F-100 Super Sabre

By Michael Hammer

The real F-100 Super Sabre

The North American F-100 Super Sabre is an American supersonic jet fighter aircraft designed and produced by the aircraft manufacturer North American Aviation. The first of the Century Series of American jet fighters, it was the first United States Air Force (USAF) fighter capable of supersonic speed in level flight.

Specifications:
Length: 15.00 m (50 ft)
Wingspan: 11.81 m (38 ft 9 in)
Height: 4.95 m (16 ft 3 in)
Wing area: 37 m² (400 ft²)
Max. takeoff weight: 15800 kg (34832 lb)

The F-100 Super Sabre semi scale model

The 3D printed F-100 Super Sabre is designed to look and fly like the full size Super Sabre. The Shark like fuselage and the thin swept back wings match the real jet with its iconic air intake and elegant lines.

The optimized edf duct ensures great performance without the use of cheater holes or non scale sized air intakes. Designed to be powered by a 50mm XFly Galaxy electric ducted fan, the model has great performance and flight times from 4-6 minutes. The model is designed to be printed from LW-PLA. Some parts need to be printed from regular PLA.

The model requires no carbon tubes or similar reinforcements. Just print the parts and glue them together with cyano glue. The Super Sabre model is designed to be powered by a 4S XFly Galaxy 50mm EDF and a 4S1800mAh quality battery. Other performance EDFs like FMS will also fit. Four 9g servos are needed to control the model.

The model features a large hatch for easy access to the battery and radio equipment. The hatch has a spring loaded locking mechanism for ease of use or you can opt to secure the hatch with 5x3mm magnets. Access to the EDF unit is done by removing the nose section which is held in place by magnets.

Control throw gauges are included with the model for easy adjustment of the correct amount of movement of both ailerons and elevator. A CG craddle is included to make it easy to balance the model correctly at the Center of Gravity.

The F-100 Super Sabre is designed with a catapult hook for bungee assisted launching. It is highly recommended to use a catapult or bungee launcher with 6-7 kg pulling force for a safe launch of the model. You can find instructions on how to build an inexpensive Bungee Launcher here: Bungee Launcher Youtube video

All parts are designed to be easily aligned and glued with cyano glue.

Model specifications:

Wingspan: 830mm
Length: 1050mm
Ready to fly weight (4S1800mAh): 900g
Max battery cross section: 40x38mm

Bill of Materials

1mm pianowire
2xM5 nuts
2xM5 nylon bolts, 30mm length.
Spring from ball point pen
Cyano hinge sheet (or use strong plastic from blister packaging. Sand with coarse sandpaper)
Cyano glue and accelerator spray, medium or thin
8 x 5x3mm magnets
4 x 9g servoes like HXT900 available from HobbyKing.com
EDF: XFly Galaxy 4S edition available from www.turbines-rc.com (Europe) or www.bananahobby.com (North America) Otherdealers can be found here: www.xfly-model.com/wheretobuy
Other 50mm quality EDFs with the same dimensions as the XFly Galaxy, like FMS can also be used to power the Super Sabre
Receiver: 4-6 ch
ESC: 40A
Battery: 4S1800mAh 25C or higher for 4S EDF (Max battery cross section size: 40x38mm)

3D Printer Requirements

Recommended Prusa MK3S or equivalent.
Nozzle: 0,4mm
Filament: Light Weight PLA, LW-PLA (foaming PLA) like PolyLight 1.0 and PLA like PolyAir 1.0 available from 3DLabPrint.com
Slicer: PrusaSlicer

Print settings

All parts are designed to be printed with 0,4mm nozzle, 0,25mm layer height

Before you start slicing the stl-files yourself, I highly recommend printing a couple of the supplied G-Code files first to see if they will print OK on your printer. For many the supplied G-Code files will do the job just fine. Try them!

If you prefer to slice the files yourself you should use the latest version of PrusaSlicer and load the supplied 3mf files into it. The 3mf files contain all the optimal slicing info for the parts. You can then choose your printer and press slice. Or you can modify the settings to suit your needs.

If you wish to slice the parts with a slicer of your own choice, it is still recommended to start by checking the slicer settings for the specific part in PrusaSlicer. It will give you a very precise overview of how the part was designed to be printed. It just takes the guesswork out of trying to find the optimal way to print the part.

You can also preview the G-code files with PrusaSlicer G-code Viewer to get an idea of how the parts should look when printed correctly. Launch PrusaSlicer G-code Viewer from the file menu of PrusaSlicer or run the prusa-gcodeviewer.exe

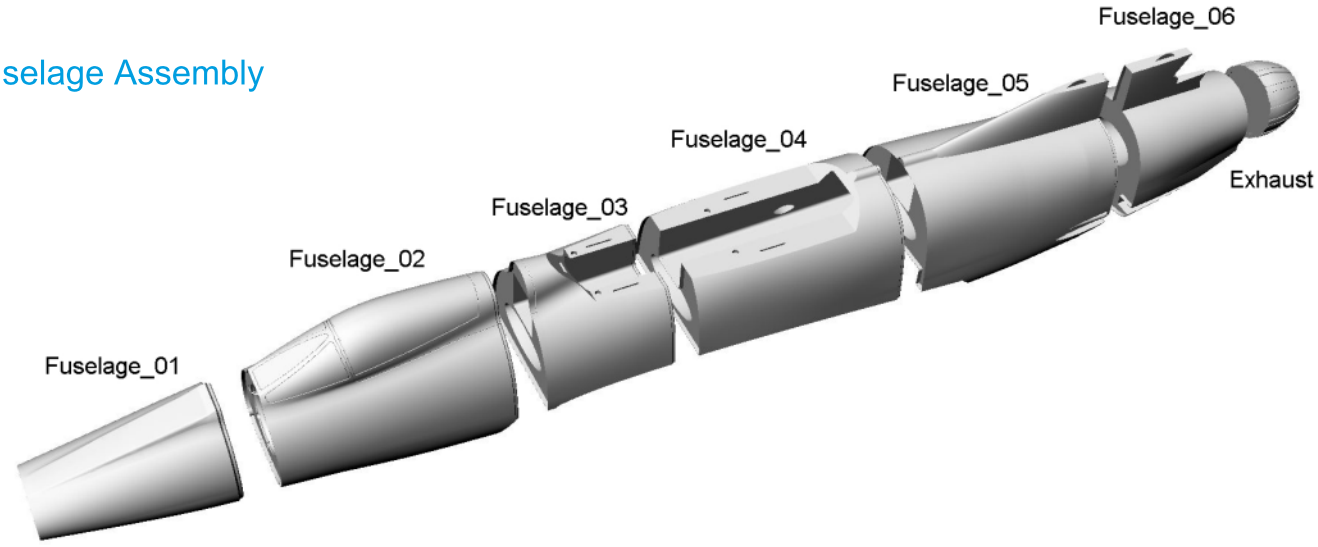
Before you start:

All printed parts should be cleaned up using a sharp knife and sandpaper. It is important to prepare the parts well in order for them to slide easily into the neighboring part.

