

Evolution Models
Equaliser E2K Instruction Manual

Evolutions Equaliser E2K has been designed to comply with the UK Pylon Racing rules. Originally designed for club competition the equaliser provided a single class racer making it equal(iser) for all who entered. The racing was fast and close, even using a 3s battery, which made the competitions fun and not too fast so it was open to all.

The model is of simple construction to make the competition accessible to all and it is easy to fly and aimed at the intermediate to advanced pilot. The Equaliser on full throttle is fast and cuts through the air with a satisfying whistle, but throttle back and it will slow down and become as gentle to fly as a glider. The speed range is astonishing!

The laser cut parts simply slot together to provide a lightweight structure without compromising strength. The Equaliser E2K is simple and satisfying to build for both the amateur and experienced builder.

Building Recommendations

Check all parts from the box to ensure that they are present; if not then please contact us at the e-mail address at the back of the instructions. We do from time to time make mistakes!!

Ensure that you use a completely flat base on which to build the model, this should be large enough the build the wing 39" (1000mm) x 16" (400mm) as a minimum.

Carefully remove the parts from the laser cut sheet by cutting the tabs, do not snap out. Retain some of the scrap material to use during the build.

Read through the instructions before starting to build, understand each step before applying glue.

The glue detailed in the instructions is for a guide only, this is what we used for the prototypes, it is at the builder discretion which glue is used, but ensure that it is suitable for the intended purpose. **Always** read the application instructions to ensure you achieve a strong joint. **Always** read the safety instructions supplied with your chosen glue.

Take your time building the model, build a straight and strong model, this will ensure the model will fly well!

Enjoy. Building **is** part of aero modelling!

This radio-controlled model is **not** a toy. It can cause serious injury to the operator, public and property if misused or abused. Ensure that you read all the instructions supplied with this kit and instructions provided with the engine and radio control system or any other components purchased separately carefully. Also, make sure that any parts bought separately are suitable for their application.

Always sand balsa and ply using a suitable face fit mask, and where possible outside away from others.

The kit contains small and potentially sharp parts, keep away from children.

Additional Materials Required	Recommended Tools
Standard Thin or Medium Cyano	Modelling Knife
Cyano Activator	Razor Plane
Aliphatic Wood Glue	Set Square
Epoxy Resin	Sand Paper
Loctite	Sanding Block
Covering Material	Drill
Radio Gear	Drill Bits
Motor	Building Board – Completely flat 1000 x 400mm Min
ESC	Bradawl

The rules for the design of this model have been taken from the UK pylon racing website (http://www.ukpylonracing.co.uk/). Should you wish to enter the National E2K Championships then ensure your model complies with the rules and any subsequent changes.

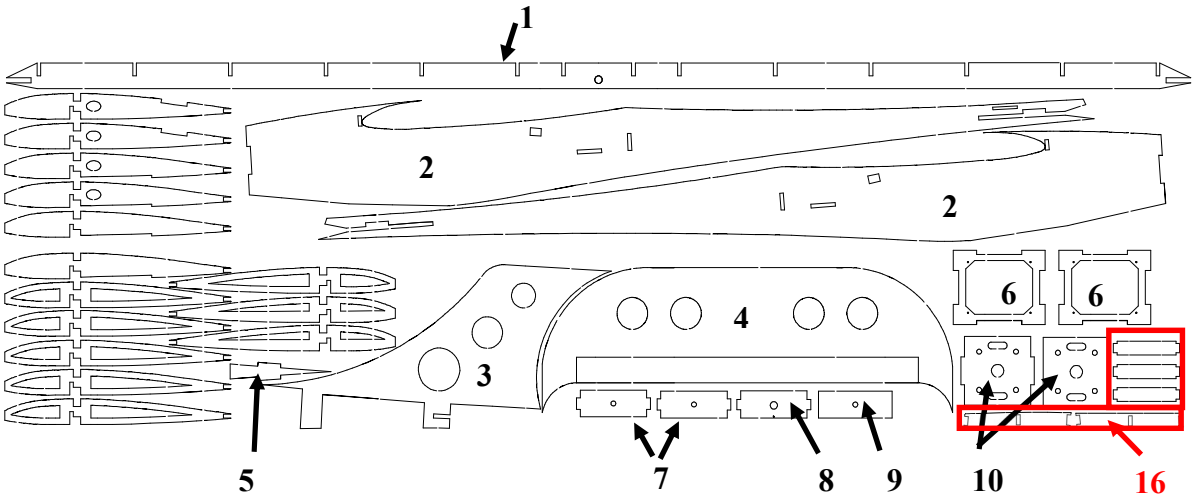
E2K Part List

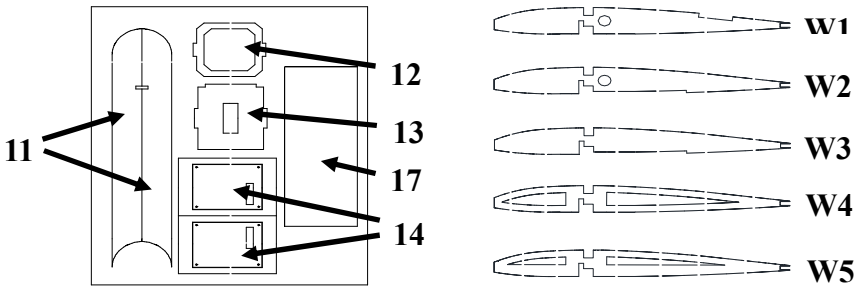
Wood Pack

Description	Sheet Size		Quantity
	Metric	Imperial	
Leading and Trailing Edge Sheet	1.5 x 100 x 915mm	1/16 x 3 x 36”	2
Leading Edge	6 x 12.5 x 915mm	¼ x ½ x 36”	1
Wing Spars	6 x 6 x 915mm	¼ x ¼ x 36”	2
Trailing Edge Spar	6 x 3 x 915mm	¼ x 1/8 x 36”	1
Wing Centre Section Sheet	1.5 x 75 x 915mm	1/16 x 3 x 36”	1
Fuselage Bottom and Front Deck Sheet	3 x 75 x 915mm	1/8 x 3 x 36”	1
Rib Capping Strips	1.5 x 6 x 915mm	1/16 x 1/4 x 36”	3
Fuselage Triangular Fillet	6 x 6 x 915mm	1/4 x 1/4 x 36”	3

