Legacy Aviation Muscle Bipe

Assembly Manual



EXTREME FLIGHT

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Please take a few moments to read this instruction manual before beginning assembly. We have outlined a fast, clear and easy method to assemble this aircraft and familiarizing yourself with this process will aid in a quick, easy build.

Please read the following paragraph before beginning assembly of your aircraft!

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Congratulations on your purchase of the Legacy Aviation Muscle Bipe! Loosely based on the hot-rodded and highly modified Waco UPF-7 flown by the late airshow legend Jimmy Franklin and known as the Mystery Ship, the Muscle Bipe is our tribute to classic barnstormer airshow style aerobatics. The Muscle Bipe features a quick assembly process that will help you get in the air fast and when powered with the recommended Torque 4016/500 motor is capable of the full range of classic aerobatic maneuvers. If you are a fan of Biplanes and have nostalgia for the classic era of aerobatics the Muscle Bipe is for you!



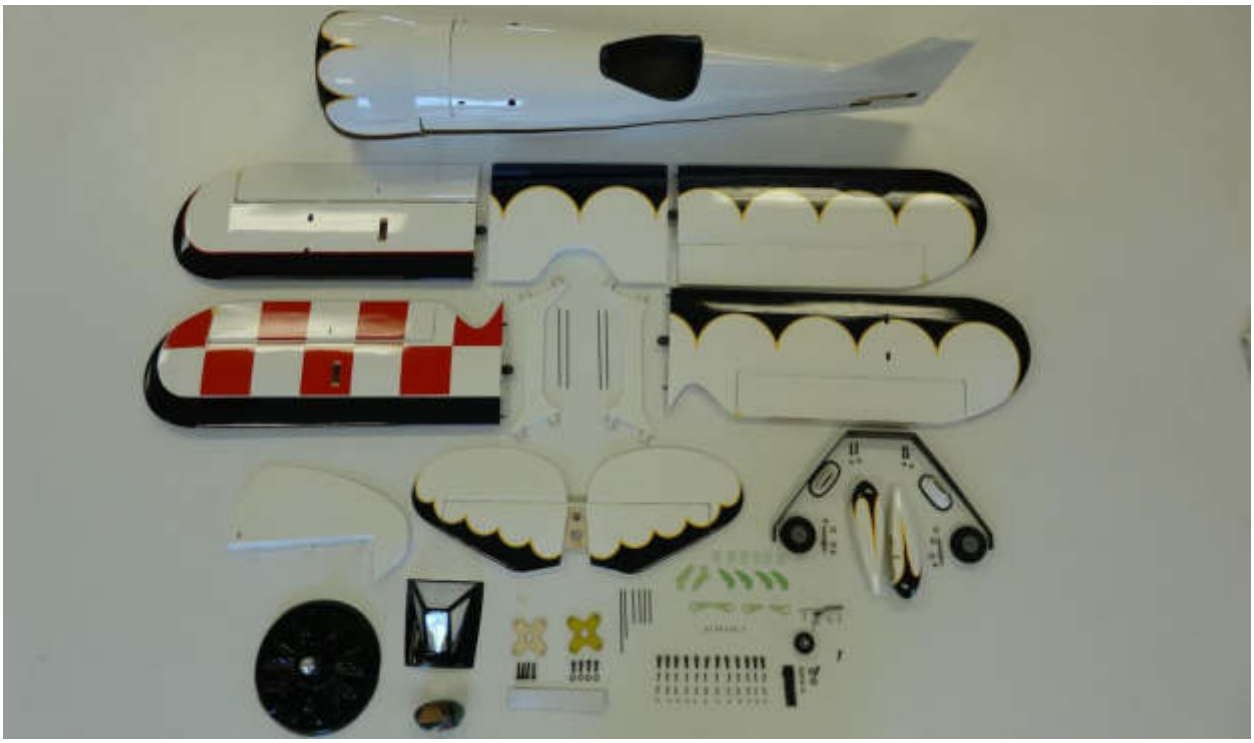
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Items needed to complete the Muscle Bipe

1. 4 micro servos (50oz torque)
2. 2 mini servos (60oz torque)
3. 1 electric motor, approximately 1600 watts and 500KV
4. 80A ESC
5. 4 6” servo extensions
6. 4 18” extensions
7. 1 7CH receiver
8. Propeller
9. Thin CA, 30 minute epoxy, canopy glue/foam tac

Recommended items to complete the Muscle Bipe

1. 4 MKS HV69 servos and Extreme Flight RC 25T lightweight 1.25” servo arms.
2. 2 Hitec 7245 servos and Extreme Flight RC 24T lightweight 1.25” servo arms.
3. Torque 4016-500 MKII motor
4. Castle Creations Talon 90 ESC
5. 4 6” Extreme Flight RC 28AWG extensions
6. 4 18” Extreme Flight RC 28AWG extensions
7. Aura Flight Control system
8. 1 16X7 Falcon or Xoar electric propeller
9. Zap/Mercury thin CA and 30 minute epoxy, RC56 canopy glue or Foam Tac



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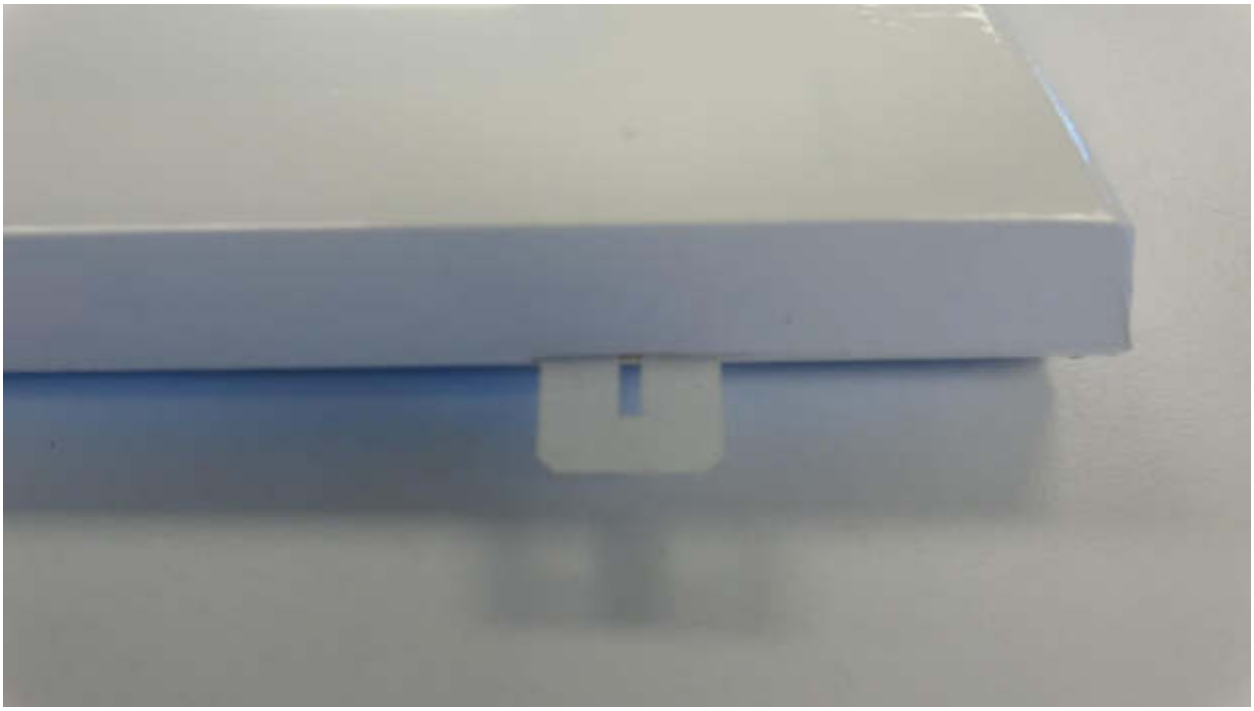
Let’s begin assembly of the Muscle Bipe (MB):

Wing assembly

1.We will begin with the wings. There are 5 wing panels, 2 upper wing halves, 2 lower wing halves and a center upper wing section. Set the center upper wing half aside as we will not be using that till later. First we will hinge the ailerons to the wing halves, begin by removing the aileron from the wing by simply pulling it away from the wing. Be careful with the CA hinges not to lose them and making sure which aileron belongs to which wing half. My preference is to insert the CA hinge exactly half way into the wing slot and then mate the aileron onto those hinges keeping little to no hinge gap. Make sure the hinge remains centered (see note) while mating the aileron to the wing, then apply thin CA to the hinge. Normally a few small drops of thin CA onto the top and bottom of the CA hinge is ample, then allow the CA to set up. Do this on the 4 wing halves. See figure 1.

NOTE: when installing CA hinges be sure the hinge remains centered side to side in the precut slot and fore/aft. When installing the aileron, or any control surface, it is very easy for the control surface to push the CA hinge into the slot resulting in a very little amount of the CA hinge actually in the control surface slot. Be sure to you have a method to combat this before proceeding.

Figure 1



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2. Locate the control horns for the ailerons, see figure 2. Be sure to lightly sand the portion that will insert into the precut slot as well as one side of the base plate. Now trial fit the control horn thru the base plate, trim the base plate slot if necessary to accommodate the control horn, then insert this into the slot (use any base plate they will fit any control horn). Now trim the covering under the base plate, make sure you do not trim beyond the base plate or cut thru the balsa. Remove that covering and this will allow a balsa to base plate glue joint. Once satisfied with the dry fit, then using 30 minute epoxy put some in the slot and a light coating on the bottom of the control horn that will go into the slot and the bottom of the base plate (the lightly sanded side) that will mate to the exposed balsa and glue this in place on all 4 ailerons and allow to dry. See figure 3.