Fuselage_06 needs to be printed with support. The optimal settings for the support can be found in the 3mf file. Use PrusaSlicer to view the settings or even better, slice the part. The best way to remove the support is by using a sharp chisel or screwdriver. Start at the duct and find the layer where the support ends and the duct starts. Press the chisel into the joint and pry the support away from the part. Work your way all around the duct while constantly making sure to pry the support free from Fuselage_06. Using the same technique, work your way towards the edges. You should be able to remove the support structure in one piece.

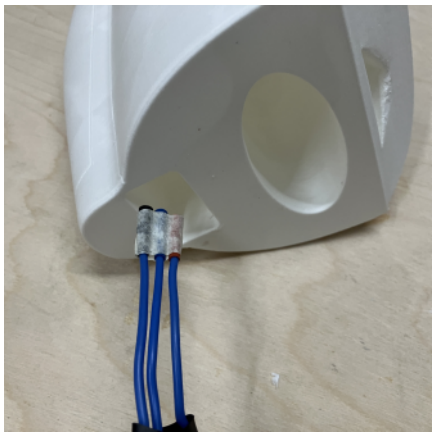
Follow the steps outlined in this User Guide. It will help you through the build process and ensure that the finished F-100 Super Sabre model will fly well and give you lots of enjoyable flight time.

Fuselage Assembly



The fuselage parts are best glued together by applying medium thickness cyano glue to the outside seam. Assemble the parts and push them together. Wipe off excess glue with a cloth and spray with accelerator.

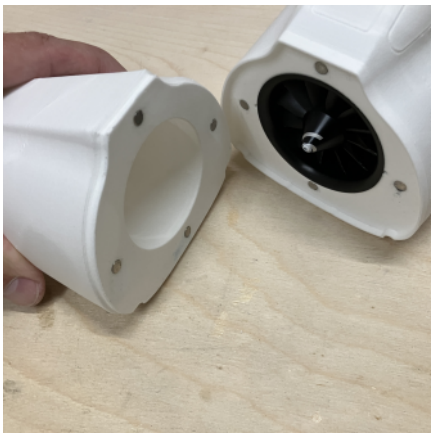
Start with Fuselage_02, the XFly edf and the ESC. Tape the three wires from the ESC together as shown. Insert the wires in Fuselage_02 and push them through the wire channel into the duct.

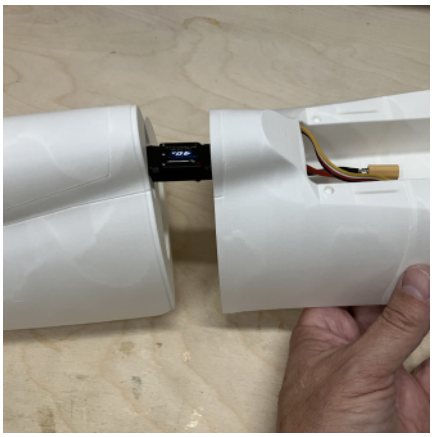


Connect the XFly edf and the ESC. Insert the edf while simultaneously pulling the ESC backwards until the edf is correctly seated as shown. Glue four 5x3mm magnets in the prepared holes and make sure that they all have the same polarity, south or north, facing the front. All magnets should be flush with the surrounding surface.Test that the EDF is pushing air out the back. The edf is held in place by the nose section, but just to be absolutely sure that the edf stays in place, you can add a bit of hotglue in the recesses as shown.

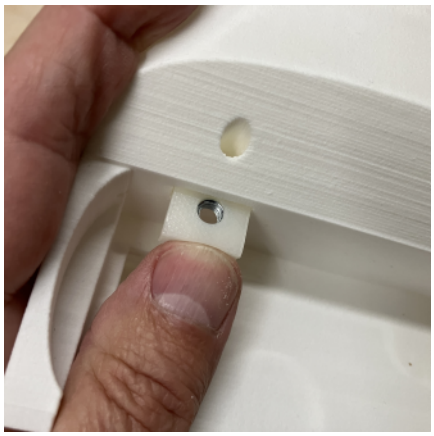
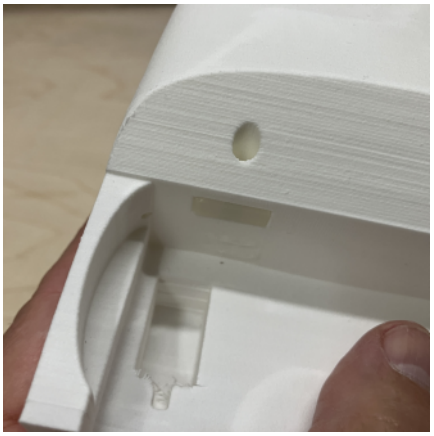


Glue four 5x3mm magnets in the prepared holes of Fuselage_01 and make sure that they all have the same polarity and is attracted by the magnets in Fuselage_02. Push the battery and signal wires through Fuselage_03 as shown. Glue Fuselage_03 onto Fuselage_02. Repeat the process with Fuselage_04.

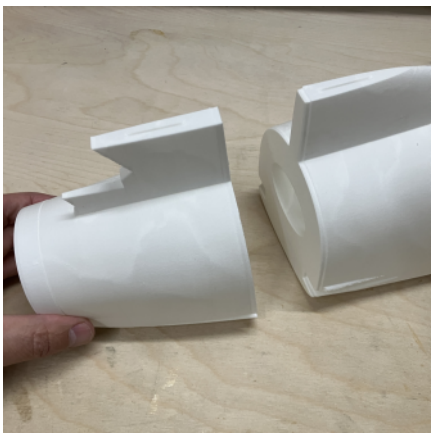


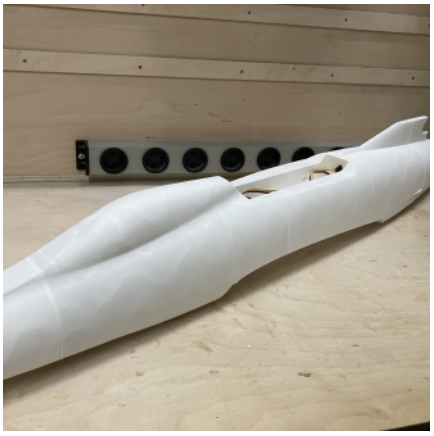


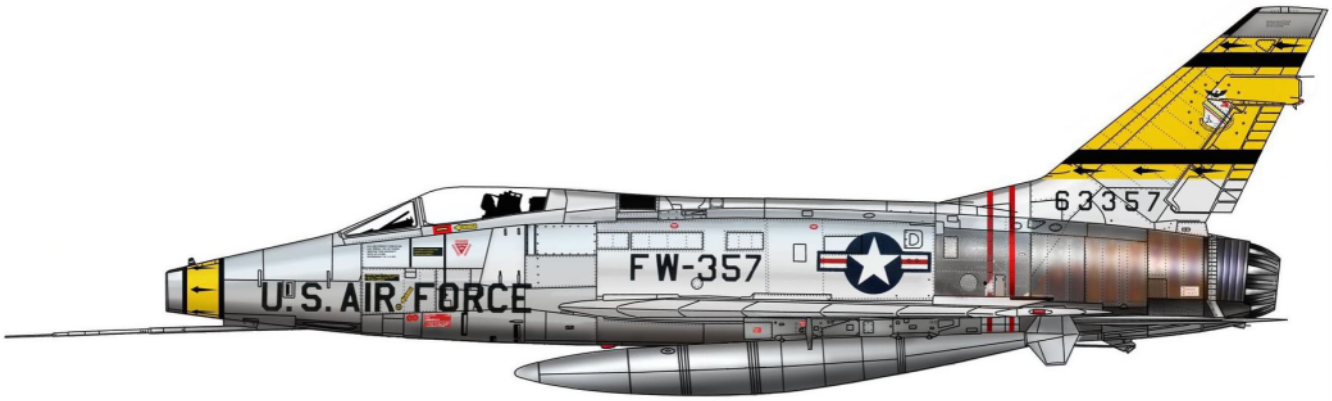
Fuselage_05 holds the M5 nuts for the M5 wing bolts. Place the M5 nuts in the PLA nut mounts and fix with a tiny drop of Cyano glue to avoid the nut falling out during the next step. Push the nut + nut mounts into the mounting holes and make sure the nut mounts are positioned as shown in the photo. Push the nut + nut mount all the way in until flush with the surface of Fuselage_04. The fit should be tight and there is no need for any glue.

