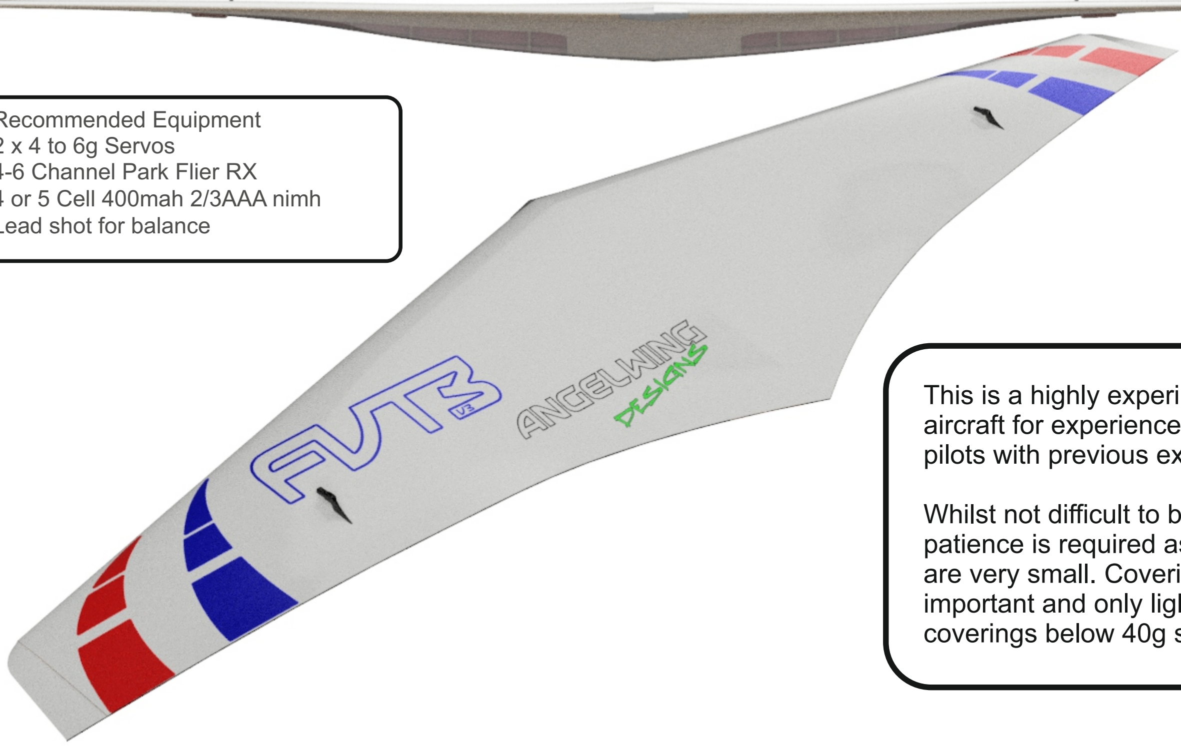
FVTB

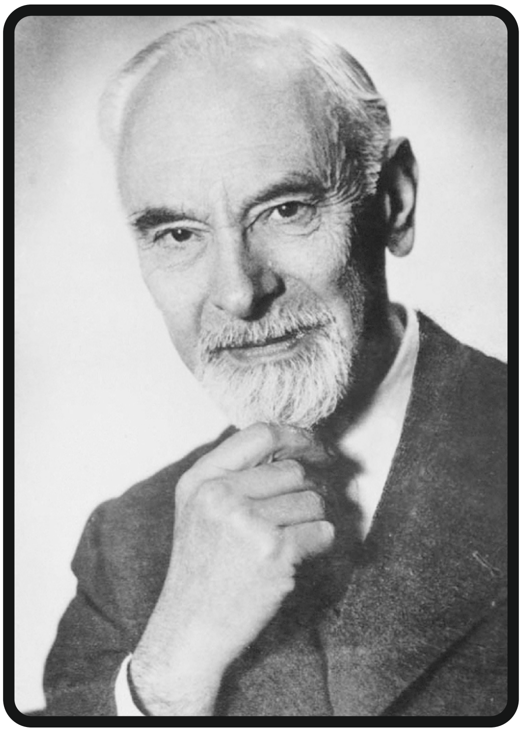
ANGELWING DESIGNS

Recommended Equipment
2 x 4 to 6g Servos
4-6 Channel Park Flier RX
4 or 5 Cell 400mah 2/3AAA nimh
Lead shot for balance



This is a highly experimental model aircraft for experienced builders and pilots with previous experience.

Whilst not difficult to build time and patience is required as some parts are very small. Covering choice is important and only lightweight coverings below 40g sqm are suitable

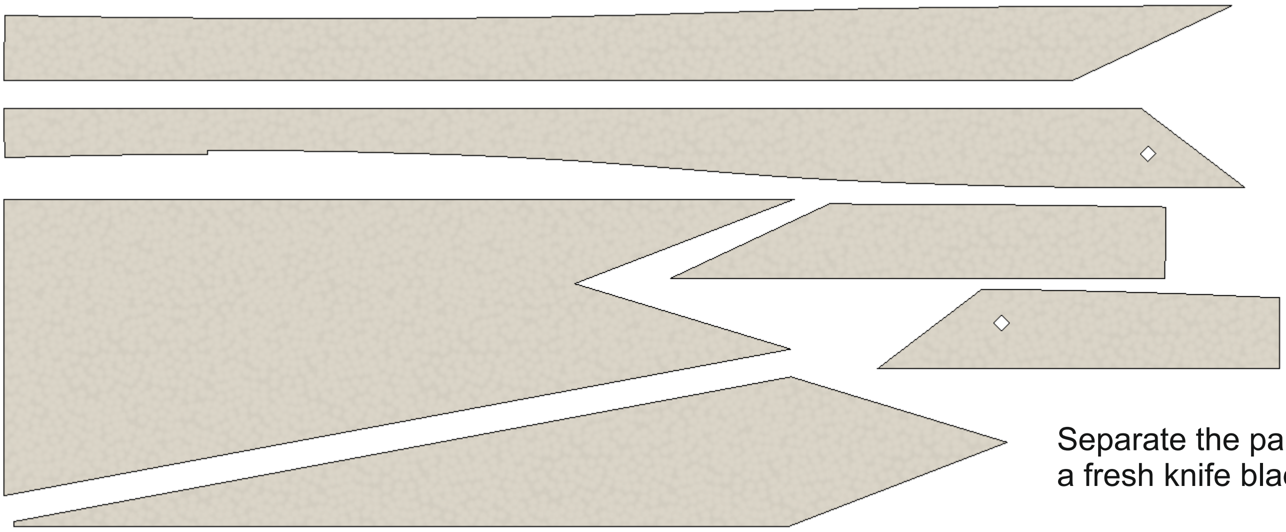


"Quite Possibly the most Unique RC model glider kit of the 21st Century"

Special thanks to Marko Stamenovic and Al Bowers, Chief Scientist at Nasa Armstrong Research Center for sharing there knowledge and enthusiasm to create such a crazy looking twisted airframe

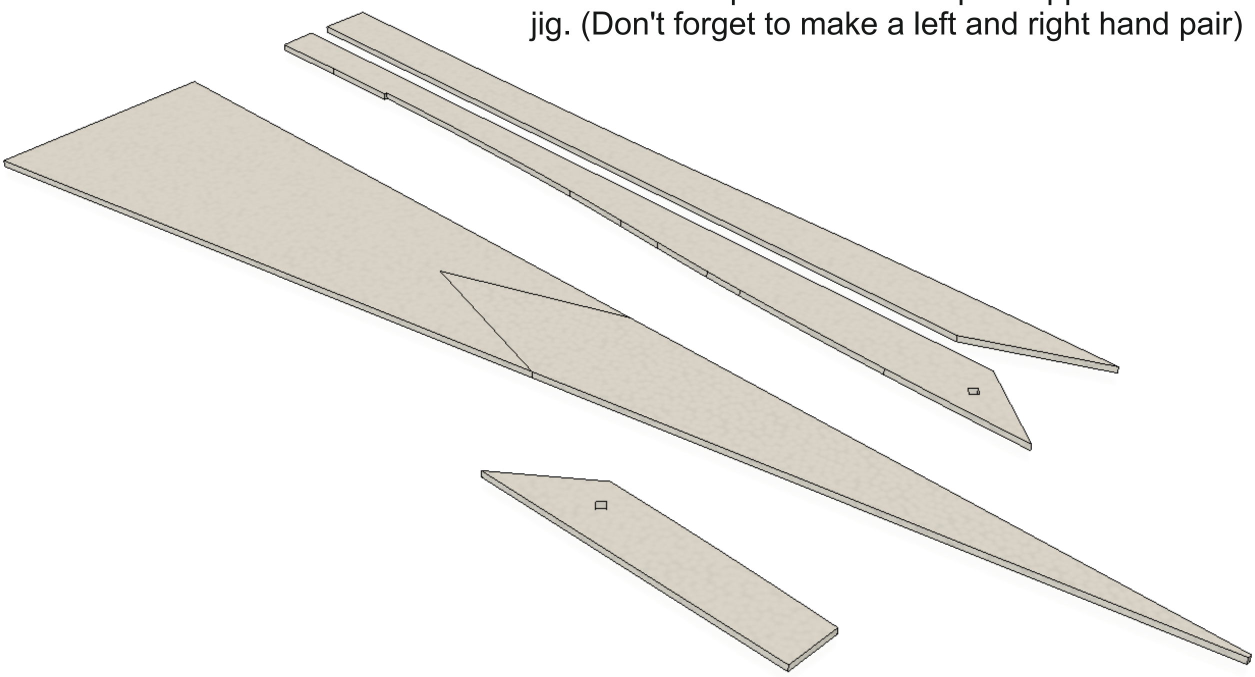
Ludwig Prandtl (4 February 1875 – 15 August 1953)German fluid dynamicist, physicist and aerospace scientist. He was a pioneer in the development of rigorous systematic mathematical analyses which he used for underlying the science of aerodynamics, which have come to form the basis of the applied science of aeronautical engineering. In the 1920s, he developed the mathematical basis for the fundamental principles of subsonic aerodynamics in particular; and in general up to and including transonic velocities. His studies identified the boundary layer, thin-airfoils, and lifting-line theories.

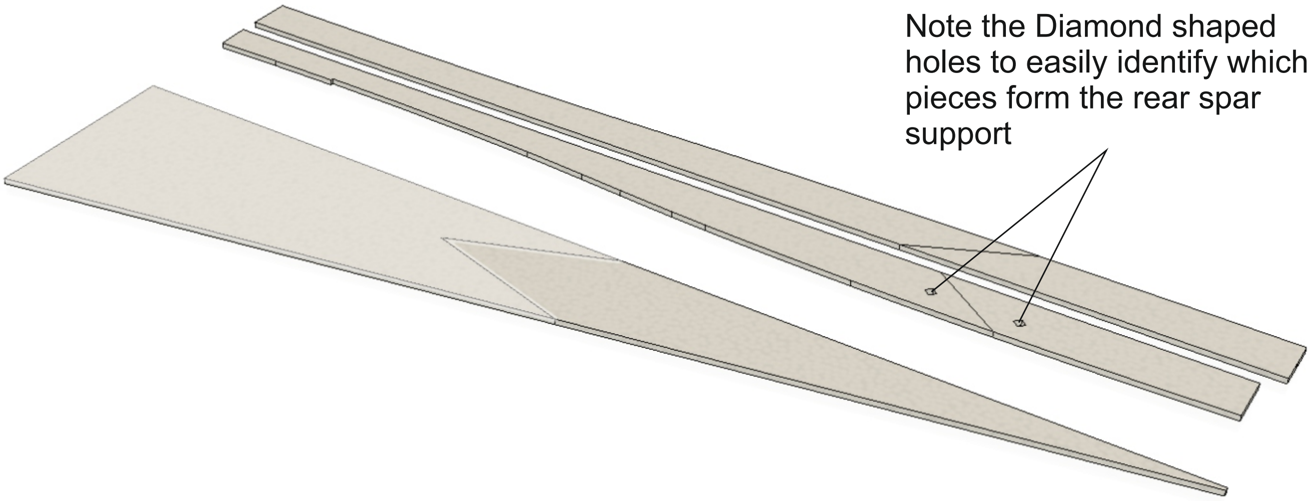
The building jig. Your kit will contain either a pair of foam or cardboard jigs that support the main spars during the construction. N.B. each wing half should only be removed from the jig once the top sheeting has been added. to prevent the spars sticking to the jig we suggest running tape along the top surfaces. The Jigs can be glued with foam safe CA, UHU Por, or even hot glue gun. (if your careful)



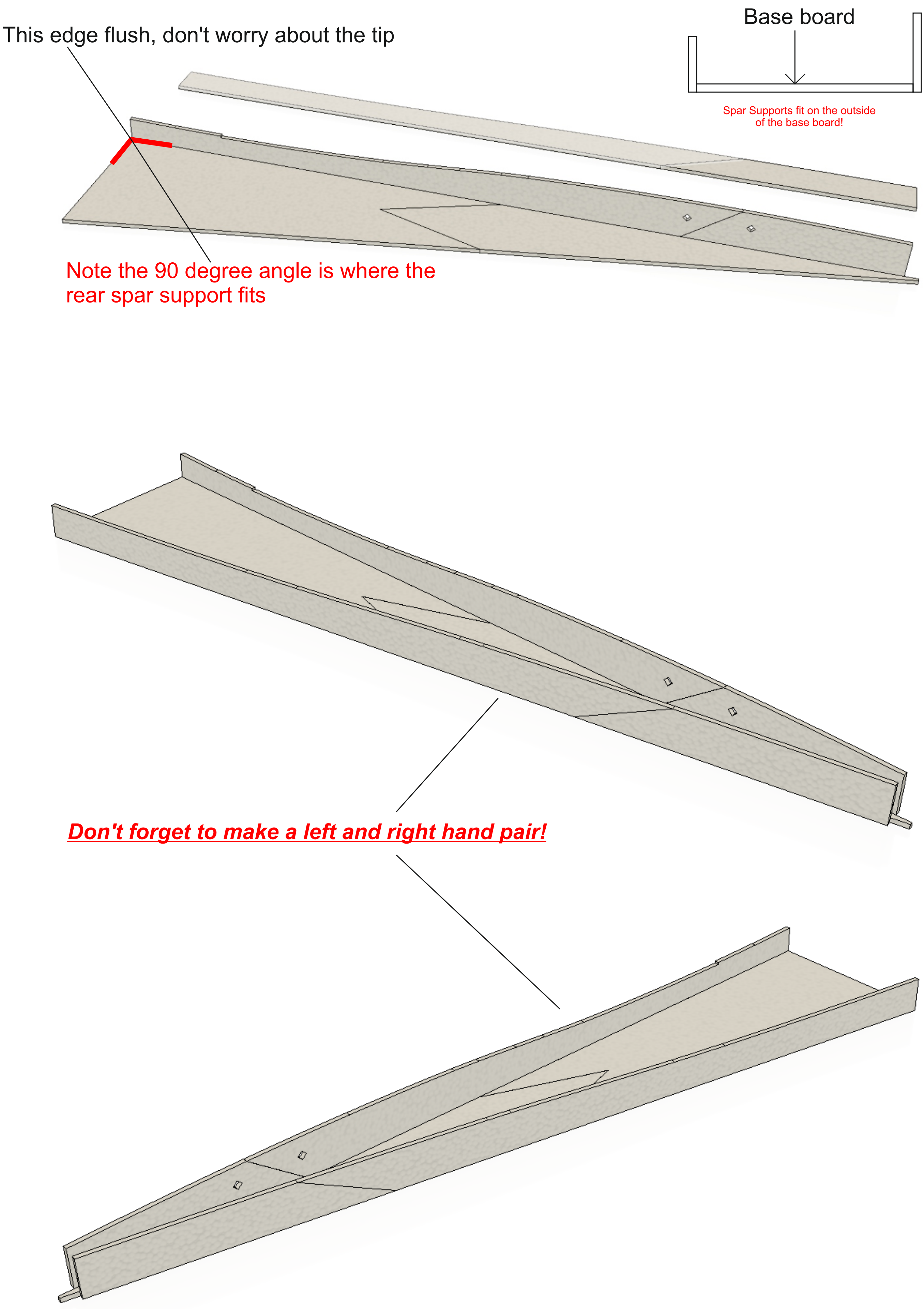
Separate the parts with a fresh knife blade.

