

"Buhor 25"



Type: Trainer
 Engine: .25 2-stroke
 Wingspan: 60"
 Wing type: 5" Dihedral, flat bottom
 Chord: 12" including ailerons
 Length: 36" fuse, 42" total
 Weight: 4 lbs, 4 oz.
 Wingloading: 13.6 oz./sq. ft.
 Radio: 4 ch, 4 standard servos

Design by Chris (aka ChrisSpad)

The "Buhor 25" is the answer to those who have asked for a simple to build Spad trainer aircraft that can utilize the popular .25 size engine. It borrows from the original BUHOR, or *Big Ugly Hell On Rails*, in the use of an aluminum rail to simplify construction. Here, a single length of C-Channel aluminum rail is used. That, along with 2mm coro for the wing, brings the weight of the materials down far enough to where a .25 engine will fly this trainer with performance to spare! Why design and build a trainer for a .25 engine when a .46 is so much stronger? Well, .25's are usually cheaper, some people already have them lying around and would like to put them to this use, and they are also much more fuel efficient than a .46, meaning they will fly much much longer on 8 oz. of glow fuel. This results in extended flying sessions. Some popular choices you should consider are the O.S. .25FX (my favorite), the Magnum XL .25A, the GMS .25, or any .25 engine with ball bearings and good power. Avoid weaker bushing-type engines, such as the O.S. .25LA. These plans are meant to be studied and followed in conjunction with the original BUHOR plans as well as the BUHOR DIHEDRAL WING instructions. Also, if you're are new to Spads, new to R/C planes, or both, it is very important that you enlist the help of a qualified instructor to guide you in this process from the beginning, both with the building phase and with flying it as well! Also spend an afternoon reading up on all the materials at www.spadtothebone.com. As a beginner, if you ignore all of this advice and go at it alone, **YOU WILL CRASH YOUR PLANE**. Also, resist the temptation to overpower this design. It is not a hot dogging plane, but a trainer that can also perform mild aerobatics. You will be pleasantly surprised by it's performance. Enjoy!

FrankC29

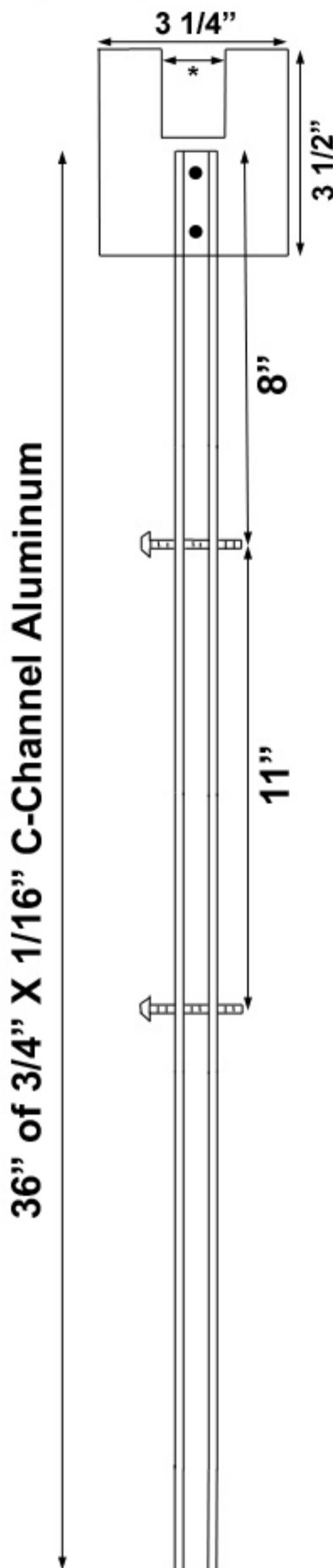
Materials Required

The following materials were the ones used during construction of the prototype. Use appropriate substitutes where needed or desired.

