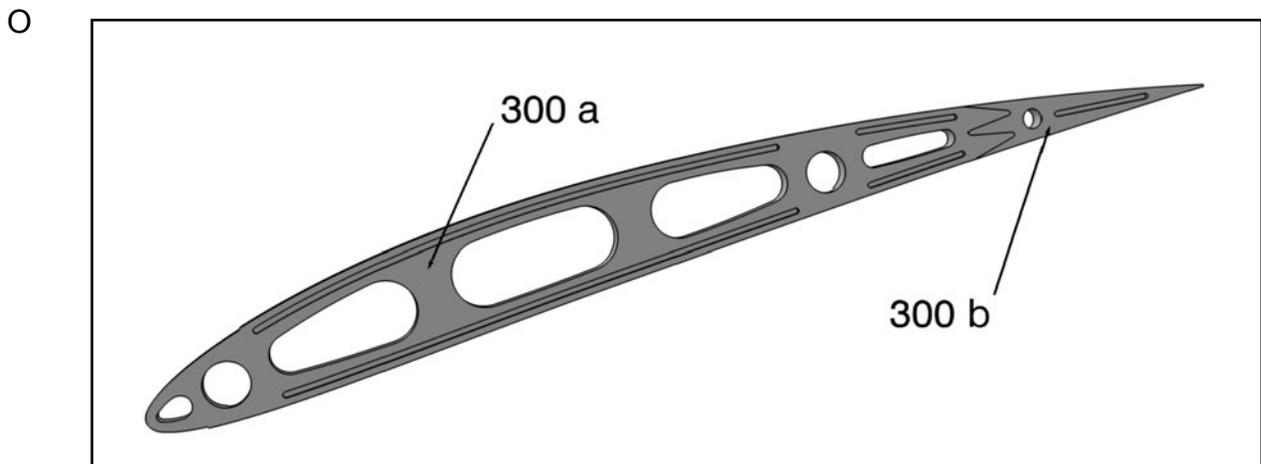
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Run a thin line of PVA glue around the edges of wing spar holes, press ribs together and use the spar tubes (325) (326) to locate the ribs accurately. PVA here is necessary to form a seal preventing the cyano creeping between the ribs and spar

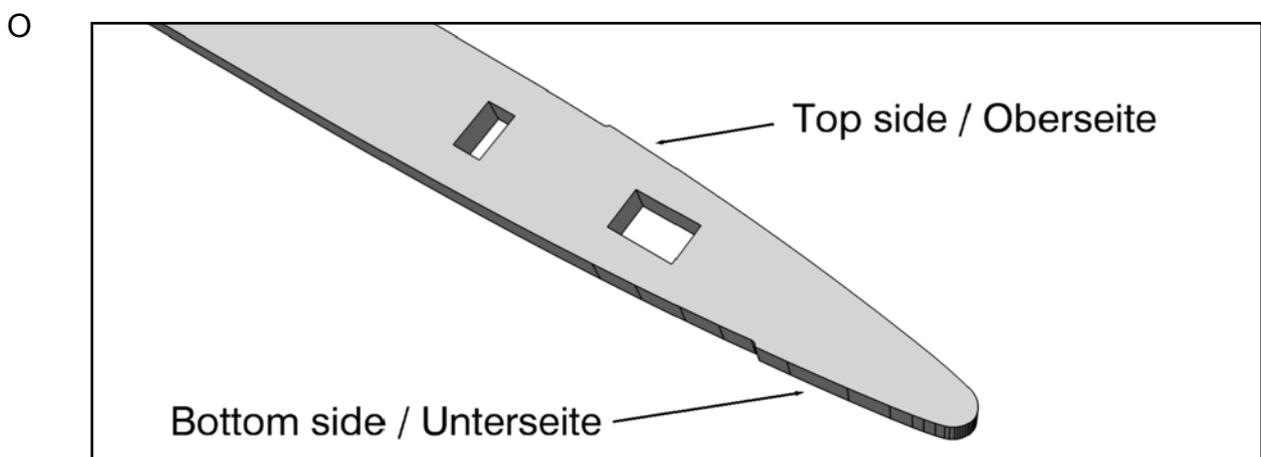
tubes. If cyano creeps into the join on the tubes you will have extreme difficulty in removing the tube causing damage to the ribs.

- O Tack the ribs with a very small amount of Cyano. So soon as the Cyano has set twist the spar tube to remove this from the ribs and then apply more Cyano to ensure these ribs are securely glued together.



Next remove the two 6 mm trailing edge Birch plywood rib ends (300b) for the two 6 mm Poplar plywood root ribs (300a). Note the 2 mm slot milled into these two 6 mm Birch plywood rib ends (300b) must be on the same side as the slotted side of the 6 mm Poplar plywood ribs. Glue these root ribs together with PVA and lay flat onto a board with a weight to keep them flat until the glue has dried.

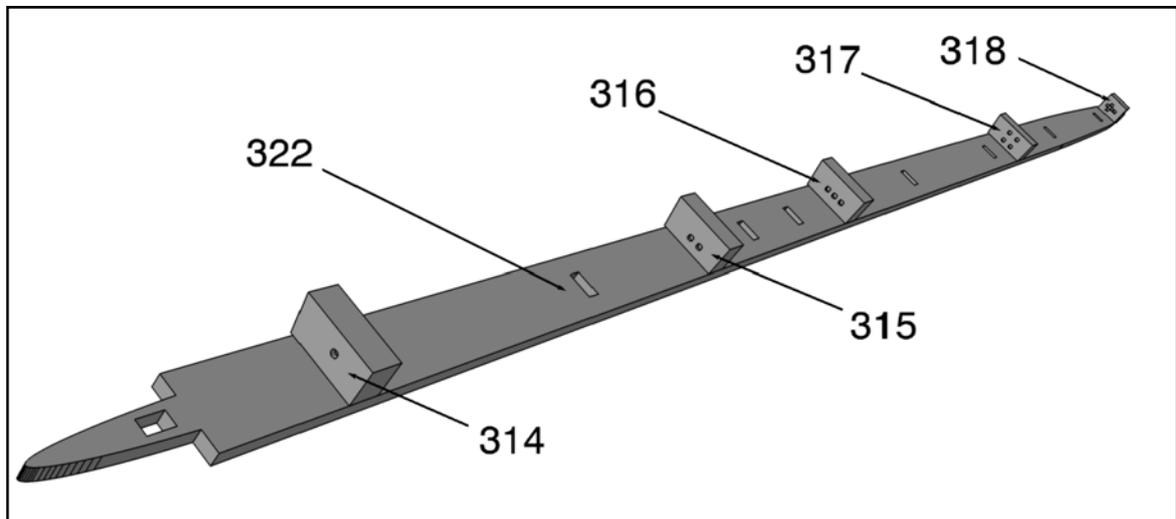
- O Cut away the rest of the main ribs (302) from the wing rib sheet and clean up the ribs by removing the retaining stubs and sanding fibers away from edges.
- O Cut away the ten aileron hinge blocks (314). (315): (316)... (317):: (318):: the two wing strut fixing clips front (333) and four rear (334) and the two aileron servo carriers (319) from the 6 mm Birch plywood. Trim off the retaining stubs and sand these parts with fine paper to remove the fibers from the edges.



Cut away the two aileron hinge rails (322) from the 3 mm Poplar plywood and trim

off the retaining stubs. Take care these hinge rails (322) have a top and bottom side, at first glance this is very difficult to see, but look at the rounded wing tip end and you will see a very tiny step top and bottom. These two steps are formed to take the 0,8mm aileron shrouds (323) You will notice the top step is further inboard than the bottom step.

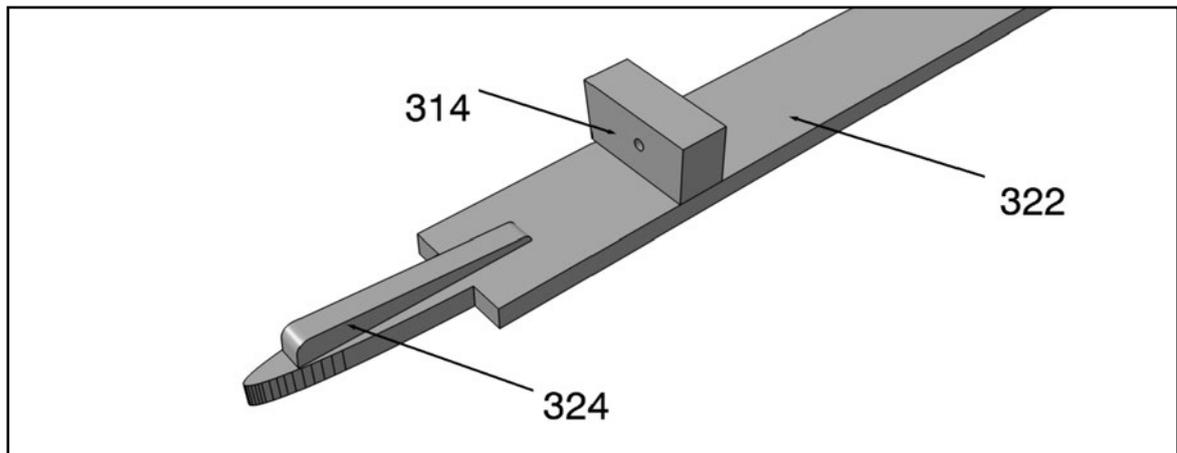
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Having established which is the top and bottom edges of the hinge rails (322) draw a small arrow on these two hinge rails with a pencil showing top edge. Look at the five hinge blocks and you will see these are numbered 1-5, 1 is inboard and the 5 is at the wing tip end, note that the 5 points for the 5 is arranged like an arrow, this arrow must point upwards on the hinge block.

- Lay the two hinge rails (322) flat on the table, we are now going to make a dry run to check for correct placement of these hinge blocks (314-318) lay the left and right hand hinge rails (322) onto the building board and insert the five 6mm birch plywood hinge blocks dry into the two hinge rails (322), check carefully to see the blocks are correctly fitted, this means with the sloping side towards the top of the hinge rail.
- When you are sure you have these hinge blocks correctly placed you can then glue these hinge blocks into the hinge rails with PVA glue, taking care to ensure these blocks are straight before glue sets hard.

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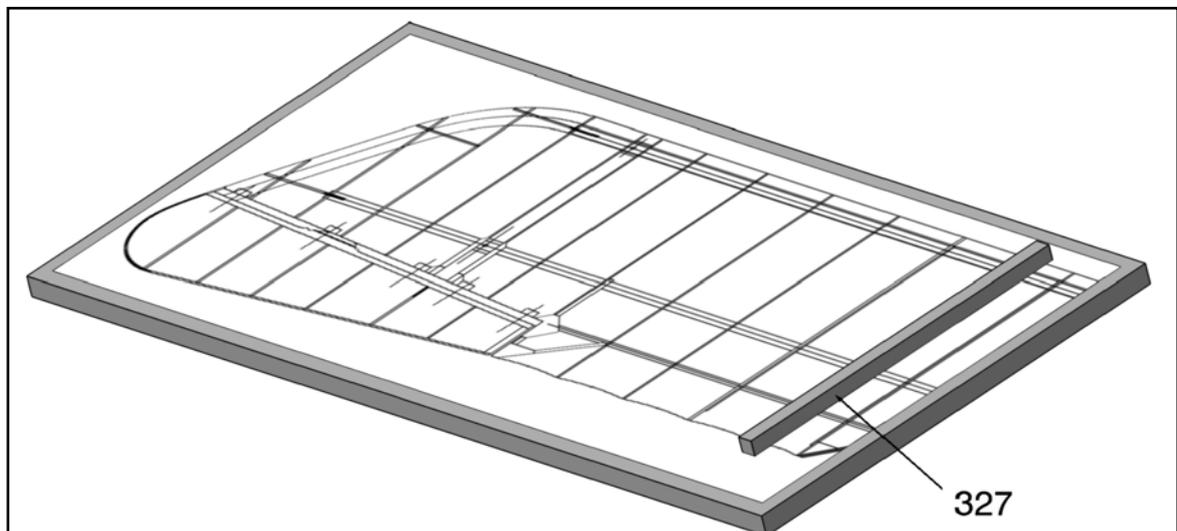


Glue with PVA the small wedge shaped piece (324) into the slot provided in the tongue at inboard end of the hinge rail (322) Note the thick end of the wedge is pointed inboard and not towards the wing tip. These two hinge rails can now be laid aside on a flat surface to allow the glue to harden.

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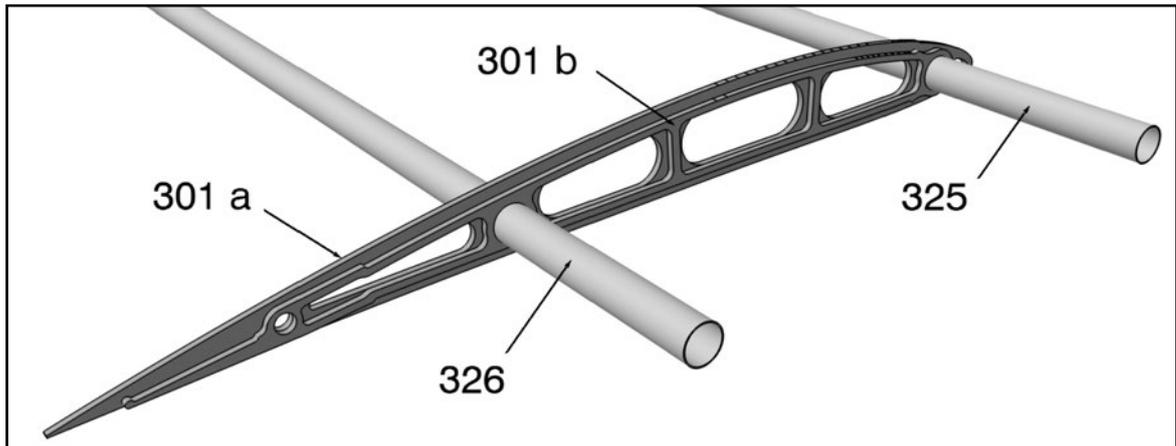
The four 16 mm diameter main spars (325) (326) and 8 mm sub spars (328) must be lightly deburred at the ends so these will fit into the wing ribs. Clean off these spar tubes with acetone to remove any grease or oily residue, then sand the tubes very lightly with 800 grit paper, and clean off again using acetone.

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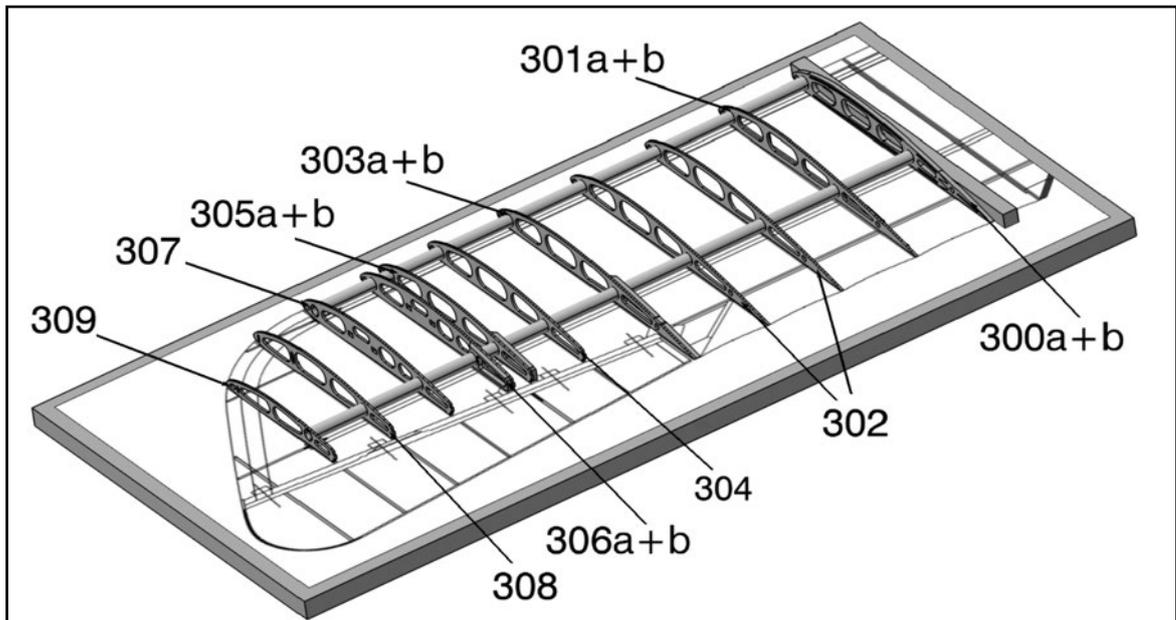
The left hand wing plan must now be laid over the building board and is best covered with a clear plastic film. Nail the 20x20x400 mm square pinewood end stop (327) accurately over the plan at the root rib end, this stop must be firm but two nails will be enough.

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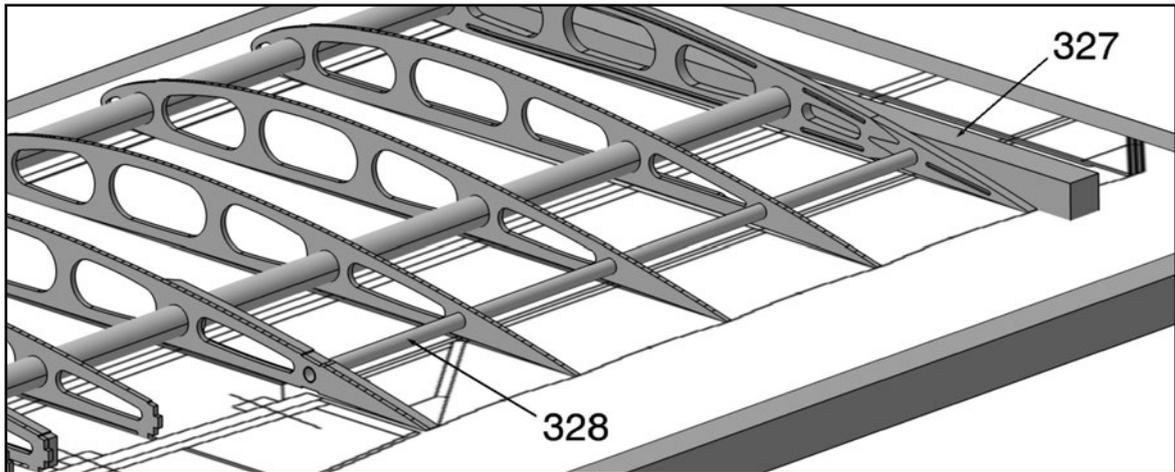
Slide the laminated ribs (301a) (301b) onto the 16 mm spar tubes (325) (326) note that the shorter tube (325) is at the front, slide ribs (301a) (301b) go slowly and do not use undue force.

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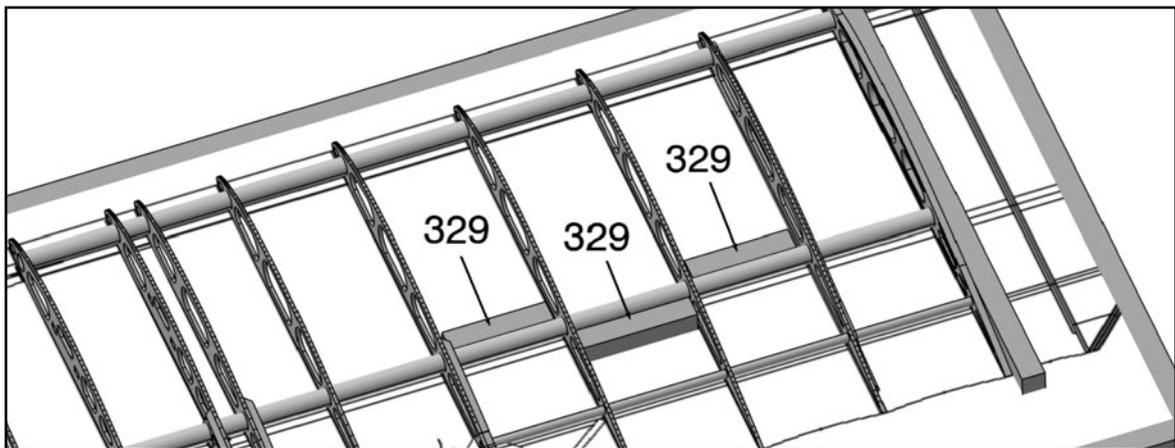
Place the root rib (300a/300b) against the stop, insert the tubes into the root rib, push the laminated ribs (301a)+ (301b) into correct position on the plan with both 16 mm spar tubes against the stop (327), slide the ribs number 2x(302), (303a)+(303b), (304), (305a)+(305b), (306a)+(306b), (307), (308) and (309) onto the tubes from the wing tip end, this is a tedious job, you have to take care that you do not break the ribs, you may need quite a bit of force to push these ribs bit by bit towards the root.

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The 8 mm sub spar tube (328) must now be inserted into the ribs, this is best done by twisting and slowly pushing this tube into the ribs until it is right through the root rib and against the stop (327).

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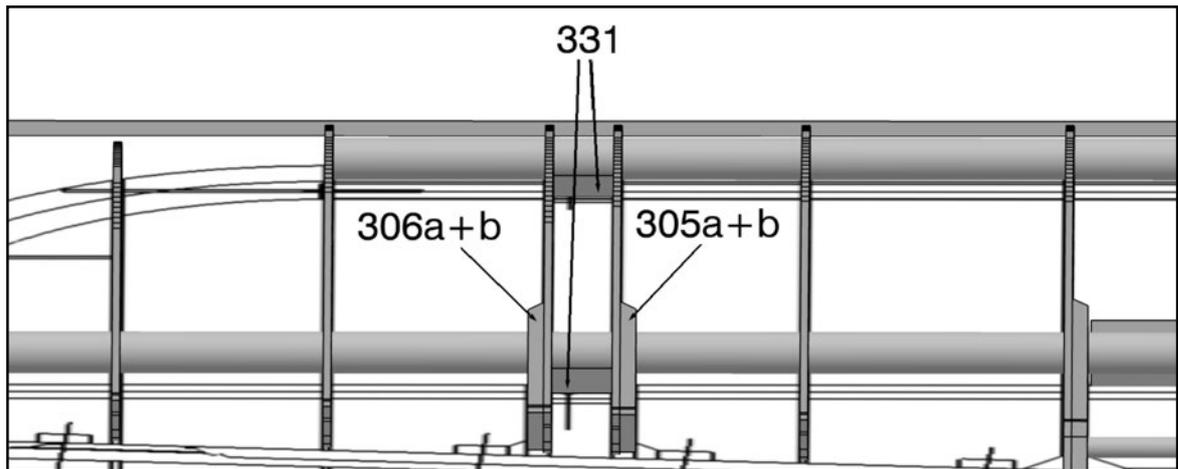


Nail the four 20 x 20 x 45 pinewood blocks (329) either side of the rear main spar. These four blocks must be very accurately placed.

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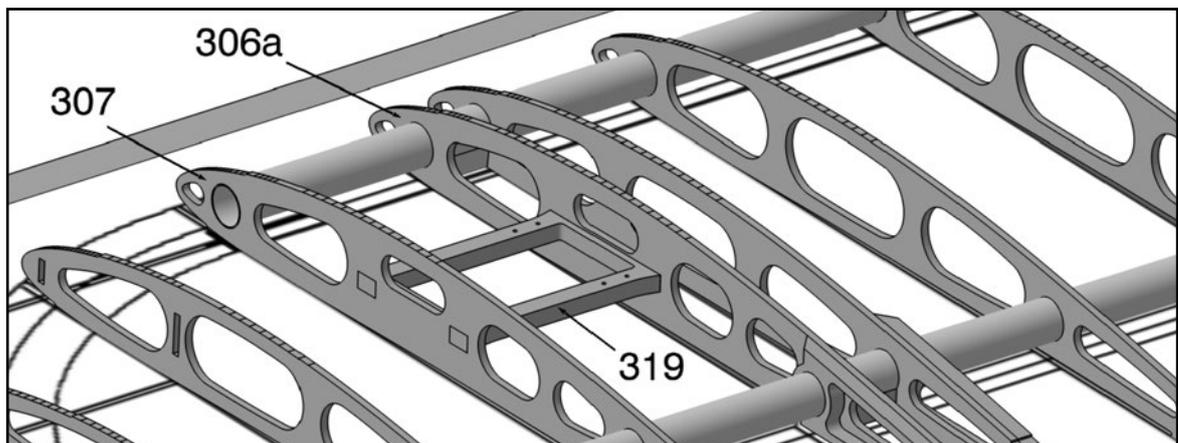
Check to see that all the ribs are very accurately placed on the spars. Lift the root rib (300a/300b) enough to be able to ensure the two 16 mm and one 8 mm tube are flush to the outside surface of the root rib.

O



Cut away the hollow rounded Beechwood wing strut mounting blocks (331) and (332) and clean off the spacer stubs. Lay these two mounting blocks (331) and (332) between the ribs (305a)+(305b) (306a)+(306b) to achieve correct rib spacing.

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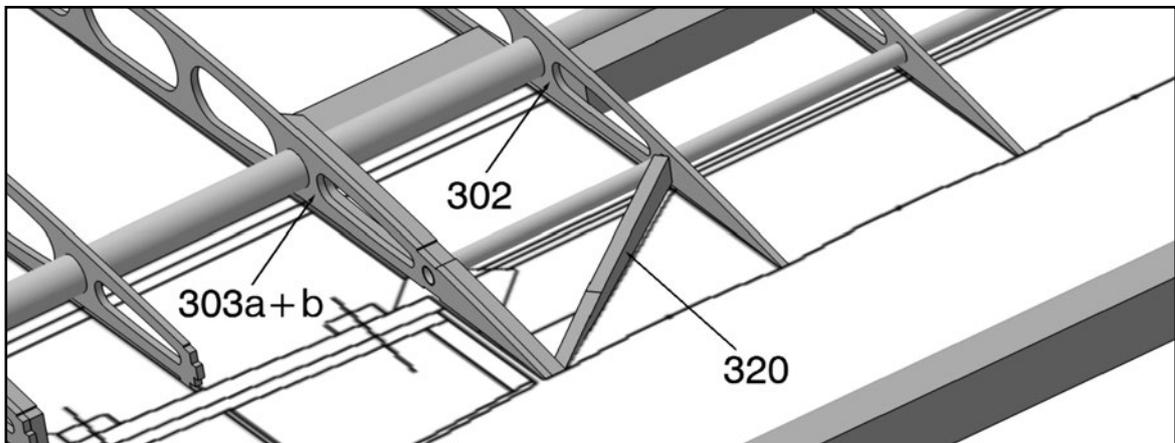


Fit and glue the servo carrier (319) between ribs (306a) and (307), use PVA to glue the carrier.

- O Have ready a really flat piece of board 800 mm long and about 100 mm wide. Slide the wing away from the stop at the root rib until the ribs come against the small pinewood blocks (329).
- O For the next job you need a heat gun with a small nozzle, I silver soldered a short piece of 8 mm stainless tube into a cap that fits over the heat gun nozzle.
- O Mix a small quantity of Araldite 2011 epoxy together. Put a very small drop of epoxy at the top of the 16 mm rear spar tube only where it goes into the ribs, put this small drop either side of the ribs except the two ribs (305a) (306a) forming the aileron pushrod opening, on these two ribs you put the epoxy on the outside only. If you put epoxy on the inside you will have trouble fitting the wing strut fixing parts (331) and (332), the front 6 mm plywood clip (333) and the two rear spar 6 mm ply clips (334).

- You can of course only place the drop of epoxy on the inside of the 6 mm root rib. I have to emphasize here that you must only put a really small drop of Epoxy both sides of the ribs, because as soon as you start heating the tubes, the Epoxy becomes very thin and will run around the tubes, and form a droplet on the underside which is difficult to remove later.
- Place a fairly heavy weight onto the board and check to see that the wing lays really flat onto the building board, carefully remove the end stop (327) now blow hot air into the outside end of the tube, after a half a minute or so you will see the epoxy melt into a very thin liquid and the epoxy will then run right around the tube.
- Keep the heat on for about three minutes but take care not to overheat the epoxy, this will turn a very dark brown if it is overheated, and will have no strength at all. At the first sign of the epoxy darkening in colour immediately take off the heat, use a small stick to touch the epoxy, if it has been heated for at least two minutes it will be hard and not sticky at all. Take care not to touch the aluminium tube as it will be extremely hot.
- Take off the weighted board and apply epoxy to the ribs on the front spar, note not to apply epoxy to the inside of ribs (303) (305a) as before. Replace the board with the weight onto the wing, blow hot air into spar outer end until the epoxy has become very thin, then runs around the tubes as before with the rear tube, heat long enough to harden the Epoxy.

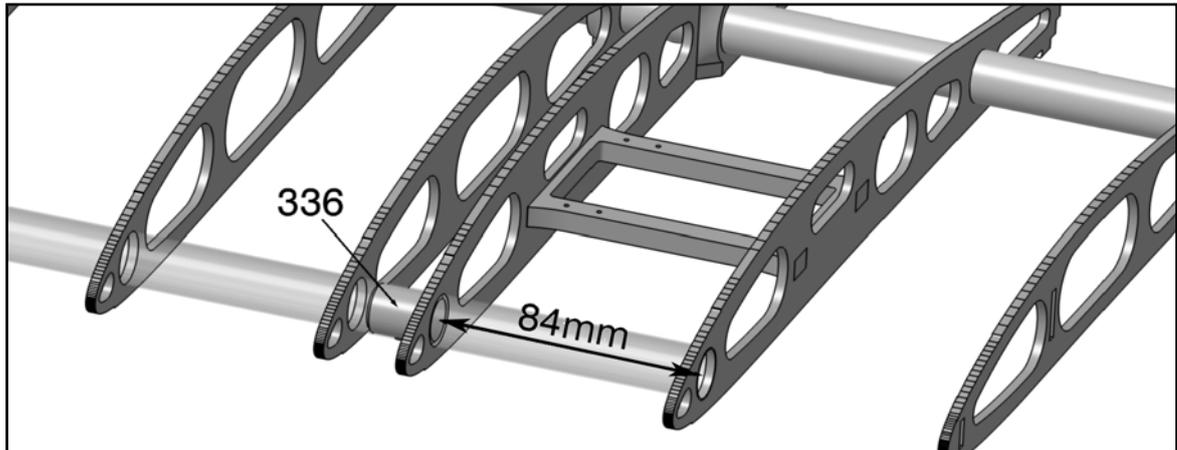
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Use epoxy to glue into position the 6 mm plywood diagonal brace (320) at the aileron opening, apply really small drops of epoxy to both sides of the ribs as before over the 8 mm sub spar. Blow hot air through this sub spar just long enough to cause the epoxy to run. You will have to be very careful heating this sub spar or there is the danger of the end rib burning.

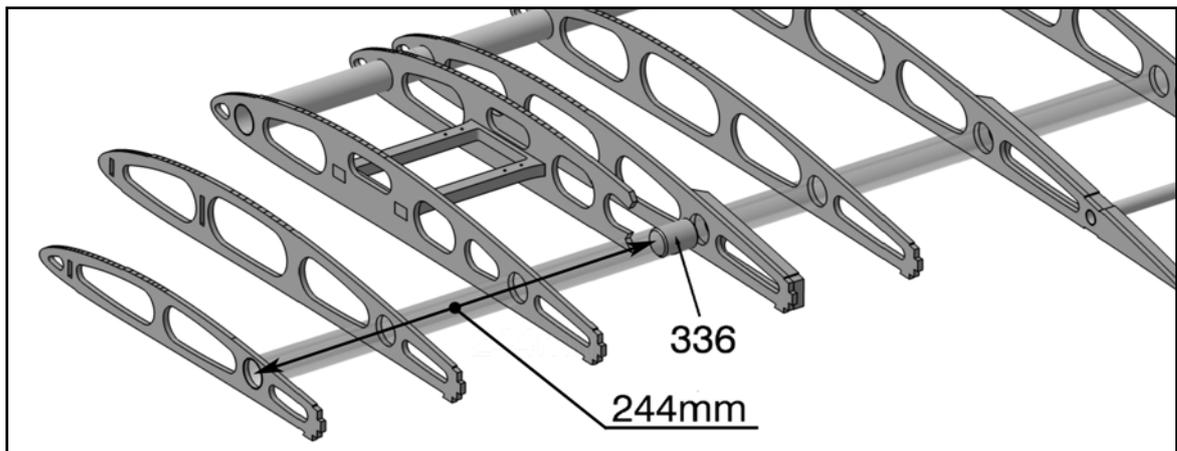
- Remove the wing from the board but leave the blocks (329) in place as these will be needed later to fit the Kevlar trailing edge rovings to the ribs.

