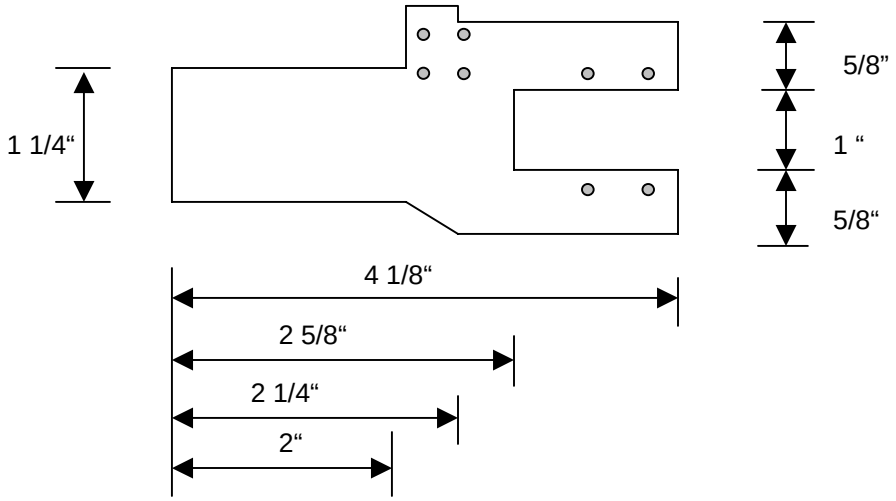
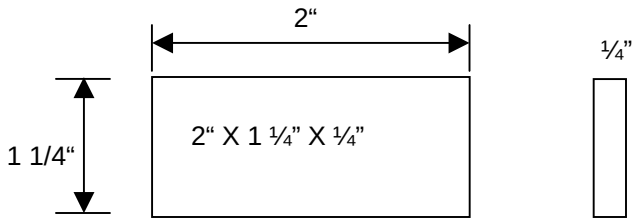
Here are a few dimensions that you can use as a guideline for construction. I will start at the front end and work our way back.

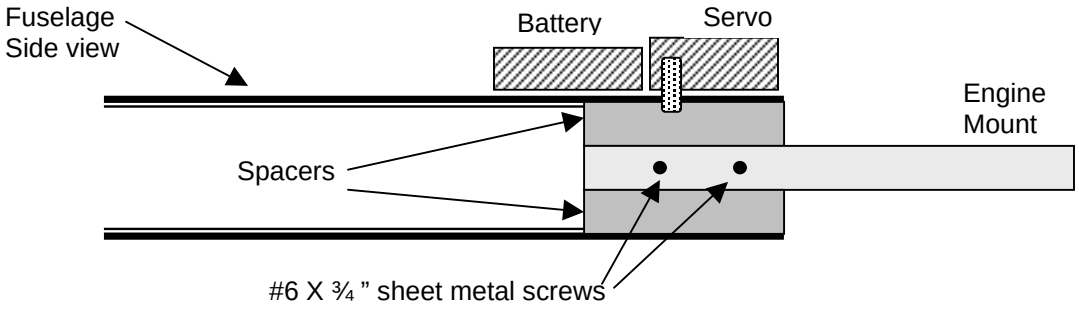
Everybody probably knows how to make a HDPE motor mount but here is how I make mine.



The shaded areas are the engine mounting holes and the holes for cable tying the needle valve in place. The 5/8” width of the engine mounting rails was determined through experience. I wanted enough strength there so that the mount would not break easily but would break just before splitting out the opening in the fuselage. Don’t ask how many dirt naps it took before selecting 5/8”.