- ___ 36" aluminum 3/4" X 3/4" X 1/16" C-Channel (also known as U-Channel).
- ___ 4mm Coroplast for tailfeathers, ailerons, and center wing wrap.
- ___ 2mm Coroplast for main wing panels.
- ___ 2 cheap unfinished yardsticks for wing spar.
- ___ Wal-Mart Poly kitchen board material for engine mount.
- ___ 17-20" of 1" X 1/8" flat aluminum for landing gear, 1 pair 2 1/4" rubber wheels.
- ___ A handful of #6 X 1/2" sheet metal screws for attaching tailfeathers to fuselage, and securing control horns to doublers.
- ___ 2 2 1/2" 10-32 bolts, 4 nuts, 2 each of washers and lock washers for wing rubber band hold-downs.
- ___ 1 6-32 bolt, 2 washers, 1 lockwasher, 1 nut for fuel tank rubber band hold-down.
- ___ 4 4-40 bolts, 8 washers, 4 lockwashers, 4 nuts for attaching engine to poly engine mount.
- ___ 2 course thread drywall screws for attaching aluminum C-channel to poly engine mount.
- ___ Scrap gutterpipe (American 2 1/2" square) for control horns and doublers. Plastic outlet boxes from a hardware store can be used for this purpose.
- ___ Zip ties in small and standard size, double-sided tape, foam padding
- ___ 4 each 4-40 threaded music wire and clevises for moving control surfaces.
- ___ Short length of 3/16" or 5/32" music wire and 1" tailwheel for ground steering.
- ___ Fuel tank and tubing (in-tank or inline fuel filter recommended).
- ___ .25 size glow engine. A good strong one is needed such as the O.S. 25fx, Magnum XL .25A, or GMS 25. Do not overpower this model!
- ___ 4 Channel radio required w/ standard receiver, standard battery pack, and 4 standard servos. One or two 6" servo extensions. No switch harness was used on mine, just plug the battery into the receiver when you are ready to fly!

You will also need the typical tools for building Spads, such as a metal straight edge, utility knife, hacksaw, drill w/ bits ranging from 1/16" to 3/16", ruler or measuring tape, snips, etc. For bonding Coroplast, a fresh bottle of name brand thin or medium CA glue will work fine. You will need either a propane torch or mineral spirits w/ abrasive pads to prepare Coroplast surfaces for proper bonding. If any of this sounds unfamiliar or confusing, I will once again send you to www.spadtothebone.com and do research on Spad building techniques. This will avoid unnecessary confusion. Let's get started!

