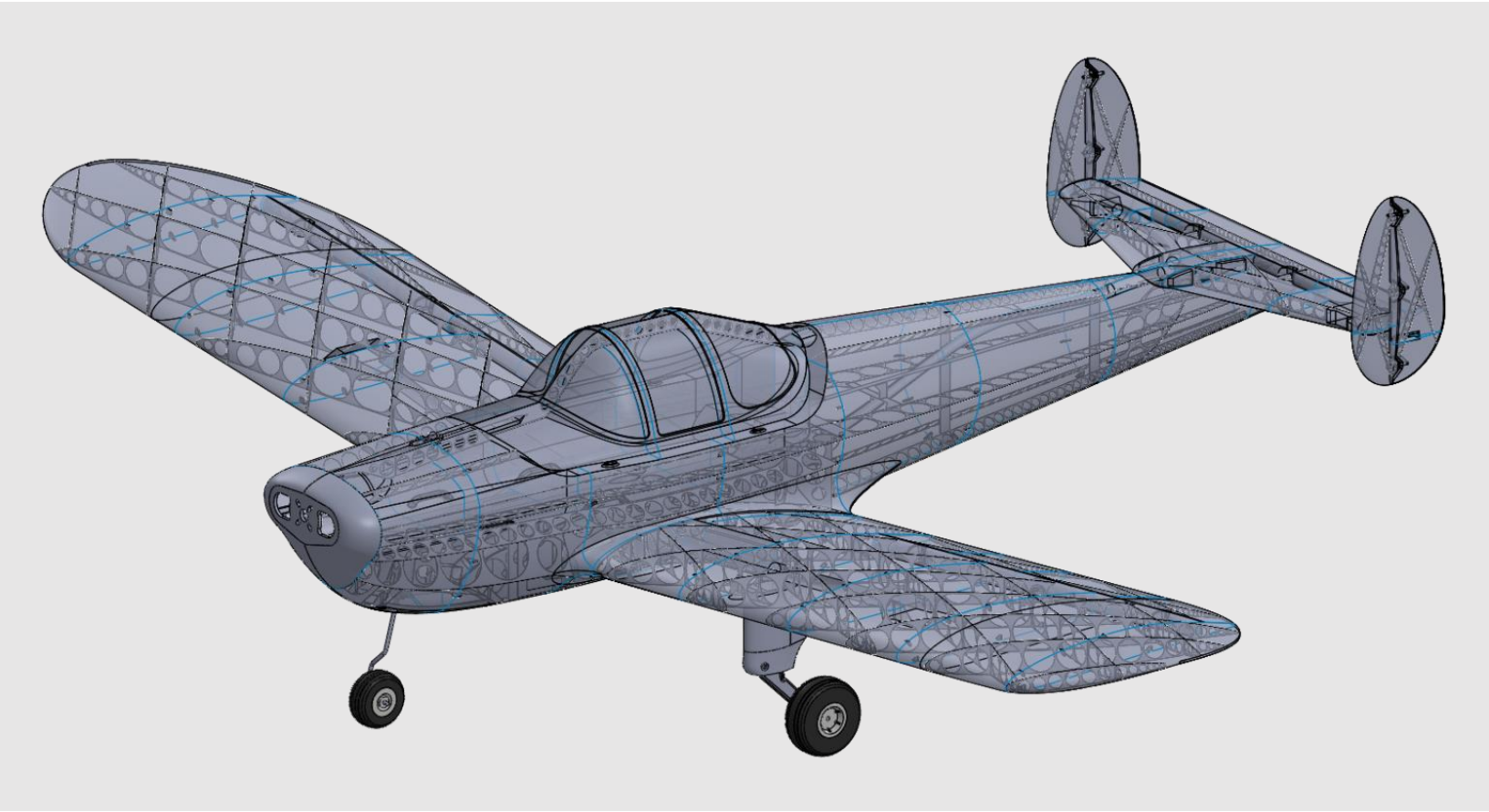
ERCO ERCOUPE

3D PRINTED R/C MODEL



BUILD GUIDE

INTRODUCTION

Thank you for purchasing a model by Lofted Aero! 3D printed aircraft are an exciting new segment of the hobby, and we've got no shortage of ideas for new designs. Your support helps us make those reality.

The ERCO Ercoupe is a general aviation aircraft from a time when flying was immensely popular. Advertised as "the world's safest plane", the Ercoupe had great visibility, resistance to spins, and gentle handling & control characteristics intended to make it easy for almost anyone to fly. Today – more than 70 years after its first flight – the Ercoupe is still unique and interesting enough to maintain a devoted following. And to become a 3D printed R/C model!

SKILL METER

Build: This model has relatively few parts and is a straightforward configuration to print and assemble. It'd make for a good introduction to 3D printed aircraft.

Flight: This model has smooth handling characteristics but is not a trainer. It is suitable for pilots comfortable with low-wing sport aircraft and runway landings.

SPECIFICATIONS

Wingspan:	1500mm (59")
Length:	1003.5mm (39.5")
Wing Area:	37.9dm^2 (4.09ft^2)
Print Weight:	1500g
Flying Weight:	3000g
Wing Loading:	79g/dm^2 (25.9oz/ft^2)
Airfoil:	NACA4412 modified

RECCOMENDED EQUIPMENT

The following hardware & electronics are required to complete the Ercoupe. In addition, you'll need some CA glue and activator, your R/C transmitter and receiver, and a LiPo battery charger.

POWER SYSTEM & AVIONICS

Motor:	Turnigy SK3 3542-800kV
ESC:	YEP 40A
Battery:	Gens Ace 4S 5500mAh
Propeller:	Master Airscrew 11x7
Aileron & Elevator Servos:	Hitec HS-85MG (x3)
Rudder & Nosewheel Servos:	Hitec HS-65MG (x3)
Aileron Servo Extensions	30cm / 12" (x2 – 1 pack)
Rudder Servo Extensions	60cm / 24" (x2 - 1 pack)

HARDWARE

Hinge Pins	2.5 x 43 Round Pins (x14 - 2 packs)
Nose Landing Gear Rod	K&S 3mm Rod
Shaft Collars	3.5mm Wheel Collar (x4 - 1 pack)
Pushrods	K&S 1.2mm Piano Wire
EZ-Connectors (optional)	Dubro EZ-Connectors
Motor & Gear Pylon Mount Screws	M4 x 14 Self-Tapping Screw (x8 - 1 pack)
Nylon Wing Mount Bolts	M6 x 60 Nylon Screw (x2 - 1 pack)
Nylon Wing Mount Nuts	M6 Nylon Nut (x2 - 1 pack)
Landing Gear Shock Absorbers	68mm x 15mm Shock Absorber
Axle Screws	M3 x 40 (x2)
Strut Screws	M3 x 22 (x2)
Axle Nuts	M3 Locking (x4)
Shock Absorber Lower Mount Screws	M2.5 x 10 (x2)
Shock Absorber Upper Mount Screws	M2 x 20 (x2)
Shock Absorber Upper Mount Nuts	M2 Locking (x2)
Shock Absorber Lower Mount Nuts	M2.5 Locking (x2)

A hardware pack containing all screws, nuts, and washers will be available from Lofted Aero in January 2019.

PRINTING THIN-WALL MODELS

Desktop 3D printers are perfectly capable of producing great-flying R/C models durable enough to withstand hangar rash and general use. However, aircraft designs contain a unique mix of thin surfaces and intricate solid supports that require some practice to print perfectly. Keep the following tips in mind when printing your model.

QUALITY FILAMENT

Using good quality filament can be the key to successful thin-wall prints. PLA is the filament of choice for these prints due to its low warp and high interlayer bond strength. While most PLA may seem identical, there's a lot of variation in diameter tolerance, moisture content, pigment consistency, and melting properties. With poor quality filament, you may notice surface imperfections, underextrusion on thin walls, and stringing between interior features. We've had great results with eSun PLA+ (sometimes sold as PLA Pro) and strongly recommend it for printing Lofted Aero models.

SLICING SETTINGS

The supplied pre-built gcode files are the safest bet to achieve properly-sliced parts. These files were prepared for a printer with the following characteristics:

- 1.75mm filament
- Direct-drive extruder
- 0.4mm nozzle
- 200mm x 200mm x 150mm print volume (or greater)

If your printer setup is different, Lofted Aero recommends using the Simplify3D slicer and the provided factory files. Simplify3D includes many features ideal for thin-wall printing, including allowing multiple processes per print, control over the layer start location, and good control of retraction settings. Additionally, the slicing process organization scheme makes it easy to modify the processes in the provided files to suit your machine.

If you choose to try slicing the STL files with a different slicer, there are a few things to keep in mind:

- Most parts should be sliced with only 1 perimeter, no solid top & bottom layers, and no infill
- "Solid" parts (landing gear components, hatch latch, wing nut holders) should be sliced with 3 perimeters, 3 solid top & bottom layers, and ~40% infill
- Nozzle temperature should be 210-220 degrees with no cooling fan
- Bed temperature should be 50-60 degrees
- Retraction should be just enough to prevent stringing between features
- Extra length on restart should be just enough to prevent sparse extrusion at layer start
- Extrusion ratio should be adjusted until print weight equals the suggested part weight

PRINT LOG

You can print and use this table to keep track of printing progress, time, and weights.

WING

Part	Weight (intended)	Weight (actual)	Print time
Wing LR1A	54g (27g each)		
Wing LR1B	68g (34g each)		
Wing LR2A	48g (24g each)		
Wing LR2B	48g (24g each)		
Wing LR3	88g (44g each)		
Wing LR4	82g (41g each)		
Wing LR5	80g (40g each)		
Wing LR6	46g (23g each)		
Ailerons 1 & 2	36g (18g per side)		
Ailerons 3 & 4	48g (24g per side)		

FUSELAGE

Part	Weight (intended)	Weight (actual)	Print time
Fuselage 1	38g		
Fuselage 2	82g		
Fuselage 3	72g		
Fuselage 4	54g		
Fuselage 5	70g		
Fuselage 6	53g		
Fuselage 7	37g		
Fuselage 8	31g		
Fuselage 9	3g		
Canopy 1	26g		
Canopy 2	20g		
Canopy 3	28g		
Nose Gear Hatch	6g		
Hatch Latch	4g		
Wing Nut Holders	10g (5g each)		

TAIL

Part	Weight (intended)	Weight (actual)	Print time
Horizontal Tails	40g (20g per side)		
Elevators	26g (13g per side)		
Vertical Tails	18g (9g per side)		
Rudders	20g (10g per side)		

LANDING GEAR

Part	Weight (intended)	Weight (actual)	Print time
Nose Gear Insert	5g		
Main Landing Gear	62g (31g per side)		
Wheel Hubs	24g total		
Main Tire (x2)	50g (25g each)		
Nose Tire	14g		
Steering Arm	1g		
Nose Strut Template	21g		

JOINING PARTS

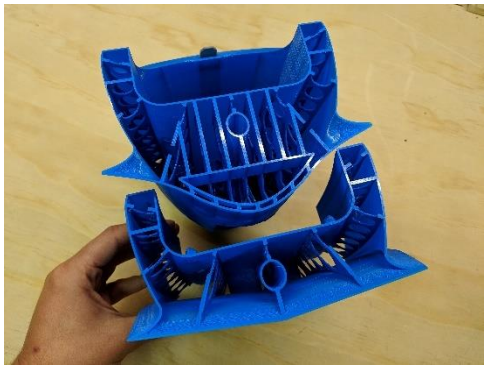
The Ercoupe's printed sections are joined together with CA glue (Bob Smith brand works well) and activator. There are a few different types of joints throughout the model.