Figure 2

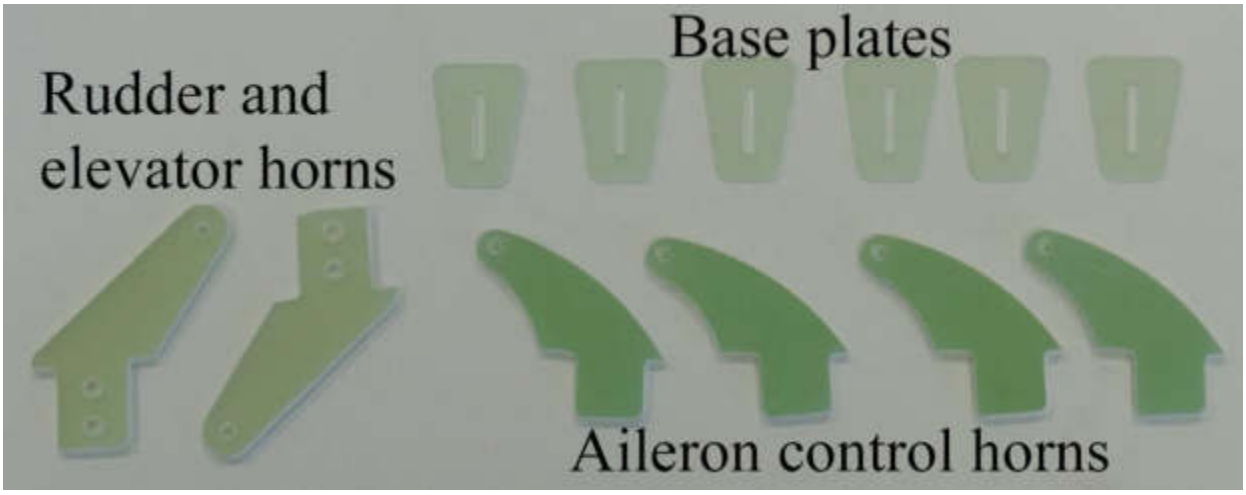
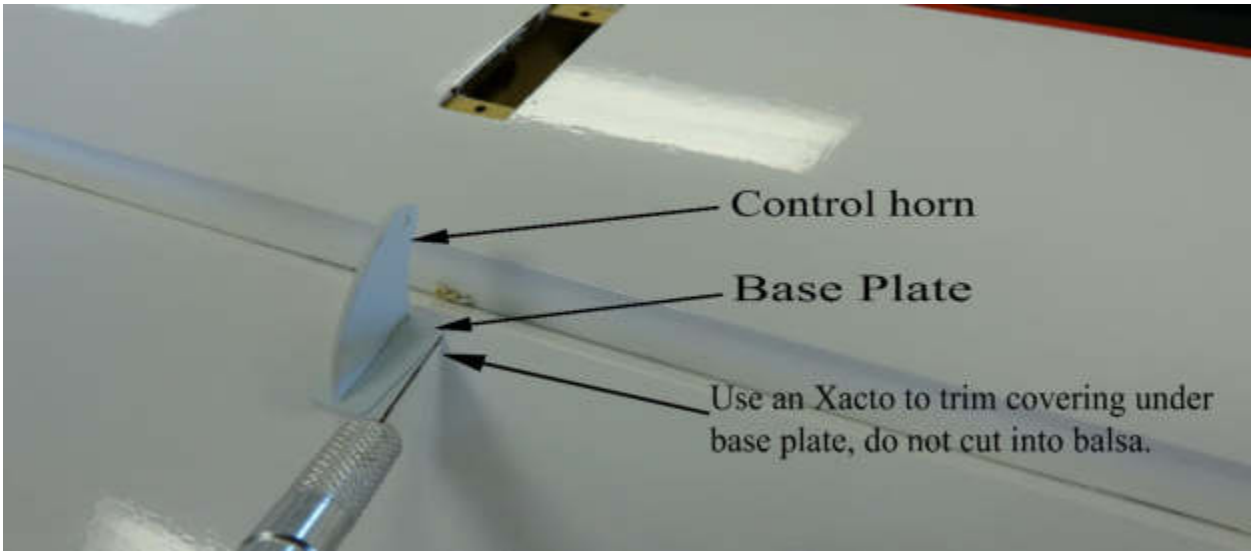


Figure 3



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3. Using your 4 micro servos (we recommend the MKS HV69 as seen in figure 4) we will now install these servos. Begin with the upper wings (they are shorter than the lower wings) and carefully pull the servo lead thru the wing and out of the wing root. Do this to the remaining upper wing half at this time. For the lower wings attach a 6" extension to the servo lead and then carefully pull it thru the wing and thru the wing root.

Figure 4



NOTE: Be sure to secure this extension to the servo lead in some permanent manner. Suggestions include tying the connection with dental floss or installing a piece of heat shrink over the connection then shrink. Using a plastic manufactured servo wire connector will work but may make it difficult to pull the lead thru the wing to the root.

-Step 3 continued-

Now secure the servo into the servo bay and orient the output shaft forward (towards the leading edge of the wing) and install the servo arm. Take the short pushrods, there will be 4 all the same length, thread a ball link onto each end about 15 turns. Locate (2) 2mm by 10mm long allen head bolts, 2mm washers and 2mm nylon insert nuts. I like to begin at the control horn, I install a washer onto the bolt, then insert that thru the eye of the ball link, then another washer and then thru the hole of the control horn and secure with a nylon insert nut. Now center your servo, this means align the servo arm with the hinge line, not perpendicular to the servo. Try to do this mechanically before using your transmitter, once this is complete put a washer onto the 2mm bolt, then thru the eye of the ball link and install onto the servo arm. You may need to turn the ball link in or out onto the pushrod to achieve the proper length, just try to turn each ball link equally. Always try to achieve a perfect setup mechanically first then go to your transmitter settings for final adjustment. If using the EFRC lightweight arms, use blue thread lock, a nylon

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insert nut is recommended on the bottom of the servo arm in any case. Make sure your servo moves the control surface in the correct direction and to the desired throw. If there is any binding fix it now, since we used CA hinges they generally do not bind, but if you have a stiff surface then unhook the pushrod and physically move the surface from bevel to bevel several times, this will loosen it up, repeat if necessary. Use these same procedures on the remaining wing halves. See figure 5.

Figure 5

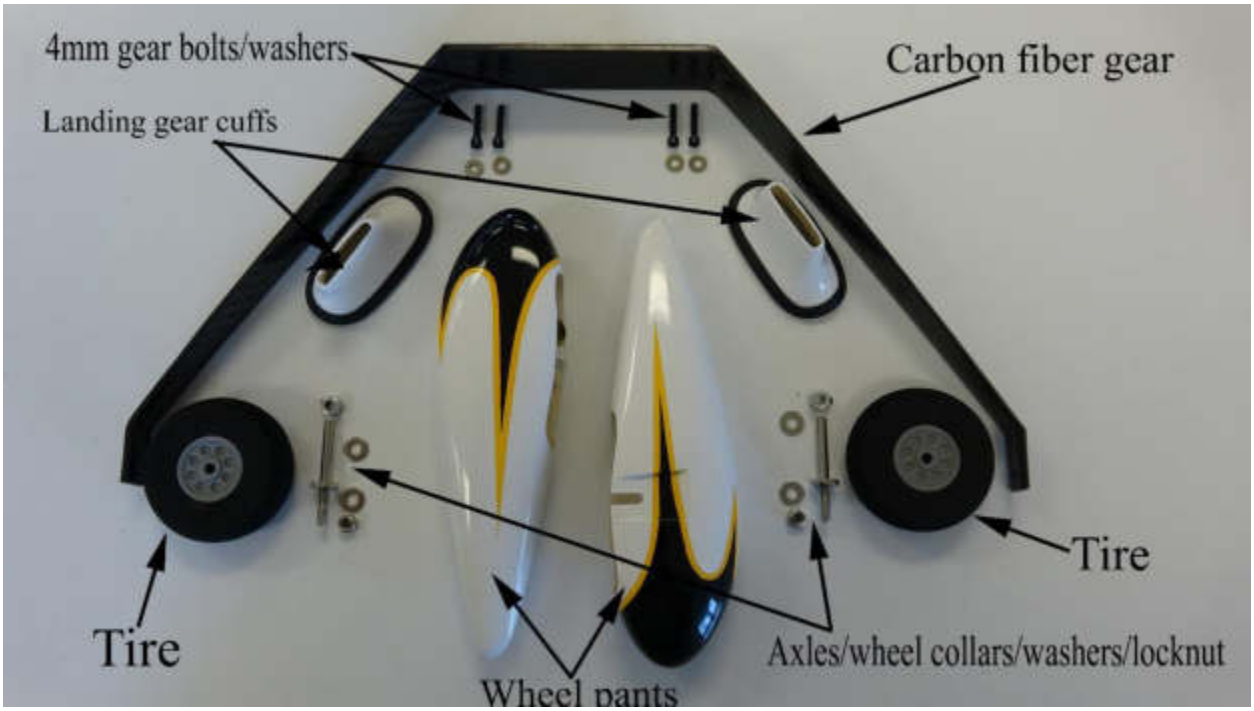


Landing Gear

4. Take a look at figure 6 and identify the various parts. Since we have the wheel cuffs, the order of assembly is important. First bolt the main gear to the fuselage. Begin by distinguishing which way the gear sweeps, I do this by laying the mounting flat onto a table and eyeball or hold a straight edge (such as a square) and you will be able to identify which way the gear is swept. The gear will mount with the sweep forward (towards the motor). Locate the (4) 4mm bolts and washers, apply a small amount of blue thread lock and then bolt the gear to the fuselage. There are blind nuts already installed, tighten and then locate the 2 wheel cuffs. Trial fit the cuffs onto the gear, I mounted mine with the end that has more sweep forward, but either way will work. Just be sure they fit flush against the fuselage, if they don't switch sides. Once the fit and look is satisfactory, I glued mine with Foam tac, welders adhesive or other flexible drying adhesives will work. I applied adhesive to the gear and cuff only.

