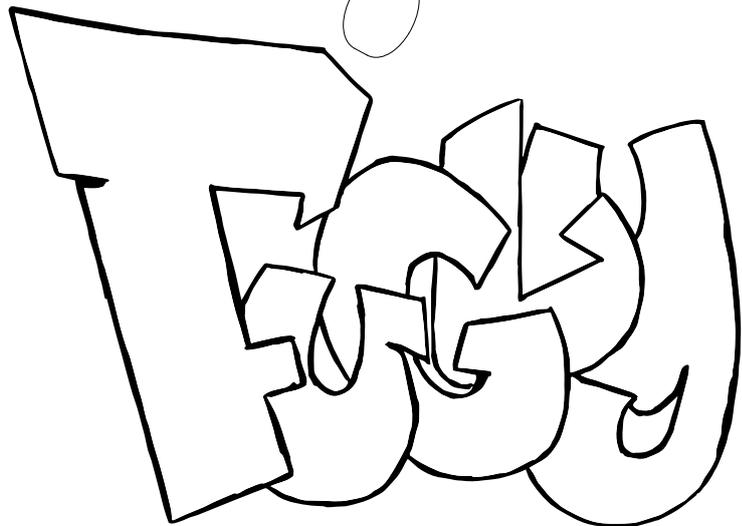
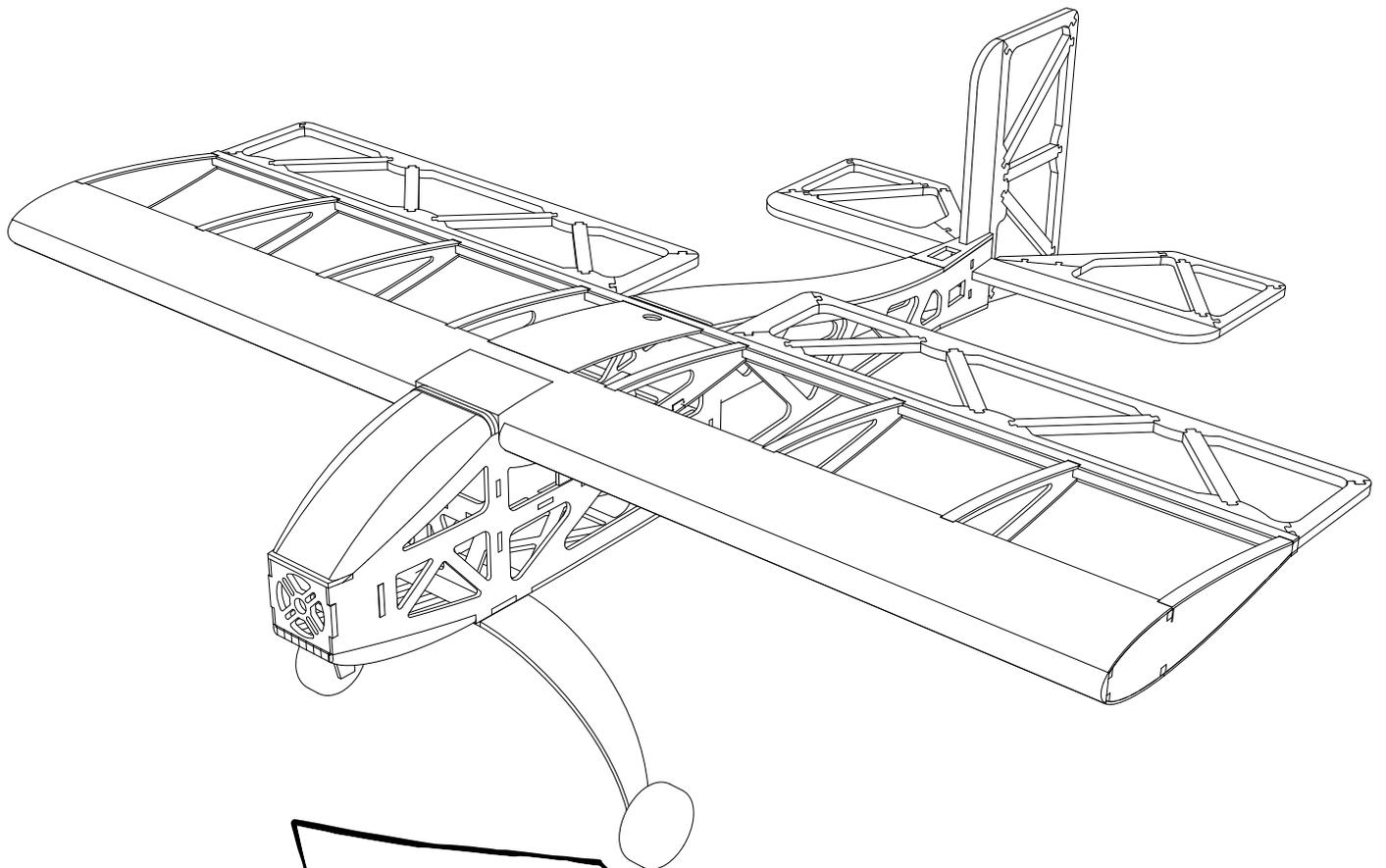




**BRAIN CUBE**

**AEROMODELS**



**Fugly**

BrainCube Aeromodels Ltd.

# Introduction

Thank you very much for buying BrainCube Aeromodels' **Fugly**, our first design in a range of easy to build, fun to fly model aircraft kits. **Fugly** is a fun-fly style model, designed to reuse the motor, speed controller, servos and batteries from popular electric ARTFs like the Ripmax WOT4 Foam-E and Acro Wot Mk2 Foam-E.

By combining careful 3D CAD design with high quality materials and high precision laser cutting, we have created a builders kit that can be built in a weekend even by the total beginner. The finished **Fugly** is small enough to fit into most cars in one piece, light enough for extreme aerobatics yet sturdy enough to be your regular "Sunday hack". Whilst the model will loop in it's own length and roll too fast to count with the controls at full deflection, dial them down and **Fugly** becomes docile enough for any competent model pilot to handle.

## Specifications

<b>Wingspan:</b>	905mm / 35.6"
<b>Flying Weight:</b>	1.2kg / 2.6lb
<b>Power:</b>	300 - 400W
<b>Battery Packs</b>	2200mAh 3S recommended

## Support

We hope that you will find **Fugly** easy to build and fun to fly, however if you have any problems, questions, comments or queries please get in touch:

BrainCube Aeromodels Ltd, Unit 3 Ballingall Industrial Estate, Brewery Lane, Dundee, DD1 5QW

Telephone: 01382 690 151 Email: [support@www.braincube-aero.com](mailto:support@www.braincube-aero.com)

# Tools & Materials

**Fugly** is easy to build, but you will require some tools and materials on top of the parts included in the kit.

**Building board** - A flat sheet of wood (20mm thick MDF is ideal) at least 900mm / 36" by 300mm / 12", topped with a layer of cork tiles for pins to securely stick into.

**Hobby knife or scalpel** - A sharp knife for cutting and carving balsa wood into shape before sanding.

**Sanding block and sand paper** - 200-400 grit sandpaper is fine for shaping balsa wood.

**Drill** - Most holes are pre-cut by our laser cutter but there are a couple of occasions where this isn't possible.

**Wood glue** - This can be PVA, aliphatic, "super aliphatic". This will be used for the majority of the construction.

**Thin super-glue** - Also know as Cyanoacrylate or CA glue, it comes in a variety of thickness's and speeds. Thin CA is thinner than water, and will wick into wood very quickly. Be careful using this glue, it will stick skin in a second given a chance.

**10 Minute Epoxy** - A strong, thick, two part, adhesive that you have to mix before use. It often comes in a twin syringe pack making it easy to measure out, and a 10 minute cure time gives a good balance between speed and strength.

**Hobby Pins** - The best ones to use are the "T" shaped pins. These are used to hold balsa parts together while glue dries.

**Masking Tape** - It's not always possible to use pins to hold parts together, so masking tape can be used instead.

**Covering Film** - **Fugly** is designed to be covered with heat sensitive film like Oracover, Solarfilm, etc.

**Covering Iron** - Covering film can be applied using a domestic clothes iron, but a dedicated covering iron is much easier to use.

# Diagram Key



Notice / caution



Information / instruction



Clamp



Pins



Epoxy



Super glue



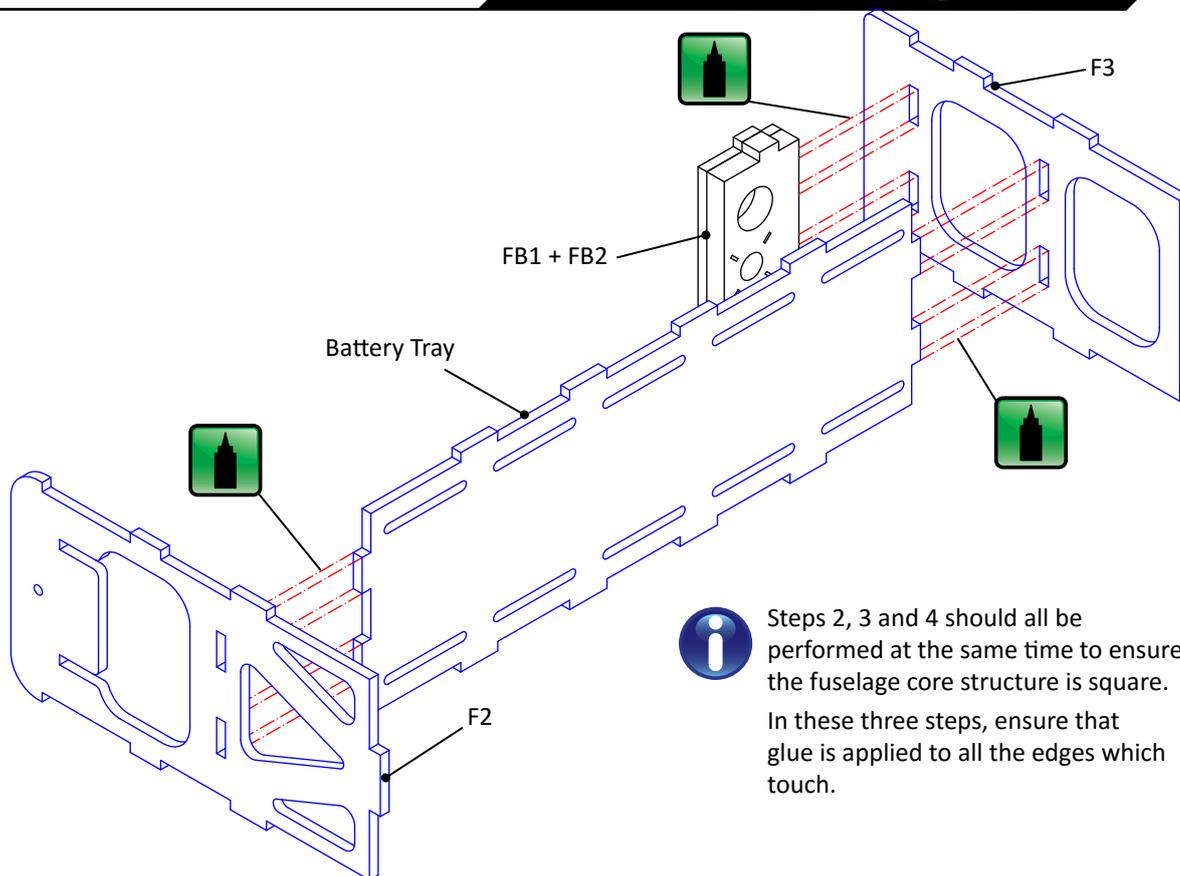
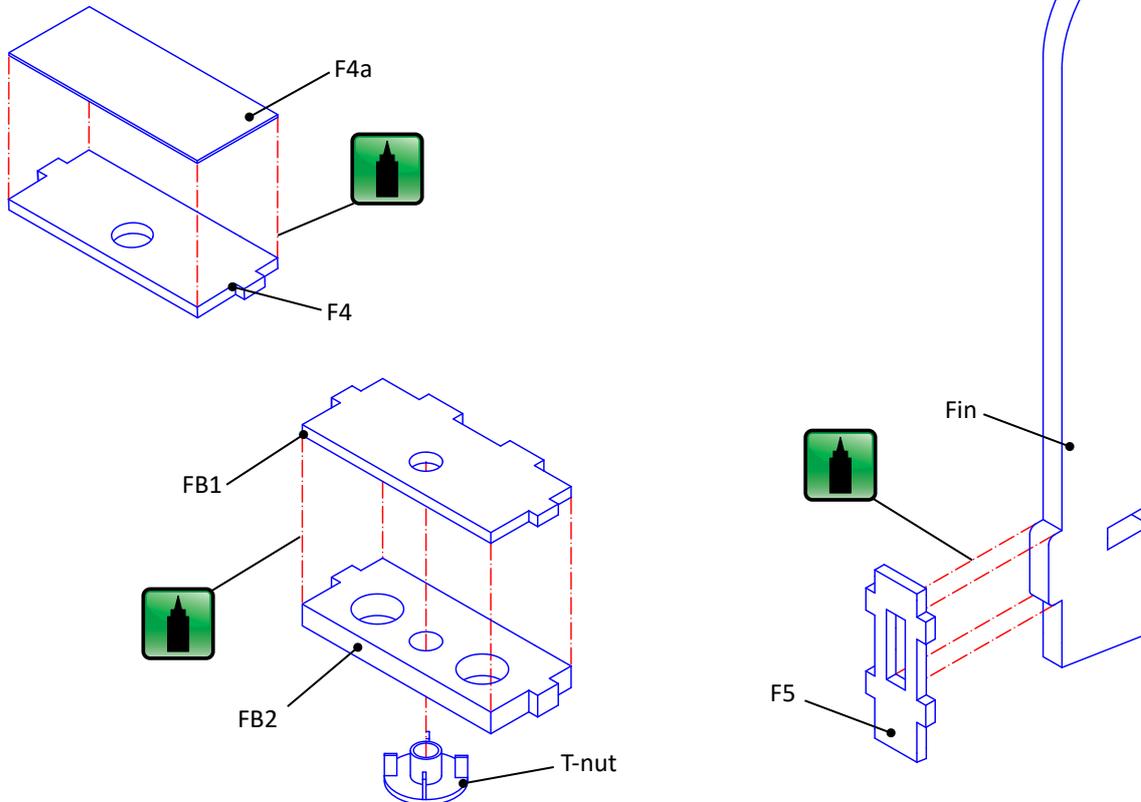
Wood glue



Masking tape



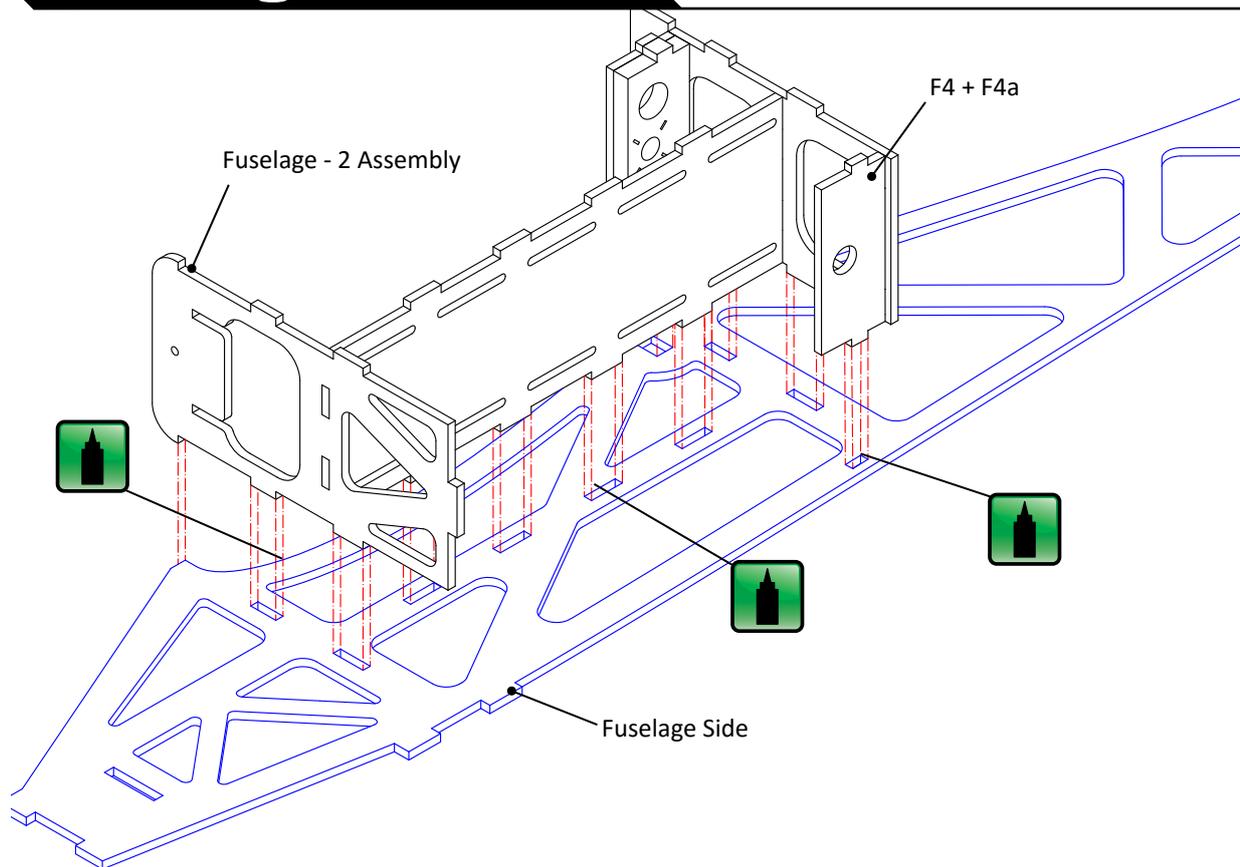
Before you begin construction make sure you cover your building board with polythene or cling film (plastic food wrap) to make sure you don't accidentally stick parts to the board.



Steps 2, 3 and 4 should all be performed at the same time to ensure the fuselage core structure is square. In these three steps, ensure that glue is applied to all the edges which touch.