BASE-TO-TOP JOINT

This is the most common type of joint, where the base of one part is glued to the top of another part. There are usually some tabs present to help with alignment. Place a bead of CA along the perimeter and internal edges of the part with the base side, as these edges have a bit more surface area. Then place that part on top of the opposite part, again using gravity to hold the parts together. Verify that the tabs achieved proper alignment and spray CA activator to secure.

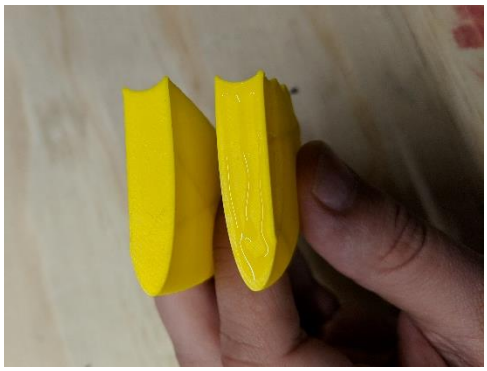
BASE-TO-BASE JOINT

Some parts are joined with their base surfaces facing each other. There are no alignment tabs in this scenario, but the increased surface area helps somewhat. Place a bead of CA along the perimeter and internal edges of one of the parts. Then place that part on top of the opposite part, again using gravity to hold the parts together. Before glue sets, gently nudge the parts to align them. Once satisfied, spray CA activator to secure.



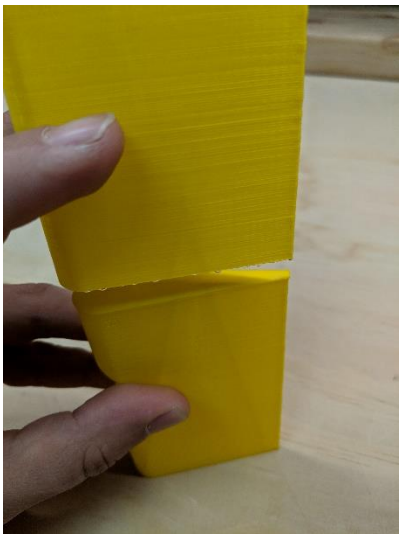
SOLID FACE JOINT

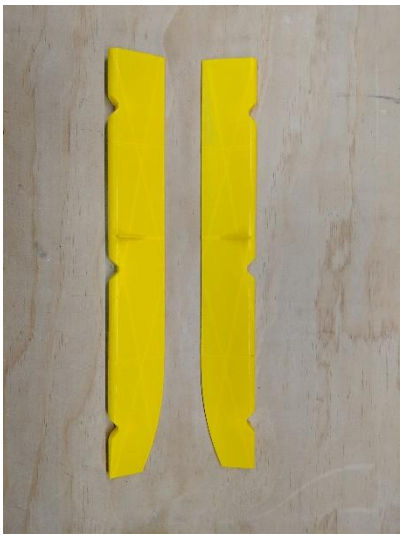
The joints on parts including control horns often contain solid faces to increase strength. Spread a thin layer of CA on one face and then carefully align with the second. Once satisfied with alignment, spray CA activator to secure. Some control surface parts join solid faces on one side with hollow perimeters on the opposite side. For these, place a bead of glue around the edges of the hollow perimeter and any internal structure, then align it on top of the solid face of the opposite part. When satisfied with alignment, spray CA activator to secure.



WING ASSEMBLY

1. Assemble the ailerons. Start by joining section 1 to section 2 and section 3 to section 4 separately. Then, glue both subassemblies together at the control horn in the middle.



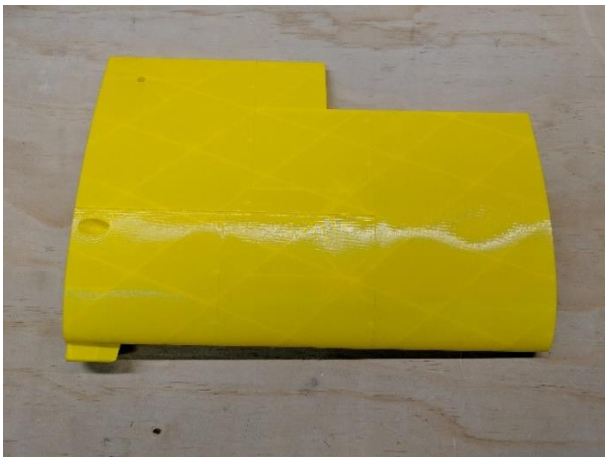
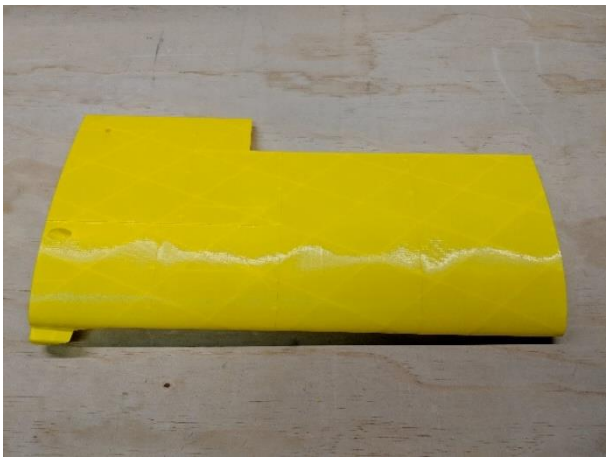
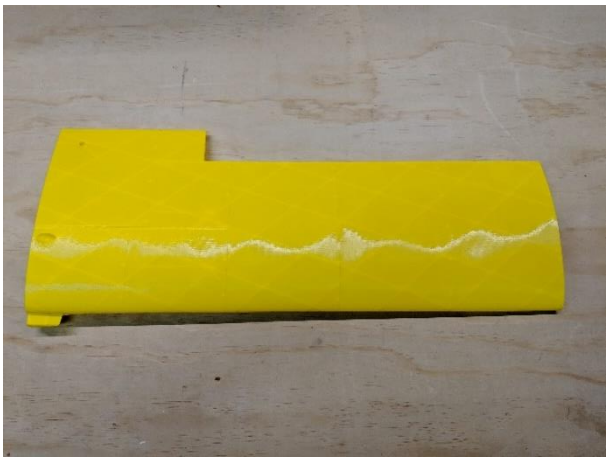
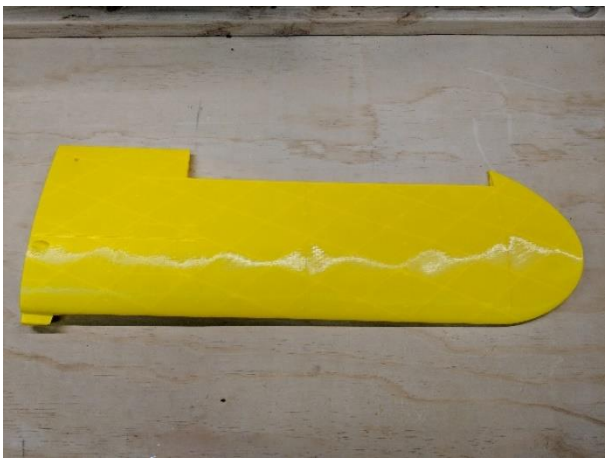


2. Assemble sections 1A and 2A, then sections 1B and 2B.



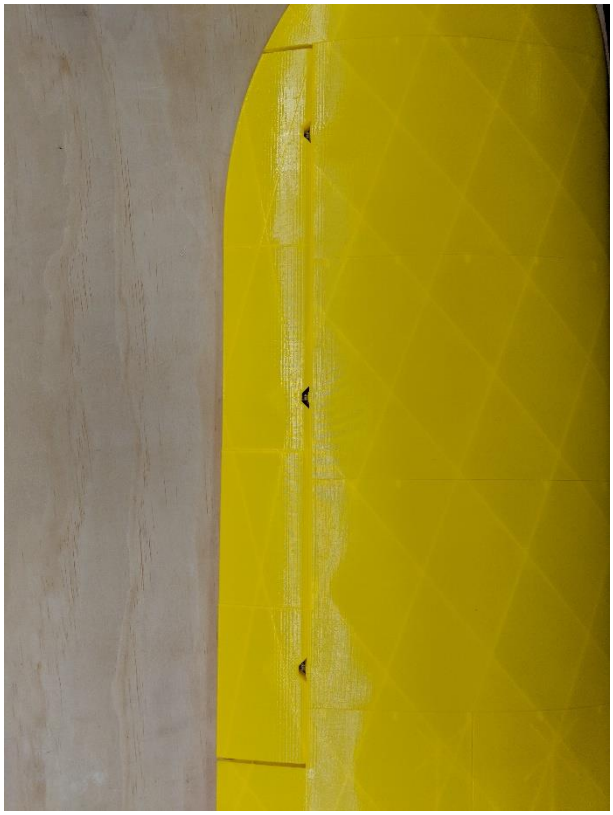
3. Spread glue liberally along the joining faces between the assembled “A” and “B” subassemblies. Join them together, standing the root ends on a flat surface to help maintain alignment. Use CA activator to secure.


4. Complete the wing panels by gluing sections 3, 4, 5, and 6 in sequential order.

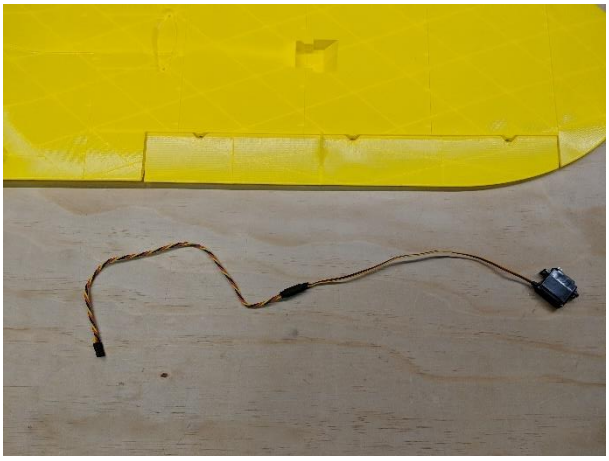





5. Place a drop of glue on each hinge pin, then push them into their mount holes in the wings. Be sure that their rotation axes are aligned with the aileron's hingeline. Then, use activator to secure.

6. Place a drop of glue on the exposed ends of all three hinge pins and carefully install the aileron, making sure the hinge pins engage their mount holes. When the aileron is fully seated, spray CA activator while working the hinge back and forth to make sure the hinge pins stay free.



