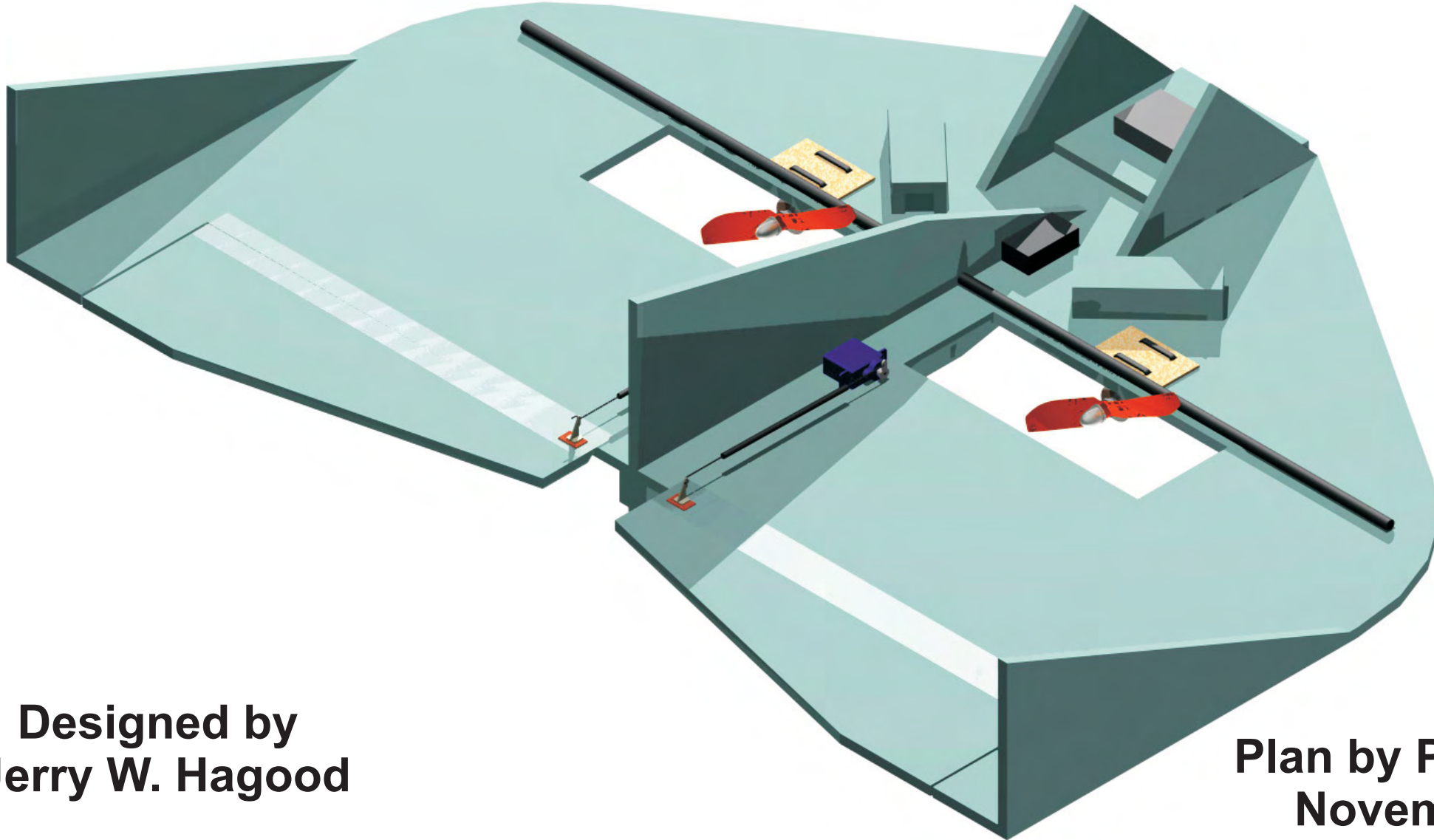


# DOUBLE TROUBLE

**An electric powered model made from sheet foam  
for full contact combat matches**

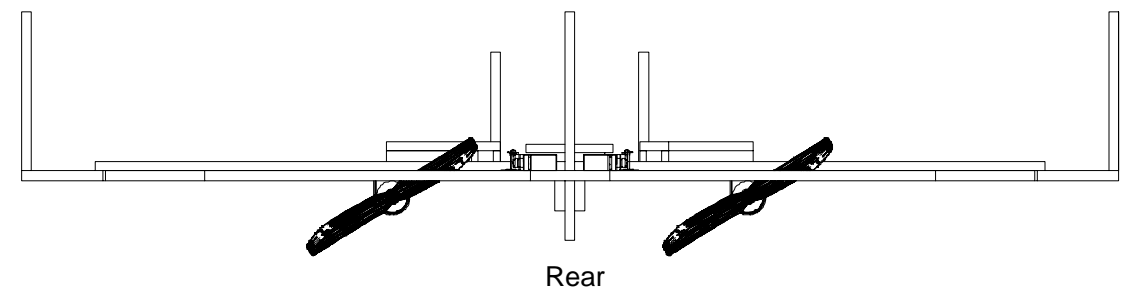
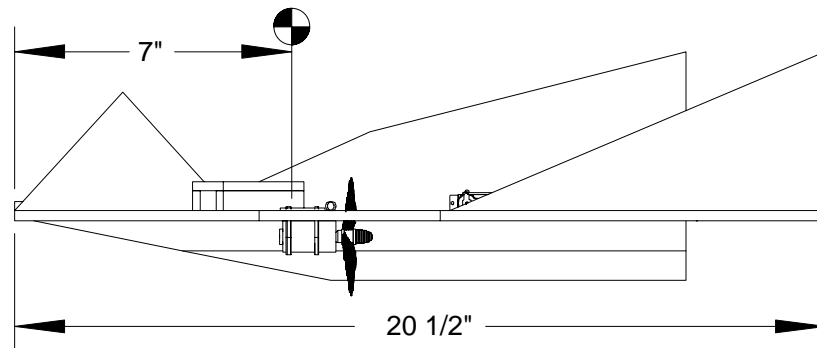
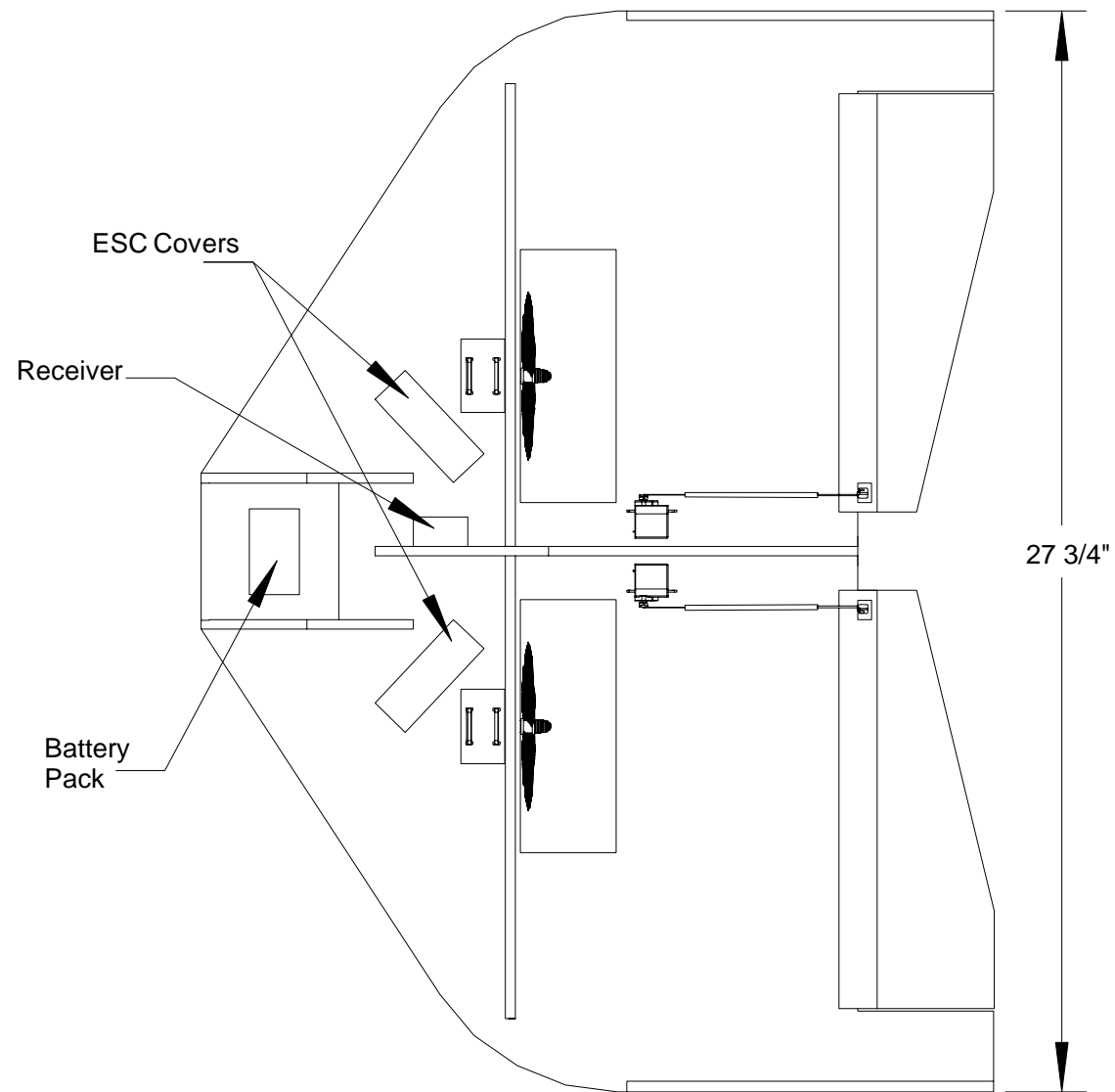