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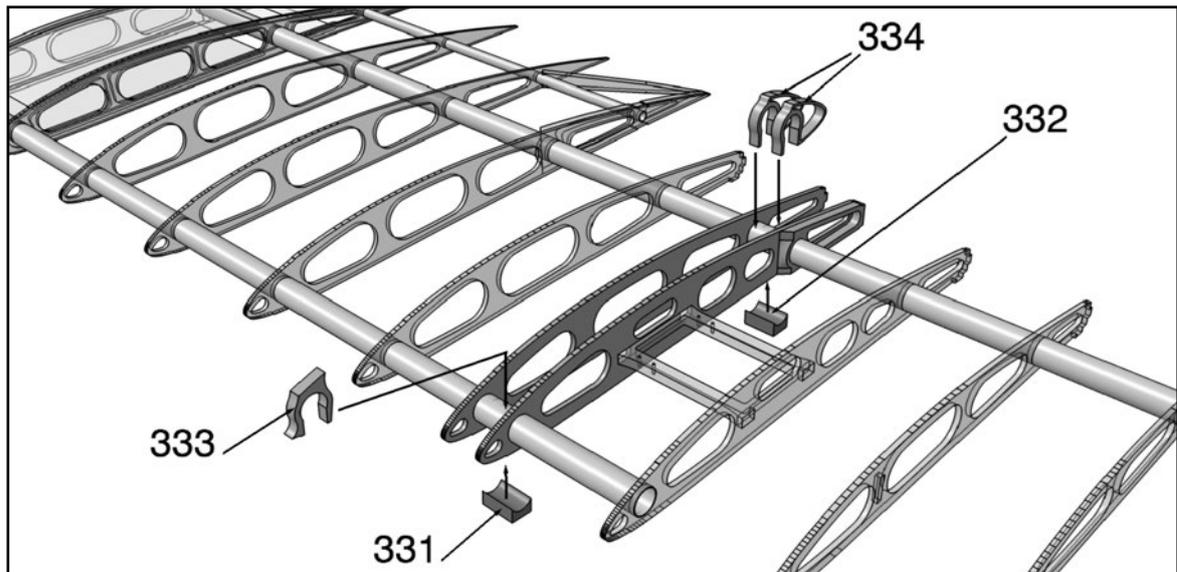
Cut a piece 120 mm long from the 10x5 balsa strip (335), cut a second piece 300 mm long. on the short piece make a mark 84 mm from one end, make a mark 244 mm from one end of the long piece. Remove the wing from the board, mix epoxy and place as much as you can on one end of the spruce dowel (336) insert this dowel with the epoxy covered end first, into the front wing spar tube with the wing being held vertically wing root uppermost, push the dowel with the short piece of 10x5 mm balsa into the tube up to the mark.

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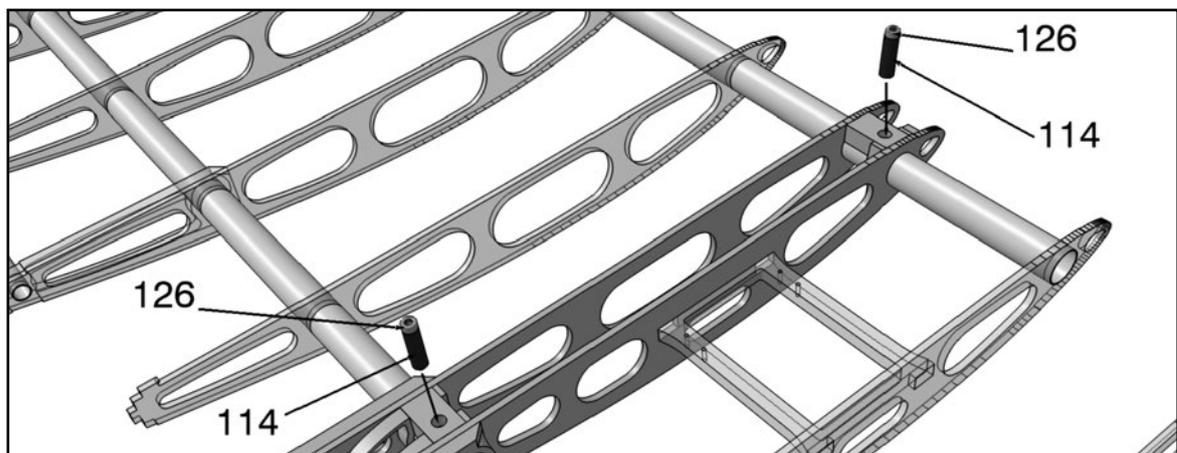
Apply epoxy to the second dowel (336) as for the first and push this into the rear spar tube up to the mark on the long piece of balsa strip, lay the wing flat(!) and heat the tube with the hot air gun just around where the two dowels (336) lay for about two minutes, this will soften the epoxy and due to the capillary action will cause the epoxy to creep between the dowel and the tube.

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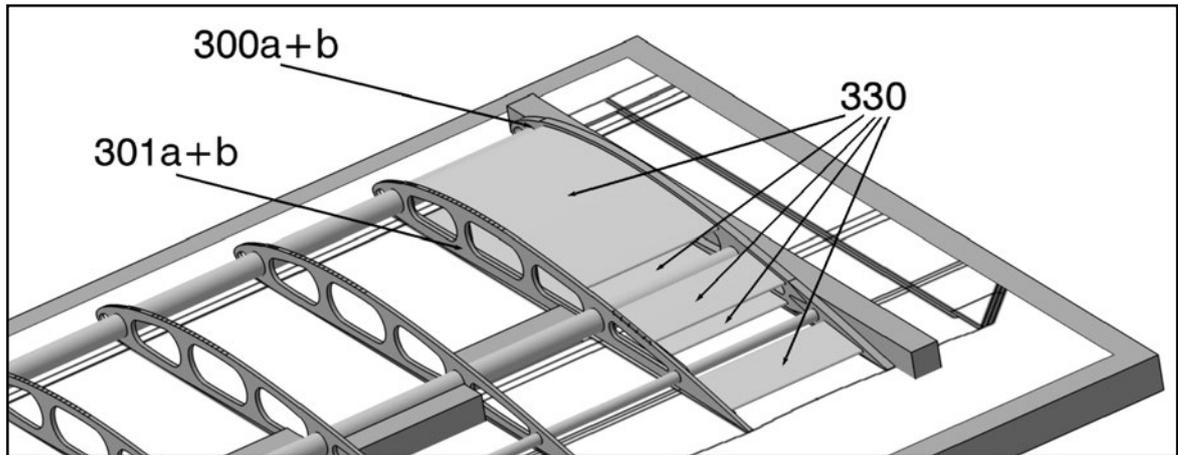
Epoxy the one 6 mm birch plywood front wing strut fixing clip (333) and the beechwood half round hollowed strut mounting block (331) to the front spar and the two 6 mm birch plywood rear wing strut fixing clips (334) with the beechwood half round hollowed strut mounting block (332) to the rear spar. Ensure you have positioned these five pieces correctly before leaving overnight for the epoxy to harden.

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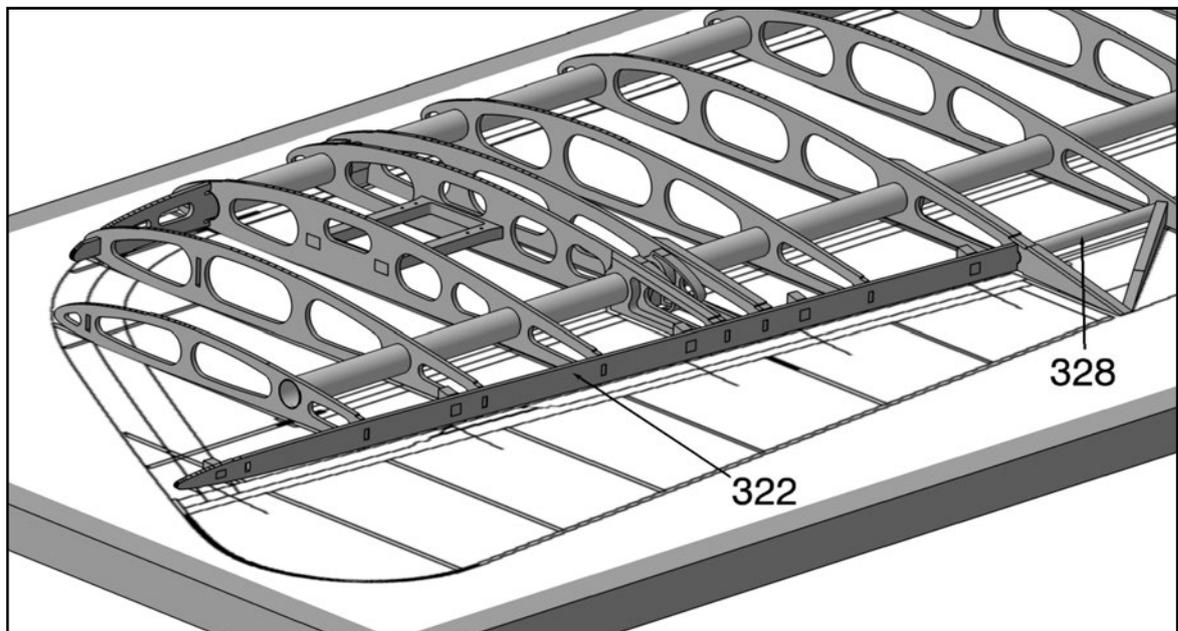
Use a 5,5 mm twist drill to open up the holes into the beechwood half round hollowed strut mounting blocks (331) and (332). Make sure you do not drill right through both sides of the aluminium wing spars, only the side against the blocks (331) and (332). Insert a M3x20 Alan socket screw (126) into two knurled brass bushes (114). Mix a little epoxy and work this well into the holes in the blocks (331) and (332), press the knurled bushes (114) into the blocks slowly and with a pointed stick clear away the extruded epoxy. Lay the wing flat on the workbench, underside uppermost overnight.

O



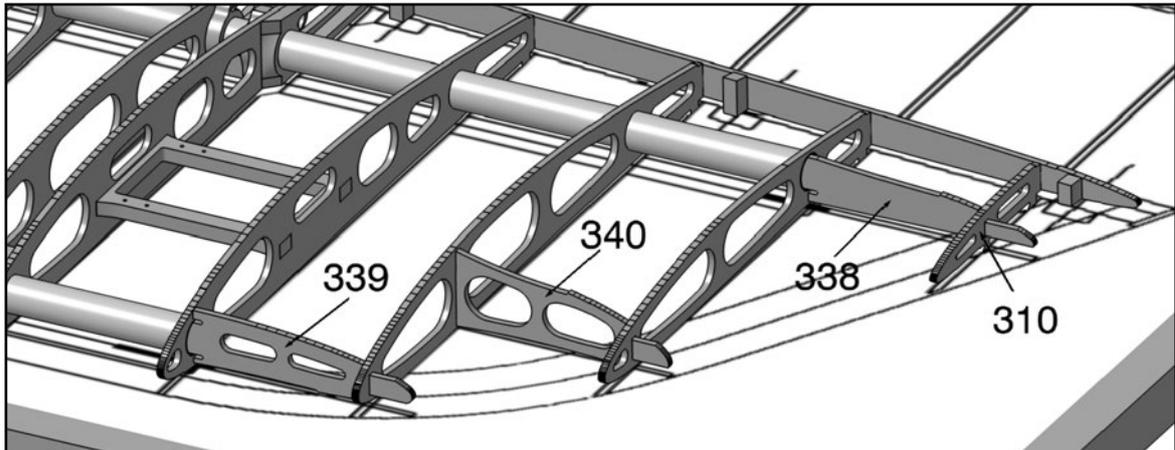
The 2 mm cross grain balsa stiffeners (330) must be glued between the root rib and the second rib. Start by gluing these balsa stiffener pieces (330) side by side with cyano to form a wide strip, then cut to length.

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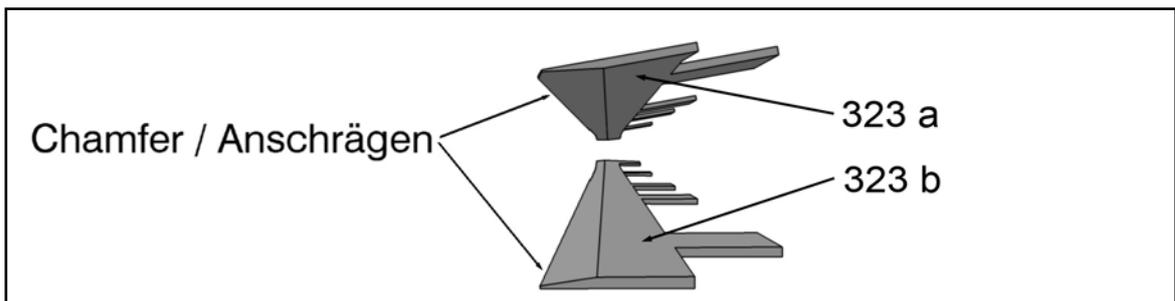
Take the correct aileron hinge rail (322), apply a little epoxy to the end with the wedge as this goes into the sub spar (328). Apply PVA glue to the holes formed to take the wing rib stubs. Insert the hinge rail end into the sub spar and now push the aileron hinge rail (322) onto the rib stubs and check to see that this fits right onto the ribs and is straight.

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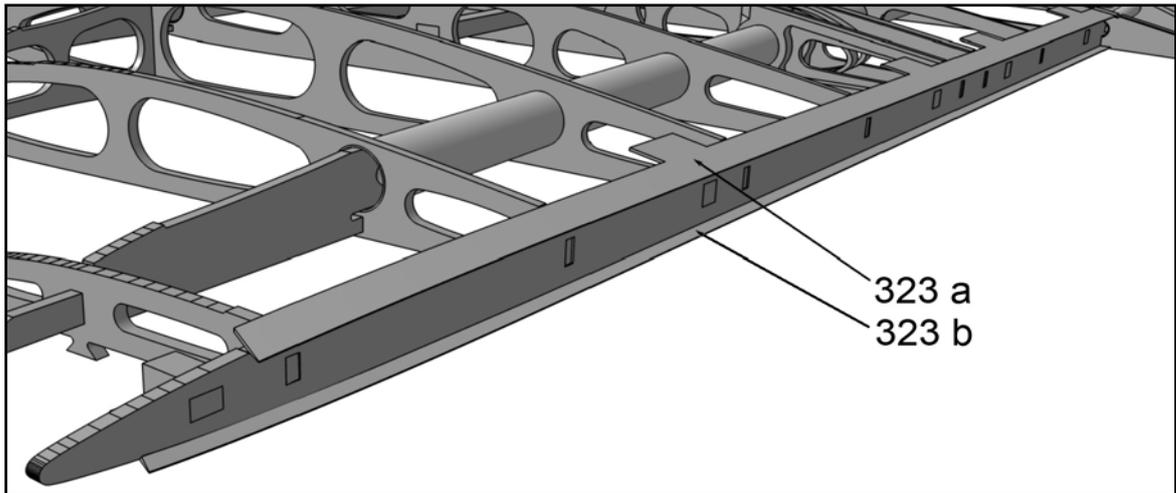
Next glue the spar end (338) into the small rib (310). Apply epoxy to spar end (338) and push this end into the rear spar as far as it will go, apply PVA to the small rib tongue, thread the small rib into the aileron hinge rail. Apply epoxy to the front spar end (339) pull the outer rib (309) outwards enough to allow the front spar end (339) to be pushed into the spar tube (325), apply PVA to the tongue and thread this into the rib (309). Now insert the rib spacer (340) between ribs (308) (309) and glue this with PVA. Lay the wing panel onto a flat surface and leave overnight to allow the glue and epoxy to thoroughly harden.

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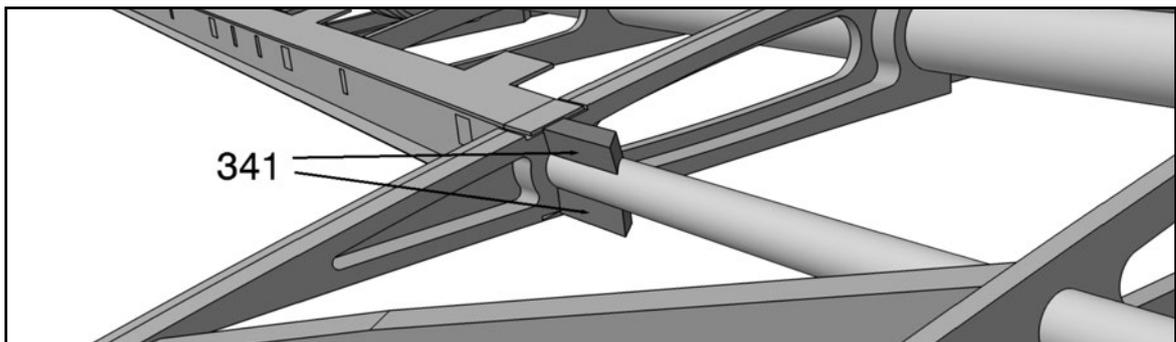
With the glue set hard onto the aileron hinge rail, you can now fit the 0,8 mm plywood aileron shrouds (323), note the top shroud is shorter than the bottom one. Cut the four aileron shrouds (323) from the 0,8 mm plywood sheet, clean off the retaining stubs. The edges that cover the ailerons must be chamfered, you must check to see that you chamfer the correct edges (underside), best done by first laying these shrouds onto the wing and marking the edges to be chamfered.

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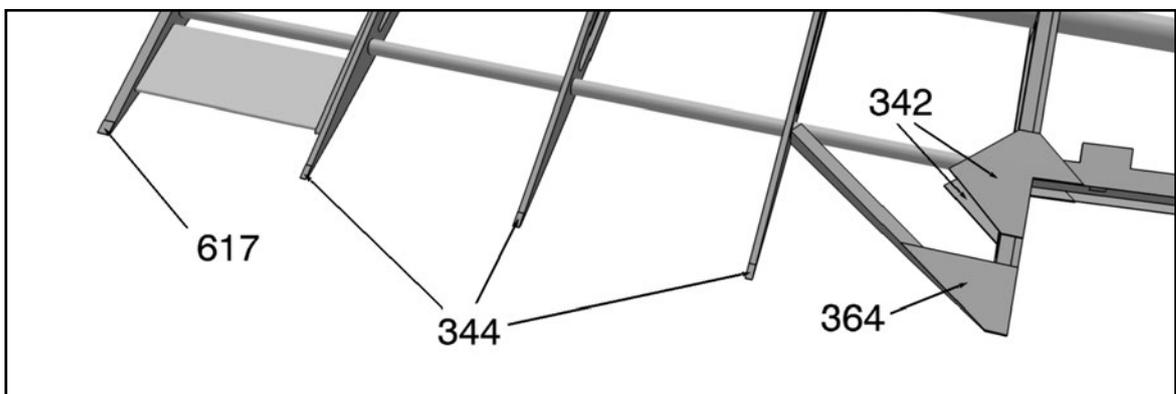
Apply PVA along the top of the hinge rail and the hinge blocks and lay the aileron shroud (323) onto the rail and lay a small strip of wood over the shroud and hold the shroud accurately in place with crocodile clips as the glue hardens. With glue thoroughly hardened you can remove the crocodile clips and glue the second shroud (323) into place.

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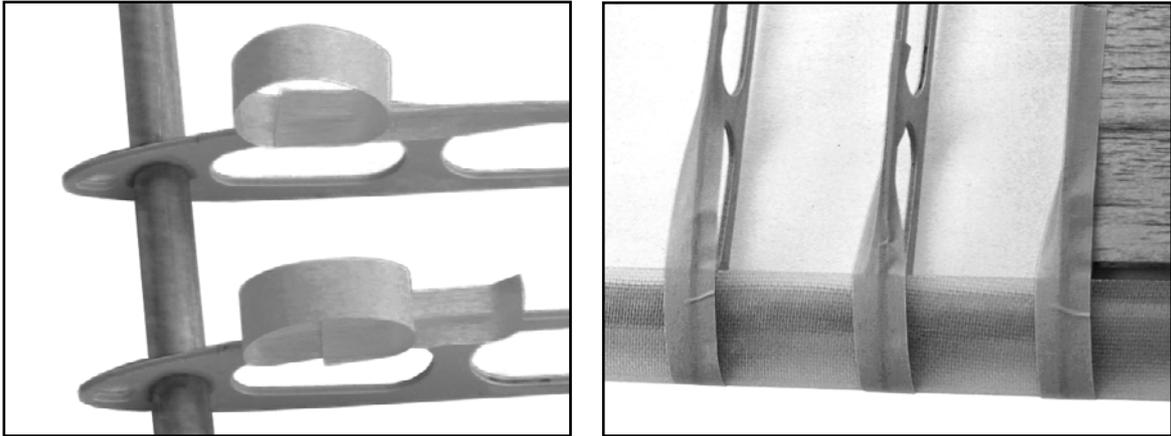
Cut away the two beechwood spacers (341) and epoxy these to the 8 mm tubular sub spar.

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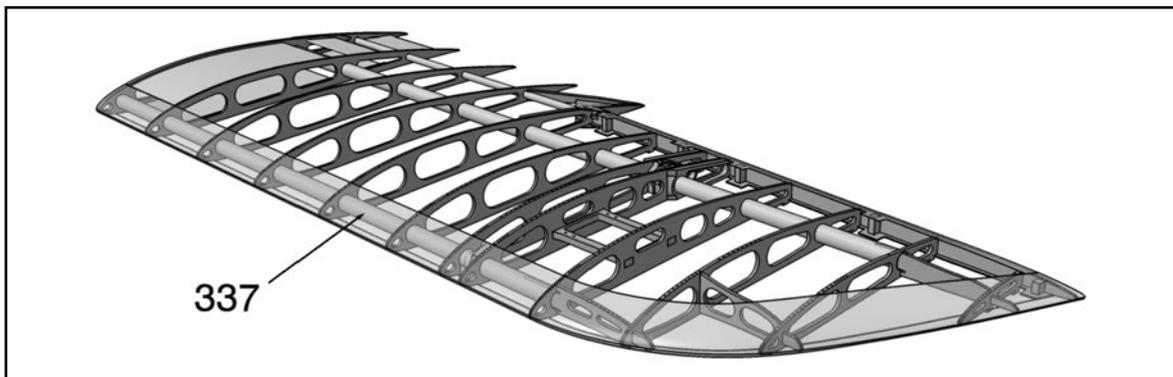


Glue the two 0,4 mm plywood scabs (342) to the wings at the aileron opening. Glue the 4 small 0,4 mm plywood scabs (344) (617) and scab (364) to the ends of the rib undersides, these must project over the rib ends by 2 mm to take the Kevlar rovings (345) forming the scalloped trailing edge.

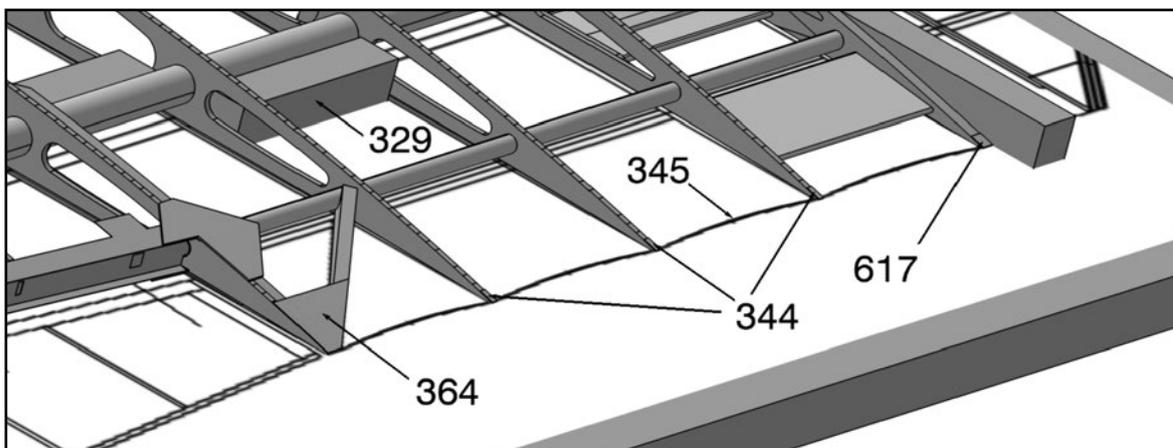
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Fit the epoxy leading edge (337) onto the wing and check to see if this fits neatly onto the ribs. When you are satisfied lay the leading edge to one side, cut 11 pieces of 20x150 mm masking tape and stick these to the top of the ribs. Mix enough epoxy to coat the nose of the ribs where the leading edge (337) fits onto the ribs. Place a very little amount of epoxy onto the ribs, push the leading edge (337) onto the epoxy coated ribs and pull the masking tape over the ribs and pull tight onto the ribs undersides. Leave overnight and next day remove the tapes and any small drops of excess epoxy squeezed out from under the leading edge.



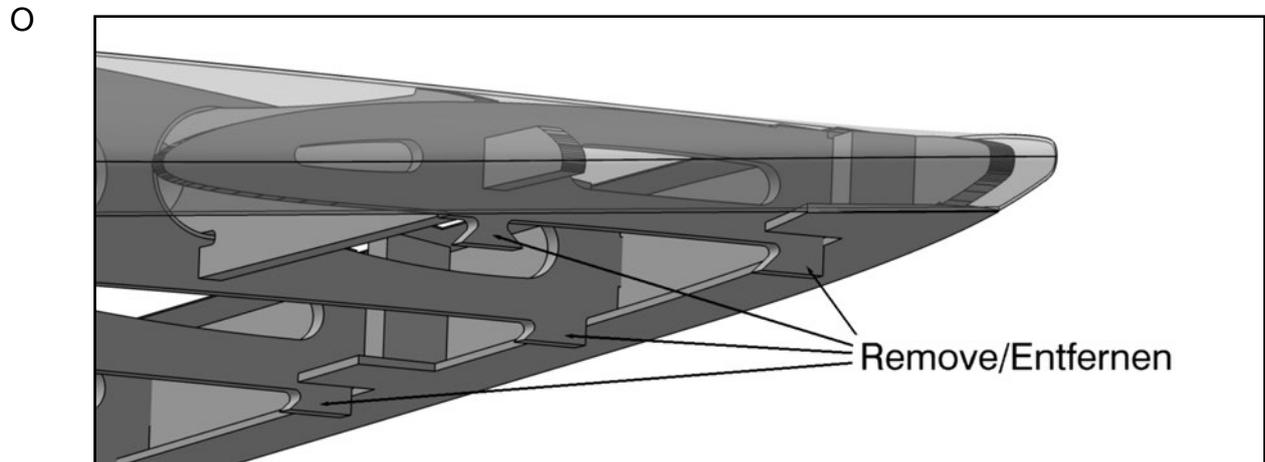
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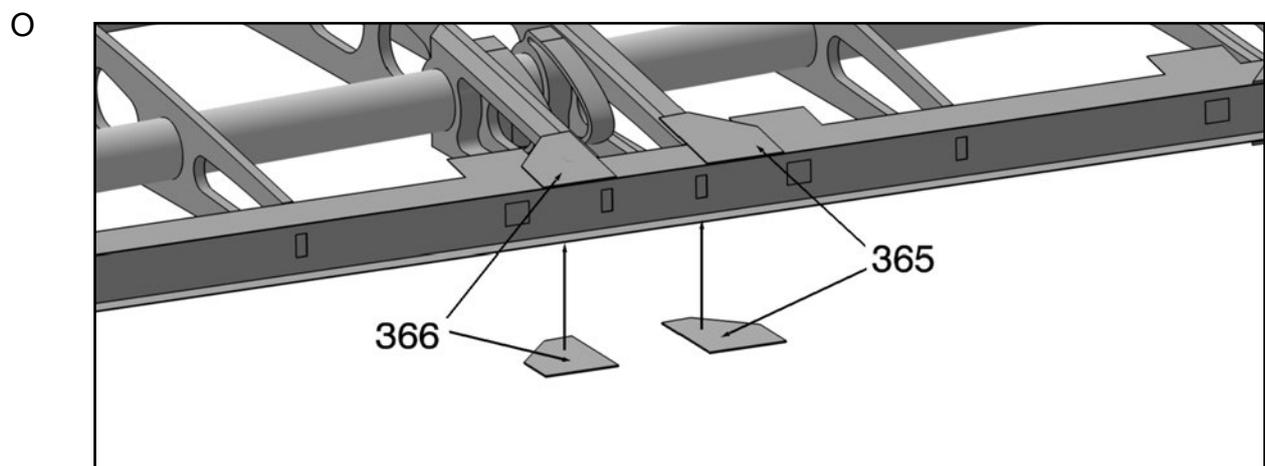
Place the wing back onto the plan with the tubular main spars inside the blocks (329). Hammer four small nails into positions marked with dots. Cut a piece of Kevlar rov-

ings 500 mm long (345), use cyano to fix one end to the root rib 0,4 mm scab (344), then glue the top 0,4 mm scabs (344) (617) in place with InstaCure+.

- O Pull the roving fairly tightly around the next nail and glue these to the next rib with cyano, then glue the top scab in place and so on to the aileron opening rib and finish with scab (364).

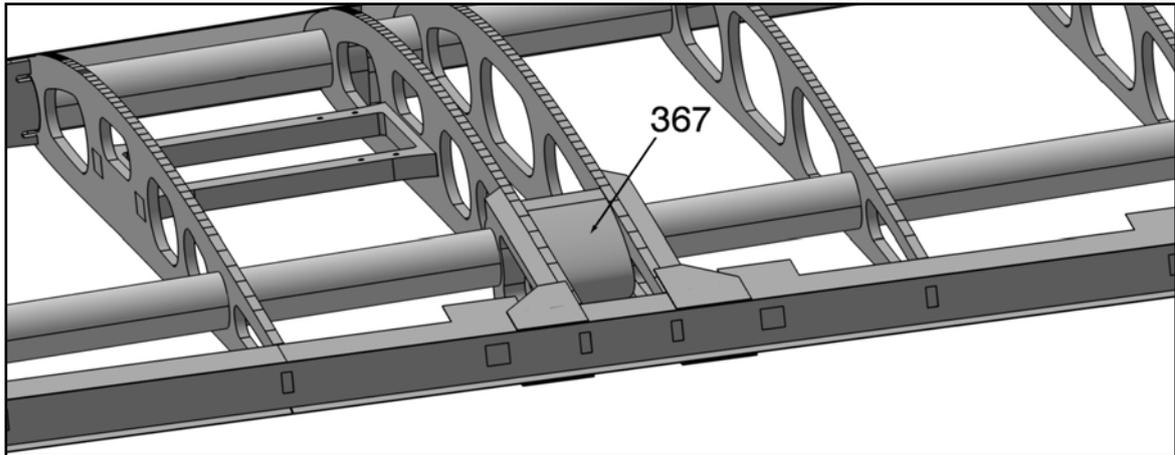


Remove the tabs from the rib ends with a sharp knife and sand the ends to clean them up.



Glue the four 0,4 mm plywood scabs (365) (366) onto the aileron shrouds (323). Note: there are two types of scabs, refer to the plan to find the correct scab for every eight positions.