Hardware Pack

Description	Quantity
100mm Pushrods	2
450mm Pushrod	1
Pushrod connectors	3
M3 Captive Nuts	5
Control Horns and bolts	3
70 x 6mm Dowel	1
Mylar hinge strip	1
Spruce Bearer	4





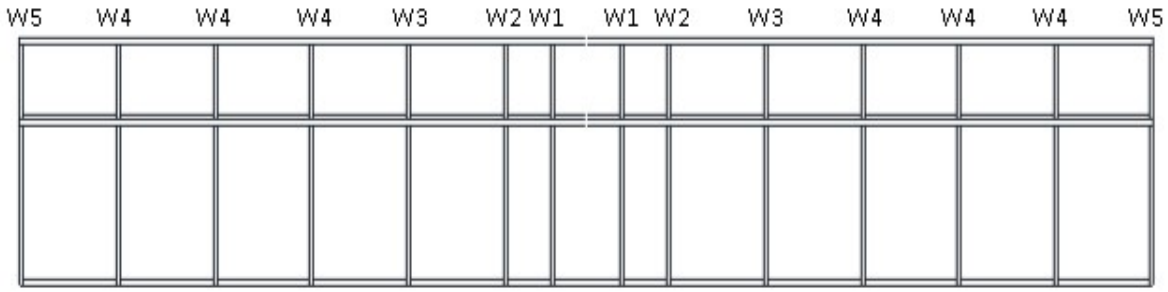
Description	Part Number
Wing Main Spar	1
Fuselage Sides	2
Fin	3
Tail plane and Elevator	4
F5 – Tail plane plate	5
Wing Servo Plate Inner	6
Fuselage Wing Plate (2)	7
F2 – Fuselage Wing Dowel Plate	8
Wing Bolt Plate	9
F1 – Main Bulkhead (2)	10
Wing Tips	11
F4 – Fuselage Former	12
F3 – Fuselage Former and Servo Plate	13
Wing Servo Plate Face	14
Hatch Parts (5)	16
Fuselage Bottom Doubler	17

Wing

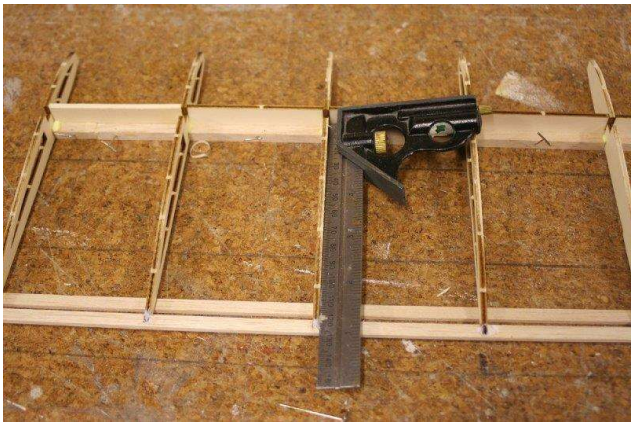
Lay the main spar (Part 1) on the board and glue a ¼ x ¼ x 36” (6 x 6 x 915mm) spar on the read bottom edge. Cut to length between the outer two rib slots. Once dry flip over so the slots face up. Using a straight edge pin to the board ensuring it is completely straight and vertical.



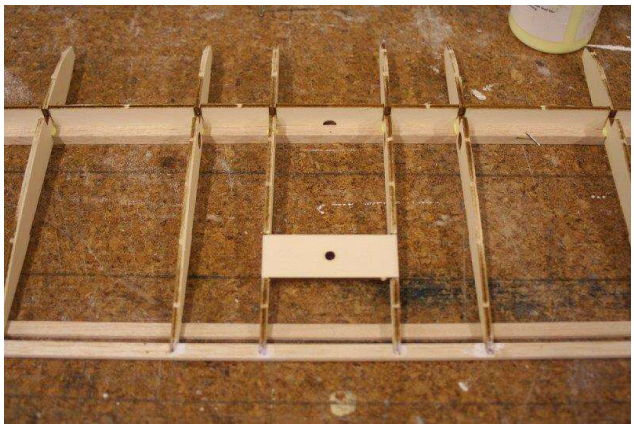

Slot the ribs as laid out on the drawing below.

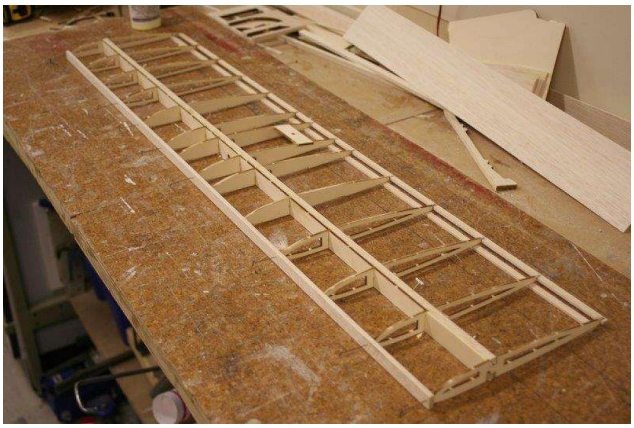


Use a scrap piece of wood to support the trailing edge and glue in the 1/4 x 1/8 x 36 (3 x 6 x 915mm) trailing edge spar. Use a square to ensure all ribs are at 90°

Glue the wing Bolt Plate (Part 9) in place. Take the ¼ x ½ x 36” (6 x 12.5 x 915mm) leading edge and drill a 6mm hole in the centre, glue to the ribs ensuring the hole is central and in line with the hole in the main spar to accept the wing dowel later. Also glue the upper main spar in place.