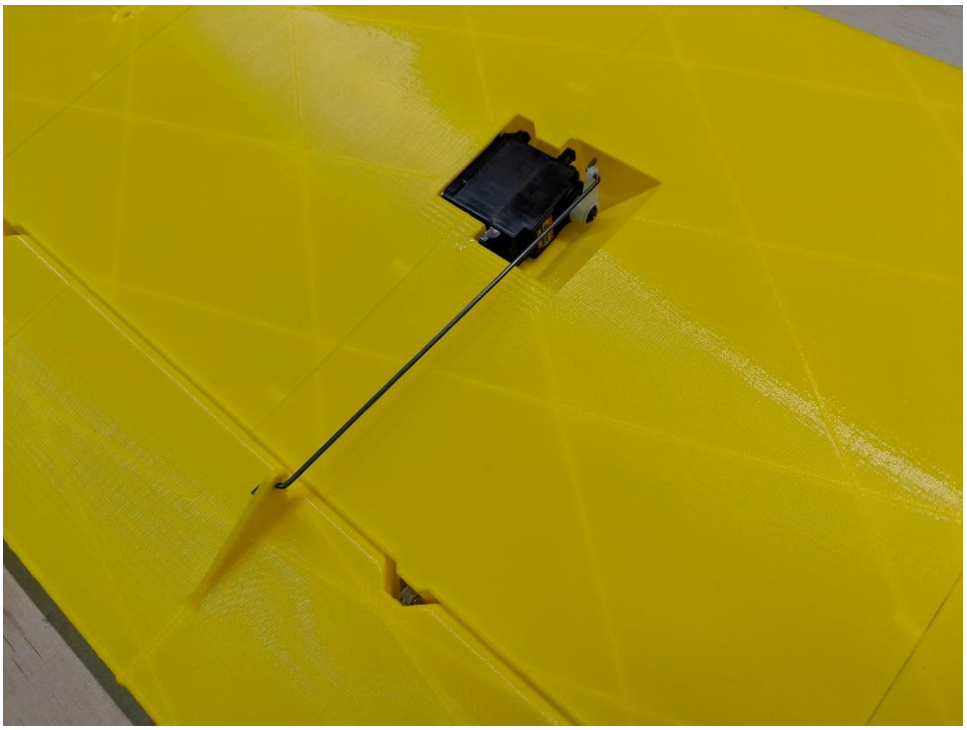
7. Install 300mm (12”) servo extensions on the aileron servos and thread the leads through the tubes in the wing.



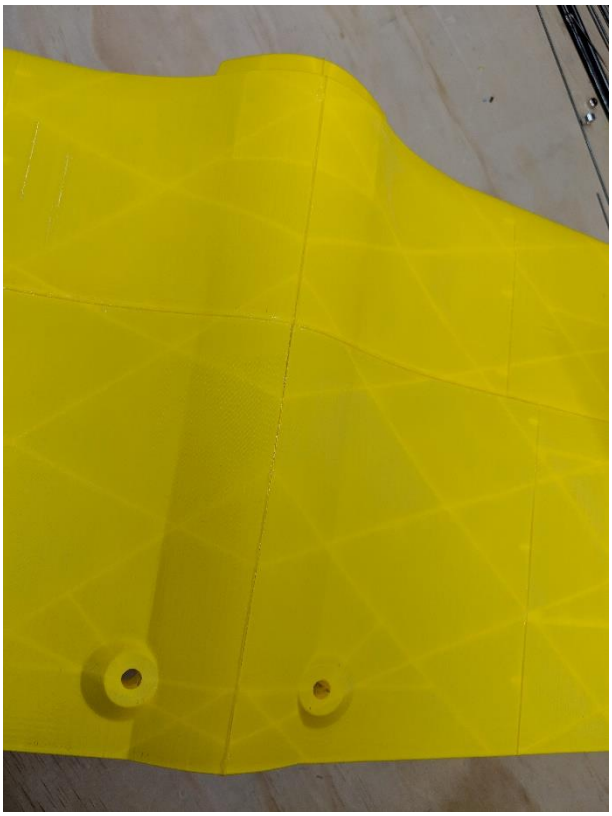
8. Center the aileron servos with a servo tester or receiver, then install the control arms.

9. Using servo tape, E6000 glue, or low-temp hot glue, secure the aileron servos in their pockets. If not using EZ-Connectors, it may help to wait to glue until after installing the pushrods.

10. Connect the aileron servos to the control horns using pushrod wire with z-bends. Alternatively, use EZ-Connectors for quick adjustable connection.



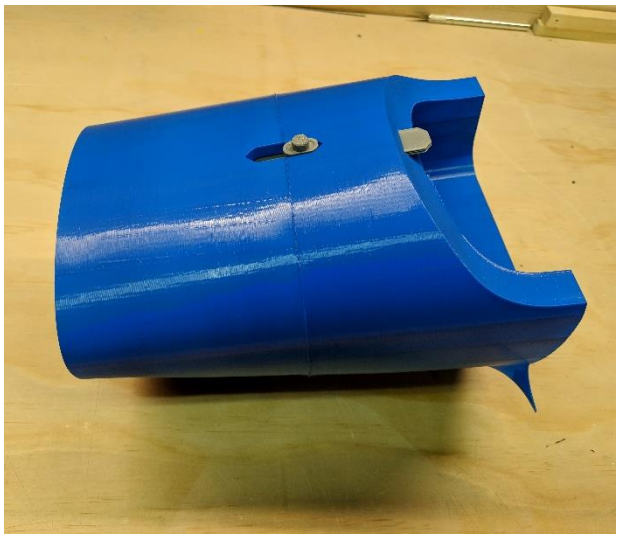
11. Spread glue liberally on one wing root, then join the two completed wings together.



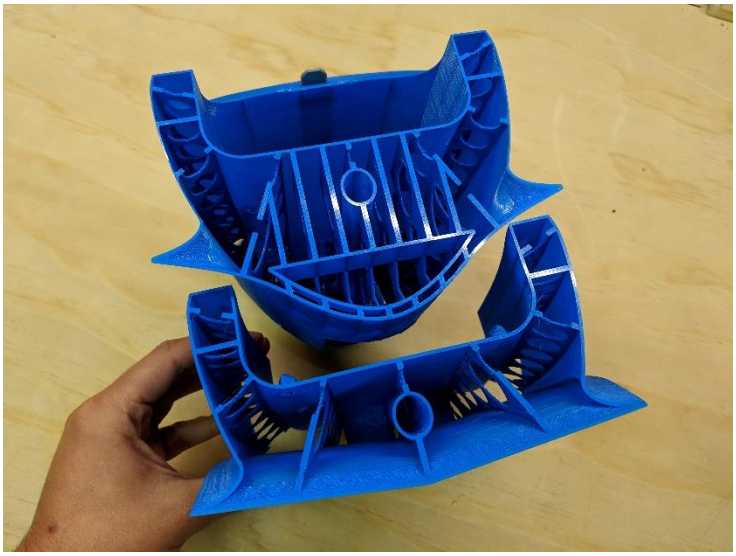
FUSELAGE ASSEMBLY

1. Install a pen spring on the end of the hatch latch, then slide it into fuselage section 2. Then join sections 2 and 3 with CA, making sure the hatch latch slides freely.

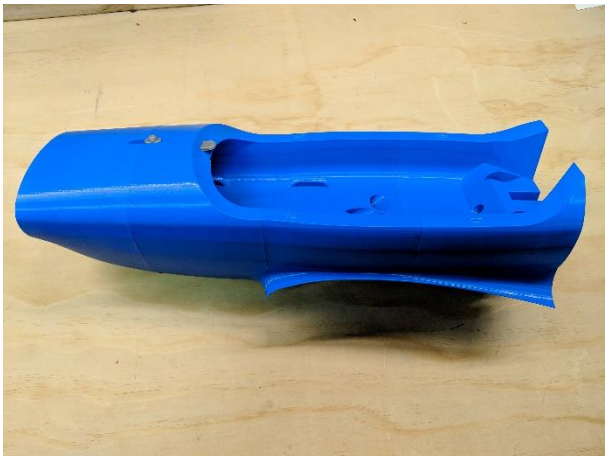
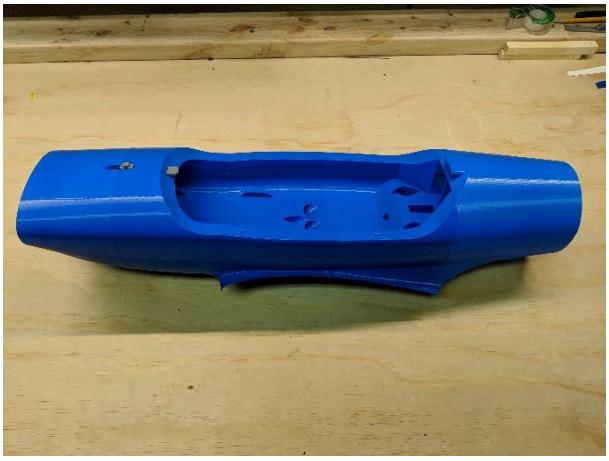




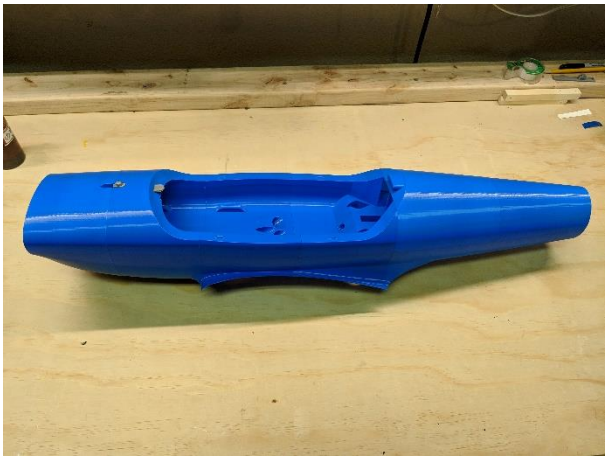
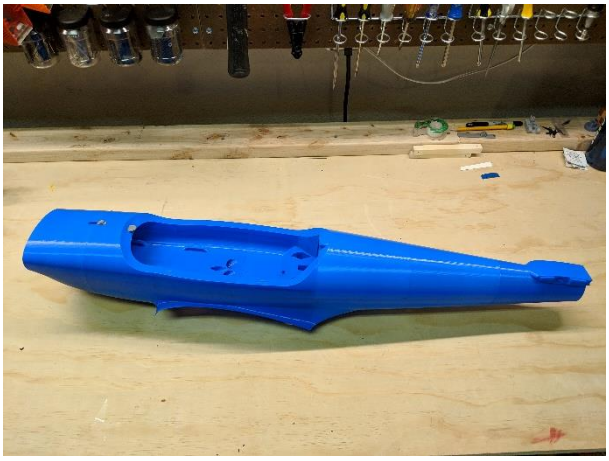
2. Join section 4 to section 3, applying the CA to section 4 to avoid getting glue on parts of the wing saddle that aren't involved in the joint.



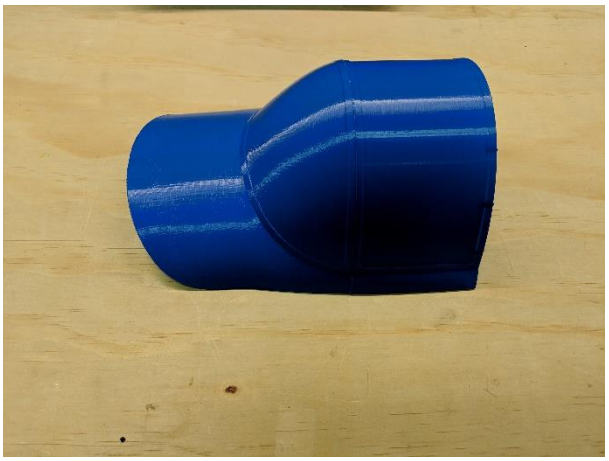

3. Join section 5 to section 4. Then join section 5 to section 6, applying the CA to section 5 to avoid getting glue on parts of the wing saddle that aren't involved in the joint.