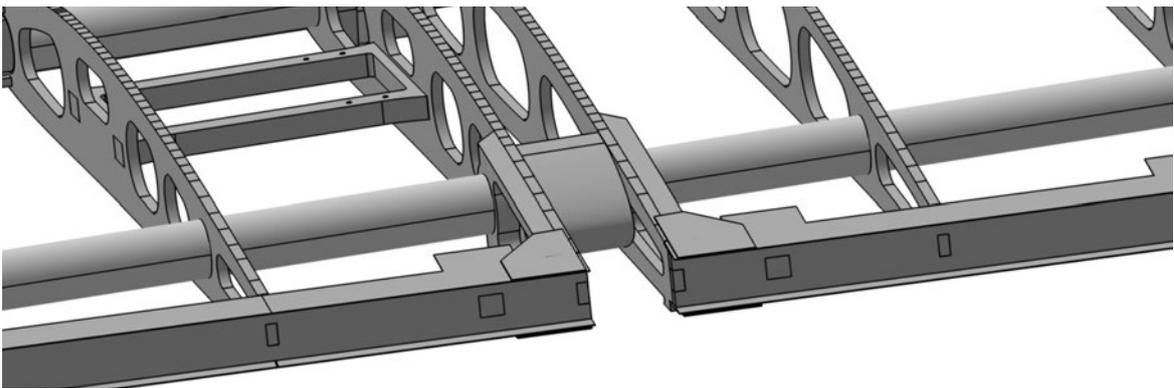
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Glue the sheeting 377 with thin cyano onto the rear wing strut fixing clips (334). Begin on the bottom side and push the sheeting step by step into position and glue it onto the clips.

O Very carefully clean up the trailing edge scabs to be ready to take the ProfiCover.

O

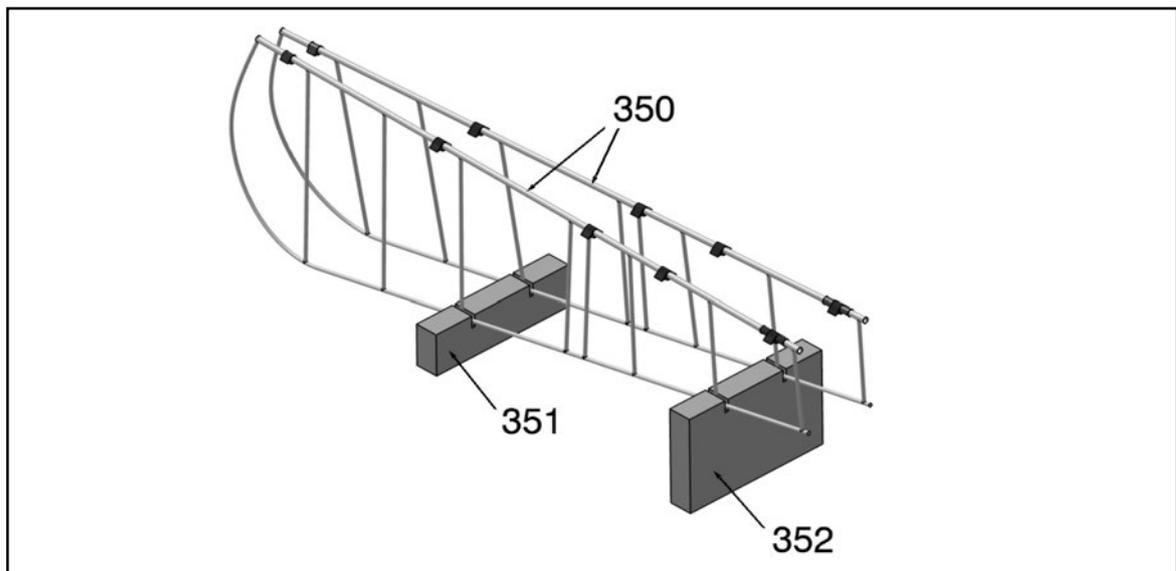


Cut off the aileron hinge rail (322) and the shrouds (323) between the scabs (365) (366). No Fear, the wings will be stiff enough, because of the tubular spars. The best way to imitate the aileron linkage is to use rubber thread from the local craft supply store. The rubber thread has the big advantage of not applying too much tension. Otherwise the ailerons will be more likely to flutter.

## AILERONS

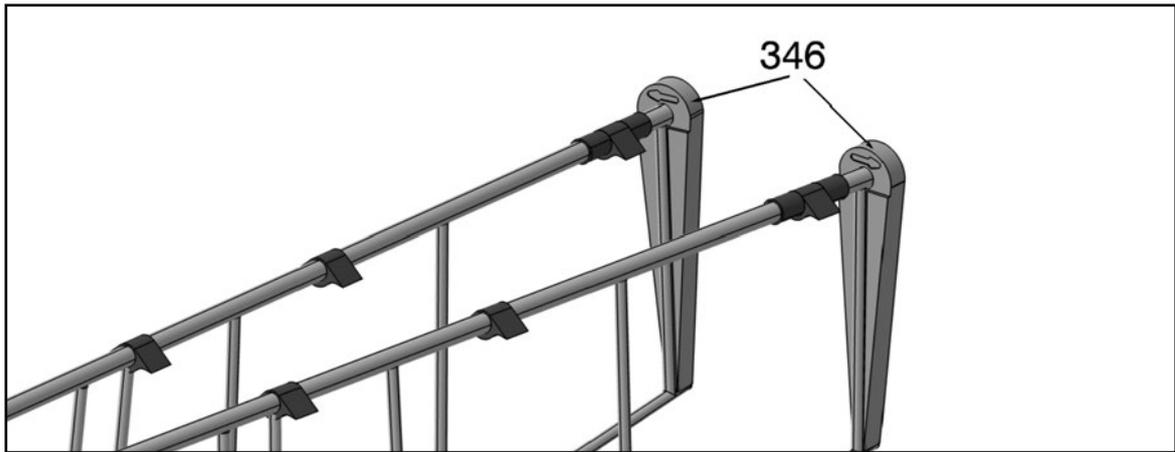
- Now we are ready do work on the ailerons. The following steps need special attention, even if the ailerons are pre-fabricated.
- Cut the 2 aileron end ribs (346) from the 6 mm poplar plywood and clean off the retaining stubs.
- Check with the wing plan to see that the thin sheet stainless steel hinges (347) (348) fit accurately onto the Tufnol hinge cores, lightly bend if necessary so the steel hinges fit tightly onto the hinge cores, else the ailerons will move very stiff. Thoroughly degrease these 10 steel hinges (347)+ (348) in Acetone as these must be glued with Araldite 2011 to the Tufnol hinge cores (349).
- Roughen the inside glue surfaces of the hinges thoroughly with 280 grit paper and again clean off with acetone. This roughening need only be done where the hinges make contact with the Tufnol hinge cores. The complete glue surfaces must be thoroughly roughened on each hinge.

○



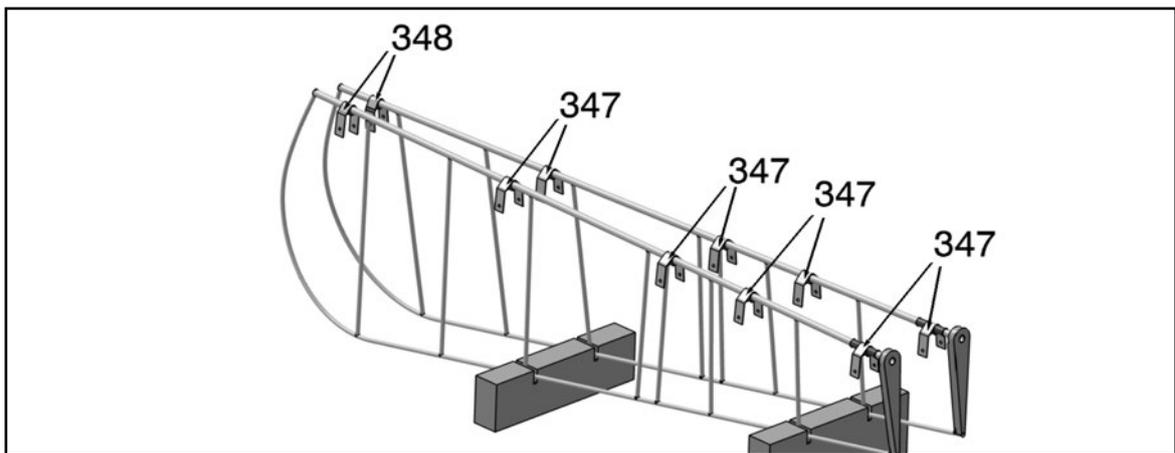
Set the 2 ailerons (350) into the 2 slotted jigs (351) (352) so that the aileron leading edge is level. The leading edges have to run towards each other on the tips to make sure that each aileron sits in the correct jig. Protect the aileron frames with a stripe of cellotape on each side of the Tufnol hinge cores, against squeezing out glue.

O



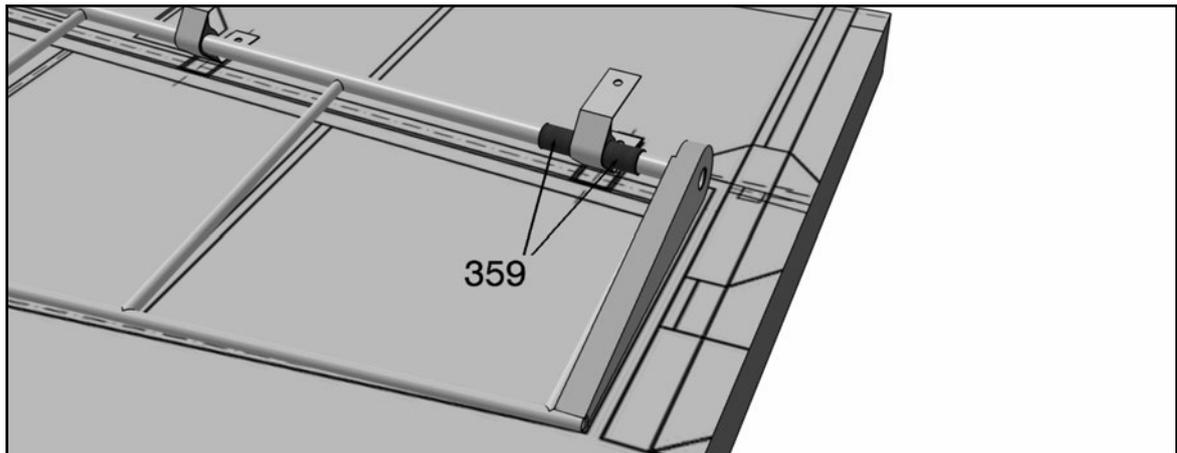
Mix Araldite 2011 epoxy and smear a little into the hole in the two 6 mm poplar plywood end ribs (346), along the grooves and in the half round slots on the ends, fit these two end ribs (346) into the ailerons with the arrows pointing outwards and hold in place with clips.

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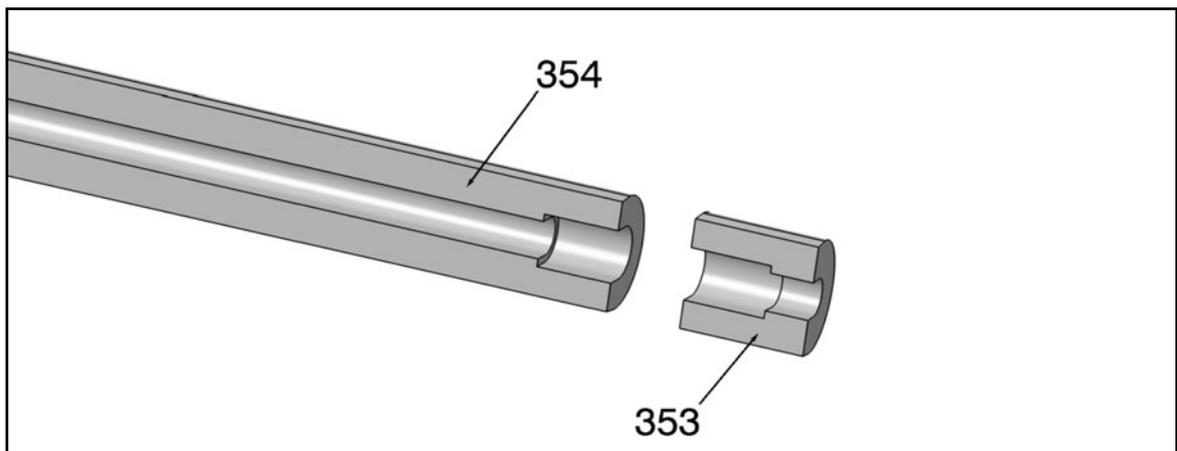
Apply a very small amount of the Araldite 2011 to one Tufnol hinge core and press a hinge (347) onto the hinge core. Take care to ensure that the epoxy does not squeeze out and run onto the 5 mm tubing forming the leading edge. Otherwise you are in big trouble, to loosen the hinge again. Epoxy the rest of the hinges onto the Tufnol cores in a like manner and leave overnight to cure hard. Note that there are two smaller hinges (348) and these are fitted one to each aileron at the wing tip ends of the ailerons. Until the ailerons are fitted onto the wings the hinges are very fragile, so take care during the next steps.

O



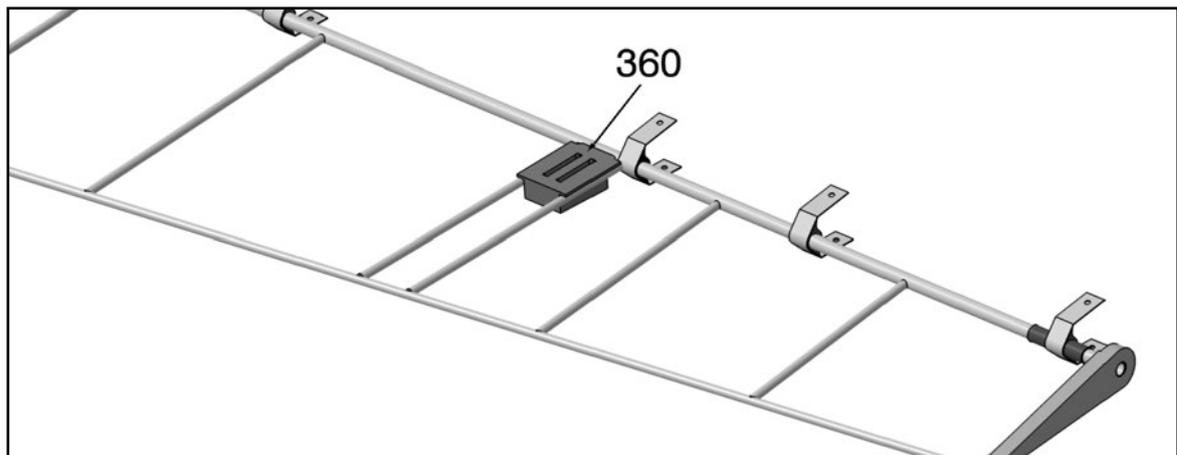
Lay the ailerons on the wing plan and position the hinge retainer (359) left and right of the inner hinge with a small gap, just big enough to make sure that the hinge can turn freely. Glue the hinge retainers with epoxy on the stainless steel frame. Work in a precise manner, because the hinge retainer (359) are positioning the ailerons on the wing.

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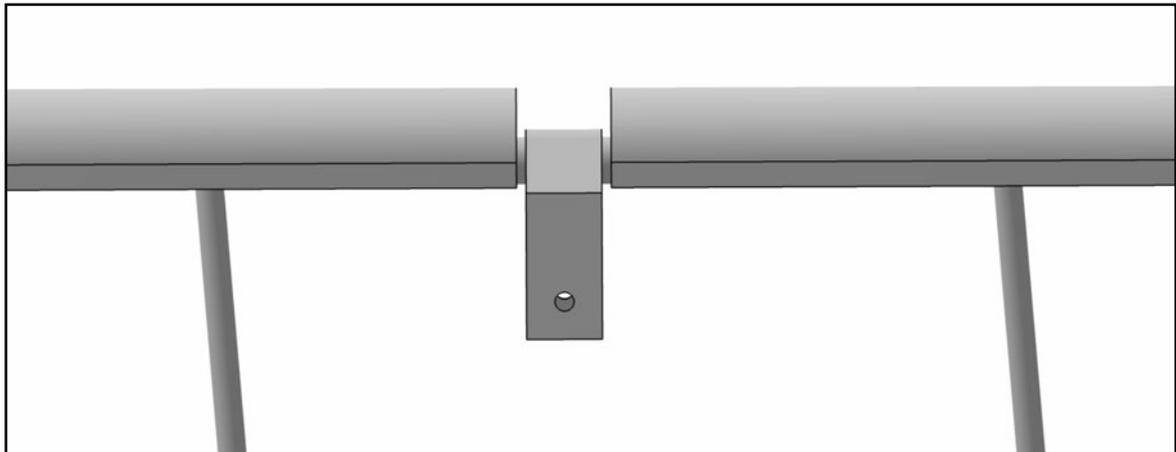
Shape the groove in the 4 spindle moulded Balsa leading edge pieces (353) (354) that fit between the root and the second hinge. These must have the groove opened up a little to fit over the four Tufnol hinge retainers (359). Dope the ends of the 12 (353) (354) (355) (356) (357) (358) spindle moulded Balsa aileron leading edges as well as the inside grooves and leave overnight to dry out.

O



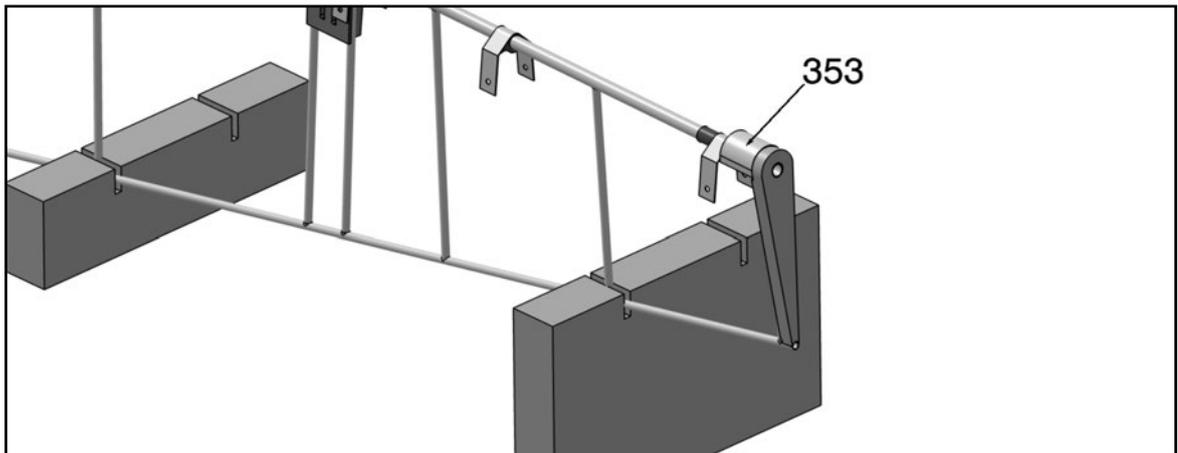
The spruce aileron horn fixing plates (360) must be epoxied onto the aileron tubing topsides, check to see you know which is the topside. The topside is when you view the aileron from the trailing edge and the wider wingtip end is twisted upwards.

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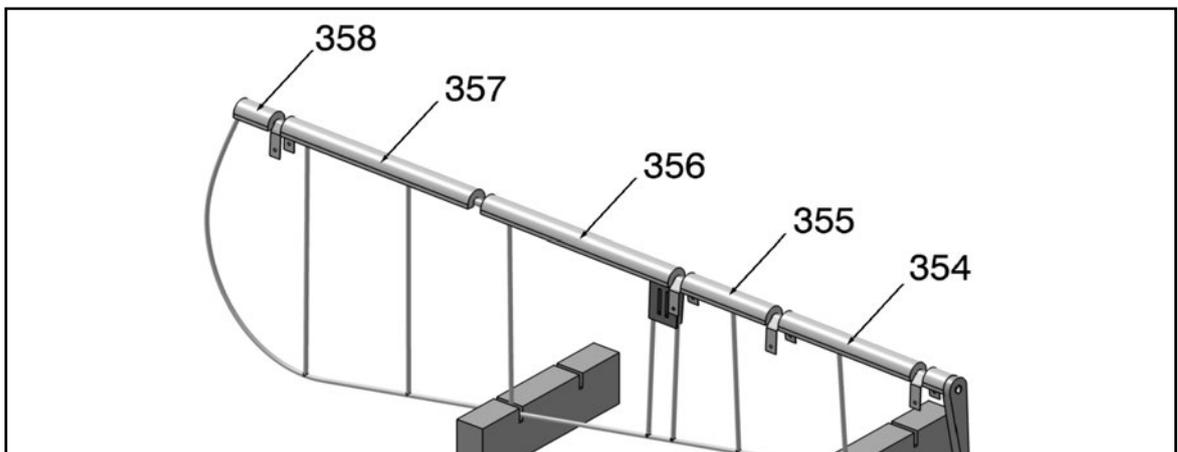
Use a fine grit paper, 600 for example, to very lightly sand the end faces of the 12 spindle moulded leading edge pieces. Set one steel tube aileron into the grooved pinewood aileron holding jigs (351) (352). Test fit the 6 pieces of leading edge (353-358) onto the aileron and adjust these so that there is a 1 mm gap each side of the hinges. Lay a steel straight edge along the top of the balsa leading edge pieces to ensure these leading edge pieces do in fact form a straight line. Sight over the balsa leading edge pieces during the hole gluing process, to ensure that they are correctly positioned. Otherwise you will not be able to glue the sub leading edges (361) on without a gap.

O



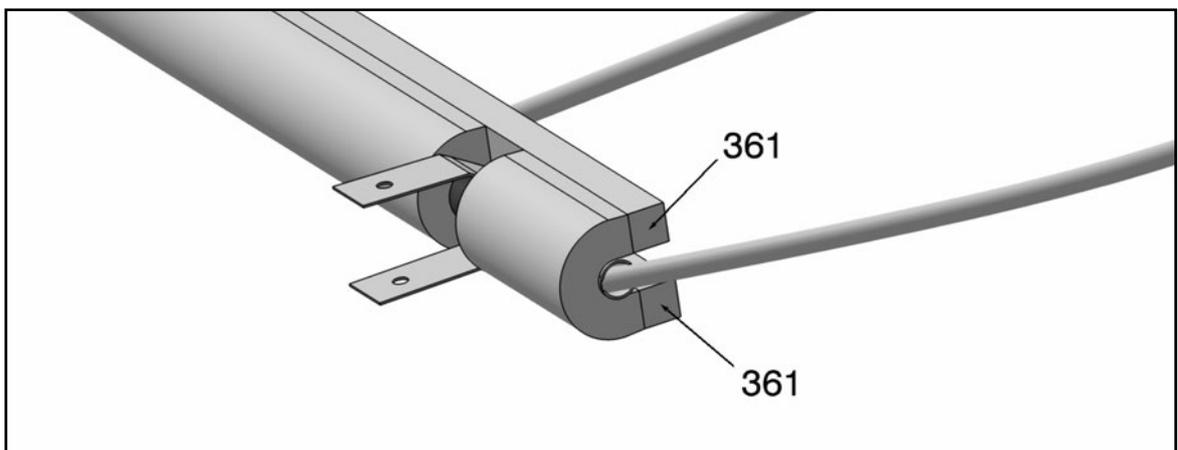
Remove from the aileron, the shortest piece of Balsa leading edge (353) and glue this onto the aileron root rib with PVA and to the aileron stainless steel frame with Araldite 2011. Let the glue harden.

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One by one remove from the aileron, the other 5 pieces of Balsa leading edge (354) to (358) and glue them onto the aileron stainless steel frame with Araldite 2011.

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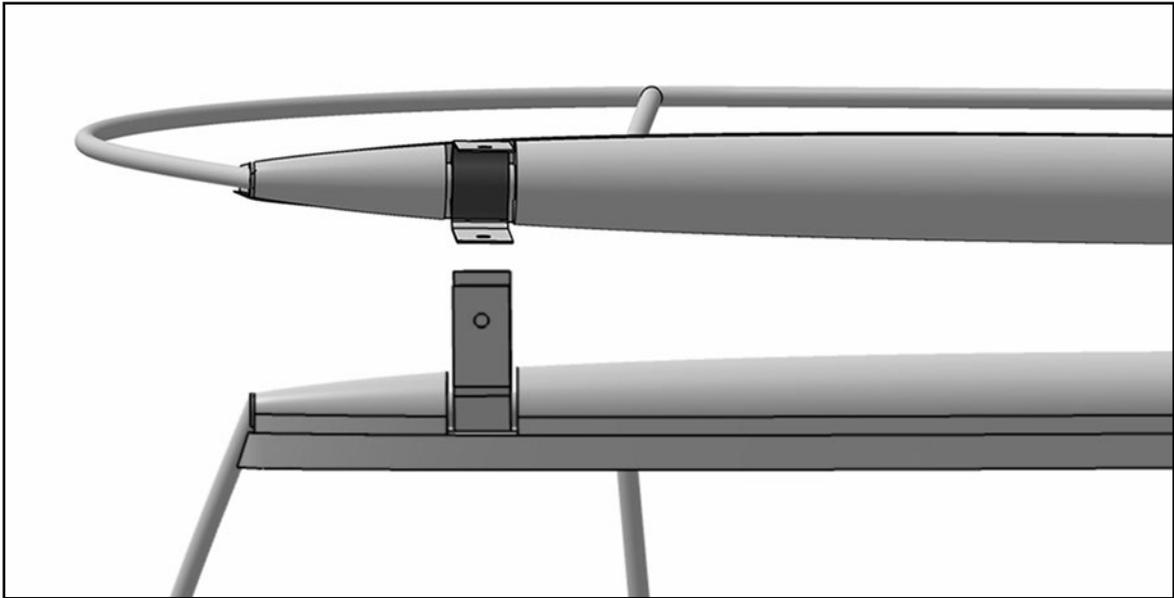


Have ready the two 5x5 mm balsa aileron sub leading edges (361). Run a small line of PVA glue along the rear side of the spindle moulded leading edge. Lay the 5x5 mm balsa strip (361) onto the glued surface. Use pins to hold the 5x5 mm strip onto the

balsa leading edge as the glue hardens. Glue the second 5x5 mm sub leading edge into place, again using pins to hold this in place. Take care to ensure that the PVA glue does not come into contact with the hinges (347) (348) as this will make the hinges stiff.

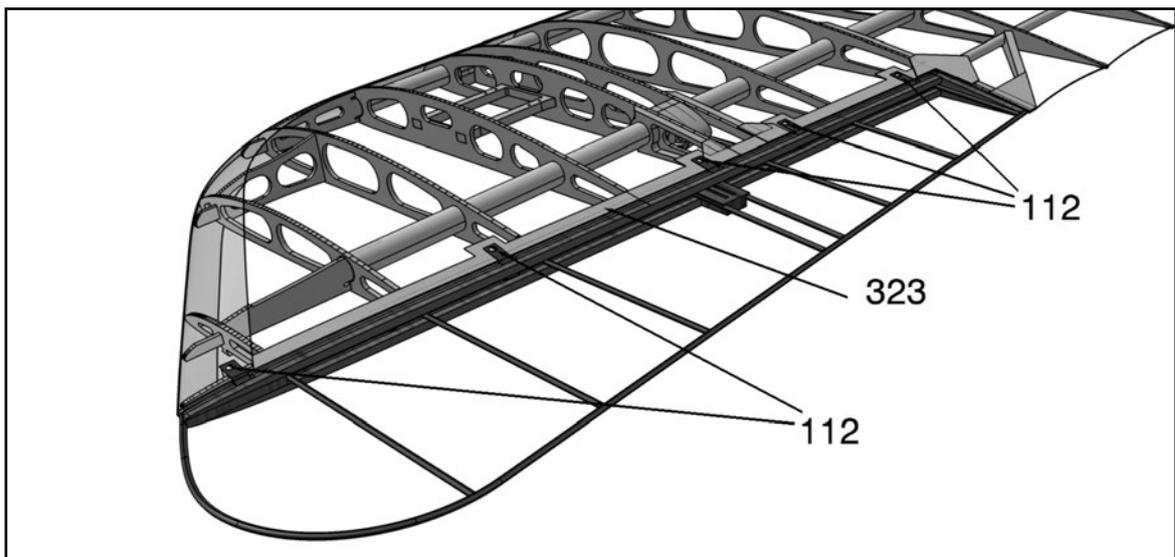
- **WARNING:** do not use any cyano instant glue on the aileron leading edges anywhere, as this will surely find it's way into the hinge cores, gluing these solidly onto the steel tube.

○



The Balsa leading edge pieces (357) (358) need to be spindle shaped to fit between the aileron shrouds (326). Best way to get a good result is to trial fit the aileron to the wing over and over again. Don't hurry! Rework the sub leading edges if necessary to allow the ailerons to move the full travel.

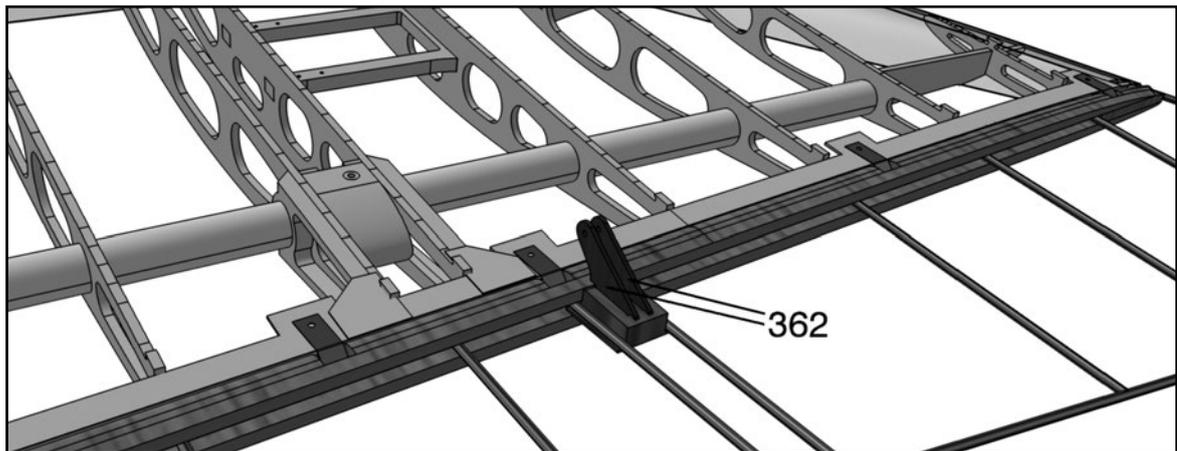
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Fit the completed aileron onto the wing using the 2x8 mm wood screws (112). To fit

the aileron, first hold the aileron accurately onto the wing, use a 2 mm drill to drill just through 0,8 mm aileron shroud (323) at the first aileron hinge on the topside. Then use 1,5 mm drill to drill through the hinge screw block (314). Insert a screw into the hole, check to see the aileron is still fitting accurately. Now fit the outermost hinge to the topside and again check to see that the aileron is correctly fitted. Fit the two screws (112) to the underside and recheck the ailerons position is correct. Fit the remaining six screws. Note, in the kit are another set of screws to replace damaged ones after finishing your model.

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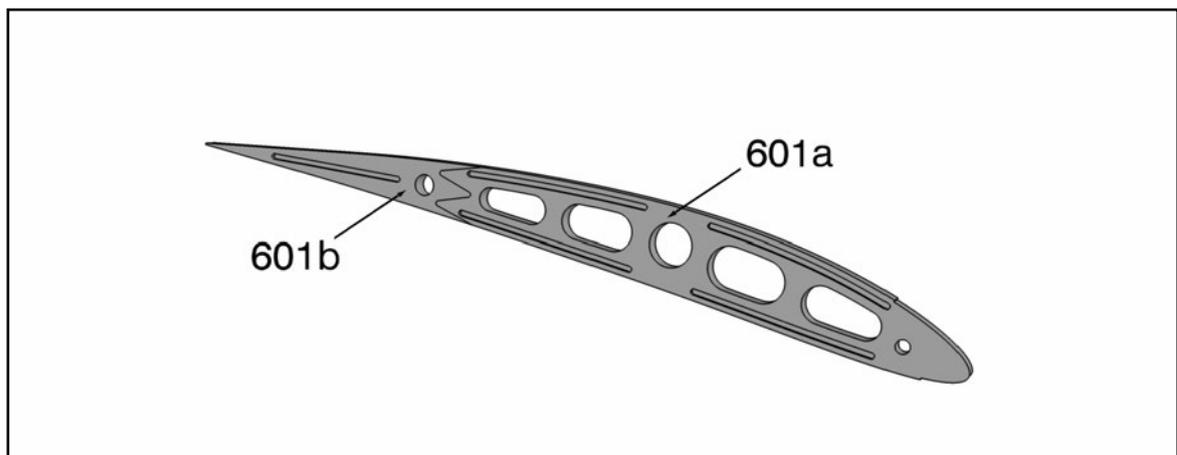
The four aileron control horns (362) must be fitted, two to each aileron. Drill several 2 mm holes through the glue surfaces and epoxy the horns into the ailerons. It is essential that these horns are in the same position on both ailerons.