Join the base plate and both spar supports for each wing jig. (Don't forget to make a left and right hand pair)



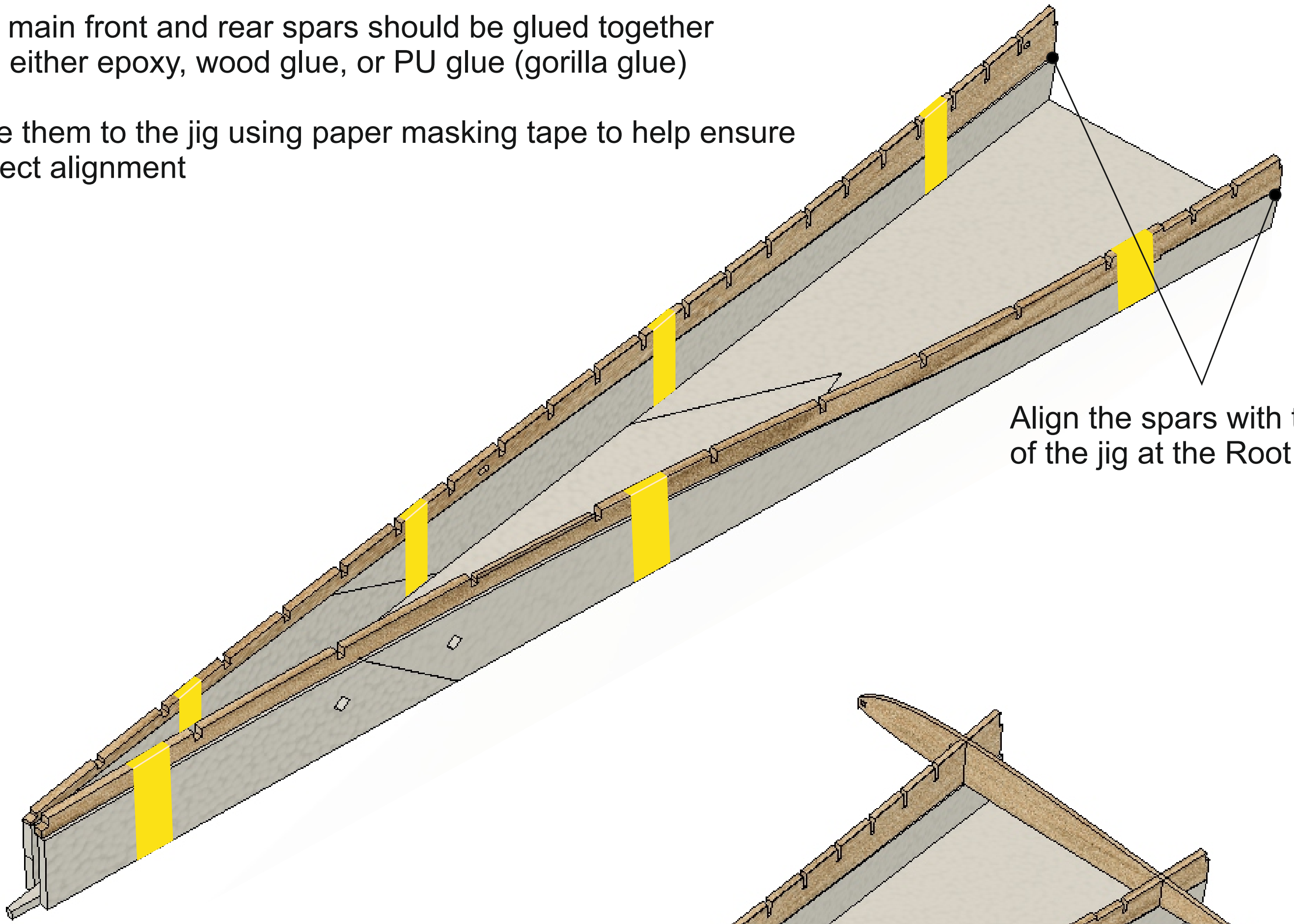


Note the Diamond shaped holes to easily identify which pieces form the rear spar support


This edge flush, don't worry about the tip
Base board
Spar Supports fit on the outside
of the base board!
Note the 90 degree angle is where the
rear spar support fits
Don't forget to make a left and right hand pair!

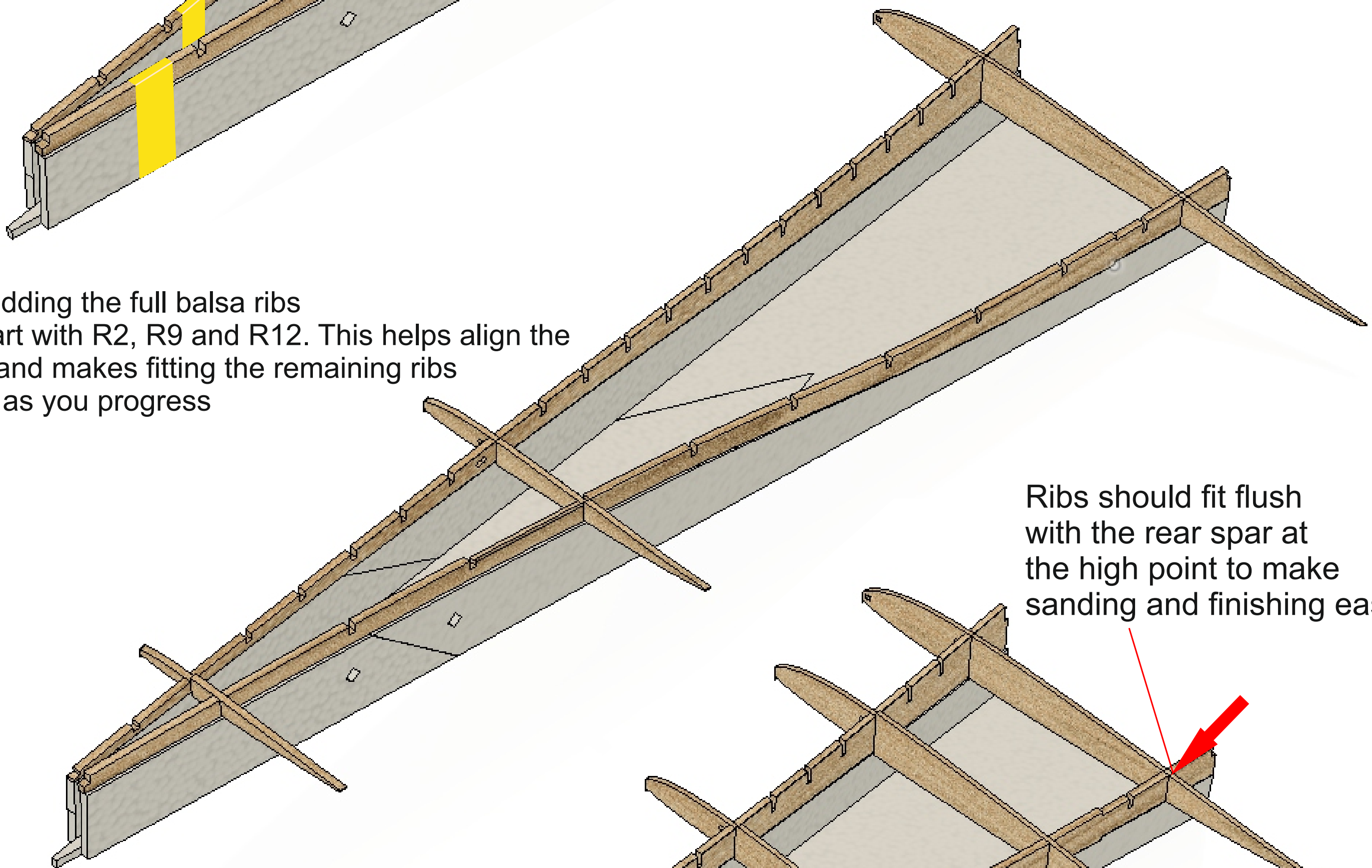
The main front and rear spars should be glued together with either epoxy, wood glue, or PU glue (gorilla glue)

Tape them to the jig using paper masking tape to help ensure correct alignment

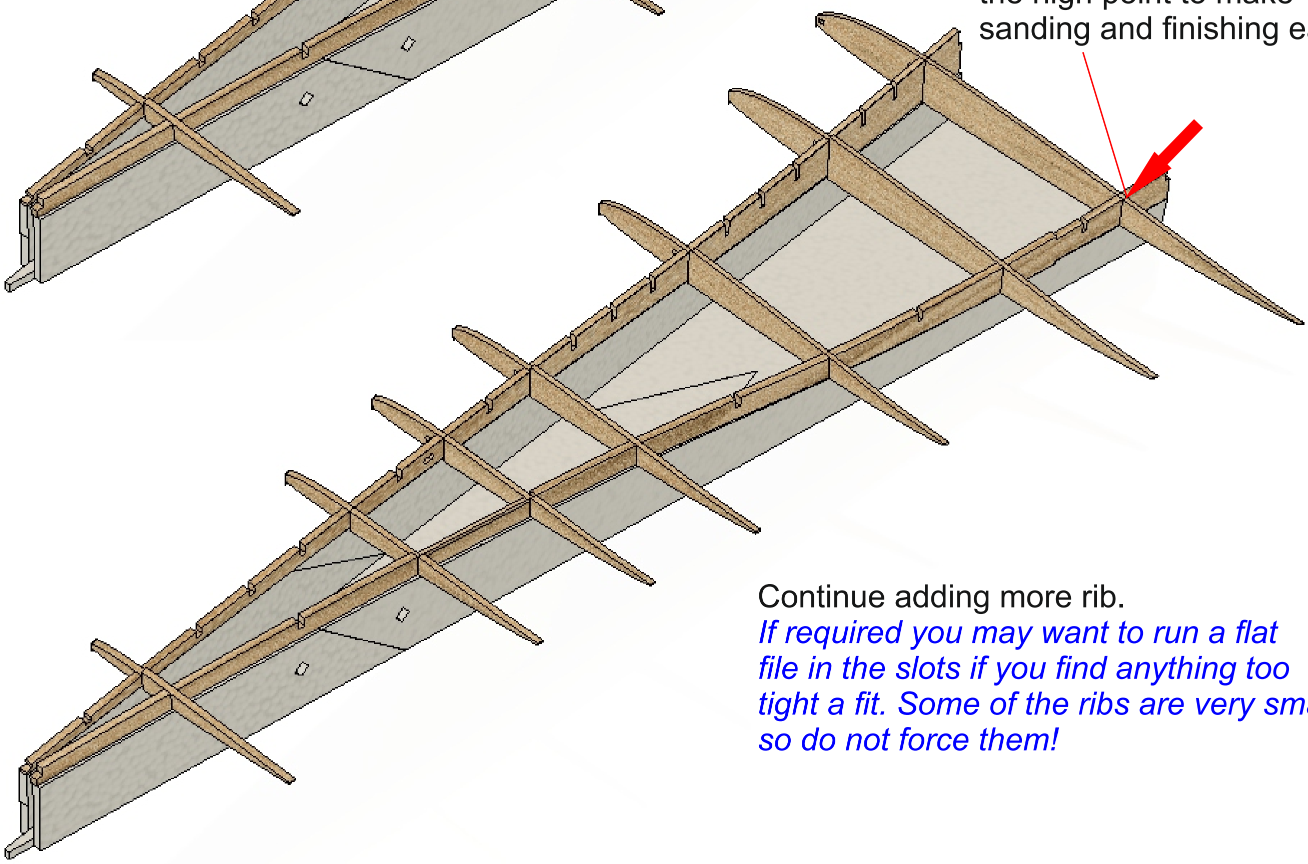


Align the spars with the end of the jig at the Root (R1)5

Start adding the full balsa ribs
We start with R2, R9 and R12. This helps align the spars and makes fitting the remaining ribs easier as you progress

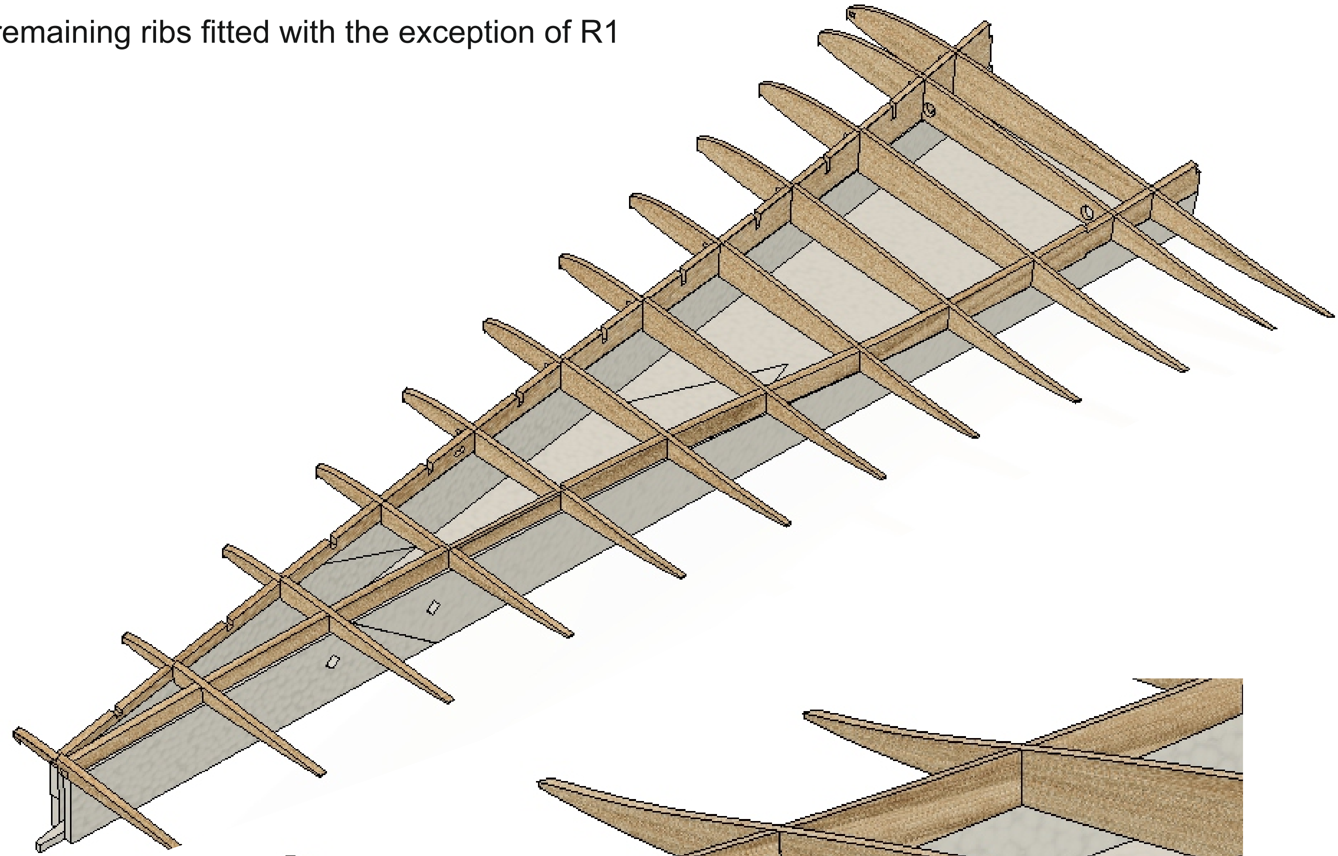


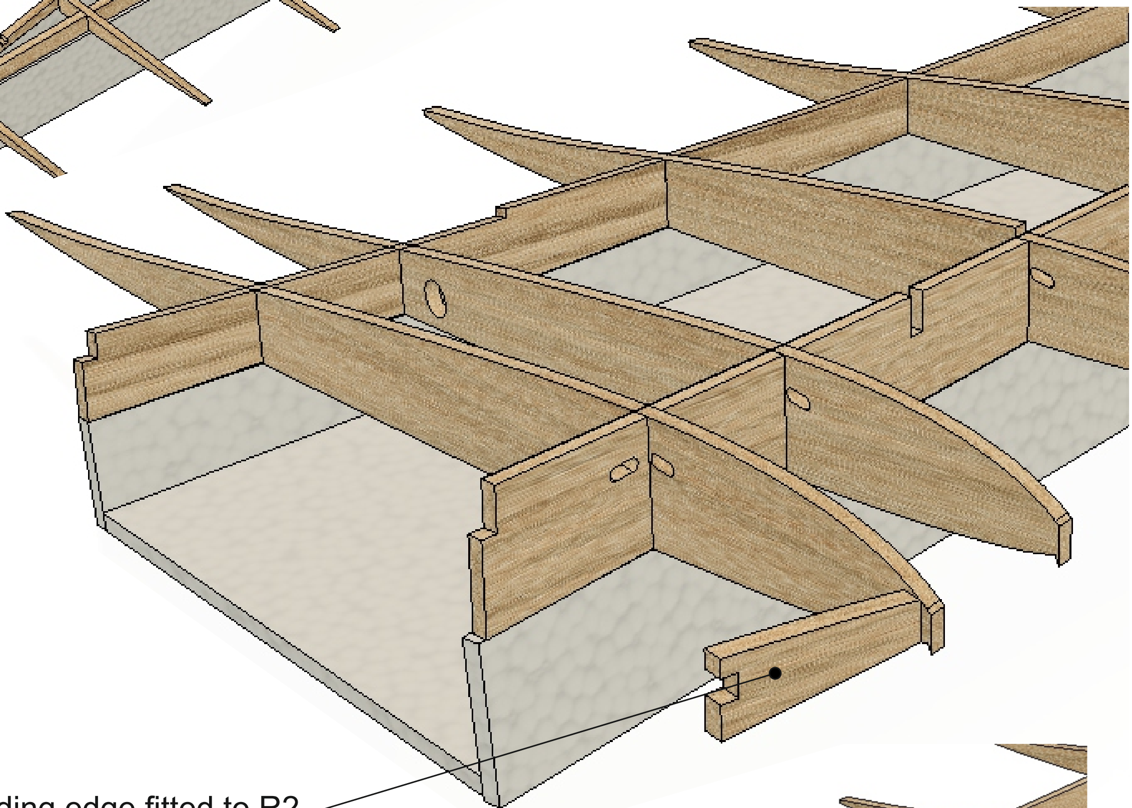
Ribs should fit flush with the rear spar at the high point to make sanding and finishing easier



