



S-Tee-250

Super Simple Series

LESS THAN 250 GRAMS! NO FAA REGISTRATION REQUIRED!

BETA KIT

WARRANTY

Willy Nillies guarantees this kit to be free from any defects in both material and workmanship at the time of purchase. This warranty does not cover ANY components or parts damaged by use or modification. In no case shall Willy Nillies' liability exceed the original cost of the purchased kit. Willy Nillies reserves the right to modify or change this warranty without notice.

LIABILITY RELEASE

In that Willy Nillies has no control over the final assembly or material used for final assembly, no liability shall be assumed or accepted for any damage resulting from the use by the user of the final user assembled product. By the act of using the user assembled product, the user accepts all resulting liability. If the buyer is not prepared to accept the liability associated with the use of this product, the buyer is advised to return the kit immediately in new and unused condition.

PRODUCT SUPPORT

This product has been designed to function properly and perform as advertised with the SUGGESTED power system, speed control, and servos, as described in advertisements and in this manual. For the proper electronics to complete this model, replacement parts, and product assembly questions, please contact us online at www.WillyNillies.com

Our aircraft are built from self-jigging interlocking laser cut. balsa and plywood parts. It's like a 3D jigsaw puzzle with instructions. Full size plans are NOT INCLUDED or needed to assemble our kits. If the instructions are read beforehand and followed during the build, our kits can be built up and ready to fly in only 2 to 4 evenings. We think you'll like the super simple construction and flying qualities of our kits and look forward to any feedback you might have.

Sincerely,

Douglas Hart

Willy Nillies

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Marietta, IL 61459

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Phone: 309.648.0449

PLEASE VISIT OUR WEBSITE and Builders Group FOR CURRENT BUILD INSTRUCTIONS, VIDEOS AND UPDATES

Introducing the S-Tee- 250!

The S-Tee has always been a great trainer that is easy to build and a great choice for a first airplane. Our version of this classic aircraft is both easy to build and graceful in its docile flight characteristics making this the perfect Sunday relaxed flyer or trainer! Enjoy it with a 1306 brushless motor or use a Cox Pee Wee .020!

We have recreated this wonderful little airplane at a slightly smaller size to come in under the 250-gram weight limit for the upcoming FAA RID rules. This means NO FAA rules or regulations for the S-Tee-250! Fly it at your local park or school yard (with permission of course) or your own large yard!

We have also updated the design to have interlocking parts. Building the fuselage and wings are a snap and takes less than a couple hours for experienced builders to frame up and have ready for covering! Beginners should allow a couple of hours and a visit or two to our builders group to get any questions they have answered very quickly.

S-Tee-250 specs:

Wingspan: 28"

Wing Chord: 5"

Wing Area: 140.75 sq in

Fuselage length from front of fuselage to tip of rudder: 19.5"

Flying Weight Brushless or Glow: 5 to 6.5 ounces.

Wing loading 6.69 oz/sq.ft.

Wing Cube loading : 6.8

Features:

Build as 2 or 3 channels (Rudder, Elevator, and Throttle)

Easy access battery hatch

Built in servo tray in fuselage includes 3rd servo cutout of throttle for Pee Wee .020 users

Clark Y flat bottom airfoil

Laser cut self-jigging construction - The entire airframe can be built and ready to cover in less than 2 hours!

Full length shear web re-enforced main spar.

Includes:

All wood pieces to build the entire airframe

.032 K&S music wire pushrods

.052 K&S music wire for Landing Gear and Elevator Half connection

Laser cut Wheel Retainers

Motor mounting Screws, Blind nuts, and Washers

Universal Quad Motor mount (Fits most 1306 motors)

6 each number 32 rubber bands for attaching wing

Recommended equipment:

2 or 3 each Emax 9051 4.3g or equivalent micro servos. Rudder and Elevator, or with optional Throttle.

Power: 1306 - 3100kv, 1-2S brushless motor, or Cox Pee Wee .020 glow engine

Battery For Brushless - 350 mah 2S Lipo battery, minimum 8 amp ESC, Gemfan 5030 or 6003 propeller or equivalent

**** Our 1/4a TD .020 completion packages are a perfect match for this airframe****

**** 2 cover packs are required to cover entire airframe****

General Practice for assembly:

Join all your pieces using thin CA (Cyanoacrylate) glue, unless we tell you otherwise. In general, only a small amount of CA is necessary to glue parts together. Use of a capillary tube is HIGHLY recommended. Using other glue types is your choice, however, you also assume the integral responsibility and weight penalties.