- Take four nylon ball joints (117) and drill these out with a 3,2 mm spiral drill, try fitting the carbon fiber rod (363) into the ball joint body, it should go in easily.
- Fit both aileron servos permanently into the wings with extension cables fitted. Screw the output arms onto the servos and fit the prepared ball joints (117) to the output arms and between the aileron control horns, use the M2x12 screws (83) and nuts (57).
- Hold the aileron at the neutral position accurately with small clamps, you can then push one end of the carbon fiber rods (363) into the ball joint (117) on the output arm, you can then hold the rod against the ball joints between the horns and mark the length accurately. Remove the ball joints (117) from the servo output arms.
- Cut both carbon fiber pushrods (363) to length, use a coarse sanding paper to roughen the ends where these go into the ball joints (117). Work epoxy into the four ball joints (117) and smear lightly the roughened end of the rods with epoxy and push the rods first into the ball joints on the servo arms, push the second pair of ball joints (117) onto the other ends of the pushrods refix the two ball joints onto the aileron output arms and leave overnight.

## BOTTOM WING

- Prepare for assembling the bottom wing by numbering with a pencil and cutting away the 6 mm Birch plywood root ribs stubs (601b), the 6 mm Poplar plywood root rib (601a) and the 6 mm poplar plywood diagonal tip brace (613); cut away the 3 mm Poplar plywood ribs (602b), (602a), (605), (606), (608), (609); the two 3 mm birch plywood spar extensions (610) and (611). Cut away from the 0,4 mm birch plywood the two wing tip scabs (612). Cut away from the 8 mm beechwood sheet the 2 wing strut fixing block halves (607a) and (607b).
- Take care with the ribs as the trailing edge is very thin and fragile and can easily be broken. As soon as the Kevlar trailing edge (345) and Proficover is on the ribs they are then considerably strengthened.
- Clean away all the retaining stubs from the above parts, take care to ensure the stubs are really removed from the ribs where the epoxy/glass leading edge is glued; any remaining stub will prevent the LE (615) from sitting flush to the ribs profile.

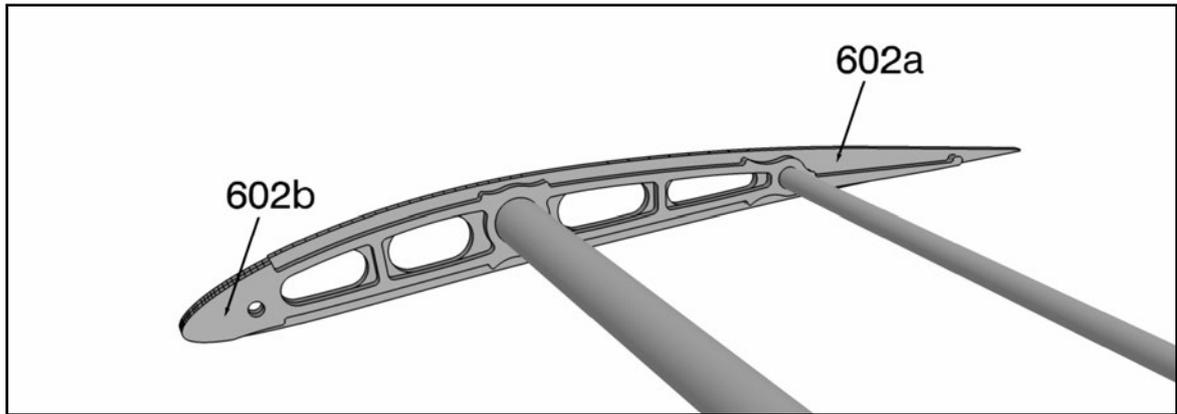
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Glue the 6 mm birch plywood root rib stub (601b) to the 6 mm poplar plywood root rib (601a) making sure you have the 2mm slots on both parts facing inwards to later take the 2mm stiffening balsa sheet (330).

- Run PVA glue around the two spar holes of skeleton rib (602b) and rib (602a), to act as a seal against the cyano, same as before with the top wing.

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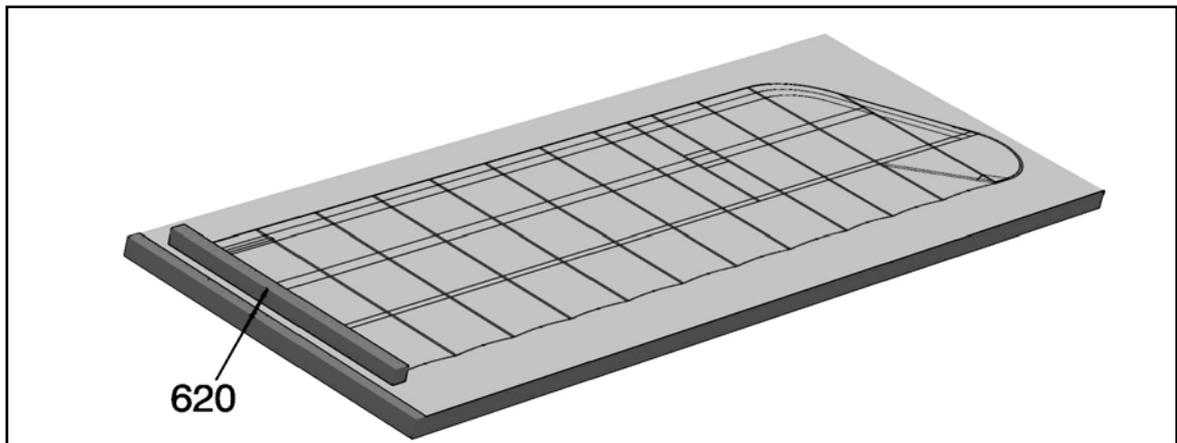


Use the spars (603) (604) to align and press the ribs together. **Note:** To support the 2 mm balsa stiffening sheet (330), the skeleton rib must be glued on the wing root side! Clamp these two ribs together and glue rest of skeleton rib (602b) onto the rib (602a) with cyano.

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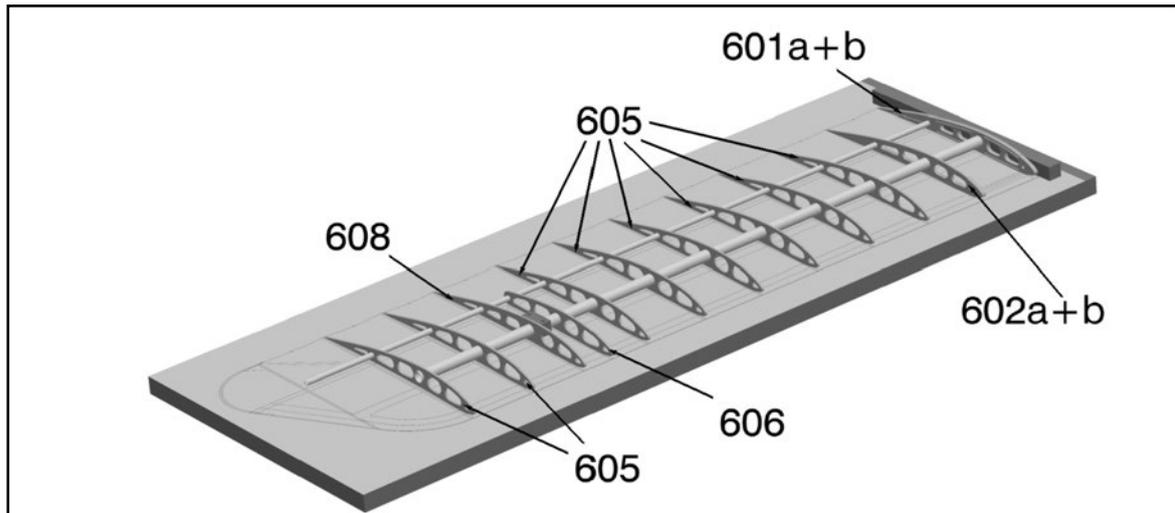
The 16 mm diameter hard aluminium bottom wing main spar (603) and the hard aluminium 8 mm diameter rear spar (604) must be thoroughly cleaned off with Acetone and then 800 grit paper and then wiped over with acetone and a cloth.

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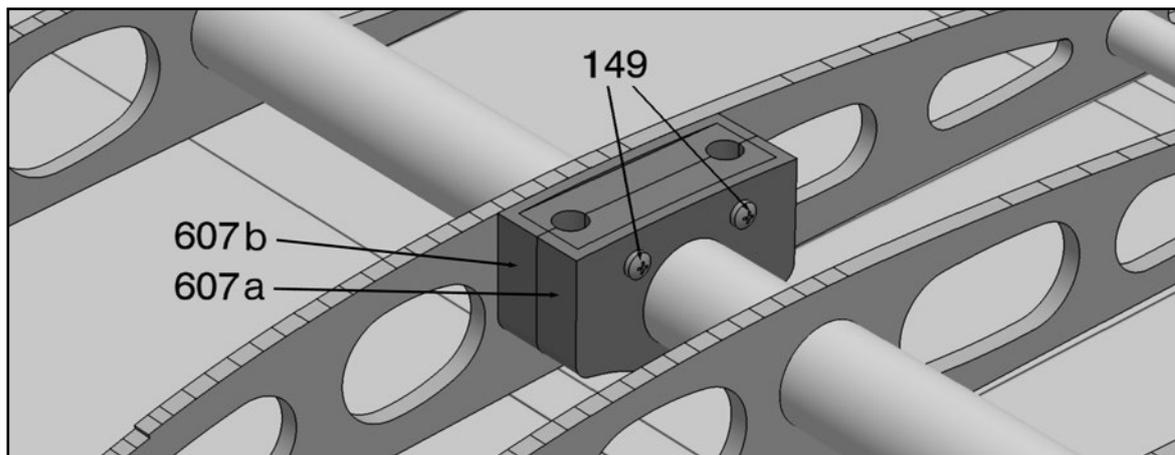
Lay the bottom wing plan over the building board and cover with transparent plastic film. Nail the 20x20 mm hardwood root fixing strip (620) accurately over the plan.

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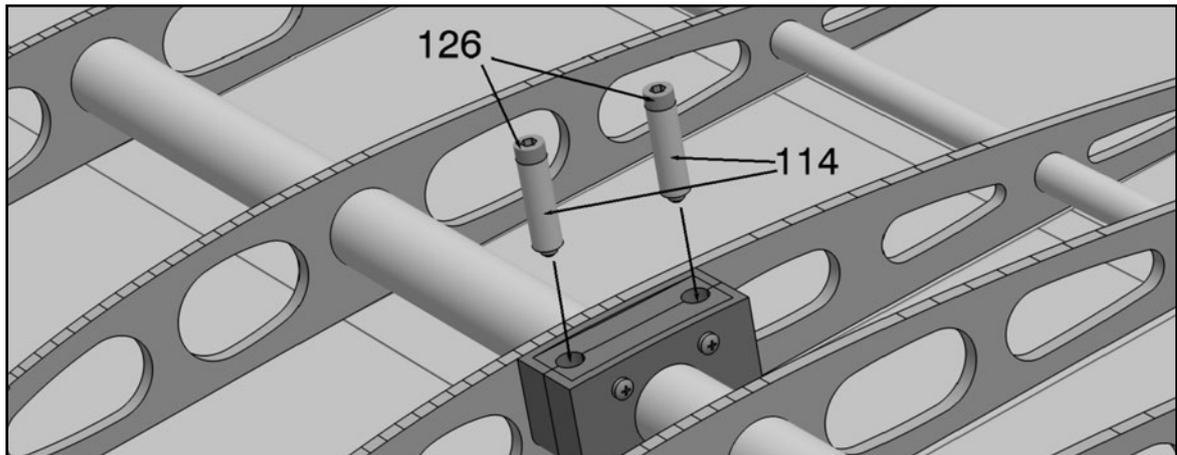
Slide first the main rib (602a) with the skeleton rib (602b) glued onto it, onto the two spars (603) (604), then the root rib (601a+b). Then slide six main ribs (605) into place on the spars; this is a tedious job I am afraid, however slide the short rib (606) into place followed by the two beechwood strut fixing blocks (607a) and (607b), note these are paired, the holes are smaller on (607b), then rib (608) and the remaining 2 main ribs (605). Now nail the four hardwood blocks (619) to the building board to hold the spars (603) (604) in place.

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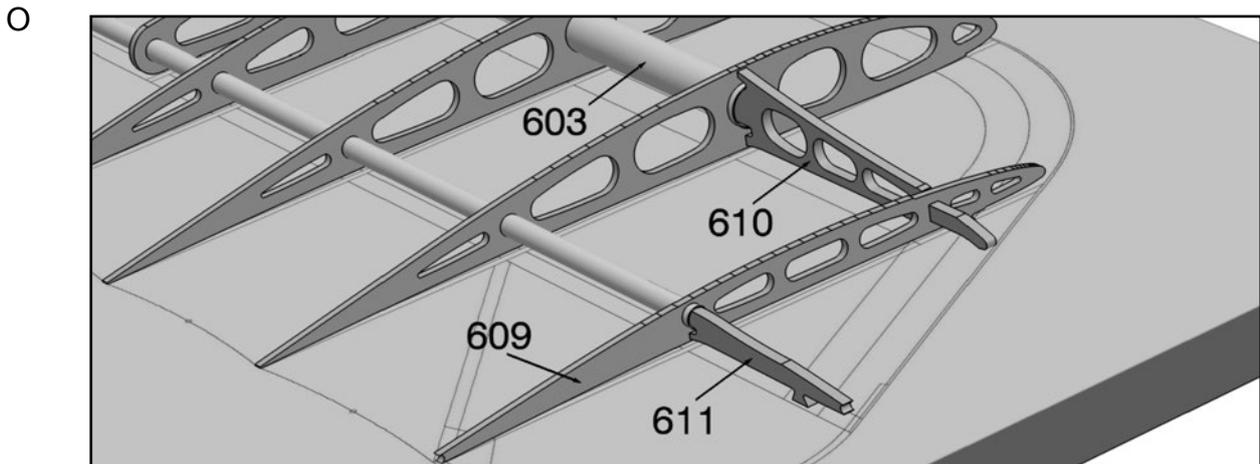


Apply epoxy to inside halves of the strut fixing blocks (607a) and (607b) and the grooves that take the knurled screwed bushes (114). Screw the two halves of the blocks together using the two 2,2x13 mm self tapping screws (149); these blocks (607a) and (607b) can be turned on the spar to gain access to the screw heads with the screwdriver.

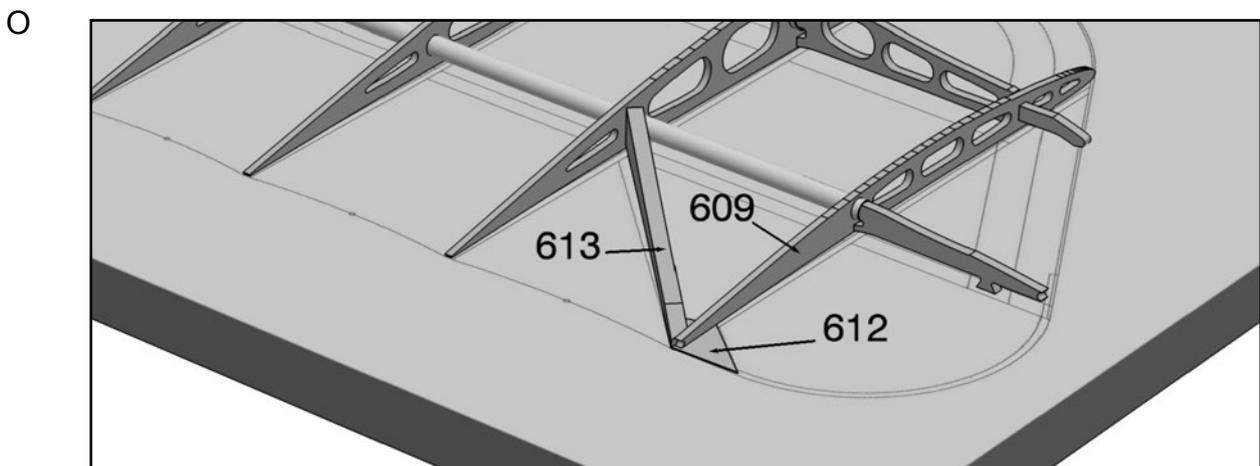
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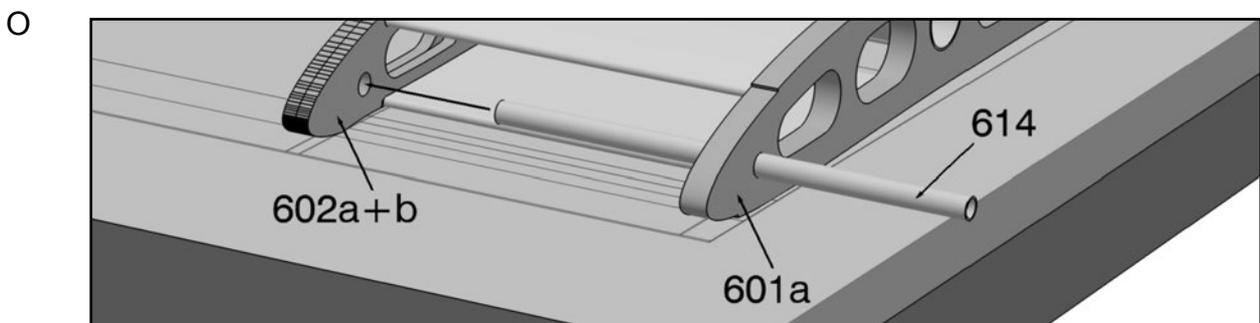
- Take two knurled bushes (114) and insert a M3x20 cap screw (126) into each bush right through to the end, push both bushes (114) into the holes in the blocks (607a+b); slide block (607a+b) away from the rib to which it is later glued, apply a little epoxy to the spar and to the face of the block (607a+b) that contacts the rib, push the block slowly against the rib to ensure that there is enough epoxy between the block (607a+b) and the spar (603); use a pointed stick to remove the excess epoxy that has exuded from around the bushes (114).
- O Carefully remove the end stop (620) apply one drop of epoxy to both sides of the ribs at the front spar top, do not use too much epoxy or there is the danger of the excess epoxy running down and forming a small droplet which will be very hard to remove, have ready a piece of timber with one straight edge 1000x100x50 mm; this is to hold the wing flat onto the board as the epoxy is hardened on the front spar tube (603) with the heat gun.
- O Adjust the position of the block (607a+b) so that it sits accurately in position; with a small nozzle fitted to the hot air gun, blow hot air through the front spar tube (603) until the epoxy melts and runs around the spar. Keep heat going until the epoxy is no longer sticky.
- O Apply a smaller drop of epoxy to the 8 mm rear spar (604) both sides of the ribs at the top and carefully blow hot air through the spar as before. Take care here with the heat gun or you will quickly burn the epoxy.



Epoxy the tip rib (609) and the two 3 mm birch ply extensions (610) (611) in place on the respective spar ends,



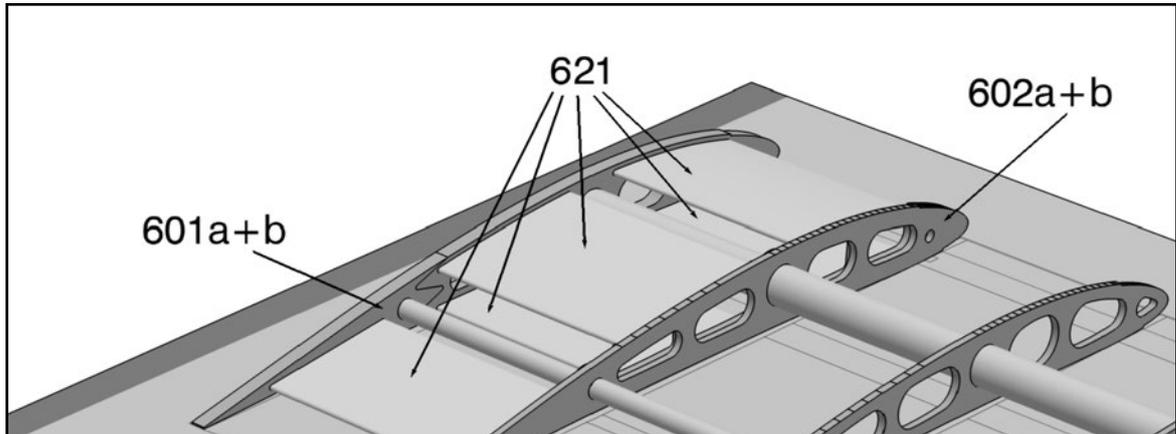
Slide the 0,4 mm plywood scab (612) under the tip rib (609), lay the 6 mm thick diagonal brace (613) in position, place scab (612) accurately and mark position of the rib and diagonal brace (613) onto the scab with a pencil, slide the scab (612) out and apply epoxy between the pencil marks, replace the scab and epoxy the 6 mm poplar ply diagonal brace (613) between the scab and the rear spar (604). Do not epoxy the top 0,4 mm scab (612) into place yet.



Clean and degrease the 5 mm brass tube (614) roughen the ends of this tube with coarse grit paper and insert this into the root rib (601a) and smear both ends with

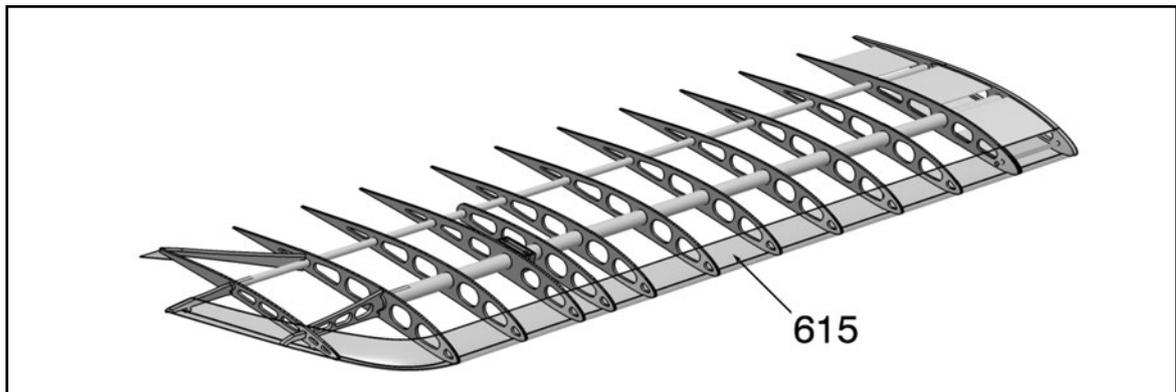
epoxy, then push this tube into the second rib (602b) (602a) leaving 1 mm protruding from the root rib to be filed or sanded away later.

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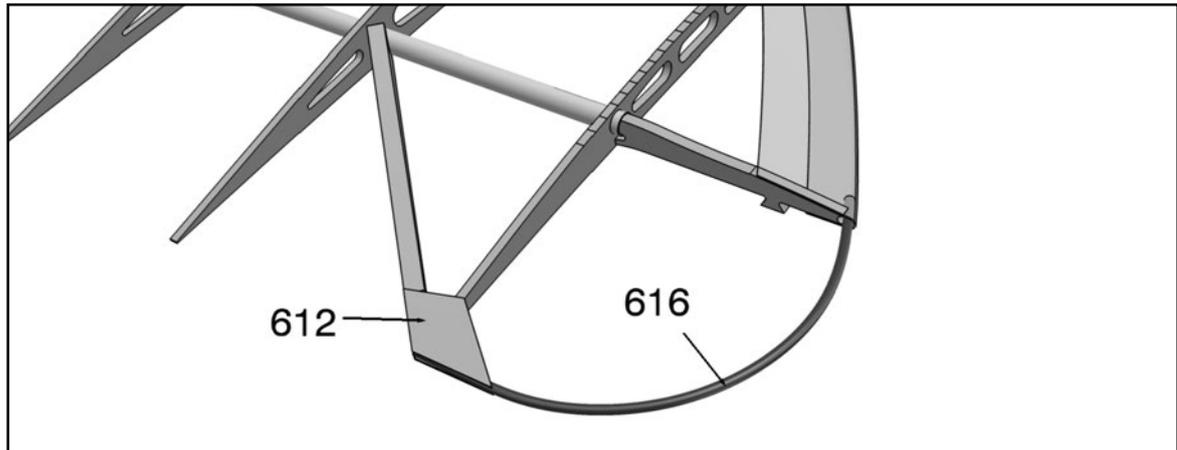
The 2 mm cross grain balsa stiffeners (621) must be glued between the root rib and the second rib. Start by gluing these balsa stiffener pieces (621) side by side with cyano to form a wide strip, then cut to length.

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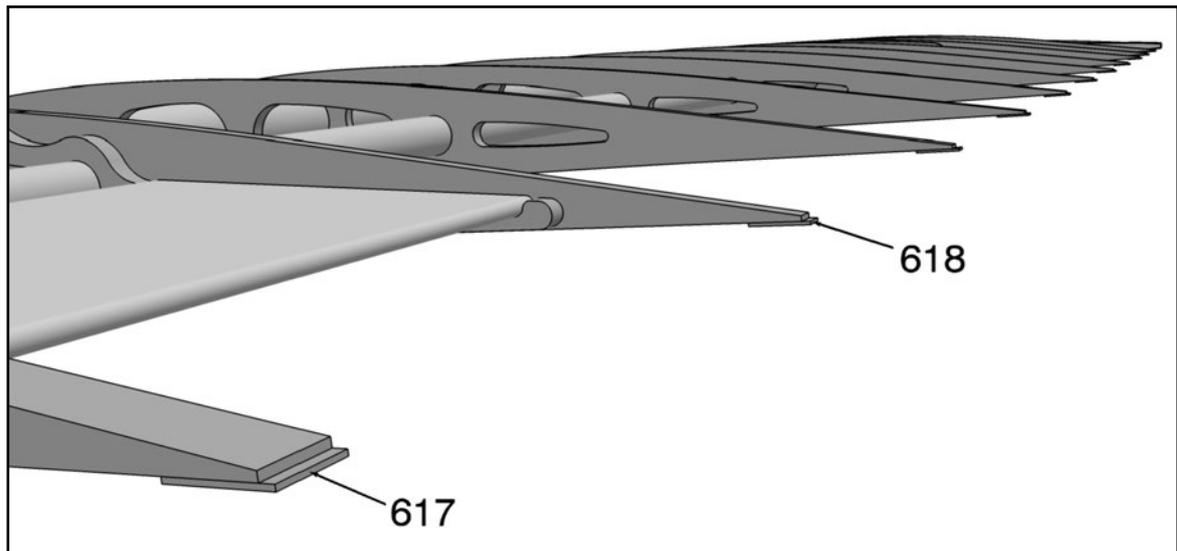
The epoxy leading edge (615) must now be fitted, check to see that the leading edge fits accurately onto the ribs and wing tip, when you are satisfied, cut from 20 mm wide masking tape, 14 strips 180 mm long, stick these strips of masking tape along the top of the ribs almost up to the cut away for the leading edge. Mix epoxy and apply to the leading edges of the ribs and wing tips very sparingly, then slide the leading edge (615) onto the ribs, use the masking tape on each rib to hold the leading edge securely in place on the ribs as well as on the wing tip.

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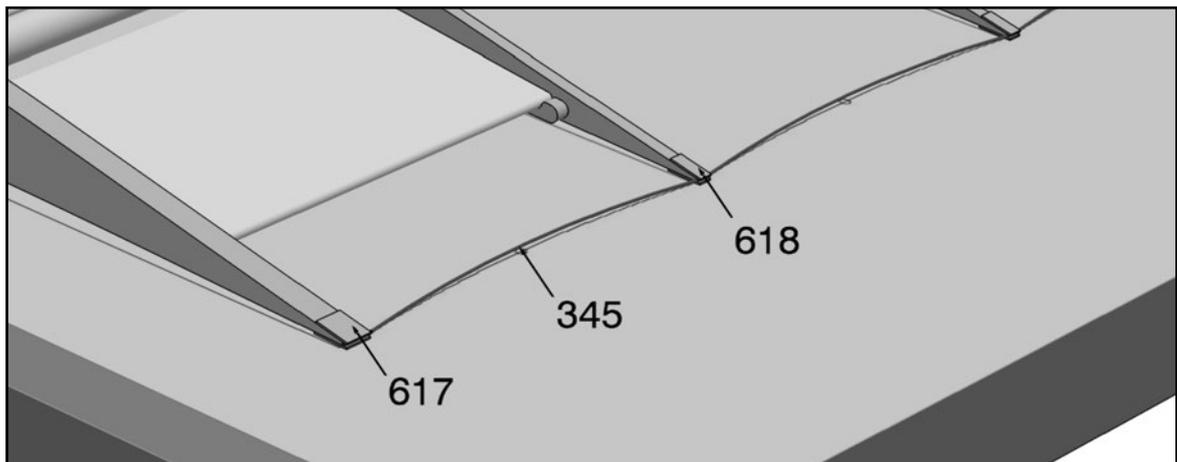
Degrease with acetone the 3 mm diameter stainless steel wing tip tube (616), roughen both ends with a coarse file, work epoxy into the leading edge at the spar extension (611), apply epoxy to the 0,4 mm scab (612) and then insert the tube (616) into the leading edge and onto the lower scab (612), apply epoxy the tip rib (606) and diagonal brace (613), then lay second scab (612) into place and secure with a small clamp. Leave overnight to allow the epoxy to harden.

O



Cut away the 0,4 mm rib trailing edge scabs (617)(618) to take the Kevlar trailing edge (345), glue ten 3 mm (618) and one 6 mm scabs (617) to the underside only of the rib ends. Use MAXI -CURE™ as this is extra thick and adheres well to hardwoods

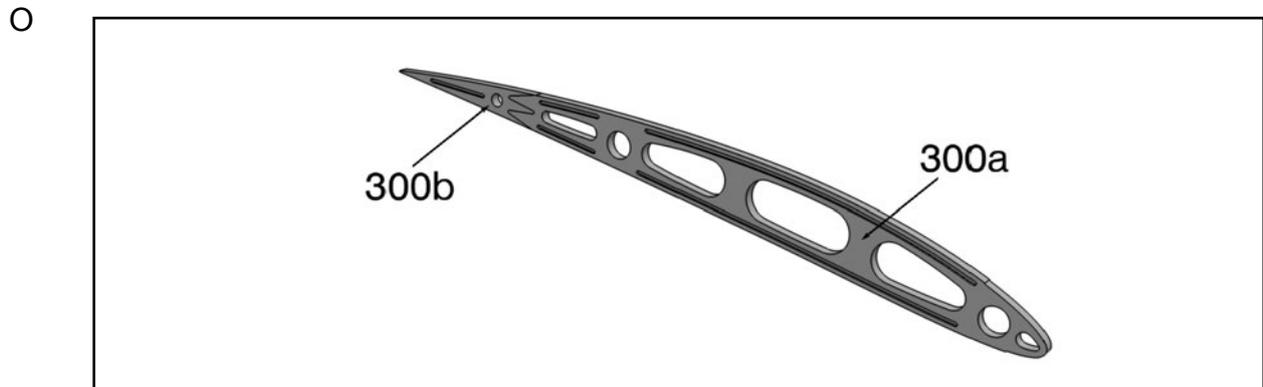
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Place the wing back onto the building board so that the four positioning blocks (619) hold the wing in place. Hammer a small nail into each point shown to take the Kevlar roving. Take a piece of Kevlar roving (345) 1100 mm long and glue this onto the trailing edge with cyano the same as with the top wing. Then glue the top trailing edge scabs (618) (617) onto the ribs with PVA. Take care to fit these scabs very accurately as it will not be possible to sand these in any way as the rib will break immediately behind the scabs.