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Figure 6



TIP: we used blue painters tape to hold the cuffs in place, as well as using the tape to seal around the area where the rubber edging meets the fuselage and the gear to cuff area to prevent any glue from running out.

-Step 4 continued-

Once the cuffs have dried, now locate the axles, tires, washers, nylon insert nuts, collars and pants. Install the axle into the gear and lightly secure with a nylon insert nut and washer. Slide the tire onto the axle, then fit the pant over the tire/axle assembly and you will notice the pant has a notch that fits to the gear. Center the tire on the axle so there is no rubbing as the tire spins, mark this spot then take the pant off and secure the collar to the axle. Use blue thread lock on the small set screw in the wheel collar. Using a file to make a small flat spot for the wheel collar's set screw will help it to stay in place. Now put the pant in place and secure with the 3mm bolt and washer and apply blue thread lock. Repeat for the other side of the gear. See figures 7, 8 and 9.

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Figure 7

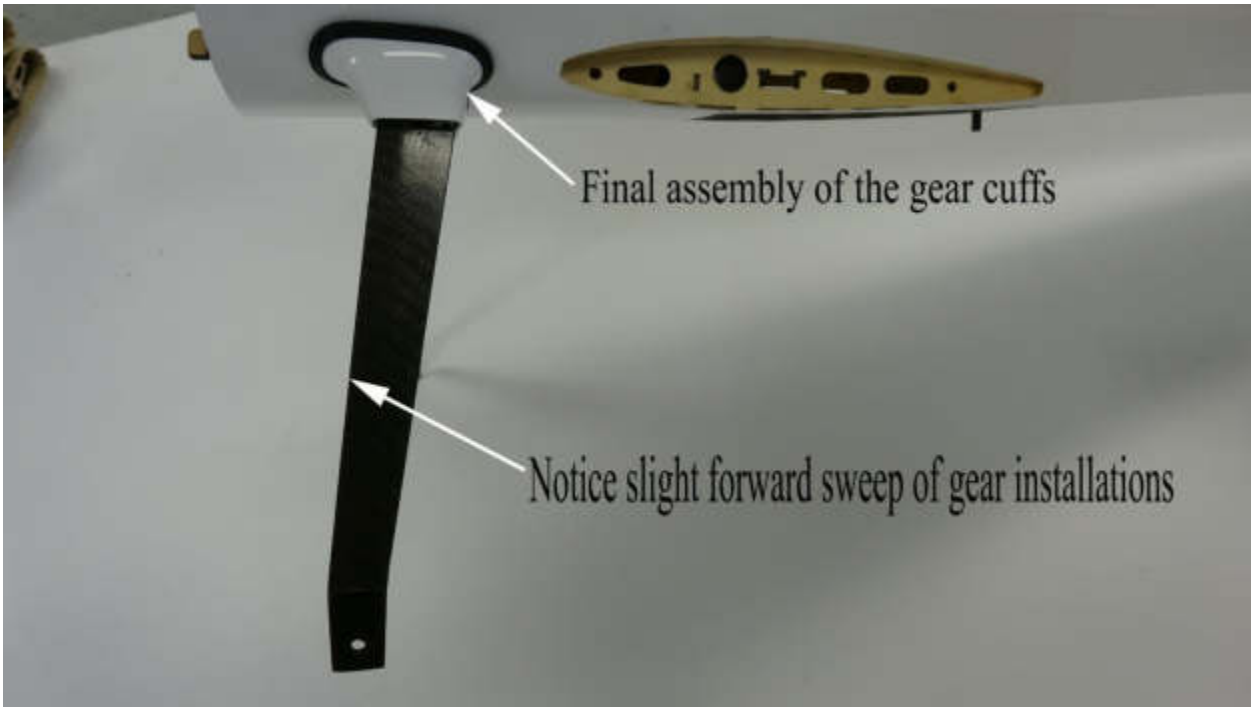


Figure 8



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Figure 9



Tailwheel assembly

5. Locate the tailwheel assembly and associated hardware, then review figure 10 for parts identification. We begin by mounting the tailwheel bracket mounting flat to the fuselage, trial fit first to be sure it is centered side to side then the pivot point of the bracket has to be centered to the rudder hinge line. Once the fit is correct, use a centering drill or similar to make pilot holes then install the 2 small wood screws and tighten. We will secure the tiller arm portion to the bottom of the rudder later in the assembly process, be sure to save that 3rd wood screw for that process. See figure 11.

TIP: applying a small drop of thin CA to either the wood screw or the pilot hole will help the screws to hold better.

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Figure 10

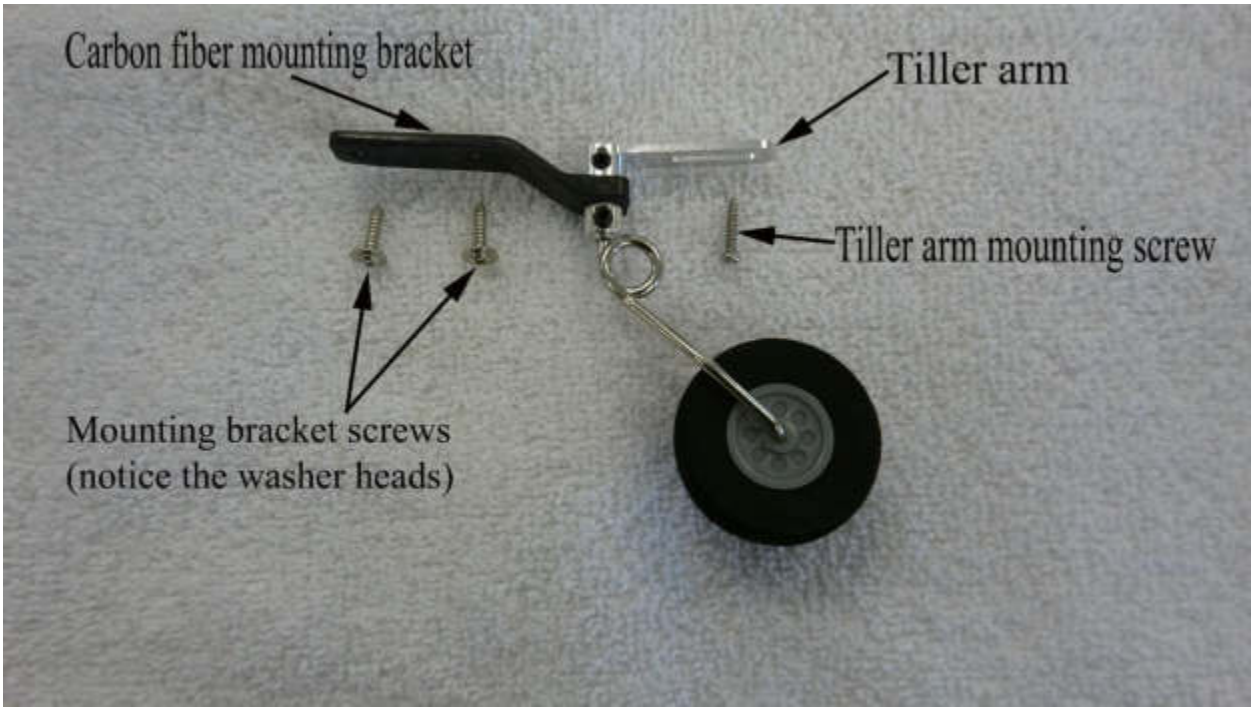
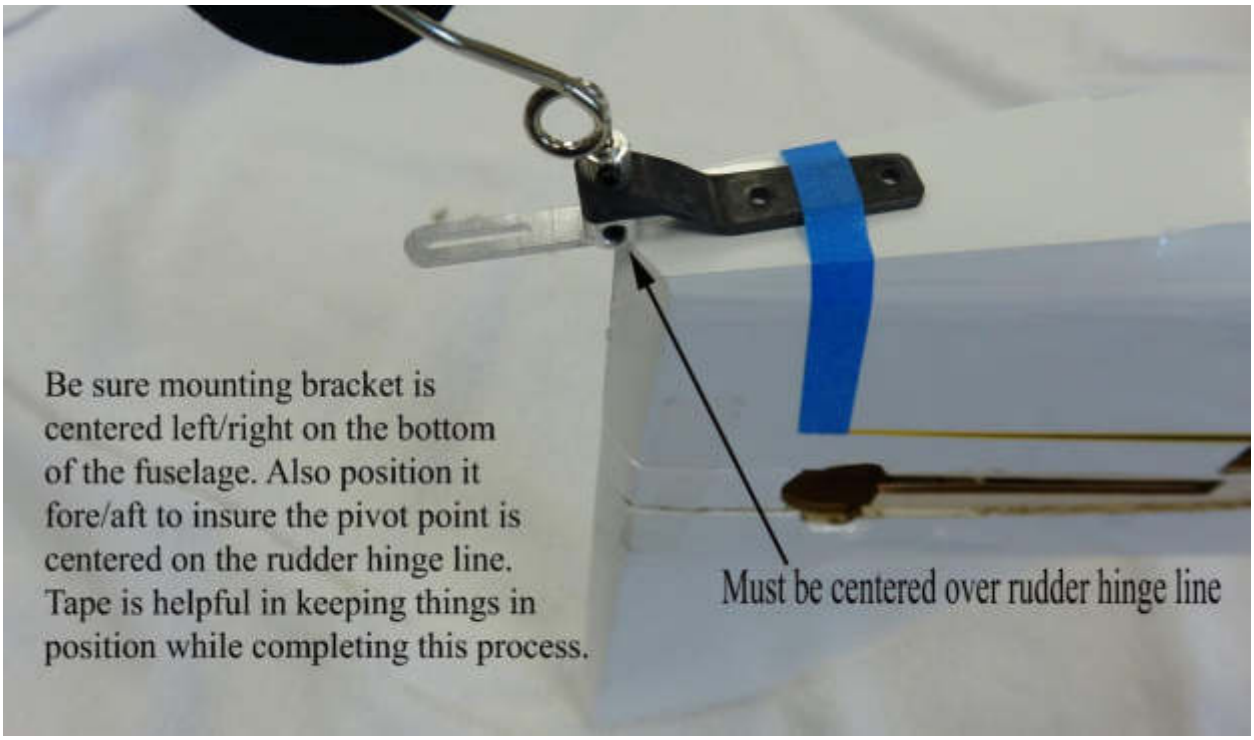