**Designed by  
Jerry W. Hagood**

**Plan by Paul Bradley  
November 2011**

# DOUBLE TROUBLE

Designed by  
Jerry W. Hagood



# Double Trouble Assembly Guide

The model presented in this package is fairly simple sheet foam model intended for full contact combat matches. The design was developed by Jerry Hagood. The original model was built from fan fold foam that is about 1/4" thick. As presented in this drawing package, either fan fold foam or 6mm sheet foam can be used.

The materials needed to build a model from this plan are listed below:

1. Fan fold foam or 6mm sheet foam
2. 1/32" and 1/16" plywood
3. Spray adhesive
4. Hot melt glue
5. Motor - Two Feigao 1308430S motor & BP10 ESC combinations (buy as combo, saves a few bucks). These are available from BPHobbies.com It is critical that all components of the power system be identically matched, both motors and speed controllers.
6. Prop -Two GWS 5x3
7. Four wire tie wraps large enough to hold the motor to the mount
8. Prop adapters for the motors
9. At least a three channel radio system capable of elevon mixing. A micro receiver is recommended.
10. Micro servos - two
11. Micro control horns - two
12. Two cell lipo battery pack in the 1600 - 1800 mah capacity range
13. Hook and loop (Velcro) fastener material for the battery pack

If 6mm foam is to be used a good source for foam sheets is RC Foam. You will find them at <http://www.rcfoam.com>.

A model built from this plan package has a span of 27 3/4 inches with an overall length of 20 1/2 inches. The total flying surface area is 418 square inches. The total flying weight will depend on the materials used, the selected motor, and battery pack. The total flying weight should not exceed 13 ounces.

## Notes from the designer, Jerry Hagood:

1. All airframe parts are cut from 1/4" blue fanfold foam. This foam is available in bundles and some times individual pieces from the suppliers. "Unfolded", the bundle can be cut into 25 pieces, about 24" x 48" each.

2. I use the low temp hot glue throughout. First by running a bead along the bottom edge where I am joining two pieces, hold the pieces in place until it cools a little then run a fillet down the outside edge where the two pieces meet.

Comment: Some builders prefer the high temperature hot glue which actually melts the foam as it is applied but I have had trouble using it. Try both and see which one you like best.

3. Cheap, light 10-15 in-oz servos, sub-micro.

4. There are several stiffeners on the main wing. One pair runs on top of the wing along the outside edge of the wing from the rear of the elevon to the point where the taper to the nose begins. These also serve as vertical stabilizers as does one which runs from about 5 inches back from the nose to the tail. A third runs on the bottom side of the wing, in the center, and runs almost the full length of the wing, as shown on the plans. The triangular pieces on top of the wing are at the front, on either side of the battery, to provide protection for the battery.

The base of the keel pieces is supported by full-length foam doublers on each side, each of which is about 3/4 inch wide. These doublers are aligned vertically, up against the base of the keel. They help to keep the keel pieces from breaking off, and also provide strength.

There are two small rectangular housings, one on each side, which house the speed controllers and also provide stiffing of the nose. The speed controllers are inserted at the rear end of the tunnel which is formed so that they can be removed if necessary.

5. The coated side of the foam is on top, glue and tape stick better!

6. I place a small length of wooden wing spar the length of the motor mounted on a small square of 1/16 model plywood and fitted around the carbon stiffener rod and cut small notches in it for the wire ties to fit in. I use a small amount of hot glue to anchor the motor. This is applied after the motor is in place and run along each side. The motor has about a 2-3 degree upward thrust line obtained by melting the foam near the prop edge with the glue gun. It is important to mount the motor securely. I use yellow wire ties.

7. I double the foam thickness between the two fins in the front and place the battery on that using Velcro and a Velcro strap which passes through the foam and locks around the battery. This helps to hold it in place when it gets hit. A small piece of thin plastic cut to the shape of the battery and glued to the top also help to protect it from prop. strikes.

8. I used Ultracote strips around the front edges. (Monokote is too heavy). Packing tape or Scotch tape will work as well. A strip cut 1 inch wide works well.

9. Once the pieces are cut out and ready to assemble, run a bead of hot glue along the edge of the piece to the joined and hold it in place for a minute or so until the glue sets. Then run a fillet of glue along the junction to add strength. Do not over do it with the glue, it adds weight! Note that there are two places where the foam is double thickness; the battery pad and each keel brace. Just run a bead of hot glue and squeeze them together. The keel brace provides longitudinal stiffness and a hard landing will break the keel if it is not doubled. The battery is shifted in order to get the C.G. correct so leave yourself the room to do this.

10. Remember to keep the weight down - no more than 13 oz. max. Mine comes in at 12 ½ oz. including the battery.

11. Hinging the elevons is best done using 1" clear tape. 3M Blendederm or Scotch tape will work fine. I only tape the hinges on the top side. Remember to bevel the edge of both the elevon and the frame at about 45 degrees so that they have room to bend.

12. For pushrods, I now use 3 mm carbon fiber tubing and 1/32" piano wire. Coat the wire with epoxy and stick it into the end of the tube (fill the end with epoxy). If you cannot get the very small carbon fiber tubing to use for push rods, then use spruce or other light weight, strong wood and drill a hole in each end to place the wire rather than wrapping the wire to the wood. I used a 0.039 wire and drilled a 0.042 hole. Coat the wire with epoxy before inserting it in the hole.

13. A good choice for a control horn is the Du-Bro Micro2 Control Horn for .047 pushrods, Cat. No. 919.

14. When assembling the controls to the surfaces, do the following: mount the control horns to the surface, connect up the push rods to both the control horn and the servo with the servo centered, center the surface, apply hot glue to the side of the servo which is to go against the air frame and press it in place. A little hot glue around the edge of the servo will finish the installation. Use "subtrims" on your transmitter to finish any adjusting which needs to be done. Note that this model is intended to fly using a computer radio. Exponential is set on about minus 40 for FUTABA and plus 40 for JR. Elevon setting is turned on and the radio adjusted accordingly.

15. Control Throws: I use control horns which are the same length as the servo arms and put the push rods in the longest throw hole on both. I set the dual rate switches to 70 percent for first flights then switch to 100 percent when you feel comfortable. The

100 percent (high rate) is 30 degrees.

16. Location of ESC: On top at the aft end of the protecting housing. I solder my connections to the motor rather than use the heavy connectors which sometimes come with them and connecting the motor before mounting it helps to save the foam from the heat gun I use to shrink the tubing I put over the connections. Rotate the motor such that the leads are next to the foam air frame and you will have enough length to make the necessary connections.

17. The required C.G. is noted on the plans (one inch ahead of the cross brace). Place all of the electronics as far forward as you can and still keep them away from the leading edge (this gets hit and you don't want to damage the electronics if you don't have to.) I may have gotten lucky and hit the "sweet spot" for the C.G. on the first try, but the plane flies great! It will flip in its own length and do Hammer Head stall turns in only a few feet. It would perform 3D if it had a tail since power to weight is greater than one.