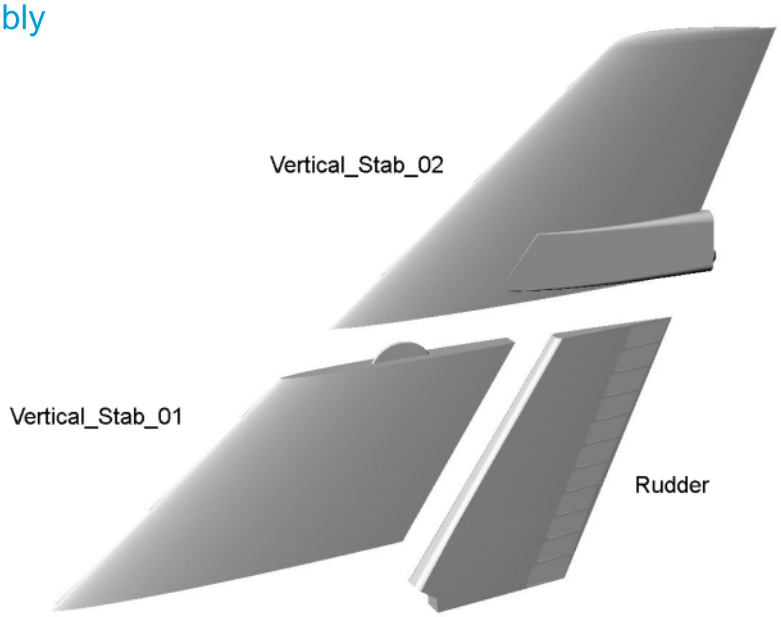
Now glue Fuselage_05 together with Fuselage_04. Fuselage_06 is printed with support and will need some cleaning up. Test the fit of Fuselage_06 and make sure the parts slide together nicely. When satified with the fit, glue the parts together. You should now have a F-100 Super Sabre fuselage as shown in the photo below.



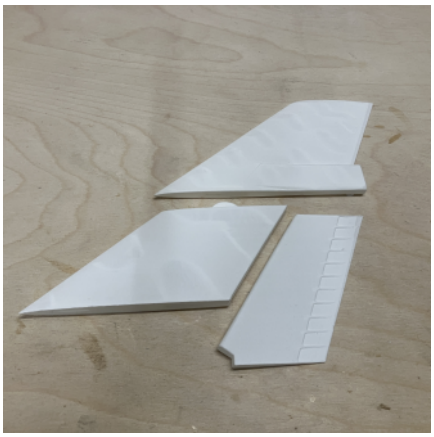




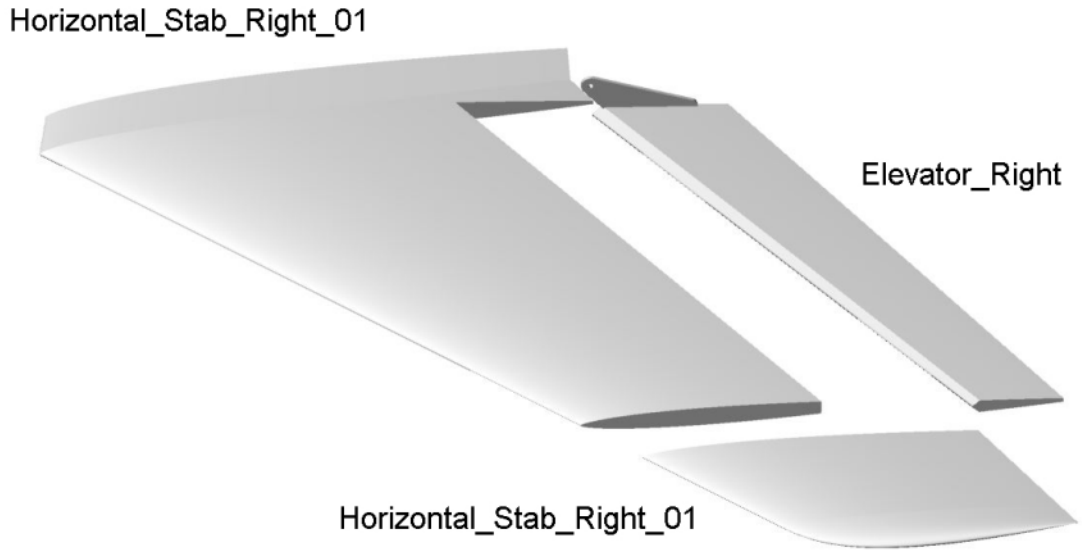
Vertical Stabilizer Assembly



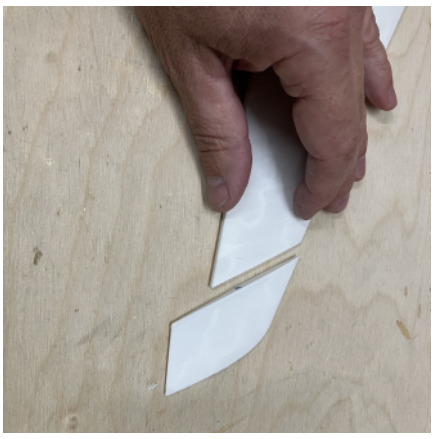
The vertical stabilizer is made from two parts and a rudder. Glue the two stabilizer parts together and make sure the leading edge of the stabilizer is straight. Glue the stabilizer assembly onto the fuselage and make sure the vertical stabilizer is pointing straight up when the fuselage is level. Glue the rudder onto the vertical stabilizer as shown below.