Figure 11



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Center wing installation

Locate the center wing section, 4 black struts and 3mm bolts/washers. The strut end that has two holes will go into the fuselage, the other end will attach to the wing. Begin by inserting the two hole end into the fuselage and install the bolts be sure to use blue thread lock. Do this to all 4 struts then mount the upper wing center section to those struts. It may require slight trimming to accommodate this attachment. See figures 12, 13 and 14.

Figure 12

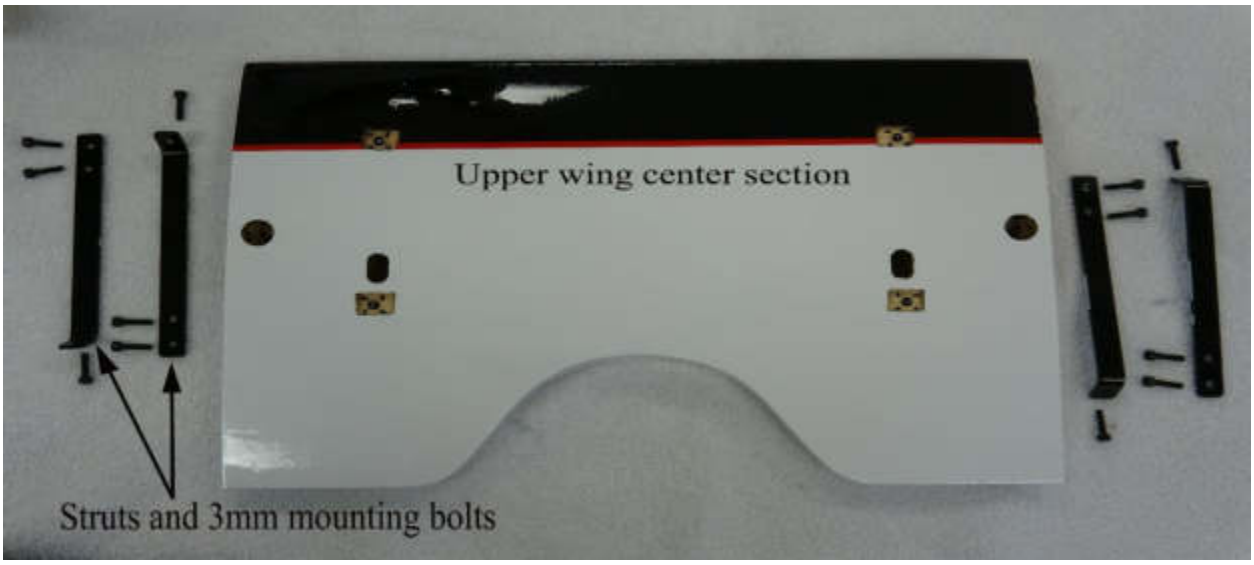


Figure 13

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Figure 14

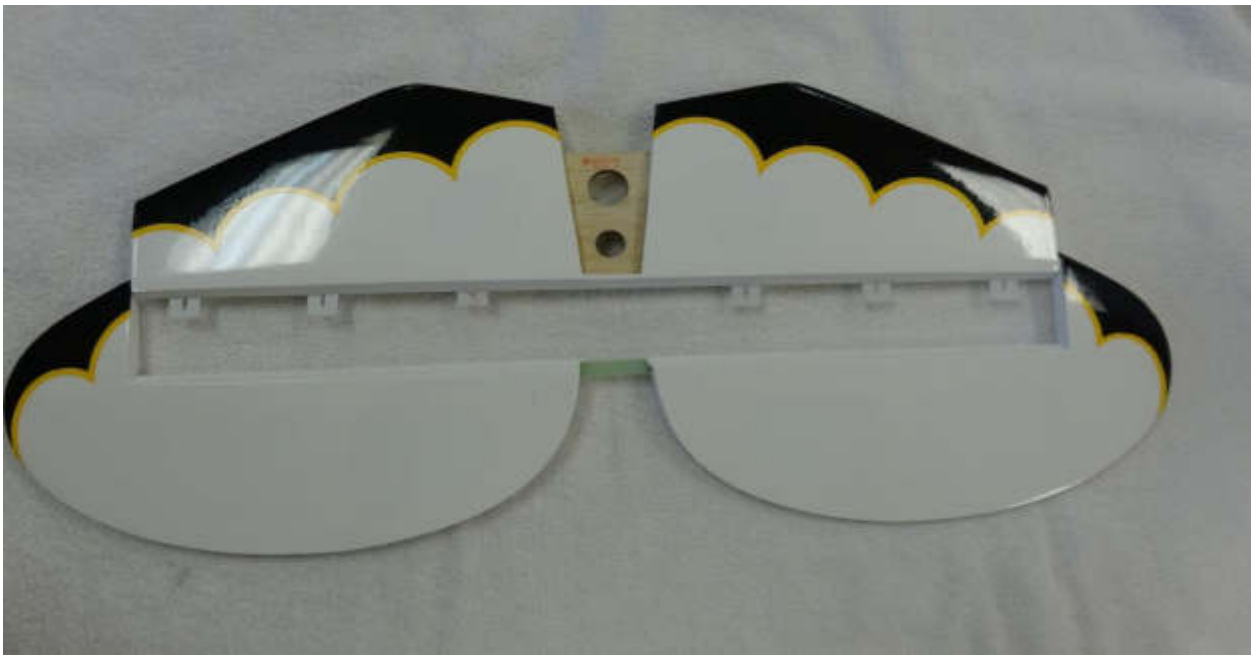


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Tail assembly

6. Locate the horizontal stabilizer and elevator, separate the two pieces and keep track of your CA hinges. You will need to remove the small plug in the rudder hinge line to insert the stabilizer, as well we suggest mounting the 4 wing halves. Now take the horizontal stabilizer and dry fit it into the slot, take a look from the front and back of the plane to assure it is parallel to the wings. Also check the orientation of the horizontal stabilizer, be sure the top side is up, one way to tell is to look at the covering scheme and make sure it matches the wings such that you have the proper side upright. Remove the stabilizer and use 30 minute epoxy to glue the stabilizer to the slot, reinstall the stabilizer and allow to fully dry. Now hinge the elevator to the horizontal stabilizer using the same methods as did when hinging the ailerons. Once hinged, now reinstall the small plug back into its slot, you may now install the elevator control horn/base plate and this will complete the horizontal/elevator assembly. See figures 15 - 19.