18. Use tape to cover all wires and hold them in place. I recommend soldering the ESC directly to the motor wires. Determine the direction of rotation before soldering.

19. Any time you are using two speed controllers (ESC) you must clip one of the red leads so that only one ESC provides power to the receiver. You cannot use a common ESC for both brushless motors. Each motor must have its own ESC. These can be connected through a "Y" to the receiver or one of the plugs can be cut off and the wires soldered to those of the same color on the remaining ESC which is plugged into the throttle channel on the receiver. I use the soldered approach since it saves having to bundle up the extra wire of the "Y".

### **Flying:**

Launch should be done at about ½ to ¾ throttle. Too much is not good since it is more likely to go out of control on the first flight until it is trimmed up. Throw the plane into the air about 20 degree upward angle while holding it by the left wing tip at about the C.G.

Start with low rates set on about 70 %.

It should fly nicely at about ½ throttle.

Flight duration with the recommended battery is in excess of 10 minutes.

Keep in mind that this air frame flies on angle-of-attack. It is a flat plate with no air foil so the nose must always stay above the horizontal if you do not want to dive.

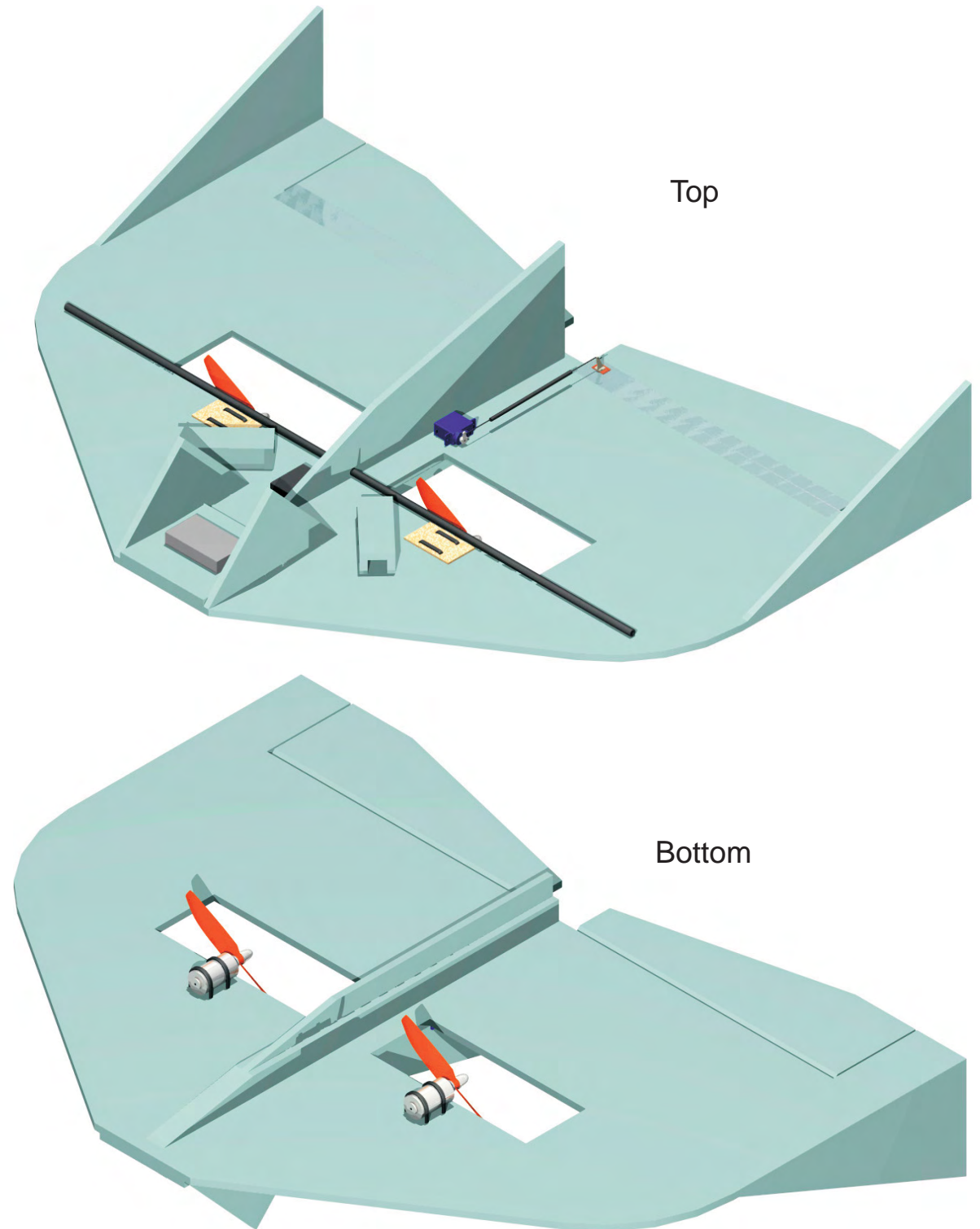
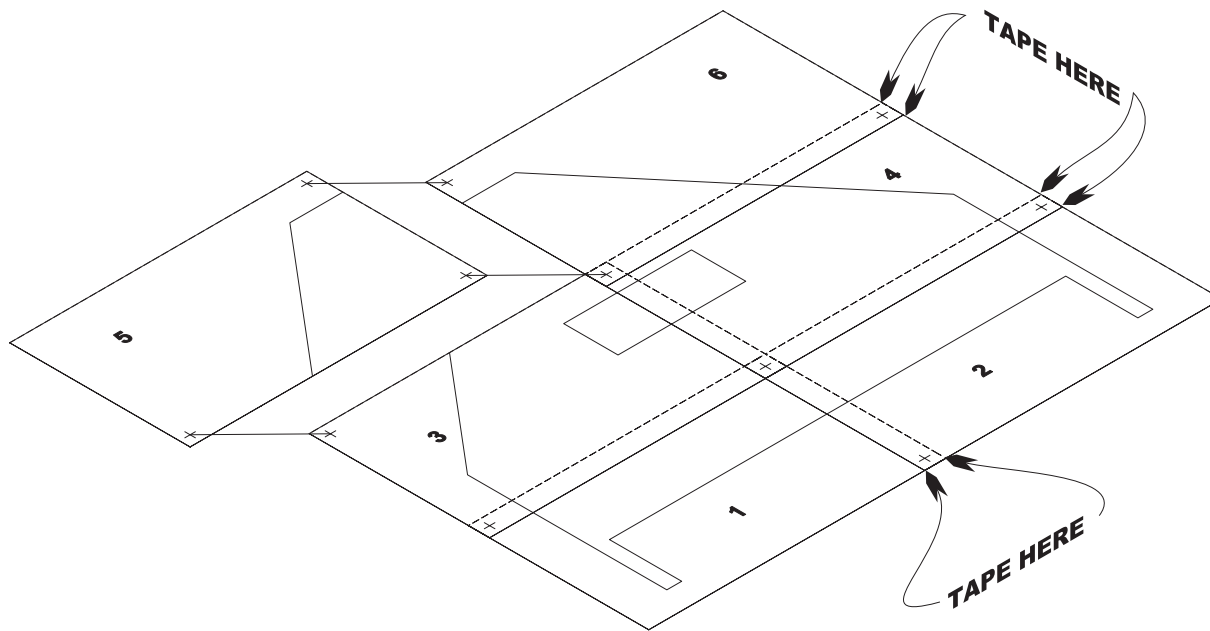


## General Assembly Notes

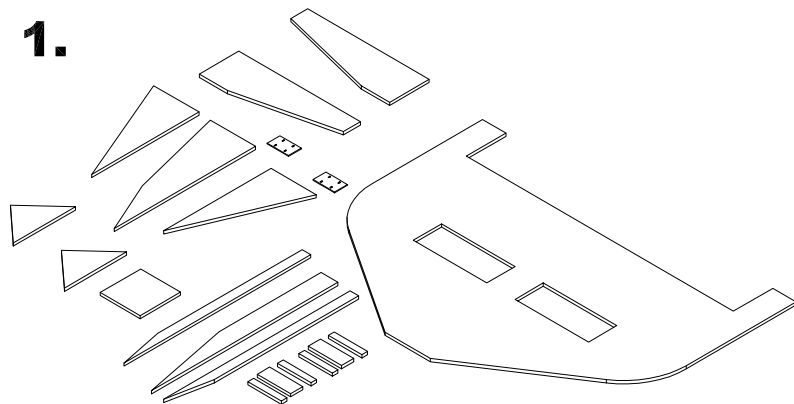
### Printing and assembling the wing template.