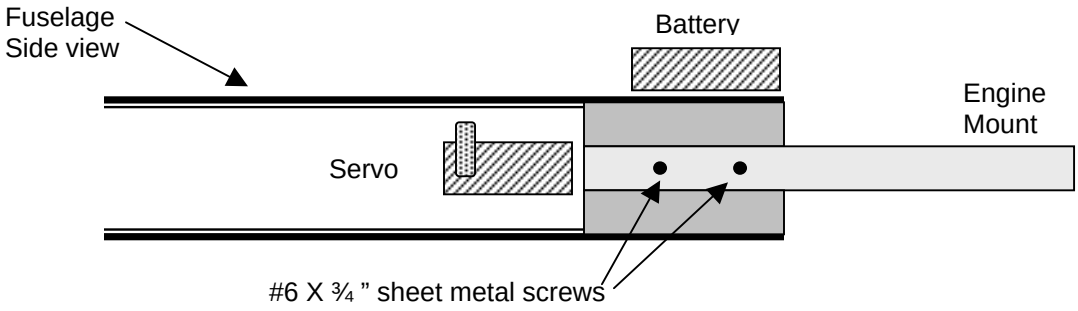


I make a couple of 2” by 1 ¼ ” by ¼ “ spacers to fit above and below the engine mount, inside the fuselage. These allow the whole fuselage to help support the engine mount instead of just the screws. I sand them to a snug fit, cover each with packing tape to fuel proof them and mount one above and below the engine mount, inside the fuselage. Secure the engine mount with two screws on each side.



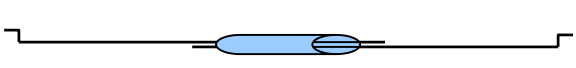
I mount an HS-81 throttle servo just behind the engine and the battery pack just behind that. I secure the servo with Goop and drill holes for a cable tie. I orient the cable tie front to rear and leave the connection lock on the top so that it will not get damaged during landings. Secure the battery with Velcro and a cable tie also oriented front to rear. If you orient the cable tie across the battery and servo they may slip out from under the tie during a dirt nap. Lou taped his battery in place and that will work too. Lou also cut out an opening in the side of the fuselage just behind the engine mount and mounted the servo with normal mounting screws. The downside to this method is that it weakens the fuselage at that point and it can break there during a hard dirt nap.

Alternate servo and battery installation



Throttle pushrod

I make up a throttle pushrod by using two pieces of small gauge piano wire with a Z bend in one end and 1” of ½A size fuel tubing. I don’t remember the exact diameter of the piano wire but it is the same diameter as the standard hole in a control horn or servo arm.



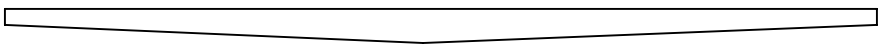
This is probably pretty common usage and allows a good enough connection to operate the throttle barrel but will come apart during a crash before you can break a servo arm or strip out the servo gears.

Cut the fuselage to 22". Lou explained earlier how this number was derived. Drill holes for a tight fit of two ¼ " wing hold down dowels. The holes should be approximately 4 $^{7}/_{8}$ " and 15" back from the front edge of the fuselage. The exact placement of the wing is determined by your flying style. Lou balanced his at 2 ¾ " back from the leading edge and he thinks that it may be a touch nose heavy. As you move the CG more to the rear, the plane will get more sensitive in the pitch attitude. I adjust mine so that on 100% throw on high rates it will just snap out on a full control high speed loop. I then reduce that to 70% on low rates and fly it there. I may switch the rates back and forth during a heat depending on how excited I am or whether I am towing a streamer or not. A full streamer attached to the back edge of the fuselage will reduce the pitch sensitivity. I like to have mine set up where it will almost cut my own streamer in a tight loop. When you are doing your initial trim flights you can drill more dowel mounting holes to shift the wing and CG to suit you.

Wing construction

Wing construction is pretty straight forward and everyone has their own preferences. I will throw out a couple of things that I do that may be of interest. The wings that I am currently flying have a span of 60" with a 11 ½" root cord and 7 ½" tip cord. Total area is aproximately 570 square inches. Each leading edge is swept back 1". It has the EPP leading edge and full span $^{1}/_{8}$" diameter fiberglass rods for spars on the top and bottom. I have a home made needle about 3" long that I use to sew the top spar to the bottom spar every 4" of the span. I use upholstery thread that is impossible to break with your hands. After I loop the thread around the top and bottom rods I tie a very tight slip knot and tighten it up as much as I can comfortably do it. I then pull the knot down inside the wing and trim flush. I then ProBond the whole thing together and this creats an I-beam type construction where one spar works in conjunction with the other for greater strength. I have never had a spar come loose from the foam using this method. Lou does his a little differently, he uses small cable ties instead of upholstery thread and puts the ProBond in the spar slot before installing the rod and tightning the cable tie.