Do not force your pieces together. If they are not fitting together properly, make sure you have the right pieces and they are oriented correctly. If needed, you can lightly sand the part to fit. On balsa "tabs", you can "pinch" the wood with your fingers to get them to fit in slots. (The tabs might be tighter sometimes, due to tolerances in wood thickness)

Control Throws:

1. Control throws are VERY critical to the characteristics of our aircraft designs and the recommended throws have been determined through flight testing during development and It is imperative that you DO NOT EXCEED our recommended control throws on your first flight!!!!

Elevator: .35" up and down, measured at the trailing edge immediately aft of the control horn.

Rudder: .45" right and left, measured at the trailing edge immediately aft of the control horn.

EXPO - if you have a computer radio, we recommend setting rudder and elevator on 25% expo to help soften the effectiveness of the controls near center.

Center of Gravity:

1. The best all-around C of G is at 1.5 inches aft of the leading edge measured from the leading edge. (Middle of the Spar). Adjust your Battery forward or aft to achieve this placement for your first flights. Adjust your battery and receiver forward or aft to achieve this placement for your first flights. Add weight if necessary.

First Flights:

1. This model is an incredibly fun and sporty type aircraft with a wide speed range. That said, don't be afraid of it! If you have followed our instructions and have set control throws accordingly with the proper Center of Gravity, you will be rewarded with a fun all around airplane.

Words of Caution:

1. This is a SMALL plane. KEEP IT CLOSE.
2. DO NOT LAUNCH AT FULL THROTTLE! The torque from the electric motor can roll the aircraft quickly!
- 3 Half throttle and a firm forward throw is all you need to get going.
4. It is highly recommended that you use highly contrasting colors in your finish. Visibility and keeping orientation are very important.
5. That all said, if you manage your throttle at 50 or slightly less, it is a tame and gentle performer and a blast to fly at high power settings also!

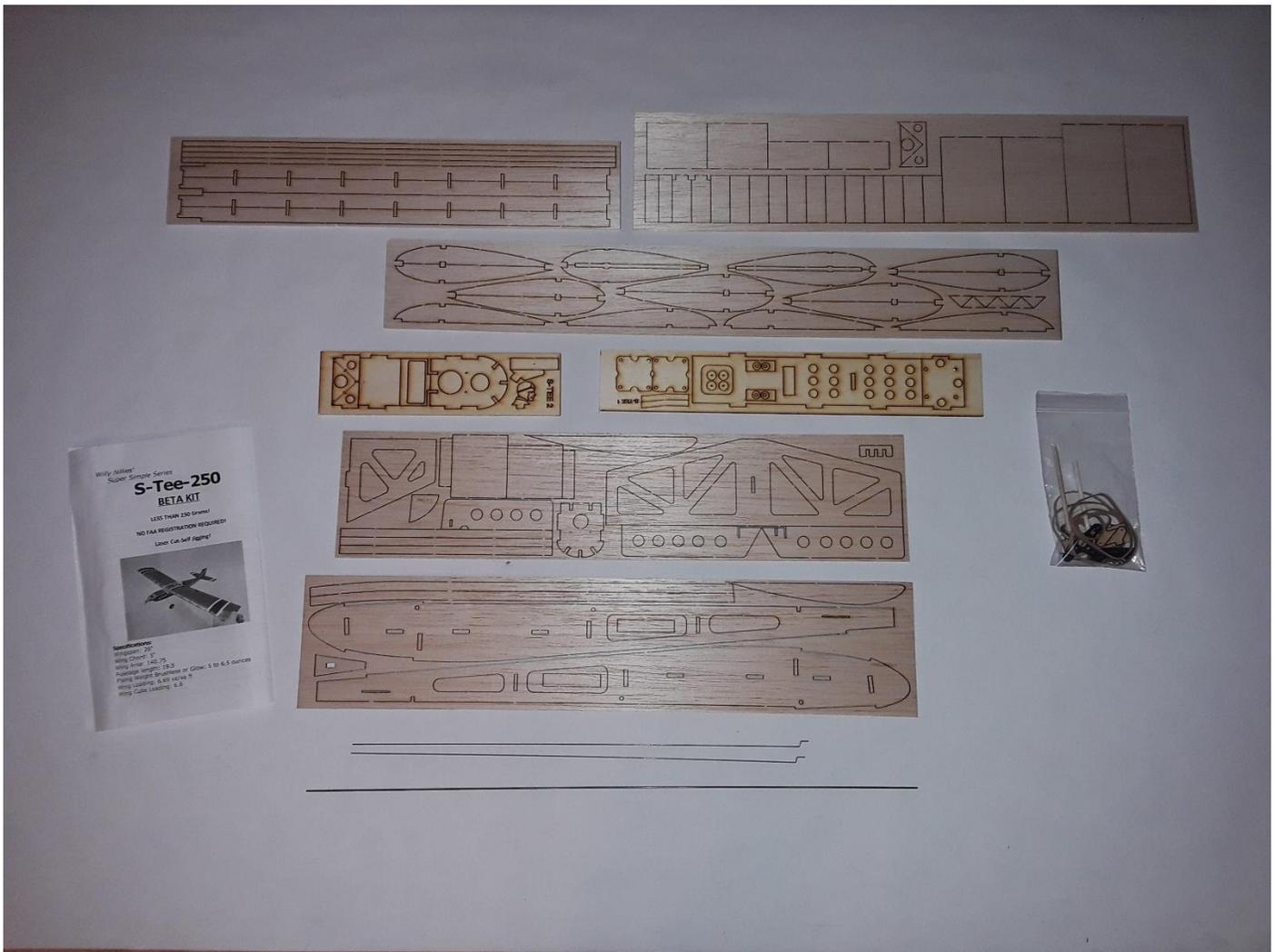
Flight Video: <https://www.youtube.com/watch?v=FFK5omwVEb0>