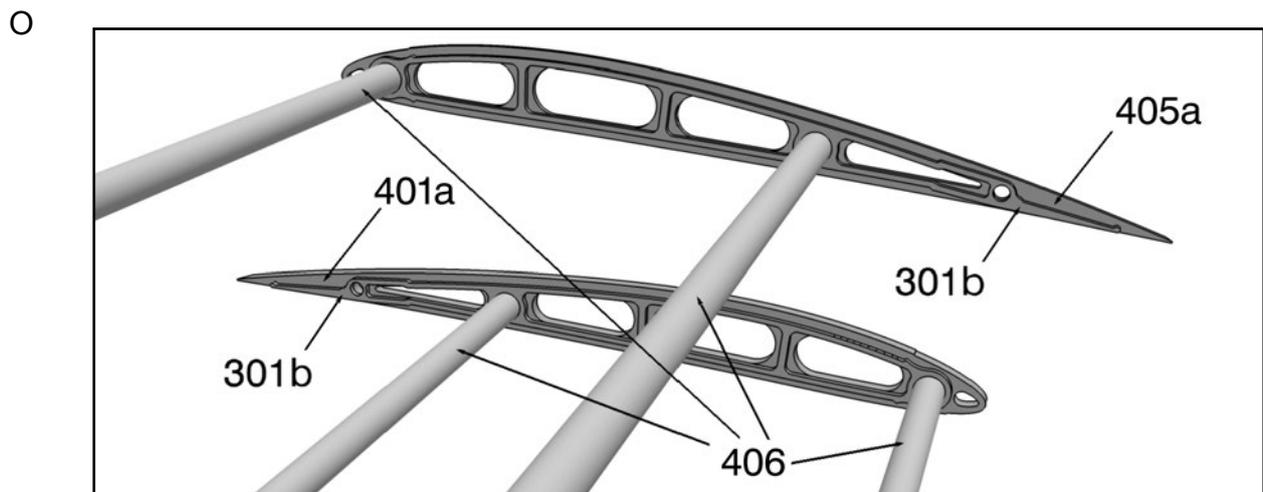
## WING CENTER SECTION

- Cut out the two Birch ply 6 mm root rib ends (300b), the two 6 mm Poplar ply root ribs (300a), cut away the retaining stubs and clean off the loose fibers caused by machining.



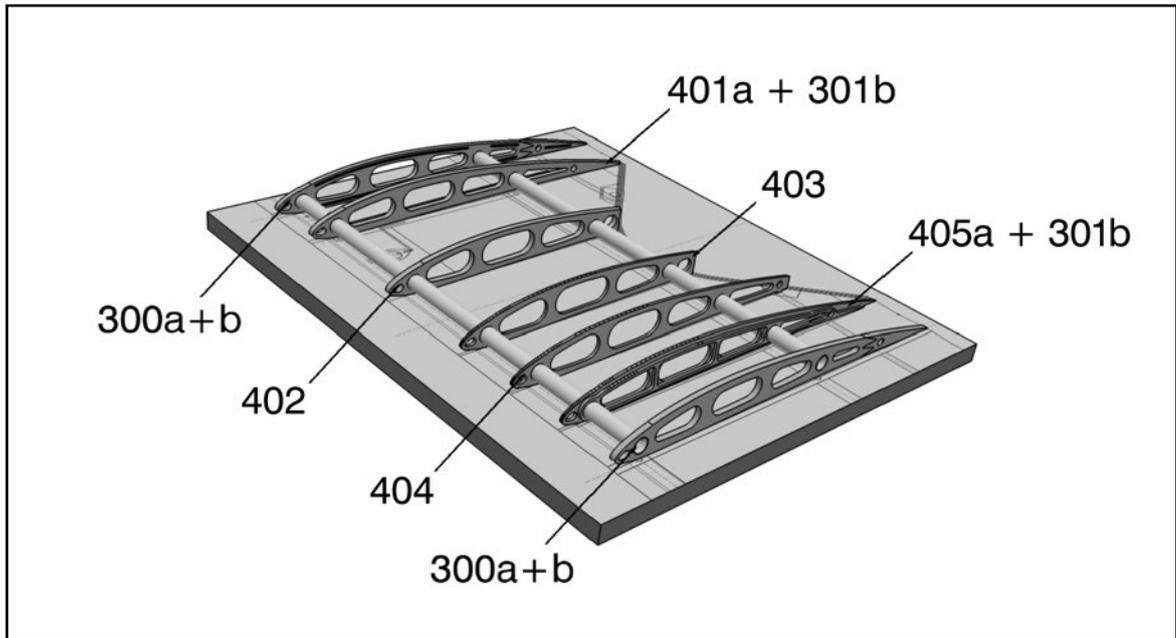
Before gluing the 6 mm Birch plywood root rib ends (300b) onto the Poplar plywood ribs (300a) check to make sure you are going glue the correct parts together, this means that on one side of each 6 mm thick root rib there is a 2 mm slot. These slots must be facing inwards so that the 2 mm balsa stiffeners (409) = 10pcs. 61x85x2 mm Balsa, can be glued into these slots. It of course follows that you should end with a left and a right hand side rib.

- Cut away the full length 6 mm poplar plywood rib (401a) the shortened 6 mm Poplar plywood rib (402) plus the two shortened 3 mm Poplar plywood ribs (403) (404); the two 3 mm skeleton ribs (301b) and the full length 3 mm Poplar plywood rib (405a). Note: rib (405a) is similar in shape to (301a) but it has the trailing edge end cut to 45 degrees. Clean off the stubs and machining whiskers.



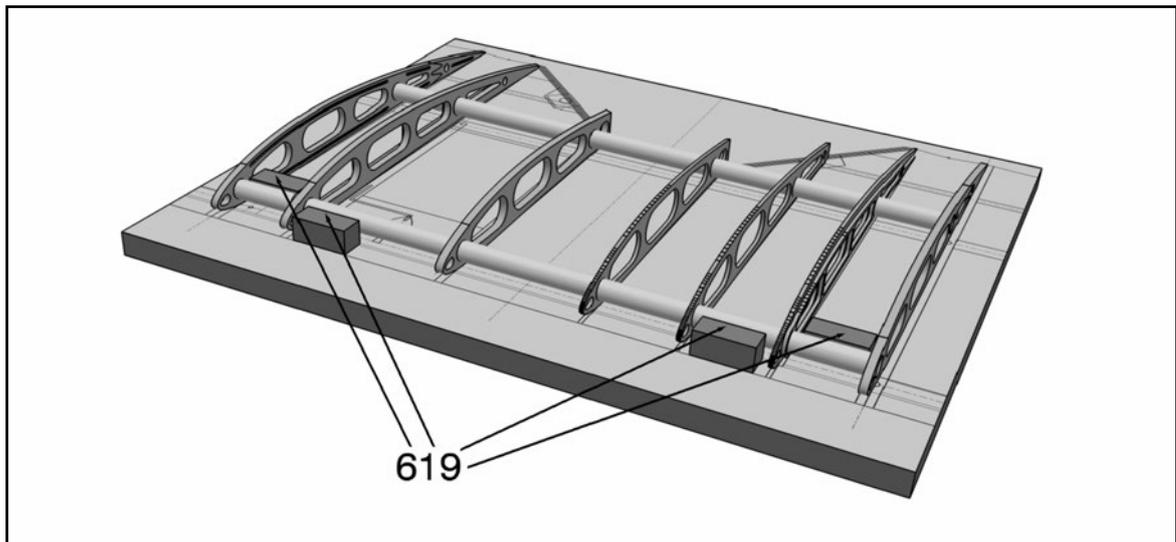
Using PVA glue skeleton ribs (301b) to the inside of the main rib (405a) and main rib (401a) after checking to ensure you have the skeleton rib (301b) on the correct sides. Make sure the spar holes are exactly aligned before glue starts to set. Use the two aluminium spars (406).

O



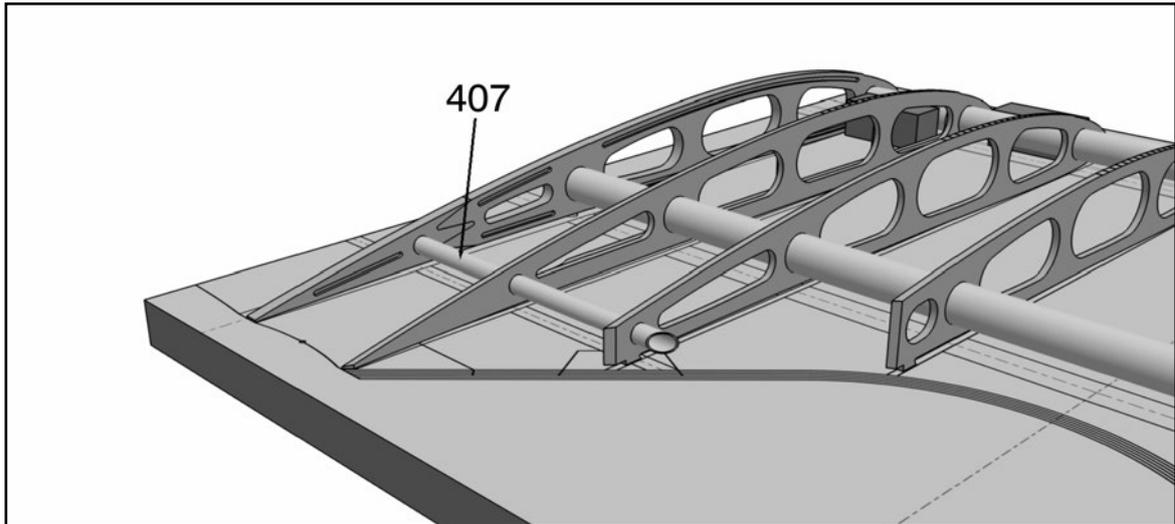
With the glue on the laminated ribs dry, thread the seven ribs onto the 16 mm aluminium tube spars (406) and lay over the plan and adjust position of the ribs until they are correctly spaced on the spars (406).

O



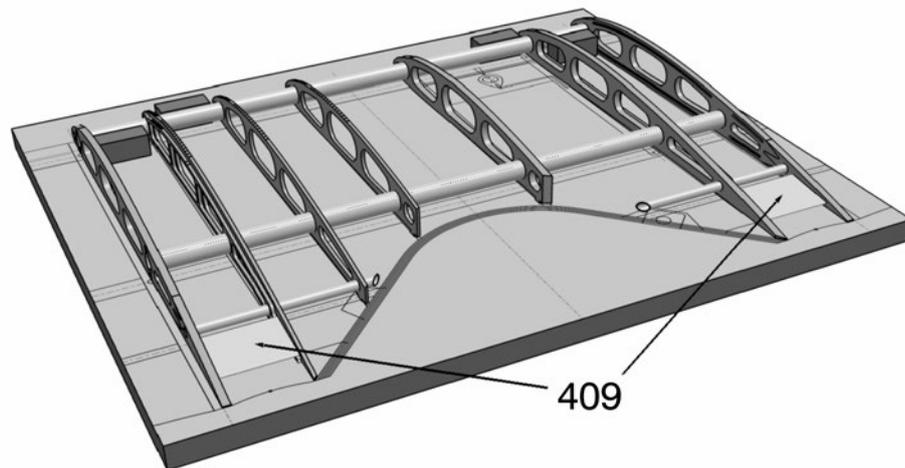
Nail the four hardwood blocks (619) to the board both sides of the rear 16 mm aluminium tube spar (406) to hold the center section accurately in place over the plan.

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File the ends of both 8 mm aluminium sub spars (407) to fit against the laminated bow (408) and insert these two sub spars into the ribs carefully.

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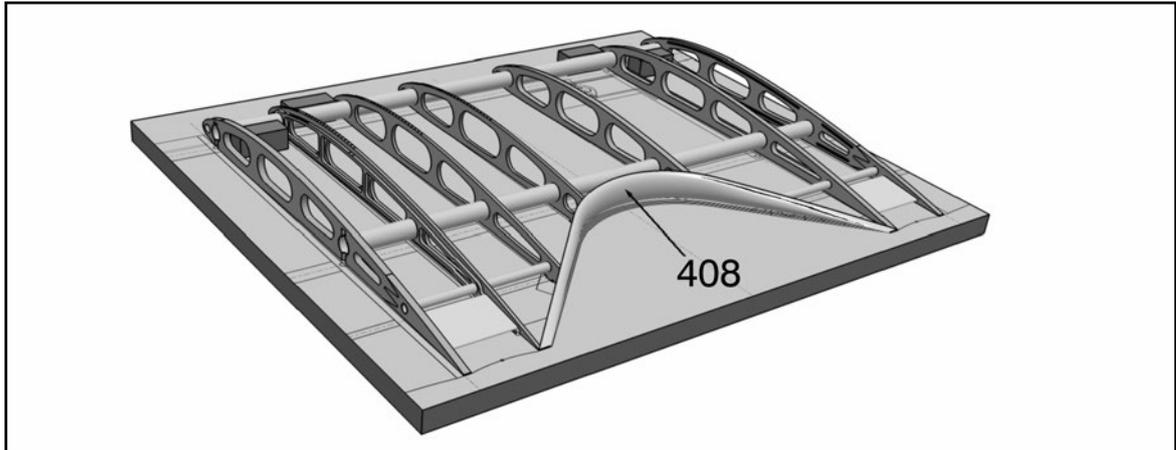


Using PVA; glue the two pieces of 2 mm thick balsa sheet stiffeners (409) at the trailing edge ends of the root ribs and allow the glue to harden.

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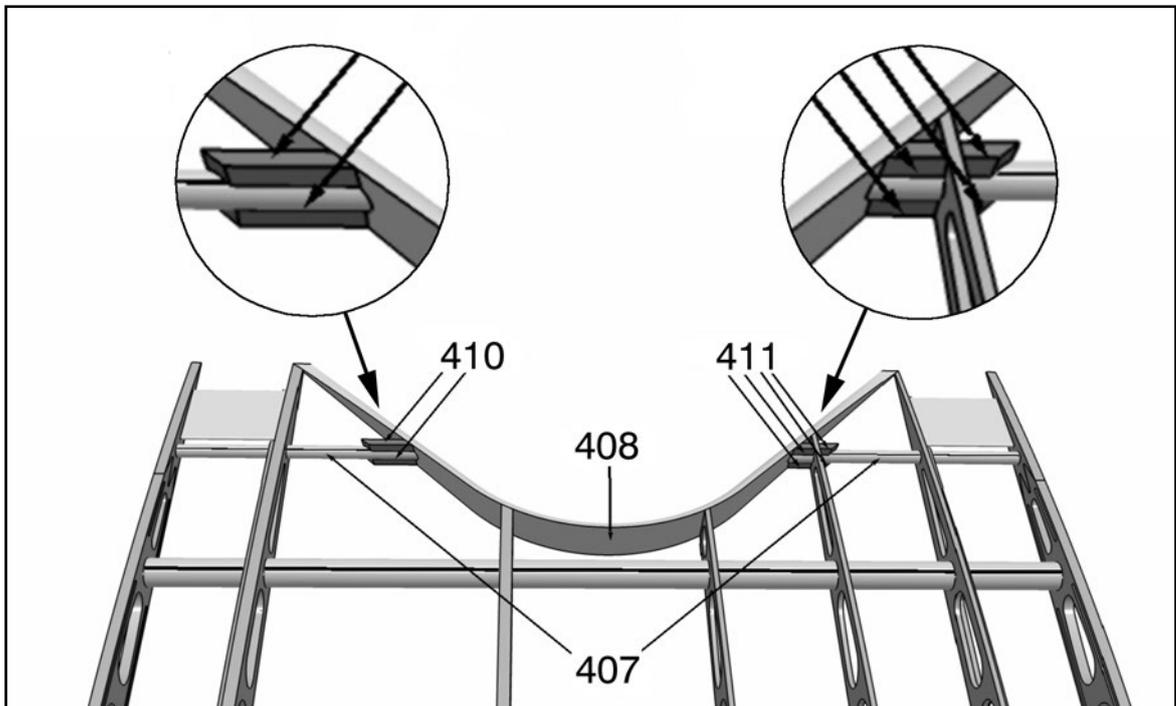
Mix epoxy and have ready the heat gun; apply a small drop of epoxy to each side of the ribs at the top of the spars as you have done with the wings; but only on the inside of the root ribs. Blow hot air through the spars until the epoxy runs around the spars and leave to cool.

O

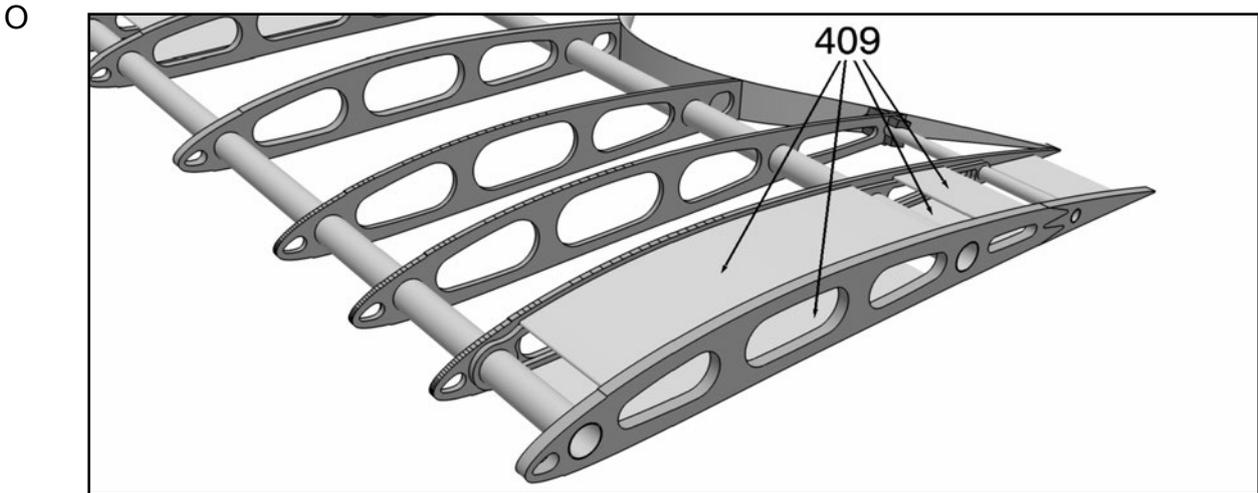


Clean up with sanding paper the laminated Balsa C/S cut out bow (408) then glue this to the ribs using epoxy and leave to cure hard.

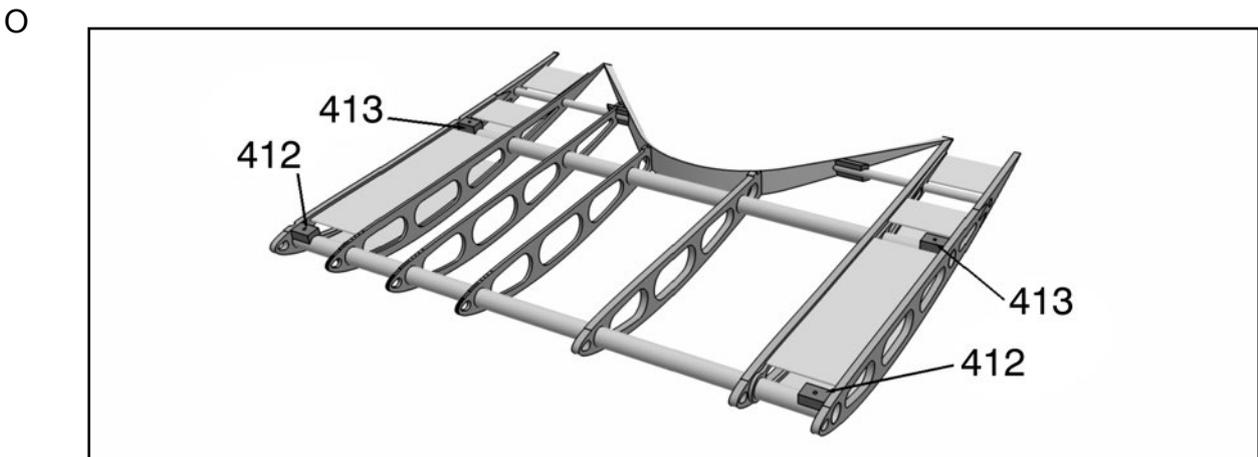
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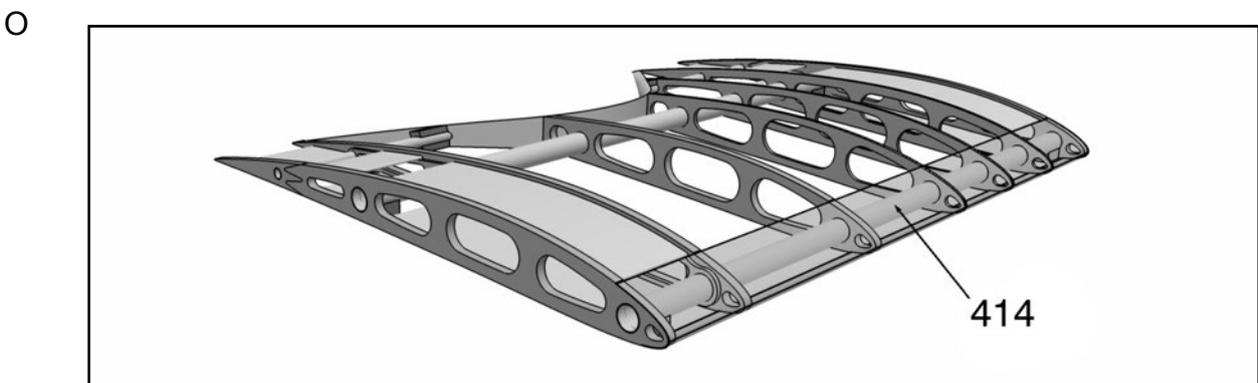
Remove the center section from the board; fit the two 8 mm sub spars (407) against the laminated bow (408) and glue to ribs and bow using epoxy. Epoxy the two Beechwood support scabs (410) long and (411) short over the 8 mm sub spars and against the bow. Leave overnight to cure hard.



With glue hardened remove the center section from the board. The 2 mm cross grain balsa stiffeners (409) must now be glued between the root rib (300a/300b) and the second rib (405a) (301b). Start by gluing these balsa stiffener pieces (409) side by side with cyano to form a wide strip, then cut to length.



Epoxy the two thinner Beechwood screw scabs (412) to the underside of the 16 mm aluminium front spar (406) and the two thicker scabs (413) to the rear spar (406); adjust the scabs so they fit with the rib contour.

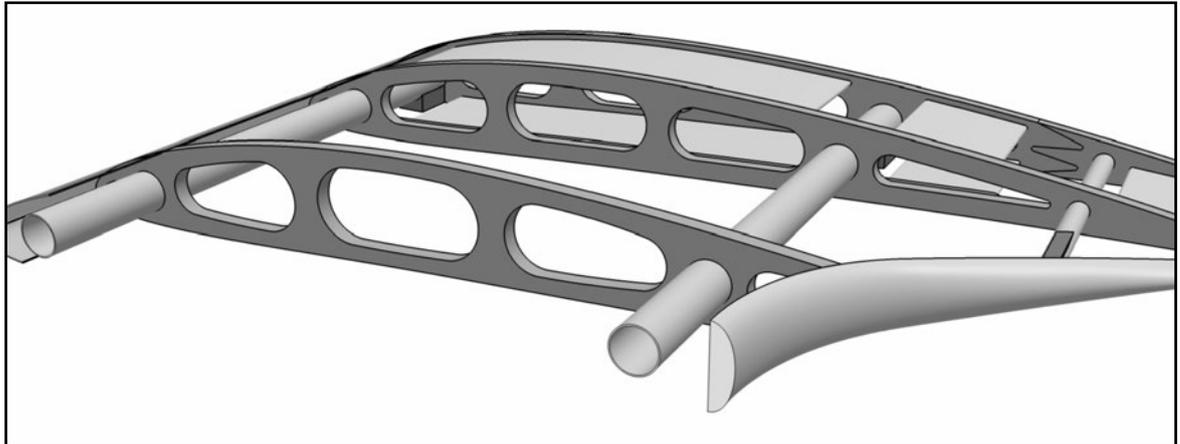


Epoxy the epoxy glass leading edge (414) over the ribs, using masking tape as

before to hold the leading edge. Again check the position of the four screw scabs (412) (413) and leave overnight to cure.

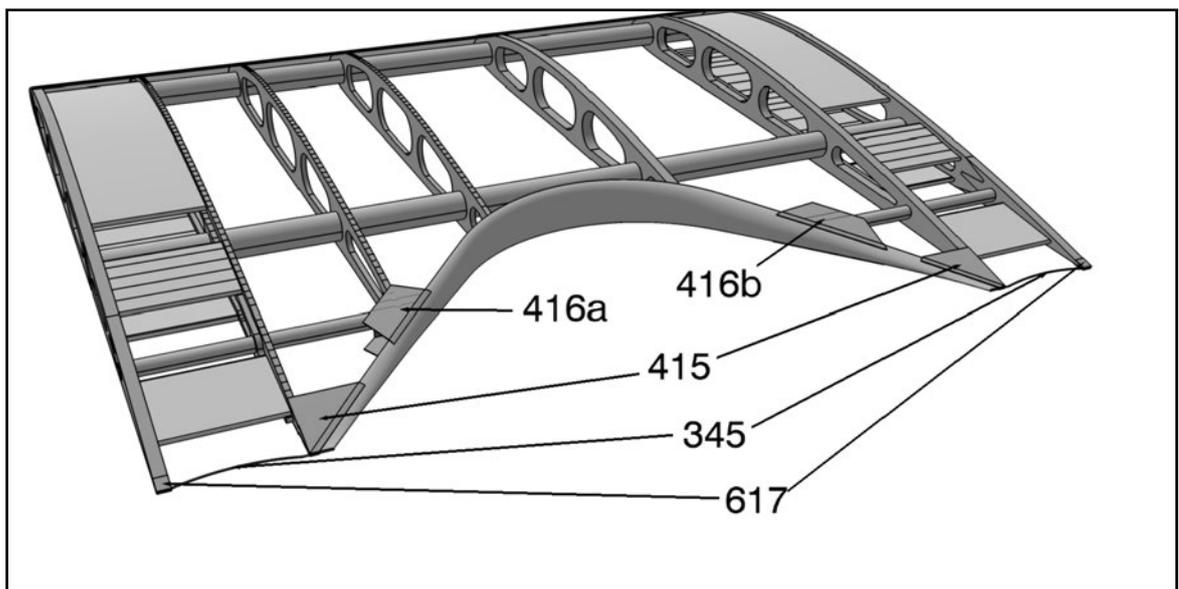
- O Remove the tabs from the rib ends to be ready to take the ProfiCover.

O



Plane and sand the C/S cut out bow (408) to shape and carefully round the outside edge top and bottom.

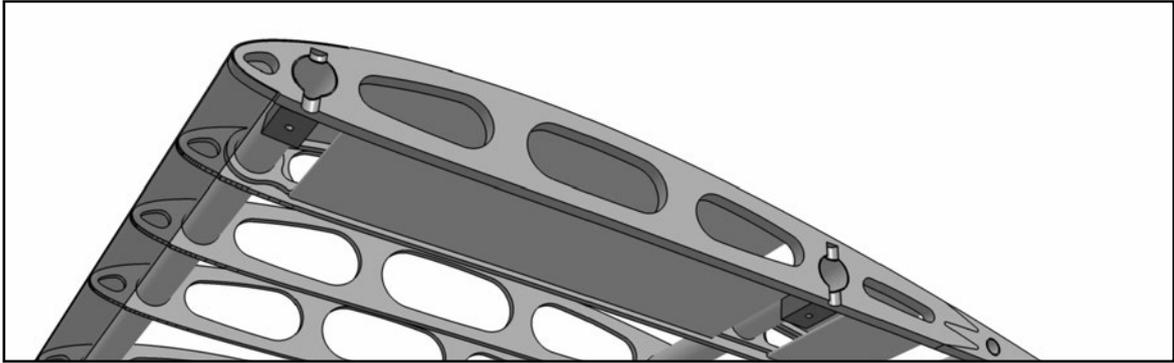
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Glue the four 0,4 mm covering scabs (415), the four covering scabs (416a) (416) and four trailing edge scabs (617) in place to take the Kevlar roving trailing edge (345), then fit the roving to the ribs same as for the top wings.

- O Fit the 4 Nylon wing dowels (125) onto the M5 threaded ends on the wing center struts; fit the center section onto the wing center struts; using a pointed knife mark the position of the M5 threads onto the root ribs (300a) both sides, remove the center section from the struts.

O

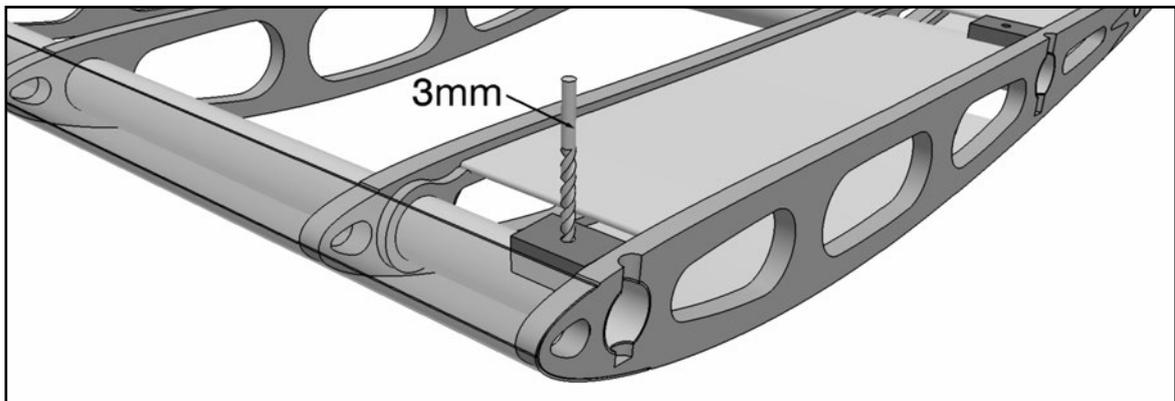


Remove the Nylon dowels (125) and cut a half round slot 2,5-3 mm deep into the rib at the knife marks; this groove is to accept the M5 screw in the wing struts holding the Nylon dowels (125). Then clean these slots up with a 5 mm round file. Cut also a half round slot into the root ribs of the outer wing halves.

O

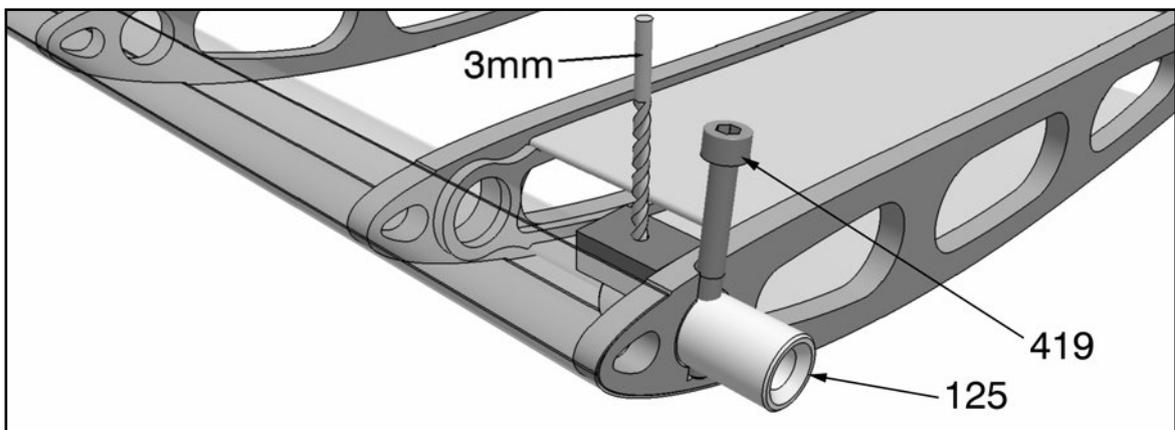
Fit the M5 x 45 socket head screw (419) into one Nylon wing dowel (125) have ready a 3 mm and a 2,5 mm drill as well as a M3 tap.