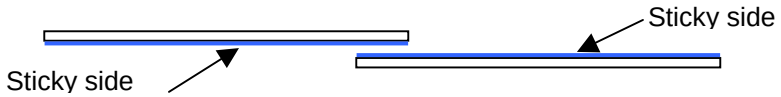
When I join the wing halves, I cut the correct angle at the two root sections and glue the wing halves together upside down on a flat surface. This results in the top of the wing being flat from tip to tip and the bottom of the wing appears to have a little dihedral. The idea here is to try to make the wing a little more of a stable platform.



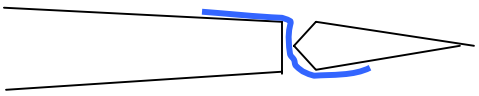
The original wing design had winglets at each tip. I believe the theory is this will help stabilize the plane in the yaw axis. I noticed that there was a decrease in roll rate with the winglets installe, so I took them off and increased the area of the vertical fin to get the yaw stability.

With the YH airfoil mounted on a flat surface, like the fence post fuselage, my incidence meter says that it has a positive 3 degrees of incidence. If you shim the trailing edge ¼ " then the incidence is reduced to a positive 1 degree. I fly mine at positive 1 deg. and Lou flew his at 3 deg. and we could not tell much difference.

The 2" ailerons give the plane a super roll rate, as good as anything else on the combat circuit. Again Lou and I have a different technique for installing ailerons. Lou uses a 4" wide piece of BiDi and he starts at the top side of the trailing edge and wraps the tape around the full length of the aileron and then back to the bottom side of the trailing edge. This gives a very strong hinge connection and seals the gap. The downside is that it adds load to the servo. My technique uses the over and under hinge which is almost frictionless and loads the servo very little. I cut strips of BiDi 1 ½ " long and 1" wide. I then stick two pieces of BiDi together sticky side to sticky side with a ¼ " overlap. This gives me a piece of hinge material 2 ¾ " long.



I then start by sticking the tape down on the top side of the wing with the overlap at the trailing edge and stick it to the bottom side of the aileron.



Alternate starting on the top side and then the bottom side of the wing. I install the hinges in groups of four and do four at the tip, four at the root and four in the center.

Horziontal Stab

The horziontal stab is 4 mil. Coroplast and should be approximately 20% of the area of the wing. Mine is 16" span and a 5" tip and 6 ¼ "

root. The elevator measures 1 ¾ " (8 flutes) I cut away all of the hinge every other inch in order to reduce hinge friction and the subsequent load on the elevator servo. Mount the stab centered with the elevator hinge line just aft of the trailing edge of fuselage. Secure with 4 #6 X ¾ " sheet metal screws. I run a shis-ka-bob skewer through the flute just in front of the elevator hinge to improve stiffness. I use an HS-81MG and mount the elevator servo on the top of the fuselage just in front of the stab using Goop and cable ties.

Vertical Fin

Fin is also 4 mil. Coroplast and the area should be approximately 20% of the area of the horziontal stab. It can be more but not any less. The fin should be designed to have the flutes vertical. A tall fin is handy for catching streamers but tends to want to flutter and move around at speed. Short coupled planes tend to want to swim through the air like a fish if they don't have sufficient fin area. I prefer to have my fin tall enough to catch a streamer or two and I increase the depth so that it extends about 4" past the end of the elevator. This gives adequate stability on the yaw axis. Some combat designs have the fin extending below the stab as well as above it. This helps the stability but I just hate to land on the fin or have to be careful of bending it during storage. Again I run a skewer through the center from front to back to give it some stiffness. Mount the fin using three plastic dry wall anchors and #8 X ¾ sheet metal screws. Glue the anchors into the flutes at the bottom of the fin with CA. Space them about an inch apart starting at the leading edge. Screw them in from the bottom side of the fuselage.