S-Tee-250 Assembly Guide, Rev: Rel, 11/04/2020

This guide is a list of steps accompanied with photos on how to assemble the Willy Nillies S-Tee-250 and follows the information provided by Willy Nillies with input from the FaceBook Builders Forum. All our kits share nearly exactly the same construction techniques with only very minor differences. As with any Beta Kit there may be recommended modifications and updates available. **Always** check the documentation that comes in your kit.

All Willy Nillies planes have been Flight tested and built from random production selections to ensure you are getting a great product. With that in mind, you may feel free to be creative and make your own modifications, however, realize that any changes made by the Builder become the responsibility of the Builder and any change to the flight characteristics are the responsibility of the Builder to correct.

Contents of S-Tee Beta Kit:



Top Row; Sheet 1, Spars, Leading and Trailing Edges. **Sheet 2**, Wing center section sheeting, Shear Webs.

Second row; Wing Ribs, Triangle braces

Third Row; Plywood, **Sheet S-Tee 2**, Landing gear Former (F2LG), Alternate Motor mount (F1A), Former 2 (F2), Hatch Tie Down, Tail Skid, Pilot head, **Sheet S-Tee 1**, Optional motor spacer plates, Dihedral Braces, Drilled Firewall for Electric Motors, Main Tray for Servos and Battery containing wheel collars and additional motor spacers.

Fourth Row; Forward Fuselage Upper and Lower Hatch covers, Hatch Cover Tongues (2), Horizontal Tail and Elevator,

Former F4 and F5, Upper Fuselage Stringers, Rudder, Vertical Tail, 3.5 degree Dihedral Gage, and Wing Tip.

Fifth Row; Fuselage sides, Lower Fuselage stringers, and Upper and Lower Hatch Fillers (2), Tail Skid Plate.

.032 K&S music wire pushrods (2)

.052 K&S music wire for Landing Gear and Elevator Half connection.



Bag of small parts contains (4) Blind nuts, (4) Washers, (4) 2-56 Screws, (6) #32 Rubber Bands, (2) Sections of heat shrink tube, (2) "Z" bent Pushrod ends, plastic Motor Mount for Brushless motor, (2) Dowel rods, and a sheet of (4) plywood Control Horns.