## Fuselage - 3

Fuselage Side, F4+F4a

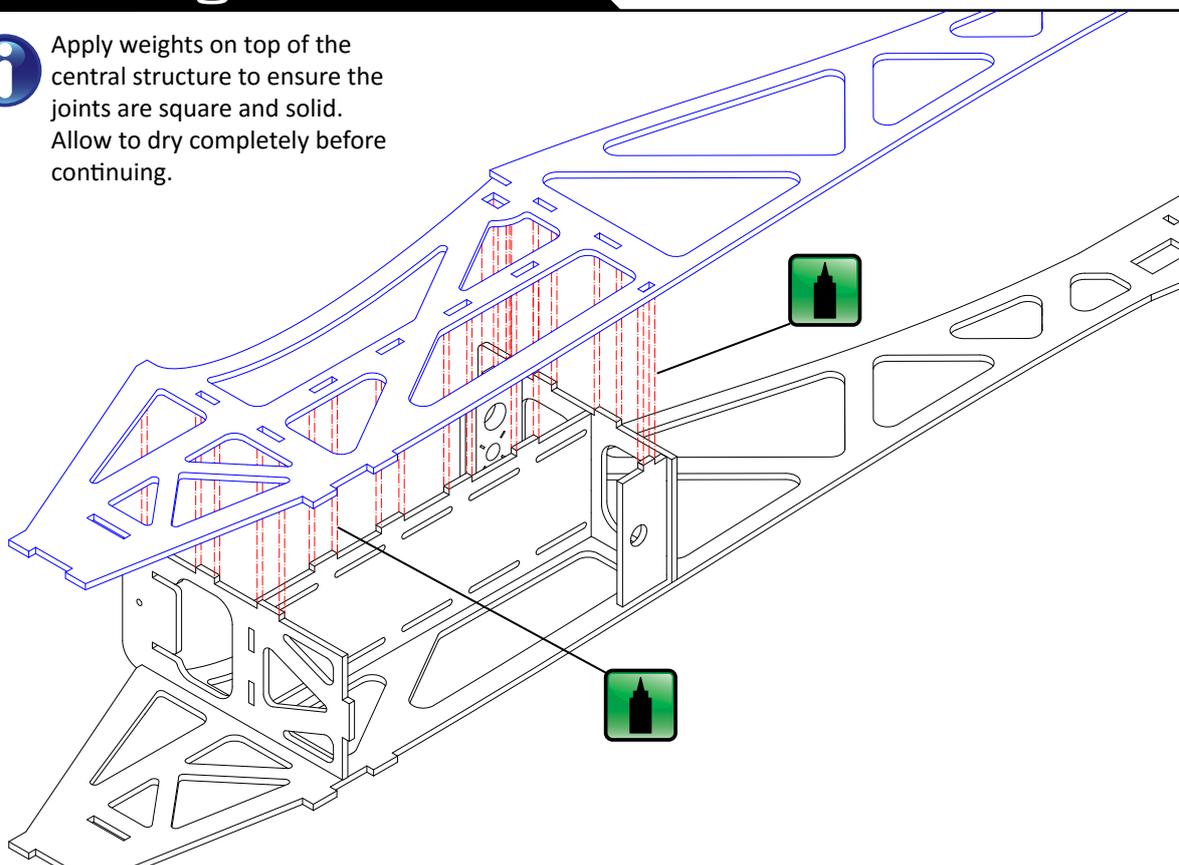


## Fuselage - 4

Fuselage Side



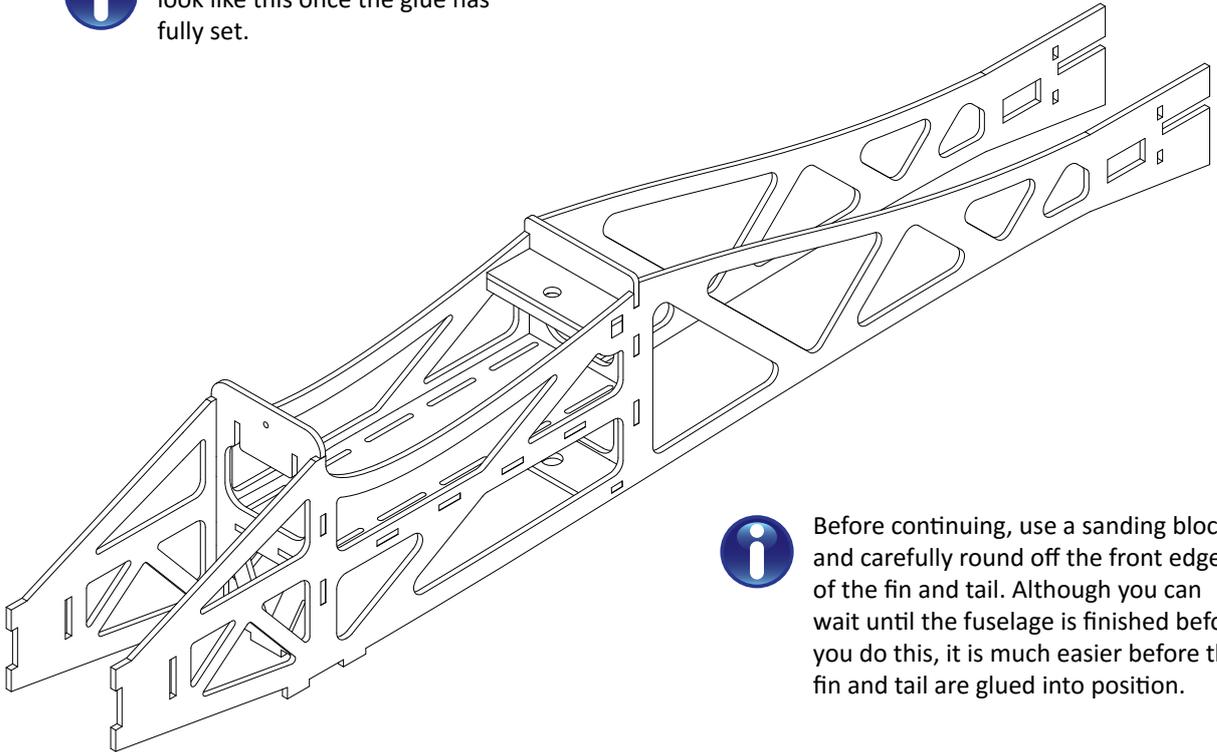
Apply weights on top of the central structure to ensure the joints are square and solid. Allow to dry completely before continuing.



## Fuselage - 5



Your fuselage assembly should look like this once the glue has fully set.



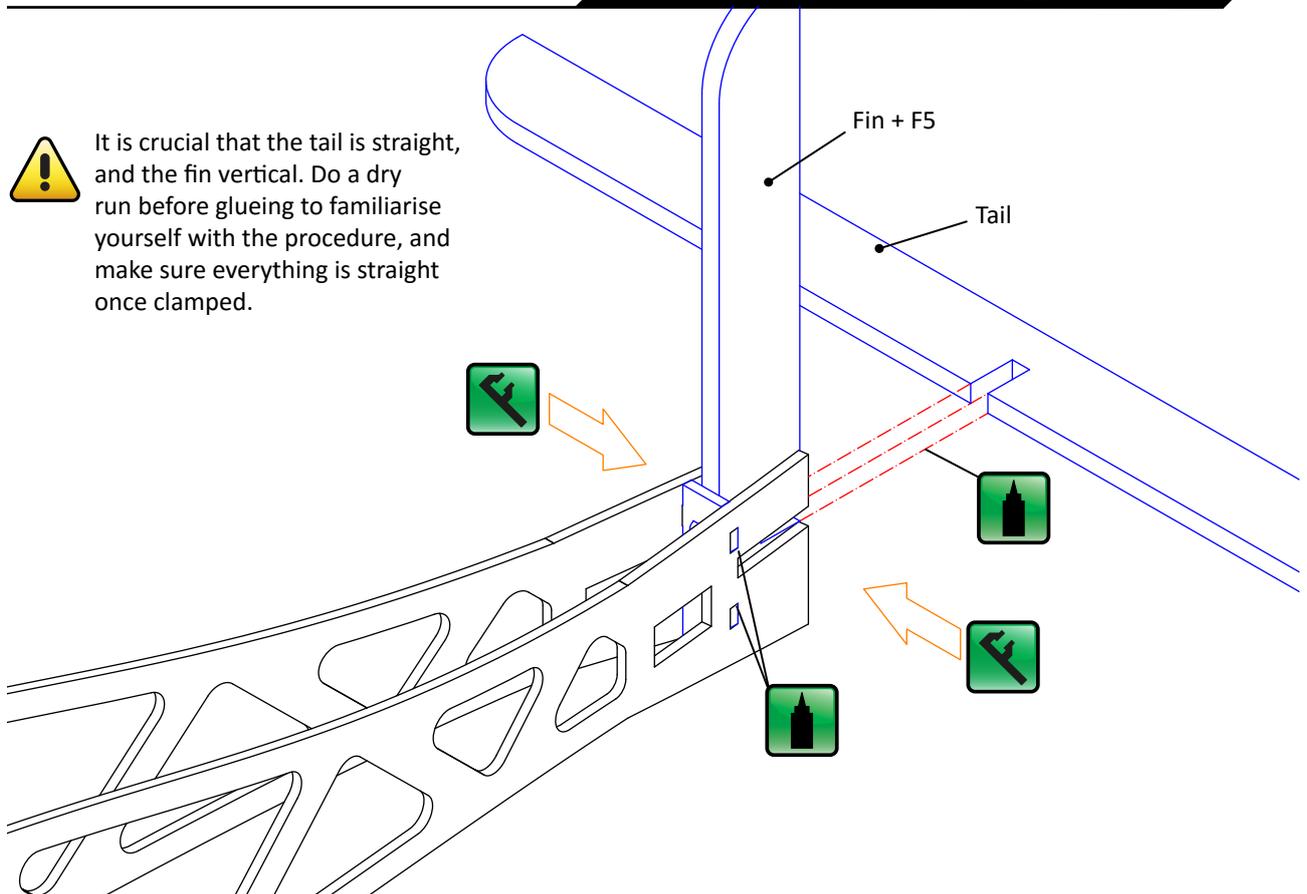
Before continuing, use a sanding block and carefully round off the front edges of the fin and tail. Although you can wait until the fuselage is finished before you do this, it is much easier before the fin and tail are glued into position.

### Tail, Fin + F5

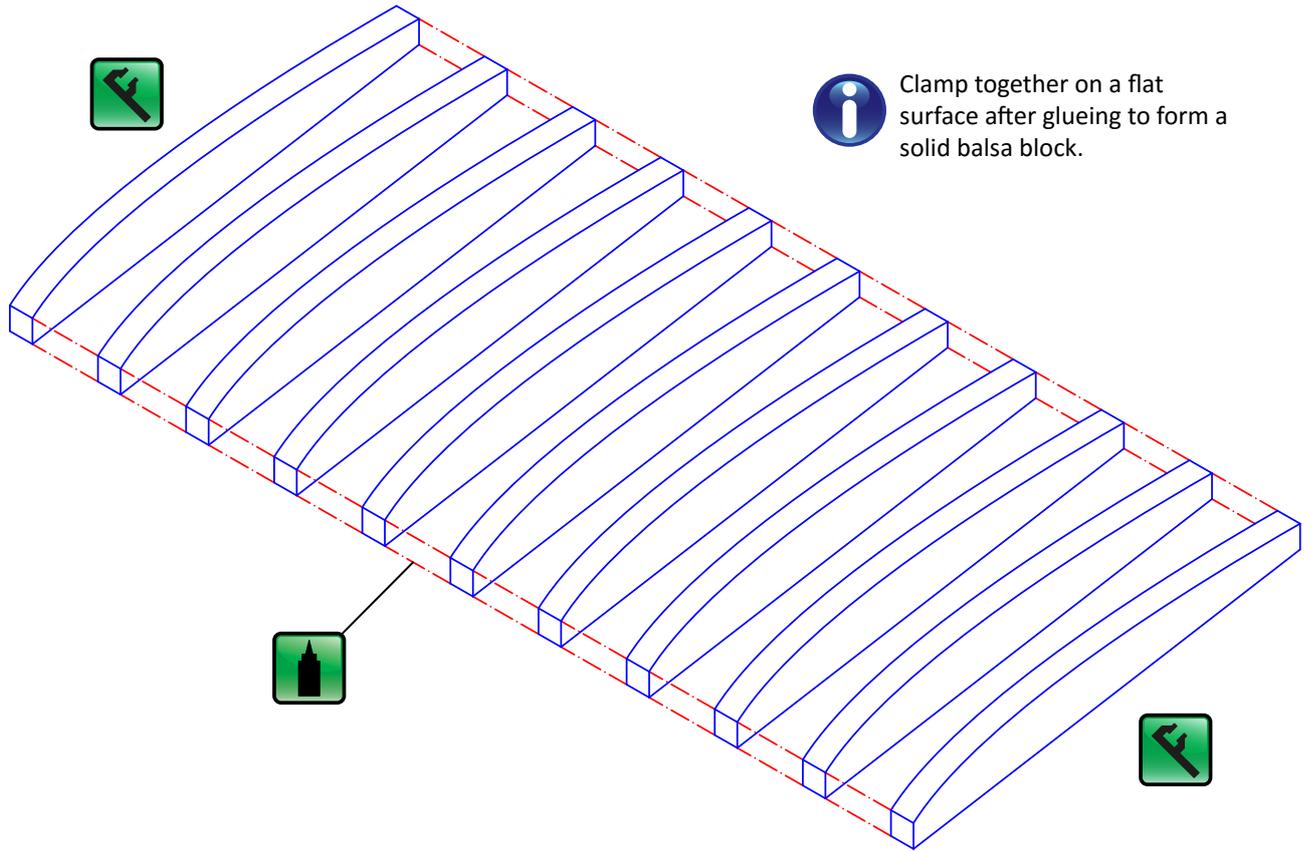
## Fuselage - 6



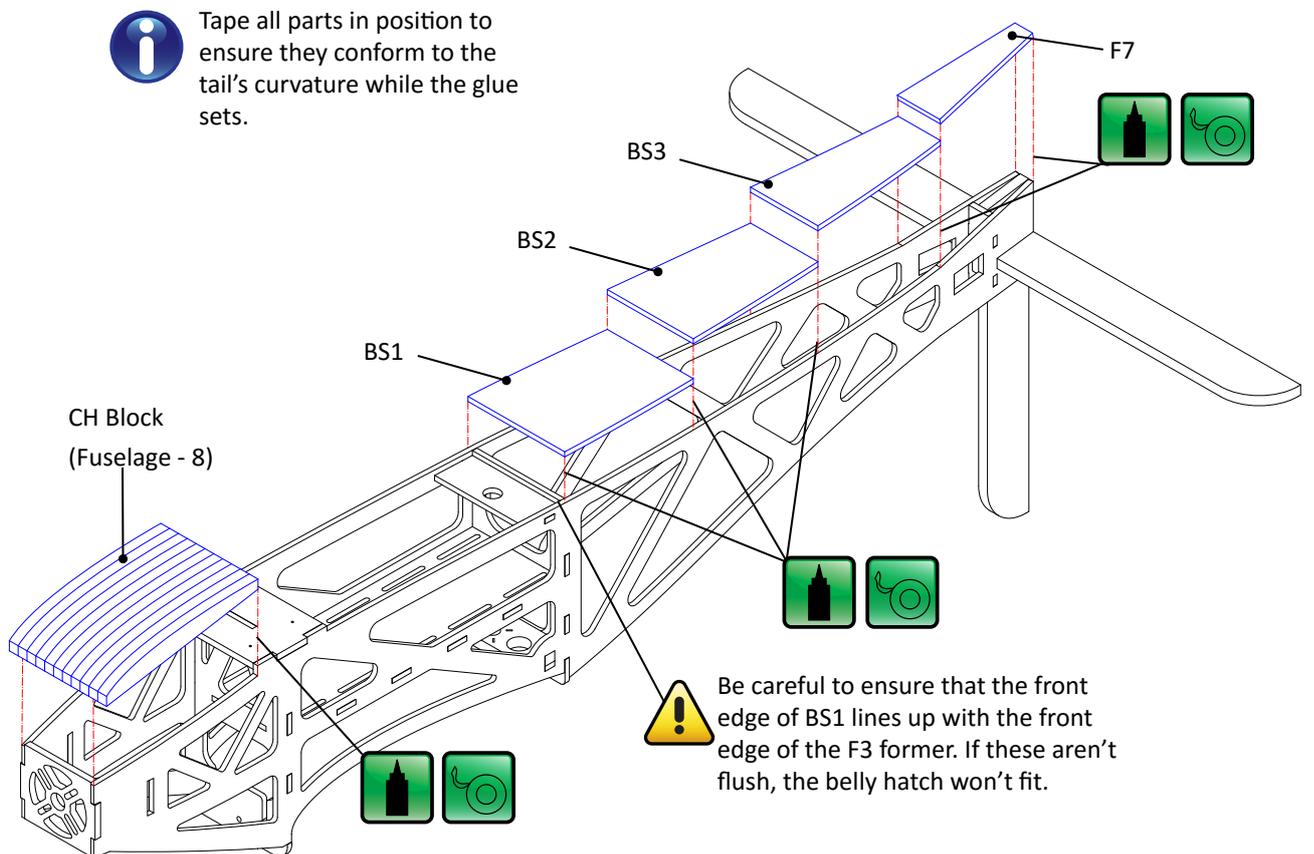
It is crucial that the tail is straight, and the fin vertical. Do a dry run before glueing to familiarise yourself with the procedure, and make sure everything is straight once clamped.







**i** Clamp together on a flat surface after glueing to form a solid balsa block.



**i** Tape all parts in position to ensure they conform to the tail's curvature while the glue sets.

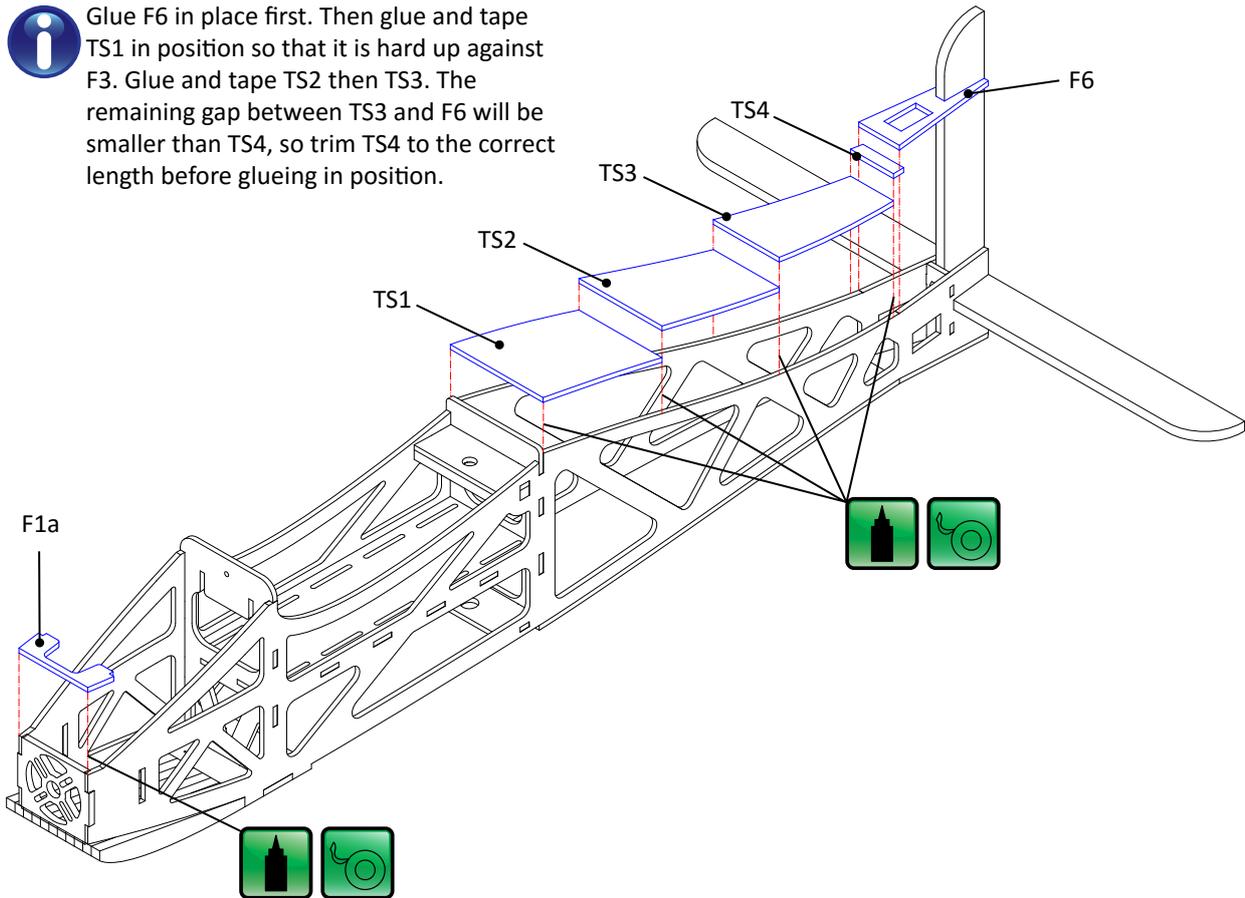
**!** Be careful to ensure that the front edge of BS1 lines up with the front edge of the F3 former. If these aren't flush, the belly hatch won't fit.