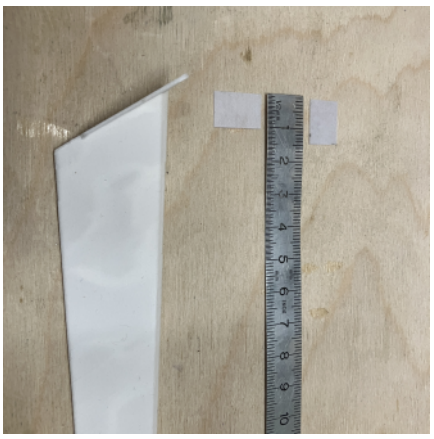


Horizontal Stabilizer Assembly

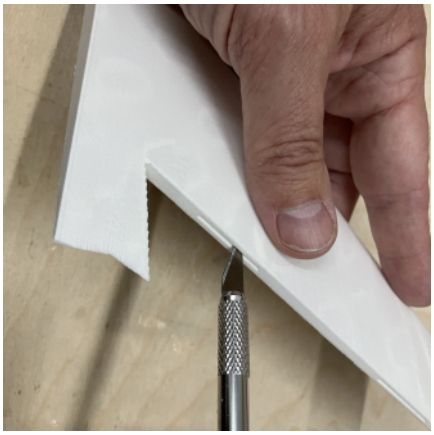


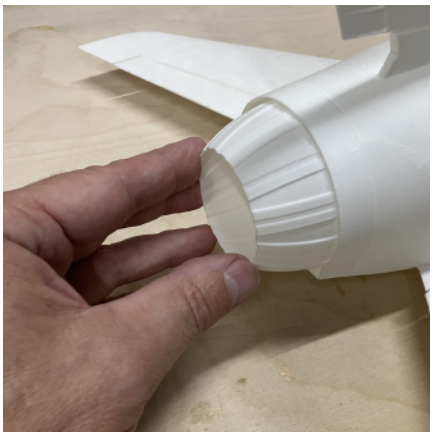
The horizontal stabilizers are each made of two parts and an elevator. Glue the two stab parts together and make sure the leading edge of the stabilizer is straight. Cut some 10x14mm hinges from a cyano hinge sheet or use use strong plastic from blister packaging. Remember to sand with coarse sandpaper)



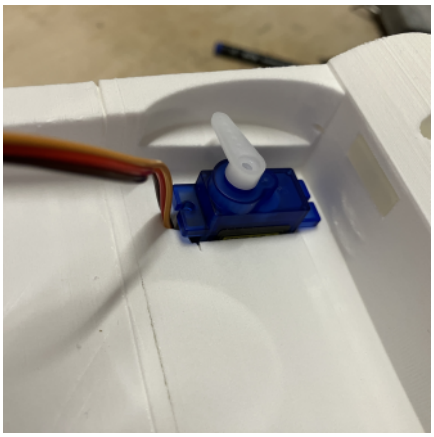
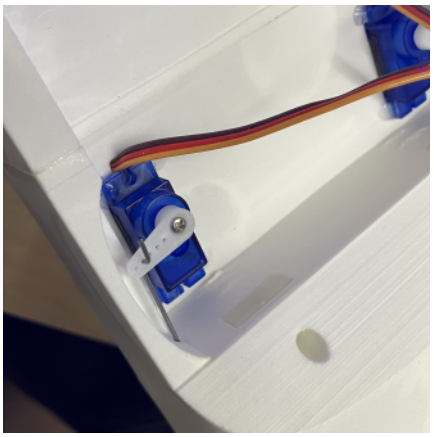


Make sure the hinge pockets are open and hinges can be inserted. If not, use an X-acto knife to open the hinge pocket. Test the fit of the elevators. Don´t glue the hinges just yet. Test the fit of the horizontal stabilizer into the stabilizer pockets in the fuselage. It may be necessary to sand the mounting area for a nice fit. Be careful not to use too much force to push the stabs into the pockets. Better to sand a little bit more than ruin the part. Glue the exhaust in place. If you plan to paint the model it is advised to skip this step until after the paint process.

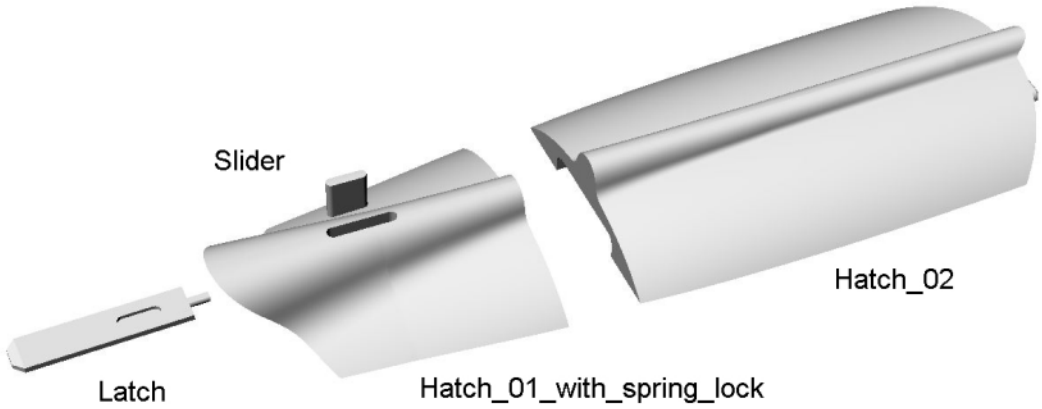




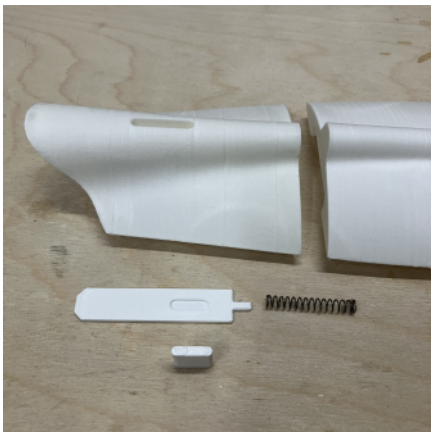
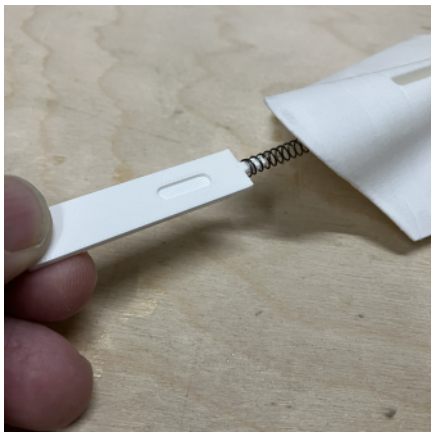
Mount the two elevator servos in the servo pockets in fuselage_05. You can wrap the servos with painters tape and glue with cyano or you can just fix them with a bit of hotglue. Cut a two lengths of 1mm piano wire, 260mm long. Make a z-bend at one end and mount the servo horn on the z. Feed the pushrod through the channel as shown in the photo below.
Mount a pushrod connector on the control horn and fix the pushrod to it. Or you can make a simple 90 degree bend as shown below.