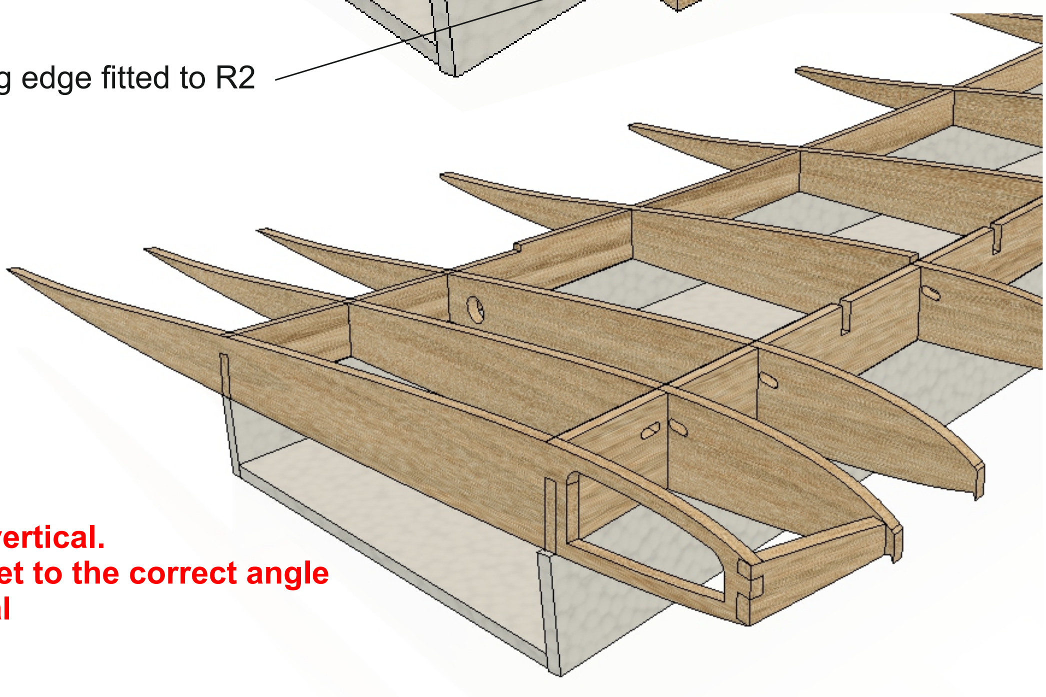
Continue adding more rib.
If required you may want to run a flat file in the slots if you find anything too tight a fit. Some of the ribs are very small so do not force them!

All remaining ribs fitted with the exception of R1



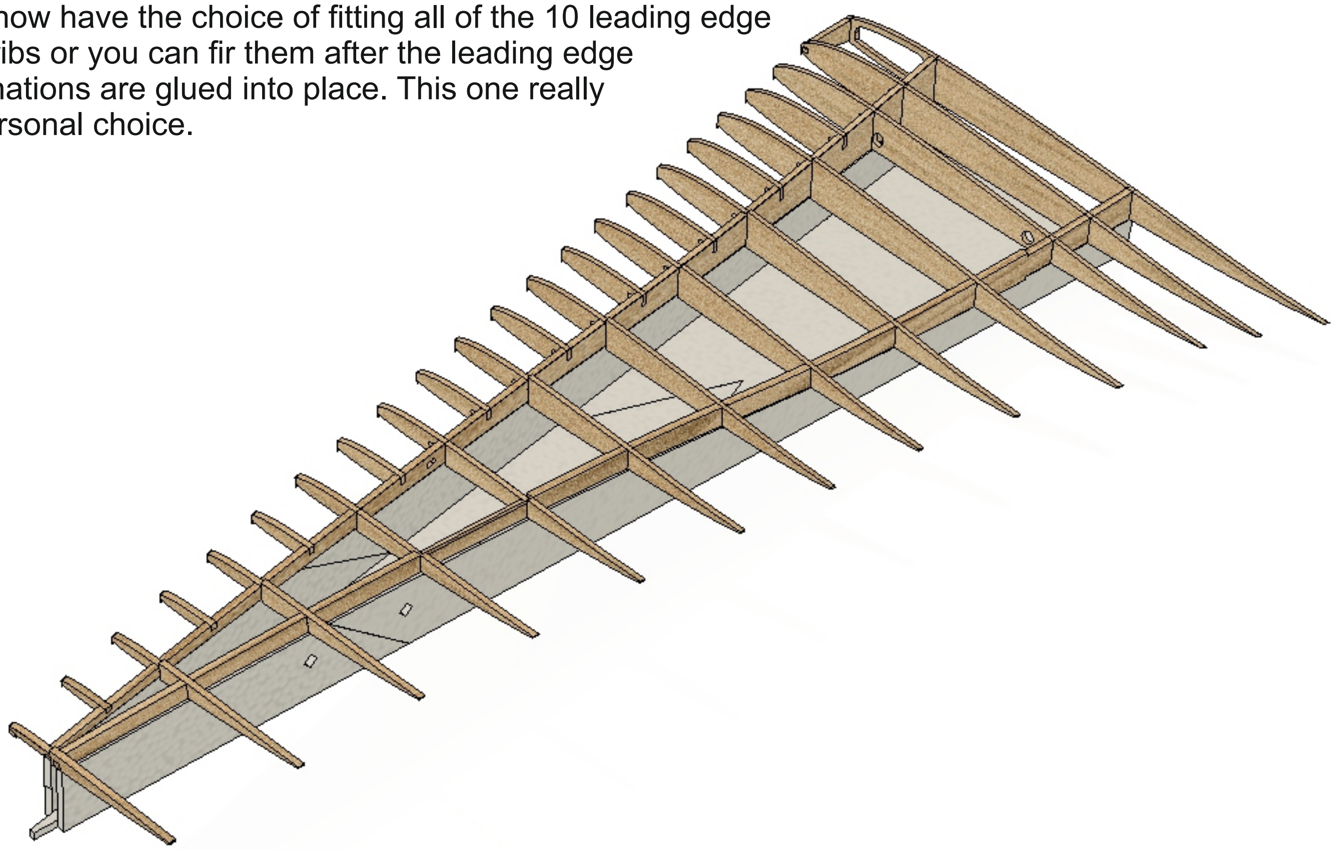


False Leading edge fitted to R2

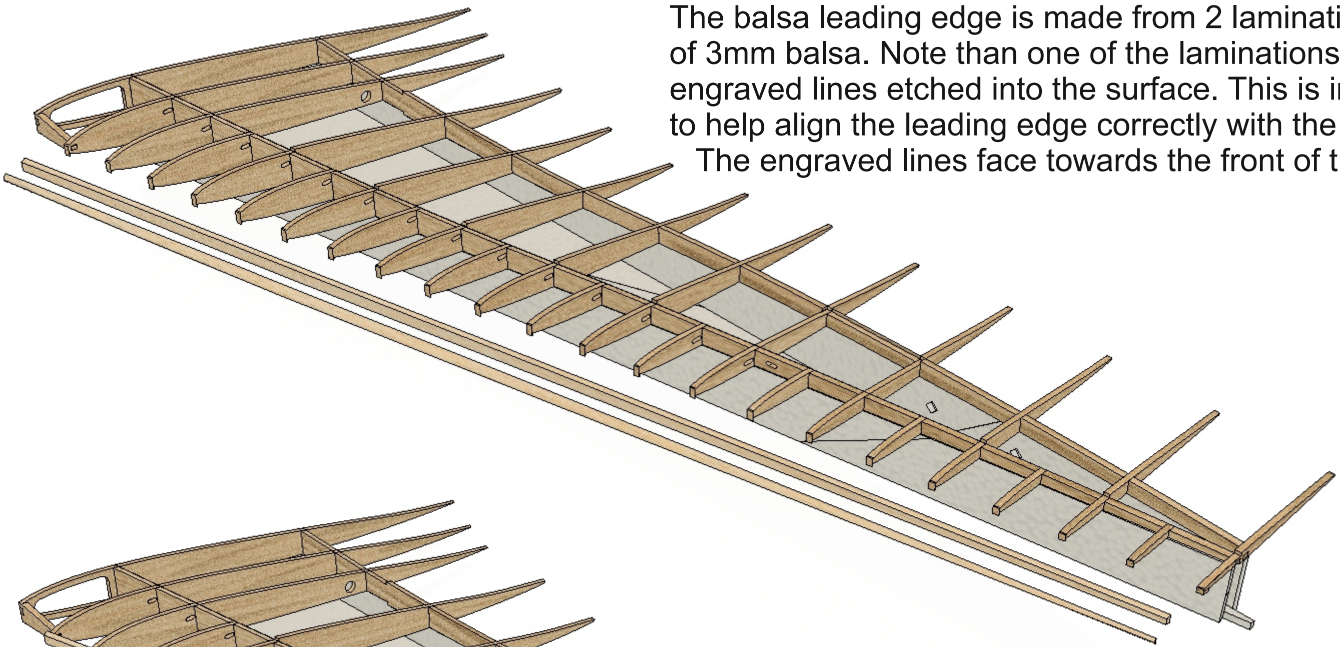


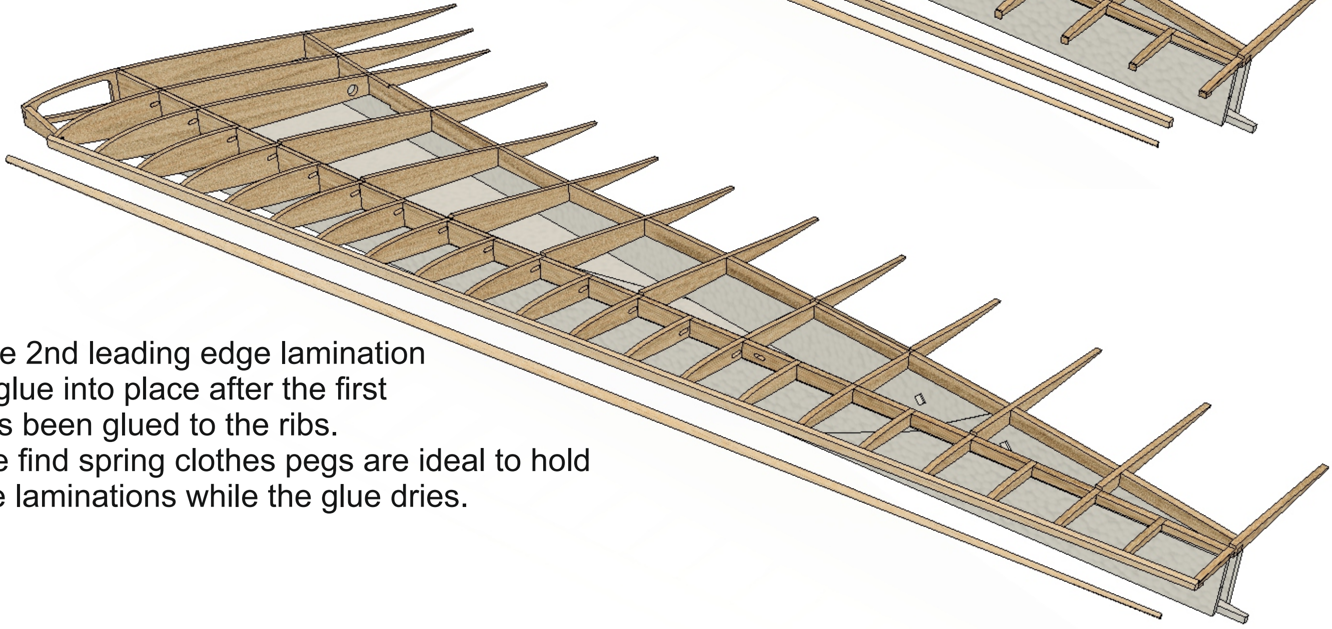
Note R1 is not vertical.
The spars are set to the correct angle for the dihederal

You now have the choice of fitting all of the 10 leading edge sub ribs or you can fir them after the leading edge laminations are glued into place. This one really is personal choice.

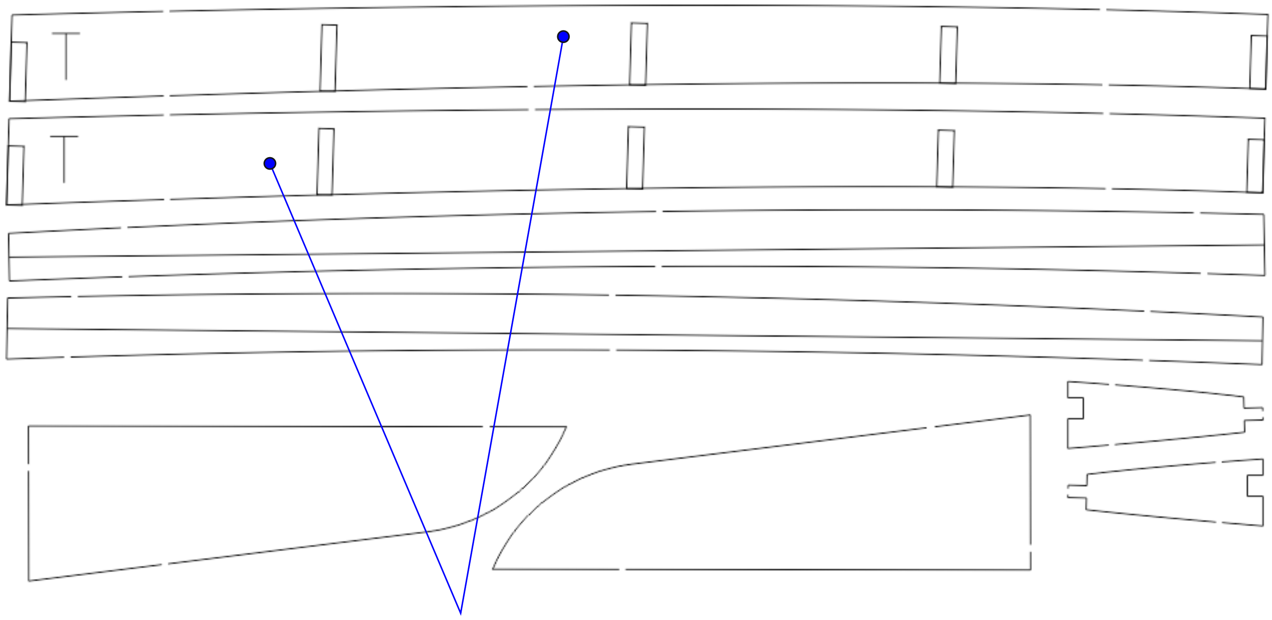


The balsa leading edge is made from 2 laminations of 3mm balsa. Note than one of the laminations has engraved lines etched into the surface. This is intended to help align the leading edge correctly with the ribs.
The engraved lines face towards the front of the ribs.