# Fuselage - 10

F1a, TS1-4, F6



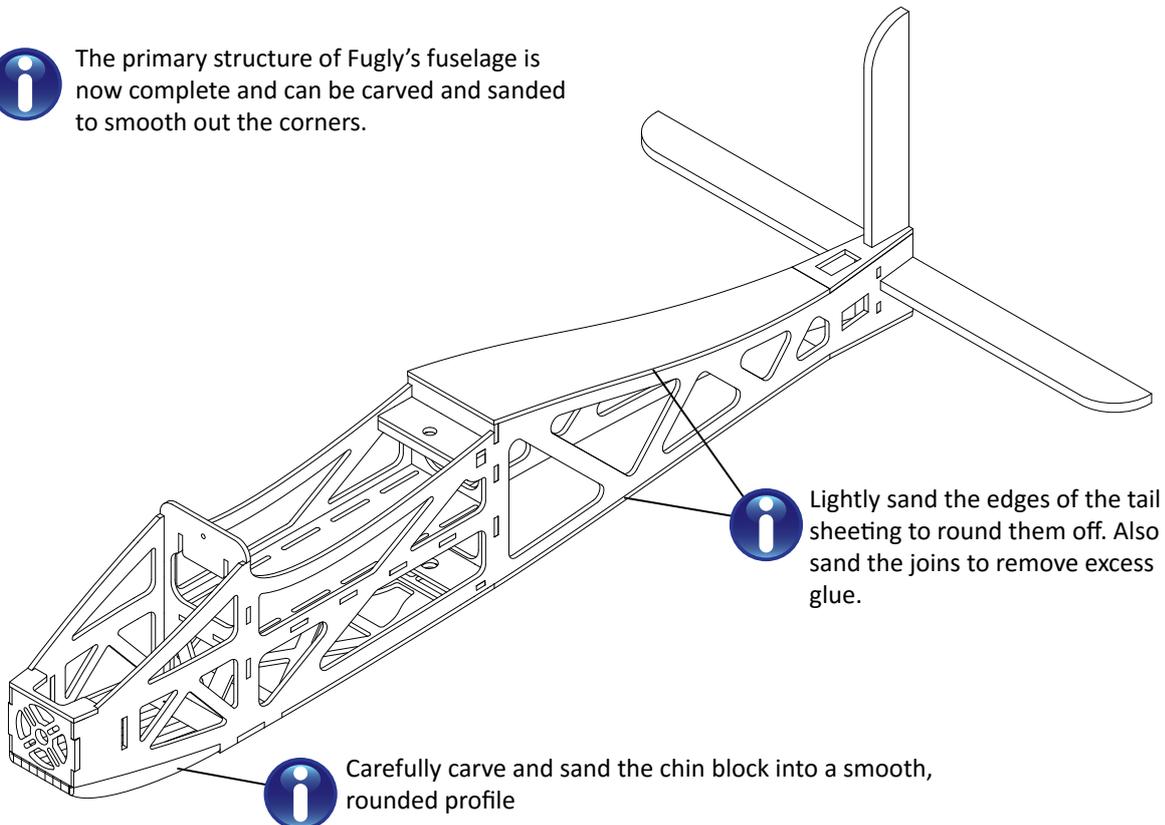
Glue F6 in place first. Then glue and tape TS1 in position so that it is hard up against F3. Glue and tape TS2 then TS3. The remaining gap between TS3 and F6 will be smaller than TS4, so trim TS4 to the correct length before glueing in position.



# Fuselage - 11



The primary structure of Fugly's fuselage is now complete and can be carved and sanded to smooth out the corners.

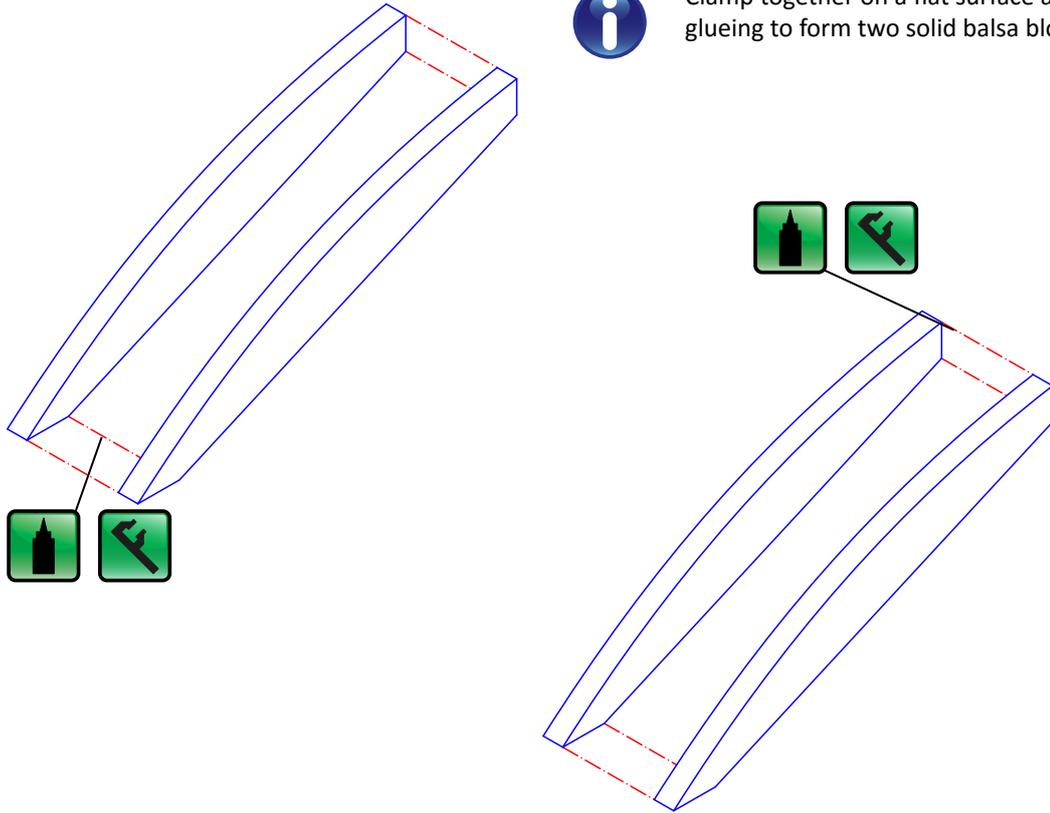


H3 x4

# Nose Hatch - 1

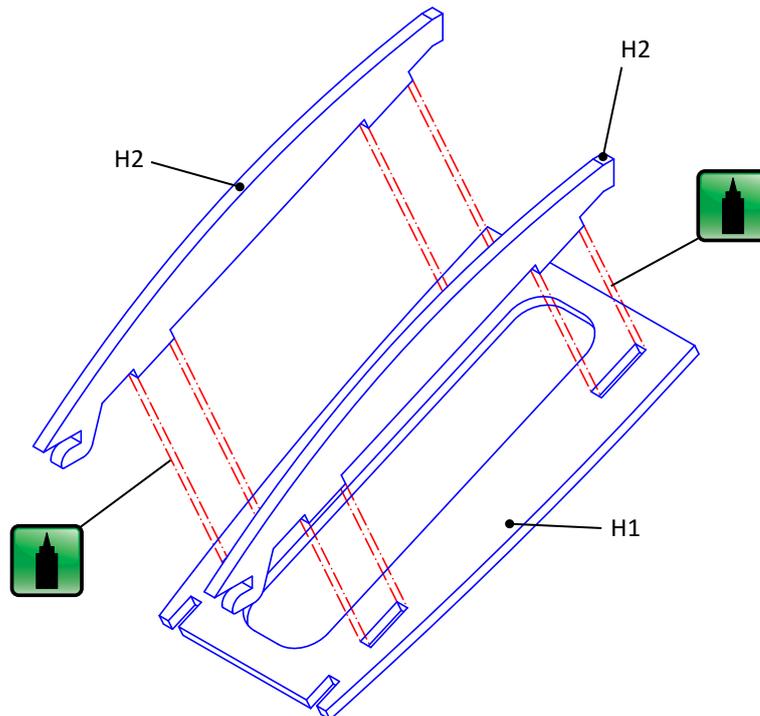


Clamp together on a flat surface after gluing to form two solid balsa blocks.



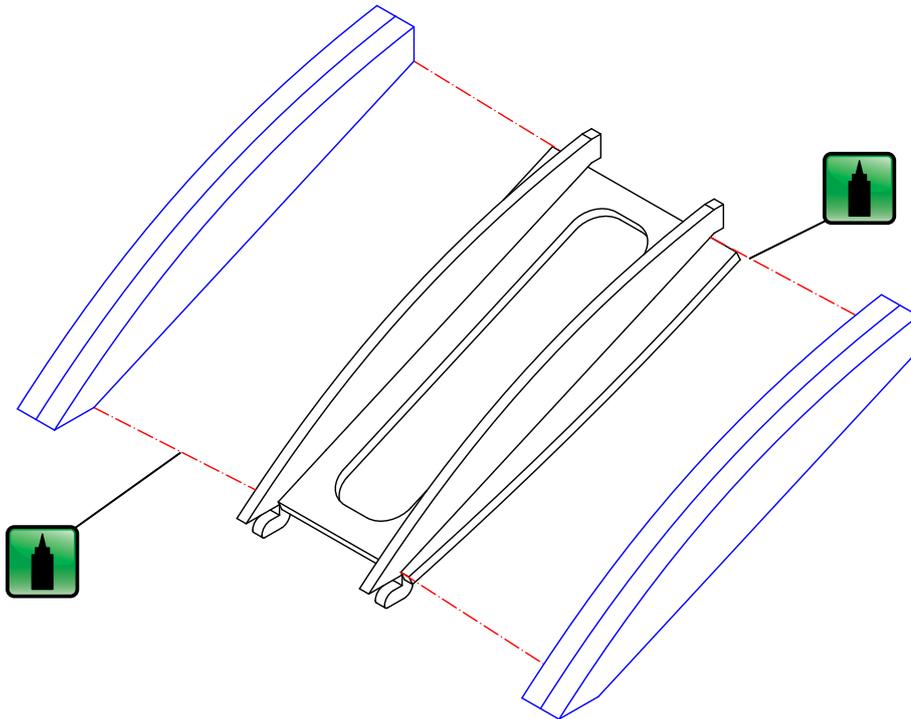
H1, H2 x2

# Nose Hatch - 2



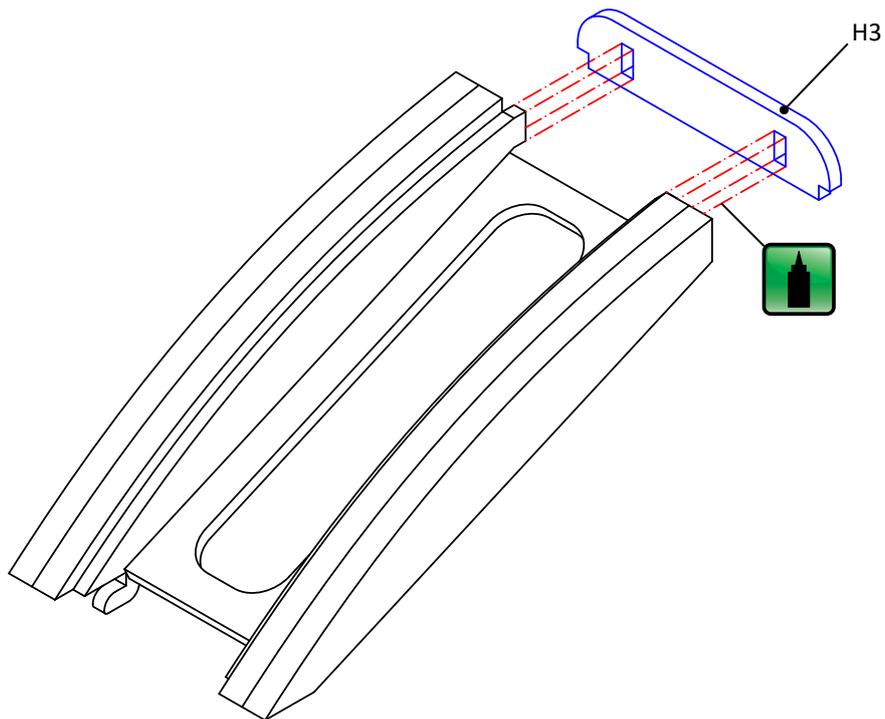
# Nose Hatch - 3

Nose Hatch 1, Nose Hatch 2

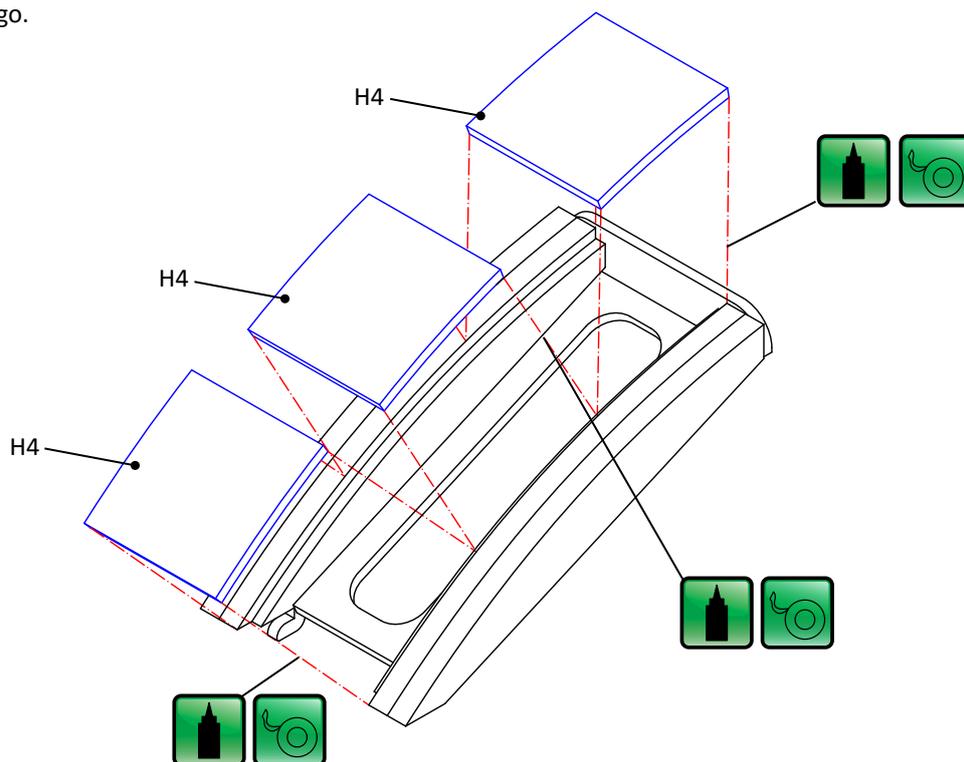


# Nose Hatch - 4

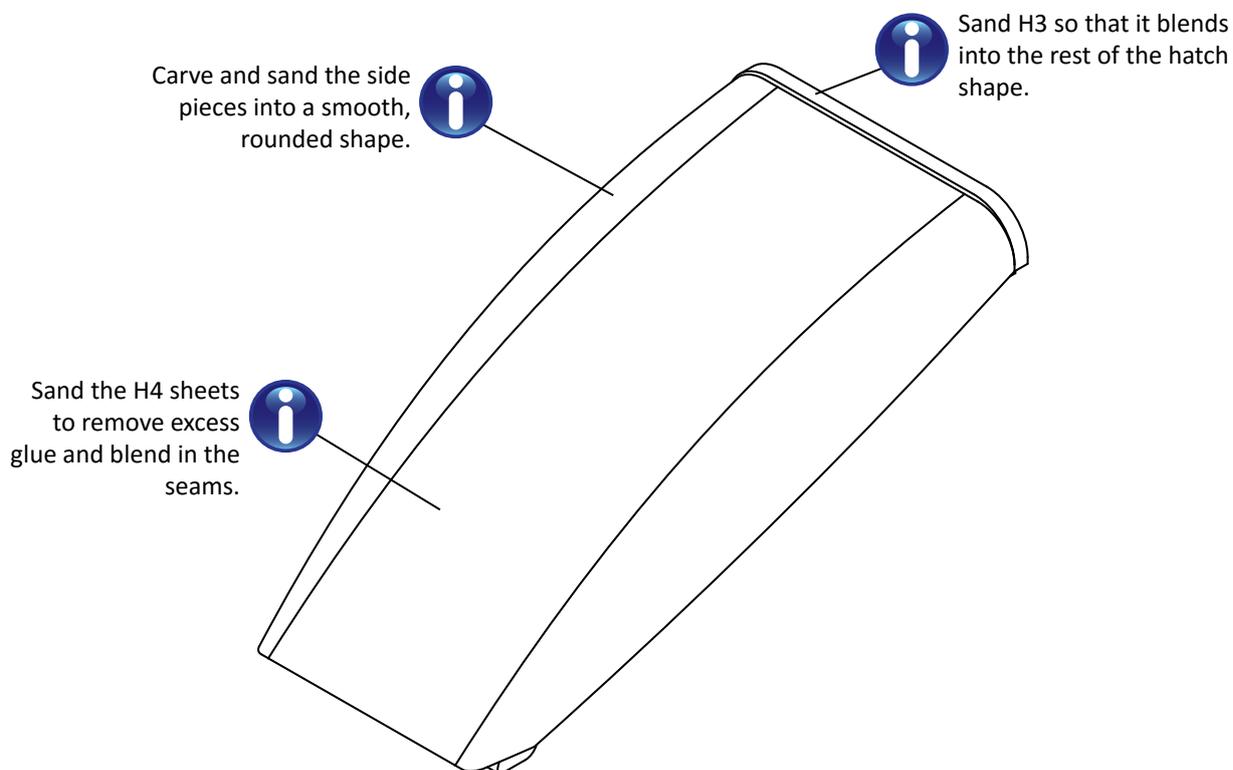
H3, Nose Hatch 3



-  Glue the H4 pieces into place from the H3 former forwards, taping them down as you go.