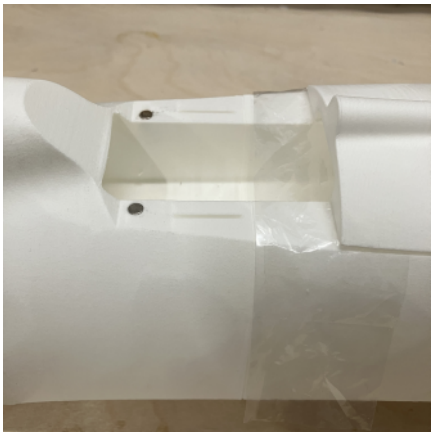

Hatch Assembly



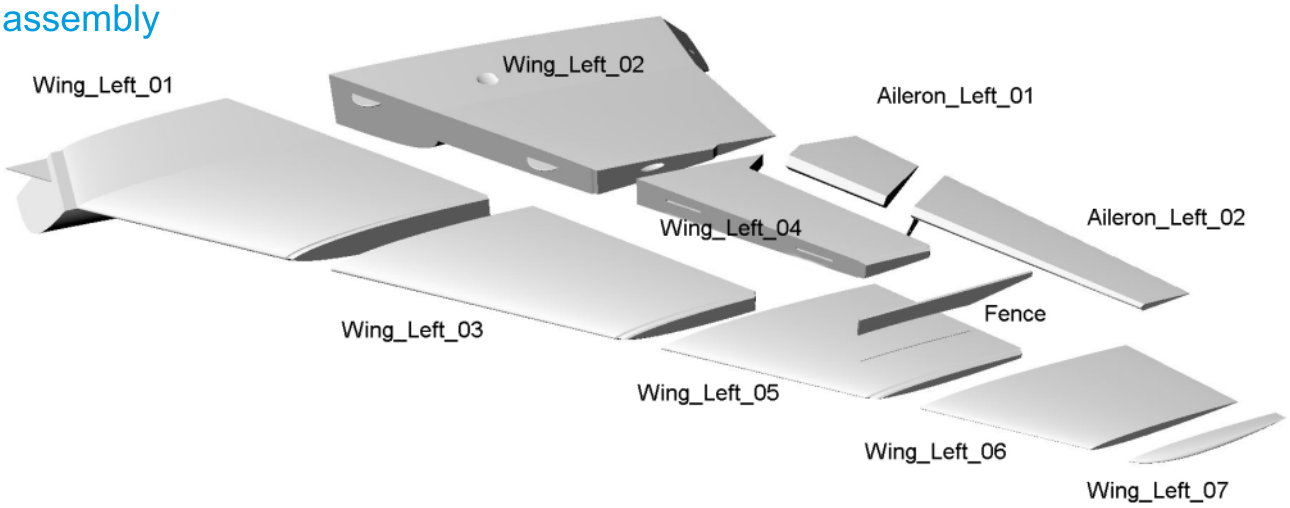
There are two options for the fuselage hatch. You can use 12x5x3mm magnets to hold the hatch in place or you can make a version with a sliding lock. The hatch with magnets are assembled from Hatch_01 and Hatch_02. If you prefer to use the hatch with the sliding lock, switch Hatch_01 with Hatch_01_with_spring_lock. You will need a spring from a ball point pen or similar. Stretch the spring to make it 30mm long when in a relaxed state. The PLA latch has a recess that fits the sliding button. Make sure the side with the recess is pointing upwards. Make sure the spring can be pushed onto the pointed end of the latch as shown in the photo.

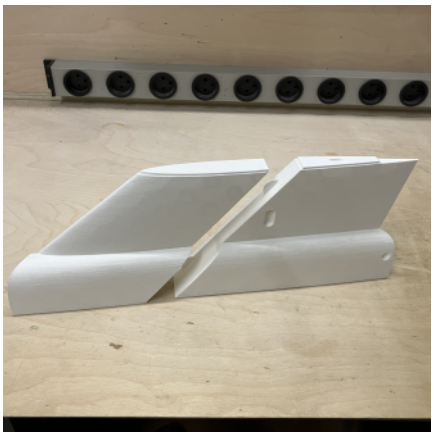
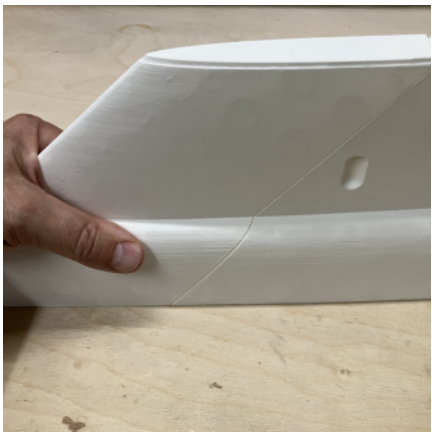
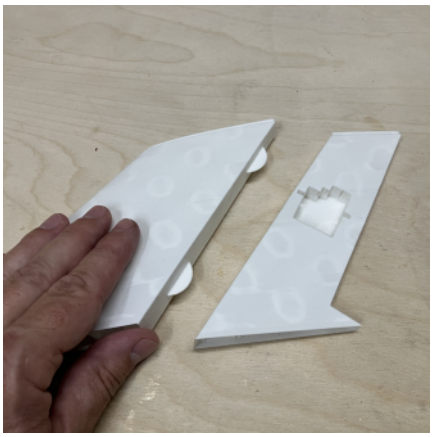

Place Hatch_02 and a piece of protective plastic film as shown in the photo. Add medium Cyano to the end face of Hatch_01 or Hatch_01_with_spring_lock and place it on the fuselage. Put some pressure on the two hatch parts and spray with accelerator.



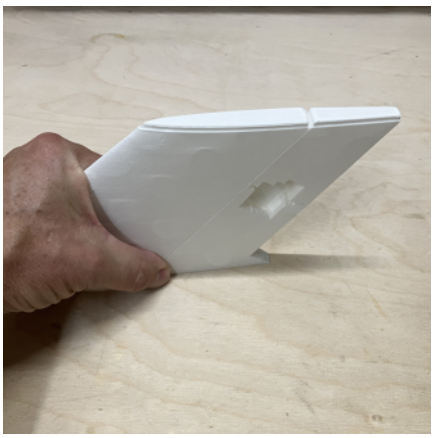
Wing assembly

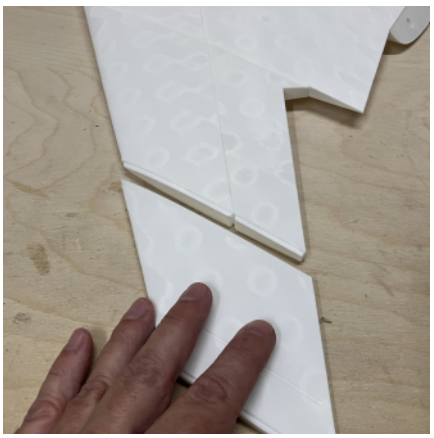


Start by gluing Wing_Left_01 and Wing_Left_02 together while pressing the parts down onto a flat surface. Repeat the process with Wing_Left_03 and Wing_Left_04.