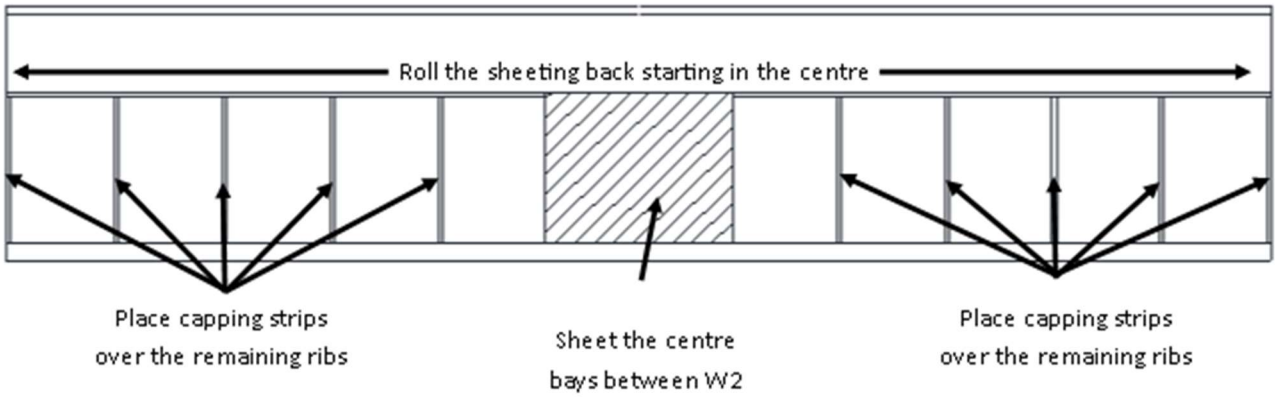




Using a piece of the 1/16 x 3 x 36” (1.5 x 75 x 915mm) sheets carefully measure and mark 63mm back from the long edge. Cut the sheet down its length to form the leading and trailing edge sheet. Glue in place as shown below, the edge of the sheet from the leading edge should be approximately halfway across the main spar. Ensure the sheeting is fully glued to the leading edge so when shaped later it cannot pull away.

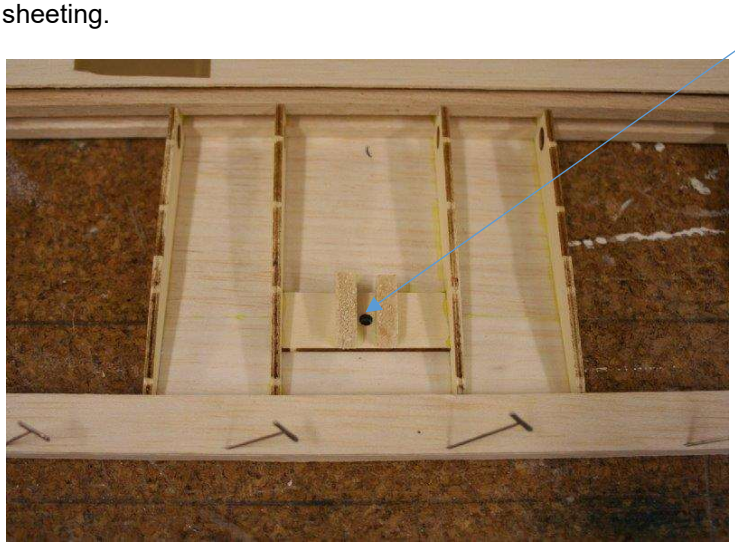


Once the sheeting has fully dried to the leading edge run additional glue over the top of the ribs, as far as you can reach without having to lift the sheeting. Roll the sheeting down on to the top of the ribs and main spar, starting from the centre run thin cyano between the sheet and spar working towards the tip.



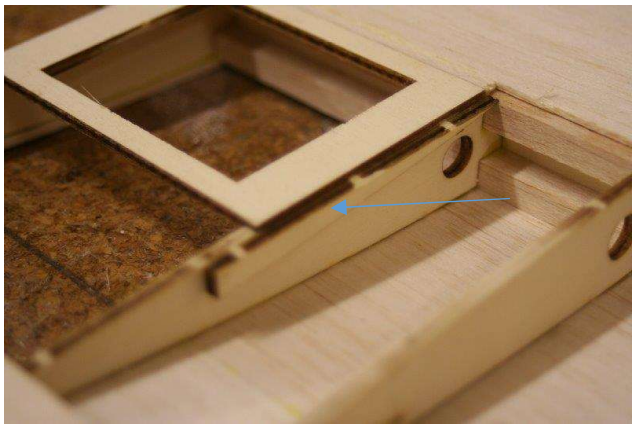
Sheet the centre section between W2 and W2 with 1/16 x 3 x 36” (1.5 x 75 x 915mm) sheet. Cap over the top of the remaining ribs with 1/16 x ¼ x 36” (1.5 x 6 x 915mm) strip wood between the leading and trailing edge.

Turn the wing over and repeat the sheeting process to the underside. The leading edge sheet will be a little narrower approximately 60mm. Check before cutting the sheet along its length. Glue two scraps of balsa or ply either side of the Wing Bolt Plate to provide additional support, and flush with the ribs. Carefully drill through the wing bolt hole and 1/16th sheeting.