The wing template had to be printed on individual sheets of paper to make sure all printers could be used to generate the complete template. The largest paper size that all printers can handle are sheets 8 1/2" by 14" (Legal size in the U.S.). The pages of this package have been set up to print on that size paper.

Sheet alignment marks have been included. Place one sheet on top of another using the alignment marks. Tape the sheets together on each side. Cut the templates from the assembled sheets. An illustration is provided below(a different model but the process is the same):

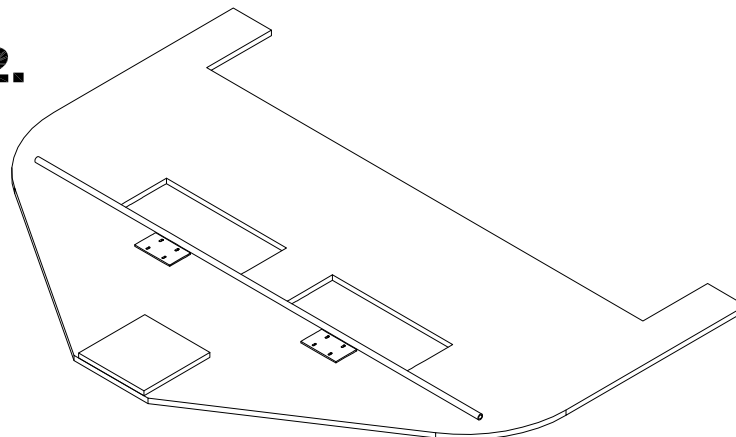


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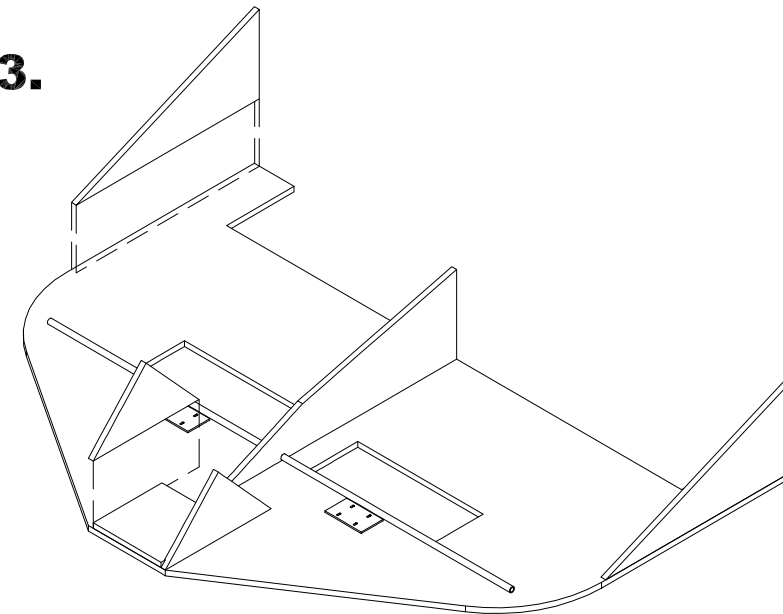
Assemble the wing template. Attach all templates to the construction materials and cut out the individual parts..

**2.**



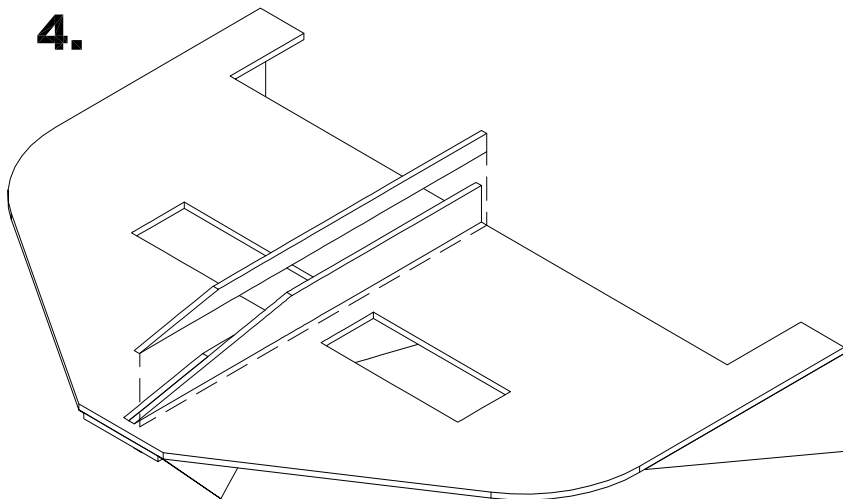
Using hot melt glue, glue the battery pack doubler to the nose. Center it on the nose span. Glue a 24" long 6mm diameter carbon fiber tube to the top of the wing surface. It is aligned with the forward edge of the prop cut outs. Glue the top 1/16" motor mount plates to the top of the wing. They are centered with the forward edge of the prop clearance cutouts and rest against the carbon fiber spar. With a drill bit or other suitable tool, open the tie wrap holes in the foam using the motor mount plate as a guide.

**3.**



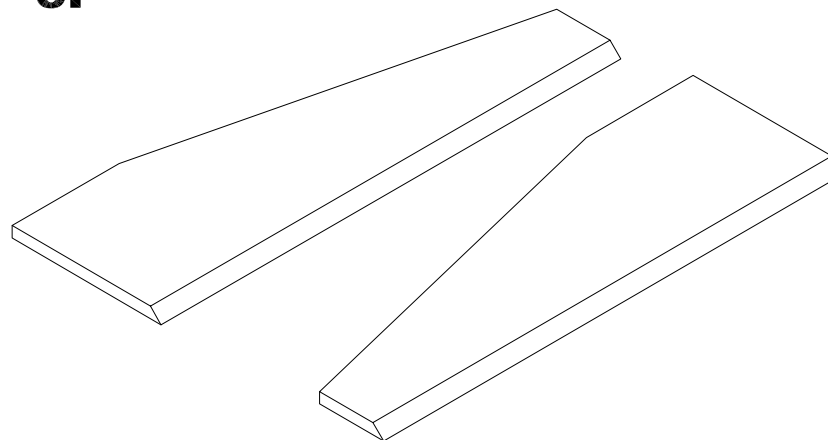
Using hot melt glue, glue the tip fins to the top of each wing tip. Glue the center fin in place. Also glue the battery pack protection fins to the top of the wing and the side edges of the battery pack doubler.

**4.**



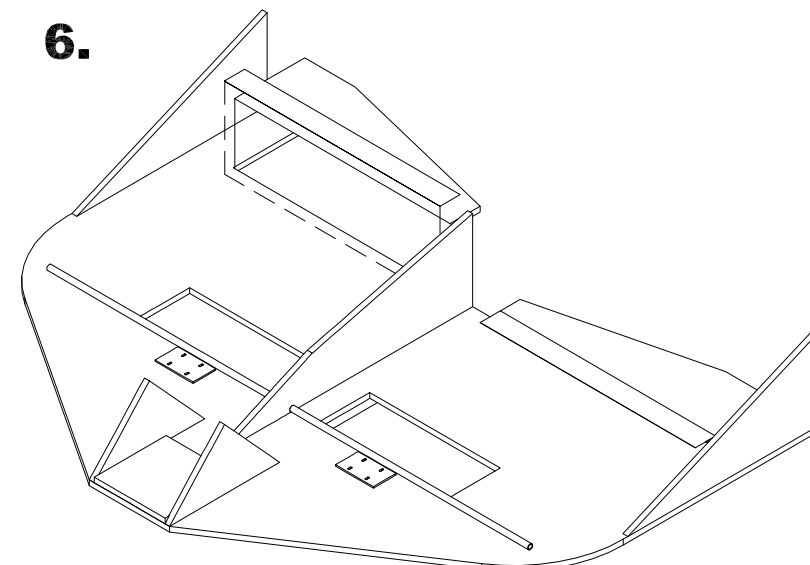
Again using hot melt glue, glue the bottom fin in place. It is centered on the wing bottom and is flush with the elevon cut out. Glue the doublers to the bottom fin and the bottom of the wing surface.