Fuselage



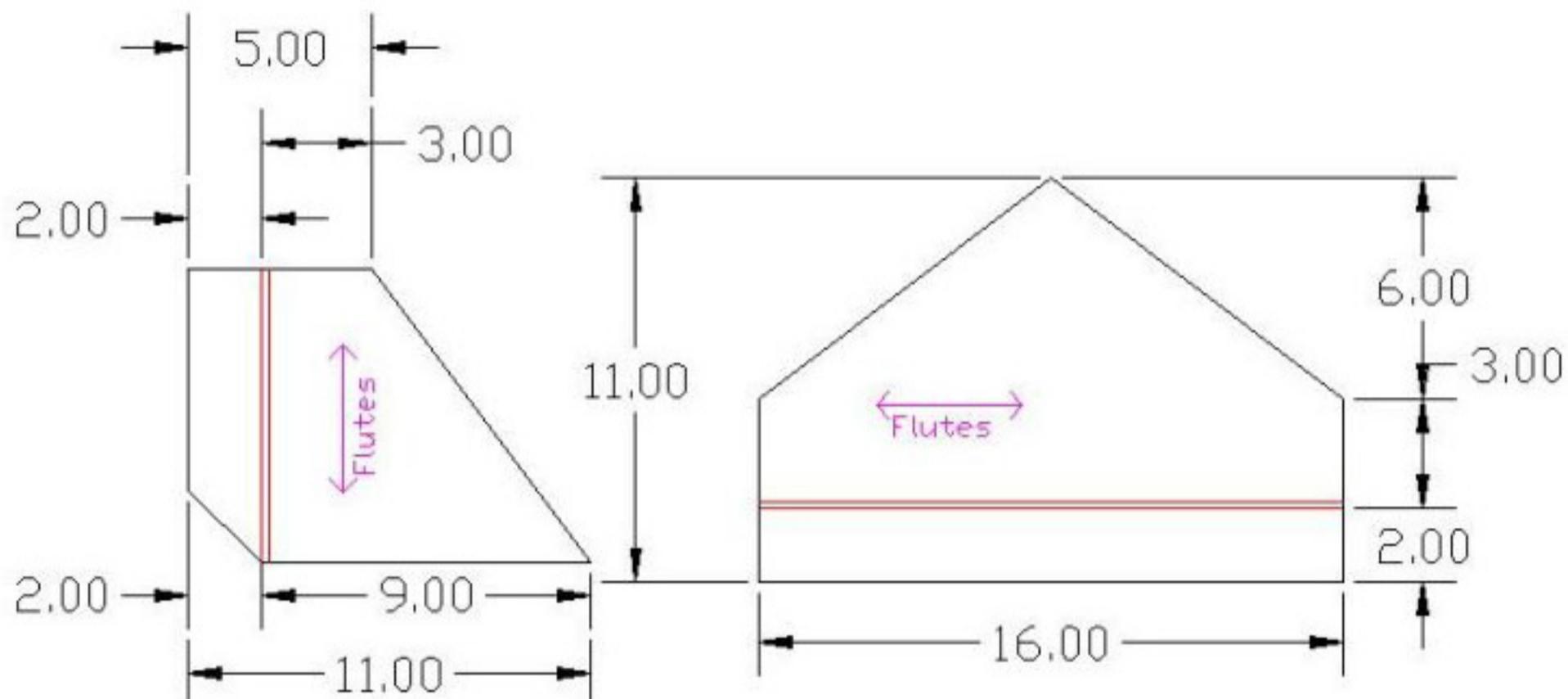
Use a hacksaw to cut a 36" length of 3/4" X 1/16" C-Channel. Cut out a Wal-mart kitchen board mount to the dimensions shown. The engine notch for most .25 sized engines is 1 3/16" wide for a snug fit. Your engine will be mounted with 4-40 sized allen bolts/nuts/washers, or equivalent.

Attach the fuselage to the engine mount using 2 coarse thread drywall or deck screws, they work the best. I have indicated a location to install the wing hold-down bolts. Unless you plan on using different materials, gear, or equipment on you Buhor 25, you can go ahead and install a pair of 2 1/2" 10-32 bolts (or something similar) at these locations.