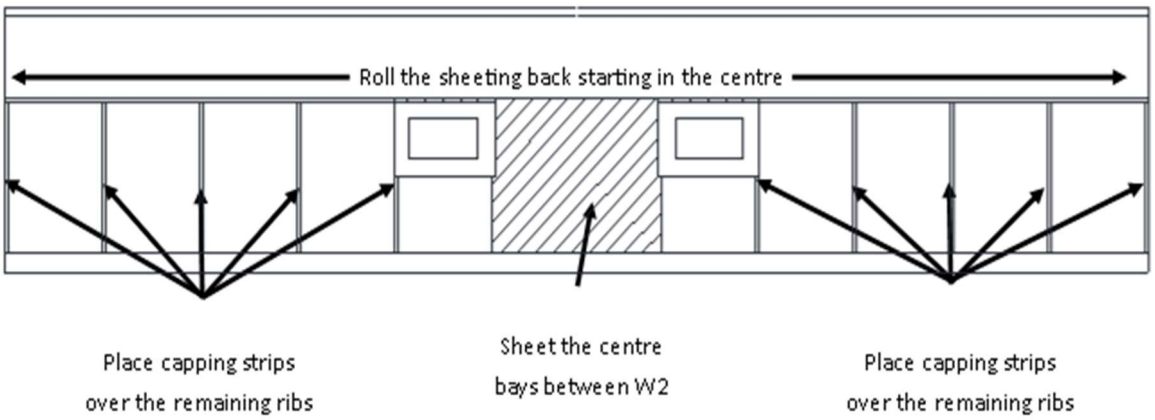


Glue the Wing Servo Face Plate outers into the notched slots on the underside of the rib, set the inner part to one side. Glue a scrap piece of ply, as shown by the arrows below, to support the centre sheeting



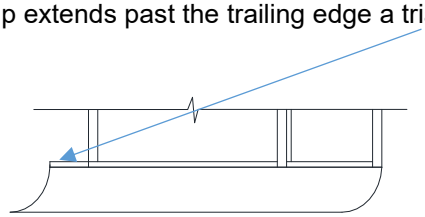


Repeat the centre sheeting as for the top wing notching around the servo plates. Glue the capping pieces in place. All sheeting should be level with the servo plates.

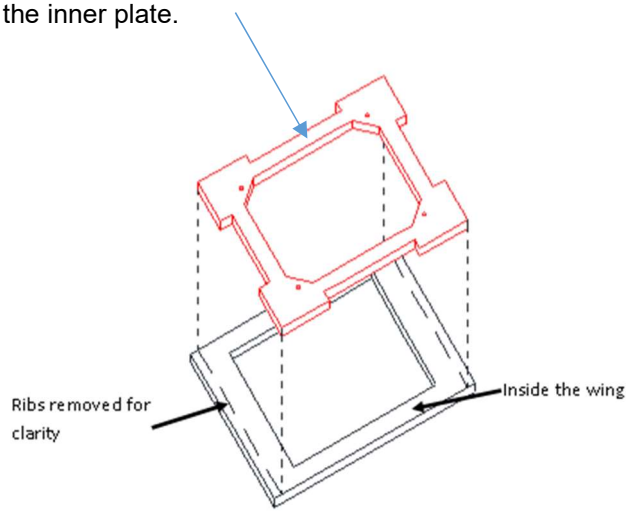


Sand the entire wing and shape the leading edge checking the profile with one of the fuselage sides.

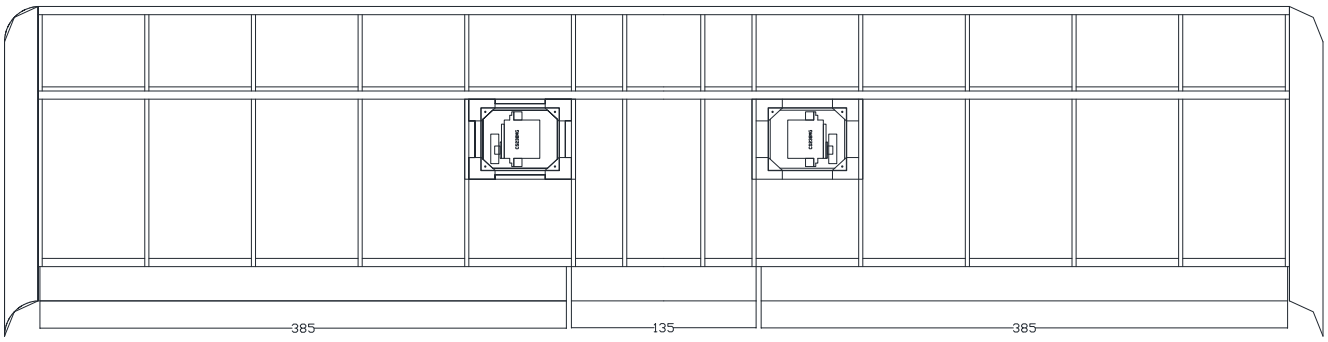
Glue the tips (Parts 11) on to W5 at 90° from the centre of the LE, through the triangulated part of the main spar to the centre of the TE. Where the tip extends past the trailing edge a triangular fillet will be required to support the covering.



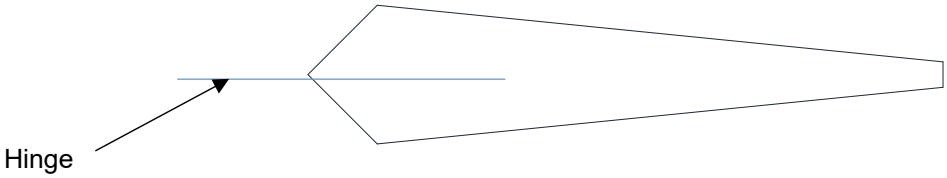
Place the Wing Servo Plate Inner inside the wing between ribs W2 and W3. Glue in place and check that the face place holes line up with the inner plate.



Take the 1/4 x 1 x 36" (6 x 25 x 915mm) trailing edge (TE) stock and cut into 3 lengths (2@ 385mm and 1@ 135mm). Glue the 135mm section to the centre of the trailing edge of the wing.