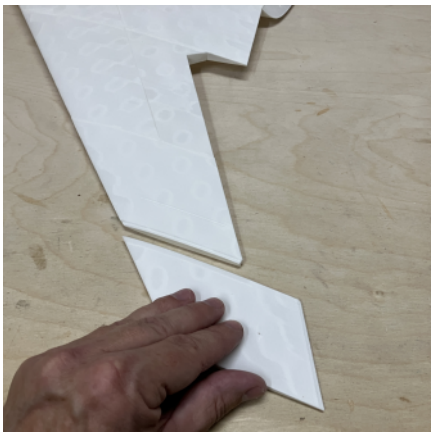
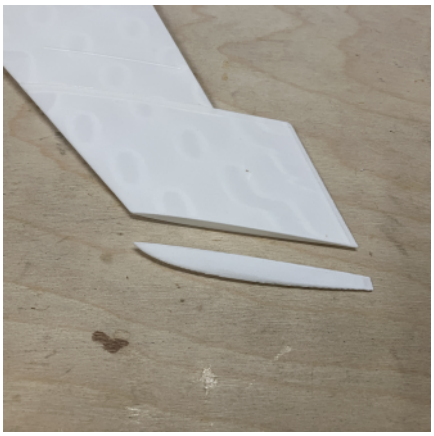
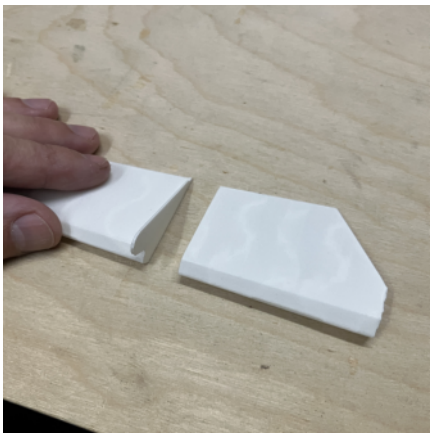




Glue the two wing sub-assemblies together and make sure the leading edge is completely straight. Now glue Wing_Left_05 as shown in the photo below again making sure the leading edge is straight.

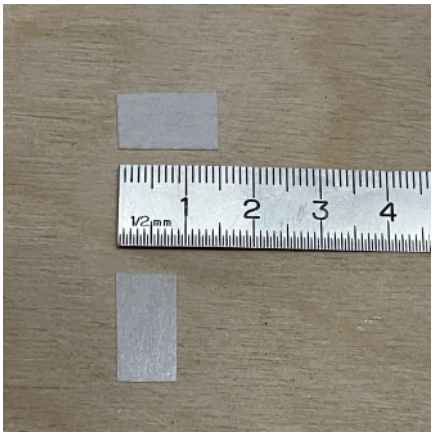


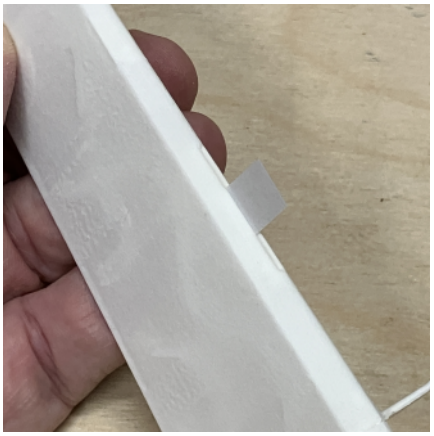
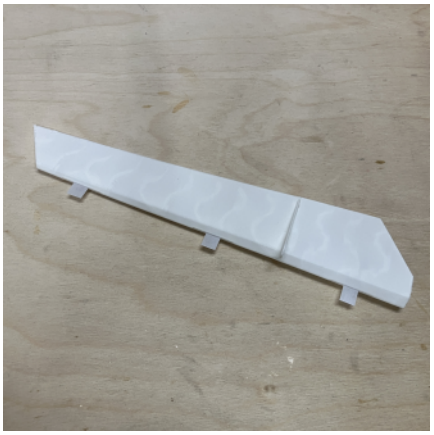


Glue Wing_Left_06 as shown below in the same way as the previous parts. Finish the wing by gluing the wing tip Wing_Left_07 to the rest of the wing.
Place the parts for the Left side aileron on a flat surface. Add medium Cyano and push the parts together.

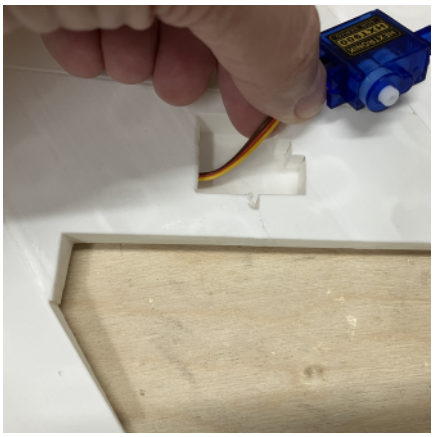




Cut some 8x14mm hinges from a cyano hinge sheet or use use strong plastic from blister packaging (Remember to sand with coarse sandpaper). Test fit the hinges and then glue them with cyano. Be very careful not to add too much glue when mounting the hinges.



Feed the servo wire through the wire channel and mount a 9g servo in the servo pocket. You can wrap the servoes with painters tape and glue with cyano or you can just fix them with a bit of hotglue.

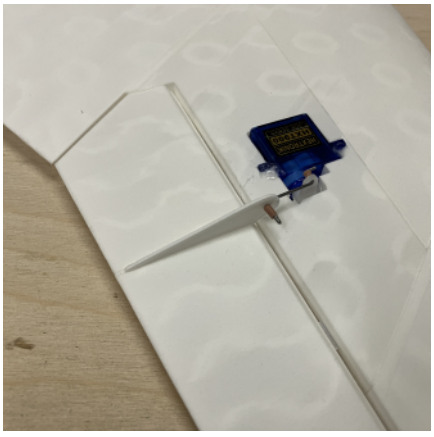



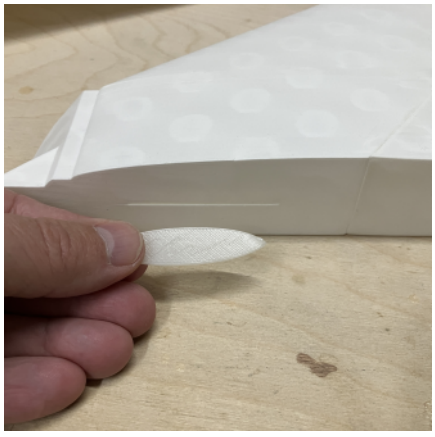

Cut 8x15mm hinges from cyano hinge sheet. Alternatively you can cut hinges from blister packaging. Just make sure to sand the surface matt with semi coarse sanding paper.
Use an X-acto knife to open the hinge pockets of both the aileron and wing. Insert the hinges and mount the aileron. When satisfied with the fit put a drop of thin cyano onto the hinges right at the hinge line. Wipe excess cyano of with a toothpick or similar. Take care to avoid getting cyano between the aileron and the trailing edge. The ailerons should move freely up and down.

Feed the wire from the aileron servo through the wire channel.

Use 1mm piano wire for the servo/aileron pushrod. You can choose your favorite method of connecting the servo/pushrod/aileron. On this size model I personally prefer to make a z-bend at both ends of the pushrod. Make two z-bends 75mm apart measured on the inside of the bends as shown in the photo. Insert the pushrod into the aileron control horn. Insert the other end into the servo control arm. Insert the servo into the wing. Test the movement of the aileron with a servo tester.