**5.**



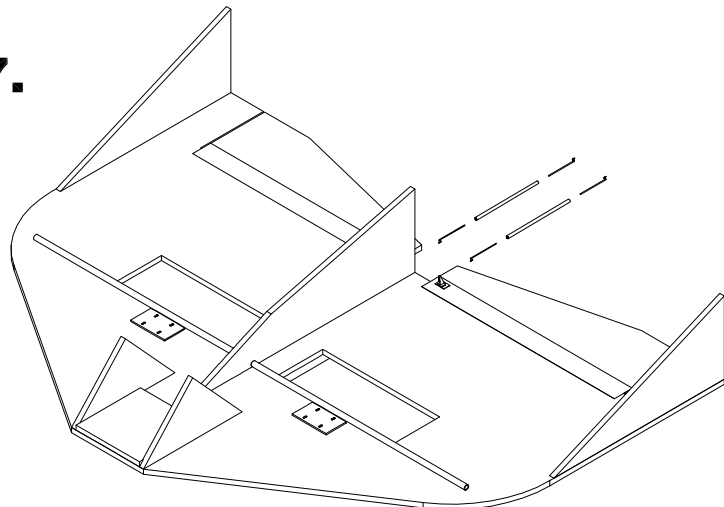
Sand or cut a bevel on the leading edge of each elevon. Make sure that you make a right and left elevon. The beveled edge will face down when they are installed.

**6.**



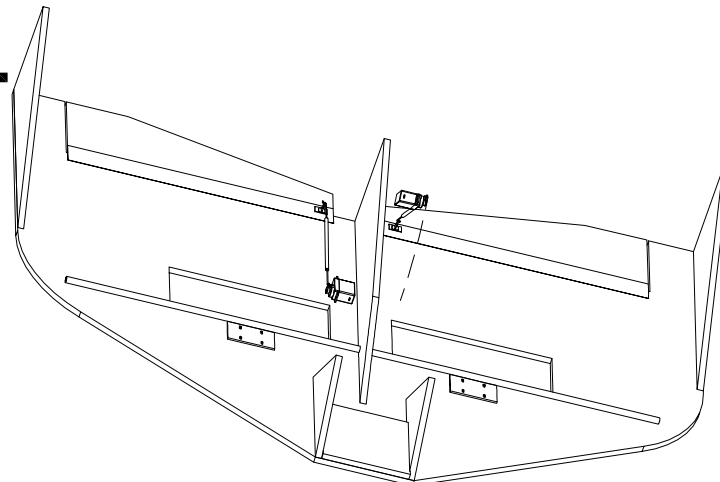
Use a suitable adhesive tape, like packing tape, to attach the elevons to the model. The elevons are installed with the beveled edge facing down. The tape is placed on the top surface. Make sure there is some clearance between elevons and the wing cut out near the tip fins. About 1/16" is good.

**7.**



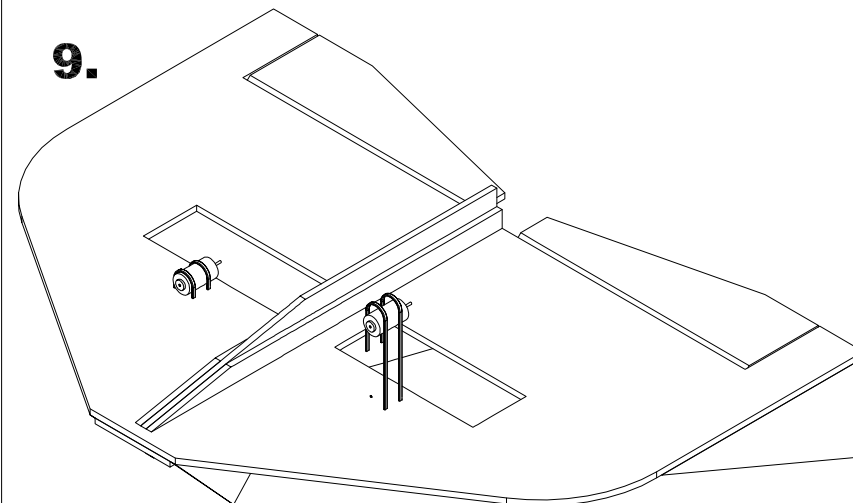
Install a control horn on each elevon. A small plate of 1/32" plywood under each horn will enhance their durability. Make up two push rod assemblies using 3 mm carbon tubes. Cut the tubes to a length of 3.5". Make up 4 sets of "Z" bends from .032" piano wire. They should have an overall length of 1.5". Use epoxy to fix the Z bends in the end of each carbon tube. The straight end of each Z bend should extend 3/8" into the epoxy.

**8.**



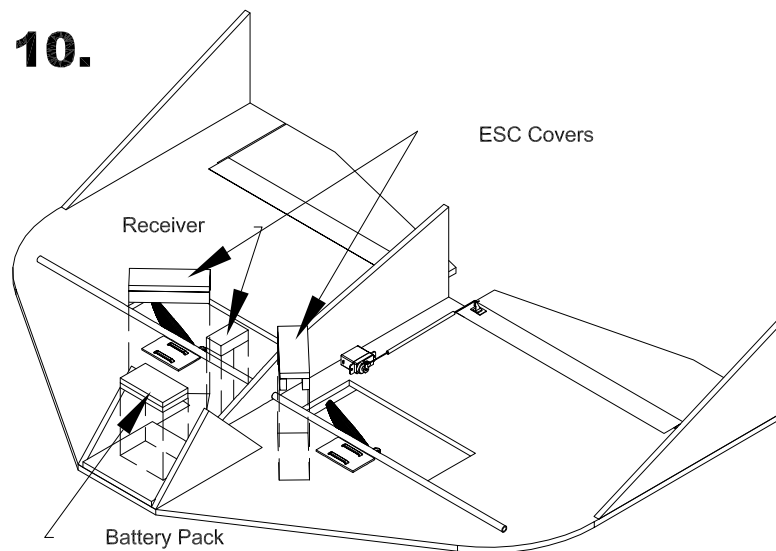
Temporarily hook up the receiver to each servo and make sure the servos are centered. Hook a pushrod to one of the elevon control horns using the Z bend. Slip a servo arm over the Z bend on the other end of the pushrod. Rotate the assembly so the servo can rest on the top of the wing surface. The output arm will be to the outside of the model. Using hot melt glue, glue the servo in place. A piece of 1/32" plywood under the servo will enhance the strength of the joint.

**9.**



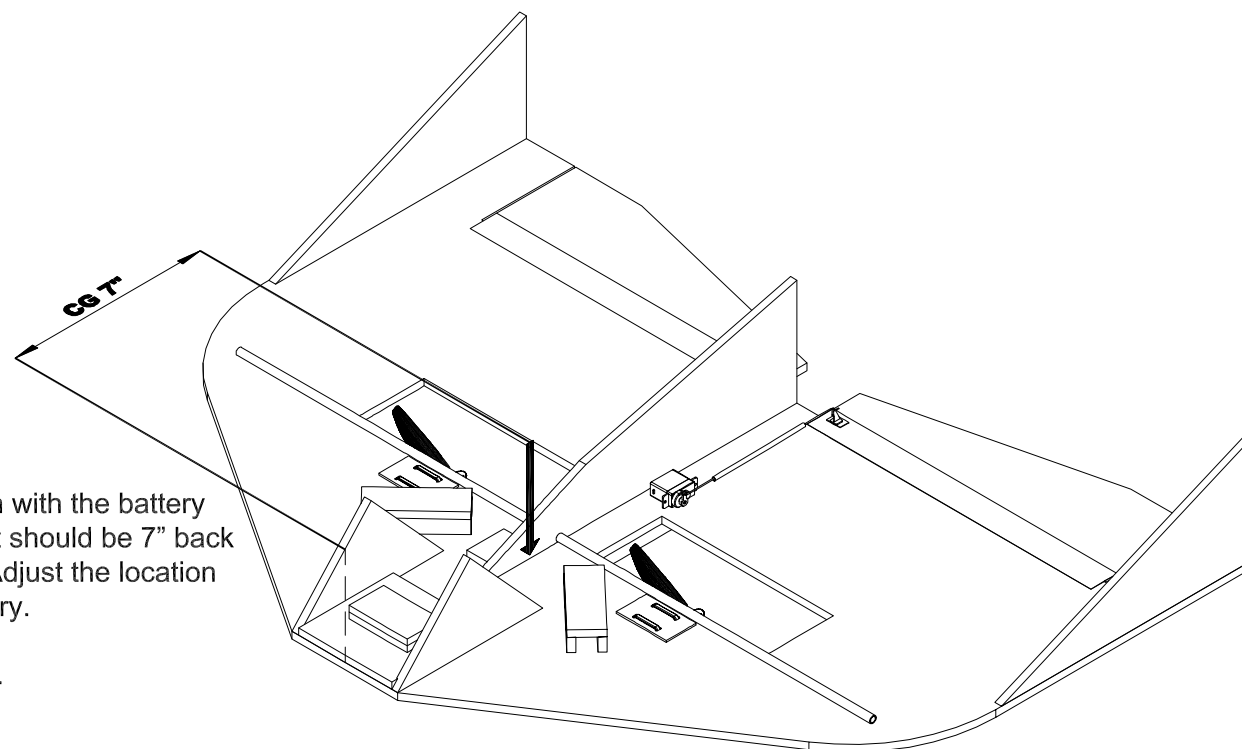
Install the motors. Use a bead of hot melt glue between the motor and the bottom wing surface. The wire tie wraps are pulled through the holes in the mount plate and around the motor.