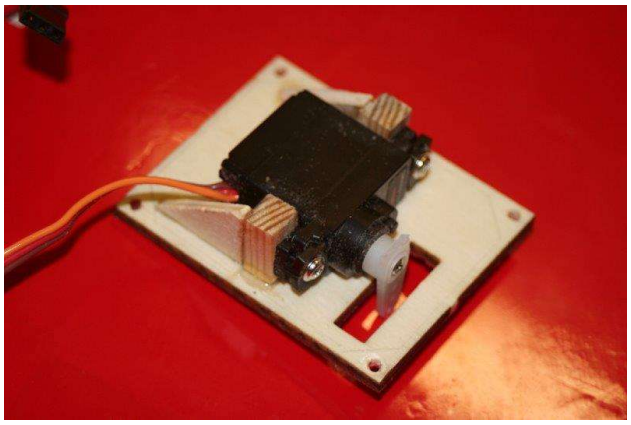


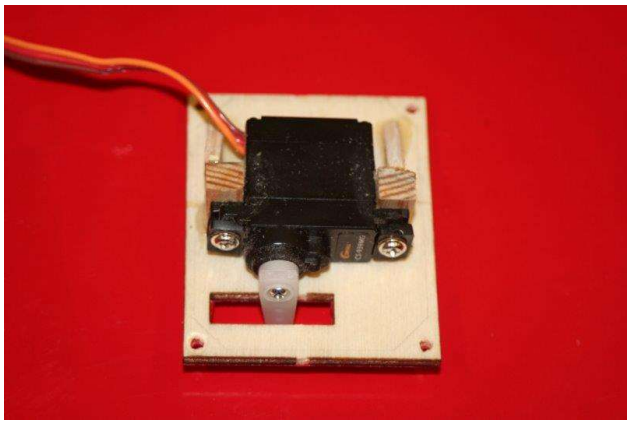
Chamfer the leading edge of the TE stock at 45°. Cut the supplied Mylar strip into six 3/8" (10mm) sections for the aileron hinges. Slot the centre of the wing trailing edge and the aileron to accept the hinges. Insert 3 hinges per aileron. Ensure when the aileron is fitted it has free movement without binding on the tips or centre section. Leave enough gap to allow movement once covered.



Controls

Install the servo by either gluing it to the ply plate or using ¼ x ¼ (6 x 6mm) spruce bearers to suit your chosen servo. Use a scrap pieces of 1/8th (3mm) Ply to provide support. Whichever method you choose Ensure the servo is secure and unable to move and the horn is positioned centrally to the cut out.





Cut down two of provided servo horns as shown below. Attach to the aileron in line with the servo horn. Insert the pushrod connector through the remaining hole in the horn and Locktite the nut in place.





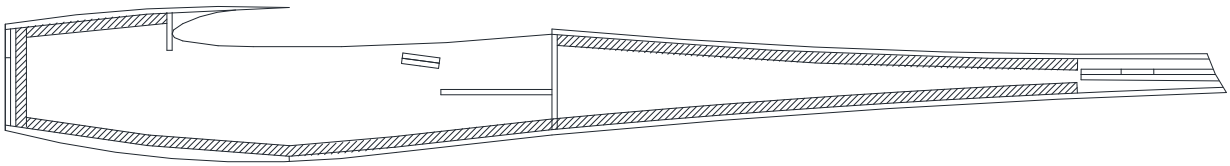
Use the 100mm push rods for the ailerons. Insert the Z bent end into the servo horn and the straight end through the push rod connector. Use Loctite on the grub screw to ensure it does not become loose. Screw the aileron servo plate in place using four screws (not provided).

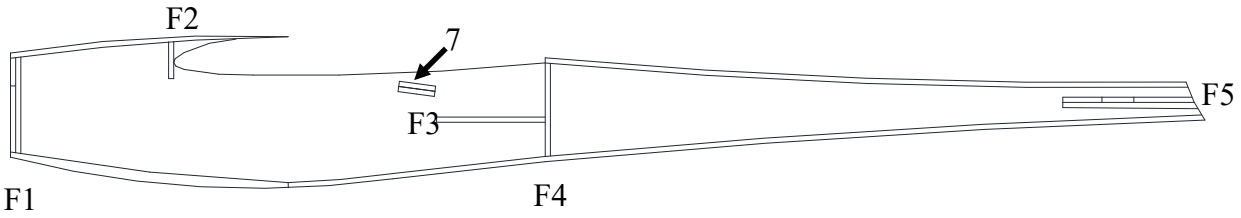
Once covered insert and glue the 6mm location dowel through the hole in the leading edge and into the spar. A spreader plate can be made from scrap ply can be placed on the top of the wing to spread the load if required.

Ensure a large M3 penny washer us used the spread the load from the bolt head.

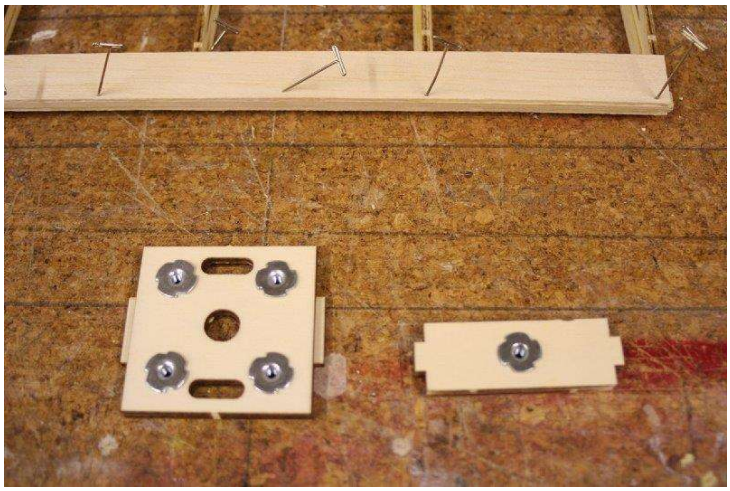
Fuselage

Using the ¼ x ¼ x36” (6 x 6 x 915mm) triangular balsa glue strips to the outer edge of the fuselage sides, Part 2, as shown hatched below. Make sure you build a left and right hand side!