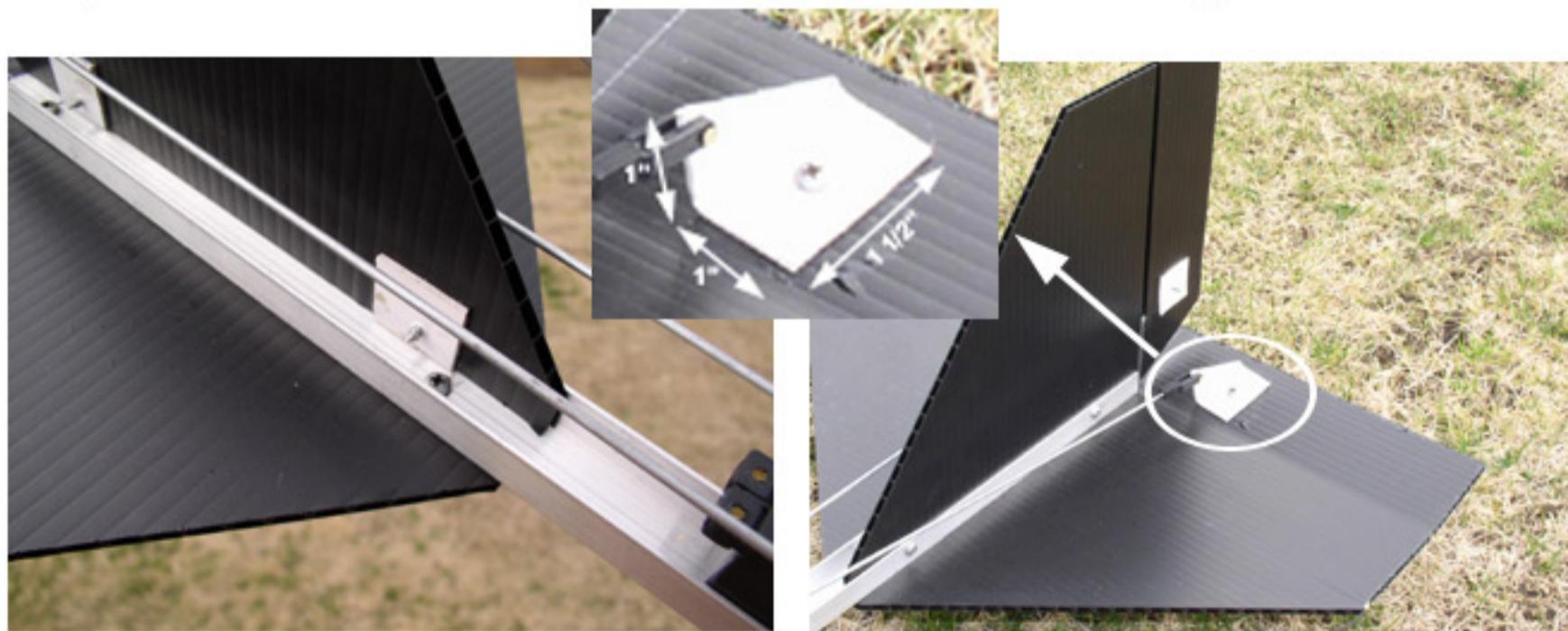
You will see that, once finished, every component is mounted directly in line with each other with no space in between, except between the last servo in the rear and the horizontal stabilizer. It goes: Engine, 8 oz. Hayes Slimline fuel tank, 600mah Nicd battery pack, wing, receiver, rudder servo, elevator servo, a bit of space and then finally the horizontal stabilizer. This makes for a simple and straightforward installation.

Servos are installed by pressing them into the channel with a small piece of double-sided tape and a standard zip tie. The landing gear, shown in Photo's 1 and 5, is mounted directly under the leading edge of the wing, or about 1/2" behind the front wing hold-down bolt.