**10.**



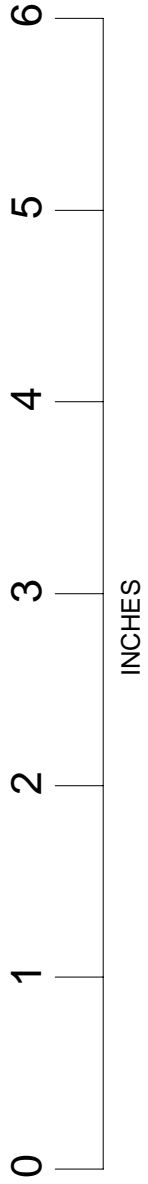
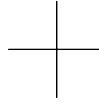
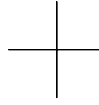
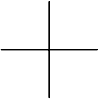
The receiver and battery pack are now installed. Both are mounted on the top side of the model. The receiver is placed just forward of the carbon spar. The battery pack is mounted on the foam plate between the two protection fins. Use hook and loop fastener material to mount both items.

**11.**



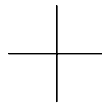
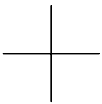
Double check the CG location with the battery pack attached to the model. It should be 7" back from the nose of the model. Adjust the location of the battery pack if necessary.

This completes the assembly.

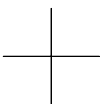
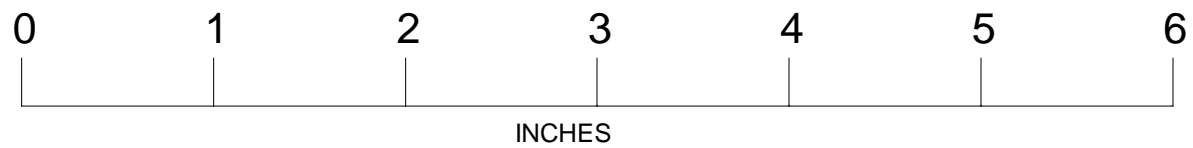


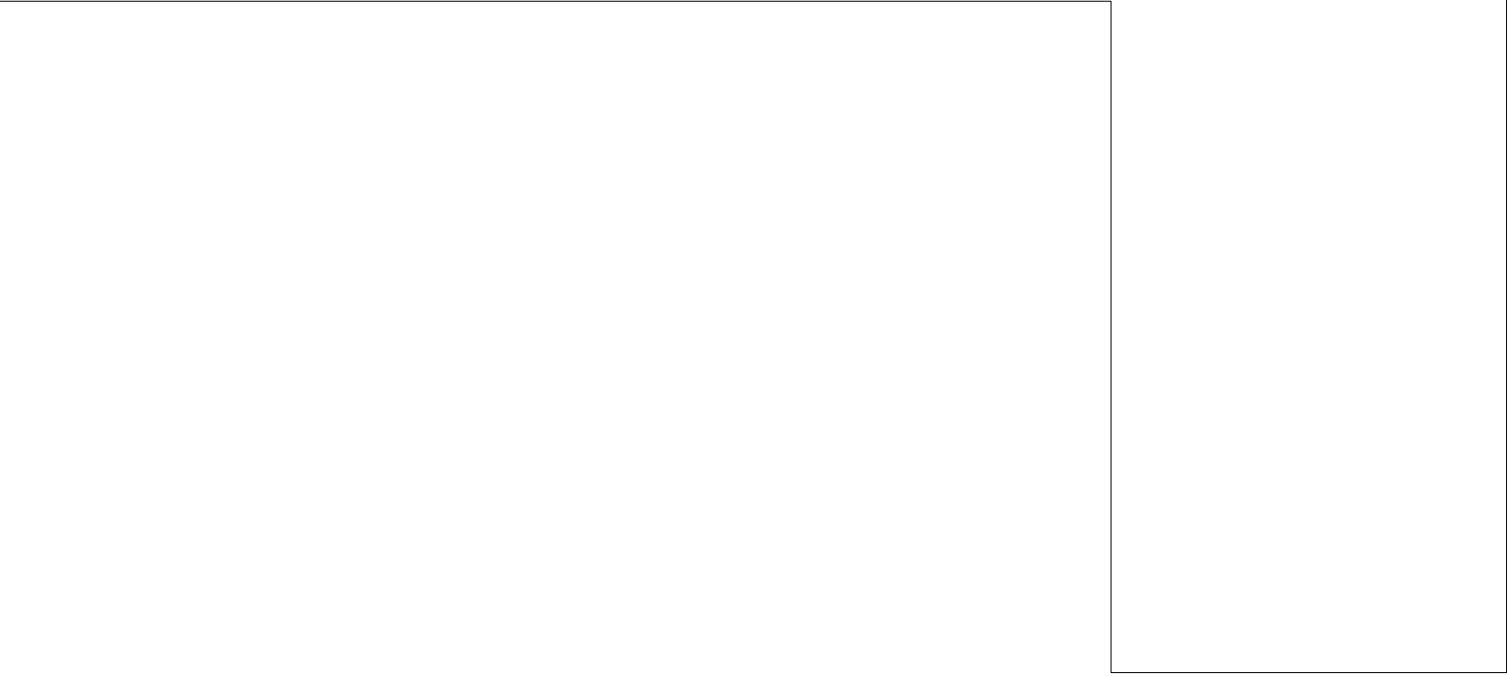
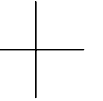
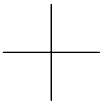
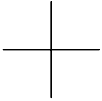
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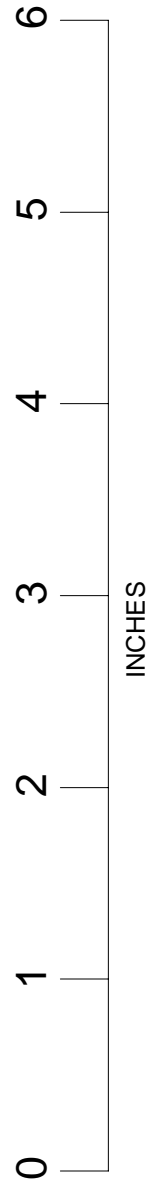
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Sheet 3 of 12