## Nose Hatch - 6

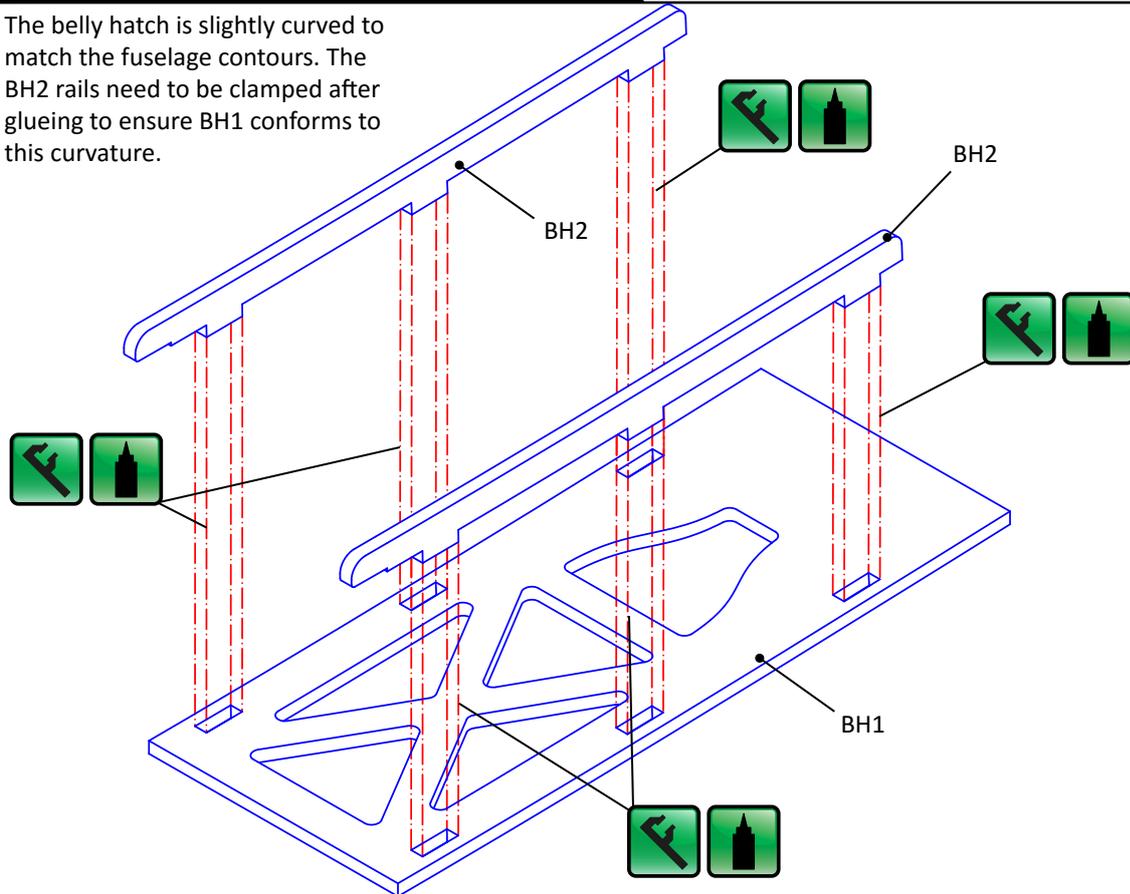


## Belly Hatch - 1

BH1, BH2 x2



The belly hatch is slightly curved to match the fuselage contours. The BH2 rails need to be clamped after glueing to ensure BH1 conforms to this curvature.

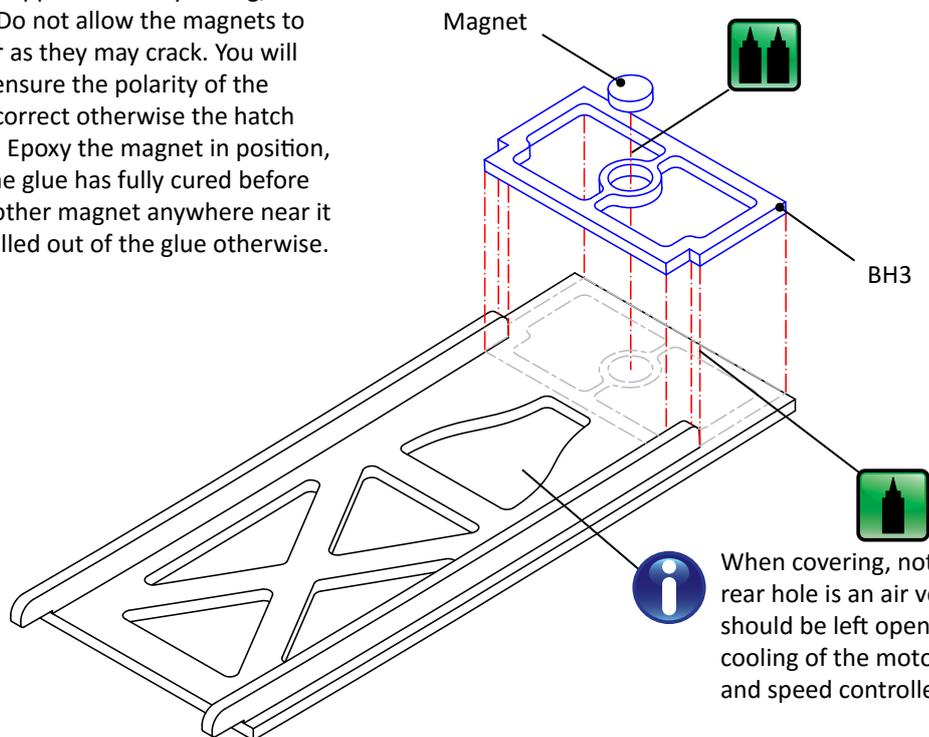


## Belly Hatch - 2

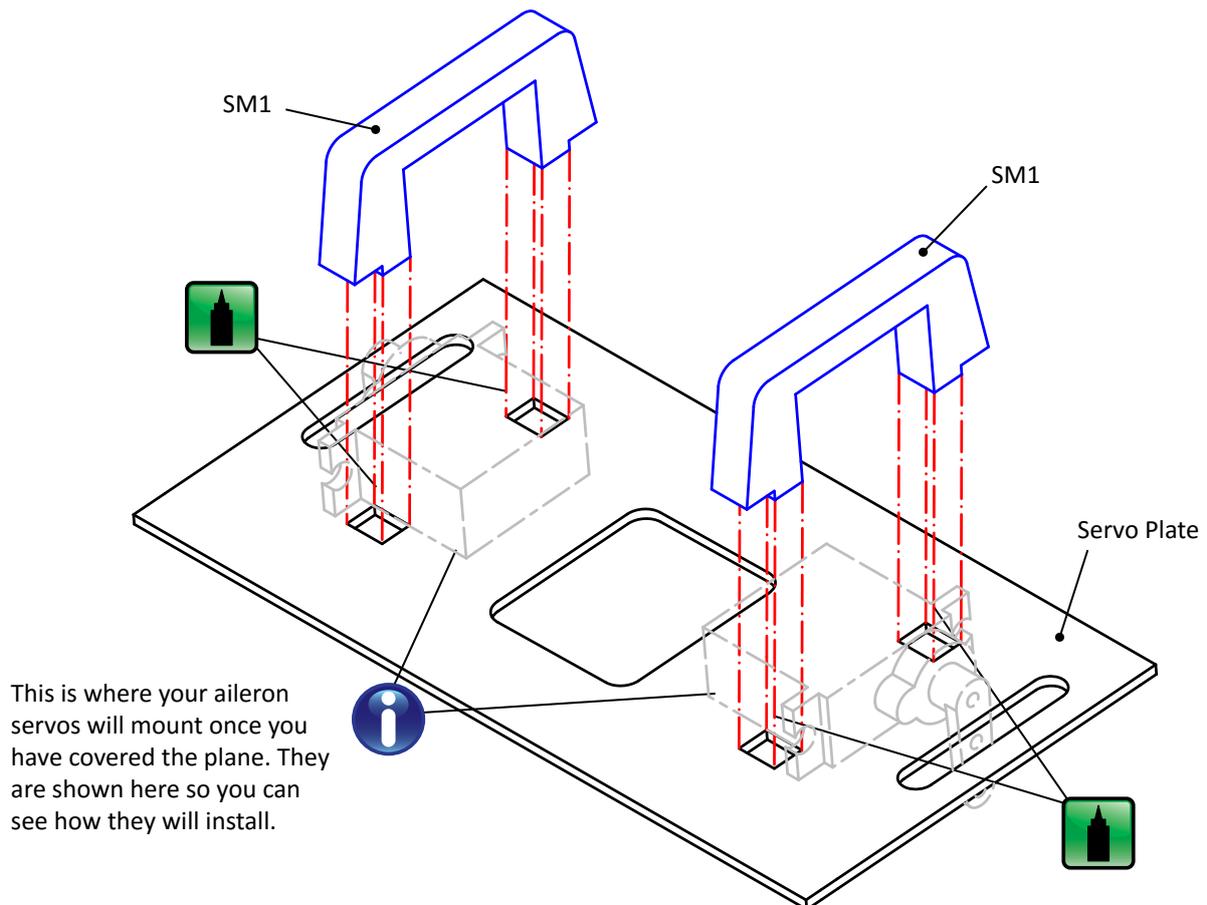
BH3, Magnet x1



The magnets supplied are very strong, mind your fingers! Do not allow the magnets to snap together as they may crack. You will also need to ensure the polarity of the magnets are correct otherwise the hatch will not close. Epoxy the magnet in position, and ensure the glue has fully cured before allowing the other magnet anywhere near it - it may be pulled out of the glue otherwise.



When covering, note that the rear hole is an air vent and should be left open for proper cooling of the motor, battery and speed controller.



## Control Surfaces



All of the control surfaces - the rudder, elevators, and ailerons - use an interlocking "jigsaw" design.

Due to the precision of our laser cutting facilities, the parts are a tight fit ensuring the finished control surfaces are square and rigid.

Although construction is a little unorthodox, it is very quick - you can build all of the control surfaces in less than an hour - and the finished parts are very strong.



Make sure you cover your building board with polythene sheet or "cling-film" (plastic food wrap) before you begin each control surface to ensure your parts do not stick to the board when glue is applied.



Each control surface is assembled on the building board DRY - with no glue.

Once fully assembled, thin superglue (Cryo Acrolate or CA) is wicked into each joint for almost instant results.



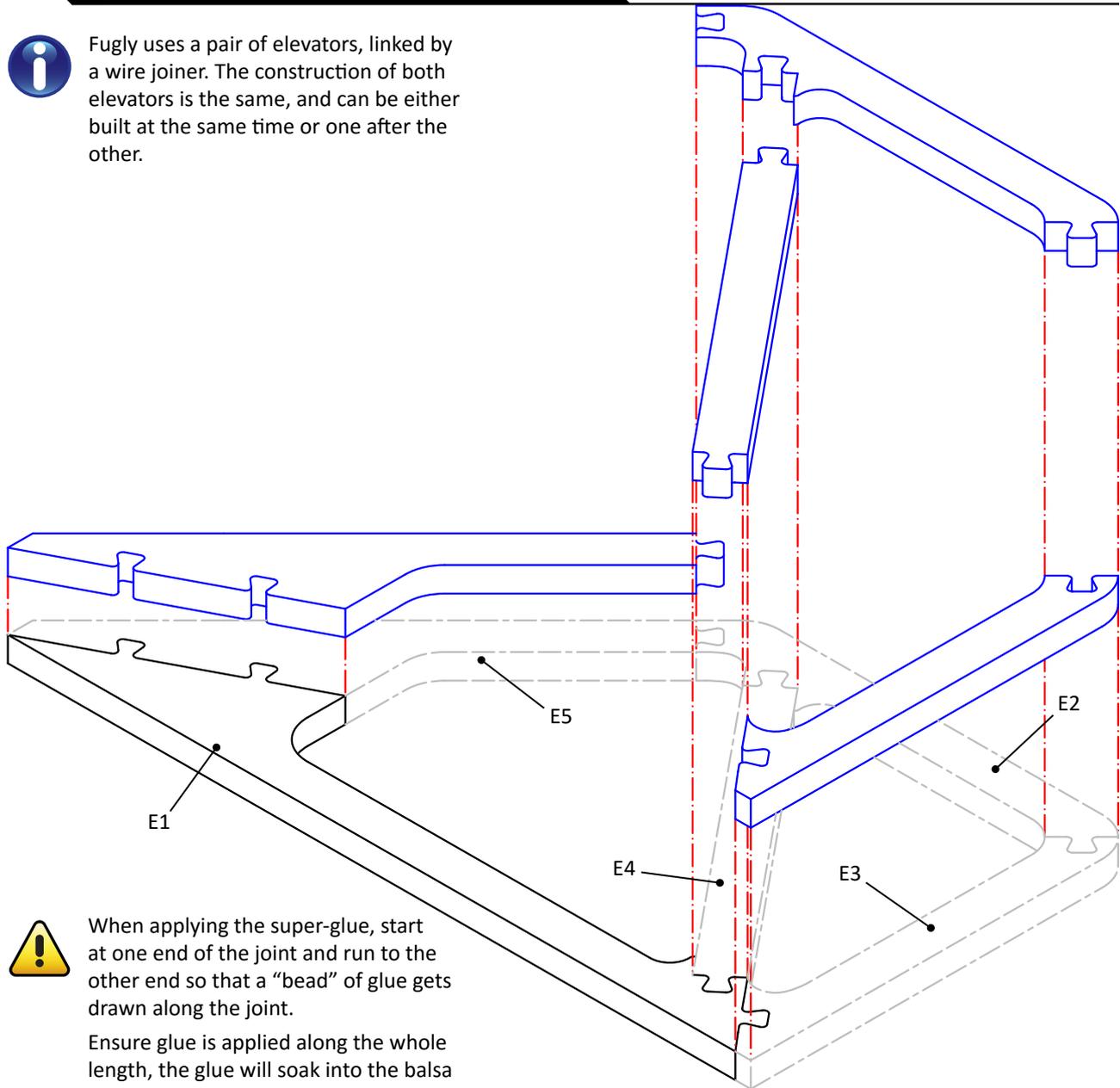
When inserting each part, ensure you follow the text etched into the balsa regarding orientation.



Carefully line-up the jigsaw ends with the matching sockets, and apply firm pressure equally to slide the parts together. Be careful not to crush the balsa wood.



Fugly uses a pair of elevators, linked by a wire joiner. The construction of both elevators is the same, and can be either built at the same time or one after the other.



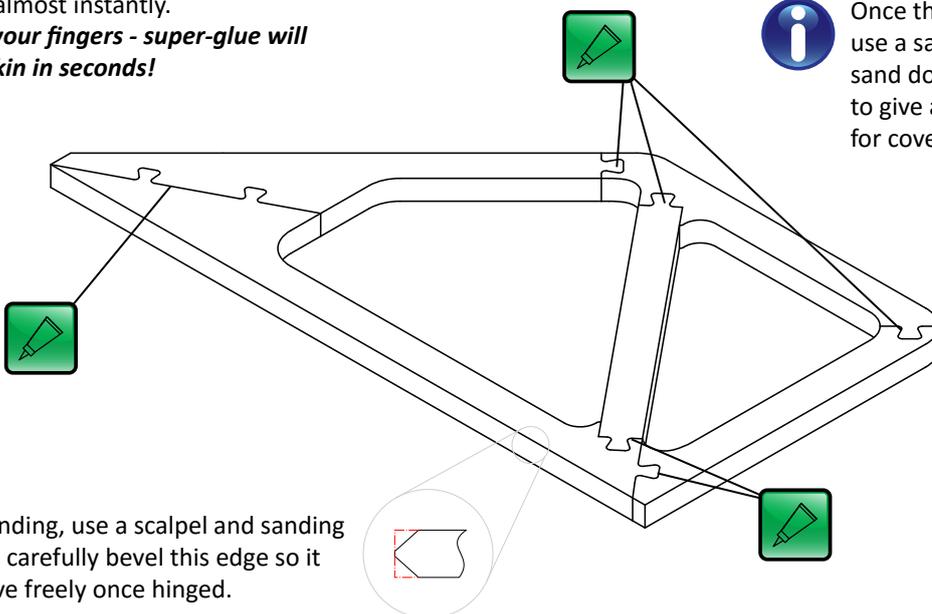
When applying the super-glue, start at one end of the joint and run to the other end so that a “bead” of glue gets drawn along the joint.

Ensure glue is applied along the whole length, the glue will soak into the balsa wood almost instantly.

**Mind your fingers - super-glue will stick skin in seconds!**



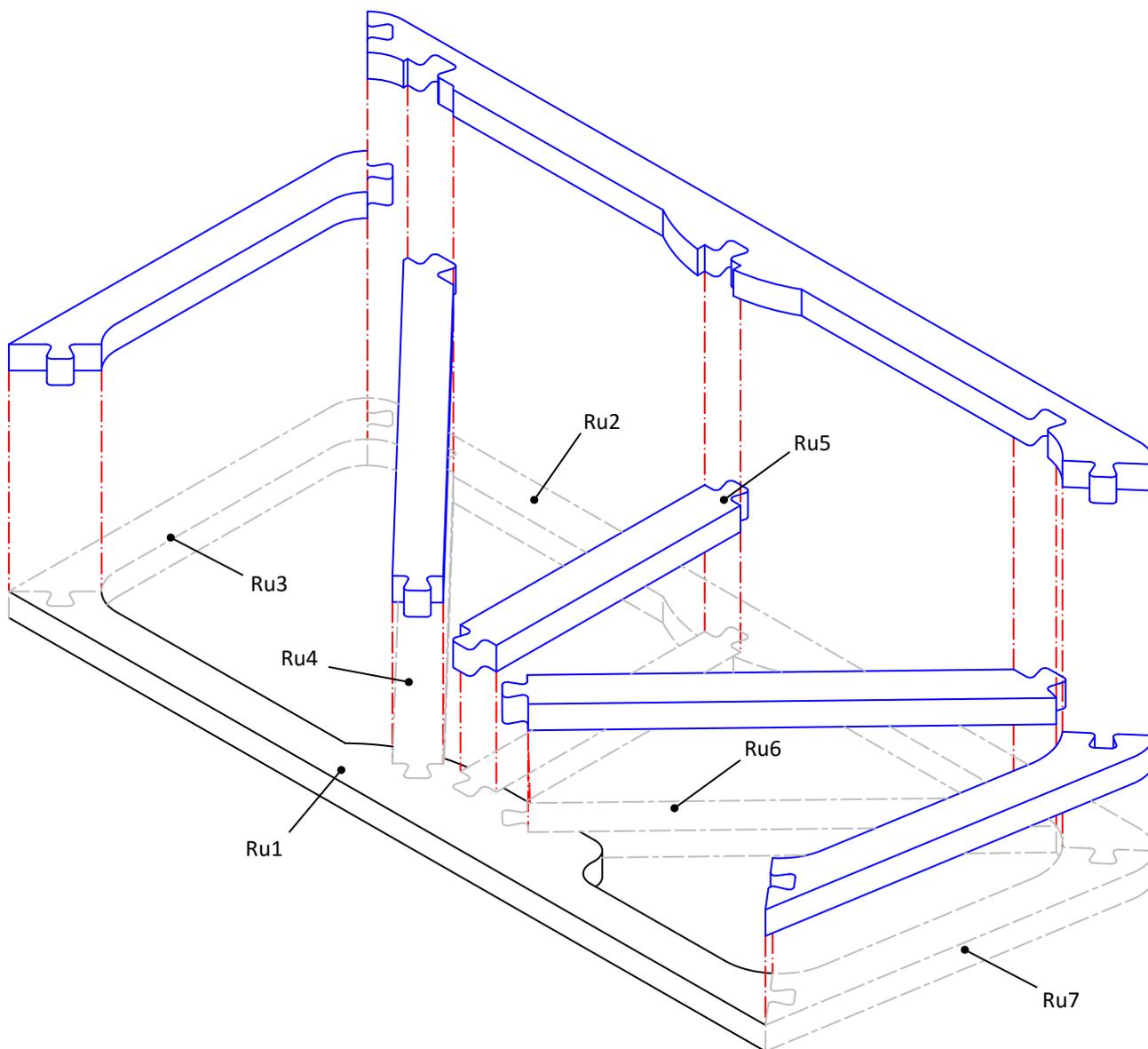
Once the glue has set, use a sanding block to sand down all the joints to give a smooth surface for covering later.