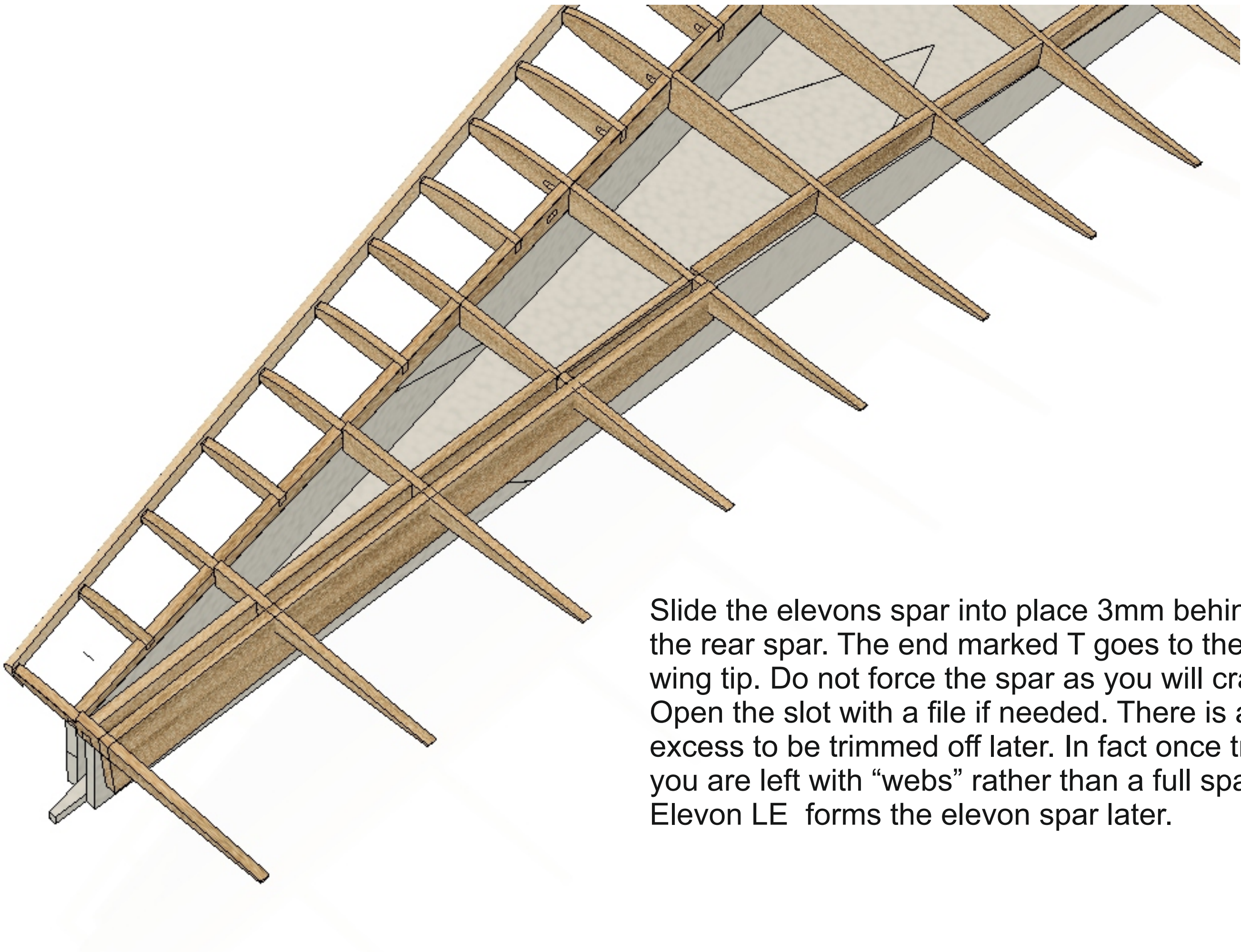


The 2nd leading edge lamination is glue into place after the first has been glued to the ribs.
We find spring clothes pegs are ideal to hold the laminations while the glue dries.

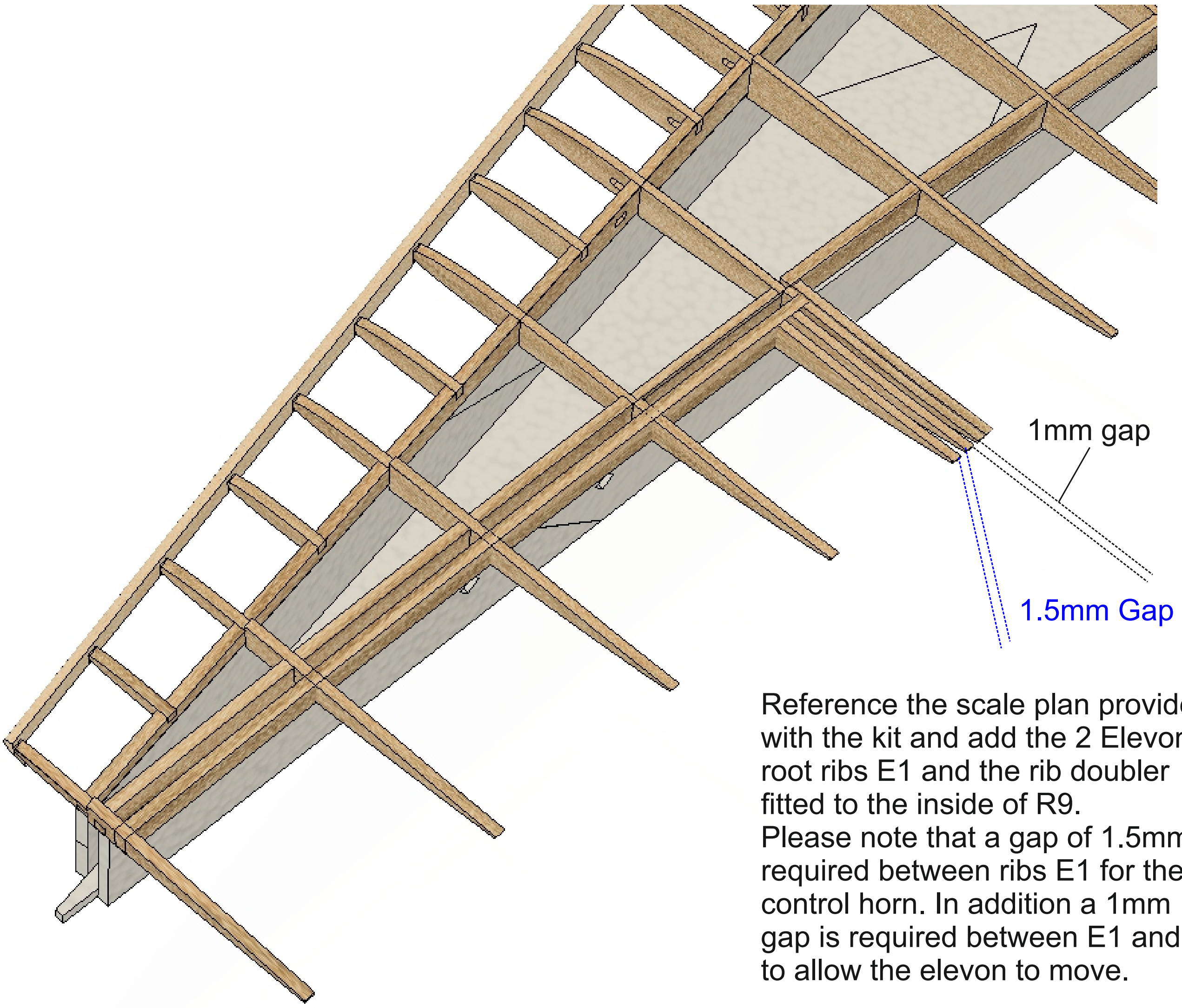


You will need the Elevon spars for the next stage, but not the elevon leading edge sheeting

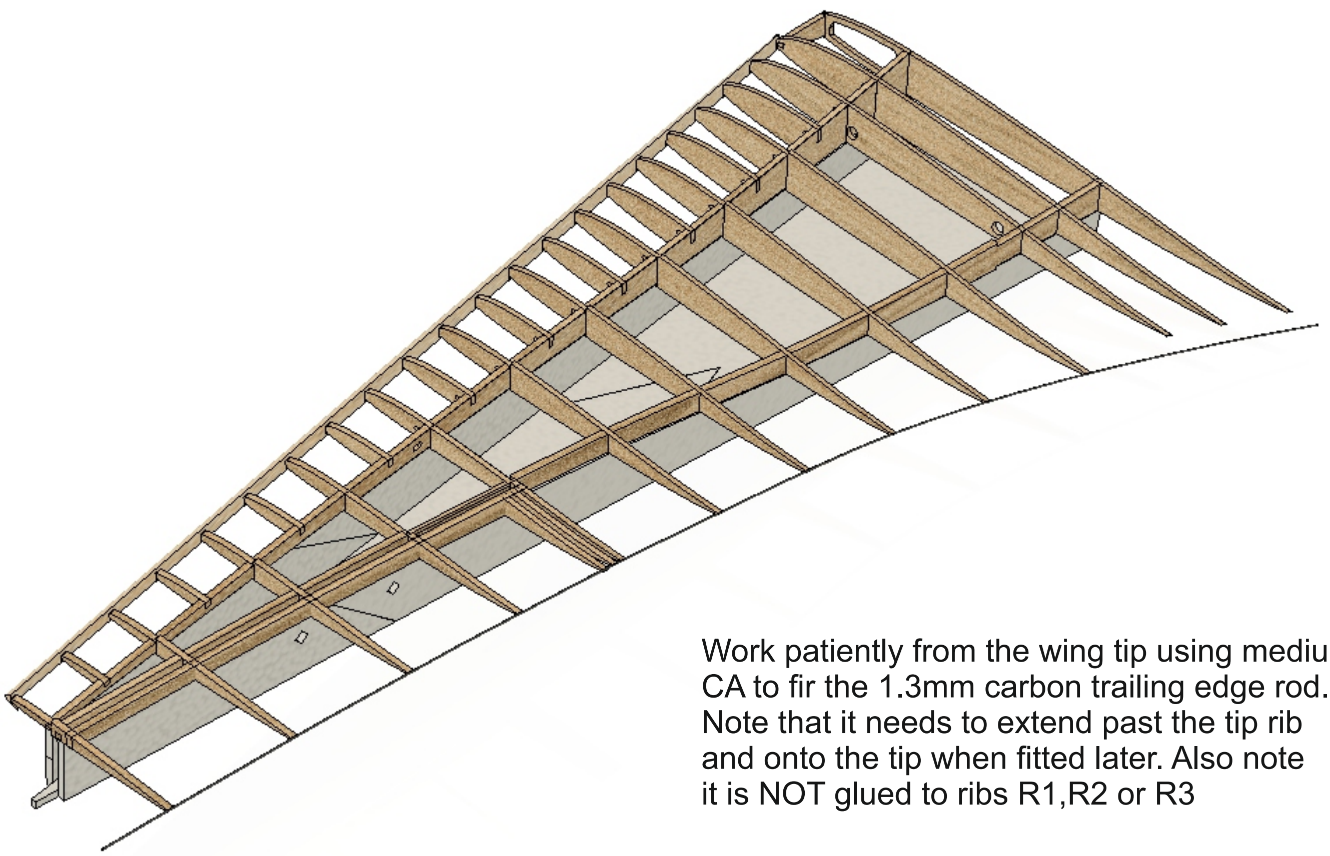
The elevons are partly built whilst in place on the wing. You need to cut these free after the wing panels are built, In fact we leave this till the wings have be sheeted, joined and sanded!



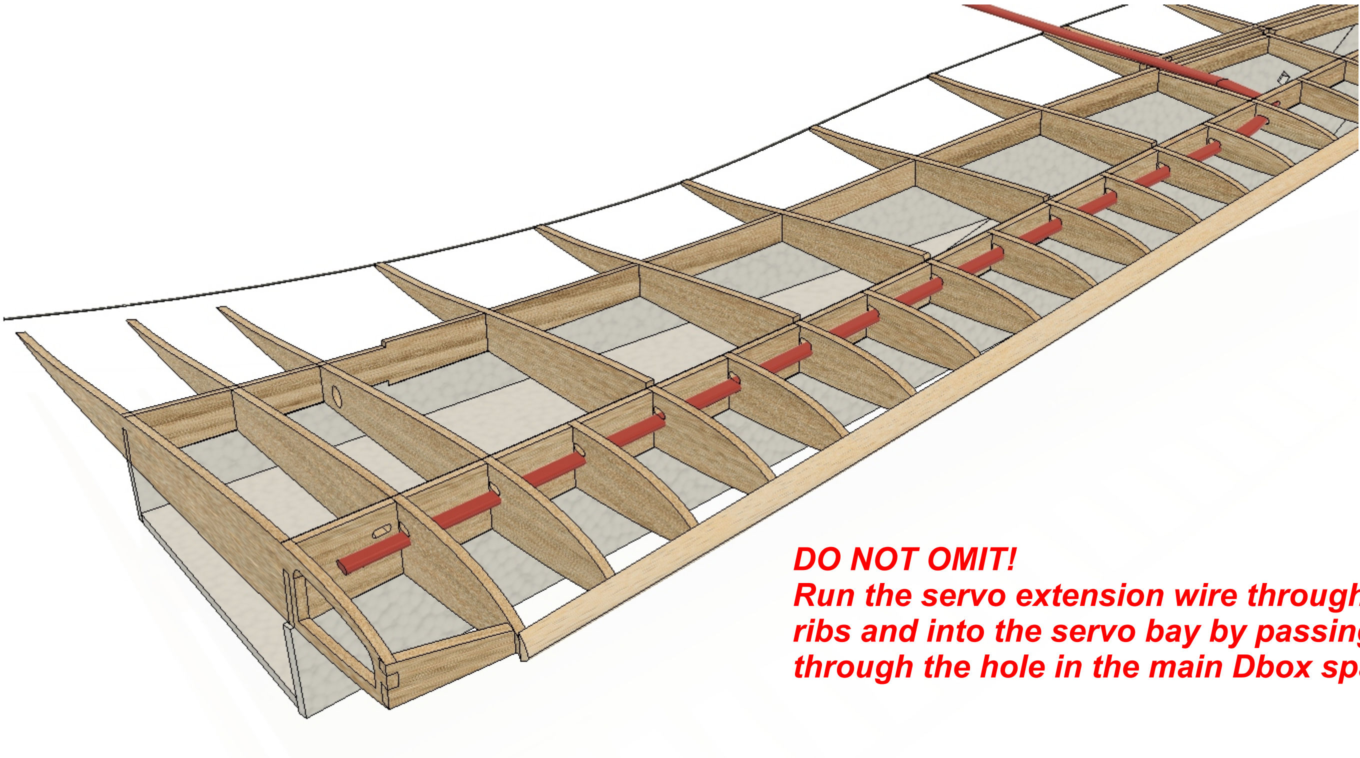
Slide the elevons spar into place 3mm behind the rear spar. The end marked T goes to the wing tip. Do not force the spar as you will crack it. Open the slot with a file if needed. There is a large excess to be trimmed off later. In fact once trimmed you are left with “webs” rather than a full spar. The Elevon LE forms the elevon spar later.



Reference the scale plan provided with the kit and add the 2 Elevon root ribs E1 and the rib doubler fitted to the inside of R9.
Please note that a gap of 1.5mm is required between ribs E1 for the control horn. In addition a 1mm gap is required between E1 and R9 to allow the elevon to move.

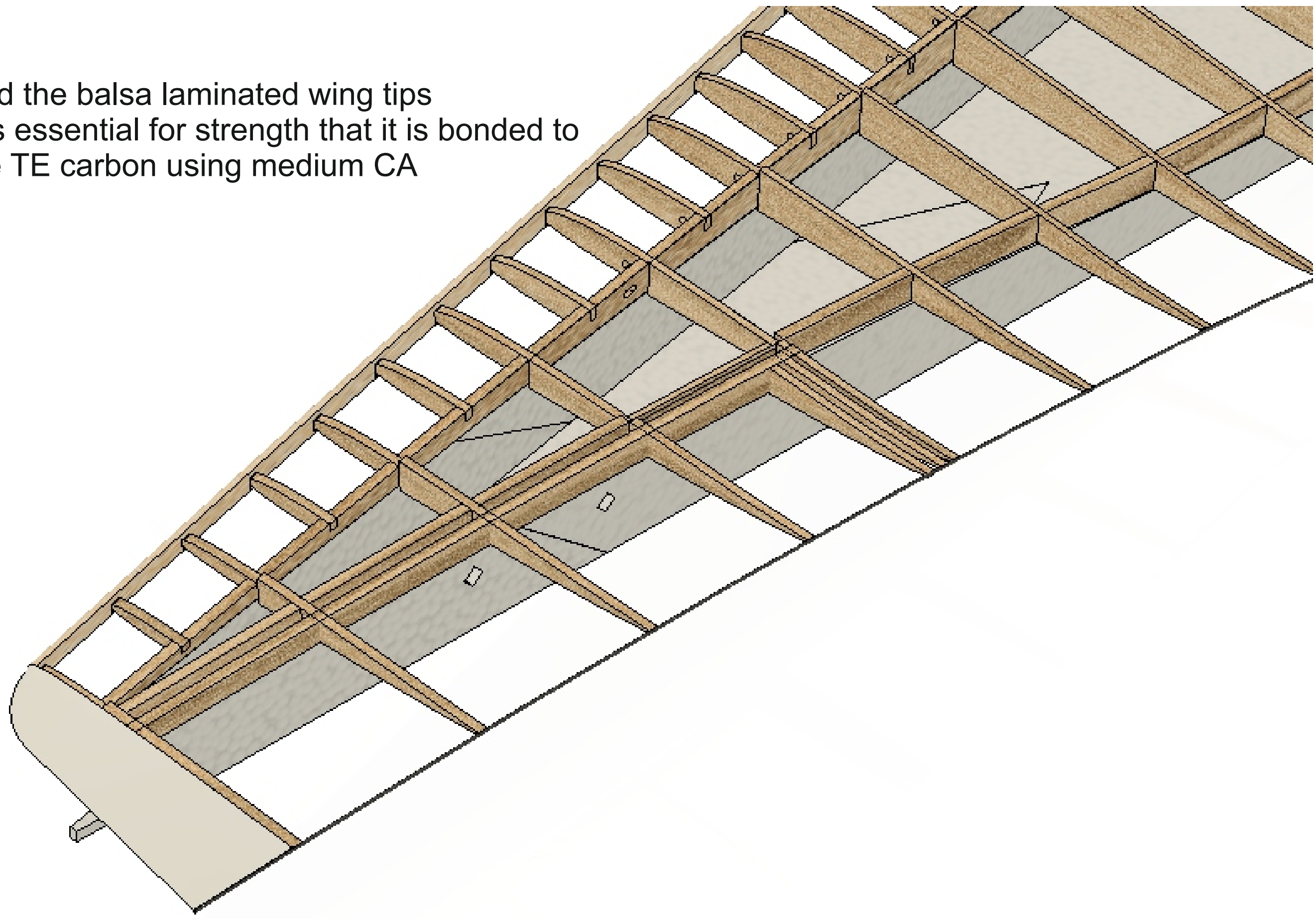


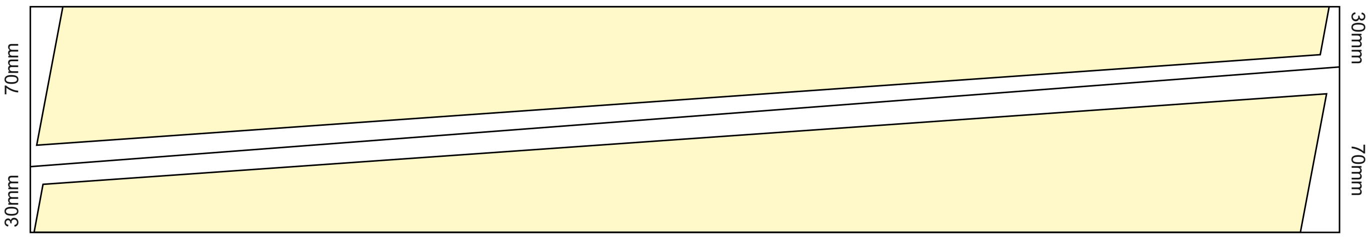
Work patiently from the wing tip using medium CA to fir the 1.3mm carbon trailing edge rod. Note that it needs to extend past the tip rib and onto the tip when fitted later. Also note it is NOT glued to ribs R1,R2 or R3