Figure 15



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Figure 16

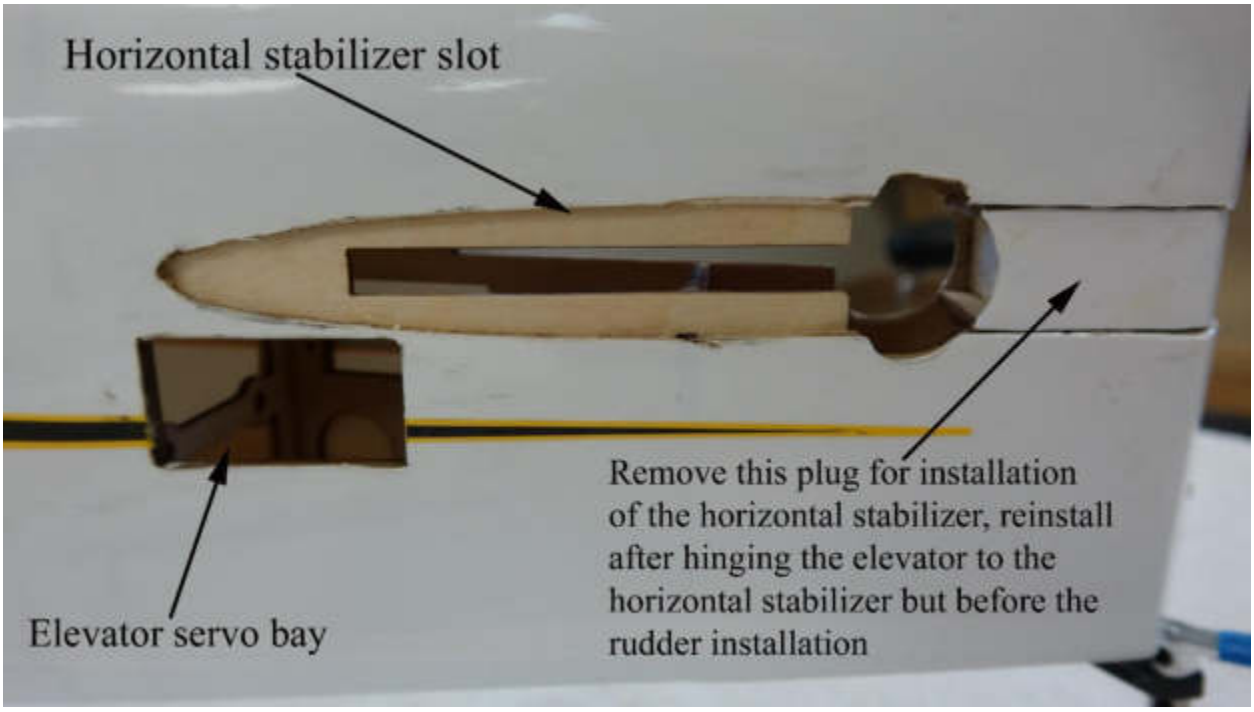


Figure 17

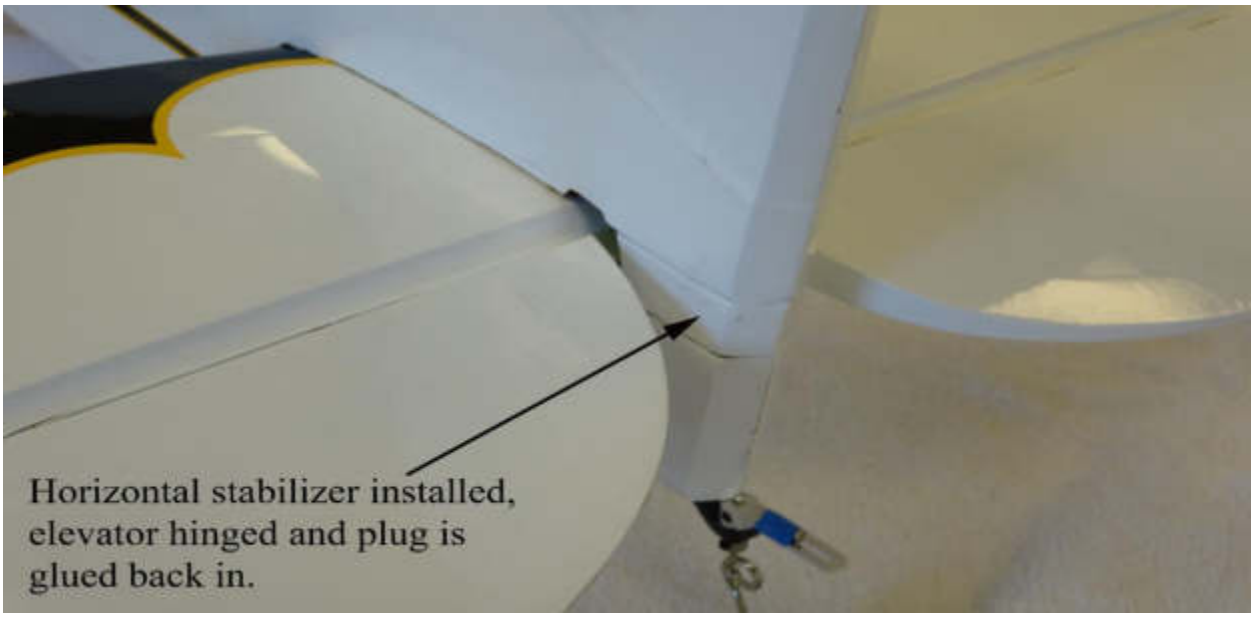


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Figure 18



Figure 19



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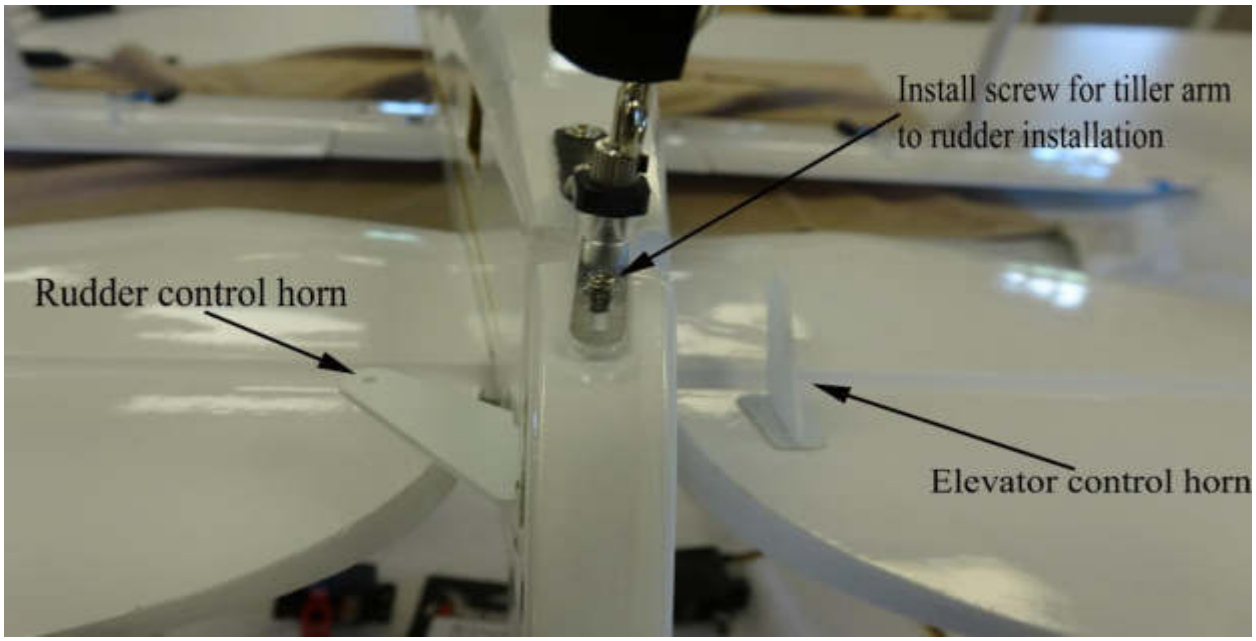
Rudder installation

7. Next locate the rudder and we will begin hinging it to the vertical stabilizer. Using the same methods as before, I chose to insert the CA hinges into the vertical stabilizer then slide the rudder onto those hinges to complete the process. Locate that remaining tailwheel screw and insert it into the tiller arm then into the bottom of the rudder. Now install the control horn for the rudder and this will complete the rudder installation. See figures 20 and 21.

Figure 20



Figure 21

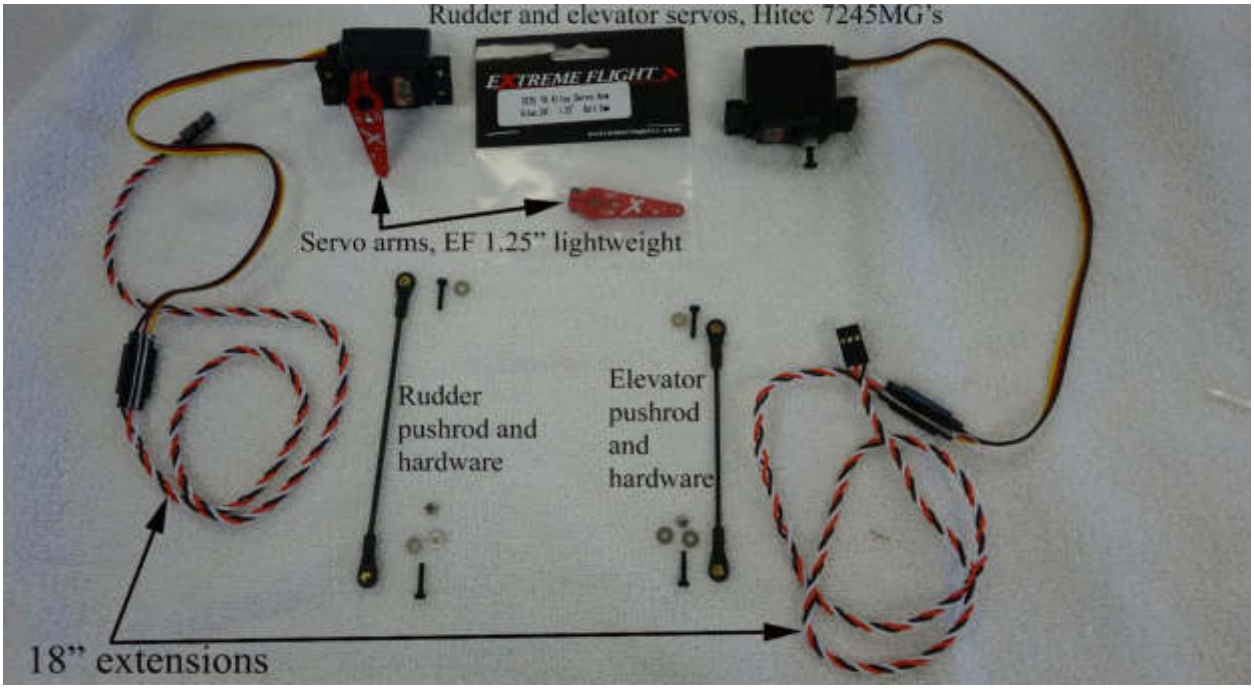


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Rudder and elevator servo installations