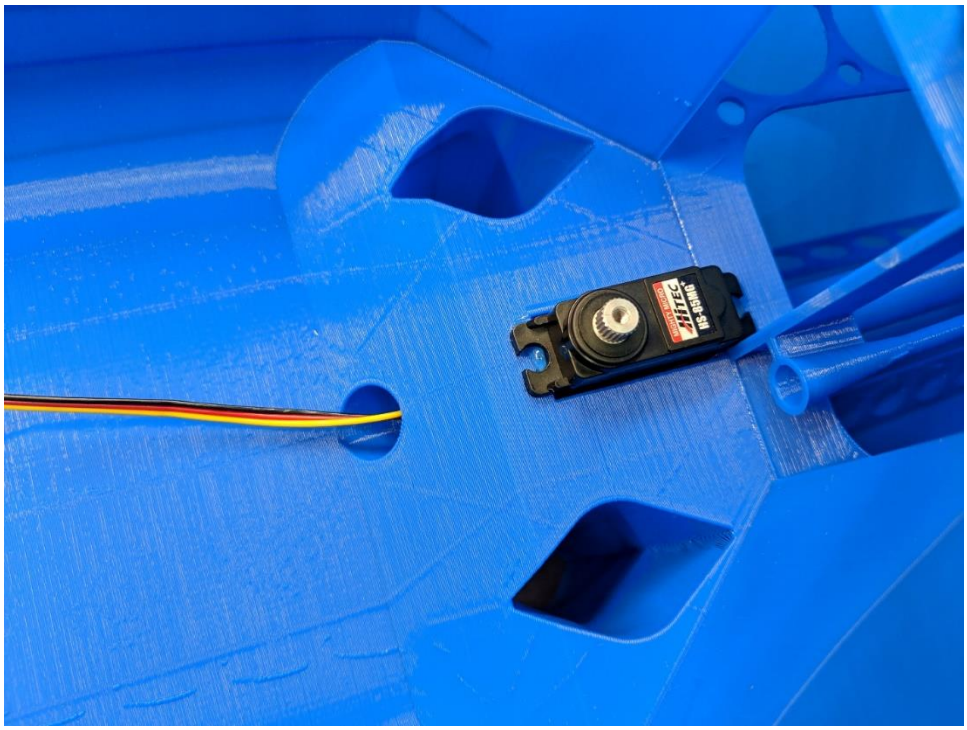
4. Complete the fuselage by joining sections 7 and 8 to the assembly. Do not attach sections 1 or 9 at this time – they'll be joined after the motor and elevator pushrod are installed, respectively.

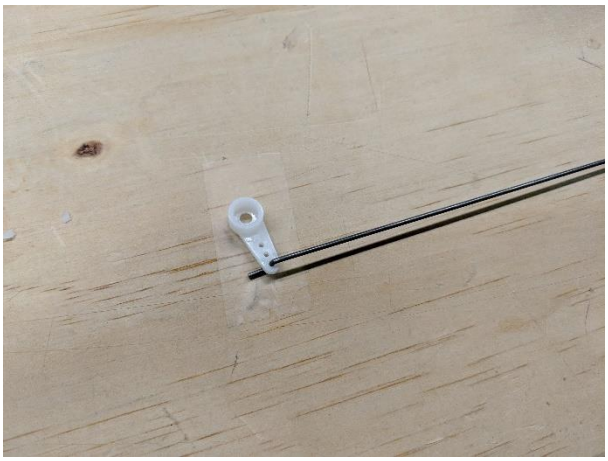
5. Assemble the canopy by joining canopy sections 1, 2, and 3.

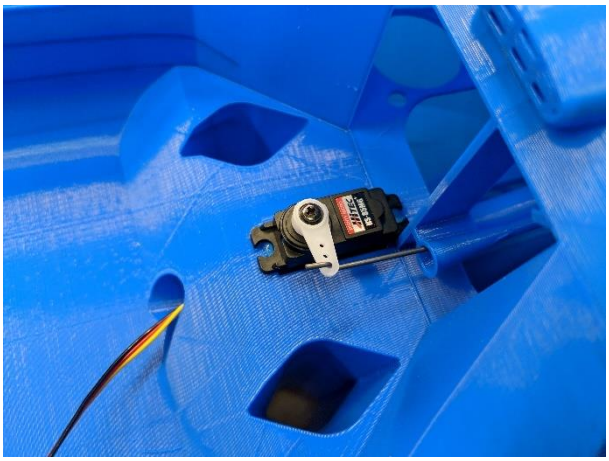



6. Center the elevator servo with a servo tester or receiver, then thread lead through its guide tube. Using E6000 glue or low-temp hot glue, secure the elevator servo in its pocket in the fuselage.



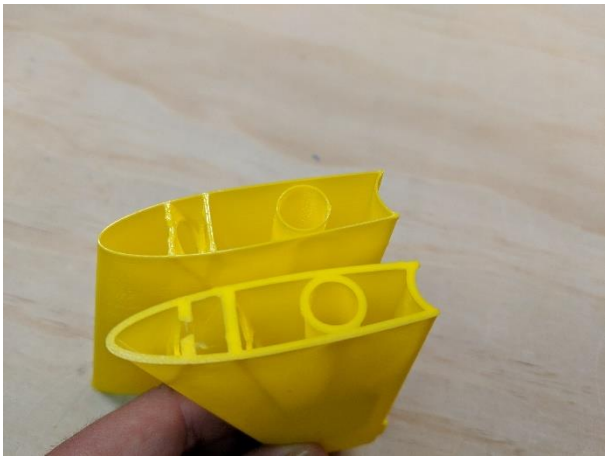
7. Make a z-bend on one end of a long pushrod and install it in the elevator servo arm. Feed the pushrod through the guide tube in the fuselage, then secure the servo arm on the servo.

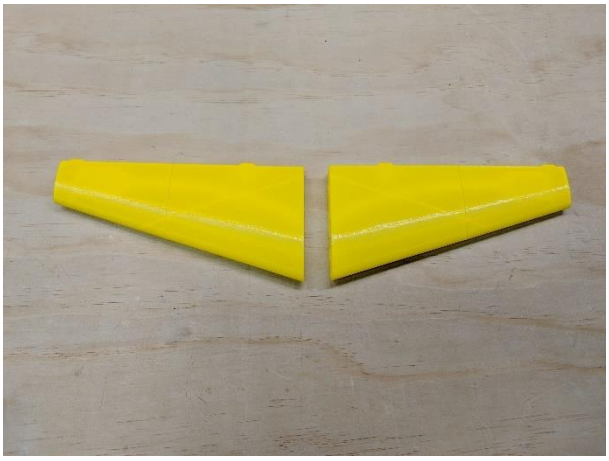




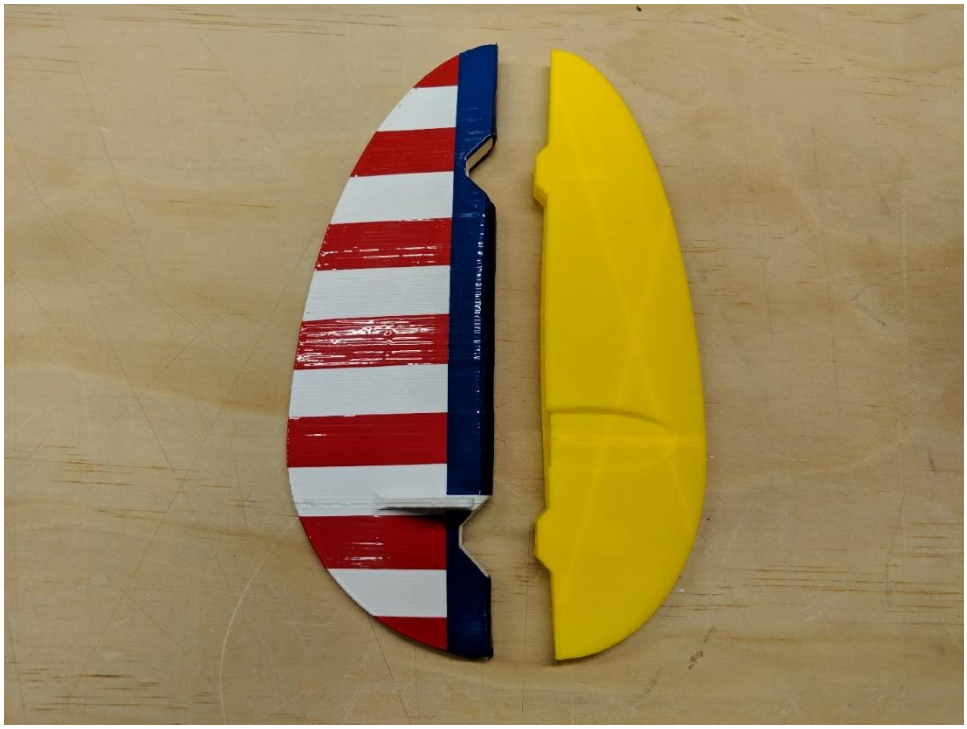
TAIL ASSEMBLY

1. Join horizontal tail sections 1 and 2 on each side.

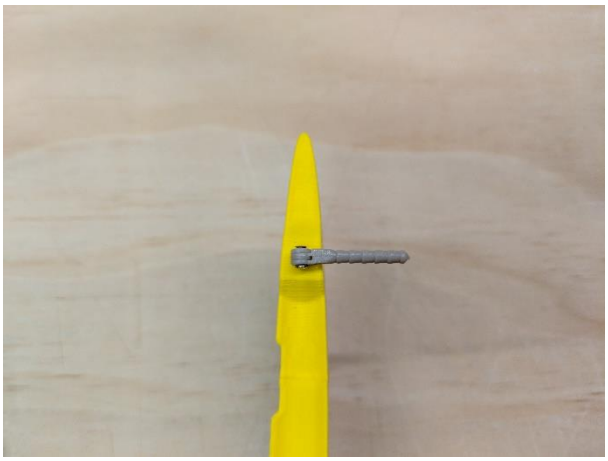


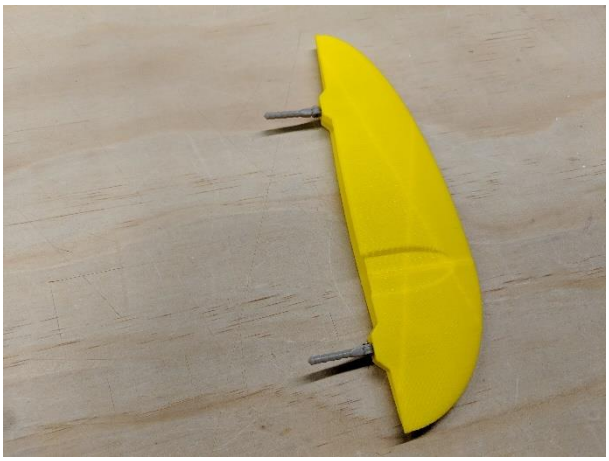


2. Join the rudder sections and vertical tail sections.



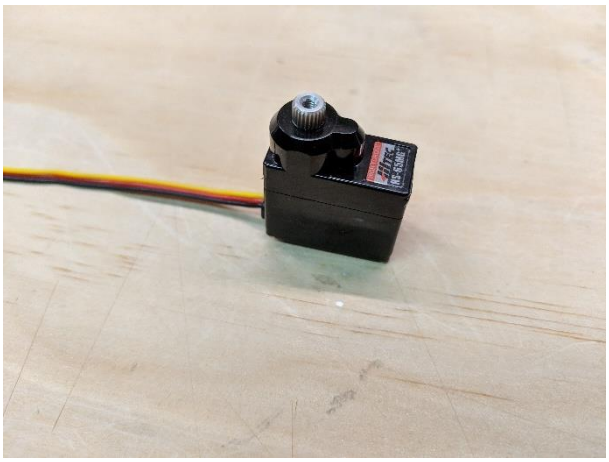
3. Place a drop of glue on each hinge pin, then push them into their mount holes in the vertical tails. Be sure that their rotation axes are aligned with the rudder's hingeline. Then, use activator to secure.