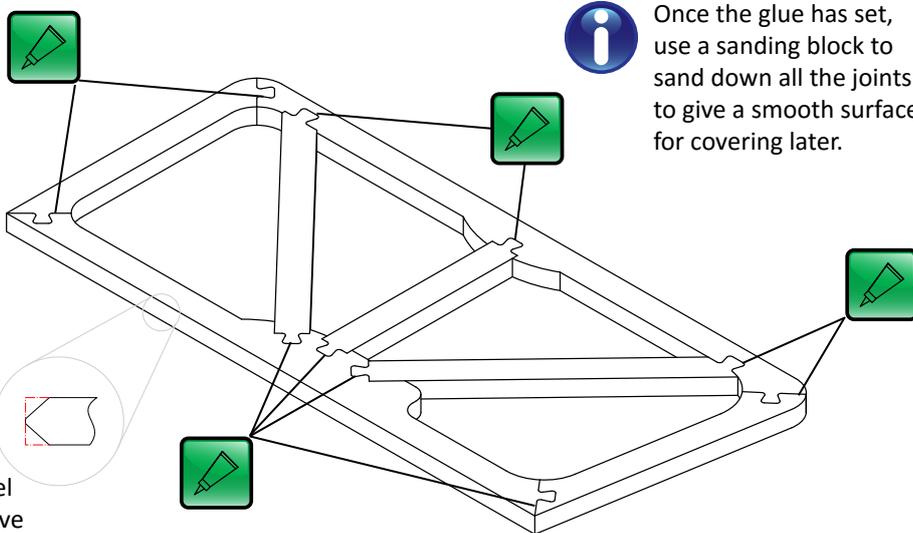
After sanding, use a scalpel and sanding block to carefully bevel this edge so it can move freely once hinged.



Replace the plastic film covering the building board to ensure there are no holes or tears for excess glue to soak through.



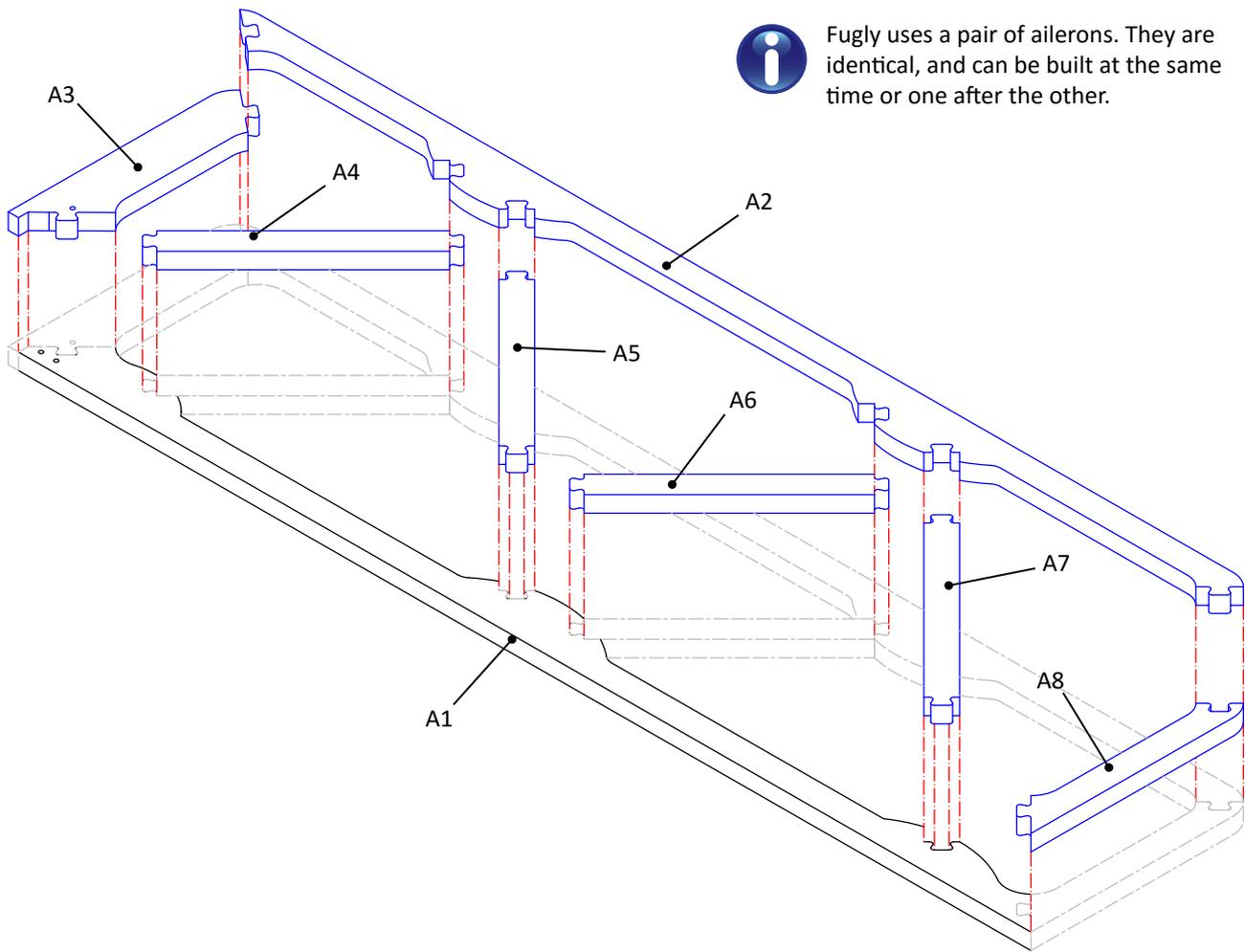
Once the glue has set, use a sanding block to sand down all the joints to give a smooth surface for covering later.



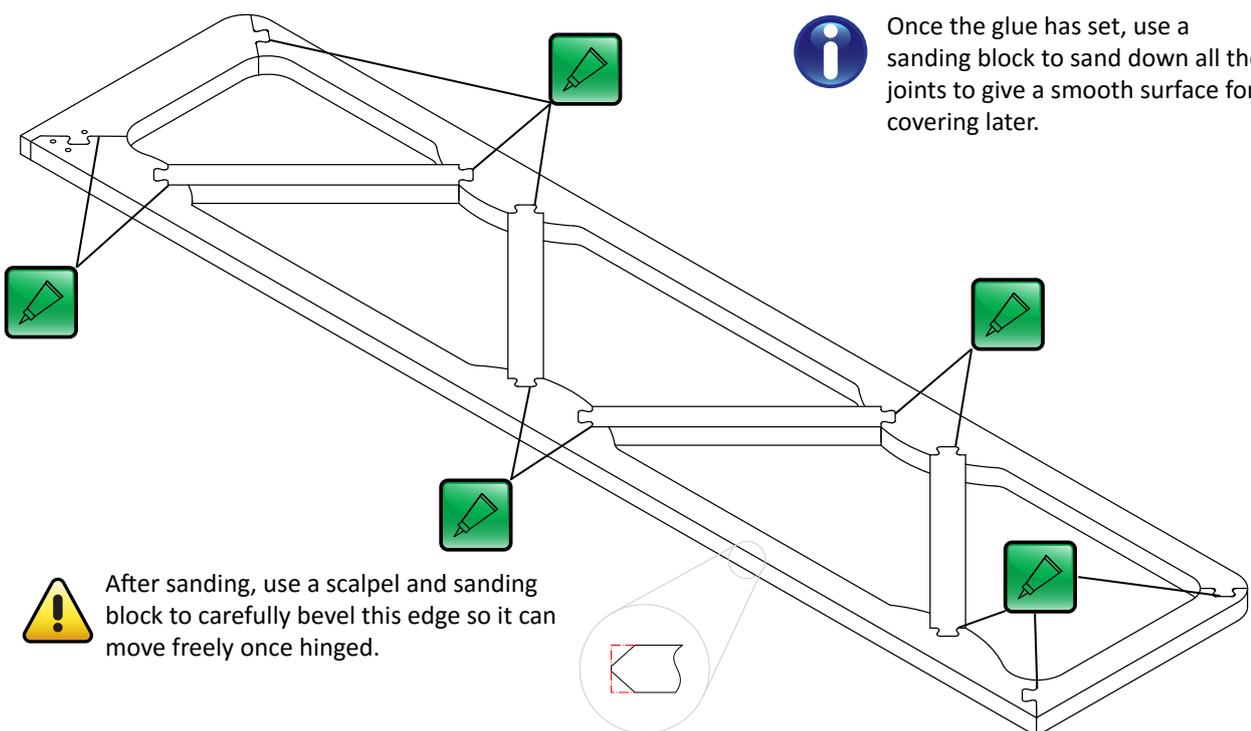
After sanding, use a scalpel and sanding block to carefully bevel this edge so it can move freely once hinged.

# Ailerons

A1 - A8



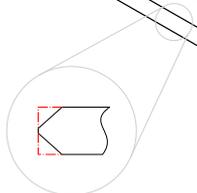
Fugly uses a pair of ailerons. They are identical, and can be built at the same time or one after the other.

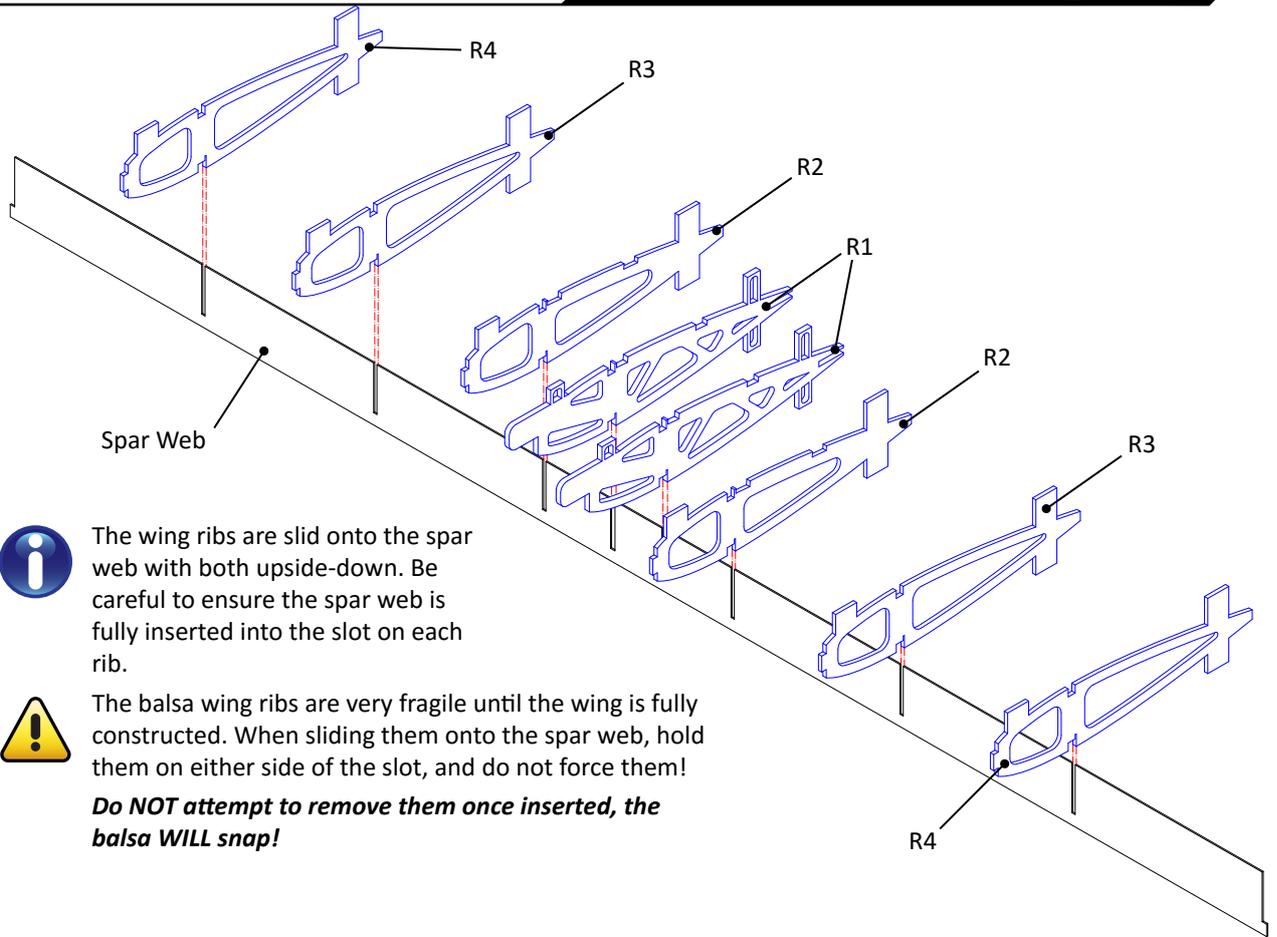


Once the glue has set, use a sanding block to sand down all the joints to give a smooth surface for covering later.



After sanding, use a scalpel and sanding block to carefully bevel this edge so it can move freely once hinged.



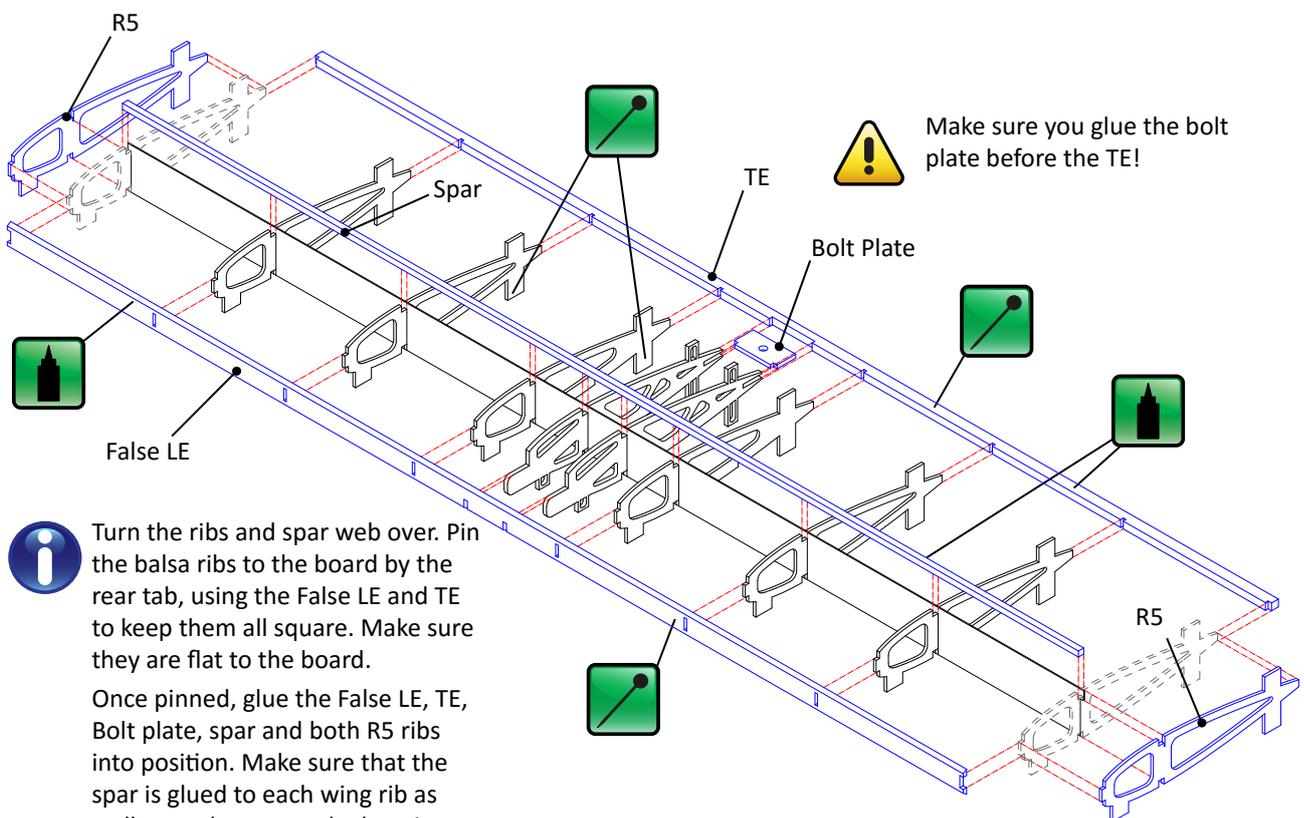


The wing ribs are slid onto the spar web with both upside-down. Be careful to ensure the spar web is fully inserted into the slot on each rib.



The balsa wing ribs are very fragile until the wing is fully constructed. When sliding them onto the spar web, hold them on either side of the slot, and do not force them!

**Do NOT attempt to remove them once inserted, the balsa WILL snap!**



Make sure you glue the bolt plate before the TE!



False LE

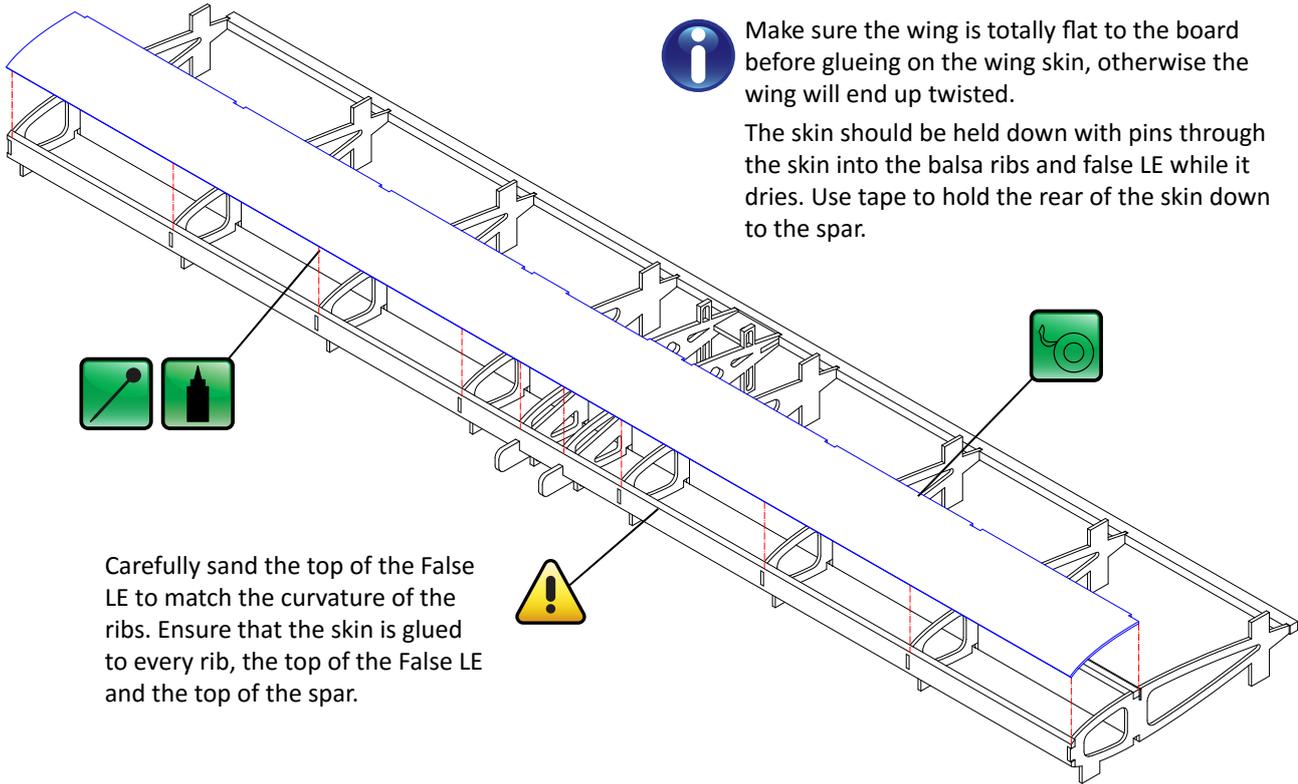


Turn the ribs and spar web over. Pin the balsa ribs to the board by the rear tab, using the False LE and TE to keep them all square. Make sure they are flat to the board.