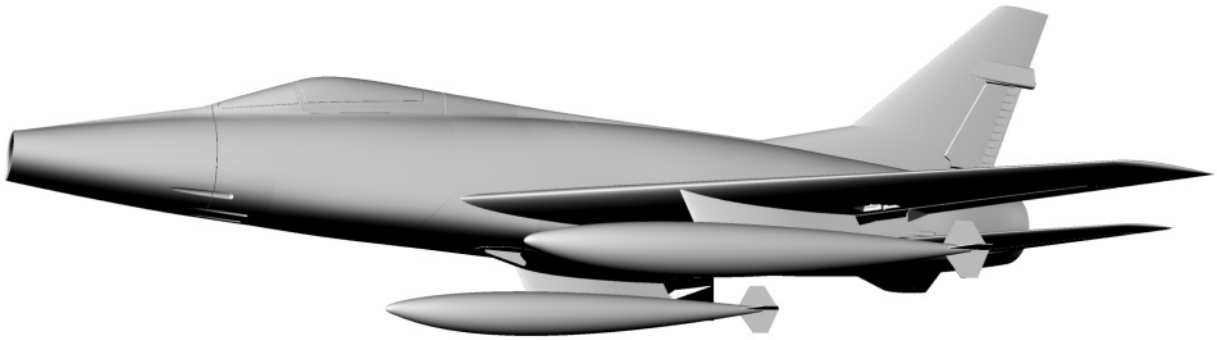
The two wing halves can now be joined. Insert the two PLA wing joiners into the slots of one wing and glue with cyano. Test that the wings halves can be pressed tight together. When satisfied with the fit, add medium cyano and press the wings firmly together. Spray with accelerator.





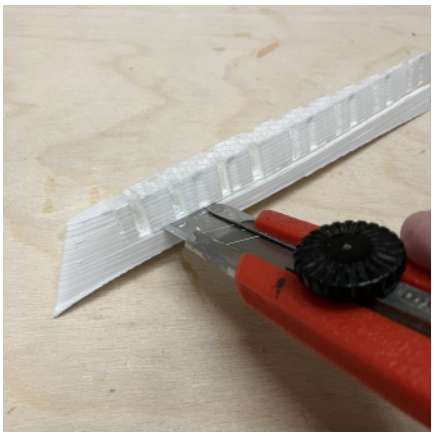
The completed wing is mounted to the fuselage with two M5 x 30mm nylon bolts. Steel bolts can also be used.

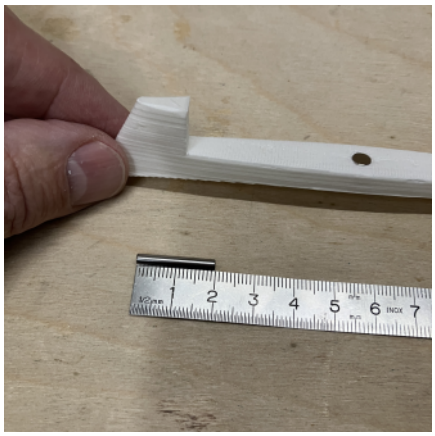
Auxilary Tanks

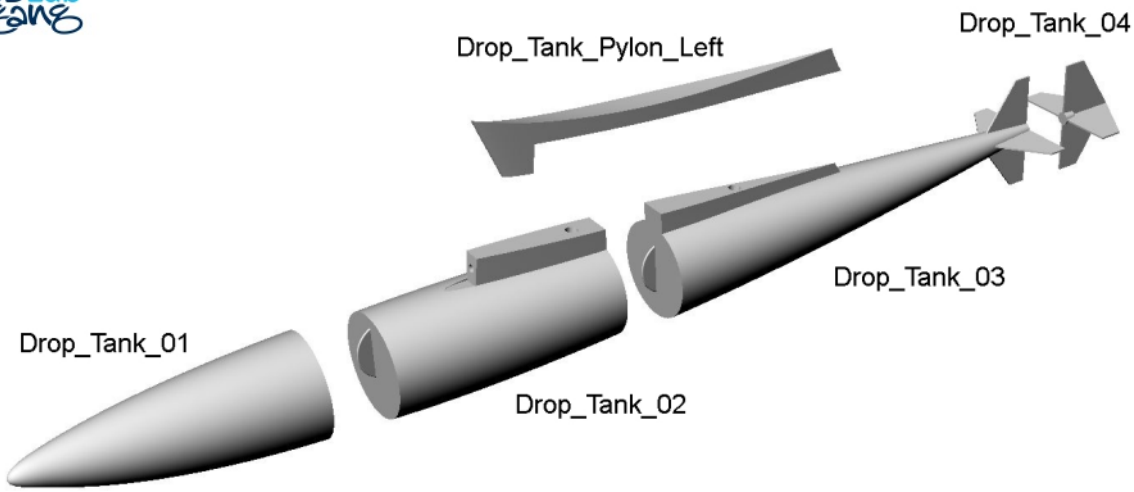


The F-100 can be flown with two auxiliary tanks, but it is advisable to practice flying the F-100 Super Sabre without tanks.

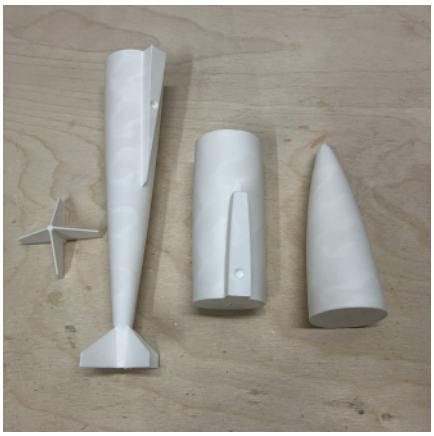
Start by removing the supports from the auxiliary pylons. Push a 3x20mm steel pin into the hole at the front of the pylon. You can also use a 3mm carbon rod, brass rod or cut the end of a 3mm drill bit. Push 3x5mm magnets into the two holes making sure to orient the poles of the magnets in an identical way. If needed add a bit of cyano to lock the magnets into place.

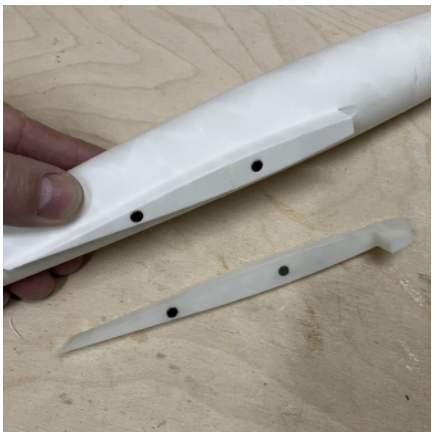


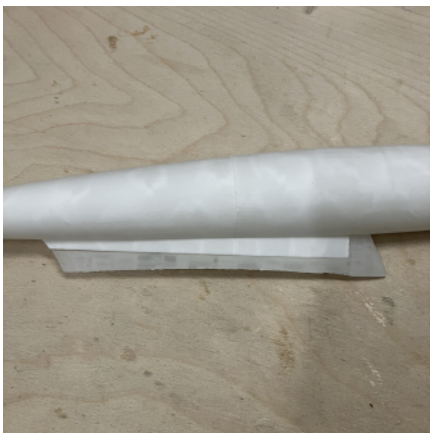




Glue the four parts of each tank together. Push 3x5mm magnets into the two holes making sure to orient the poles of the magnets in such a way that the tank in attracted to the pylons. If needed add a bit of cyano to lock the magnets into place.