Tailfeathers

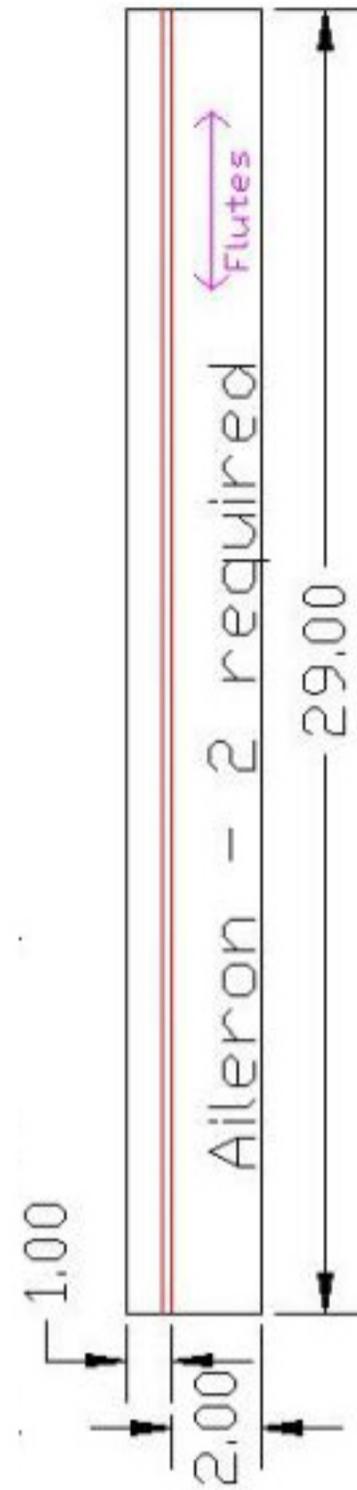
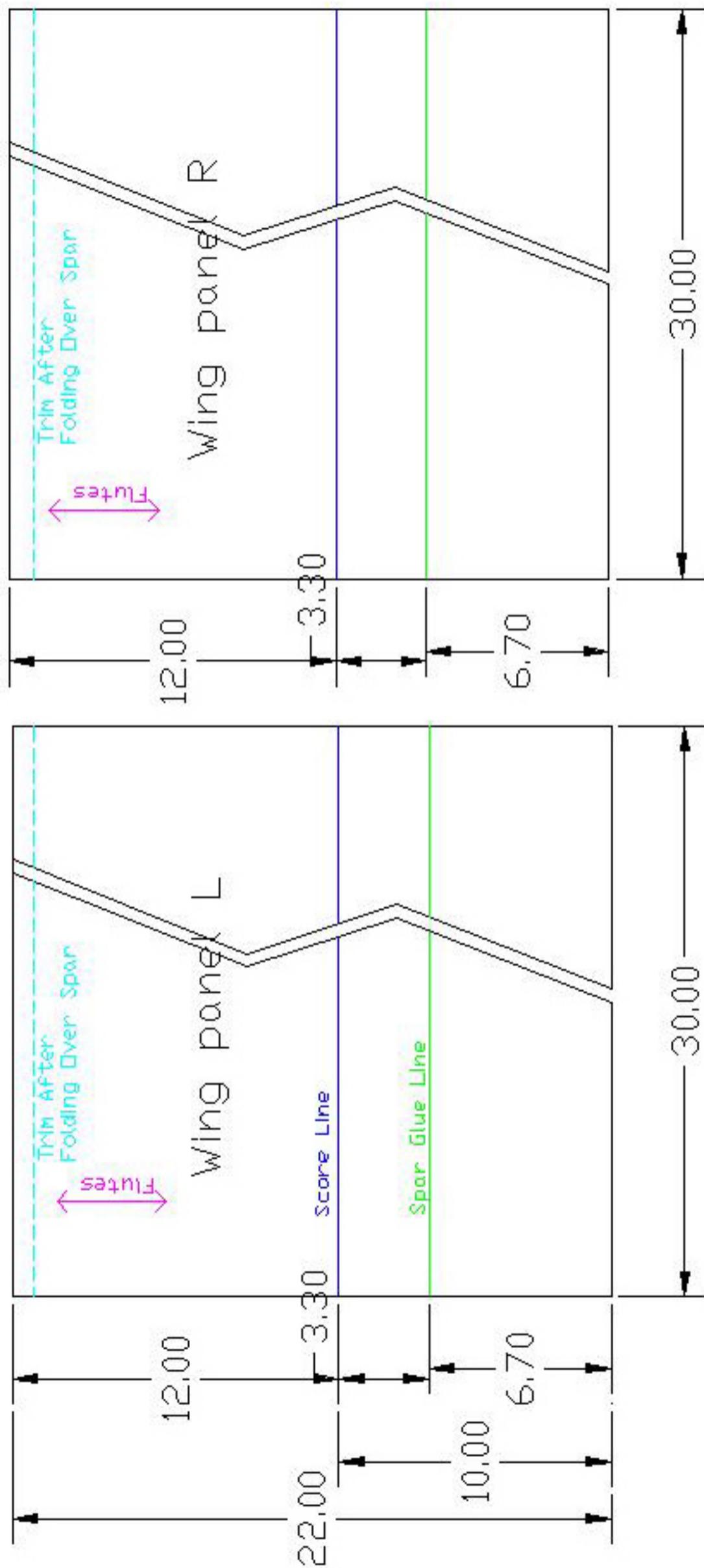


The tailfeathers are cut from 4mm coroplast to the dimensions shown above. Please take note of the direction of the flutes. As long as you use only a .25 engine on your Buhor 25, no stiffening measures should be needed (such as dowels or rods inserted into the flutes, etc.). This will only add weight unnecessarily. Hinges are made by cutting away one side of the flute, leaving the other side intact to form the hinge. Attach your tailfeathers to the rear of the aluminium rail fuselage as shown:



I cut my control horns 1 1/2" long, 1" wide and 1" tall. The doubler plates were approximately 1" square. These measurements aren't terribly important, they could be a tad smaller or bigger with no real noticeable effect. Do not make them TOO small however, or control authority will suffer.