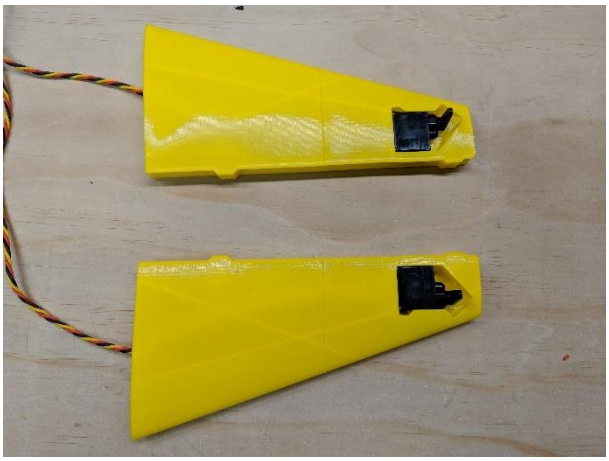


4. Place a drop of glue on the exposed ends of all hinge pins and carefully install the rudders, making sure the hinge pins engage their mount holes. When the rudders are fully seated, spray CA activator while working the hinge back and forth to make sure the hinge pins stay free.

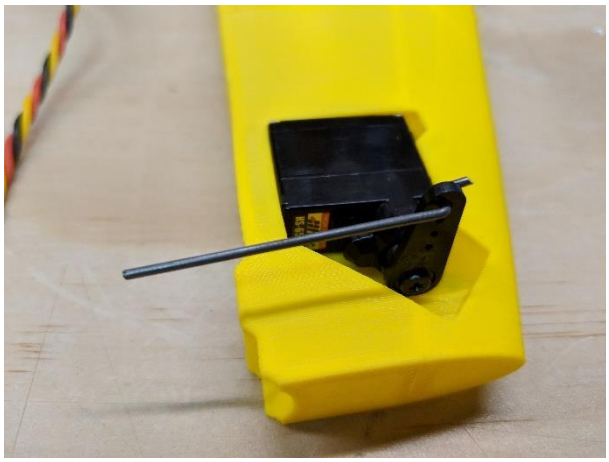
5. Install EZ-Connectors on the rudder control horns as shown. Remove the tabs from the rudder servos.



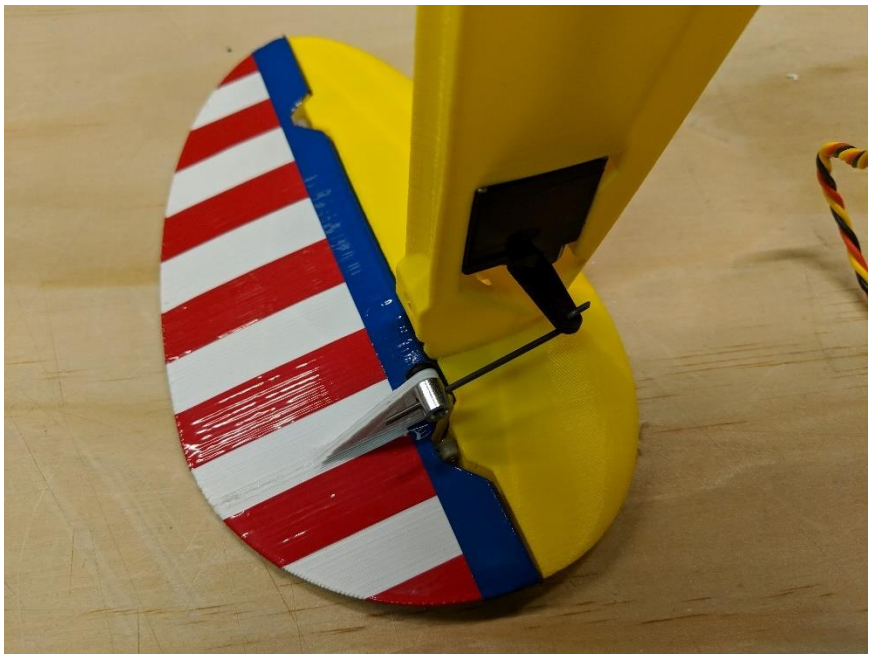
6. Install 600mm (24”) servo extensions on the rudder servos and thread the leads through the tubes in the horizontal tails. Soldering is recommended to avoid the bulk of servo connectors.



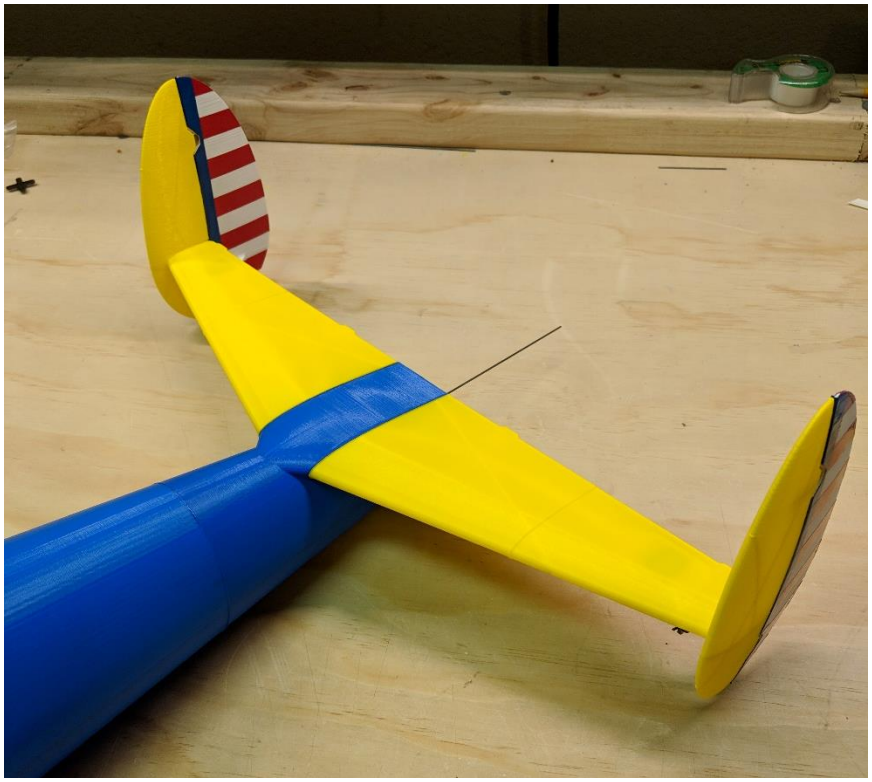
7. Center the rudder servos. then install the control arms. Glue the rudder servos in their pockets. Make rudder pushrods with z-bends on one end and insert into the rudder servo arms.



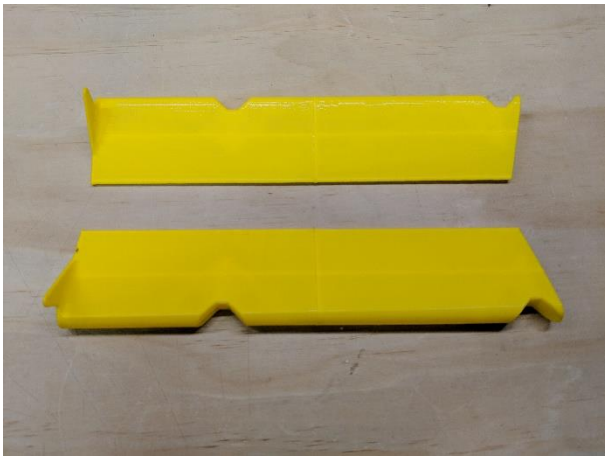
8. Spread glue liberally on the end of the horizontal tail halves. Set the vertical tail & rudder assemblies in place while sliding the rudder pushrods through the EZ-Connectors on the rudders. When satisfied with alignment, use CA activator to secure. Center the rudders and tighten the EZ-Connectors.



9. Thread the rudder servo leads through the tubes in the fuselage. Glue the completed tail halves onto Fuselage 8, making sure to keep them level.

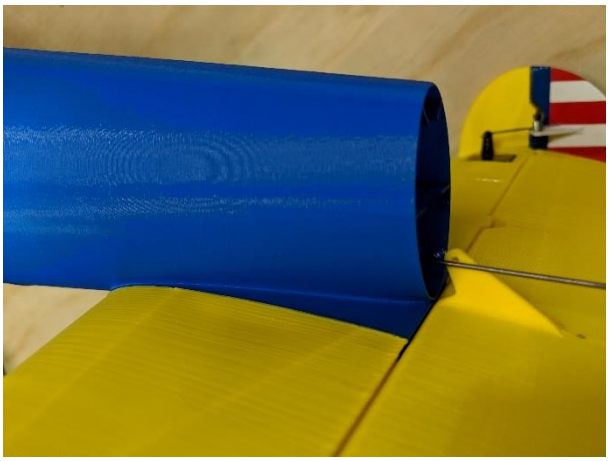


10. Assemble the elevator by first joining sections 1 and 2 on each side, then joining both halves in the center at the control horn.

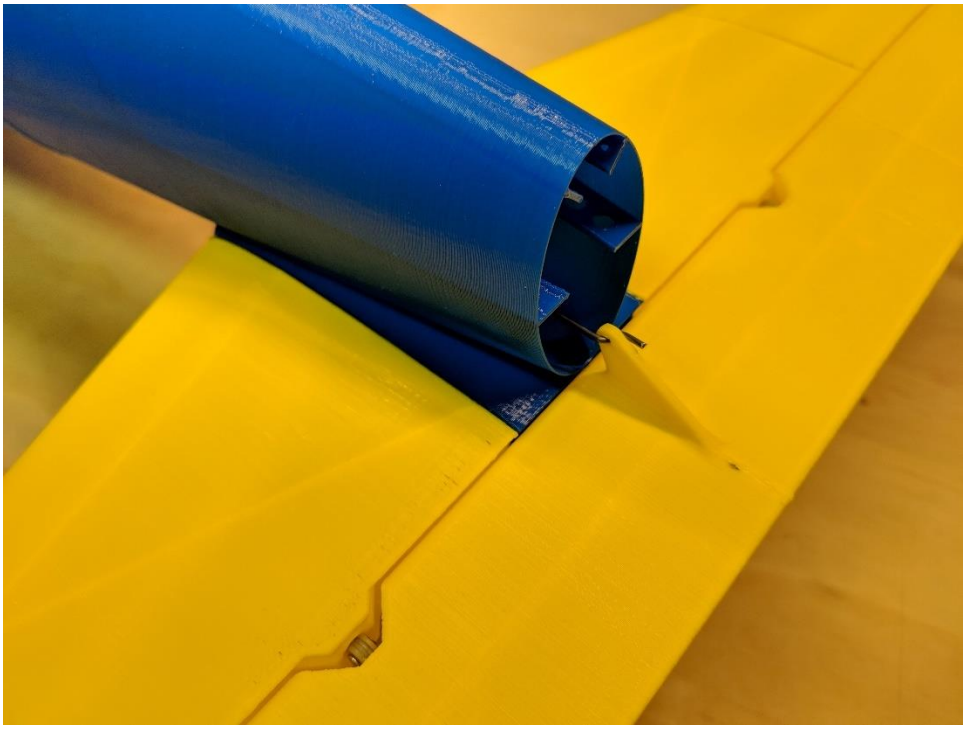


11. Place a drop of glue on four hinge pins, then push them into their mount holes in the horizontal tails. Be sure that their rotation axes are aligned with the elevator's hingeline. Then, use activator to secure.