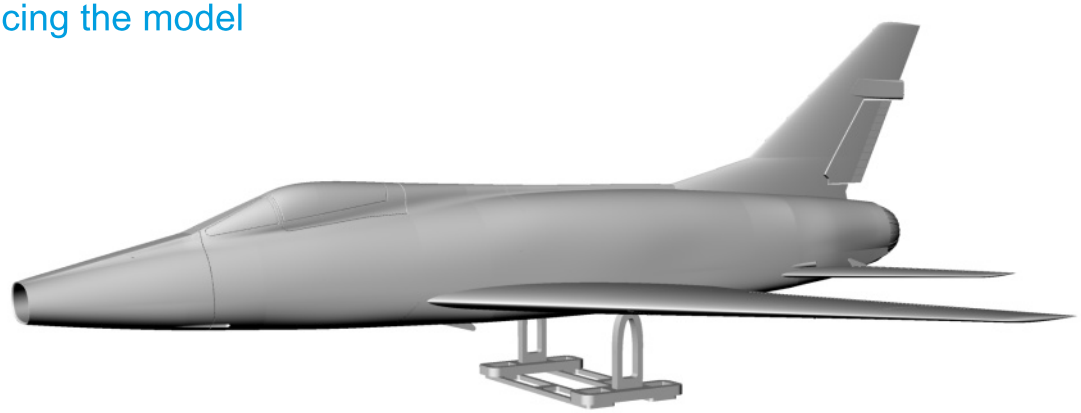






Check that the tank can slide onto the pylon with the pin fully inserted into the tank and the magnets holding it in place. When satisfied with the fit, glue the pylons to the underside of the wings making sure to align the pylons with the marks in the wing surface.

Balancing the model

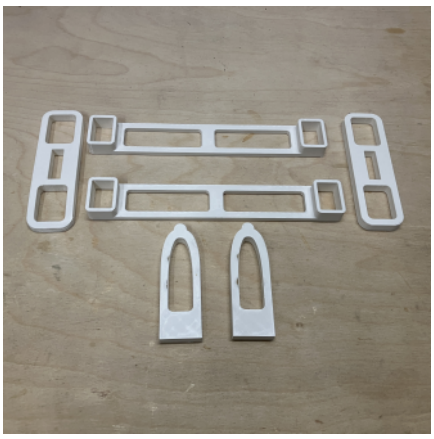


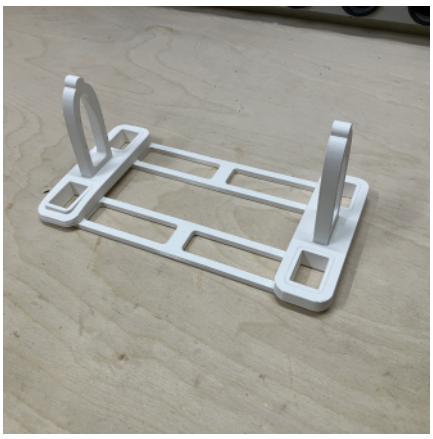
Before first flight make sure the model balances at the Center of Gravity, CG which is indicated underneath the wings by two recesses.

To help you balance the model, a balancing cradle is supplied with the Super Sabre files.

Assemble the CG-Cradle as shown in the photo below. It´s not necessary to glue the parts together. Most of the parts can be used to balance other jets from the same designer.

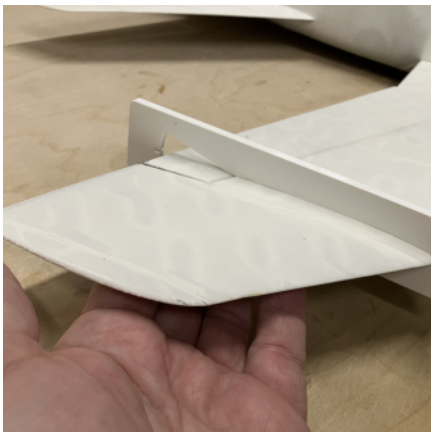
Place the ready to fly model on the CG-Cradle while making sure the contact points of the craddle are placed into the recesses in the wings. Move the battery forward/backward until the model balances nicely on the CG-Cradle. When the correct location of the battery has been established, note the position of the battery and use blocks of foam to secure the battery. It is especially important that the battery is not able to move backwards during the launch.

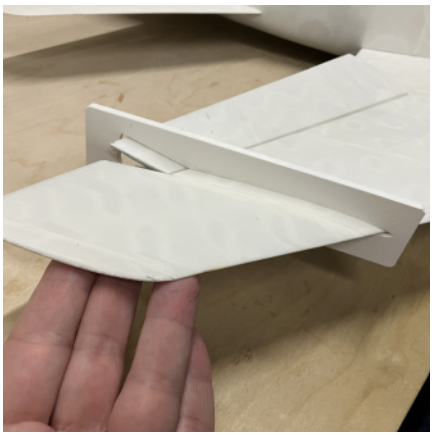


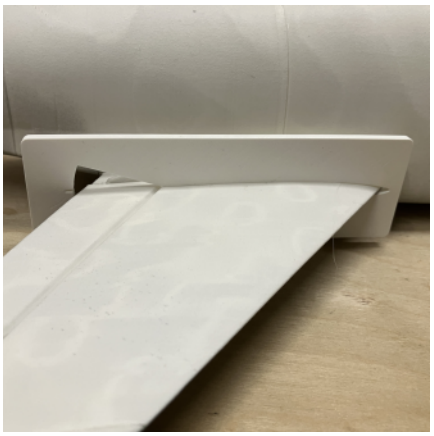


Control Throw Adjustment

Use the control gauges to adjust the aileron and elevator control throws. Push the control throw gauges in as far as they will go as shown in the photos below. The gauges have marks to indicate the neutral point of the control surfaces. Use your radio to program the control surfaces to move only in the space restricted by the control throw gauges.







First flight

Always remember: It is the airflow across the wings that creates lift. So keep the airspeed up at all times.

The F-100 Super Sabre model flies much like a real jetfighter. Speed should be kept up at all times and flying is all about energy management. Energy will bleed quickly if for example very tight turns are performed resulting in slow speed and in worst cases, a stall. If the Super Sabre model is flown in a scale like manner with gentle maneuvers and enough speed, the model will fly "Like on Rails" with no bad habits at all. Make sure your place of flying has plenty of open space as the Super Sabre will cover a lot of distance in a short period of time.

It is highly recommended to use a catapult/bungee system to launch the F-100 Super Sabre model. A catapult/bungee system will launch the model in a predictable way with plenty of airspeed at a nice angle. And it will do it again and again. Check out this Youtube video about building a simple yet very reliable catapult system.

The F-100 Super Sabre should be launched with a pull of 6-7 kg and at a 5-10 degree upward angle. Add full power to the EDF just after the launch. Keep the wings level and fly straight until speed builds up. Do not begin a climb out straight after the launch. Get airflow across the wings before any maneuvering.

It is not recommended to hand launch the Super Sabre model.

Landings should be performed on a grass strip with short cut grass. Bring the model in low over the end of the grass strip but with enough speed to avoid any stall situation. At very low height over the grass keep dialing in elevator until the model settles on the grass at almost stall speed.

Extras

If you want to hang your model on the wall, the supplied Wall Hook fits the bungee hook. Drill the holes with a 1mm drill bit and insert a piece of 1mm piano wire.
Decals for the Super Sabre can be printed on waterslide decal paper. Use both clear and white paper for best result. You can find plenty of tutorials on how to make decals on Youtube.

I wish you many successful flights with the F-100 Super Sabre

Michael Hammer

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Other EDF-models by the same designer

Available from:
3DLabPrint.com