O



Lay the center section upside down onto the table, with a 3 mm drill; drill down through the screw scab as you will find these holes filled with epoxy, and through the aluminium tube on the screw scab side only.

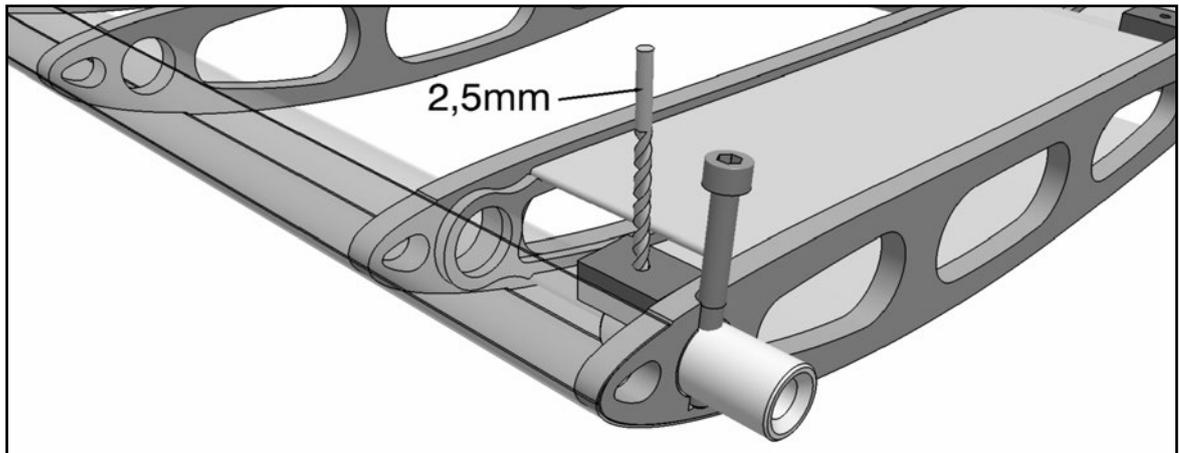
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Press the Nylon dowel (125) into one wing spar tube and check to see the M5 screw

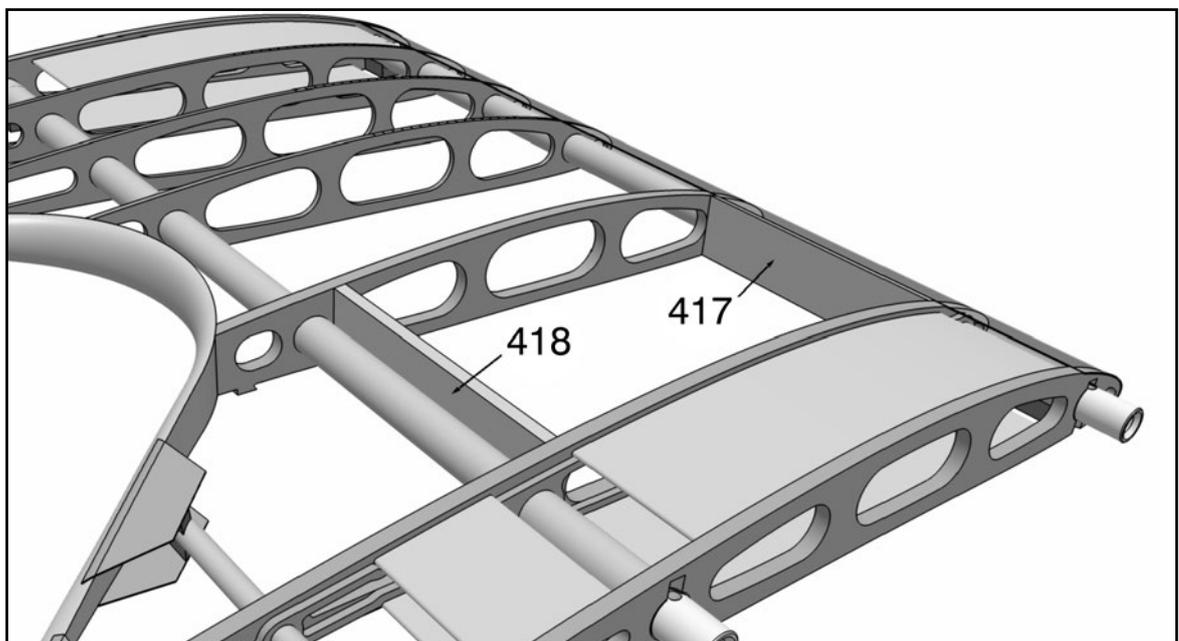
is halfway in the slot; hold the Nylon wing dowel firmly in place and with the 3 mm drill, drill just a millimeter, and no more, into the Nylon to give a center for the 2,5 mm drill.

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Without removing the Nylon dowel (125) use the 2,5mm drill to bore through the Nylon dowel, then thread this hole with the 3mm tap. Screw a M3x12 socket head screw (181) into the Nylon dowel (125), do not remove this screw yet. Fit the other 3 Nylon dowels in the same manner. Before removing the Nylon dowels mark these Nylon dowels and the respective number on the root ribs by the spar tubing.

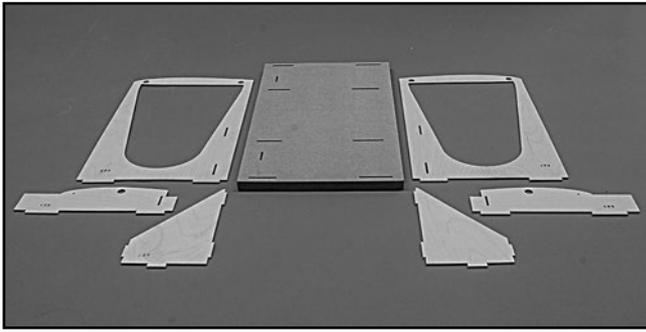
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Lay the center section onto the table, and glue the two radiator spacer (417) and (418) into place by pushing it against the spar tubes. Use a right angle to align them vertically between the ribs.

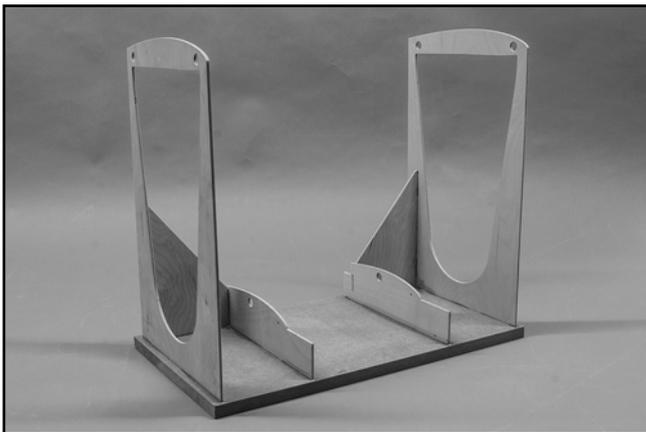
## RIGGING JIG

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This jig is made from the 19mm hardboard base (451) and the 4mm plywood side braces (452) and is used to set the four Nylon dowels (125) at the correct height on the wing strut screws.

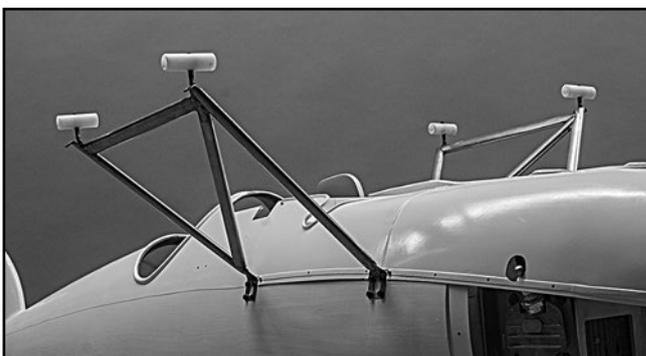
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Apply PVA glue to the two slots in both sides (452), insert the tongues on the diagonal braces (453) into the sides slots fully and allow the glue time to grip (our Titebond needs only 15 minutes). Then apply PVA to the slots in both short side braces (454) stand the two units upright and wait for the glue to grip. It remains to apply glue to the slots milled into the base (451) and push both units into the respective slots

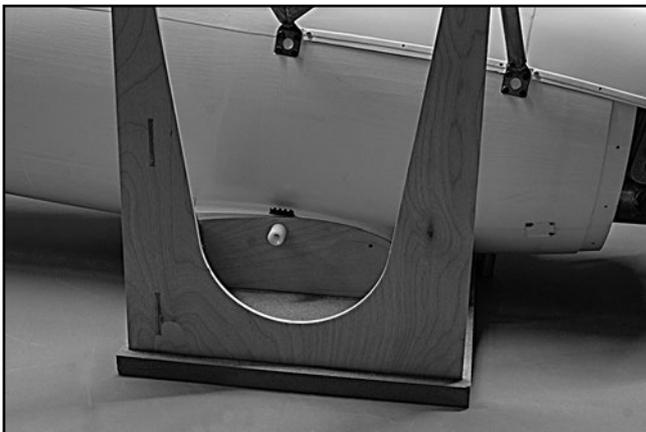
and leave overnight.

○



Remove the four Nylon dowels (125) from the center section and screw these Nylon dowels right way up, onto their respective screws on the wing struts. Ensure that you do this accurately, if not the fixing screws (181) will not run into the threaded portion of the Nylon dowels (125).

○



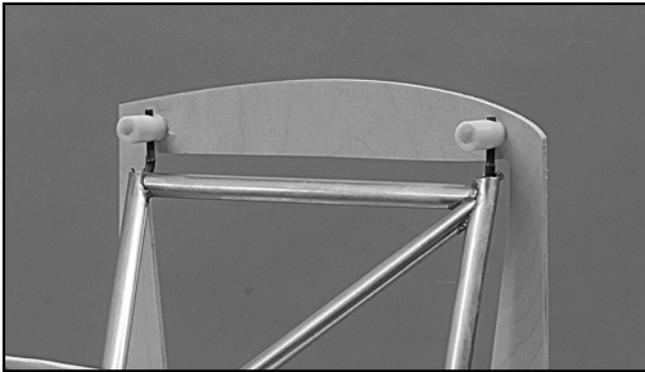
Lay the wing jig onto a long flat workbench; remove both undercarriage units (2), place the fuselage between the small braces (454) and insert from the inside of the fuselage one stepped Nylon dowel (622) through the bottom wing dowel hole in the fuselage bottom wing stub right through into the 3mm plywood side brace. Insert the second stepped Nylon dowel (622) into the opposite side.

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Tilt the fuselage carefully until the 4 mm diameter holes in the small side brace (454) line up with the brass tubes (19) in the bottom wing stubs, then insert the two 4x40 mm steel dowels (623).

O



Screw the Nylon dowels (125) up or down until they fit exactly into the holes on the large side braces (452).

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With the Nylon dowels (125) correctly placed with the incidence jig; fit the center section onto the Nylon dowels and insert the four M3x12 socket head screws (181) into the Nylon dowels (125) through the screw scabs (412) and (413).

O

screwing the dowels (125) up or down. It can be necessary to remove and refit the center section several times.

O

Remove the fuselage from the jig.

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Remove the C/S from the cabane struts without turning the dowels, you must take great care with this or the incidence angle will be altered. Fix the position of the dowels with masking tape so that they cannot be moved in any way, use a short piece of string to hold the cabanes from spreading as before until the C/S is refitted. The work on the fuselage fitting the wind screen, guns and so on is far easier with the center section removed.

## COVERING THE WINGS, ELEVATORS AND RUDDER

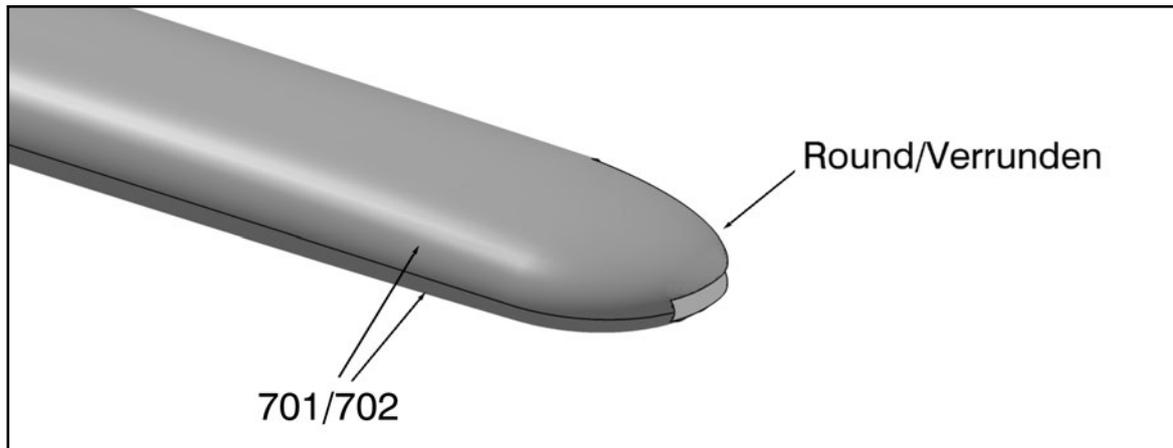
### Lozenge Pattern Camouflage

- During the 14/18 war, many German aircraft wings were covered with linen printed with the so called Lozenge camouflage pattern. As there is no commercially available printed Lozenge form covering material obtainable, I decided to make my own using our ProfiCover. The colouring material must be carefully chosen to withstand the heat from the electric smoothing iron, to this end I used the colouring material from the Silk-screen printing industry that is used solely for Tee Shirts and similar. The type I used is a single component air drying medium, taking about an hour to dry. I rang a company that is a specialist for Silk-screen printing materials. These colour I used were supplied in one liter plastic bottles.
- The Tee shirt colours that were available were not correct but by mixing I managed to obtain a very good match. I then made a photo copy of the Lozenge pattern enlarged to the correct scale a few times and held these together with Sellotape® so that I had a strip 2,5 m long. Next I purchased a roll of thick polyester tracing film. I used this to make a stencil for each colour. I laid one length of tracing film over the photocopied layout and cut out all the holes for say green, you must cut these holes slightly oversize so that the different colours overlap a little.
- Remove the stencil and lay a second sheet of tracing film again over the photocopied layout, cutting all the holes for yellow for the second stencil and so on. The ProfiCover was stretched over a table, the first stencil was fixed with Tesa Crepe band and the colour was applied with a foam sponge roller used normally for painting radiators and similar. Use the roller carefully by rolling from the outside to the center of the hole to prevent the colour from creeping under the edges. It is very difficult to see through the stencil enough as to whether the paint has indeed crept under the stencil.
- This is probably the first time you have used Kevlar for a trailing edge, but this does not give rise to any difficulties. Note! You must cut the panels lengthways from the ProfiCover roll and not across the width. Cover the underside first by tacking the Proficover to the wing root and then pulling the material tightly over the wing tips. Tack the covering material to the leading edge underside. Trim the covering at the trailing edge so there is a surplus of ten millimeters. Run the electric iron along the ribs tacking the material securely onto the ribs. Take great care with the iron at the trailing edge as it is very easy to break the ribs ends. Now fold the covering up over the Kevlar roving and onto the inside of the material, tacking this down onto the underside. Make a cut into the covering along the topside of the rib so you can neatly tack down the covering material both sides of the trailing edge of the ribs.
- The underside must now be taughtened with the iron so that the trailing edge is pulled in between the ribs. This must be done before covering the top half. Cover the top half by overlapping the trailing edge by about three millimeters on the underside. If you decide to use rib tapes these can be cut from ProfiCover 7,5-8 mm wide.

- Tack the rib tapes to the leading edge and carefully pull the tapes over the ribs without undue tension, if you pull the ProfiCover tape too much it will not stay straight. It is best to start with the underside first. You will find the ProfiCover adheres well to the stainless steel tubing without any additional adhesive. Covering the elevators and rudder is completely straightforward.

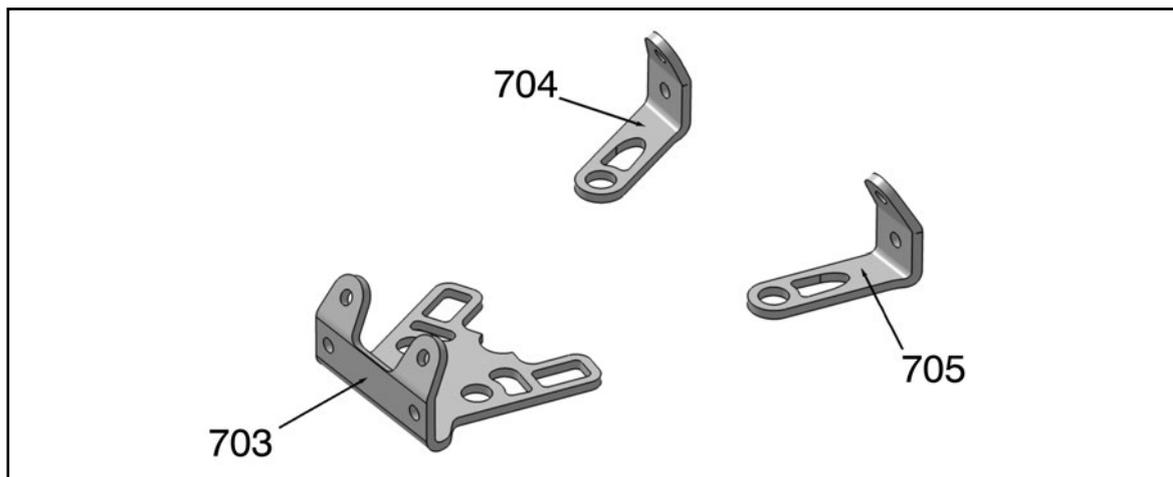
## WING STRUTS

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The eight ends of the spruce wing struts (701) and (702) must be rounded off with coarse and fine grit paper. Hold the matching pairs together with Sellotape® and clean the rounded ends off with 320 grit paper.

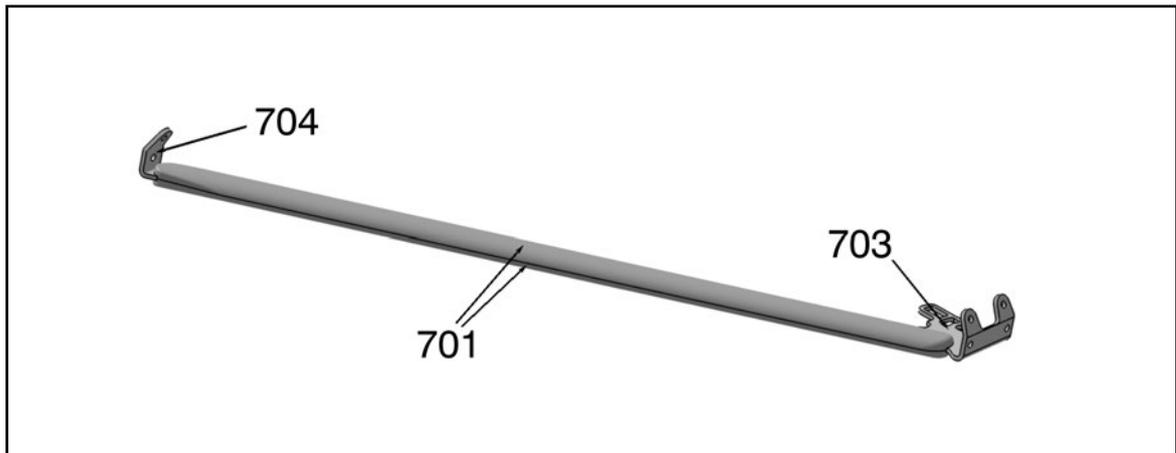
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The six 2 mm brass rigging tags (703) (704) (705) must be degreased with Acetone and a cloth; fit the struts together dry before finally gluing these together.

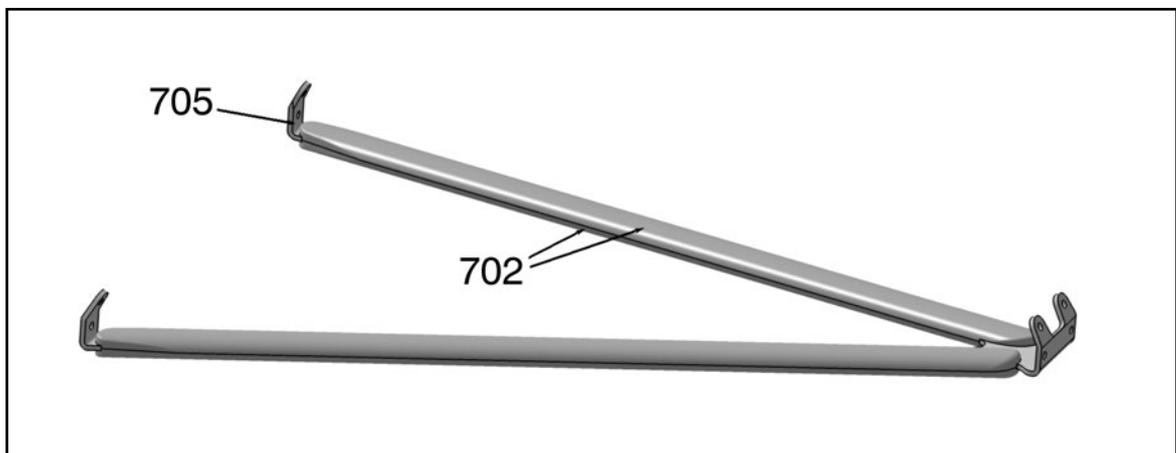
- These struts are rather complicated and you must ensure you can put these together correctly when you have smeared Epoxy onto the struts. Take care to fit the top rigging tags (704) (705) in the correct ends so these rigging tags fit against the curved top wing underside.
- Gluing these strut together with Epoxy is a rather messy job; use thin one way Latex gloves for this work.
- Cover the building board with plastic film and lay the struts (701) (702) out with the six 2 mm brass rigging tags (703) (704) (705) at the ends in the correct order; this will considerably help when gluing the struts together. Have ready at least eight small clamps or G-cramps.

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Mix together a desert spoon full Araldite 2011 Epoxy; smear a thin film over both ends of one strut half (701). Use a pointed strip of hardwood to work the epoxy evenly around the recesses. Press first the lower rigging tag (703) into the strut end; fit the top rigging tag into the strut end. With pliers carefully press these two rigging tags into the strut ends, take care not mark the wood with the pliers, use a small piece of plywood to protect the strut while pressing the brass tags into the epoxy coated wood. Smear a thin film of epoxy onto the rest of the strut evenly. Using the pointed stick work the epoxy into the two recesses on the second half of the strut and press the second half strut onto the first half using Sellotape® to firmly hold together both halves.

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Epoxy the second two strut halves (702) together as for the first ones, no need to use Sellotape®; Sellotape® is only required to hold the first strut together while you epoxy the second strut. Now clamp both struts together firmly; using the pointed stick, remove any surplus epoxy squeezed out and leave overnight for the epoxy to cure hard.

O

Next day remove the clamps and Sellotape®; sand off any small beads of epoxy with a fairly coarse grade of paper. Using a fine grit paper clean up the struts. Apply a coat of dope to the struts and leave to dry. Sand off with 400 grit paper and recoat with dope. Leave these struts for 24 hours to allow the dope to dry out, sand off with 400 grit paper and recoat with dope. Next day sand off again with 400 grit which should leave a really nice surface to paint.

## PAINTING AND FINISHING

- Painting the model and the first flight, is for me the most pleasurable aspect of the whole project. However to start with the fuselage and tailfeathers.
- Remove the wing center section struts (3) and the undercarriage legs (2). Take a piece of clean lintless cloth; an old linen bedsheet is ideal; apply acetone to the cloth and wash the whole of the fuselage, the two engine cowls and the two epoxy sandwich tailplane halves to remove as much as possible the release agent from the gelcoat surfaces.
- Cut out from the vacuum formed 0,5mm Polystyrene sheet the 4 air outlet covers (58) and 6 inspection hatch covers (71) as well the hinges thereto. You must sand the edges down so these parts fit flat against the fuselage and cowling.
- These Polystyrene formings must be glued to the fuselage and top and bottom engine cowling with cyano, but first the glue surfaces on the gel coat must be thoroughly cleaned with acetone as described.
- Please note, should you have chosen a paint scheme where the natural wood grain finish goes right to the nose then you must first fill the wood grain with black paint before gluing these Polystyrene parts to the fuselage. In this case these air intake covers and inspection covers were painted a dark grey colour.
- To simulate the half turn quick release catches on the inspection hatch covers, use a normal office paper punch to make paper discs. These paper discs must be glued with very thin cyano such as low viscosity Insta-Cure, or Insta-Flex allow the cyano to soak through the paper. As soon as the Cyano has hardened these discs can be sanded smooth with 600 grit paper.
- Bore two 1 mm holes into these paper discs 2mm apart; shape a piece of 0,6 mm copper wire and bend this into a U shape and fit this copper loop into the two holes. Glue the wire with cyano and trim off the overhang on the inside with side cutters. Note these small loops should be horizontal and not vertical.
- To spray the top (60) and bottom (61) engine cowls you will find it much easier if you make up two simple jigs to hold the cowls for spraying. Without these jigs you will find it almost impossible to hold these two cowls and at the same time spray them.
- I sprayed the outside and inside of the top cowl with silver paint as this cowl is made from aluminium sheet on the full size. I only sprayed the strip that simulates the aluminium sheeting around the bottom cowl. This allows one to slightly rub away the top coloured paint until the aluminium starts to show, this to give a worn affect.
- Use 600 grit wet or dry paper to rub down all surfaces without woodgrain structure, so these sanded surfaces are matted. Use the paper dry, if you use soap and water as is normal, this has the effect of polishing the surfaces. Take care with the tailplane

surfaces, avoid using too much pressure here. Remove the sanding dust with lintless cloth thoroughly as this white gelcoat dust has the tendency to stick firmly if it is not immediately wiped off. Use a fresh piece of cloth soaked with Acetone and wash over the sanded surfaces; do not use soap and water.

- You now need 2 component black auto paint, Glasurit or Sikkens I have found to be the best. Steel wool number 1, a piece of lintless cloth and kitchen roll paper.
- Screw a small piece of kitchen roll into a ball, cover this paper ball with the cloth. Put a little thinners used for 2 component paint onto the cloth.
- Transfer the black paint, without hardner, onto the cloth with a brush, rub this paint charged cloth onto the woodgrain thoroughly using a circular motion. Note that this 2 component paint without hardner dries fairly hard after two hours at 20 degrees.
- Blacken a small section at a time, then remove as much black paint as you can with the steel wool, you will find it easier to rub off the paint with vertical strokes; i.e. cross grain and not with the grain. If the grain is not evenly filled then rub over again with the cloth and paint. Do not blacken too big an area as the paint starts to dry very quickly and will be very difficult to remove when it is tacky.
- You will find the steel wool quickly fills with the paint, as soon as this happens take a fresh piece, you will need quite a lot of steel wool. This blackening of the wood grain is quite messy but you will find it goes quite well if you work on small areas at a time. The steel wool has the very real advantage as it removes any remaining release agent very effectively.
- You will now find small particles of steel wool spread every where inside and out of your fuselage. Before you start painting, this steel wool must be removed entirely. You can blow it out of the fuselage with compressed air, and off the outside surfaces. Then use a tacky rag to clean off the fuselage. Make thorough job of blowing out your fuselage to remove any sanding dust and other unwanted particles.
- Now you have to make Lasur paint (for those who may not know this term, Lasur is a slightly coloured transparent paint) with a very light yellow brown colour. I used the Glasurit transparent matt 2 component paint and added just a little yellow, start with a very tiny amount of yellow and spray this onto a white surface; add yellow if necessary to increase colour intensity and add the very slightest touch of light blue.
- Spray a little Lasur onto the underside of the fuselage; if you are not happy with the effect you can wipe off the lasur and add a little more colour and try again.
- Mask off the nose and fuselage front end, the tail end and cover the entire wood grain area with paper and masking tape. I used a flexible plastic masking tape from 3m for the paint line.

- Fill all holes in the fuselage with newspaper to avoid overspray, especially in the cockpit, spray the colour onto the fin and rudder, tailplane wing struts and undercarriage legs with the bottom inspection hatch (13) and the rudder horn cover (8).
- Please note the ProfiCover does not need any form of primer, you spray the paint directly onto the material.
- Refix the wing struts (3) only, this time using the M3x10 hexagon head screws (4) and safety nuts (52).
- Fix the undercarriage permanently to the fuselage, this time with the hexagon headed M3x8 screws (4) and safety nuts (52). Fit the spreader bar tube (6) between the undercarriage legs and bend the split pin (7) arms just a little.

## PAINTING THE MG'S AND ENGINE

- In painting your model you are attempting to create an illusion; you are going to paint plastic parts to look like metal, to make this illusion effective you have to use paint in an unusual fashion to succeed, you have to use a technique used by all artists who have ever painted with oils. The trick is never to use pure colours over any area, instead you dirty the colours up by mixing wet in wet paint together on the object. Next time you have a chance to look really closely at an oil painting, you will notice this clever effect. These three imitation parts, guns and engine, are all metal and were mat black on the full size machine. If you simply paint these parts mat black overall they will have a dead, an almost two dimensional appearance like pictures painted by numbers. The solution is very easy, you mix other colours into the black paint. You need Humbrol mat paint in these colours: rust red, black, a very dark green and an umber or sand colour and white spirits.

### IMITATION ENGINE

- Have a palet cut from hardboard and use a brush to transfer black and umber coloured paint onto the palet. Start with one cylinder and paint the cylinder black, wipe the brush out on kitchen roll paper, apply a very little umber onto the wet black paint in several places and use the brush to mix the two colours together so a lighter colour exists in patches. Now mix together on the palet black and umber, do this by adding a very tiny amount of umber to black until the black starts to lighten, lightly paint this mix onto several places and brush out well so there is a very subtle change from black to a lighter shade.
- Mix the dark green and black on the palet until it is almost impossible to see the green; use this colour to paint over the black very sparingly to give the slightest very deep green tinge, this will give a very realistic finish. Paint a second cylinder only with black and look at the difference from say a meter away, I'll leave you to decide which is best. On the fullsize engine the intake manifold was wrapped in cord for insulation, so use umber darkened a little with black and paint over the intake manifold. You must now use black, brush this black into the umber overall so that the umber is clearly visible but with a rather black and dirty appearance. The cog nuts fixing the intake manifold are painted black brush a very minute amount of umber onto the top of the cogs so as to simulate reflection.
- Around the exhaust flanges on the cylinders you can use a very thin pointed brush and paint these flanges with the rust red paint, then tone this red down while still wet with UMBER so there is no strong red paint left, only a redish brown colour blending into the mat black; here you have to imagine the heat causing rust to form at the flanges and the start of the exhaust pipes.
- Paint a very small amount of UMBER around say a third of the edge of the valve heads and just a little on the top edge of the valve rocker arm lever this to give the effect of light reflecting, use the smallest amounts of umber possible.

- If your artistic work does not please you, wait for the paint to dry and then paint over again.

## SPANDAU MACHINE GUNS

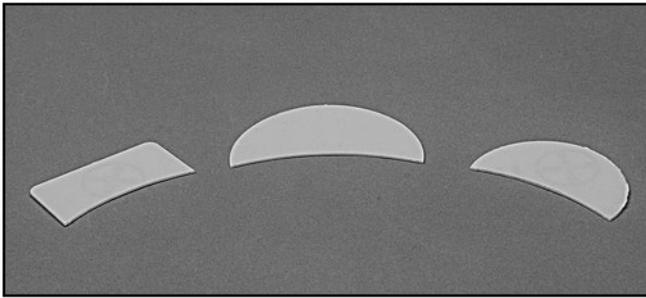
- These need only mat black and mat dark green. First paint the machine guns completely with mat black; before the paint has time to dry, paint a little green onto the black and mix this into the black so there is just a hint of green, but only just the slightest hint. The vacuum formed amunition shute cover (111) was made of leather, you have to paint this to give the effect of paint being cracked and the leather showing. Paint an old piece of leather and when the paint is dry bend the leather to form cracks to give you an idea.