12. Dry-fit the elevator onto the hinge pins and center it, then mark the location of the elevator control horn on the pushrod. Make a z-bend at this location.



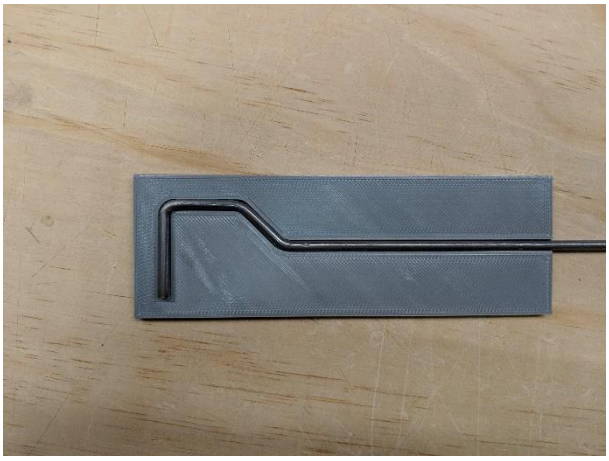
13. Fit the z-bend into the elevator control horn. Then place a drop of glue on the exposed ends of all hinge pins and carefully install the elevator, making sure the hinge pins engage their mount holes. When the elevator is fully seated, spray CA activator while working the hinge back and forth to make sure the hinge pins stay free. Note: it may help to move the elevator servo to its full “up” position during this step.

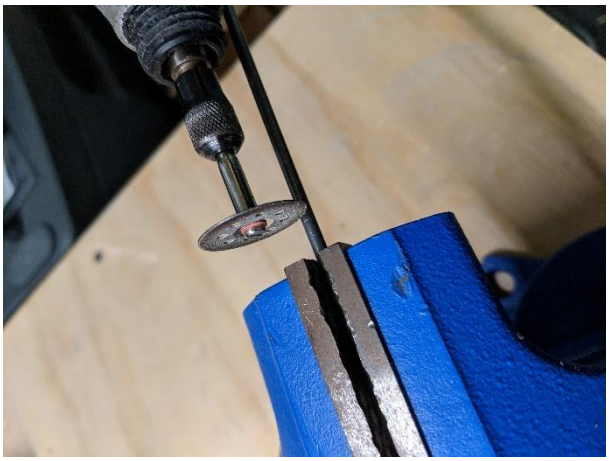


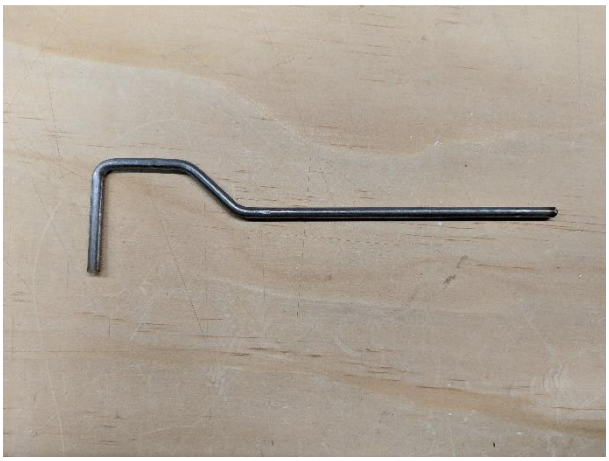
NOSE GEAR ASSEMBLY

1. Glue the nose wheel hub halves together inside the nose tire.

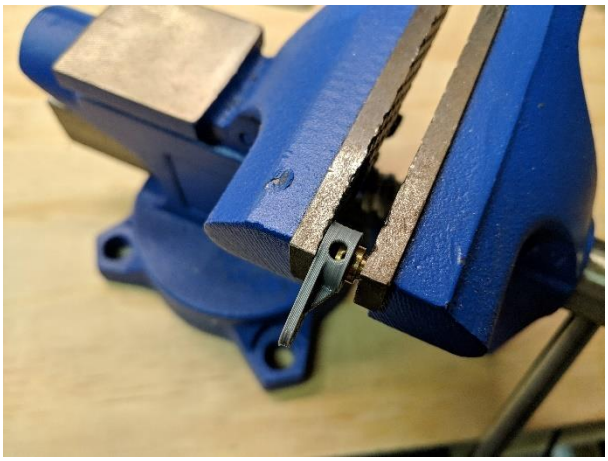
2. Use a bench vice and a hammer to bend the nose gear rod to conform to the shape of the printed template. Cut the excess with a hacksaw or rotary tool.



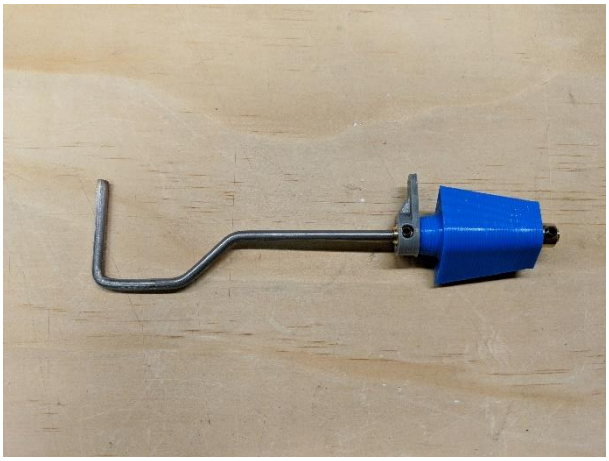


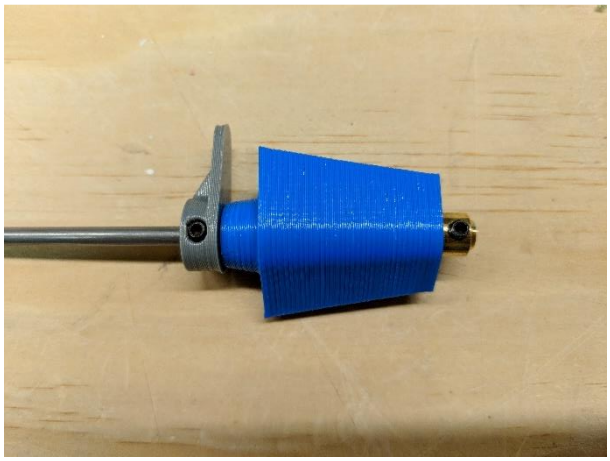


3. Press a shaft collar into the nose steering arm, making sure to align the set screw holes.

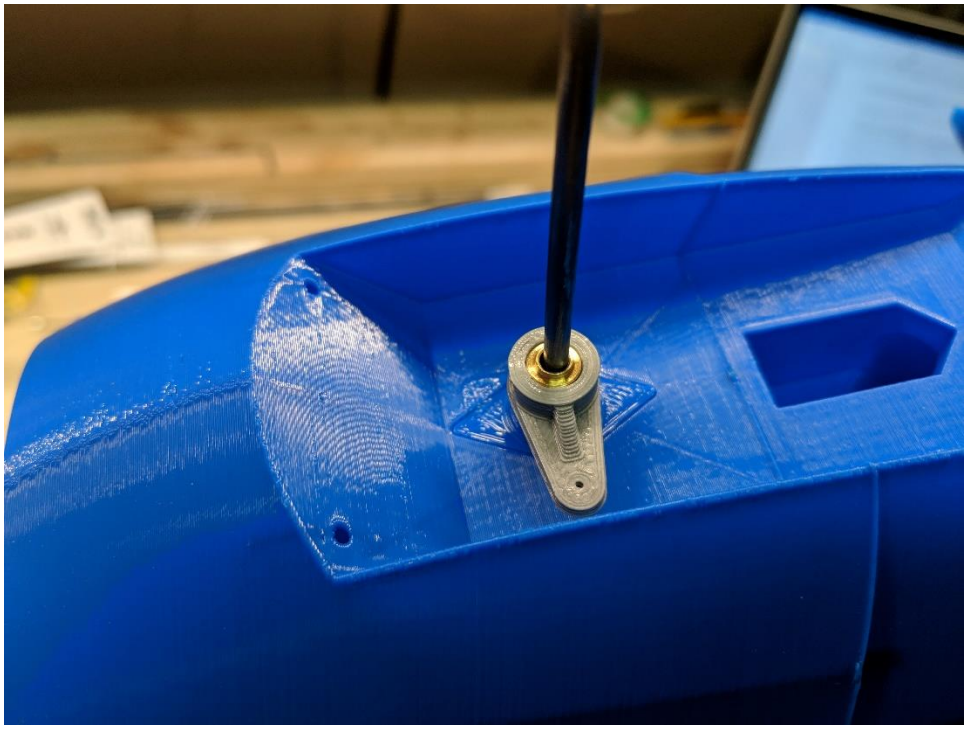


4. Slide the nose shaft through the steering arm and printed nose gear mount insert, then secure by tightening the shaft collar inside the steering arm and another shaft collar on the end. Using thread locker is recommended. The shaft should be free to rotate but with as little slop as possible. Ensure the steering arm is parallel with the axle. Tip: grind flat spots in the shaft for tighter holds when using set screws.

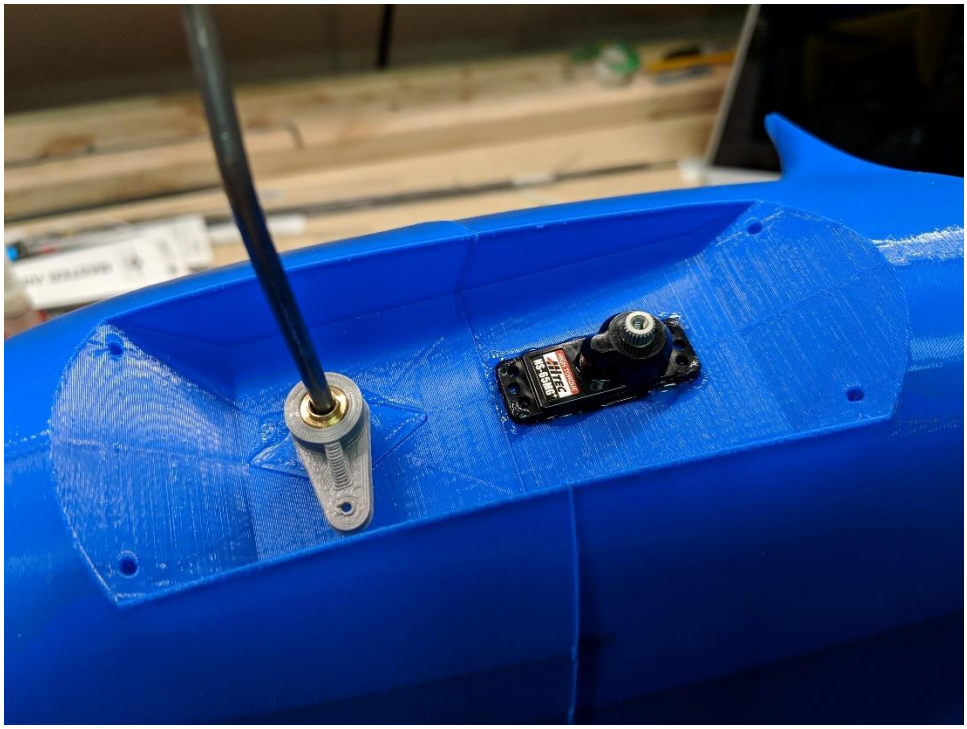




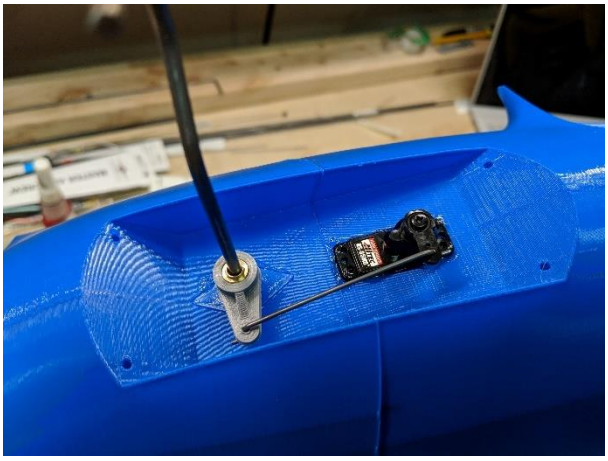
5. Spread CA on the sides of the nose gear mount insert, then press it into place in the fuselage. Spray activator to secure.