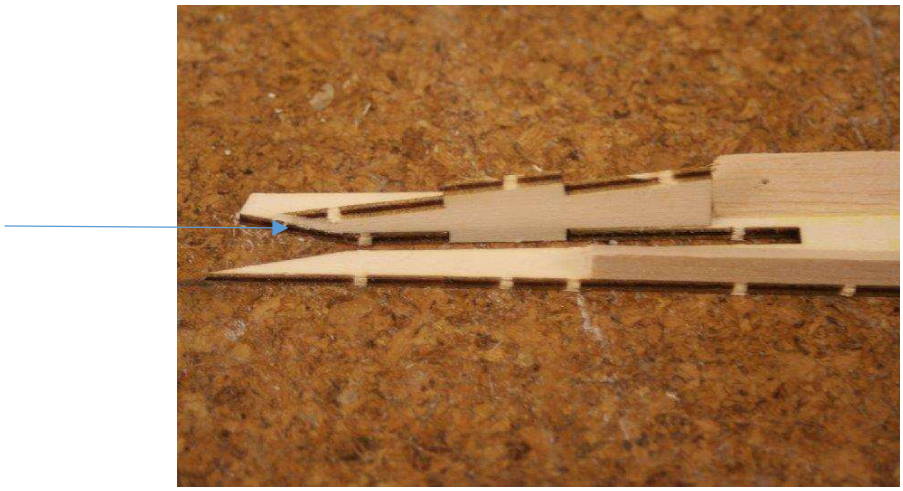


F1 and Part 7 are formed with two parts glued together. F1 has a part with locating lugs, the part without lugs sits on the inside of the fuselage. Once dry insert captive nuts on the part without lugs (inside) using a little epoxy to hold in place. The captive nut on W7 should sit underneath when installed in the fuselage.

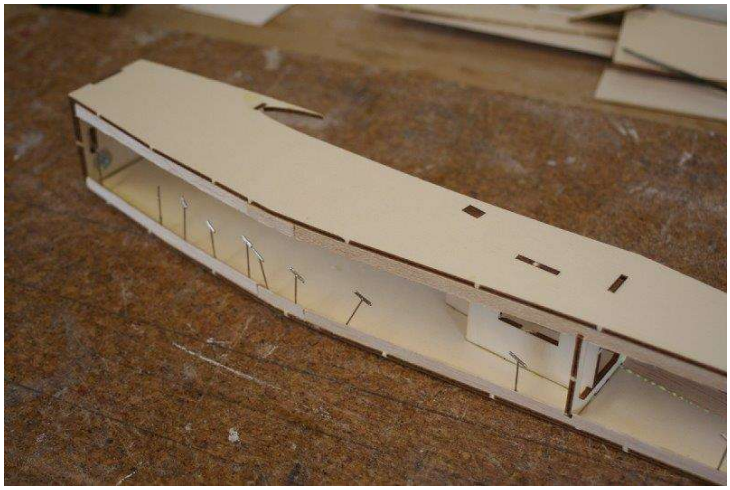


Insert the formers F1 to F5 and Part 7 on one side of the fuselage as shown below. F1 should be glued in place using epoxy resin.

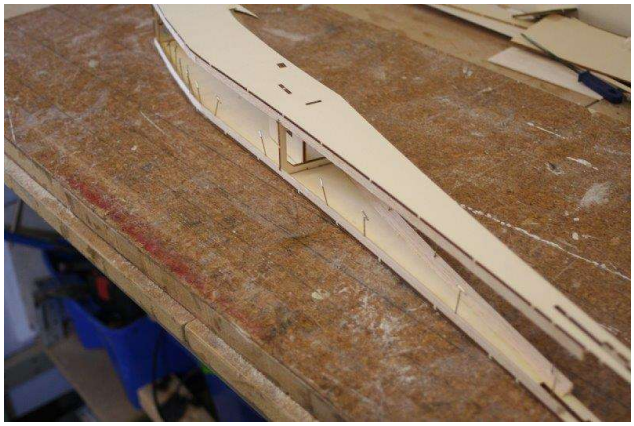
Cut F5 to follow the elevator cut out at the rear of the fuselage



Once dry offer the other side and glue together, again using epoxy on F1.



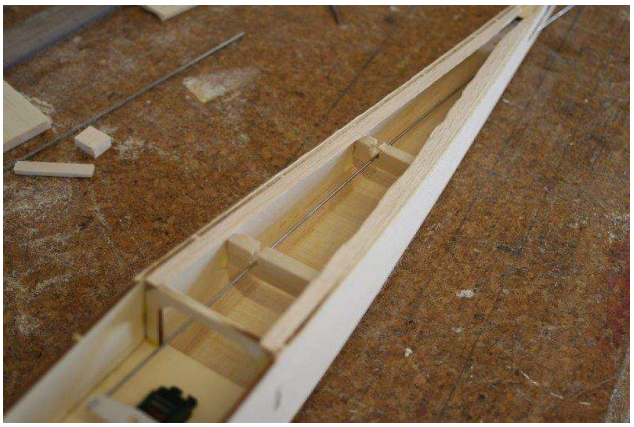
Pull the fuselage sides together so that the lug on F5 locates on the other fuselage side. This should ensure that the sides are pulled in equally but check to ensure the rear of the fuselage is equal and along the centre line.



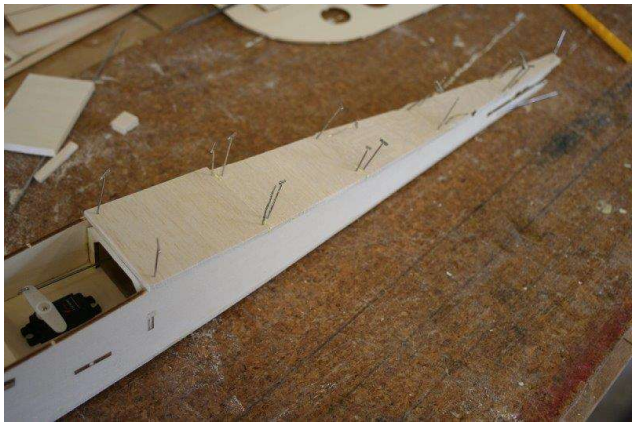


There is a slot at the rear of the fuselage for the pushrod to exit above the tailplane. Screw the servo in place (if needed use additional ply to make sure the screw is fully engaged) and connect the pushrod. Make up two guides as shown below from scrap balsa or ply, these will prevent the pushrod deflecting under load. Alternatively, a snake could be used here if you prefer.