Once pinned, glue the False LE, TE, Bolt plate, spar and both R5 ribs into position. Make sure that the spar is glued to each wing rib as well as to the spar web along its entire length.

## Wing - 3

### Top Wing Skin



Make sure the wing is totally flat to the board before glueing on the wing skin, otherwise the wing will end up twisted.

The skin should be held down with pins through the skin into the balsa ribs and false LE while it dries. Use tape to hold the rear of the skin down to the spar.

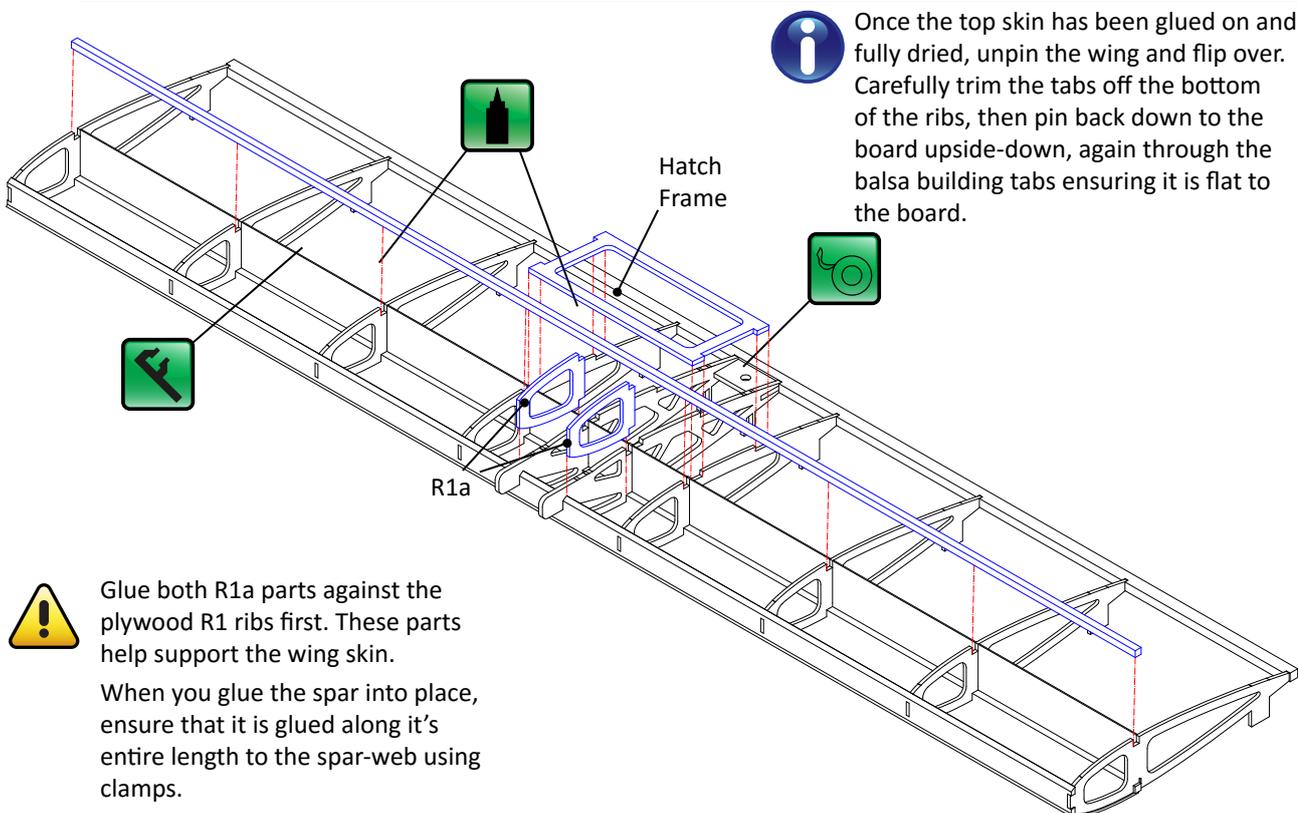


Carefully sand the top of the False LE to match the curvature of the ribs. Ensure that the skin is glued to every rib, the top of the False LE and the top of the spar.



## Wing - 4

### Spar, Wing hatch frame, R1a x 2



Once the top skin has been glued on and fully dried, unpin the wing and flip over. Carefully trim the tabs off the bottom of the ribs, then pin back down to the board upside-down, again through the balsa building tabs ensuring it is flat to the board.



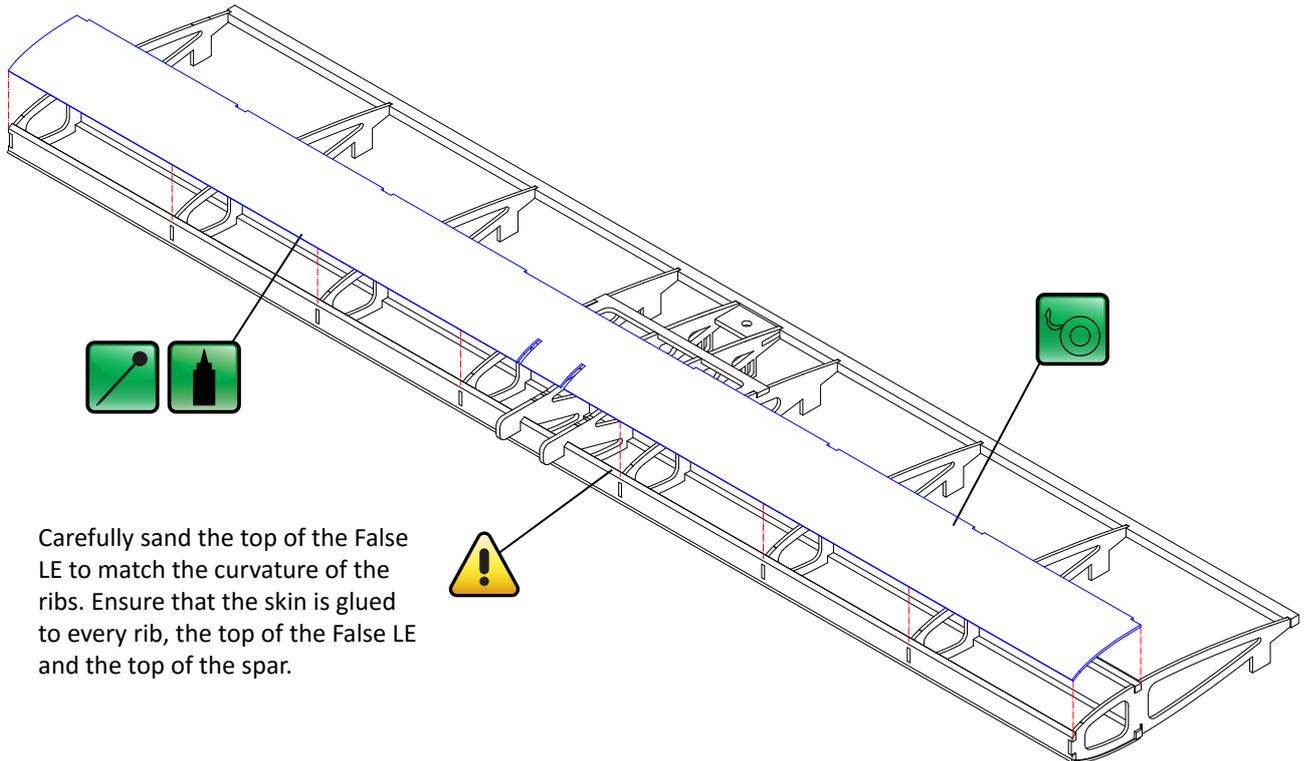
R1a

Hatch Frame

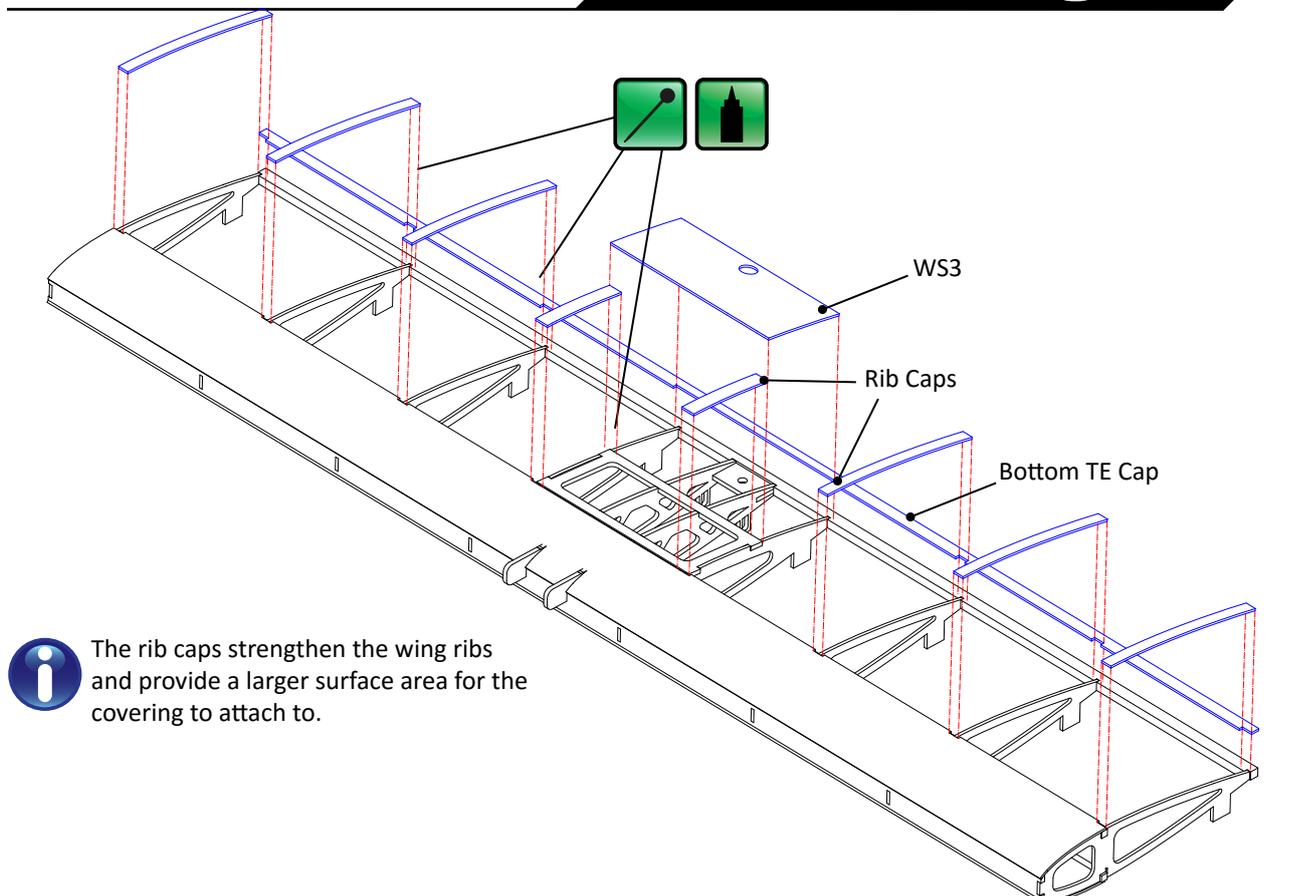


Glue both R1a parts against the plywood R1 ribs first. These parts help support the wing skin.

When you glue the spar into place, ensure that it is glued along it's entire length to the spar-web using clamps.



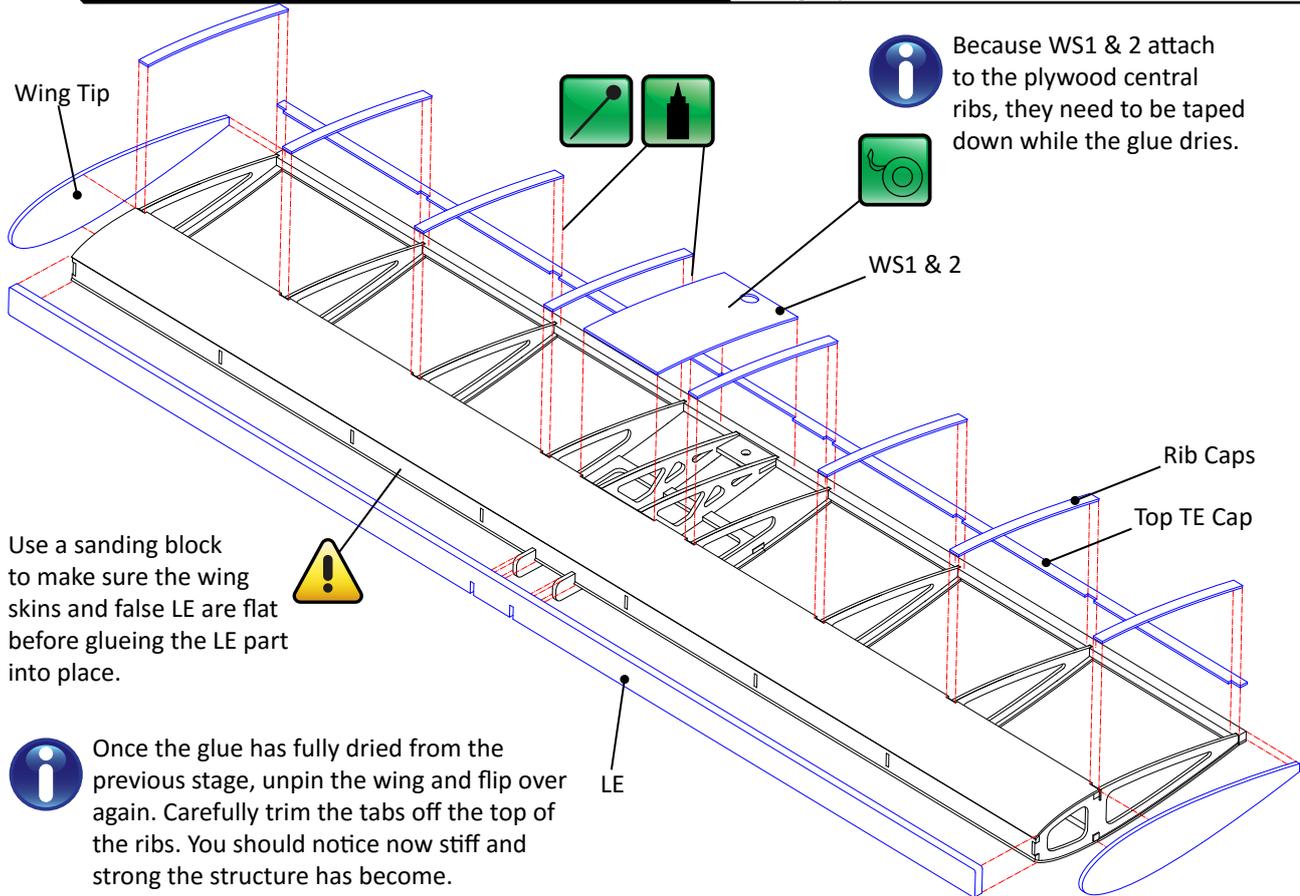
Carefully sand the top of the False LE to match the curvature of the ribs. Ensure that the skin is glued to every rib, the top of the False LE and the top of the spar.



The rib caps strengthen the wing ribs and provide a larger surface area for the covering to attach to.

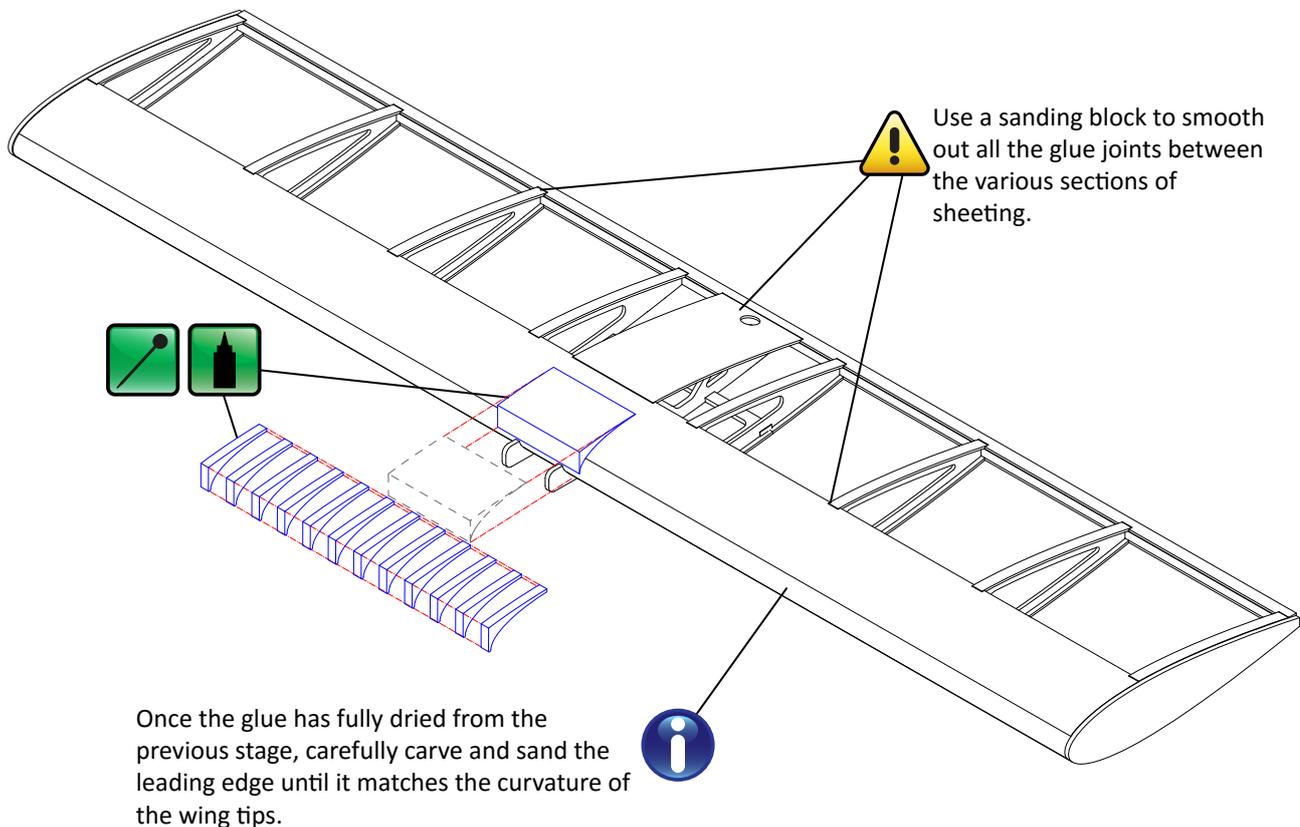
# Wing - 7

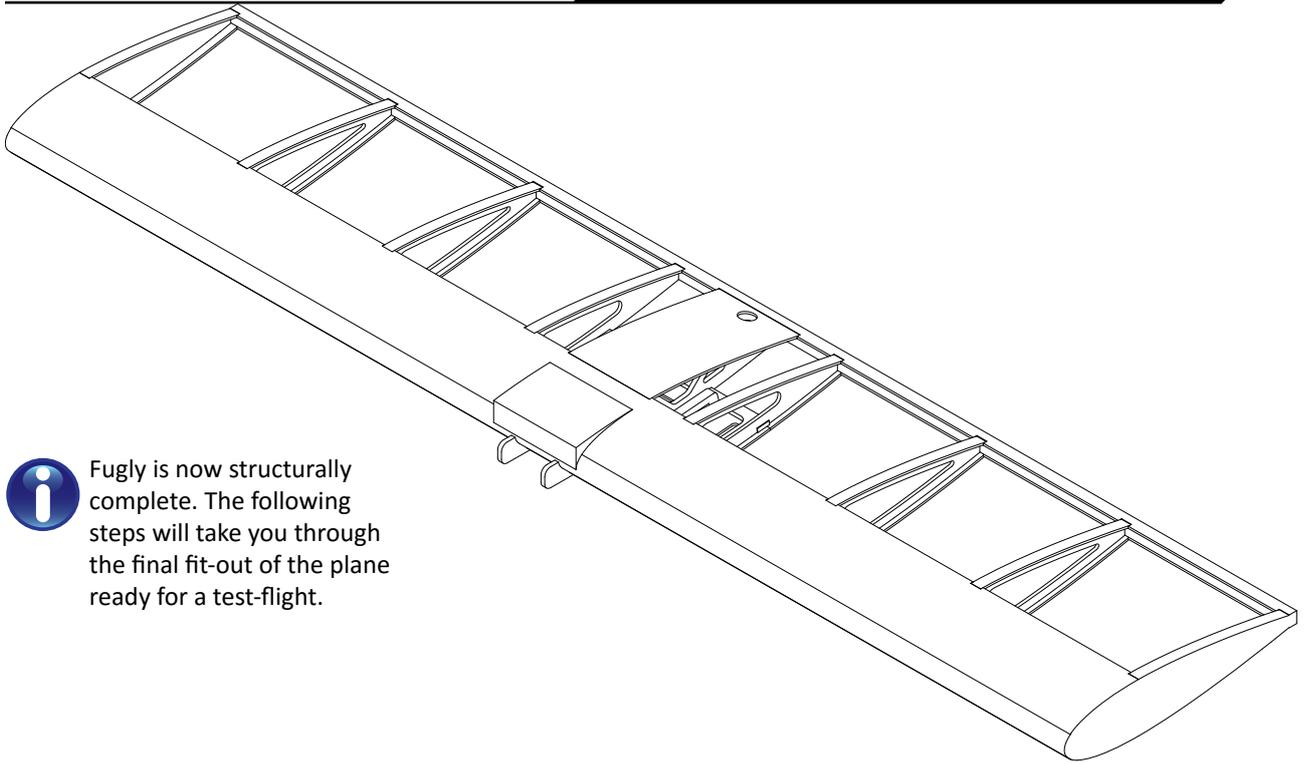
Rib Caps, Top TE Cap, WS2, WS1, LE, Wing Tips



# Wing - 8

WF x 12





Fugly is now structurally complete. The following steps will take you through the final fit-out of the plane ready for a test-flight.