DO NOT OMIT!
Run the servo extension wire through the ribs and into the servo bay by passing it through the hole in the main Dbox spar.

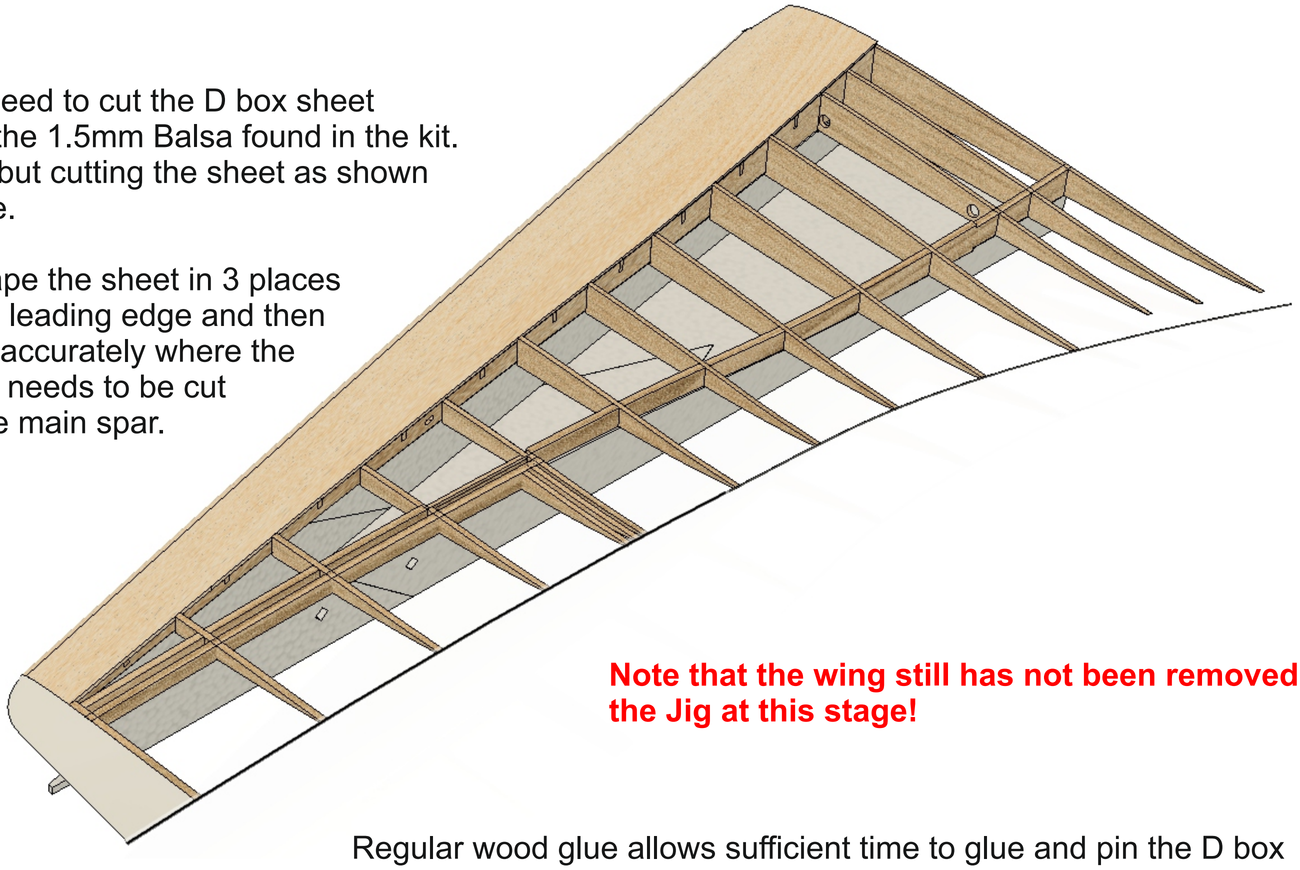
Add the balsa laminated wing tips
it is essential for strength that it is bonded to
the TE carbon using medium CA





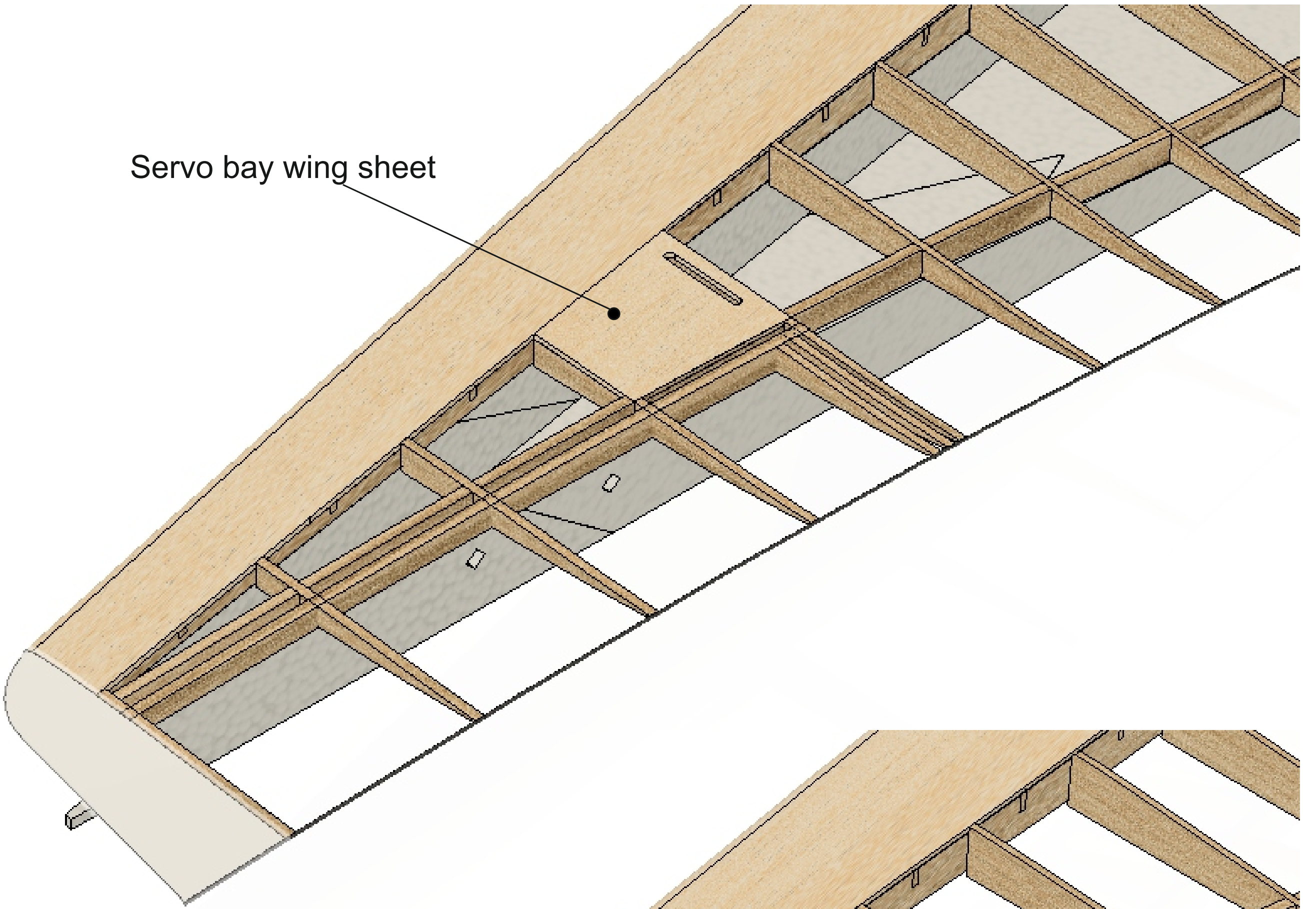
You need to cut the D box sheet
from the 1.5mm Balsa found in the kit.
Start but cutting the sheet as shown
above.

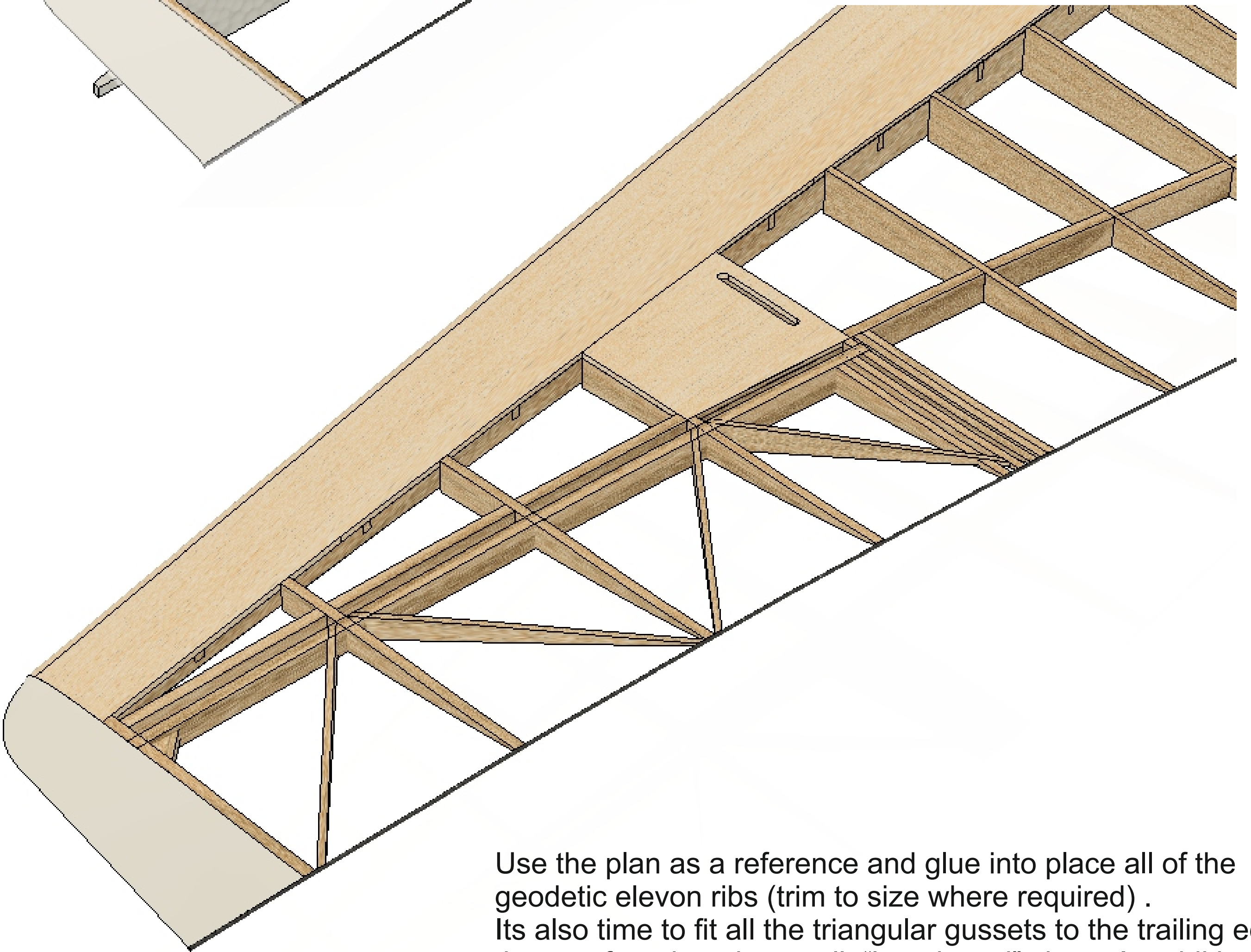
We tape the sheet in 3 places
to the leading edge and then
mark accurately where the
sheet needs to be cut
on the main spar.



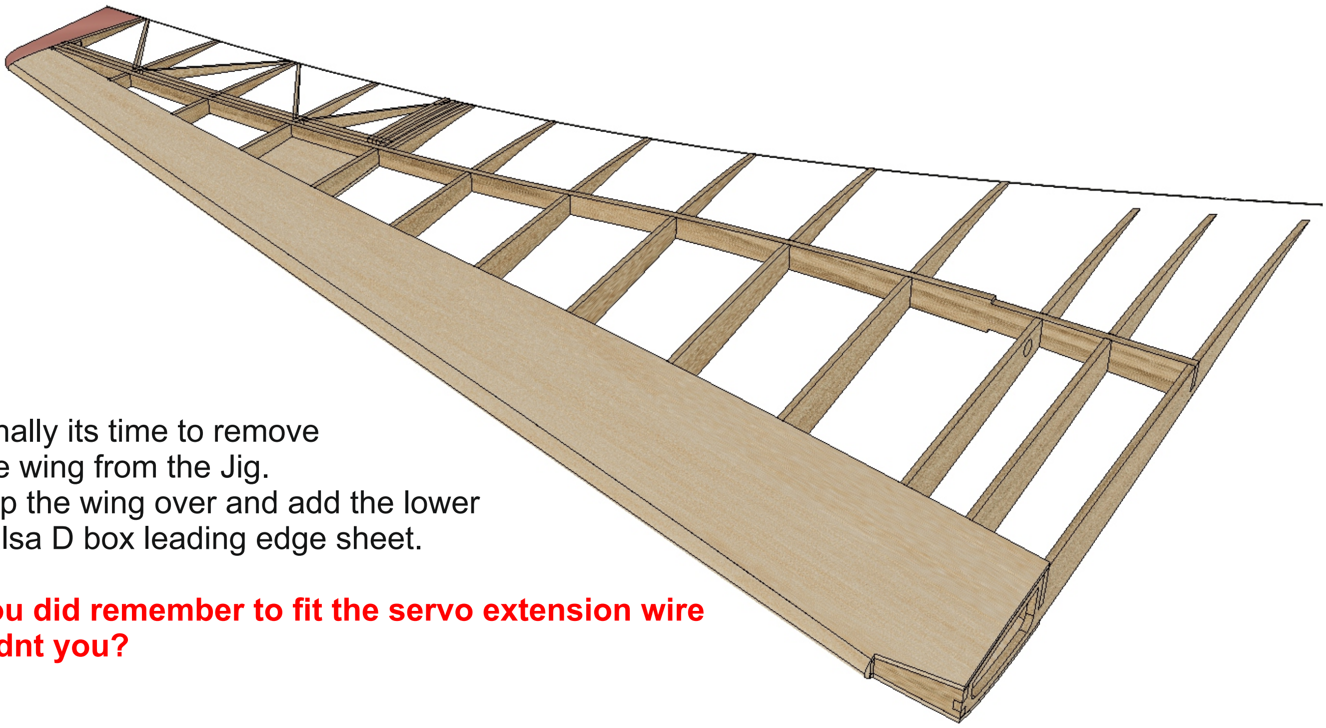
Note that the wing still has not been removed from the Jig at this stage!