Wing Dimensions



The two wing panels, left, are made of 2mm coroplast. The two ailerons, above, are made from 4mm coroplast. Center wing wrap (see Photo 3) is also made from 4mm coroplast. By following the "Buhor Dihedral Wing" plans, using these dimensions, you will build your wing. Read next page for more details.

Wing Building

Because an excellent tutorial on building a wing very similar to that used on the Buhor 25 exists, I am going to cheat a little and direct your attention to the “Buhor Dihedral Wing” plans, currently located at:

<http://www.spadtothebone.com/freeplansbuhordihedral.htm>



Page 1 of the Dihedral Plans

The only difference between the Buhor 25 wing and the traditional Buhor Dihedral wing are:

1. The Buhor 25 wing is made from 2mm coroplast, except for the ailerons. The regular version is made completely from 4mm coroplast, too heavy for a .25.
2. A few measurements vary, notably the chord and spar locations. Be sure to make note of the dimensions on Page 5 of *these* plans! The proper spar location for the Buhor 25 is 3 1/4" behind the leading edge, and the total chord including the ailerons is 12".

Otherwise, the steps and methods are the same. The spar is *EXACTLY* the same, so follow the instructions regarding it's construction to the letter.

Reference Photos



Reference Photos, cont.

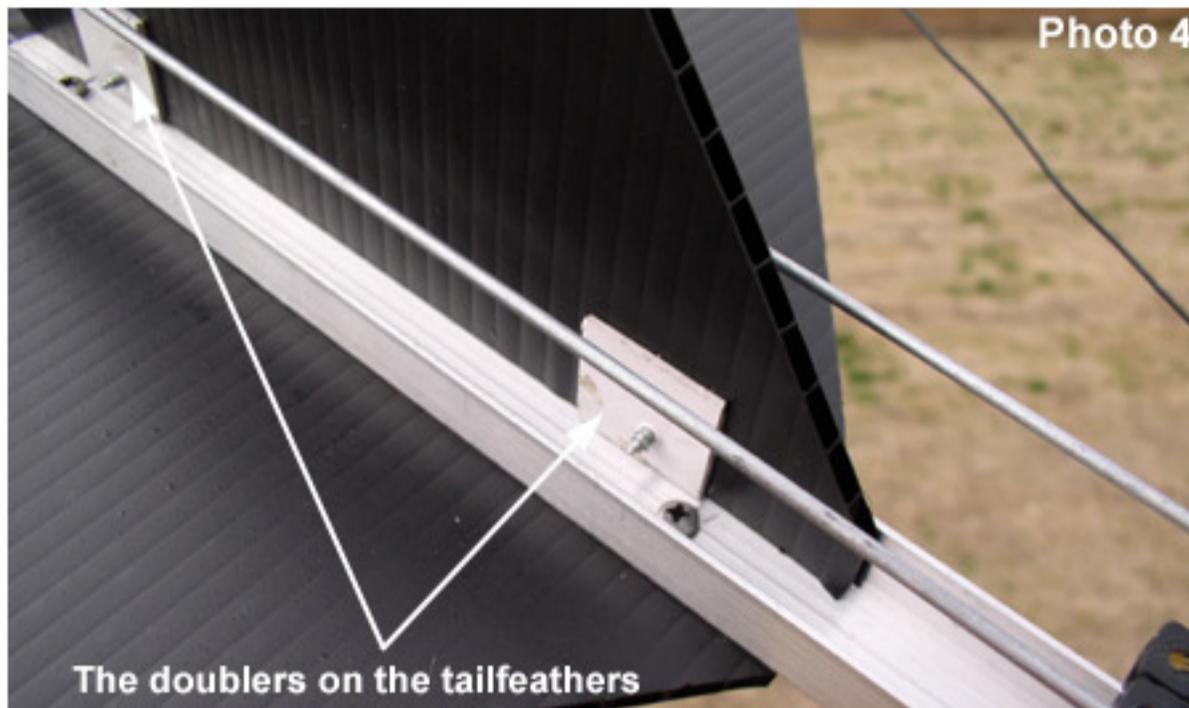


Photo 4

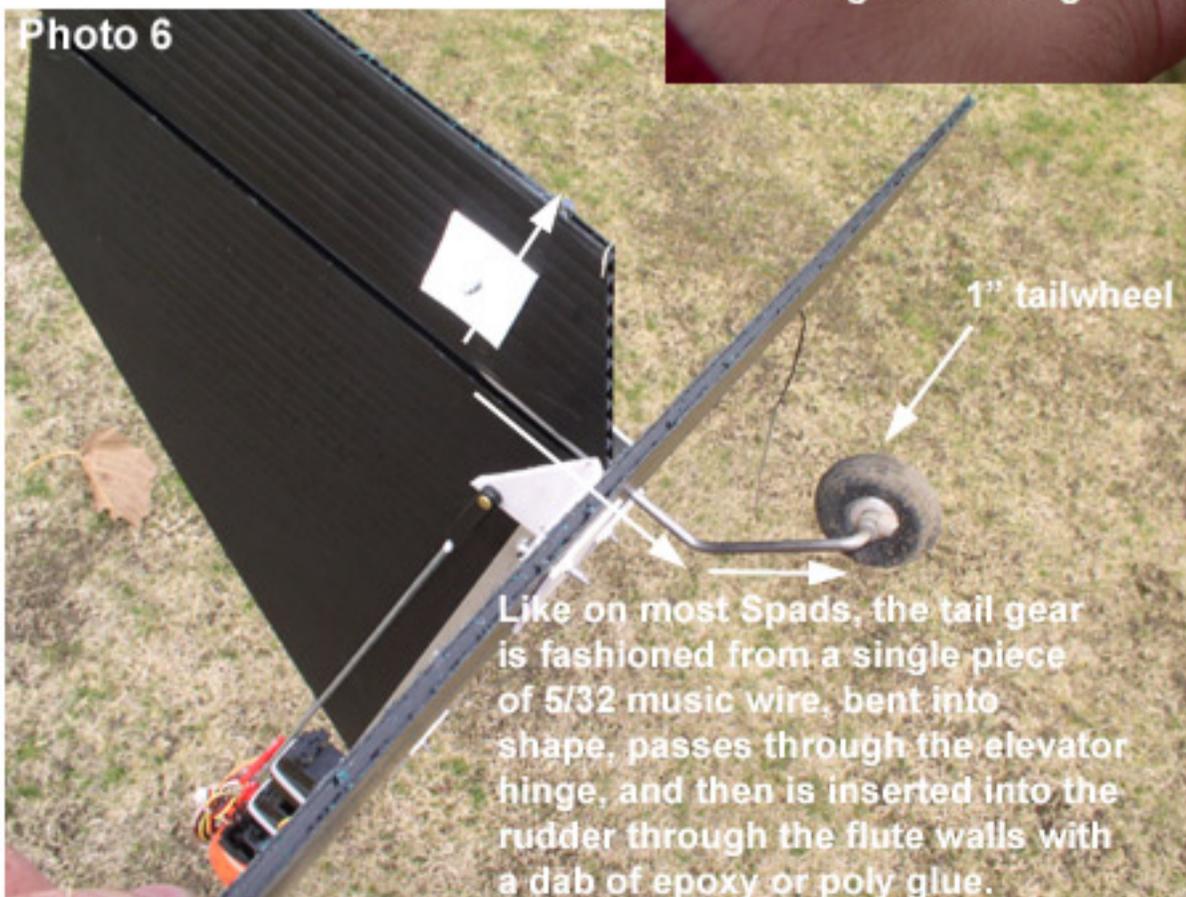
The doublers on the tailfeathers were glued on. This puts any strain from crashing/flipping on the PVC doubler, and not on the more easily torn coroplast.



Photo 5

The wing rubber bands will attach to this 2 1/2" 10-32 bolt, with a nut/lockwasher/washer on each side of the fuselage. Do not overtighten, or you may start to crush the C-channel walls.