## LEATHEREDGING

- Slit the red surgical tubing (118) along one side for the entire length so this will fit over the cockpit opening bead moulded in the glass fiber. You can secure this tubing with a little Pattex or similar contact adhesive.
- Lay one piece of leather 390x60mm (119) from fuselage middle join to fuselage middle join, glue this leather down with transparent contact adhesive, you have to really pull this leather around to get it to fit over the surgical tube without undue folds.
- Glue this leather onto the glass fiber so there is a neat flange 8 mm wide laying flat on the glass fiber fuselage. Fit second piece of leather (119) same as the first.
- The piece of leather (120) 190x25 mm is glued around the front opening behind the MG's glue this down with contact adhesive.
- Space 36 eyelets (121) around the cockpit opening and 16 around the front opening. using a pair of double pointed dividers To do this you first have to drill through the leather and Fiberglass with a 2 mm drill. I found it eased the job of inserting the eyelets, by first threading these one at a time onto a piece of 1,5 mm wire, poking the wire through the hole and then pushing the eyelet down into the leather.
- These eyelets (121) must now be sewn using a button twine of a light brown colour.

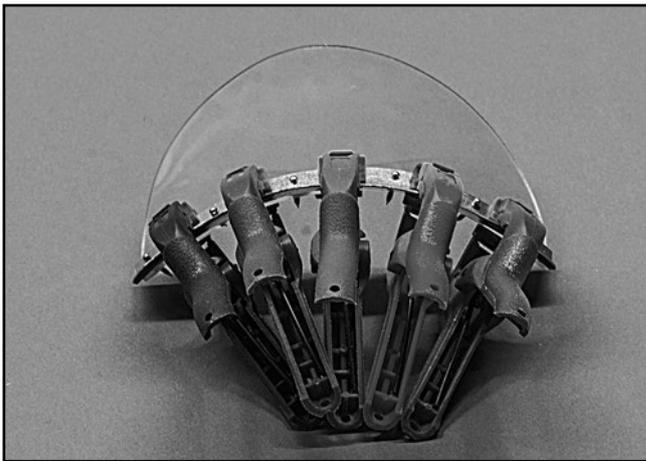
## WINDSCREEN

O



Cut the matching Windscreen (122) out of the clear plastic film. Modify it until it matches perfectly to the Albatros you want to built. Unfortunately every Albatros had a unique windscreen. As a result of this we are not able to provide every used Windscreen.

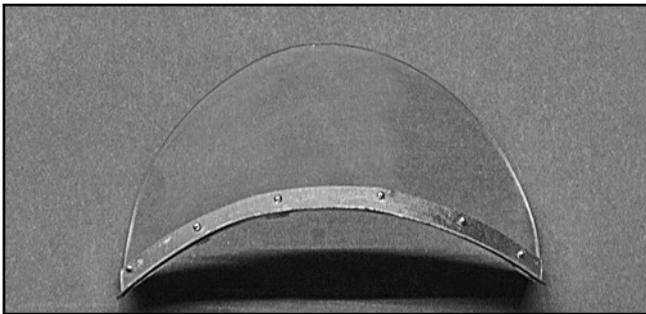
O



Shape the transparent windscreen (122) into a curve using a hot air pistol. The 0,5mm aluminium frame (123) is fixed to the windscreen using the tiny brass nails. Drill six holes evenly spaced along the bottom edge with a 1mm drill 3mm from edge. Hold the aluminium frame (123) onto the windscreen with clips and then with the 1mm drill bore the holes through the aluminium frame (123). Insert a 1x9mm nail (124) into each hole

from the front apply a very tiny spot of epoxy to each nail shaft and leave overnight.

O



Next day cut the excess nail shafts (124) and if necessary the aluminium frame back.

O

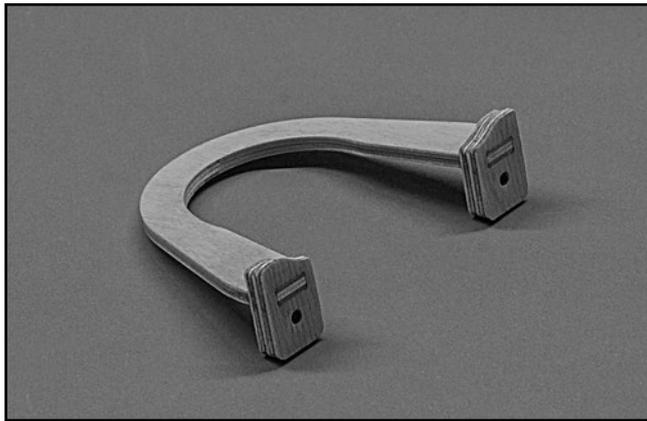
It then remains to drill a 2mm hole at each end of the frame (123). Fix the windscreen to the fuselage using two M2x8 woodscrews (112).

O

Permanently fit the two machine guns using two M3x20 (187) and two M3x25 (51) socket head screws and M3 safety nuts. The ammunition shute cover (111) is fitted on the left side with four 2x8mm screws (112). Now fit the center section using the four M3x16 socket head screws (186).

## FITTING THE FUEL TANK

O



Using Epoxy, glue the 3 mm thick plywood tank collar (153) to the two 6 mm thick plywood retaining feet (154). Use two 3,5 x 13 self tapping screws (18) and two M4 washers (21) to fix this collar to the tank rails later. Give the finished collar a coat of dope.

O

Next you need a short piece of 6 mm steel wire dowel, or an old 6 mm twist drill. This is heated up to melt the three holes in the tank to take the nipples (156).

O



Use a fine felt tip pen to mark a line on the plain side of the tank 22 mm from the base right across the width; now mark a line 22 mm from each side; at these two crossing lines you now have to melt a hole through. Heat the 6 mm diameter wire dowel, or old drill. Dowel does not need to be brought up to red heat, push this hot dowel firmly against the tank body the lines cross and it will melt its way through. Quickly and carefully pull out the

heated dowel leaving a neat and wicker free hole. Melt the second hole in the tank body and then the third hole through the middle of the tank screw cap.

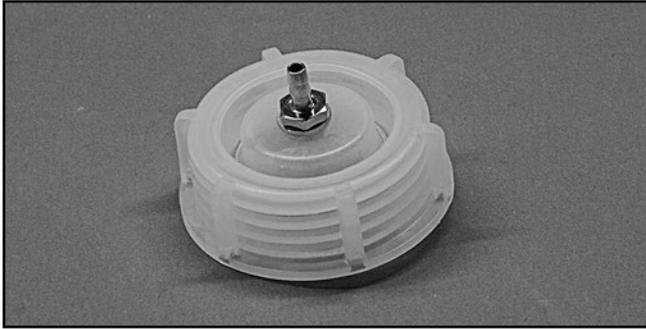
O



For the next job you need a little Loctite to fix the nuts to the nipples securely. To insert the two single sided nipples (156) into the tank use the piece of 0,8 wire (160) and thread this through a hole in the tank and out through the neck, it is then a easy matter to thread the nipple onto the wire and hold the tank vertical so the nipple will slide down the wire against the hole to enable you to pull the nipple through

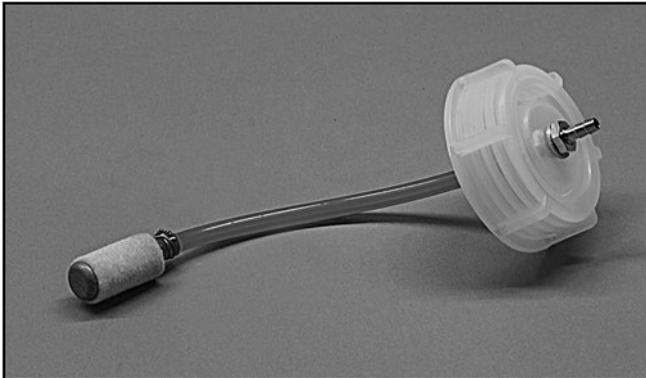
the hole.

O



The double sided tank nipple (158) must be fitted to the screw cap same as for the single sided nipples (156), note that the threaded portion must be on the outside.

O



Push a piece of fuel tube onto the felt clunk filter (159); wrap a piece of the 0,8 mm iron wire twice around the the fuel tube over the nipple and twist the ends twice together, cut off the waste ends of the wire. Cut the fuel tube to a length so that with the screwed cap fitted, the filter is about 10 mm from bottom of the tank. Fit the fuel tube onto the nipple and secure with the

0,8 mm wire (160).

O



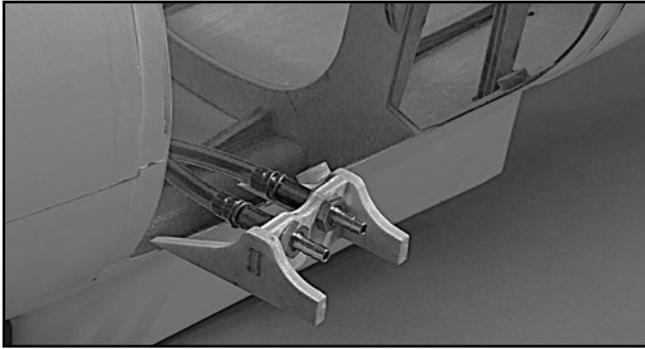
Cut two pieces of fuel tubing (161) 420 mm long, push both pieces onto the two single sided nipples (156) and secure these with the 0,8 iron wire (160) as before. Push the double sided nipple (158) into the tubing with plain side going into the tubing, secure the tubing with the 0,8 iron wire (160).

O



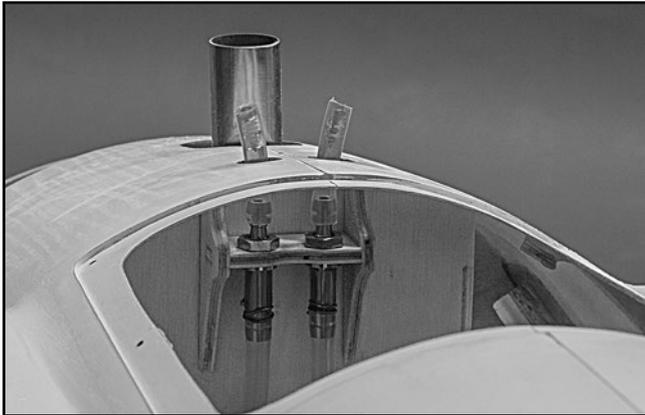
Push the finished tank into the former almost up to the nipples, turn the fuselage upside down and fit the collar over the tank and secure this with the two 3,5x13 mm self tapping screws (18) and M4 washers (155).

O



For the recessed fuel fitting support glue together the parts (200) and (201) and protect the parts against the gasoline with a coat of dope. Fit the two double sided nipples and secure the nuts with thread locking compound.

O



This unit must then be glued to the rear of the silencer box. Cut two holes into the fuselage underside to allow the two short pieces of fuel tubing with the threaded portion of a screw pushed in, to be fitted in these.

## ELEVATOR SERVO CABLES

○



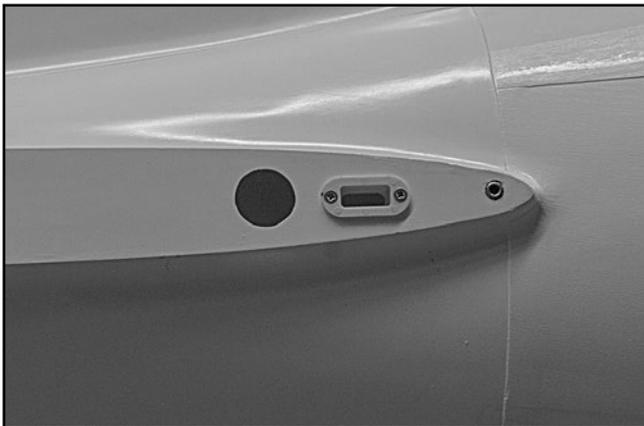
Cut an oblong slot in both tailplane stubs to take the MPX sockets (not supplied with kit) along with the socket carriers (available from Graupner) these slots are 17 mm long and 8 mm high and 45 mm from the nose of the tailplane stubs. Ensure the nylon carriers are a tight fit into the slots. Cut a 18 mm diameter hole 10 mm on the rear side of the cable socket slot these are to ease the fitting of the screw scabs

(14).

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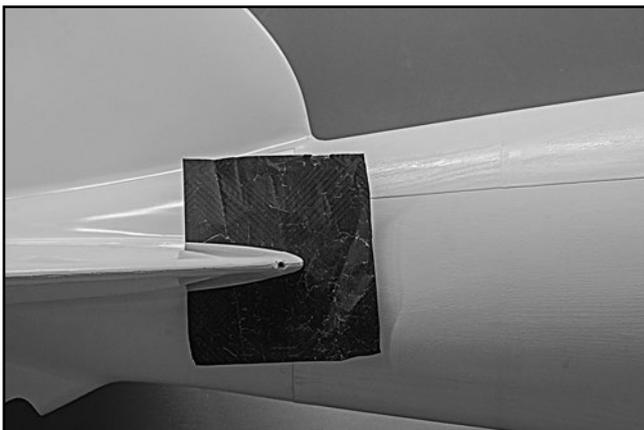
Glue the four 8x8x3mm plywood screw scabs (189) with microballons thickened epoxy, just inside the slots both sides of the fuselage.

○



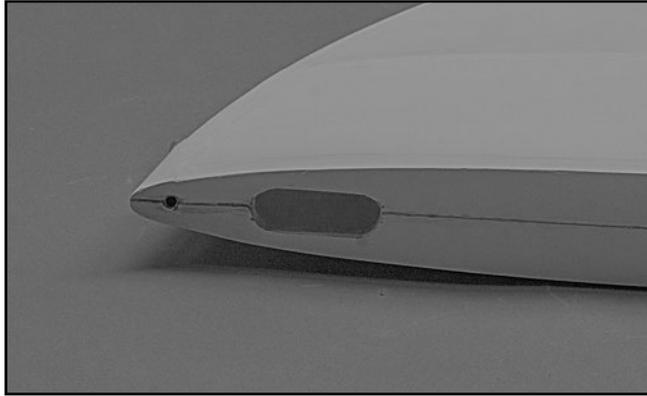
Leave overnight to allow the epoxy to fully harden. Next day insert the cable connector carrier into the slot and use a 1,5 mm drill to drill through the plywood screw scabs. Then screw the two counter sunk screws (78) into the screw scabs.

○



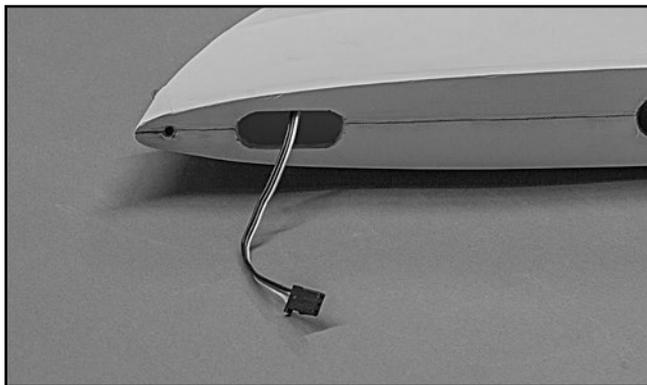
Fit the two tailplane halves onto the fuselage with a small gap between the two cable sockets lay a piece of carbon paper over the conector and press the tailplane half onto the socket apply a little pressure and then remove the tailplane halves, the carbon paper should leave a mark on both halves.

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Remove the tailplane and cut a hole into the tailplane big enough to go over the socket with a small gap right around. Refit the tailplane to check that the hole is big enough.

O



Remove the tailplane and using a bent piece of wire, poke a hole carefully through the soft material supporting the front phenolic paper dowel tube, make this hole big enough for the servo cable to pass through.

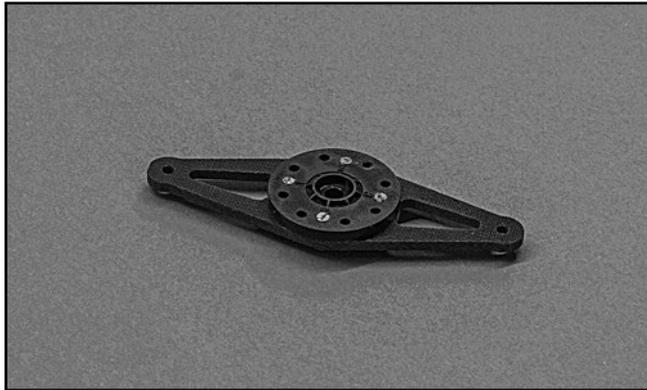
- O Cut the servo cable connector off and solder the cable onto the plug using heat shrink tube to secure the solder joints.
- O Complete the second tailplane half exactly as for the first.
- O The elevator servo cables must be made up. Use heat shrink tube to secure the wires onto the socket bodies. Thread the cables through the white plastic carriers and then thread these into the fuselage and up to the receiver box. Apply as little as possible cyano to the join between the socket and the white plastic carrier to permanently fix the socket. Use a small screwdriver to transfer the cyano glue.
- O Use PVA to glue the cover strip onto the servo cable bridge (168), reinforce both ends with button twine or similar and a small amount of cyano glue. The two servo cables are pulled through the bridge (168) with a piece of strong thread. To get this thread through the duct use a piece of 1,5 mm wire. This duct must be fixed about half way up the fuselage side. Lay a short strip of double sided adhesive along the duct to temporarily hold the duct in place.
- O Push the duct down towards the end of the fuselage carefully. One cable goes directly into the duct and one is pulled across the fuselage. Make sure the cables are not hanging down or they can get in the way of the rudder control wires.
- O Press the duct onto the inside of the fuselage and secure with two 5 mm wide strips of the double sided adhesive tape to act as straps, one at the front and the other as

far back as you can reach. Now permanently fix the duct with silicone by the adhesive straps, use as little silicone as possible.

- O Fit one ferrite oxide choke ring on each cable just before the receiver. Solder the servo connectors to the cables and secure with heat shrink tube.

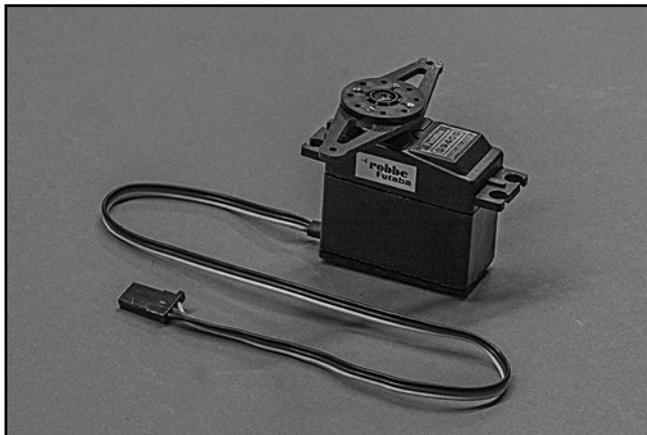
## FITTING THE RUDDER

○



The 2mm thick Tufnol yoke (54) must be fitted to the 21 mm diameter servo output disc, use four M2x12 cheese head screws for this. These screws are a tight fit in the nylon and need no further securing. Cut off the protruding screws flush to the output disc.

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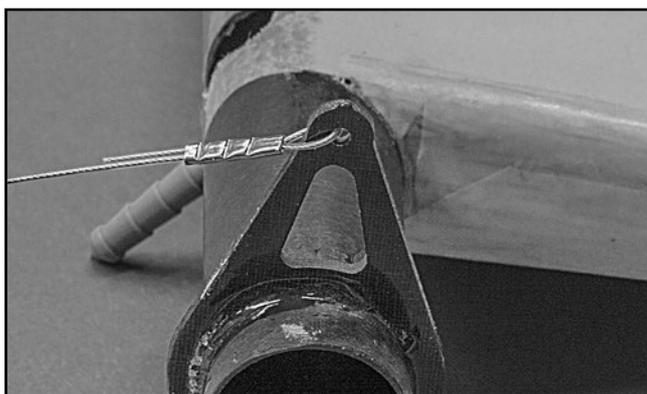
The fuselage former must be slightly hollowed to take the rudder servo cable. You must cut a slot into the inspection hatch flange over the rear servo screws so that you can drill out the rudder servo fixing screw holes. Fit the servo output disc with the yoke (54) fitted onto the servo. Secure the metal fixing screw with middle strength Loctite.

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Fix the rudder servo onto the plywood carrier using the four screws and rubber grommets supplied with the servo.

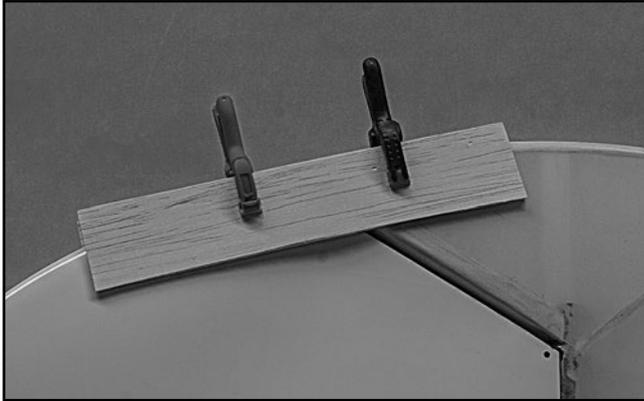
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Cut two pieces of the 15 kilo wire (170) 1400mm long. Fit one piece of wire to each side of the rudder horn (43) using a crimping sleeve (171), press these sleeves really flat with pliers and using pinchers crimp three times carefully. Thread these two control wires into the fuselage and insert the Robart hinges into the sockets, adjust the

rudder position so that the gap is correct over the fin, screw in tight the two small socket grub screws. Check to see that the two loops of wire are sitting correctly on the rudder yoke.

O



You can reach the wires from the cockpit opening and pull these forward to the servo. The rudder can be clamped in the neutral position with two strips of wood.

O



Turn the fuselage upside down, support the fuselage so it is not resting on the rudder, then fit the two cables onto the rudder servo yoke using a crimping sleeve each side, after you have ensured these two cables are not crossed. Do not pull these cables too tight and only flatten one end of the crimping sleeves (171) slightly.

O



Turn the fuselage upright and remove the two strips of wood clamping the rudder, check to see the rudder moves properly. When all is satisfactory turn the fuselage upside down and crimp the sleeves (171) really flat onto the wires with three grooves made with the pinchers, trim off the overhanging wire.

## PILOTS SEAT

○



Fit the two 6 mm stainless steel tubing seat rails (148) into the holes in the formers, slide the two Tufnol cross braces (150) onto the rails (148) and center the rails and fix at both ends with cyano.

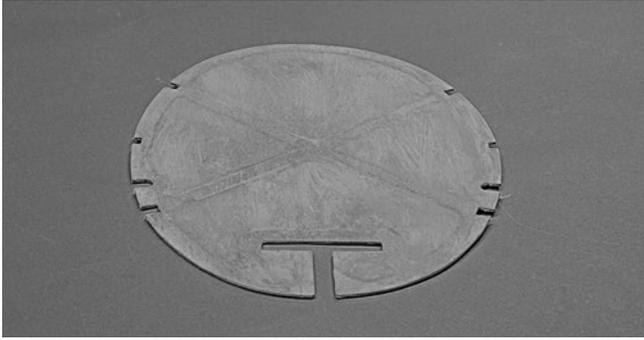
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Wrap a short piece of adhesive backed Klett band (147) around the cross braces (150). Fit two pieces of Klett band (147) to the underside of the GRP seat (146).

## FABRIC FUSELAGE CURTAIN

O



Cover the curtain former (180) with ProfiCover, very lightly shrink the ProfiCover, this can be later painted with the sand coloured dope as used for the cockpit skinning (178).

O



Place the curtain into the fuselage and drill a 1,8mm hole into each bracing. Fix the curtain with four 2,2x9,5mm screws.

## RIGGING WIRES

### Undercarriage:

- Cut two pieces 160 mm and 480 mm long from the plain Bowden cable (110). Using the crimping sleeves (173) with the turnbuckles (174) fix the short pieces of Bowden cable to the top cable fixing points on the undercarriage legs (2). Screw the two turnbuckles almost the full way unscrewed so that just about two threads are still in the body. Fit the 480 mm Bowden cable between the turnbuckles and the bottom cable fixing points on the undercarriage legs. Before crimping the sleeves (173) make sure the cables will be taught with the turnbuckles screwed rather more than halfway in. Press the sleeves (173) flat with pliers, then using pinchers, press at least four indents into the sleeves (173). Tighten the turnbuckles so wires are really tight. Use the nuts to lock the turnbuckles (174) and use the iron wire (92) as well.

### Wing center section:

- Refit the center section onto the four Nylon dowels (125). Take care that you do not allow these dowels to turn before they are inserted into the tubular spars, best is to fix one side at a time. Screw in the four M3x12 socket head screws (181)
- Cut four pieces of 100 kg wire (172) 110 mm long and four pieces 400 mm long. Use the 110 mm long wires to hang the eight turnbuckles (174) onto the wing struts (3) so that these wires holding the turnbuckles (174) are about 70 mm long. Bend the crimping sleeves slightly oval so these slide over the two wires. Use a pair of pinchers and not pliers to crimp these sleeves as pinchers cutting edges close parallel and not inclined as is with pliers or similar.
- Thread the four 400 mm long pieces of wire (172) into the brass rigging tags (17), you will find this a rather tedious job, however slide the oval pressed crimping sleeves (173) over the wires and crimp just once. The other ends must be threaded through the turnbuckle eyes after threading the eight crimping sleeves onto the wires.
- You can then tighten up the turnbuckles slightly to see that when the sixteen sleeves are finally crimped that there is enough threads on the turnbuckles to tighten the wires. If not you must open the crimping sleeves and tighten the wires. You now have to use the centering jig (455) to correctly align the center section over the fuselage. Hold this jig to the underside of the center section so both hooks are onto the ribs, the small slot on the underside of this jig must be over the fuselage join line. Altering the turnbuckles length one side or the other will allow the center section to be pulled into the correct position.

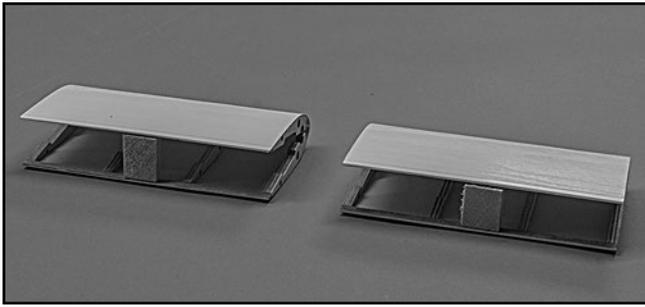
### Wings:

- Fit the 4 wings onto the fuselage with the wing struts (701)(702) screwed firmly in place between the wings.

- Cut from the 100 kilo wire (172) the wing wires, 4 pieces 680 mm long and 4 pieces 120 mm long. Take sixteen crimping sleeves (173) and very lightly bend these oval so they fit over the two strands of the 100 kilo wire (172).
- Bend up 25 mm on one end of the 380 mm long wire and insert the short end into the outside hole on the lower side brass rigging tag (703) and pull this wire through, slide two crimping sleeves down the wire and over the short end and push the sleeves up tight as you can against the rigging tag (703). Crimp the sleeves flat with pliers and using pinchers lightly crimp the sleeves at least six times.
- Fit the remaining three 380 mm wires to the rigging tags (703) bottom end of the struts, using the outside holes. Fit the four 120 mm long pieces of cable to the wire loops at the top of the steel tube wing struts (3) same as you have done for the longer wires.
- Unscrew the four steel turnbuckles (174) as far as you can and then screw the eye screws in one and a half turns. Fit one turnbuckle to one short wire from the wing struts (3) using one crimping sleeve (173), fit the turnbuckle with the hexagon nut on the topside.
- Adjust the short 120 mm and the long 380 mm wires so they are hanging correctly on the rigging tags (17) and the 2 mm wire loops on the wing struts; pull both wires taught and mark the turnbuckle bottom eye onto the bottom wire, slide two crimping sleeves (173) over the wire, bend the wire to a right angle at the mark and thread the wire through the turnbuckle eye, push the sleeves over the short end but do not crimp before you have checked to see that by screwing the turnbuckles together you can tighten the wire until it will ping like a guitar string. Satisfied?... then crimp the sleeve as before.
- Fit the other three turnbuckles (174) and screw the nuts up tight to turnbuckle body.
- Use the center section aligning jig (411) to check the center section is correctly placed, the two hooked top ends fit over the ribs and the slot must be over the fuselage join line. You can carry out any corrections by slackening the turnbuckles one side and then tightening up the other side.
- Fit the remaining four wires, which run from the rigging tag (17) on the fuselage, to the upper rigging tags of the wing struts (704) (705). These will not need any turnbuckles, so crimp one end of the wires on the rigging tag (17). Thread the wires through the upper rigging tags (704) or (705) and two crimping sleeves. Pull the wires taut and crimp the sleeves as before.

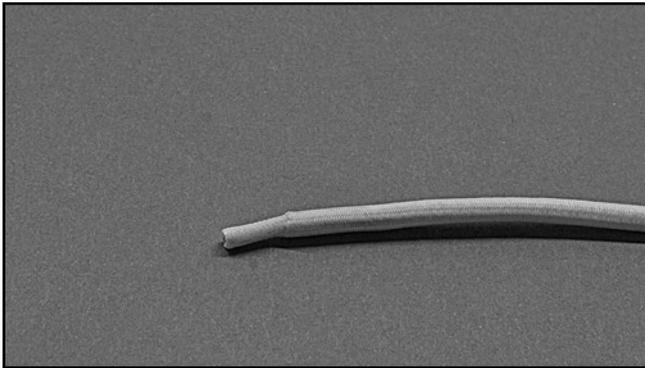
## WHEEL AXLE FAIRING

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The glass fiber axle fairings (185) must be held open enough with small pieces of wood to enable the plywood ribs to be doped with two coats of clear dope.

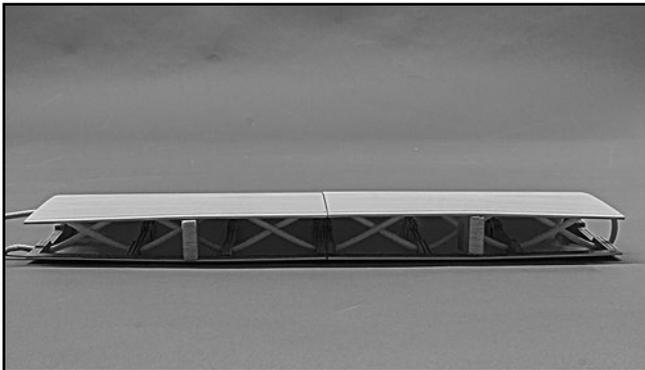
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The rubber shock cord (16) must be threaded through the two axle fairings (185) after both parts are painted. It is important you place the ends of the fairings together with the larger holes to take the shock cord (16) facing each other on the inside. The shock cord will not pass through the smaller holes as it is supplied. So the cord end (about 1

centimeter) must be made thinner. Clamp one end only in the vice and use pliers to really pull the cord to a maximum, so reducing thickness, apply very thin cyano, such as Flash Thin onto the stretched portion, hold the cord at full stretch until cyano is hard. You then need to cut the ragged end off and you will find the cord just fits into the hole.

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Push the end of the cord (16) into one hole in the outside rib and then cross over to the next hole in the inside rib and so on, through both fairing halves and back again to the beginning. Keep the shock cord really taught to hold both halves together, then finally glue the shock cord into the outside rib holes, you can then trim off the two ends one side and the loop the other.

## WHEELS AND AXLE

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Wheels (191) must be wiped off with acetone to remove wax and parting agent, use a fine grit paper to re-ally mat inside the tyre groove after painting the wheels. Use the Black cyano glue IC-2000, this is perfect for rubber and glass fiber, to glue the tyres (197) together and onto the hubs.