8. Now locate your rudder and elevator servos, hardware, extensions and servo arms. See figure 22.

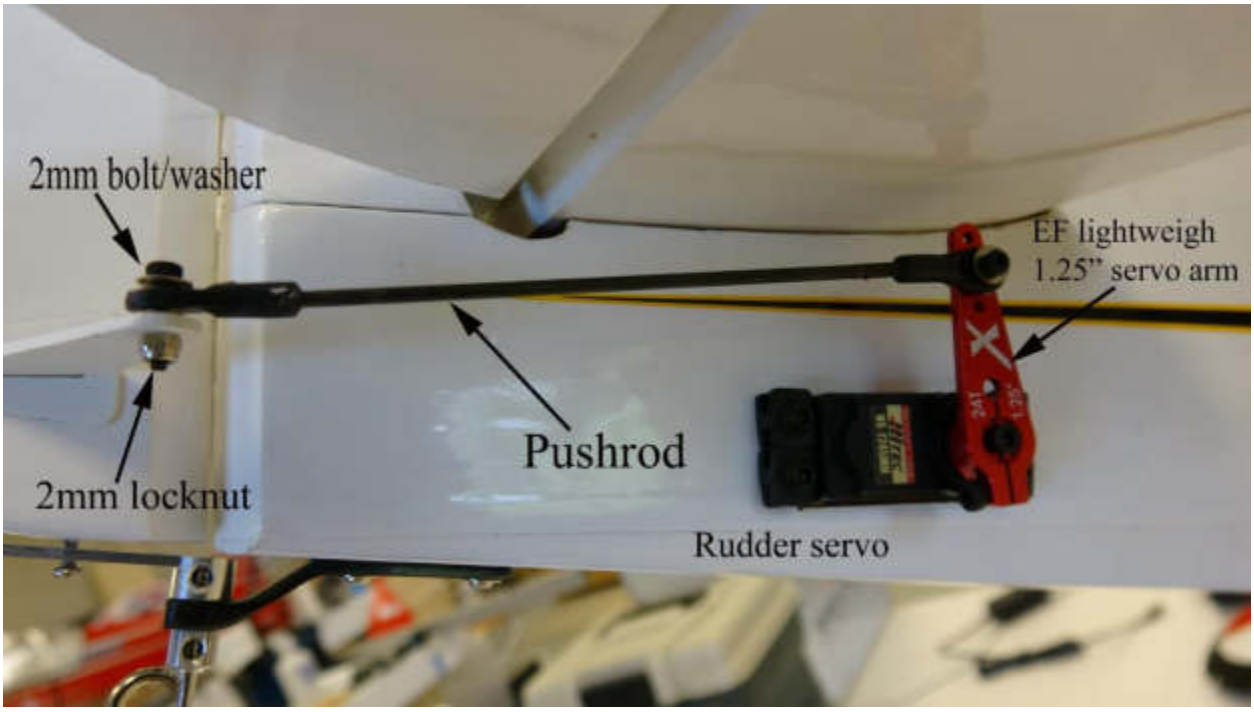
Figure 22



Next you will pull the extension/servo wires thru the fuselage then secure the servo to the respective servo bay using hardware supplied by the servo manufacturer, the servo output shaft should be oriented forward for both the rudder and elevator. We suggest Extreme Flight RC servo socket head screws to secure our servos, available in 30 or 100 quantity packs, they make the overall look more pleasing and are socket head so much easier to install. Now thread the ball links onto each end of the pushrods, start by threading them about 12-15 turns, now center your servos with your transmitter, the longer of the two pushrods is for the rudder, the shorter of the two is for the elevator. Next install the servo arm, we used Extreme Flight RC 1.25" lightweight arms as shown in figure 19. With the control surface centered, trial fit the pushrod and see if it fits, if not turn the ball link on each end equal number of turns till the overall pushrod is of proper length. Then using the same procedure as in step 3 with the ailerons you may install the pushrod/ball links. Also be sure the servo arm is perpendicular to the control horn, once this has been adjusted mechanically as much as can be, then make any small final adjustments in your transmitter. We will give suggested throws/expo at the end of this manual. See figures 23 and 24.

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Figure 23



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Figure 24



Motor and ESC installation

If using the Torque 4016-500KV MKII motor from Extreme Flight, the installation is quite easy. The motor will need to have the X Mount and prop adapter installed, refer to the included instructions and figure below. The firewall is already spaced for this motor, simply locate the 4mm mounting bolts/washers and bolt the motor to the firewall, blind nuts are already installed so just apply some blue thread lock. We used the Castle Creations Talon 90 ESC, you will need to resolder the motor bullet connectors to use the CC Talon 90 as it has bigger bullet connectors, CC provides these with the Talon 90. See figures 25 – 28.

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Figure 25

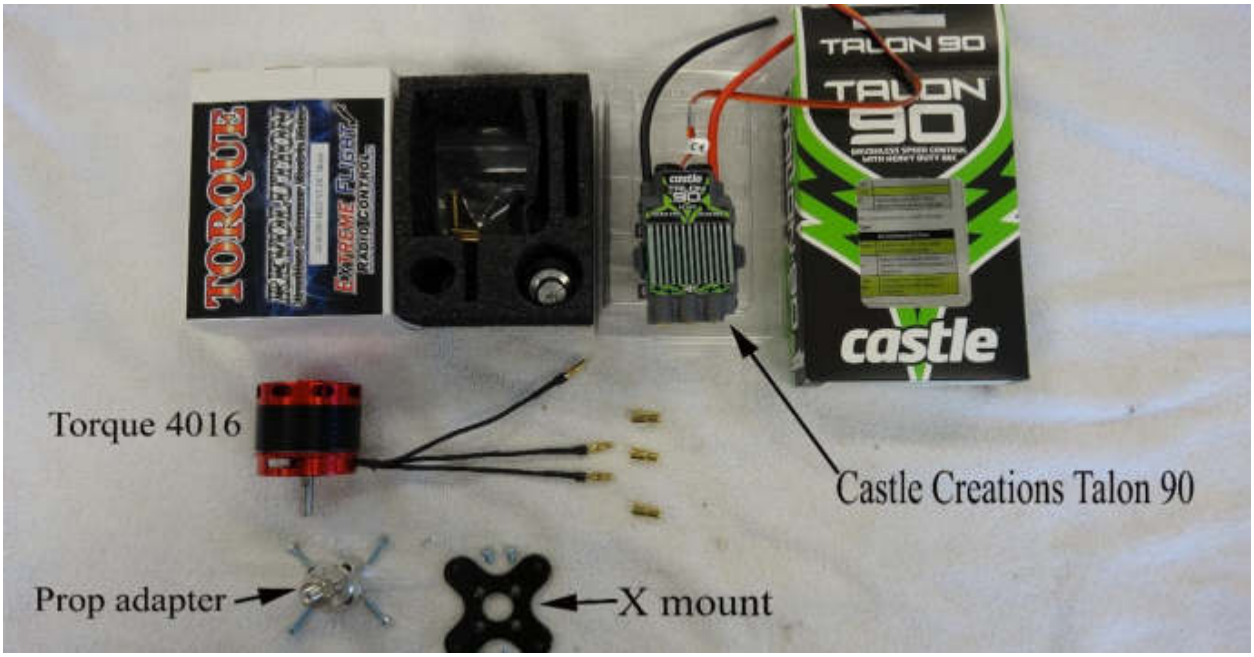
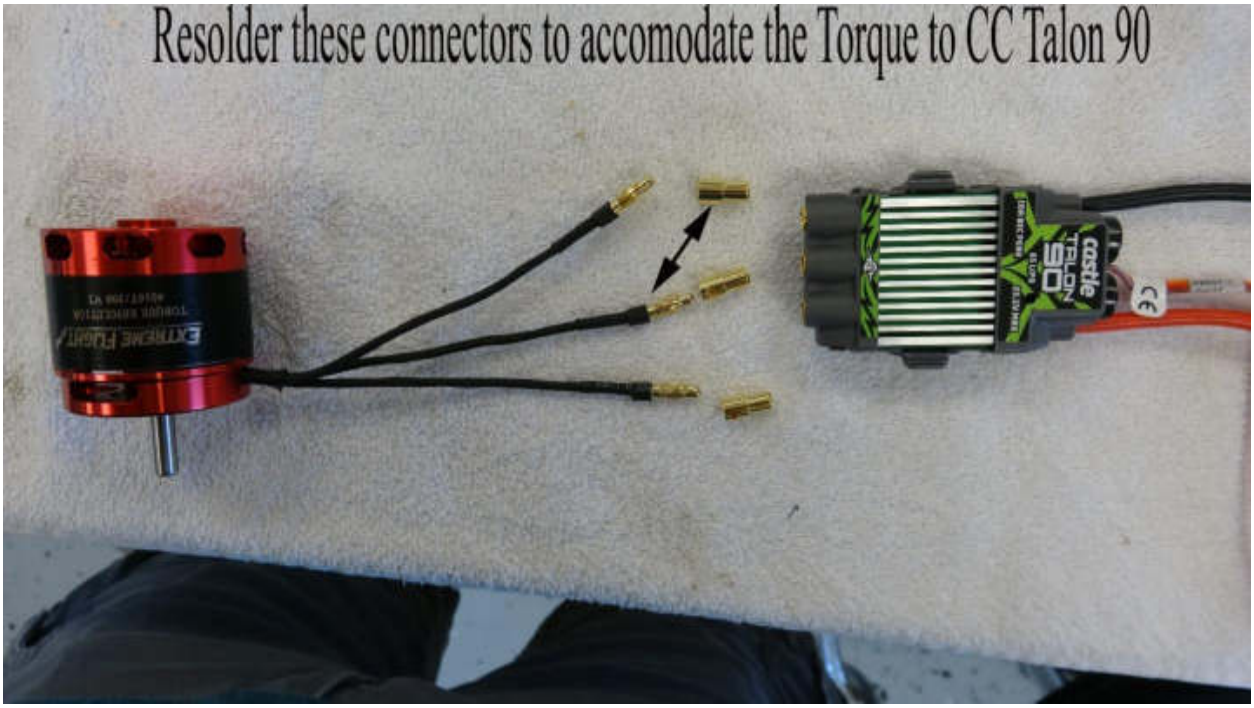