Sheet the lower front section of the fuselage using Part 17 and then 1/8" (3mm) balsa back to the centre of the wing cord. Sheet the remaining top and bottom with 1/8th (3mm) balsa so the grain runs between the sides. Sand the edges to provide a smooth radius, remember that all radius should not be greater than ¼" (6mm) to comply with the E2K rules. Sand the front top deck down to a point above the wing.



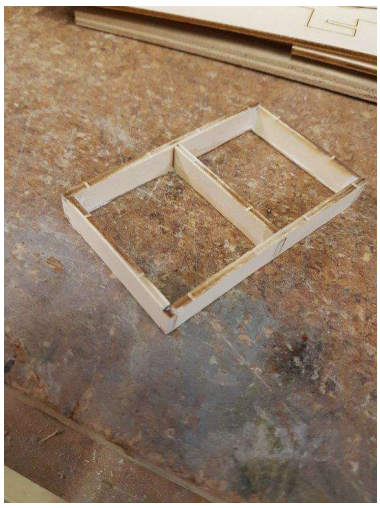


Ply Layer (Part 17) with 1/8 Balsa on top - Only 1/8th balsa back from here

Optional Hatch

An optional hatch can be constructed using the 5 parts provided on the cutting sheets.

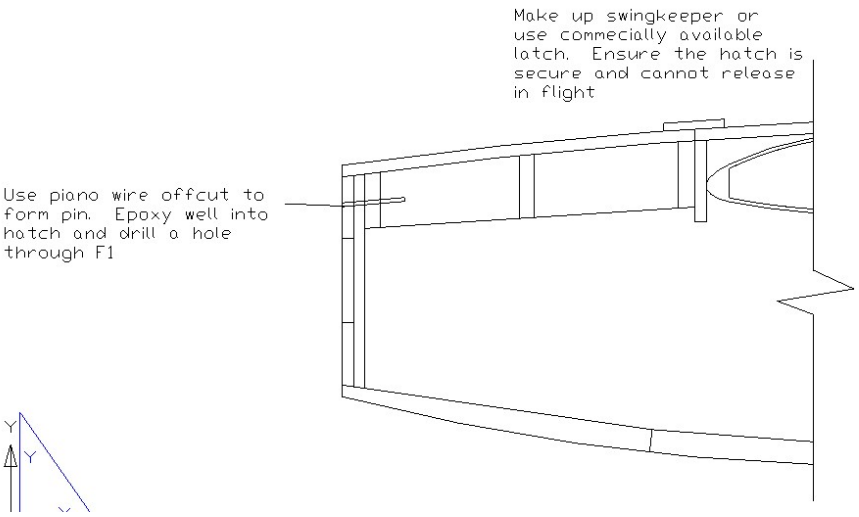
Build the parts as shown below ensuring that they are at 90° and fit between F1 and F2







Drill through F1 into the front of the frame and insert an off cut of piano wire. Glue the wire into the frame to allow the hatch to be held in place at the front edge. Make up a swing keeper to the rear edge of the hatch using scrap material.



Tail plane and Fin

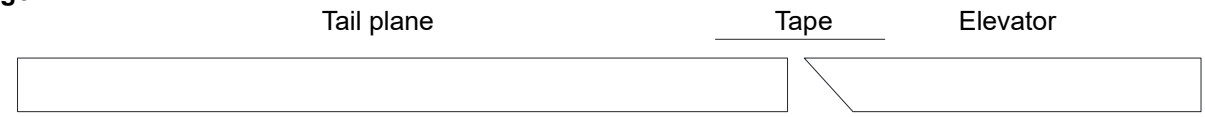
Round off the leading edge of the tail plane and fin with sandpaper.

The leading edge of the elevator should be chamfered to a 45° angle. Be careful to ensure the upper edge remains straight. The elevator is joined to the tail plane using tape or covering material.

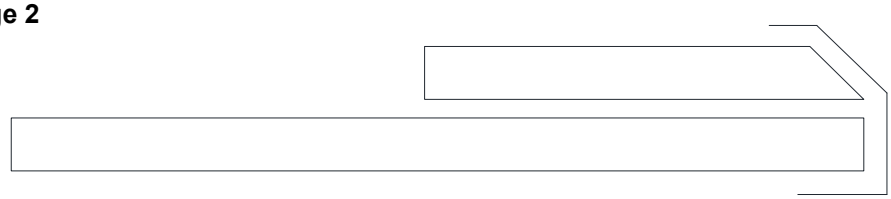
Stage 1: Using a 1" (25mm) wide piece of fibre tape or covering material, place the tape so only half the tape is on the tail plane TE. Leave a gap between the tail plane and elevator of approximately 1/32" (1mm) place the elevator onto the remaining tape and firmly stick in place.

Stage 2: Fold the elevator back on to the tail plane and apply another of piece of tape to the underside. Ensure that the elevator has full, unrestricted movement.