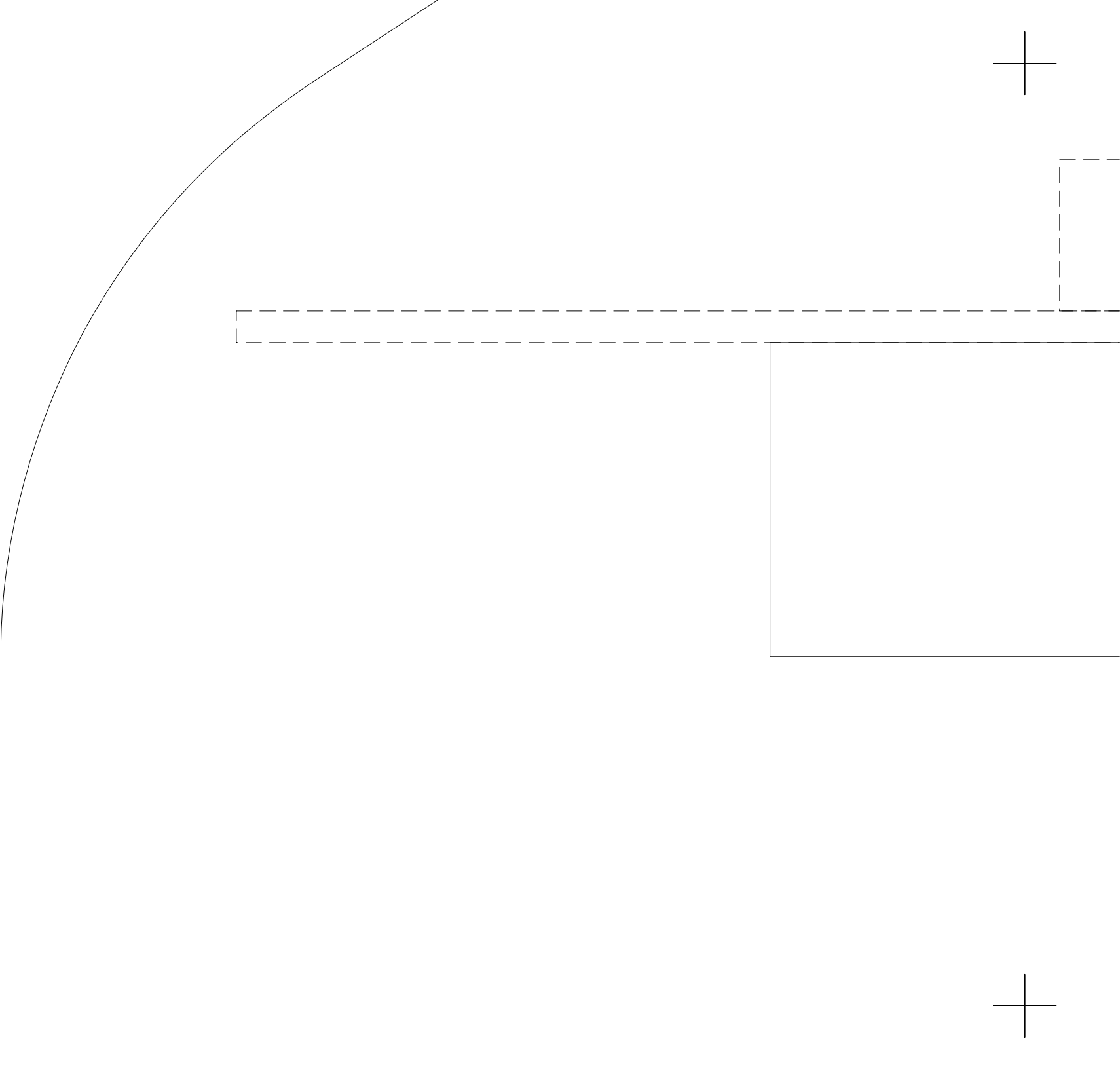


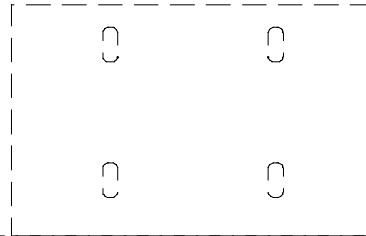
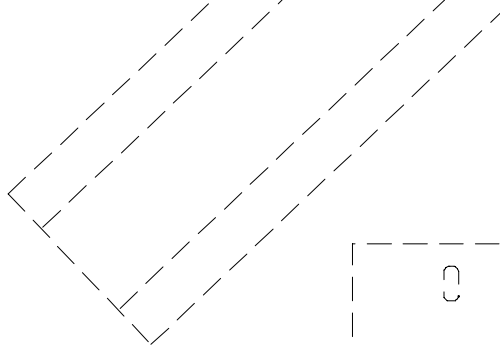
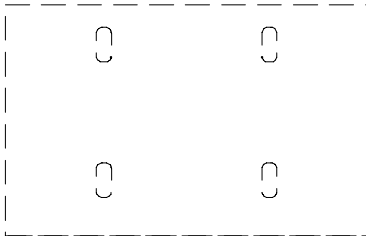
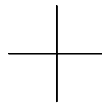
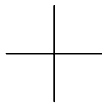
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Sheet 5 of 12

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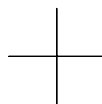
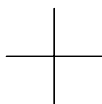
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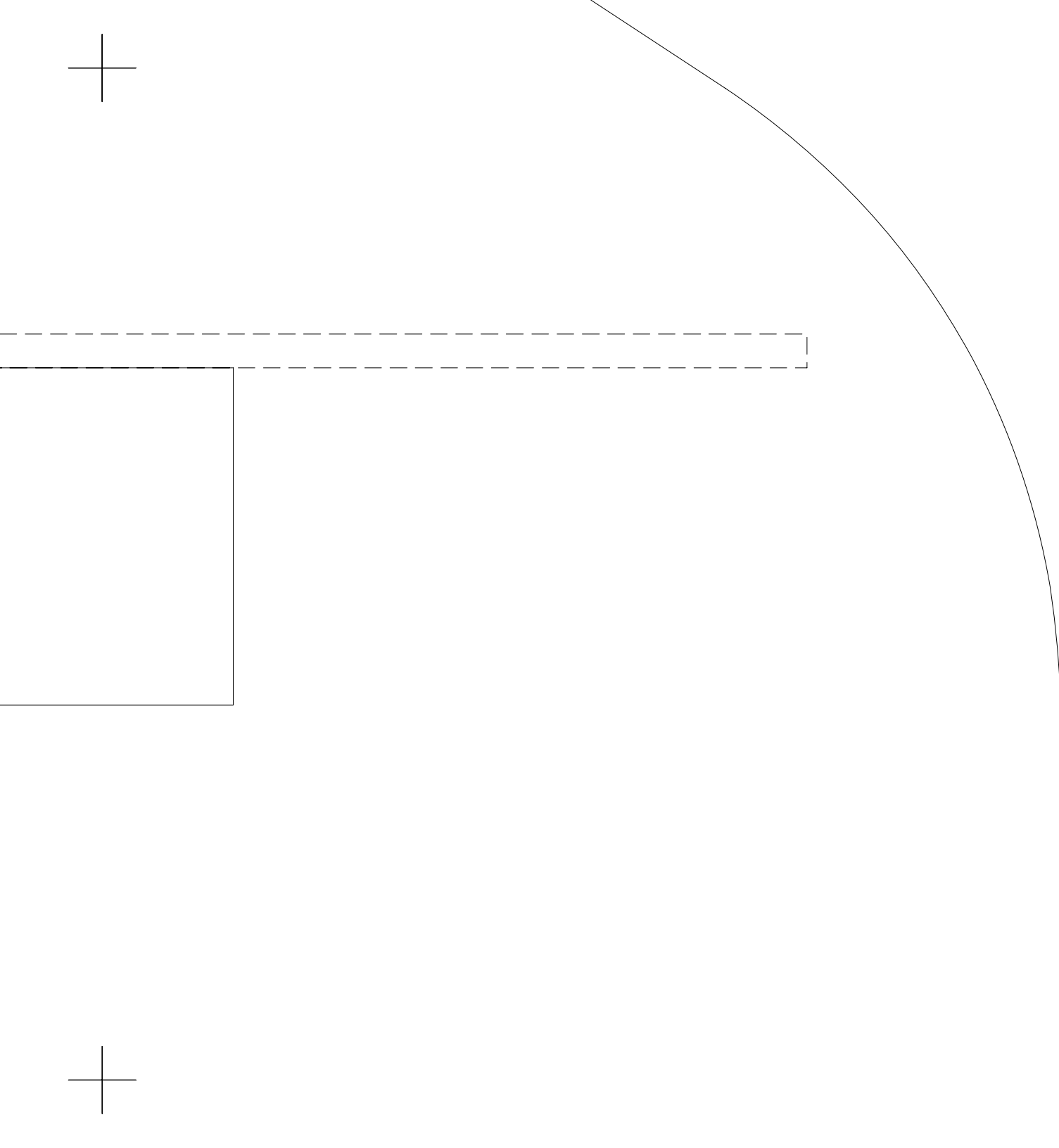
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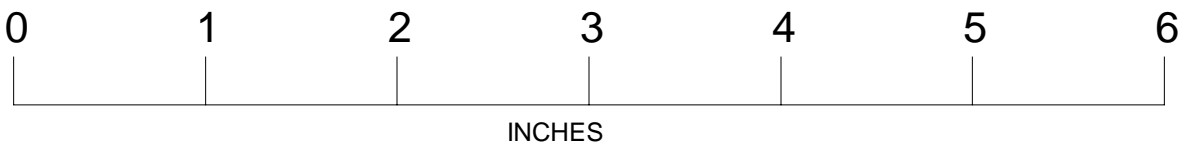
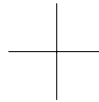
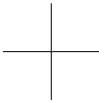