Figure 26

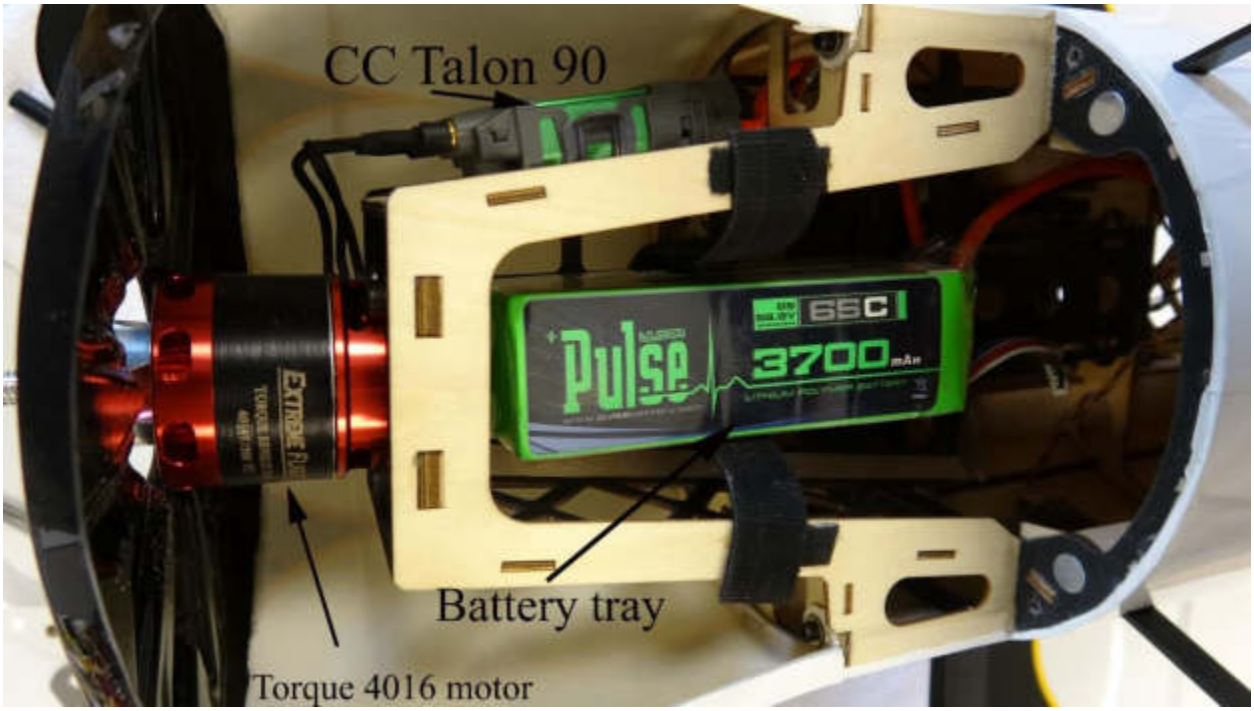


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Figure 27



Figure 28

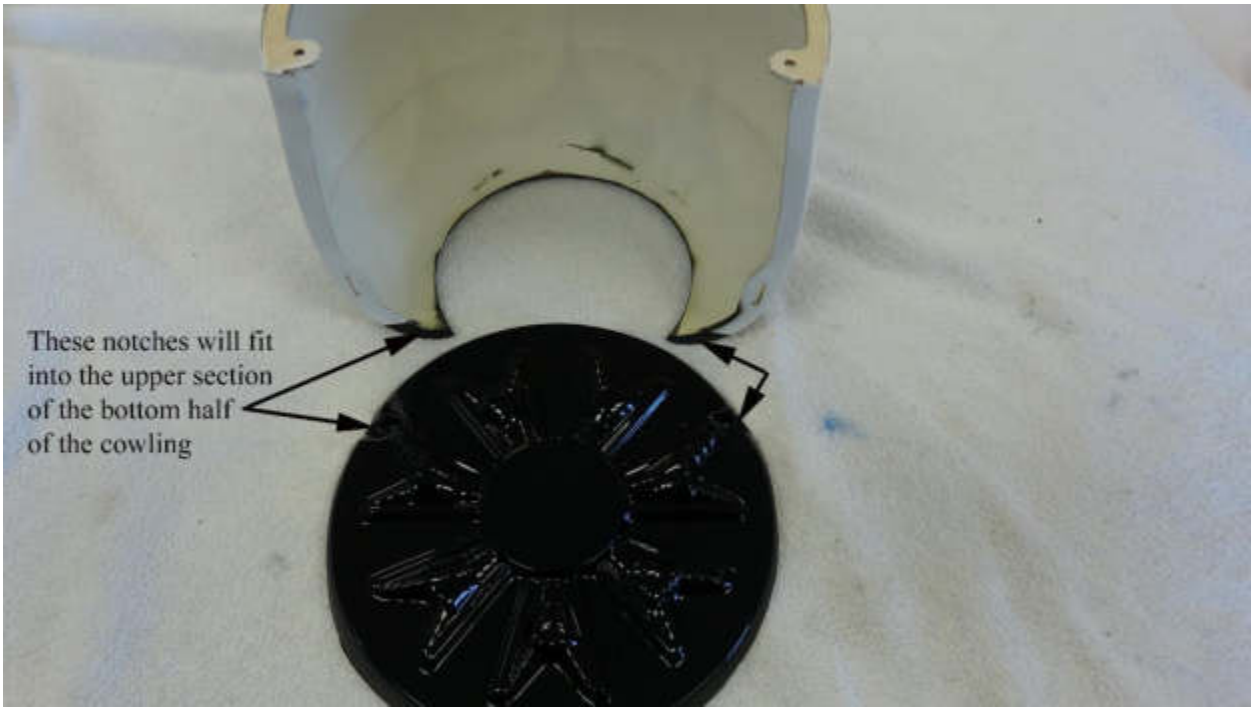


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Cowling

10. The top of the cowling has no bolts and is easily removable for access to the battery compartment. It is held in place with 2 magnets and hooks. Locate the radial engine piece and trial fit the piece into the bottom half of the cowling. Notice there are two notches in this piece and they fit to the upper portion of the cowling. It should fit with no shaping necessary. However, it is wise to sand the areas that will mate to the bottom section of the cowling to enhance the glue joint. We also suggest cutting a hole in the center of the piece to allow your choice of motor to protrude, cut as necessary. Once the trial fitting is satisfactory, glue in place. We used foam tac, however epoxy, welders adhesive as well as other adhesives will work. We only glue the radial engine piece to the bottom half of the cowling, the top half does not receive any glue because it has to be removed for battery access. See figures 29 and 30.

Figure 29



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Figure 30



Final assembly

11. We will now fish two 18” servo extension wires from the upper wing center section into the fuselage. There are holes in the wing and fuselage to run these extensions, refer to figure 31 for our setup. You can use black electrical tape or heat shrink to disguise these wires as they run along the struts.

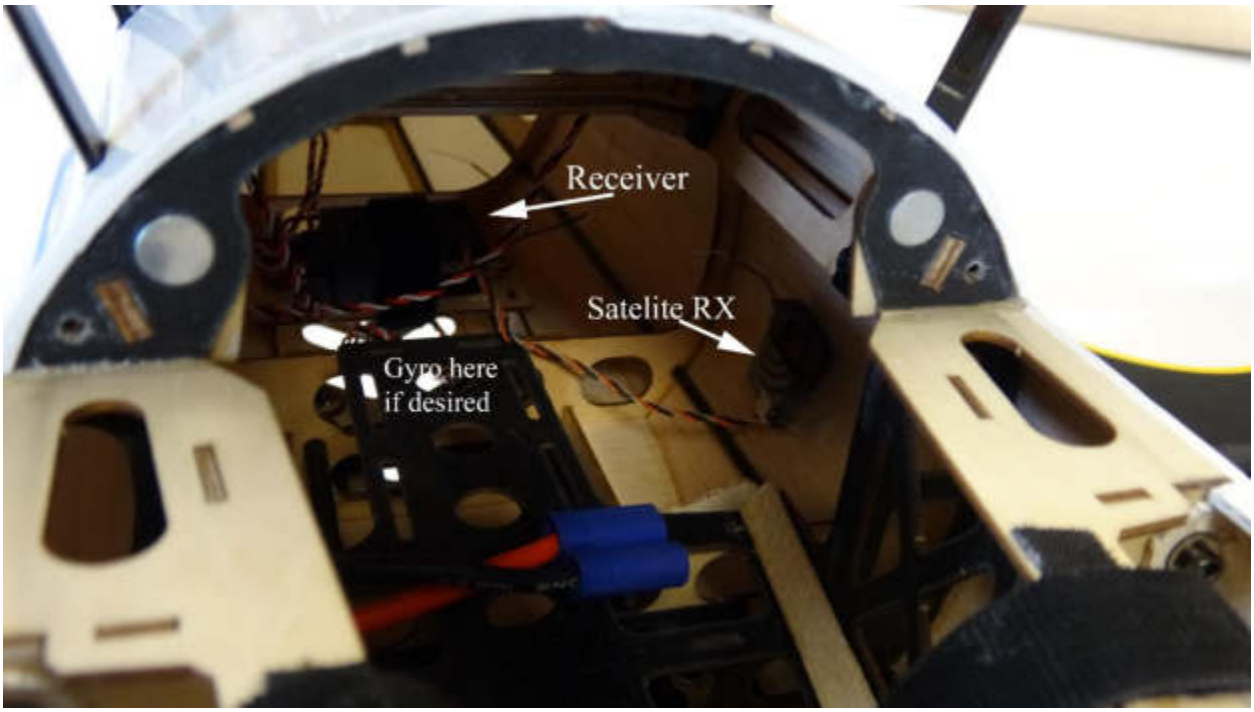
Figure 31



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Now choose a location to mount your receiver, we used the platform that is located just inside the removable hatch on the bottom of the fuselage. We also used an Aura flight control system (gyro) and mounted it on the aft portion of the battery tray. See figure 32.