## Covering

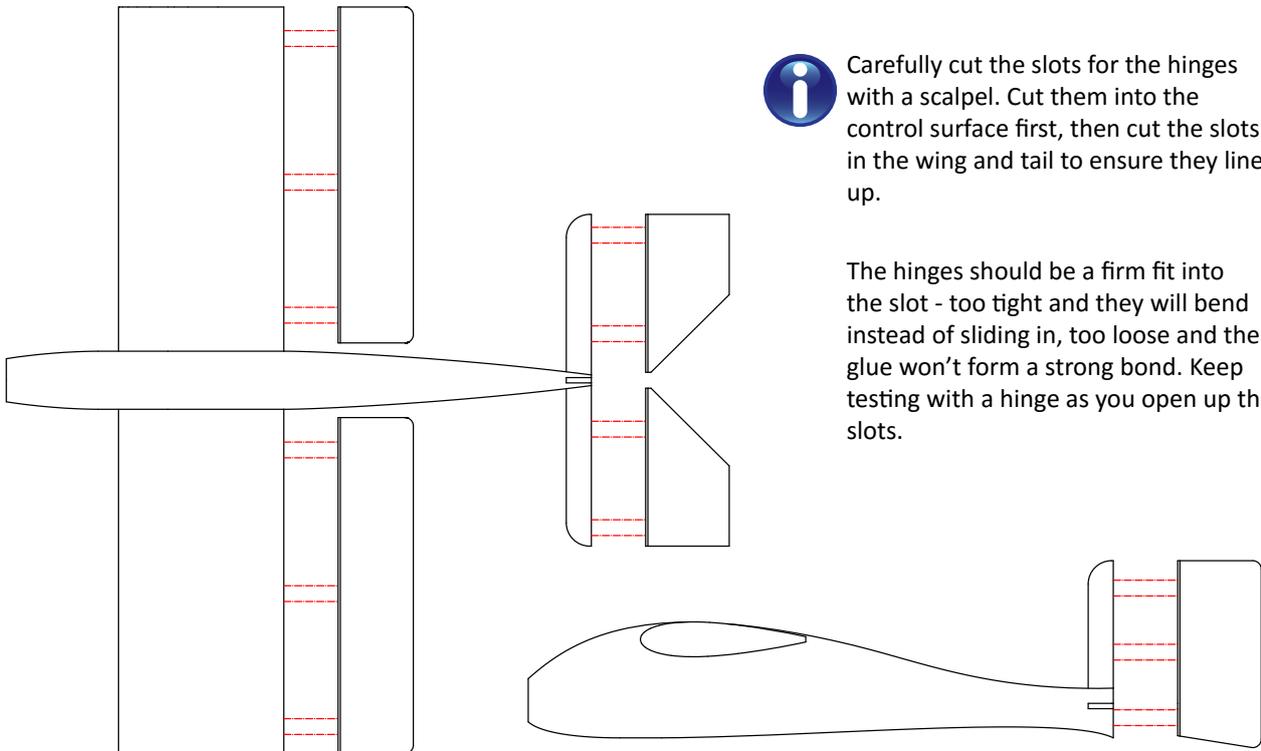


Fugly is designed to be covered in heat-shrink film. There are many brands available, such as Oracover, Solar Film, Coverite, etc. Please read, and follow, the instructions for the particular film that you are using. Ensure that all seams are fully sealed to stop them lifting away in flight. Make sure that the exhaust vent in the belly hatch is open to help everything stay cool in flight.

# Hinge Slots



Fugly uses "CA Hinges". These are a rectangular piece of fibrous plastic film which is inserted into slots cut into both sides without glue. Once in place, thin super-glue is "wicked" into the hinge material, which saturates both the hinge and the wood in contact with it. Once set (which happens in seconds) it forms a flexible but very strong hinge.

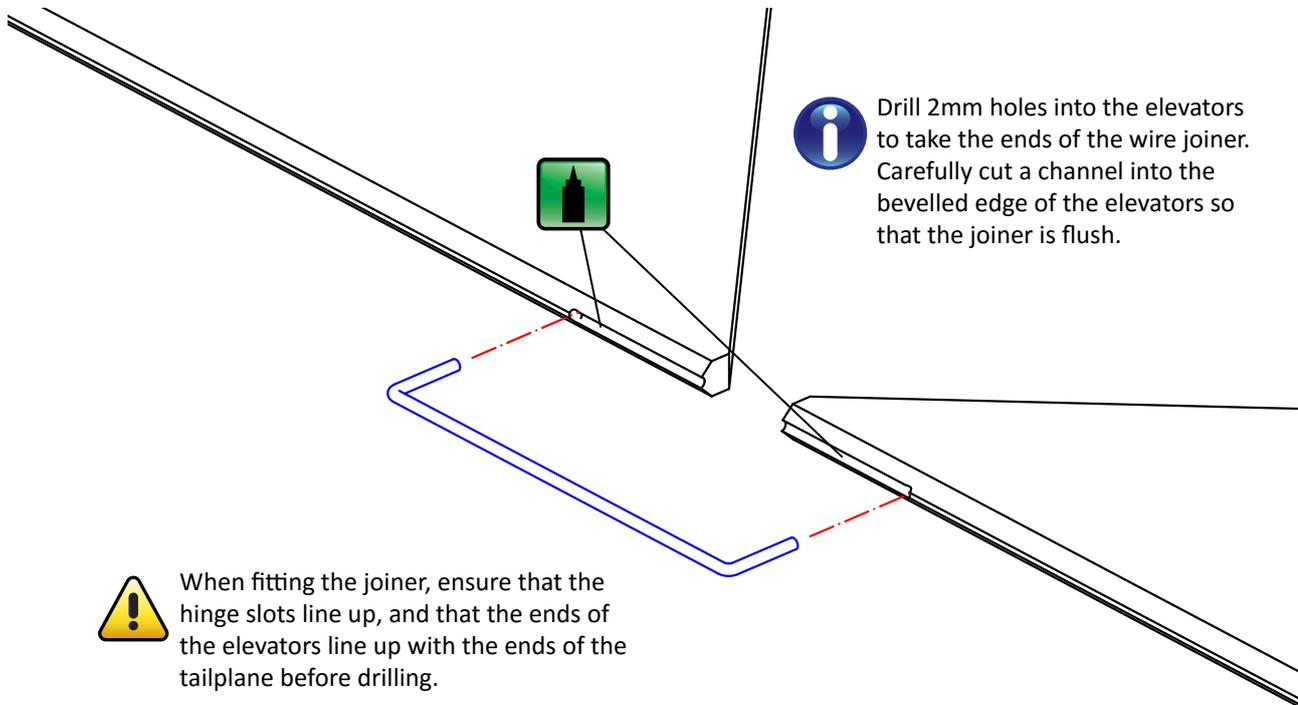


Carefully cut the slots for the hinges with a scalpel. Cut them into the control surface first, then cut the slots in the wing and tail to ensure they line up.

The hinges should be a firm fit into the slot - too tight and they will bend instead of sliding in, too loose and the glue won't form a strong bond. Keep testing with a hinge as you open up the slots.

# Elevator Joiner

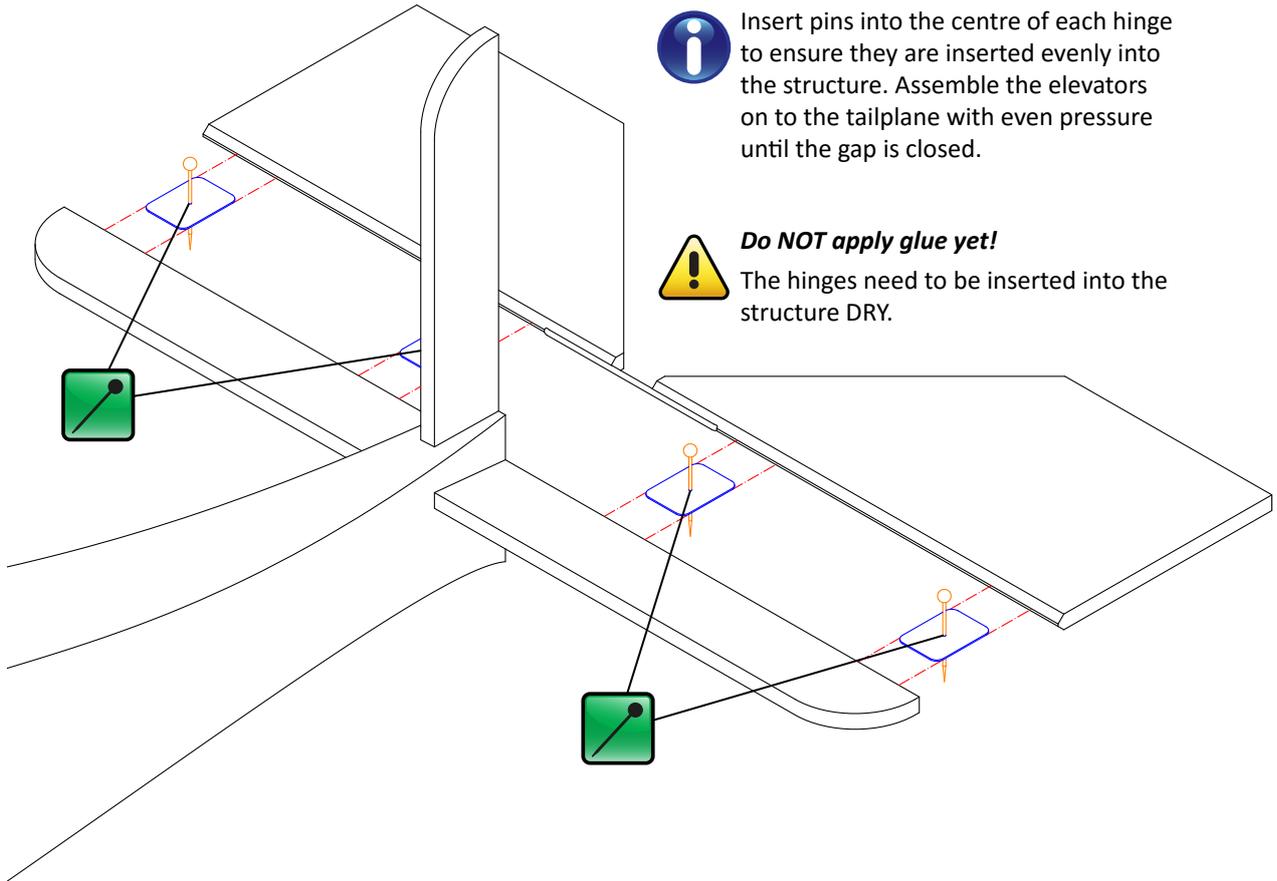
## Elevator Joiner Wire, Elevators



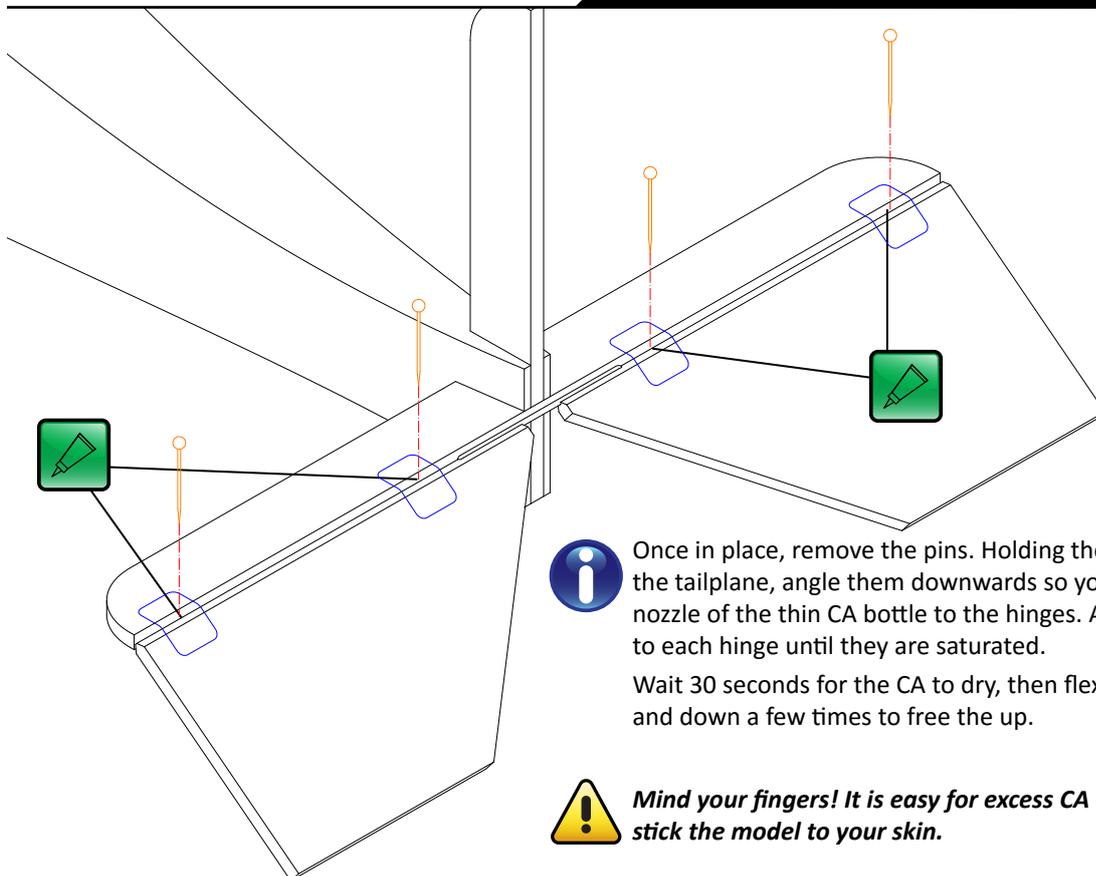
Drill 2mm holes into the elevators to take the ends of the wire joiner. Carefully cut a channel into the bevelled edge of the elevators so that the joiner is flush.



When fitting the joiner, ensure that the hinge slots line up, and that the ends of the elevators line up with the ends of the tailplane before drilling.



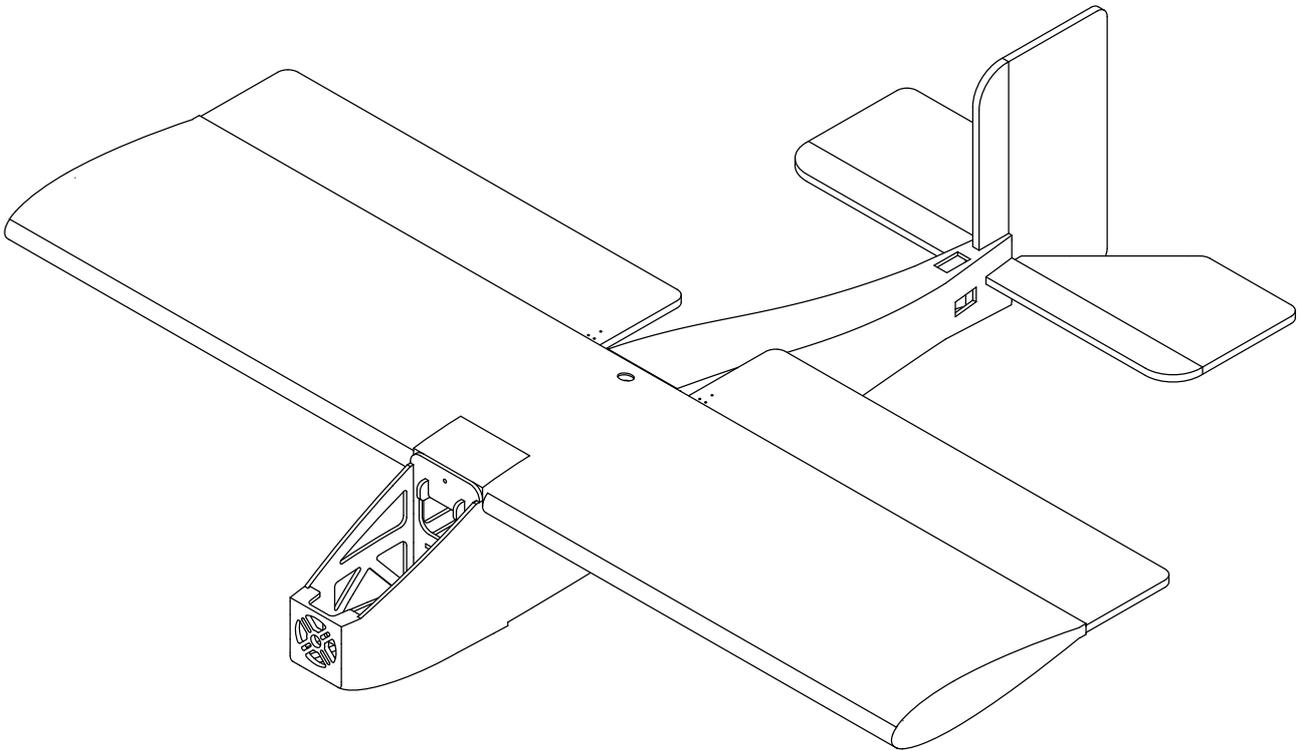
## Elevator Hinges - 2



## Finish Hinging



Repeat the hinging procedure for the rudder and both ailerons. Once complete, your model should look like this.