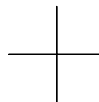
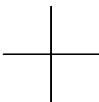
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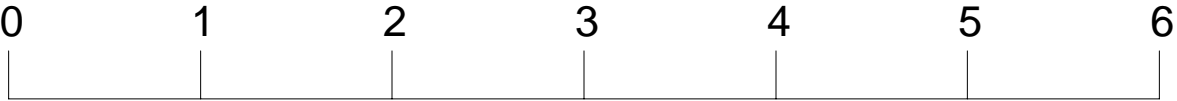
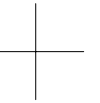
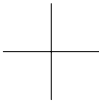






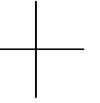
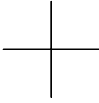
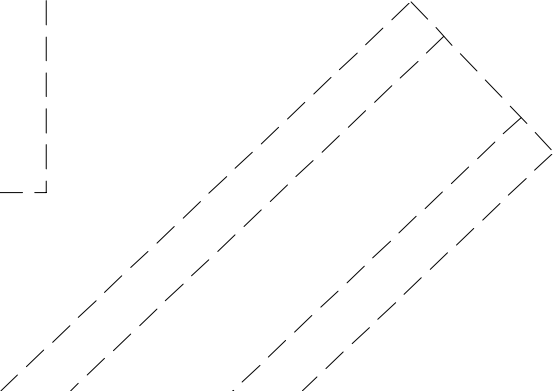
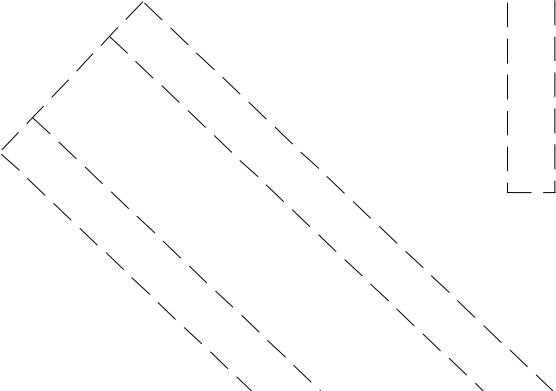
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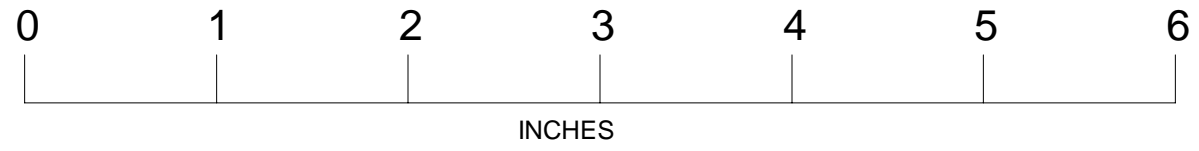
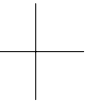
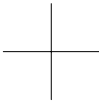




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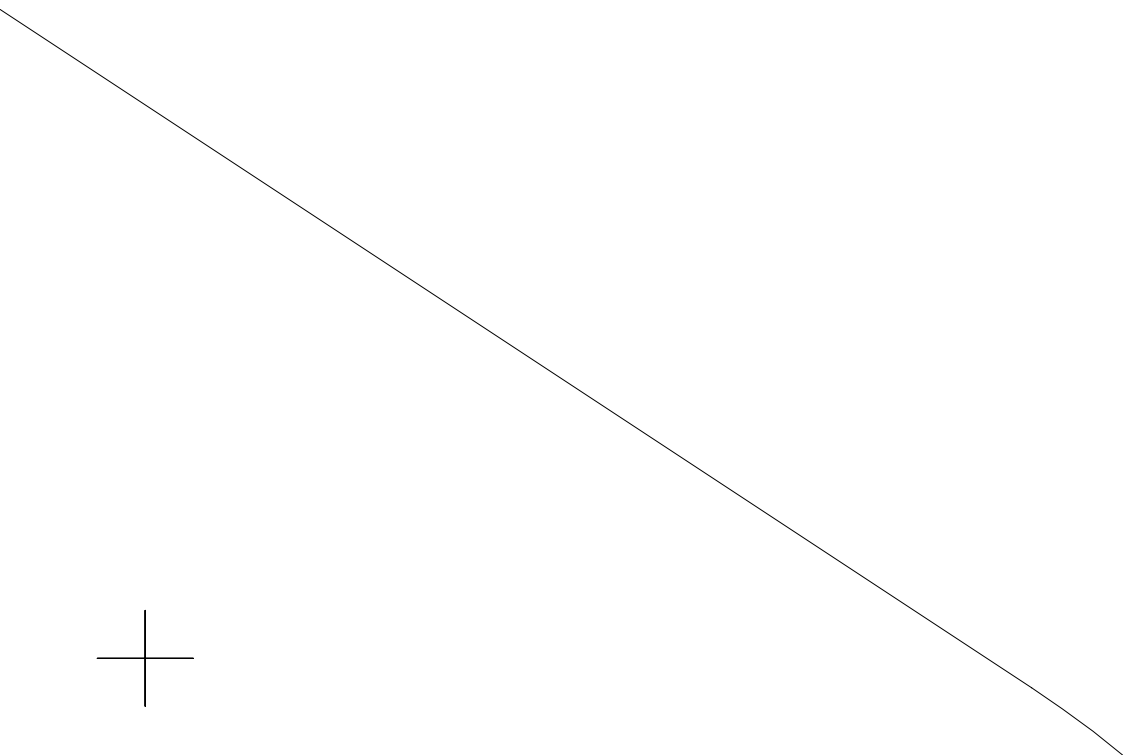
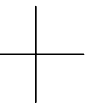
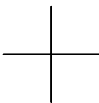
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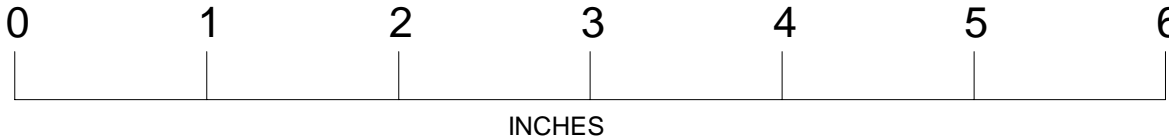
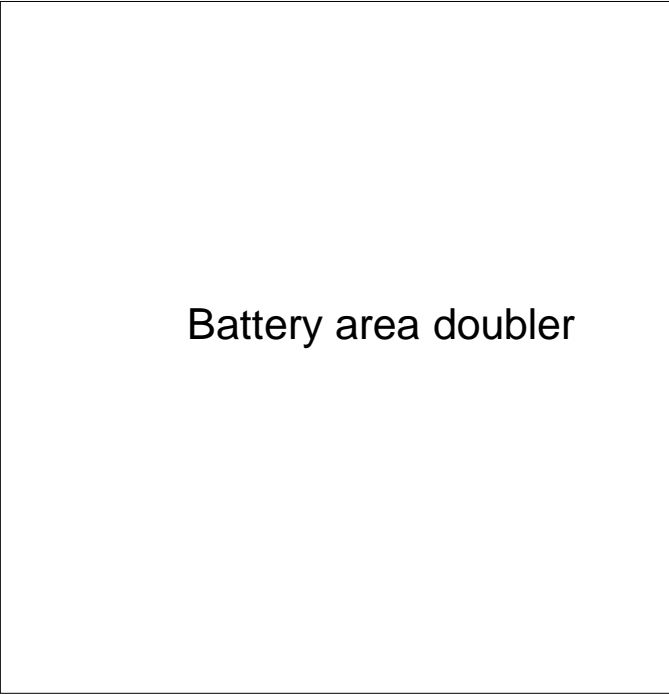




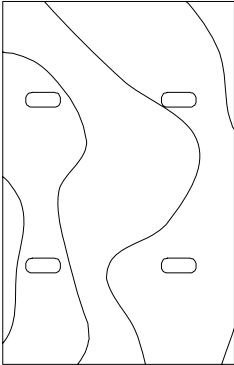
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Motor Mount Plate - make 2  
from 1/16" plywood



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