Stage 1

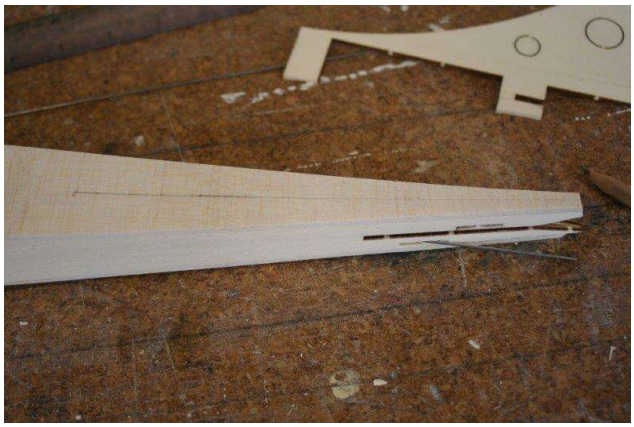


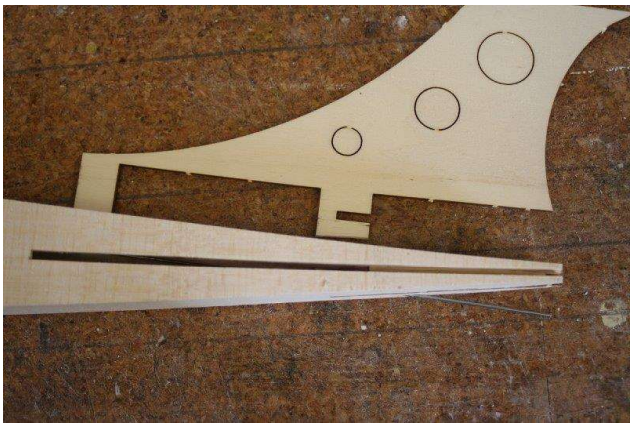
Stage 2



A traditional mylar type hinge can be used if preferred. Whatever method you choose ensure the hinge is secure.

Measure the base of the fin and mark a line along the centre of the upper deck. With a sharp knife cut 1/16" (1.5mm) either side of the line to create a 1/8" (3mm) slot for the fin.





Cover the fuselage, tail plane and fin before gluing together. Once covered insert the fin first followed by the tail plane in their corresponding slots and when satisfied that they are square mark the position with a pen or pencil. Remove the covering material where they touch the fuselage to ensure good adhesion.

The fin should be glued in place first followed by the tail plane. Ensure the fin is vertical and tail plane is horizontal to the wing

Connect the elevator to the servo using the longer pushrod provided in the same configuration shown to connect the ailerons.

Receiver and Battery Position

The receiver is to be located between the servo tray and flight battery. Mount as close to the servos as possible to allow maximum space in the battery compartment. Ensure it is isolated from airframe vibration and that they are not able to move when the model is in flight. The flight battery should be positioned to achieve the Centre of Gravity (CoG) position described below.

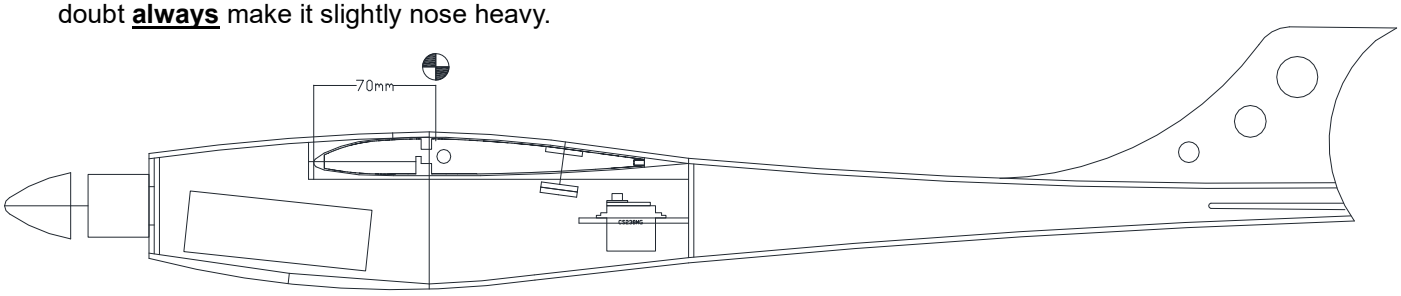
Control Throws

The following control movement is recommended for initial flights:

Ailerons - 7mm Up and Down measured at the tip
Elevator – 3mm Up and 2/3mm Down measured at the tip

Centre of Gravity (CoG)

The Equaliser E2K's **CoG <u>is critical</u>** and should be 65 to 70mm back from the Leading Edge of the wing. If in doubt **<u>always</u>** make it slightly nose heavy.



Once you have completed the model, and all components, including receiver and battery have been installed check the balance of the model. Place a finger under the wing to see where the CoG, add weight to the Tail or nose to correct. If possible, change the position of the lipo, radio battery and receiver rather than adding weight.

First Flight and subsequent flights

We would only advise that you fly your model from a recognised model flying site; **<u>do not</u>** fly from a park or public area. This model is designed for the experienced modeller in mind. Before every flight check the model for damage, check all controls surfaces, hinges and linkages etc are secure, if in doubt **do not fly**. Make sure the wing is securely fitted to prevent the wing lifting in flight. After each flight check the model for any landing damage of flight stresses, never fly a model if you believe that it has been damaged or find any signs of fatigue. Always check the elevator hinge to ensure it has not split.

Contact

If there are any issues with you kit please contact us at the address below, please allow 24hrs for us to get back to you. Also, contact us for any advice or help during your build, we are only too happy to help.

support@evolution-models.com

Safety & disclaimer

This Radio-Controlled model is not a toy. It can cause serious injury to the operator, public and property if misused or abused. Ensure that you read all the instructions supplied with this kit and instructions provided with the engine and radio control system or any other components purchased separately carefully. Also make sure that any parts bought separately are suitable for their application.

Evolution Models do not have any control over the final assembly of the model or material used for final assembly. No liability shall be assumed for damage resulting from the use of this product. By the act of using the final assembled product the user accepts all resulting liability.

We guarantee the kit will be free from defects both in material and workmanship at the date of purchase; this does not cover any parts damaged by use, misuse or modification. Evolution Models' liability will not exceed the original cost of the purchased kit.

This disclaimer does not limit or reduce Evolution Models' liability for death or personal injury caused by Evolution Models' negligence.