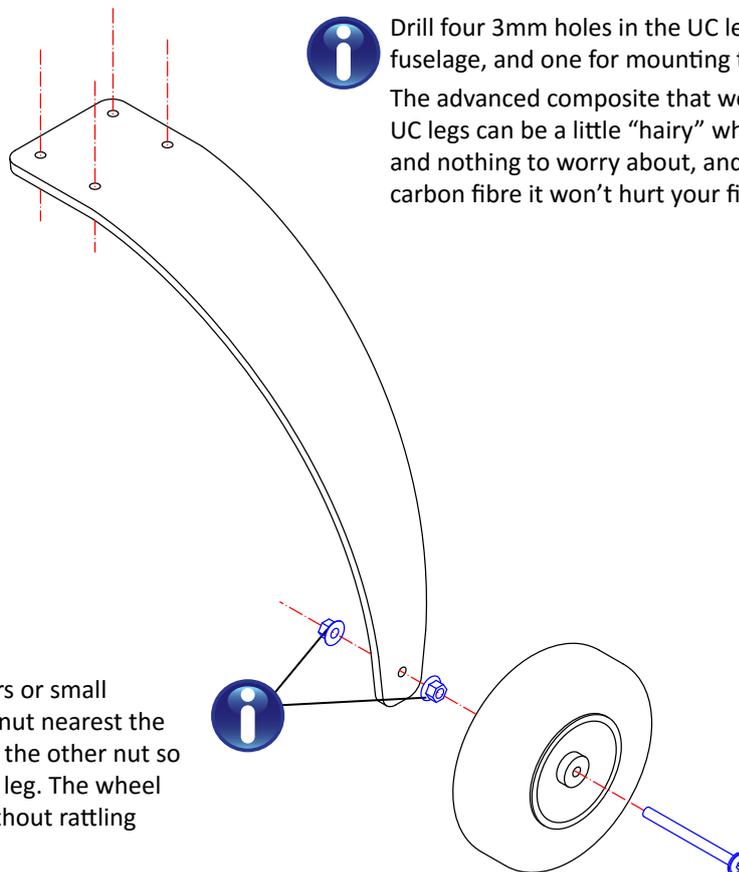
## Undercarriage - 1

UC Leg, wheel, axle bolt, flange nuts



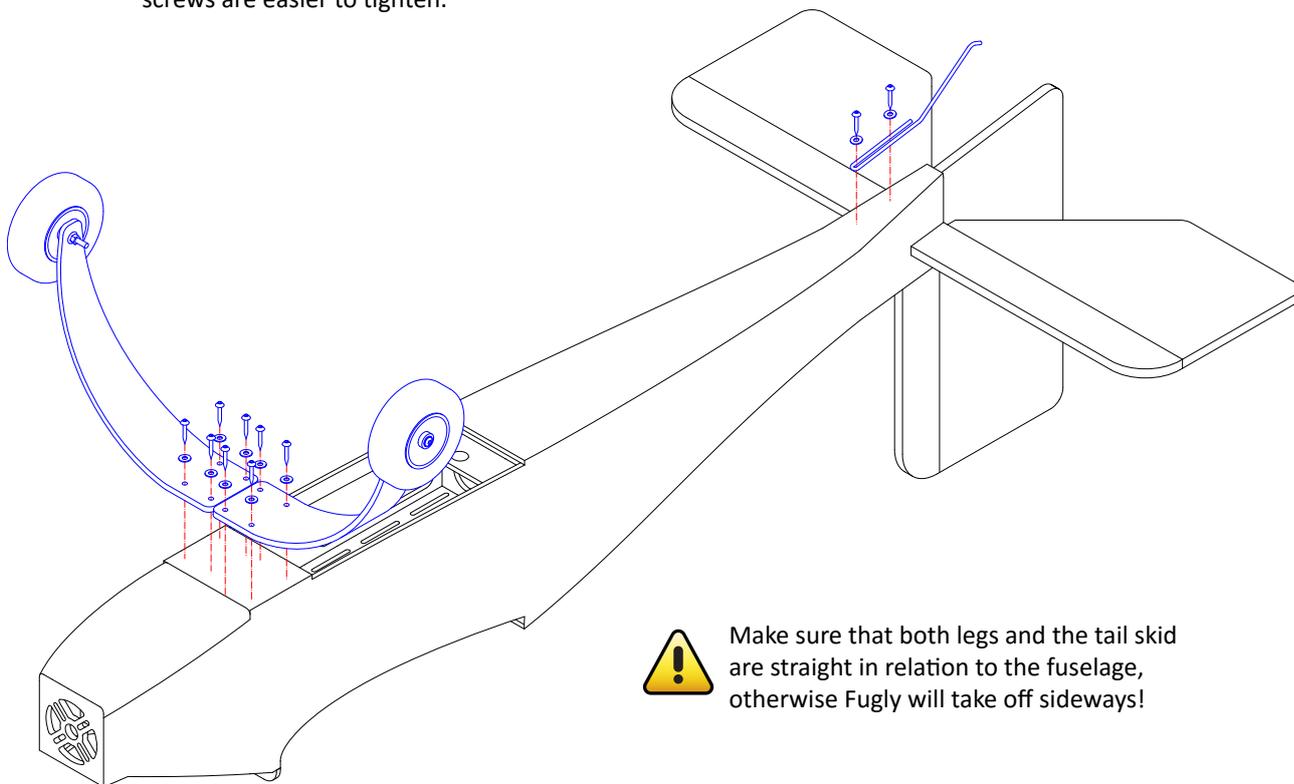
Drill four 3mm holes in the UC leg for mounting to the fuselage, and one for mounting the wheel.

The advanced composite that we have used to build the UC legs can be a little "hairy" when drilled. This is normal, and nothing to worry about, and unlike fibreglass or carbon fibre it won't hurt your fingers.



Use needle-nose pliers or small spanners to hold the nut nearest the wheel and tighten up the other nut so that both grip the UC leg. The wheel should turn freely without rattling around.

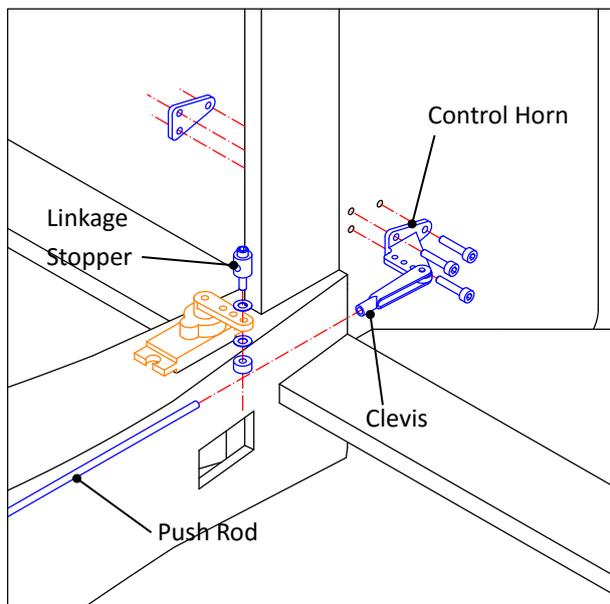
**i** Drill small pilot holes before mounting the UC legs and tail skid so the self-tapping screws are easier to tighten.



**!** Make sure that both legs and the tail skid are straight in relation to the fuselage, otherwise Fugly will take off sideways!

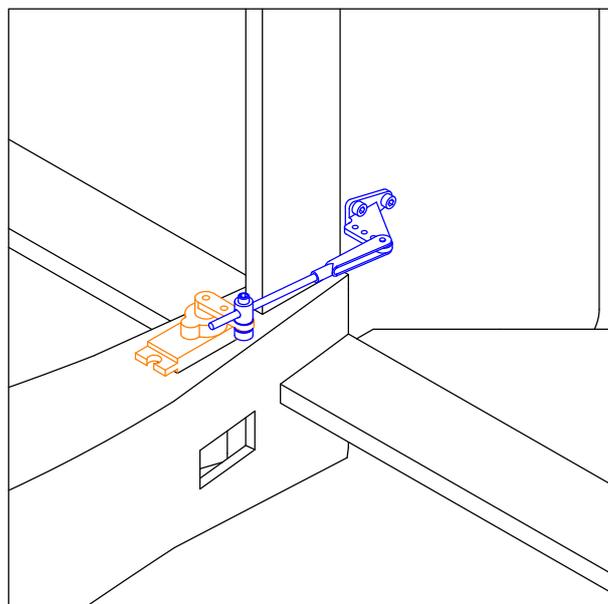
Control Horn x 4, M2 Bolts x 12, Push Rods x 4, Clevises x 4, Linkage Stoppers x 4

## Servos



**!** Make sure that the linkage stopper can rotate freely in the servo arm.

**!** Make sure that you use thread lock on the knurled ring that holds the linkage stopper onto the servo arm, as well as the stopper grub-screw once the push rod is in place.



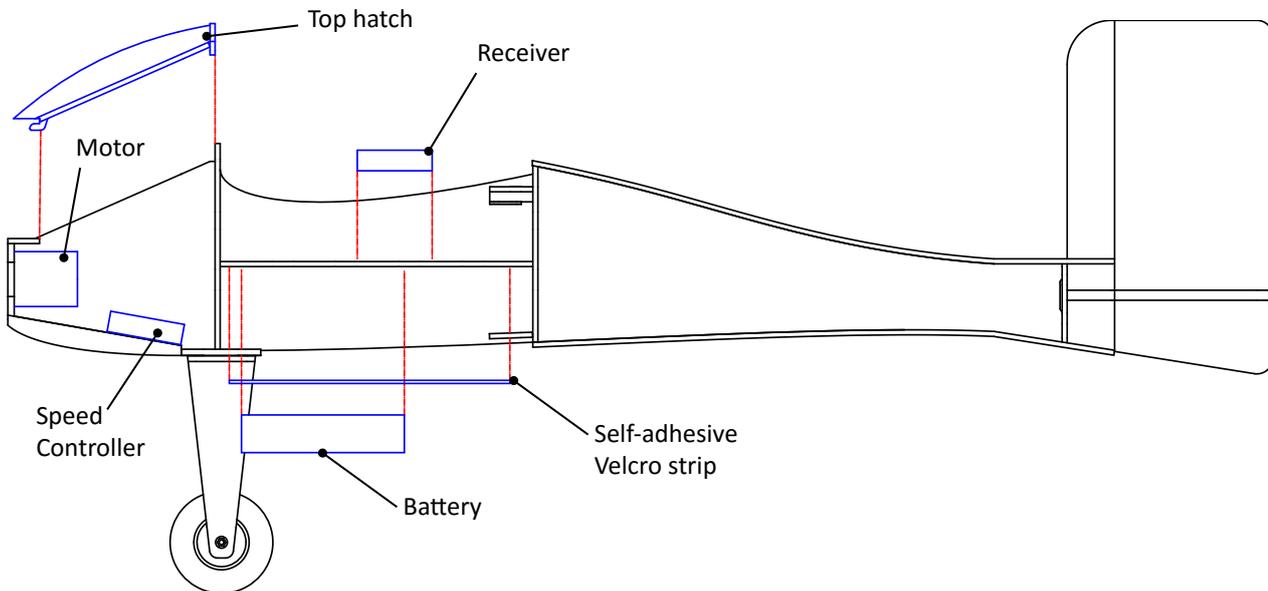
**i** Repeat this installation procedure for the other three servos. You will need servo extension leads for the two tail servos. You may not need any for the aileron servos, depending on where you position the receiver and how long the servo leads are.

# Electronics

Motor, Speed Controller, Receiver, Battery, self-adhesive Velcro strip, top hatch



Make sure the motor turns in the correct direction once you have fitted it. If it doesn't, swap two of the connections from the speed controller. The top hatch is retained by hooks at the front, and a small, countersunk screw at the rear. The receiver and speed controller should be fixed in place with double sided tape.



Make sure that you use thread lock on the motor mounting bolts so they don't vibrate loose.

The Velcro strip is to stop your battery sliding during flight - you will need to attach Velcro strips to these as well (some are included in the kit). There is also a yellow double sided Velcro strap - this is to loop around the battery and through the slots in the battery tray to make sure the battery does not fall out during extreme manoeuvres!

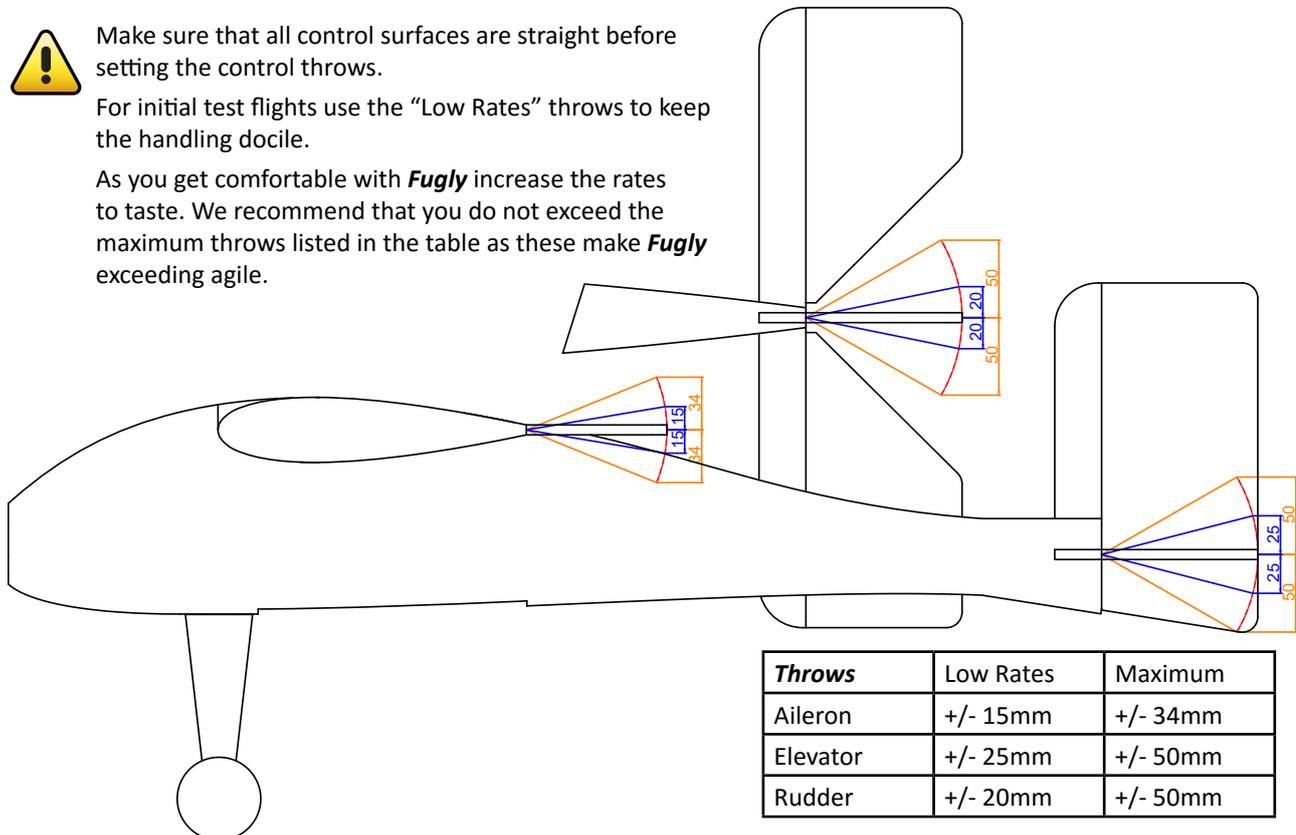
# Control Throws



Make sure that all control surfaces are straight before setting the control throws.

For initial test flights use the "Low Rates" throws to keep the handling docile.

As you get comfortable with **Fugly** increase the rates to taste. We recommend that you do not exceed the maximum throws listed in the table as these make **Fugly** exceeding agile.

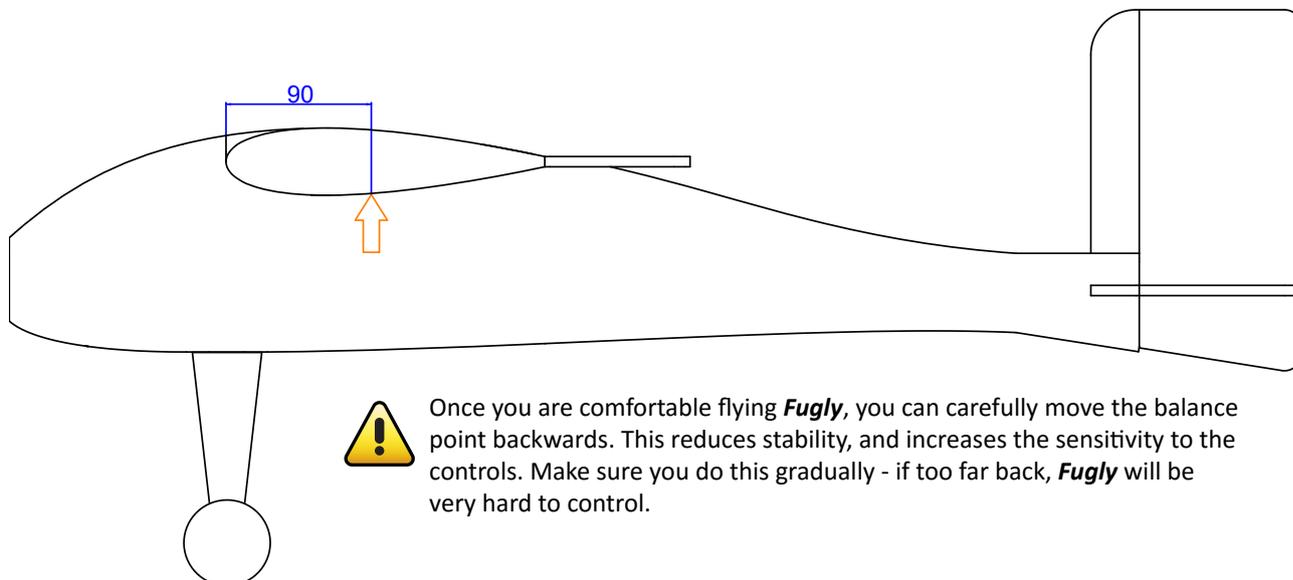


Throws	Low Rates	Maximum
Aileron	+/- 15mm	+/- 34mm
Elevator	+/- 25mm	+/- 50mm
Rudder	+/- 20mm	+/- 50mm

## Balance



The stability of any aircraft depends on its balance. Once your **Fugly** is fully finished, mount the battery and close the hatch. Using your finger tips, one under each wing right next to the fuselage, find the position where **Fugly** remains horizontal. This is the balance point. Move the battery forwards or backwards until the balance point is **90mm** from the leading edge of the wing. You may have to add ballast to the nose depending on the equipment you have used. Once you have found the correct battery position, mark the battery tray so that you can easily replace the battery at the correct position.



## Test Flight



Congratulations, your **Fugly** is ready to fly! If you are not an experienced model pilot, we recommend you ask one from your club to test fly the plane for you to trim it out.

Before the first flight, make sure you do a range check of the radio with the motor running and a friend holding on to the tail. Make sure you have the fail-safe set to kill the throttle if your radio has that capability. Make sure that all the controls move in the correct direction and are centred when you release the sticks.

Whilst **Fugly** can handle quite a breeze, for the first few flights try and stick to calm weather.

We hope you have enjoyed building your **Fugly**, and that you have great fun flying it. If you have any feedback for us, good or bad, need spare parts, or just want to send us a photo for our Facebook page please get in touch:

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# Good Luck!