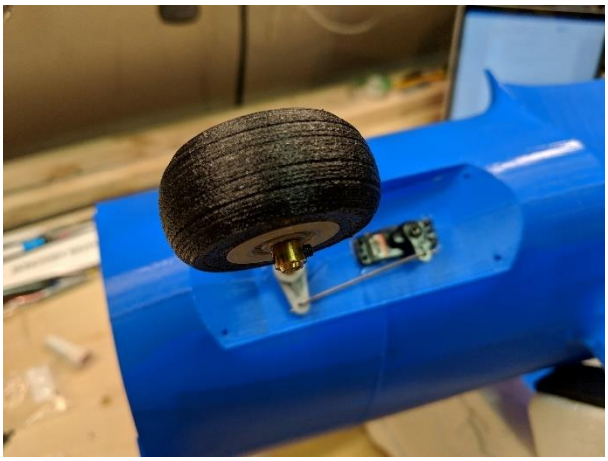
6. Thread the nose steering servo lead through the tube in the fuselage, using an extension if necessary. Fix the servo in place with E6000 glue or low-temp hot glue.

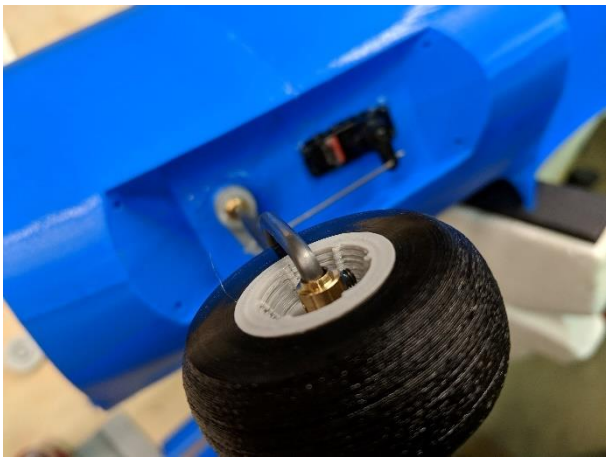


7. Make a nose steering pushrod with a z-bend on each end. Center the nose steering servo with a servo tester or receiver, then install the pushrod and control arm.

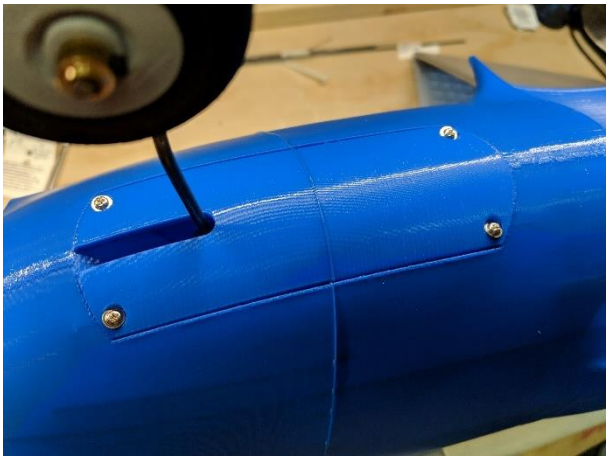


8. Using two shaft collars, install the nose wheel as shown.





9. Glue the two halves of the nose gear hatch together and install it on the fuselage using four servo screws.

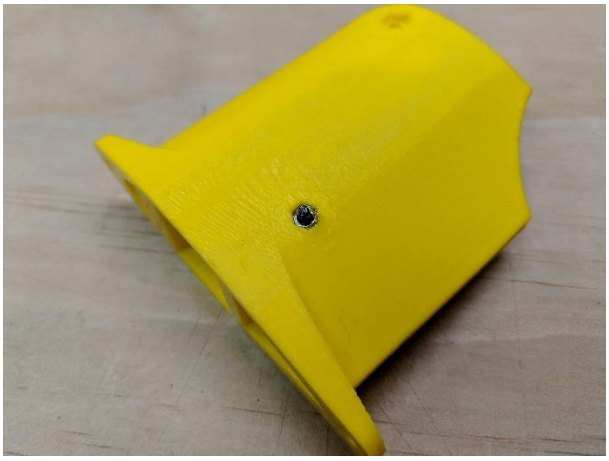


MAIN GEAR ASSEMBLY

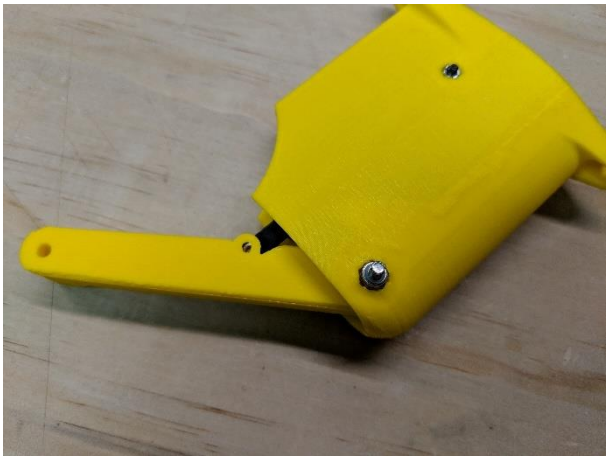
1. Glue the main wheel hub halves together inside the tires.


2. Adjust the shock absorber springs to their stiffest position. Install a short ball link in each end.

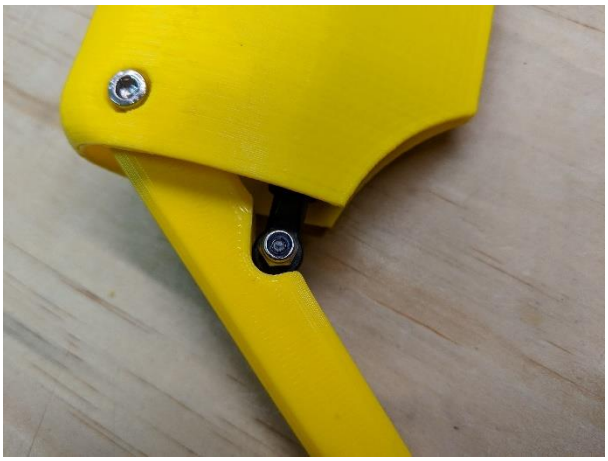

3. Align the top end of the shock absorber (the ball link you just installed) with its mount hole in the gear pylon. Secure with an M2 x 20 bolt and an M2 nut.

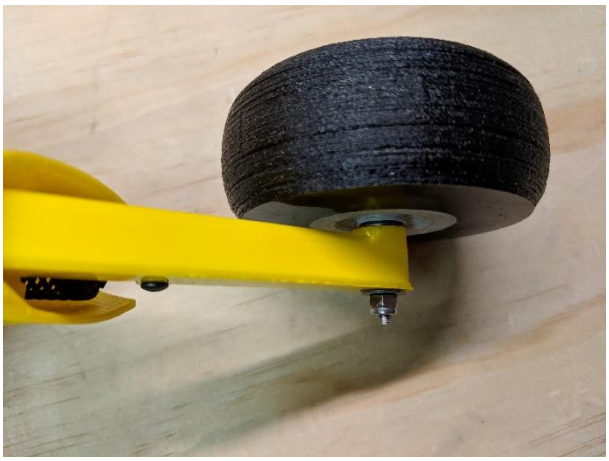
4. Install the strut with an M3 x 22mm bolt and an M3 lock nut. The strut should be slop free but able to pivot with little resistance.

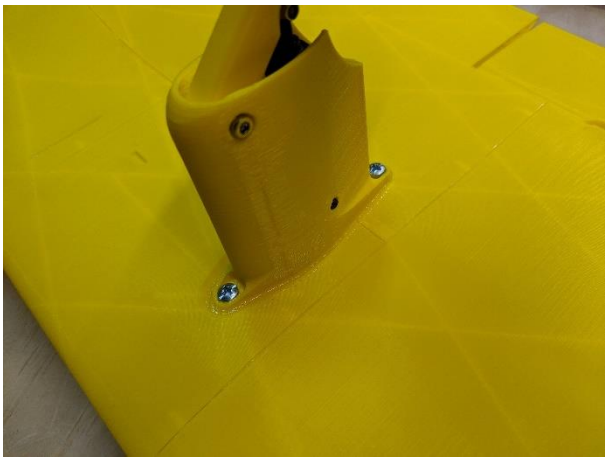
5. Attach the lower end of the shock absorber to the strut with an M2.5 x 10 bolt and an M2.5 lock nut.

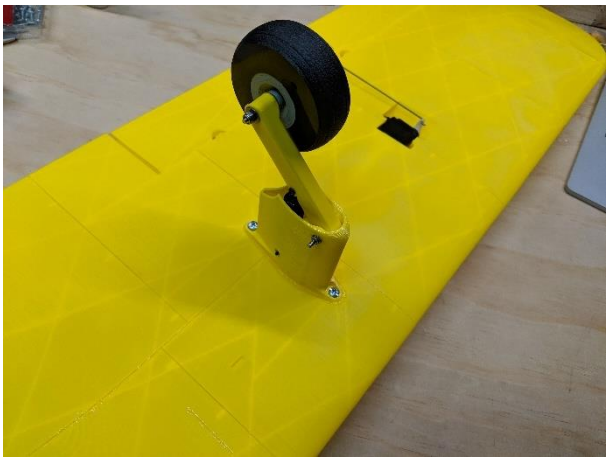



6. Attach the wheel to the strut with an M3 x 40 bolt, three M3 washers, and an M3 lock nut. It should be able to rotate freely.

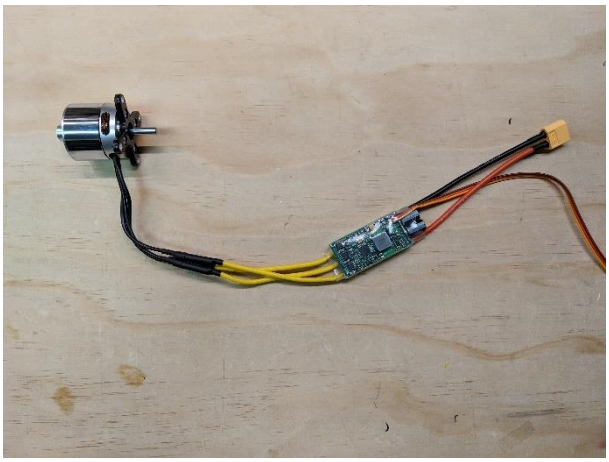
7. Attach the pylons to the wing with M4 x 14 self-tapping screws. Liberally apply CA to the joint as well.