Regular wood glue allows sufficient time to glue and pin the D box
top sheet into place Its important to use sufficient pins to ensure
the sheet is held into place on each rib and sub rib. 2 - 3pins per rib!





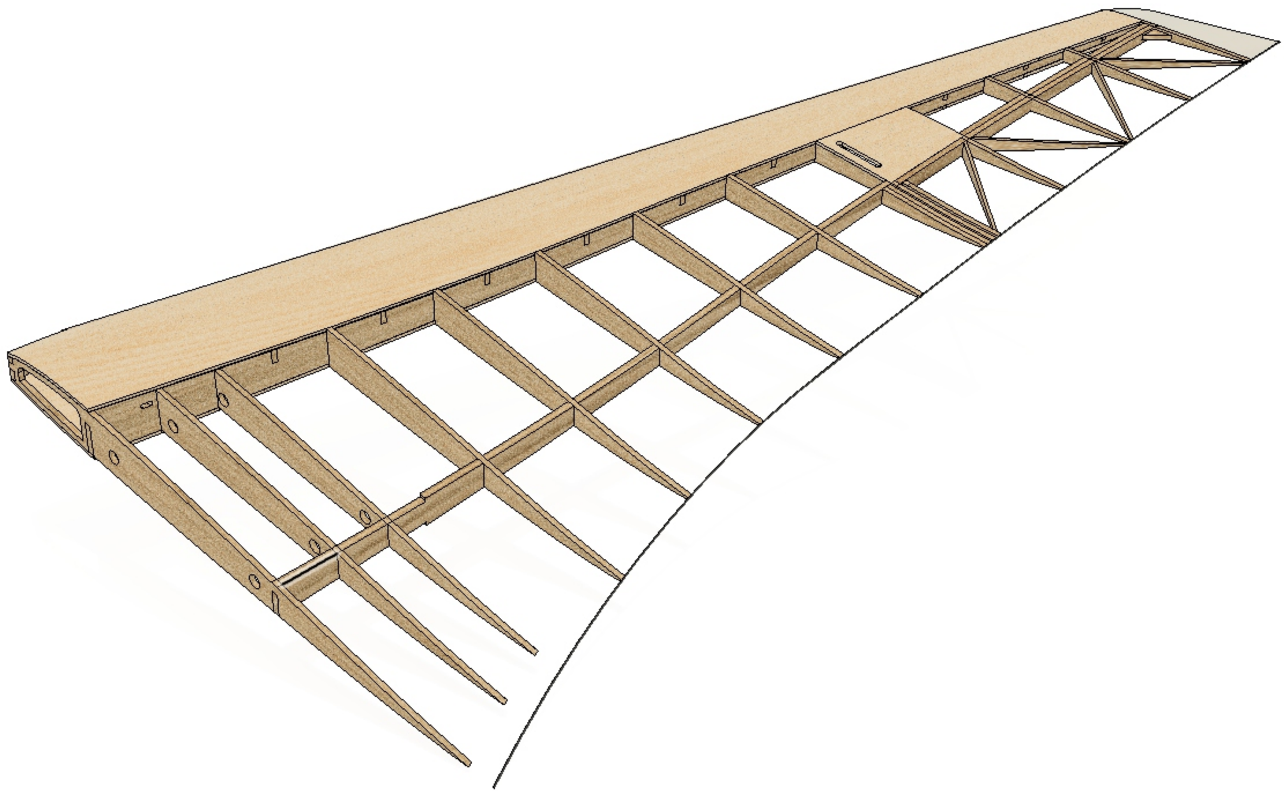
Use the plan as a reference and glue into place all of the geodetic elevon ribs (trim to size where required) .
Its also time to fit all the triangular gussets to the trailing edge that are found on the small "laserboard" sheet. In addition to the 2.5mm balsa gusset fitted between R9 and the rear spar.
(Please note the gussets are only shown on the paper plan)



Finally its time to remove
the wing from the Jig.
Flip the wing over and add the lower
balsa D box leading edge sheet.

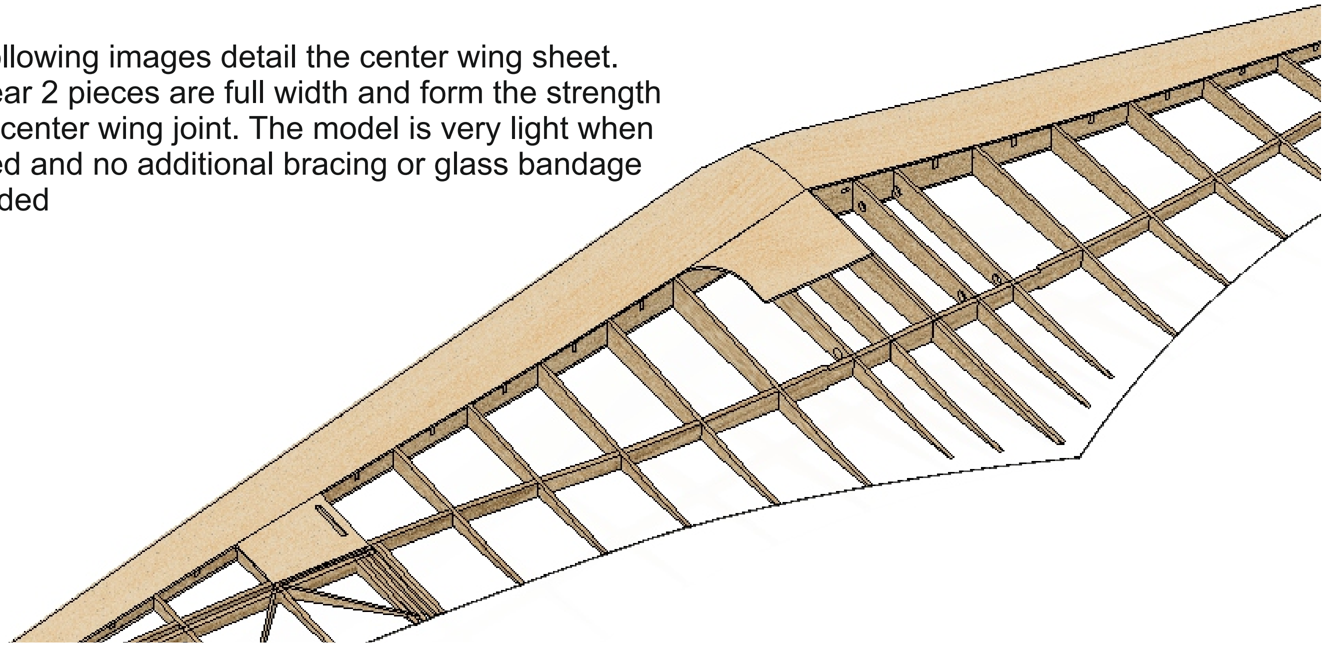
You did remember to fit the servo extension wire didnt you?

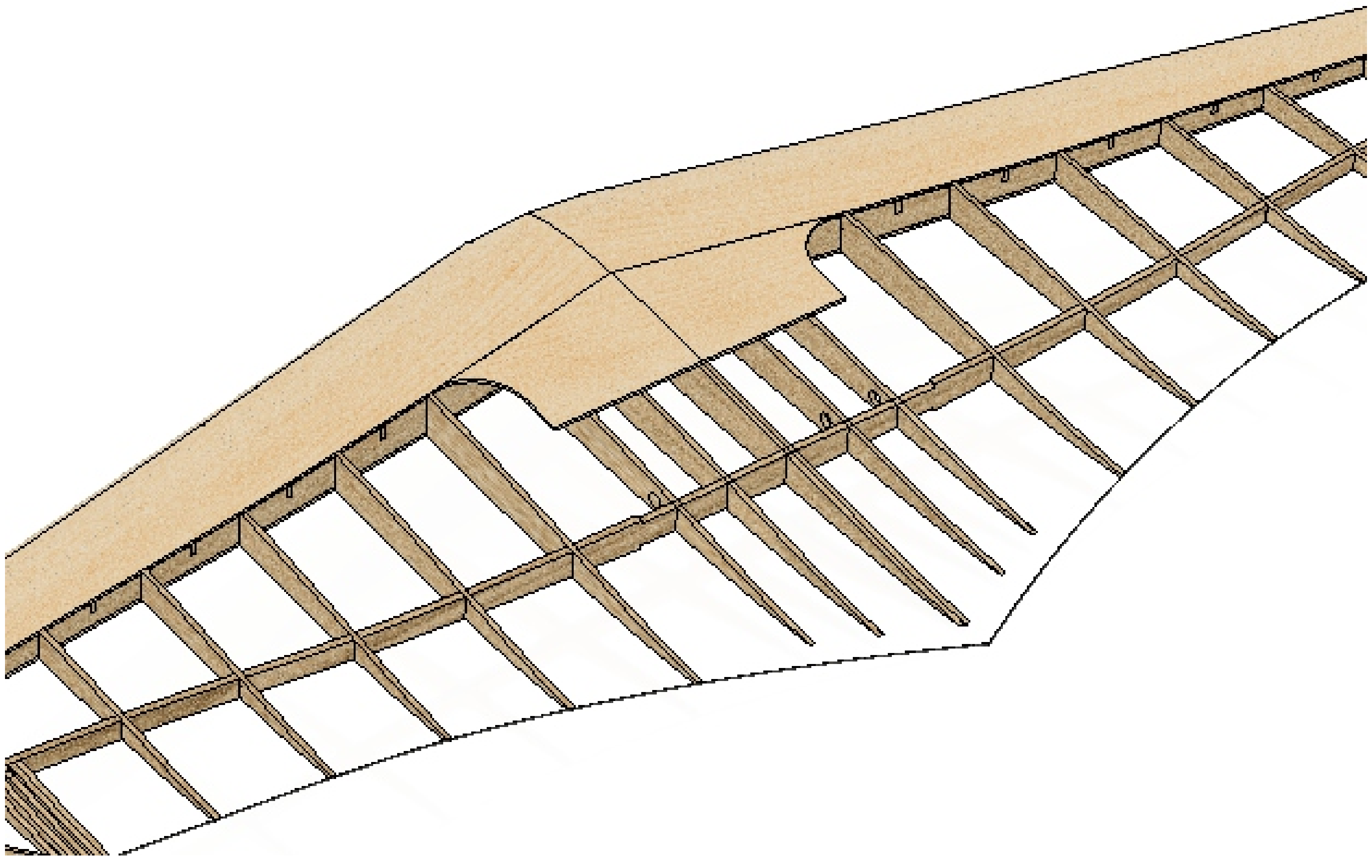
Repeat all the previous steps to make to ***opposite*** wing half.

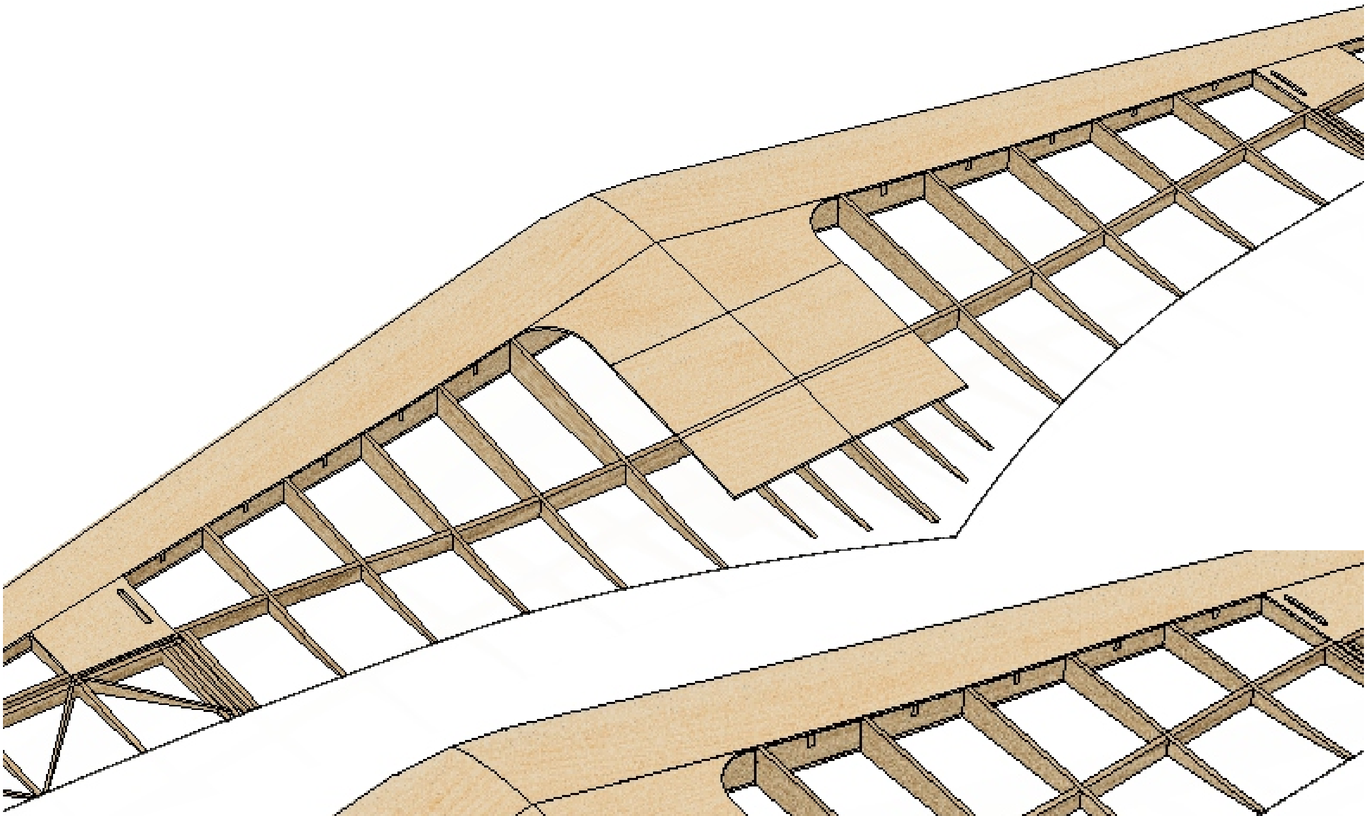


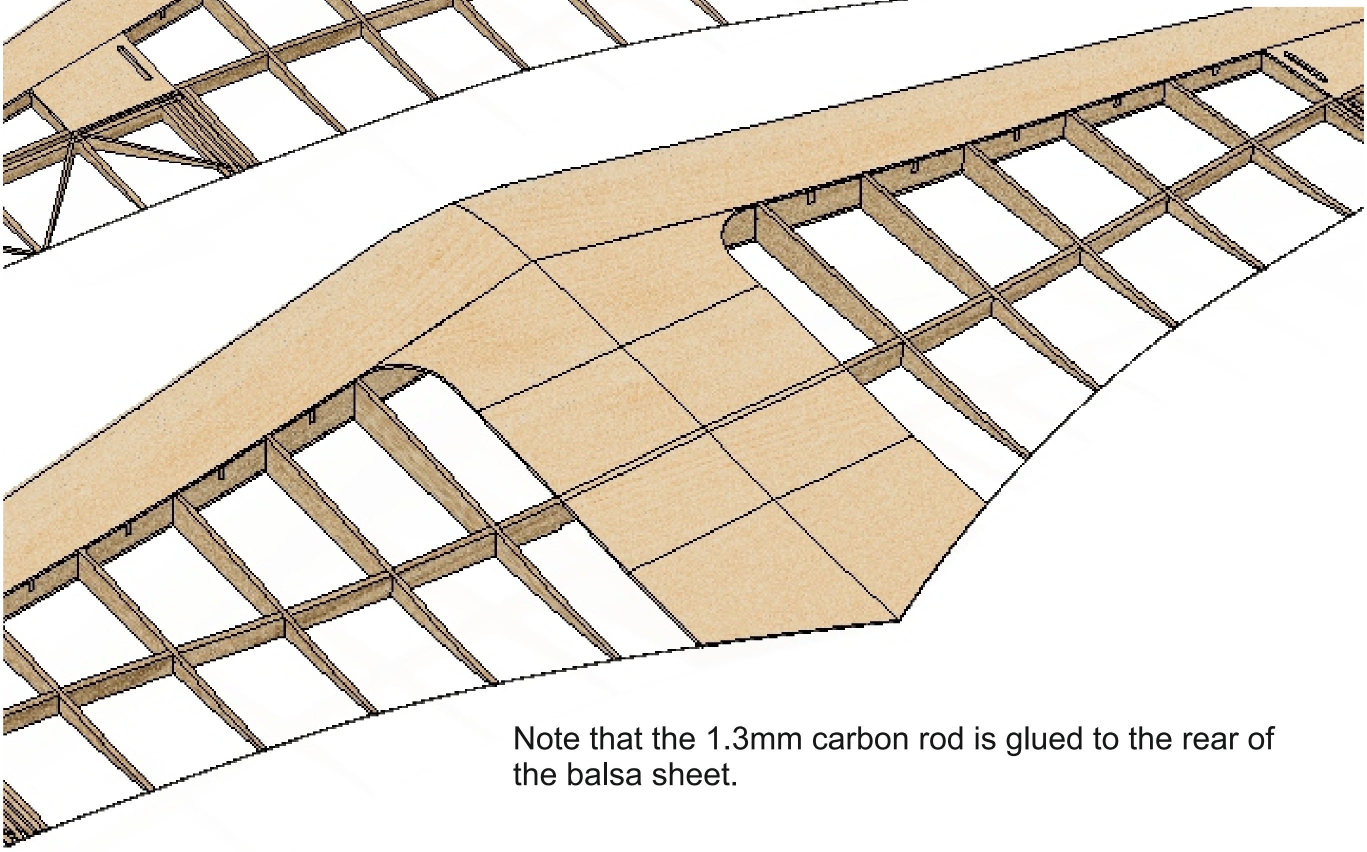
Join the two wing panels using wood glue and clothes peg to hold them together.
When viewed from the front the leading edge should appear as a straight line.