I drilled the bolt holes on the landing gear as close to the edges of the landing gear as I could to maximize mounting area strength.



1" tailwheel

Like on most Spads, the tail gear is fashioned from a single piece of 5/32 music wire, bent into shape, passes through the elevator hinge, and then is inserted into the rudder through the flute walls with a dab of epoxy or poly glue.

Reference Photos, cont.



Throttle servo installed under engine mount with a zip tie and double sided tape.



Front of the Buhor 25. The fuel tank is simply held on with rubber bands, and a standard zip tie keeps the battery pack in place. The engine is an O.S. .25FX swinging a 9X6 APC prop.

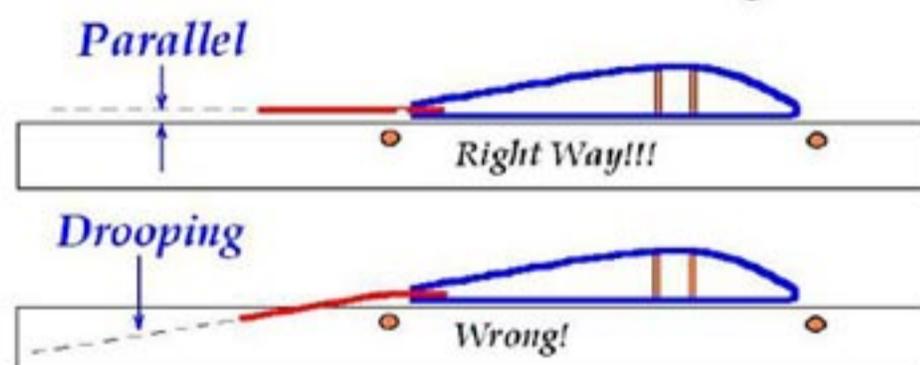


I cut 1" slots along the hinge line, every 2". This loosened up the hinge quite nicely. This is my personal favorite method for relaxing a stiff hinge.

Preparing for Flight

The model, when finished, should balance directly on the spar with an empty fuel tank. If you built your Buhor 25 with the same materials and equipment as shown, this should be easily accomplished with little gear movement. Check your ailerons. They should travel freely and not be too stiff. As you can see in Photo 9 on Page 9, I cut 1" slots every 2" along the hinge line. I also tapered the aileron tips 2". The slots freed up an overly stiff hinge and the tapered tips help to prevent flutter. With the ailerons in the neutral position, when viewed from the side, they should be parallel or very slightly reflexed from the fuselage. Drooping ailerons are unacceptable, and can cause erratic flight behavior (see diagram below). Beginners should keep control throws moderate to start with, say 1/2" (ailerons) and 3/4" (elevator/rudder) each direction.

Aileron Neutral setting



The wings and tailfeathers are large, and are mounted to a single aluminum rail. This has proven more than sufficient for a .25 engine after many flights of rigorous testing, however it is NOT recommended that you install anything larger than a .25, or else trouble may ensue. Also, use plenty of #64 rubberbands when attaching the wing; do not be greedy here, as it takes a few more than usual to firmly secure the large wing to the comparatively narrow fuselage. I use 7 pairs (14 bands total) and have never had a problem.

The model is surprisingly powerful, nimble and aerobatic. After some testing, I find the APC 9X6 prop to give the best overall performance. Big loops, sharp turns, hammerheads, Cuban-8's, tailslides, inverted loops, and much more can be done and done well. Take offs are short and the climbing ability is impressive. Landings are feather light, just like a trainer should be. However, High-G maneuvers, like snaps, spins and high throttle dives are asking for trouble. You may get away with it...or maybe not.

DISCLAIMER:

Beginners should seek a qualified instructor to assist in the building and flying of this or any trainer R/C aircraft, and follow all safety rules and regulations set forth by the AMA. Fly your model airplane in a safe manner away from homes, businesses, and never fly over persons! Spadtothebone is not responsible for damage done to property or persons as a result of Spad building or flying. Build, fly, and modify this design at your own risk.