Figure 32



Any satellite receivers can be mounted to the fuselage sides.

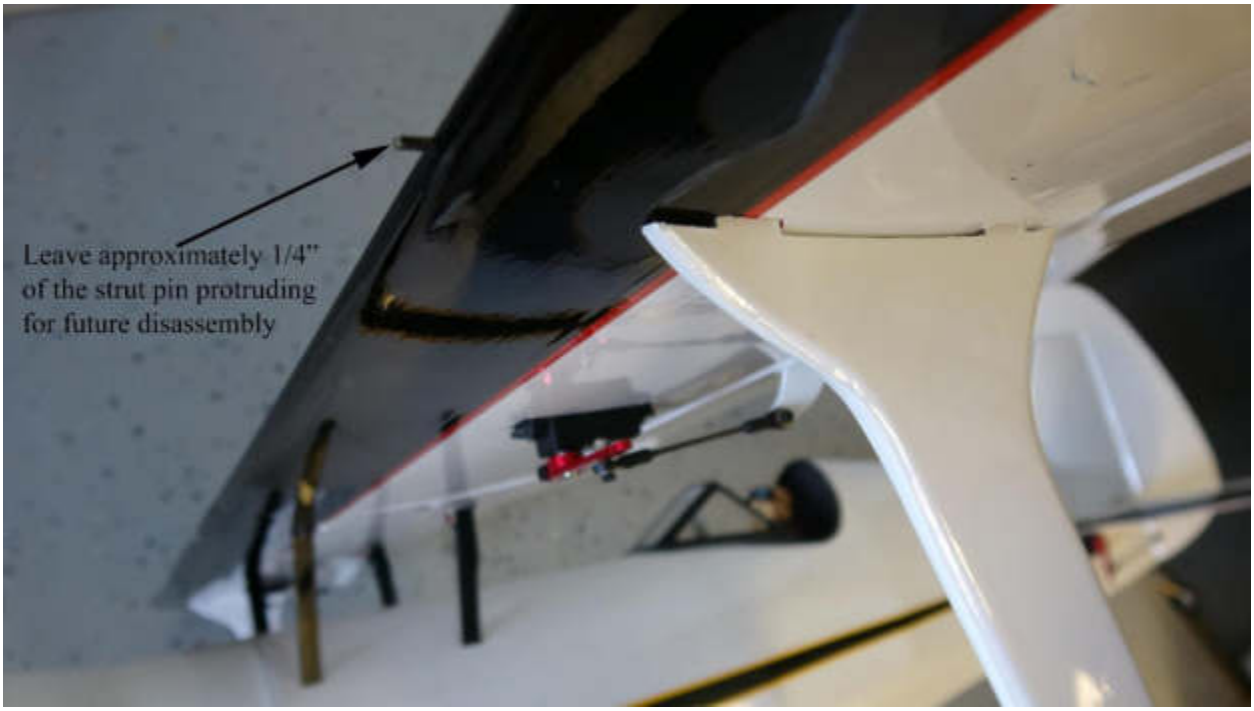
The wings are mounted by sliding the carbon tubes into the wing receptacles and then slide one wing on at a time, be sure the tube is fully inserted into the wing before installing the remaining wing half. It does not matter if you install the upper or lower wings first. Once the wings are installed and bolted on using the (4) supplied 3mm bolts/washers then install the struts. The struts are installed by orientating the larger end on the lower wing. Gently pull the top and bottom wing tips apart just enough to slide the strut into the slots for the. I prefer to insert the top portion first then the lower portion into the bottom wing. Next locate the 4 pins and insert the pointed end into the leading edge of the wing and slide them all the way till about ¼" of the pin is protruding. Do not push the pins flush with the wing's leading as they will be difficult to remove should you ever want to disassemble the airplane. See figures 33 and 34.

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Figure 33



Figure 34



We suggest a 16X7 propeller if using the Torque 4016 motor, it can now be mounted to the motor and using the supplied prop nut yields a nice overall look.

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Setup/Throws

Center of gravity: we balanced ours using the top wing as our reference. There are two holes where the wing bolts are located, the CG range is front of that hole to 1” behind the hole. Move the 6S fore/aft in the battery tray to the desired CG location. See figure 35 for locating the CG range and figure 36 for our battery location.

Figure 35

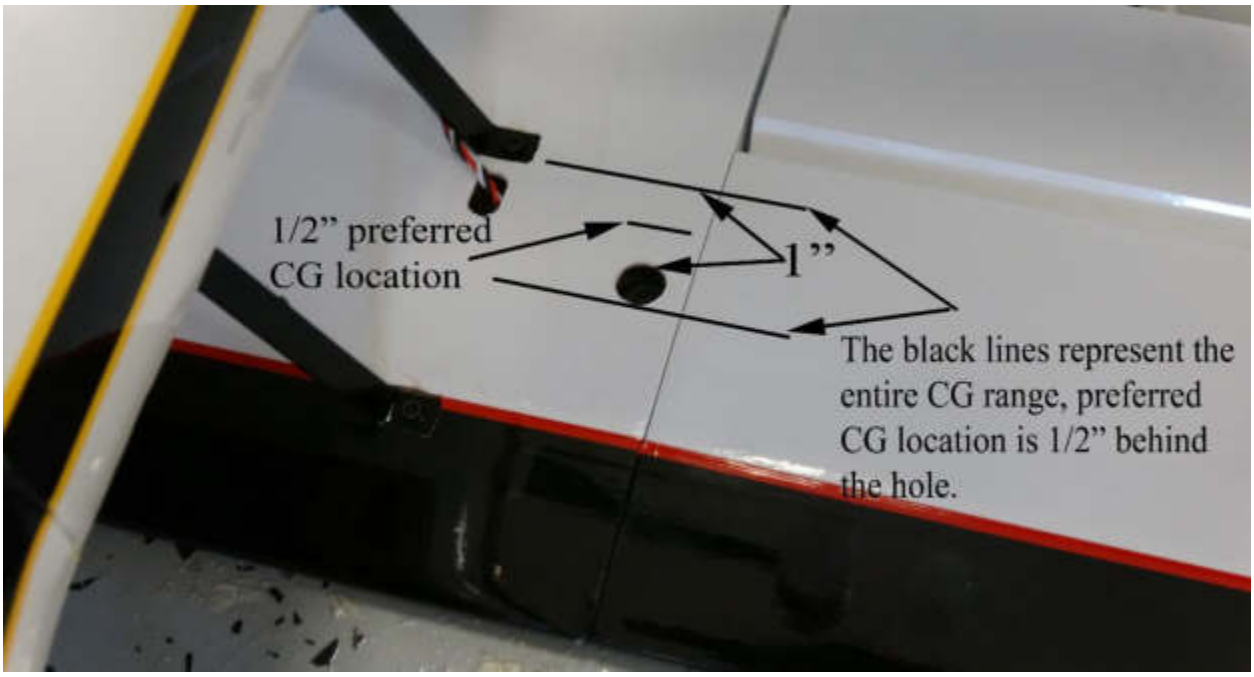


Figure 36



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Recommended throws:

Ailerons	Elevator	Rudder

Low: 5/8” or 15 degrees/20% expo…3/4” or 15 degrees/20% expo...2” left & right/25% expo

Med.: 1 1/4” or 25 degrees/30% expo…1 1/4” or 23 degrees/30% expo…2.5” Lt/Rt./35% expo

High: 1 3/4” or 37 degrees/40% expo…1 3/4” or 30 degrees/40% expo...3” Lt/Rt, 40-45% expo

Note: the throws are measured by an angle finder or holding a ruler to the outer most portion/where the chord is the widest of the control surface. Be advised the high rates will make the Muscle Bipe extremely responsive and is only recommended for expert fliers.

Gyro: we used the Aura 8 flight control system. There are various ways to setup a gyro, we will look at our setup. First go to www.flexinnovations.com and refer to their instructions regarding the Aura 8 FCS. We chose to run a separate receiver and setup up the gyro using the downloaded software. This allows you to make all adjustments thru a computer directly into the Aura 8.

Flying the Muscle Bipe: this is not a dedicated 3D plane and as such excels at sport flying and classic aerobatic maneuvers. You will find with a proper setup the Muscle Bipe is a very mild mannered airplane and is capable of loops/rolls/spins/knife edge flight and various derivatives of those base maneuvers. Takeoffs should be made by slowly advancing the throttle and guiding it with the rudder, it will likely become airborne before full throttle is achieved and this is normal. Landings are made by establishing a constant glide path and just before touch down slowly retard the throttle and touching down.

Thanks again for your purchase of the Legacy Aviation Muscle Bipe!

Jeff Williams

Team Extreme

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