The following images detail the center wing sheet.
The rear 2 pieces are full width and form the strength of the center wing joint. The model is very light when finished and no additional bracing or glass bandage is needed



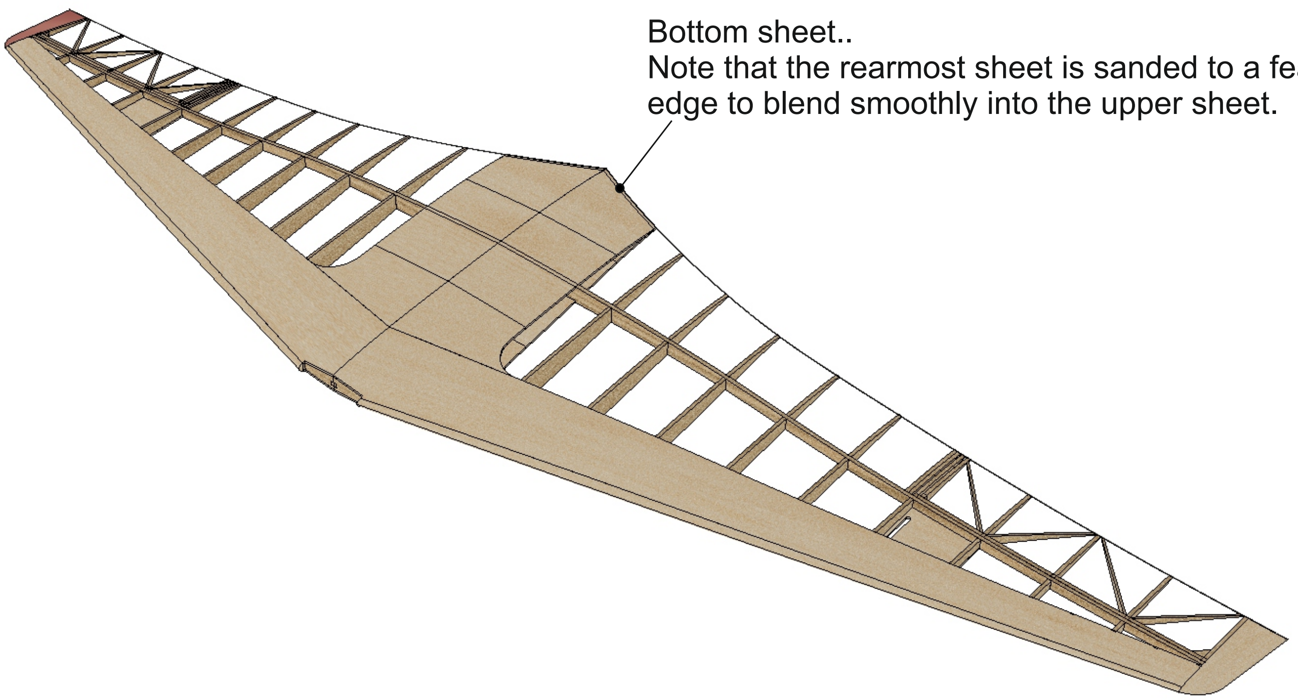




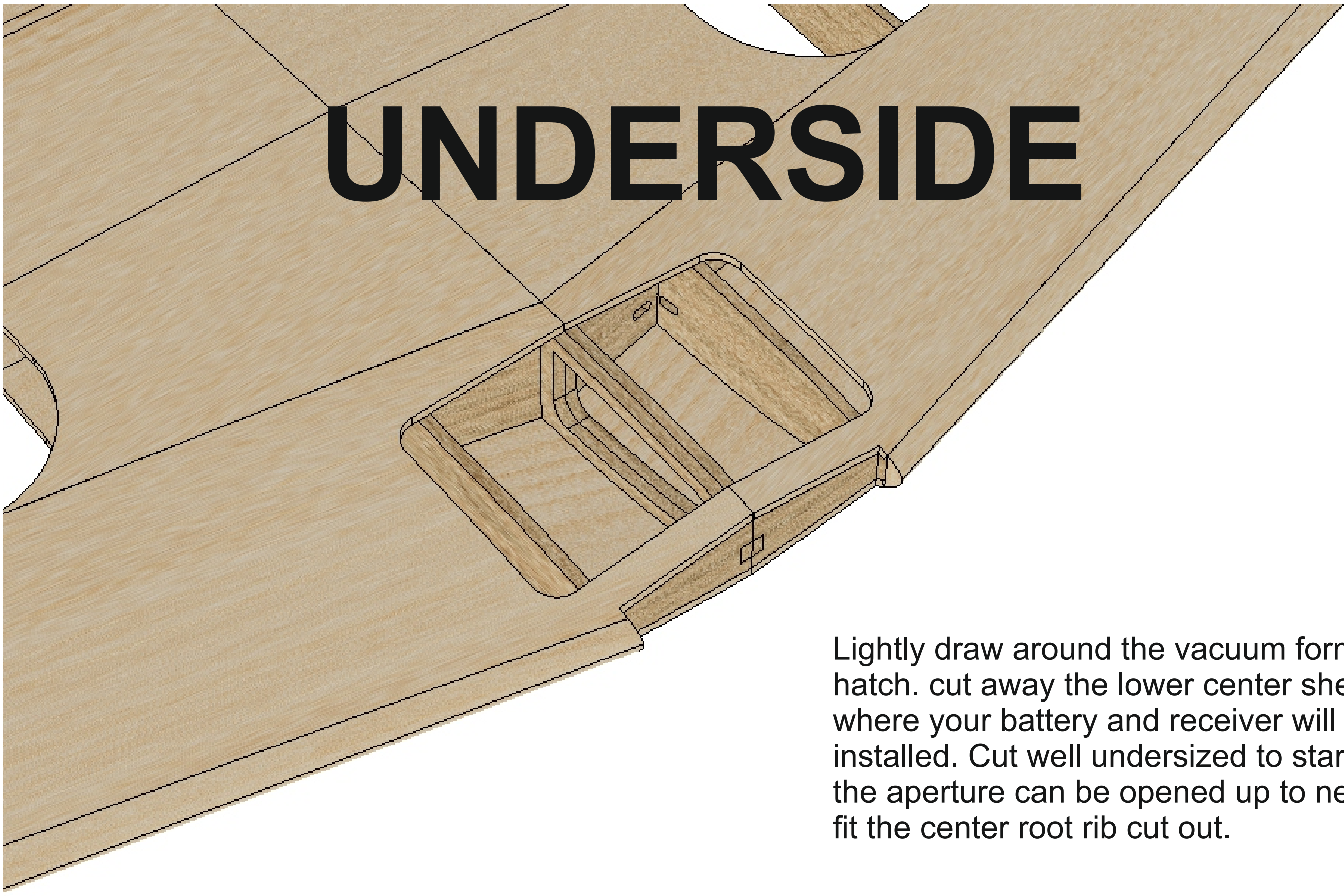


Note that the 1.3mm carbon rod is glued to the rear of the balsa sheet.

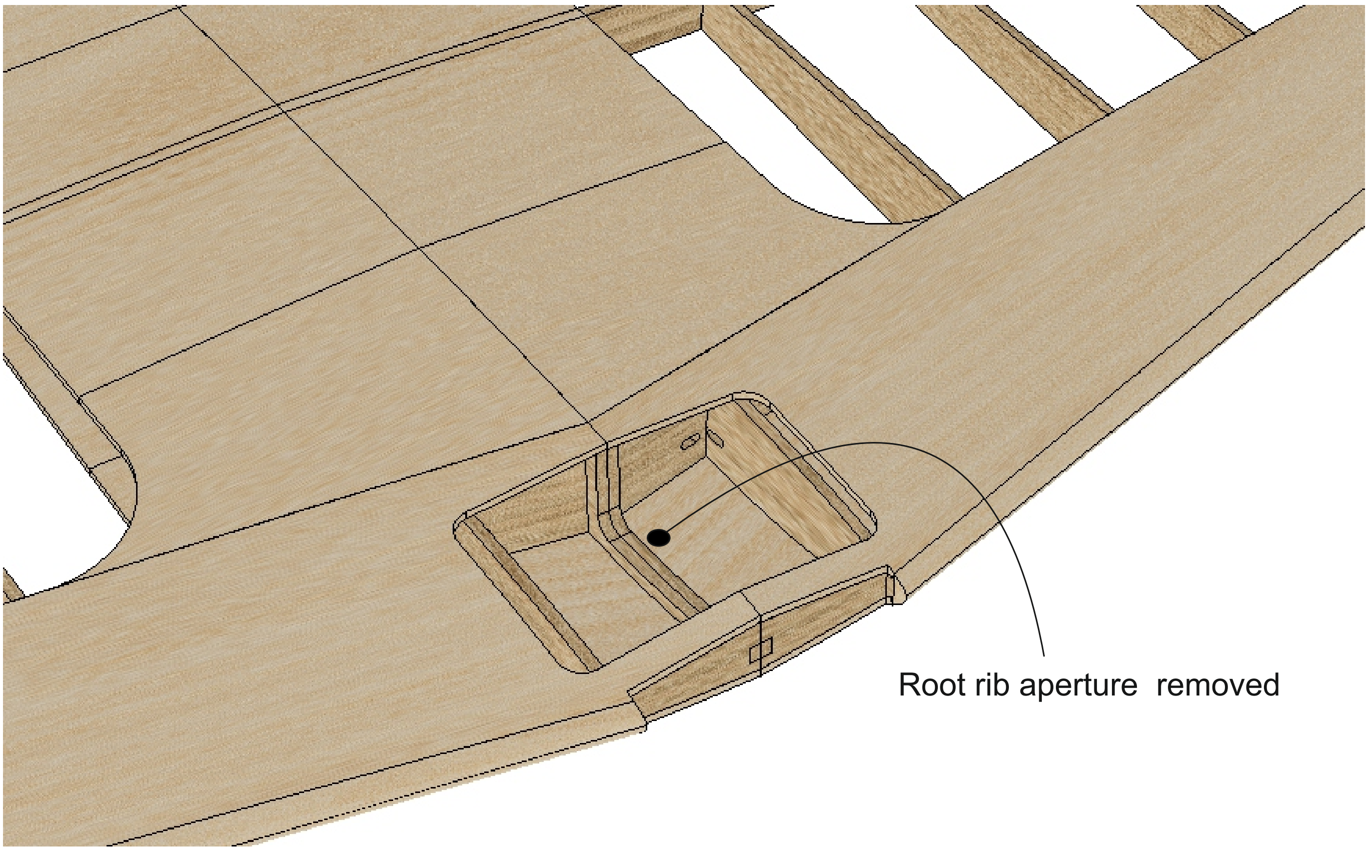
Bottom sheet..
Note that the rearmost sheet is sanded to a feather edge to blend smoothly into the upper sheet.

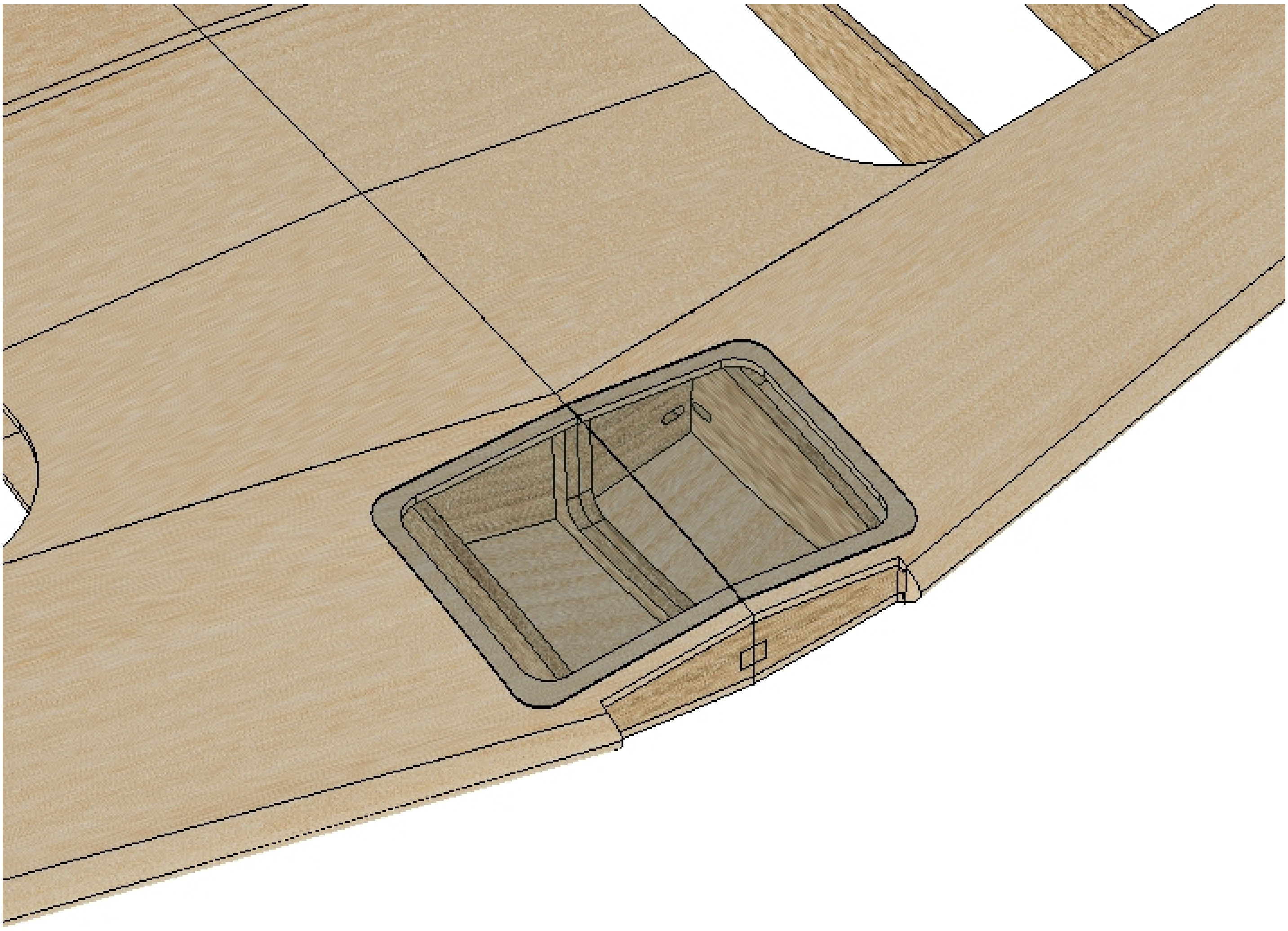


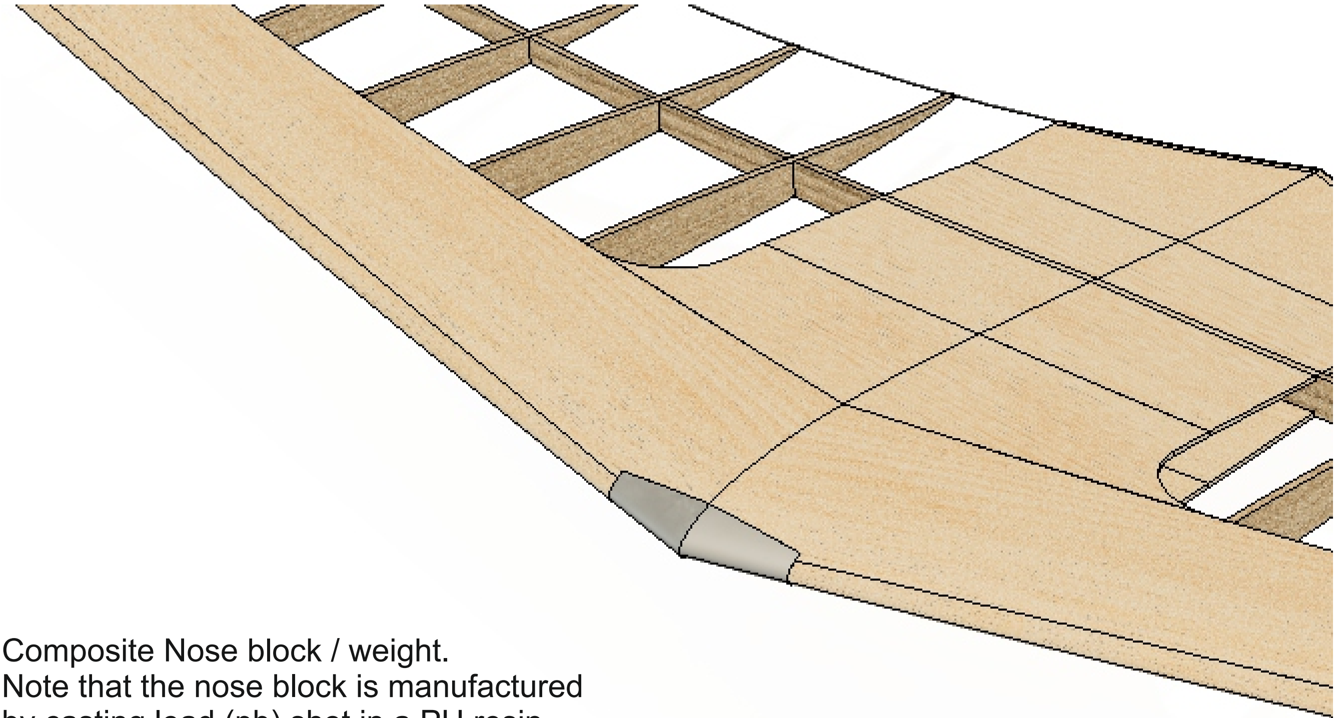
UNDERSIDE



Lightly draw around the vacuum formed hatch. cut away the lower center sheet where your battery and receiver will be installed. Cut well undersized to start with. the aperture can be opened up to neatly fit the center root rib cut out.