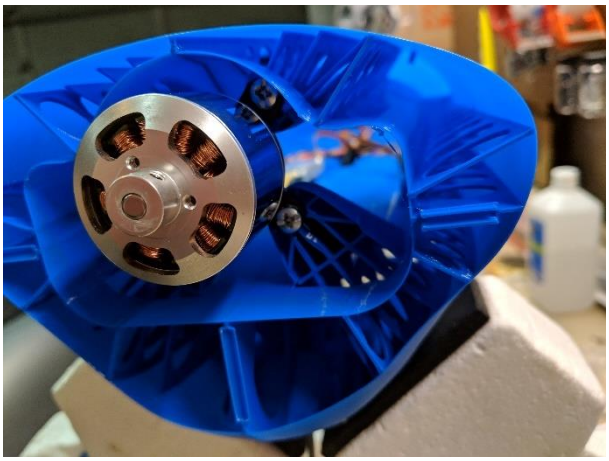


POWER SYSTEM INSTALLATION

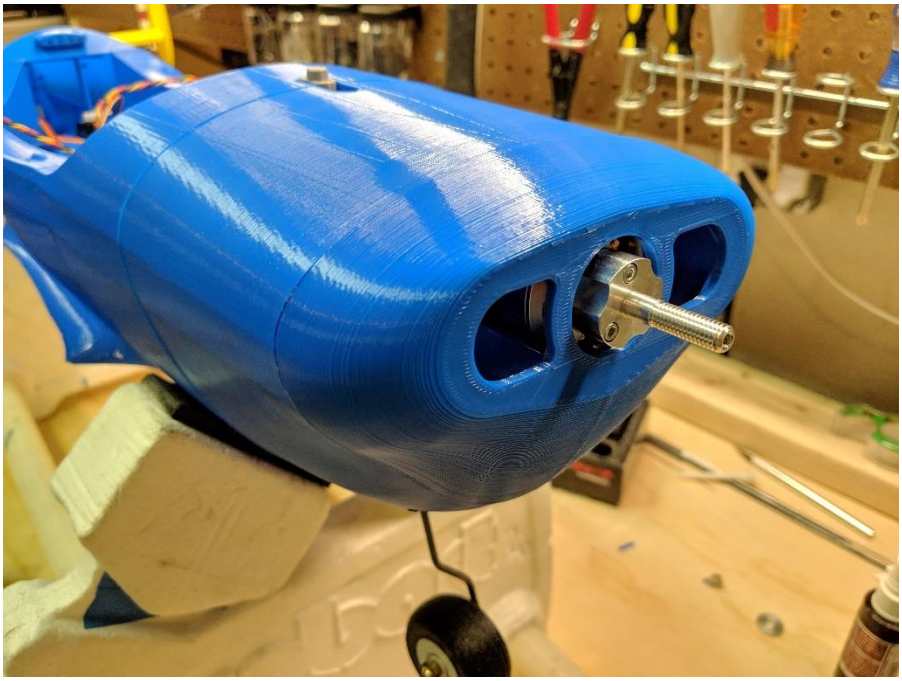
1. Install the cross mount on the motor – use thread locker. Then connect the motor and ESC with bullet connectors or direct solder joints. Verify proper direction.



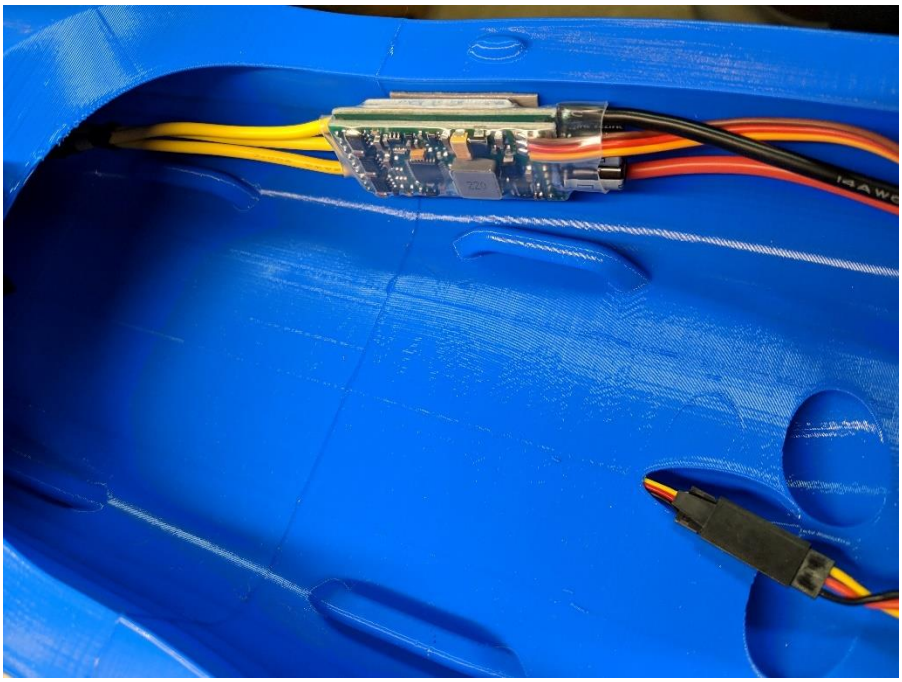
2. Lower the ESC and wiring into the fuselage from the front. Then, use four self-tapping screws to attach the cross mount to the fuselage. You can reinforce with CA for additional strength.



3. Install the prop adapter. Then join fuselage section 1 to section 2, ensuring that the center hole is aligned with the motor shaft.



4. Use double-sided tape or Velcro to fix the ESC to the inside of the fuselage.

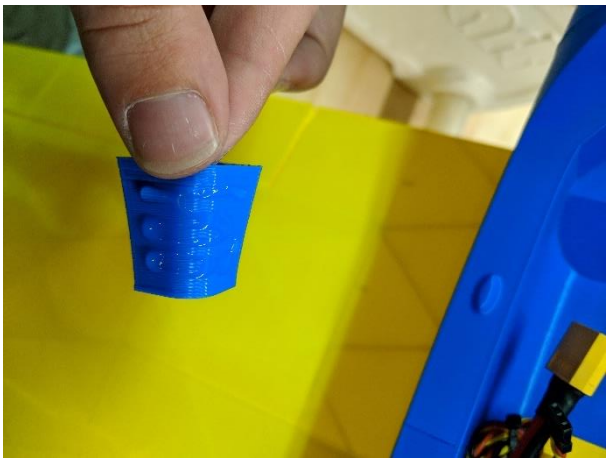


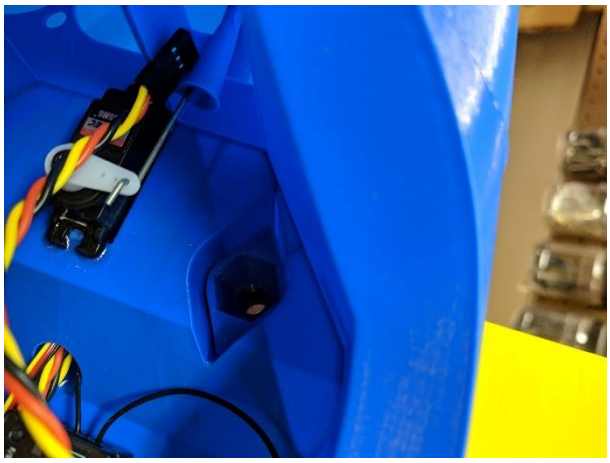
NOTE: Should you wish to install a front-mounted motor, an alternate Fuselage 1 is included. However, the default layout with the motor mounted from the rear is recommended for overall robustness

FINAL ASSEMBLY

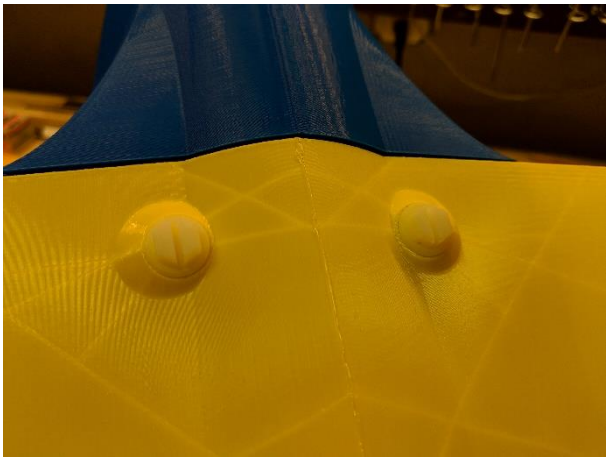
1. Fit the wing into place, threading the aileron servo leads through the tubes in the wing saddle.

2. Spread CA on the body of each wing nut holder, then drop them into their pockets in the fuselage.





3. Drop nylon nuts into the nut holders with a few drops of CA on each. Install the wing bolts and tighten to drive the nut holders into their pockets. Secure the nut holders with CA activator.



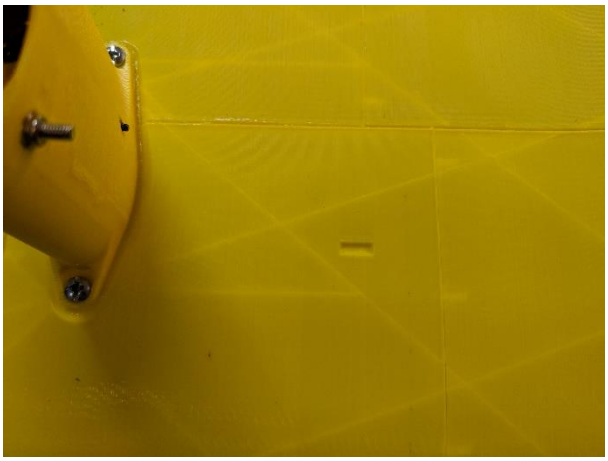
ELECTRONICS SETUP & FINISHING

1. Connect the ESC and all servos to the receiver. If your ESC does not have a switching regulator, it is recommended to use a separate BEC to power the servos and receiver. If possible, each aileron should have its own channel to enable independent end points and differential. The rudder servos can share a channel, but the nose steering servo should have its own channel if possible.

2. Adjust control deflections using the suggested throws below. The Ercoupe is a tame aircraft, but using a moderate amount of expo (~25%) can keep things smooth.

Ailerons	**22 mm** up **12 mm** down
Elevator	**12 mm** up **12 mm** down
Rudders	**12 mm** left **12 mm** right

3. With the propeller and canopy fitted, position the battery such that the aircraft balances on the CG marks on the underside of the wing. Secure with adhesive Velcro and/or Velcro straps.



4. Apply graphics if desired. You're ready to fly!

NOTE: Since the Ercoupe was designed to be easy to fly, most had no rudder pedals. Instead, the rudders were linked mechanically to the yoke along with the ailerons. For an authentic experience, you can replicate this with your model using an aileron-to-rudder mix. Just be careful with crosswind landings!

CONTACT US

Have a question, issue, or just a cool idea for the next aircraft we should model? Drop us an email at:

info@loftedaero.com