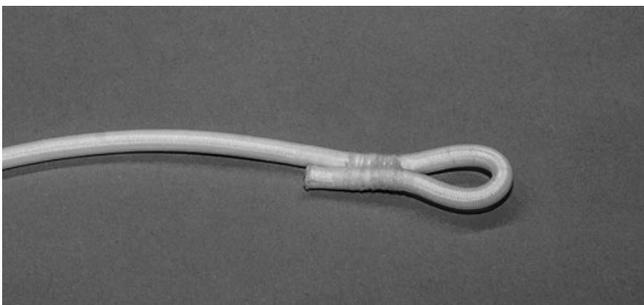
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Bowden cable (110) and the crimping sleeves (173) on both axle sides so that this allows the axle (55) to move a maximum of 35 mm vertically.

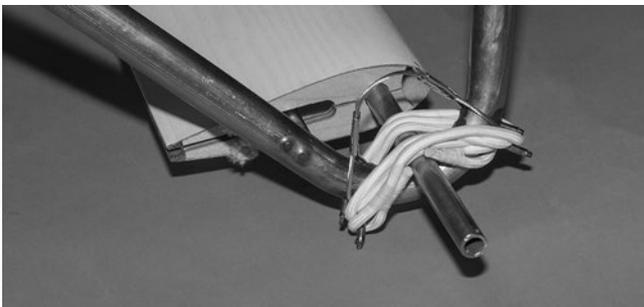
Drill a 2 mm hole 2 mm from both ends of the axle (55). Mark holes with a center punch, make these center punch indents fairly big, use a pillar drill if possible, note this axle is very very hard stainless steel, use a really good quality drill with very slow RPM and cutting oil, Bel-Ray for example. Attach the wheel axle fairing to the axle and the spreader bar. Make a loop from the

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Cut two 550 mm long pieces from the bungee cord (16). Form 20 mm long loops at the ends and secure them by winding them with yarn and saok them with thin cyano.

O



Hook one loop of the bungee cord into one undercarriage leg (2), wind the bungee cord three and a half times around the axle and the undercarriage leg and hook the second loop in. Fit the bungee cord on the other side in the same manner.

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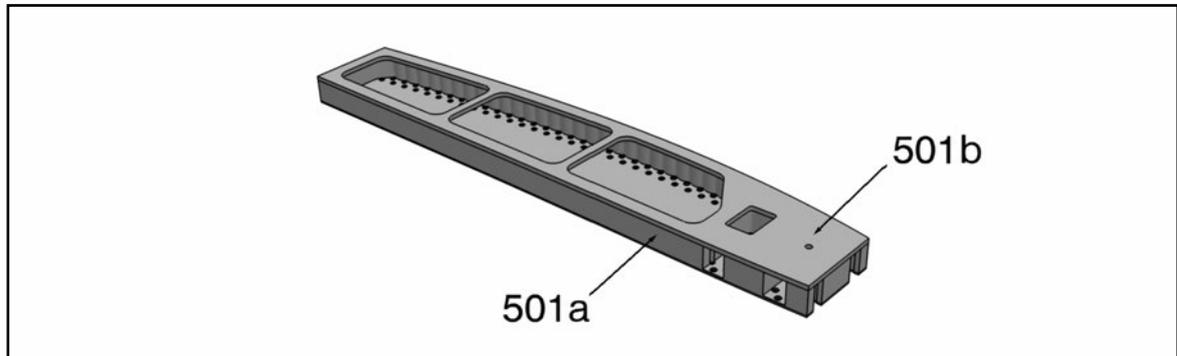


Push the tufnol wheel bushings (199) into the wheels and push them onto the axle. Secure the wheels with a M10 washer (202) and a split pin (7) on each side. The wheels need no further support and can easily be removed for transport.

## WATER COOLER

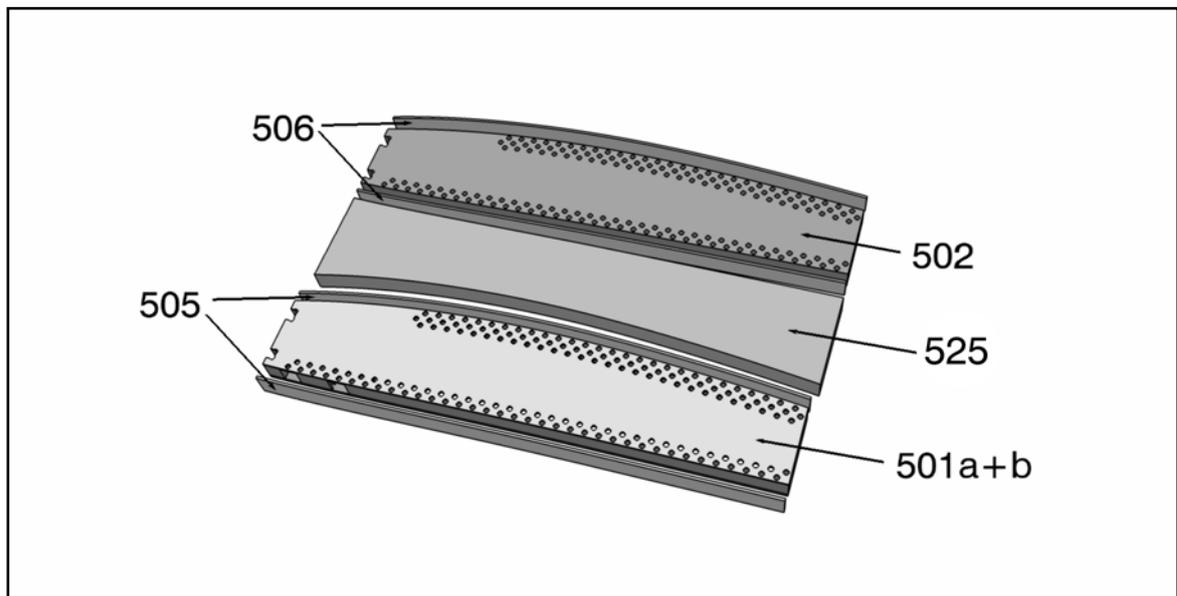
- Check the holes in the four parts (501a)(502)(503) and deburr with a knife blade where necessary, to allow the tubes (504) to be inserted.

○



Glue the 1,5 mm Birch plywood rib (501b) to the outside face of the right hand 8,5 mm thick plywood/Polystyrene sandwich rib (501a), best way is to use a little Titebond III, bring the parts together quickly and lay Birch plywood side down onto a flat surface, check to see that the Birch plywood rib is properly placed. Apply pressure for a few minutes.

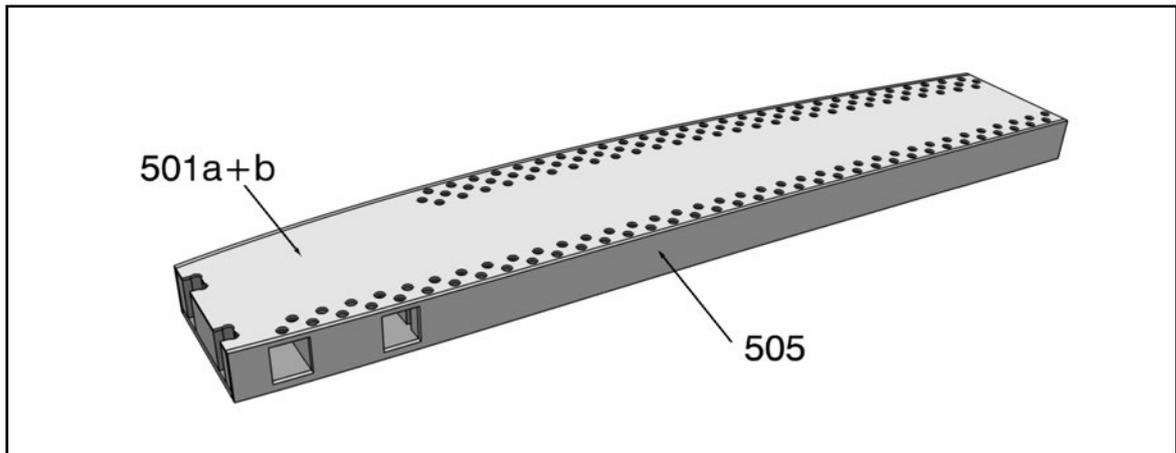
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Use the milled 9 mm Birch plywood jig (525) to glue and press the 9 and 10,5 mm Polystyrene capping strips (505) and (506) onto the top and bottom face of (501a/b) and (502). Use INSTA-CURE + gap filling.

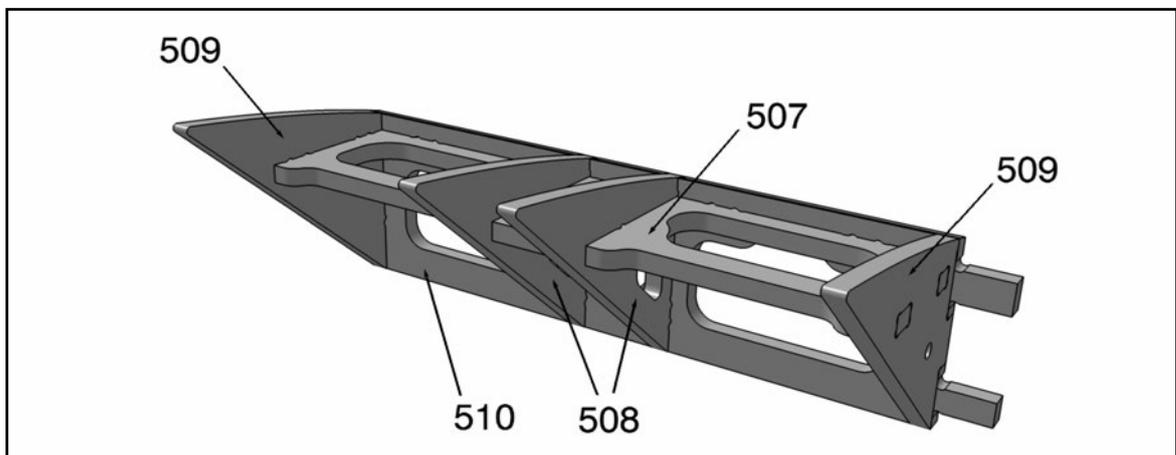
- Cut the 9 and 10,5 mm Polystyrene capping strips (505) and (506) to length.

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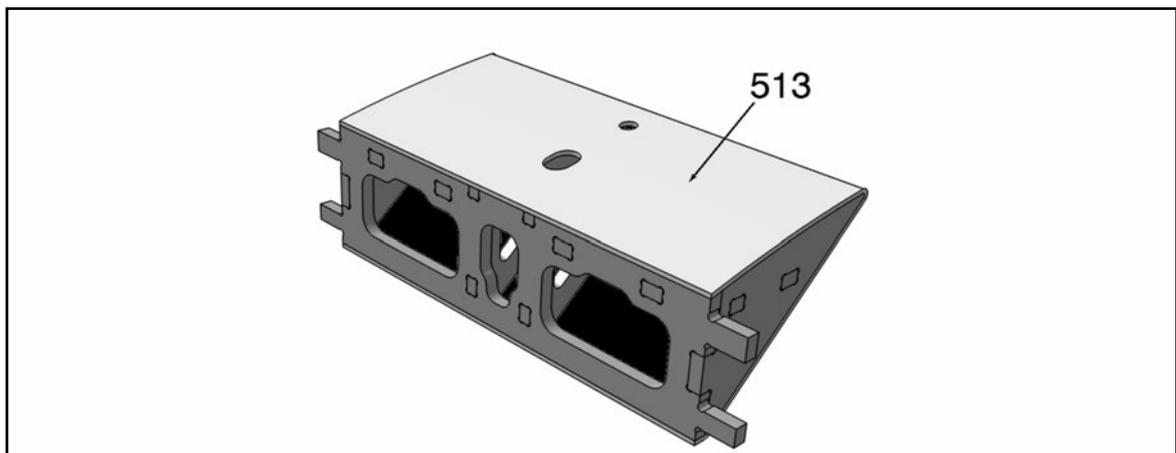
Now cut out the two square holes, I used a 2mm spiral drill and used this to mill out a hole big enough to allow a small file to be inserted.

O



The six components (507) to (510) that form the cooling tower base are grouped on a 3 mm Poplar plywood sheet. Clean up the parts with fine grit paper. Fit these parts together in your hands, when you are satisfied that these six parts are neatly together apply INSTA-CURE medium viscosity cyanocrylate. It will not run everywhere like the very thin types will.

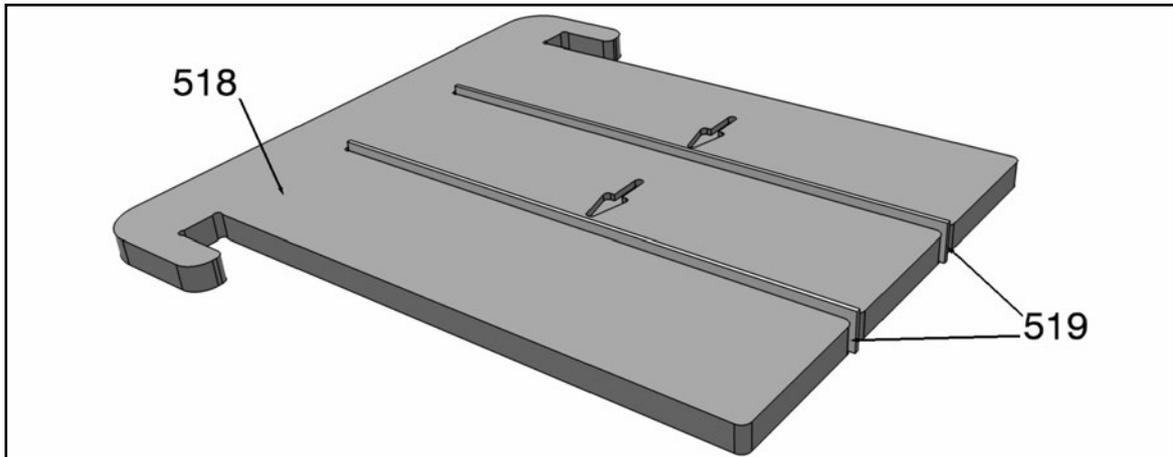
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Press the assembled base into the 1 mm thick preformed Polystyrene plastic cover

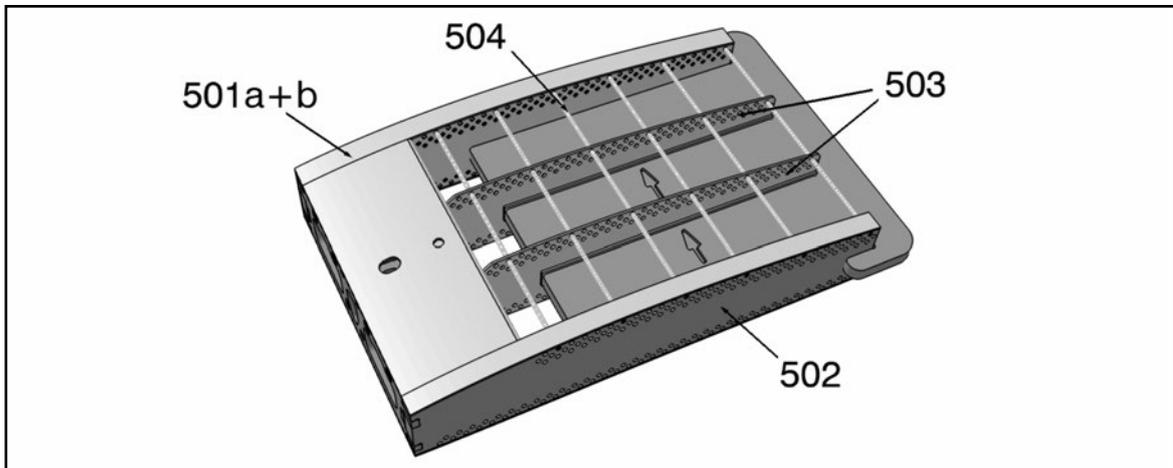
(513) check for a neat fit, do not apply cyano to the wood first but glue through the lightening holes, making sure the cover does not move out of place. Glue only one side at a time allowing the cyano to run down towards the Vee. Allow at least 15 seconds for the cyano to set hard, then apply cyano to the second side. Apply cyano one side at a time to the front edges but through the holes as before, taking care to ensure the edges make a straight contact along the plywood. I found this was best done holding the unit in the hands.

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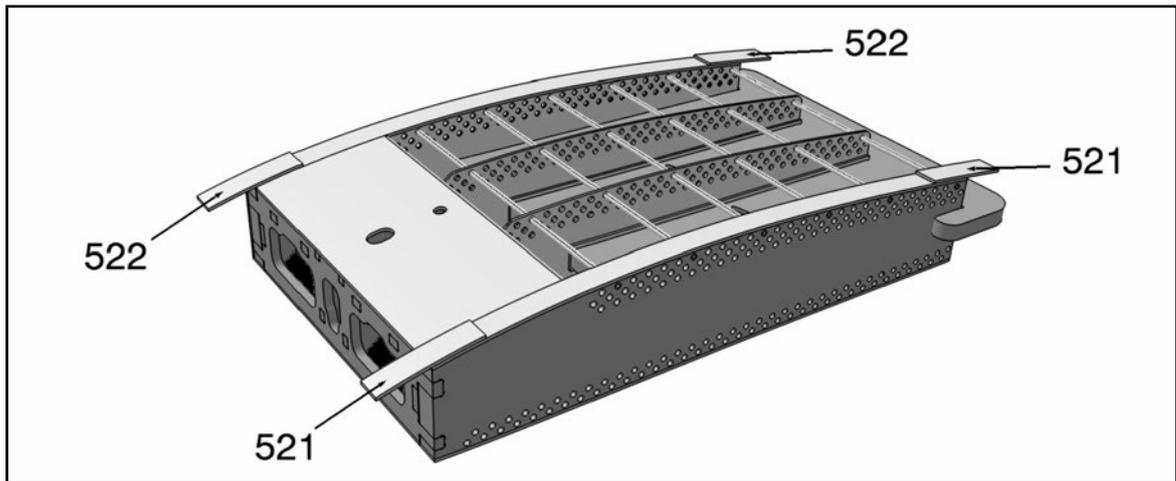
Glue the Polystyrene spacer (519) into the birchplywood jig (518). Note the spacers have to be glued on the faces that are indicated by the milled arrows.

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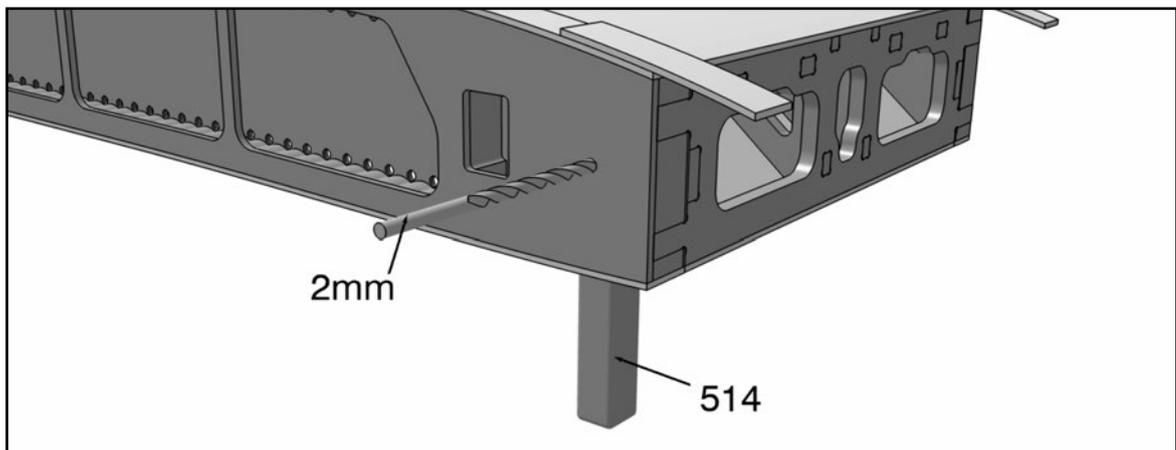
Assemble the two side ribs (501a/b) and (502) onto the completed radiator header tank, insert the two Polystyrene middle separators (503) into the assembly jig with the arrows uppermost. Cut six pieces of the 2mm tubing (504) and thread these through with a spacing of four holes, check to see that the two ribs (501a/b) (502) fit neatly into the radiator header tank both sides then apply the same cyano to the joints of the ribs and base.

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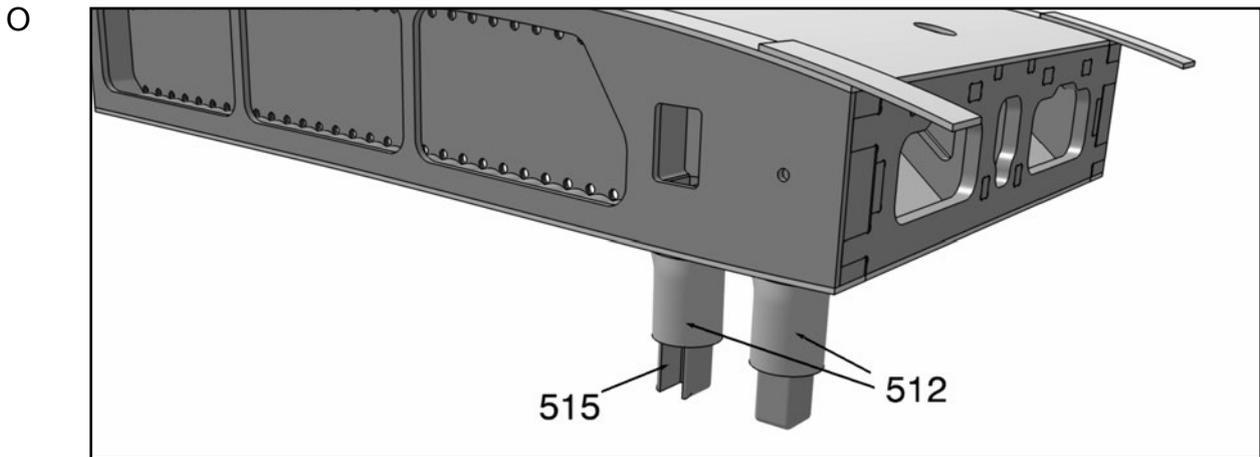


Cut two strips 39 mm long from the 9 mm (521) and two from the 10 mm (522) Polystyrene strips, these are glued onto the topsides with an overhang of 17 mm.

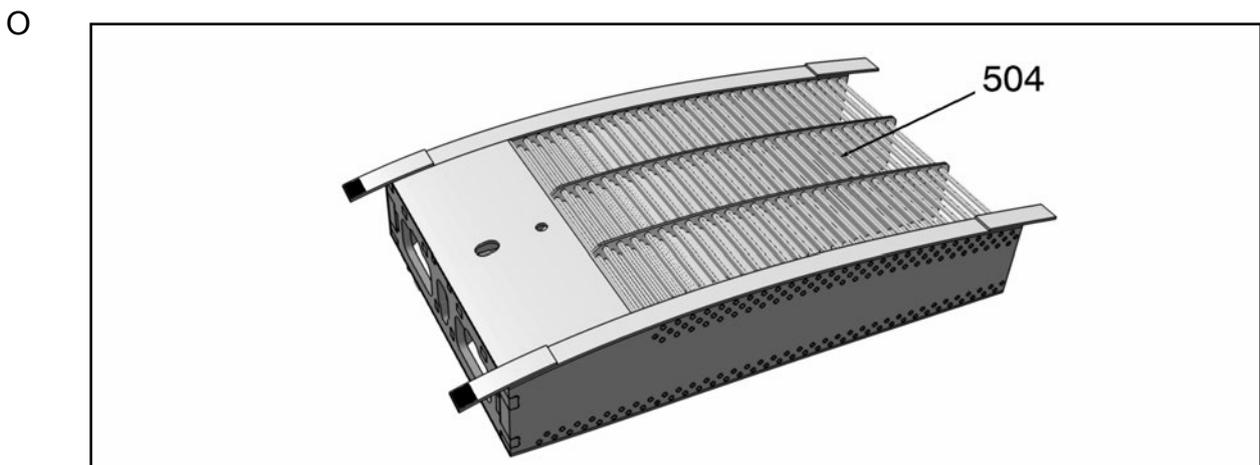
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The front 6,5x6,5 mm spruce peg (514) must be pushed in far enough to enable you to fit a 2,2x9,5 mm sheet metal screw (12) into the peg, pre drill the hole into the peg with a 2 mm twist drill this will prevent splitting the peg when the screw is driven in. This screw then serves the purpose of allowing the cooling water pipe running to the front of the dummy engine to be removed allowing access to the engine for servicing and has to be mounted after installing the Radiator into the center section.

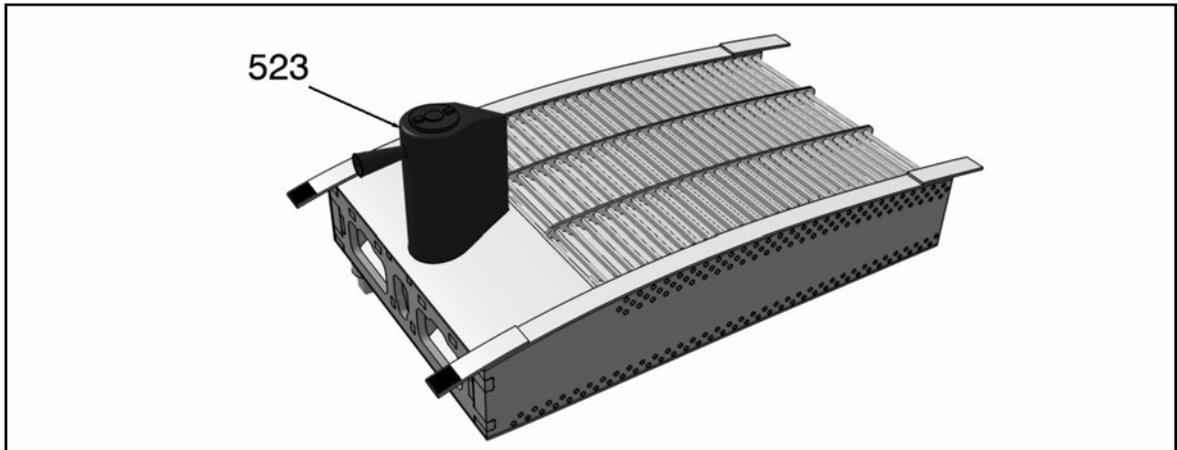


The U-channeled peg (515) is to allow the aileron servo cables to be carried down into the fuselage via the second cooling water return pipe. Please note these two pegs must not be glued into place. The two short shaped aluminium pieces of tube (512) are just slid into position also not fixed with any glue. The two cooling water tubes (516) (517) are held in place with a 14 mm long piece of heat shrink tubing (511).



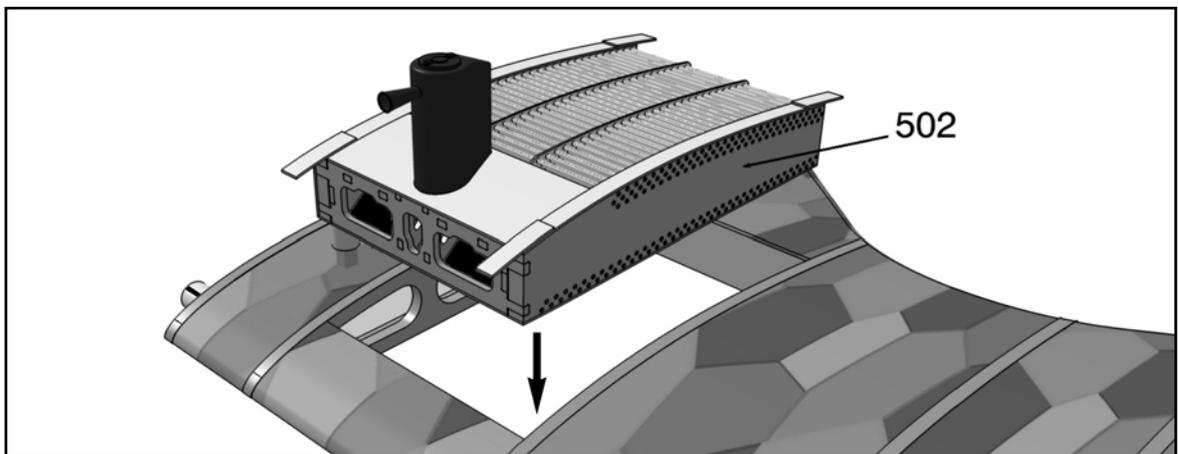
Cut the rest of the 2 mm tubing (504) to length and insert all into the holes, it is best to use INSTA-FLEX™ cyano to glue these tubes into place, it is better to squirt a little of this cyano onto a piece of glass or porcelain and then use a small screwdriver to transfer the cyano onto the joints, this way there will be no untidy runs which will stand out when the whole unit is painted. Remove the plywood jig (518).

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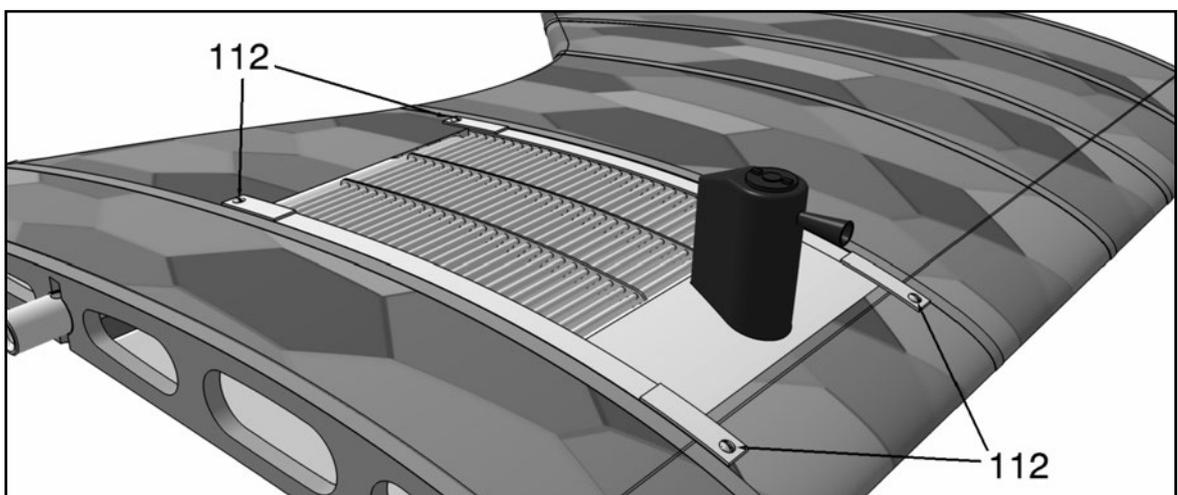
Glue the equalizing tank (523) on top of the header tank into the milled holes.

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Smear a small amount of epoxy onto side rib (502) and insert the radiator into the wing center section. Glue the radiator onto rib (401a) with the rest of the epoxy by applying it through the root rib.

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Mark the positions of the 4 slotted wood screws (112) and bore the four holes with a 1,5mm drill. Insert the screws and secure them with a drop of cyano. Note: the

screws are acting as a scale detail without any further function, therefor no additional support is needed.

## CENTER OF GRAVITY

- Make a pencil mark 162 mm from the leading edge of the center section root ribs (300a/300b) your Albatross must hang horizontally when suspended from these two pencil marks.
  
- For accuracy in setting the CG it is best to drill a 2 mm hole into both ribs (300a/300b) at the CG marks, drill these holes carefully and slightly towards the underside, insert a 2,2x9,5 mm round head PK screw (12) into these holes, deep enough but allowing you to hang the model on the 60 Kg Nylon covered wire loops and fit the two top wing panels, the wing struts need not be screwed to the top wings.

It is obvious that the model must be complete as if ready to fly to position the CG correctly.