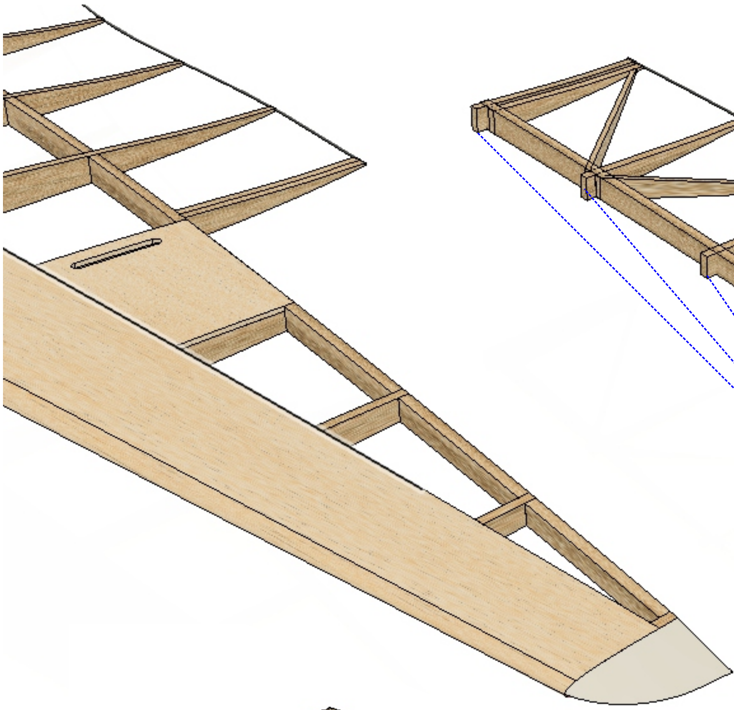


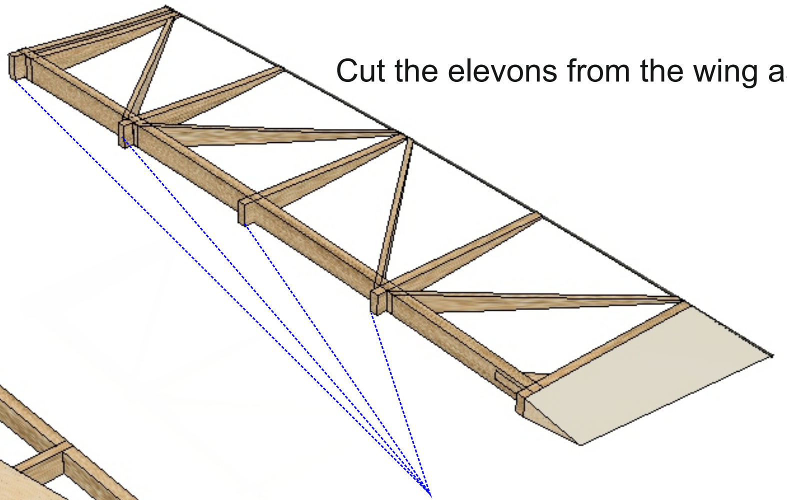




Composite Nose block / weight.
Note that the nose block is manufactured
by casting lead (pb) shot in a PU resin.
Please handle the nose block with care and use gloves and a mask
when sanding / shaping the nose block to match the wing profiles.

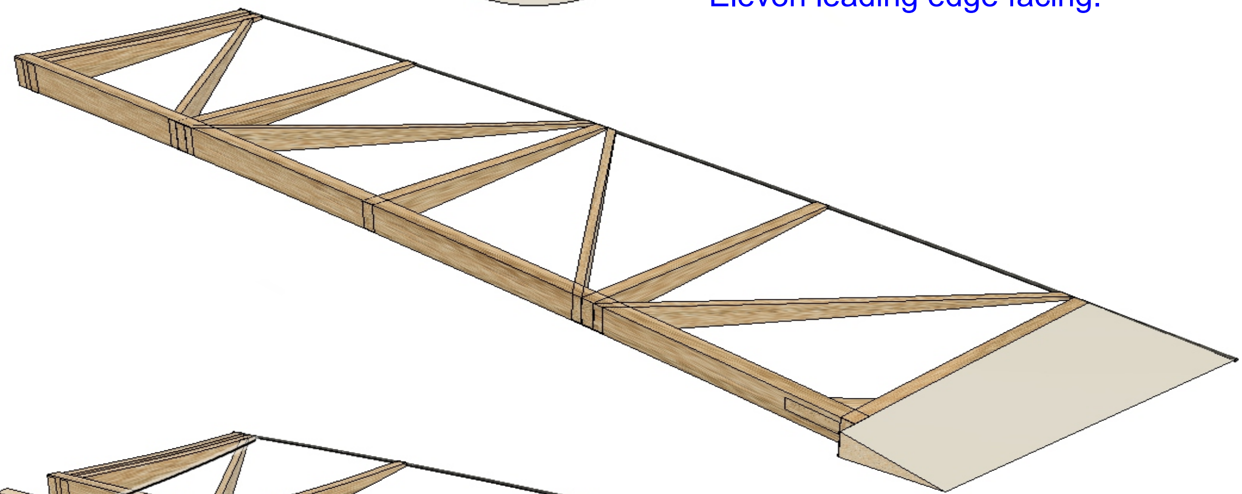
The entire wing, and wing tips should now be carefully sanded to its final shape.

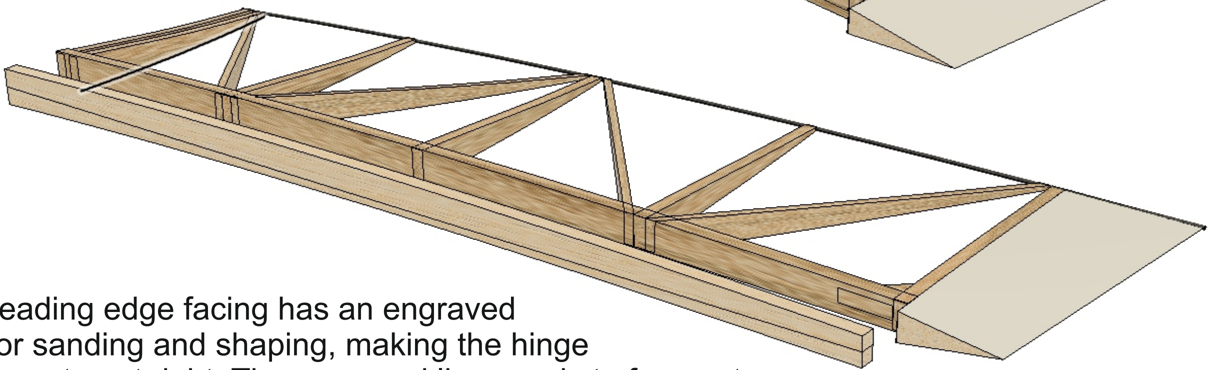




Cut the elevons from the wing assembley.

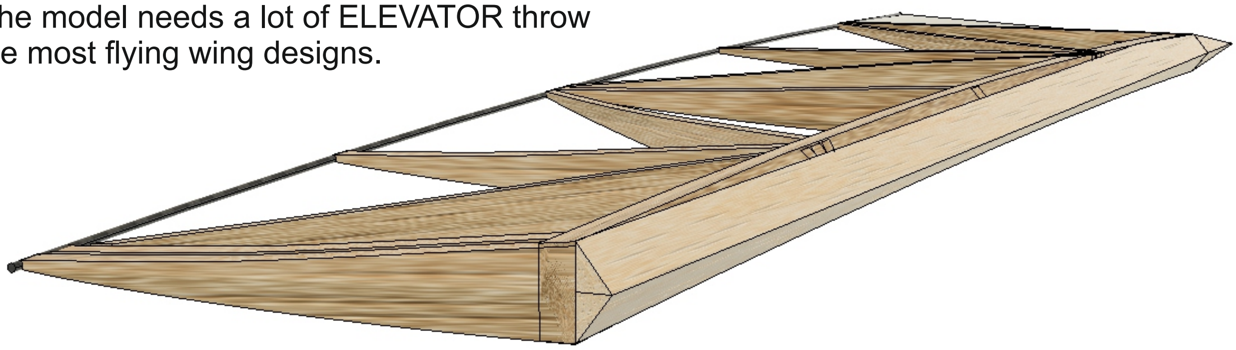
When removed you will have 3mm deep tabs extended in front of the elevon spar. These need to be trimmed off to facilitate the Elevon leading edge facing.

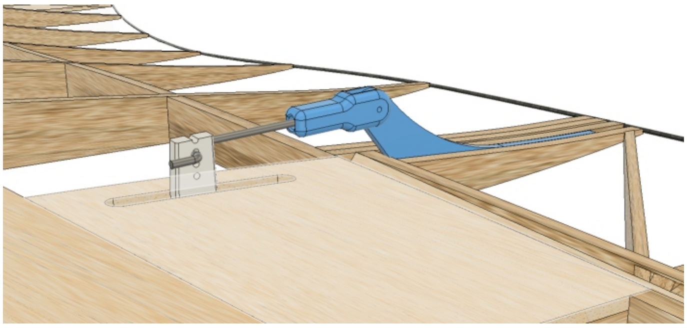


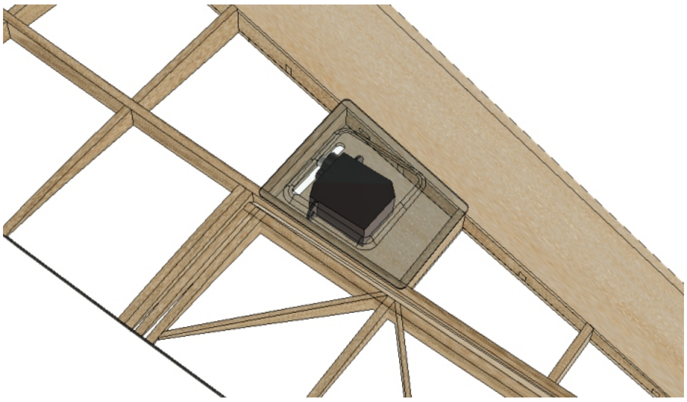
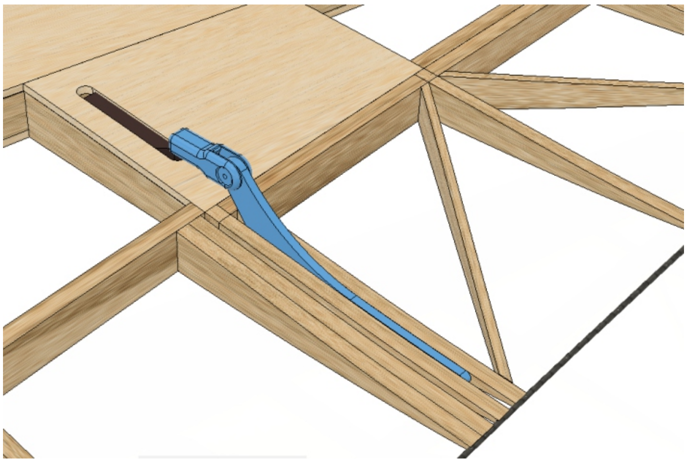


The leading edge facing has an engraved line for sanding and shaping, making the hinge line easy to get right. The engraved line needs to face out.

Elevons need a 45 degree bevel sanding / planing onto them along the engraved line. This may sound excessive but the model needs a lot of ELEVATOR throw unlike most flying wing designs.





Servos are simply glued to the wing sheet. A **small amount** of hot glue works well as does contact adhesive such as evostik or a silicone adhesive. We do not recommend CA (superglue) These images of the servo and linkages are for reference only, as we assume that you already have experience with balsa RC model building.

Final Construction notes

The model is more than strong enough for its size and weight. However it is really easy to ruin the model and the unique wing twist by using the wrong covering materials!

We only recommend Feather Cover, Oralite, or ParkLite covering. Coverings heavier than this all have higher shrink properties and can destroy the trailing edge or induce twists into the wing.
Please use the wing Jigs to make sure you haven't induced any unwanted twist into the wing. We can get away with a little extra twist at the tips (washout) but reducing the twist will reduce the stability of the aircraft, and could lead to non co-ordinated turns. CG is critical and you must not go beyond the recommended 82mm rearward point. We understand that you will need extra noseweight to achieve this but it is vitally important. Failure to comply with the CG will lead to uncontrollable flight, dutch roll, and a generally unpleasant experience.

Also note the recommended control throws (they are correct!) and a good starting point for you to tune to your own preference.

FVT3

Span	1200mm	47.25 inches
Root Section	Propietary Reflex	8% Thick (approx)
Tip Section	Propietary Symetrical	7.5% Thick (approx)
Twist	Non Linear Twist	BSLD
Weight	220 to 250g	7.9 to 8.9 oz
Wing Area	19.2 dcm2	297 sq inch 2.06 sq ft
Wing Loading	11.45 - 12.85 g/dcm2	3.8 - 4.3oz sq ft
Dihedral	Approx 3 degrees	
Elevator Throw	30 degree up and down	No Expo
Aileron throw	20 degrees up, 15 degrees Down	20 to 30% Expo
CG	80 to 82mm from Leading edge	CRITICAL!

As you can see from the data table above the FVT3 (v3) is very lightly loaded. Despite this,due to the thin wing section and low drag it can penetrate well into smooth slope lift. What it doesn't like however is blustery conditions or turbulence. Turbulence simply tosses the model around. So for test flights pick a day with light winds 5 to 10 mph (2.2 - 4.5 m/s). Launching is simple despite the lack of a "skeg" or anything to grab. Hold the model by the nose with your thumb underneath the nose and you four fingers on the upper surface. Its natural using this method to push the model away in a slightly nose down attitude (exactly what we need).

You will quickly notice that the model is amazingly pitch stable. Hence the large elevator throws, but sensitive in roll. Roll inputs should be applied smoothly and progressively. If you have any pronounced "Dutch roll" then your CG is simply too far back. Allow the model to settle naturally and keep the flying speed at its natural happy point.

Losing altitude quickly is best done by holding the model in a tight turn with some down elevator in. Applying down elevator only increases the speed of the model but as soon as you back off the application of down elevator it tends to instantly zoom back up to height.

Loops are easy after a short dive buy the application of full up elevator and reducing the elevator as you go over the top. Rolls are messy! but possible at speed. The FVT3 was never designed to be aerobatic in any way.

Landing is easy you just have to fly the model to touchdown. If you slow the model too much you will not see a conventional stall but will loose directional stability.

We hope you have fun exploring this unique flying model.