Some of the tools you need are a knife for trimming and some sandpaper for dressing edges and smoothing out joined areas. The minimum of tools needed is a benefit of the Laser cutting process and the design of the kits. These sanding blocks are made from a 1 x 2 Poplar with nice square edges and are 6" long. The paper is wrapped around tight and stapled to make it easily replaceable. These are easy to make up with different grits from 120 to 600 depending on the task. Sanding stick to match are easily made by gluing strips of sanding paper to Craft sticks or Tongue depressors. For round areas, a strip taped around the handle of your knife is handy and gives a nice grip as well.

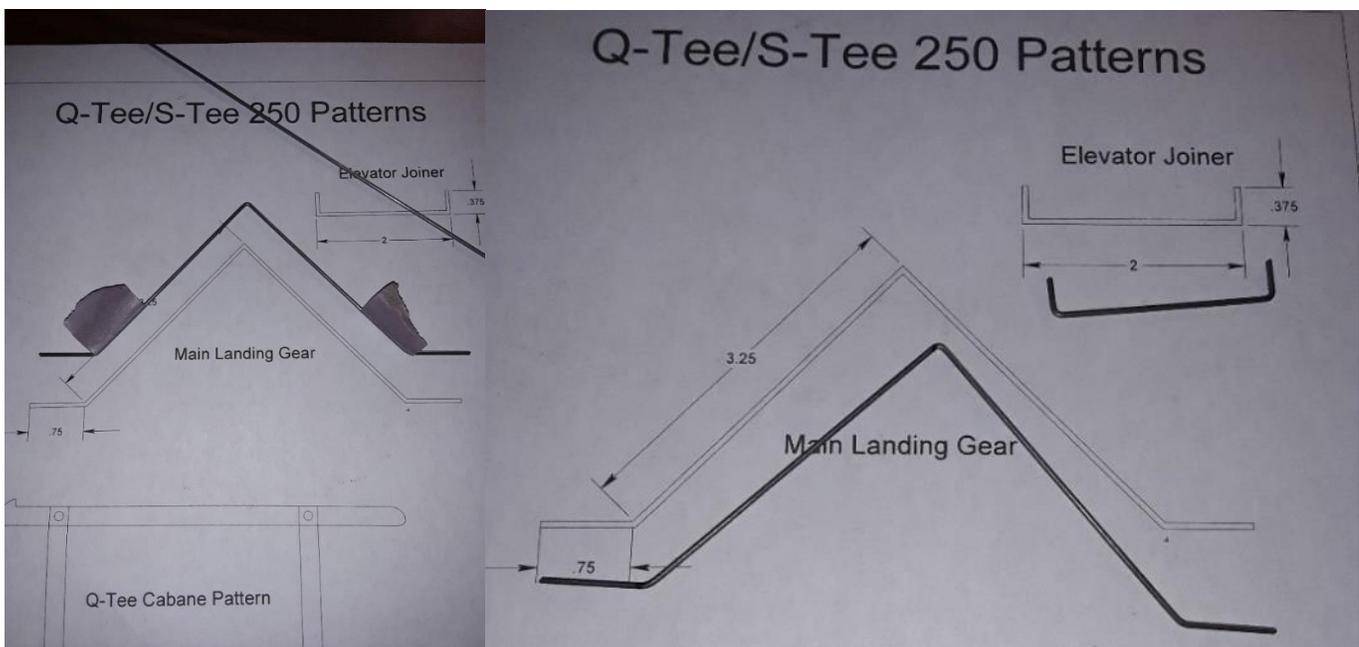
Preparing to Build:

Once you have inventoried all your parts you may punch them all out and sand the edges lightly to remove the nubs and any charring left by the Laser process. Some builders prefer to punch the parts out as they go. This allows them to reference the sheet layouts for the items they are building.

Occasionally there is a hole that needs a slight cut to remove the slug. Use caution so that excess Balsa is not removed. The fits of the Tabs and Slots are self-jigging to align the assembly to build a straight and true airplane.

Prepare your subassemblies before you get started. This will build confidence in your abilities and familiarizes you with the parts so once you start building you can move right along.

We will start with the Landing Gear and Elevator Joiner. The pattern sheet for the Sioux can be found in the "Download" section of the Willy Nillies website and on the FaceBook Group page "Files".

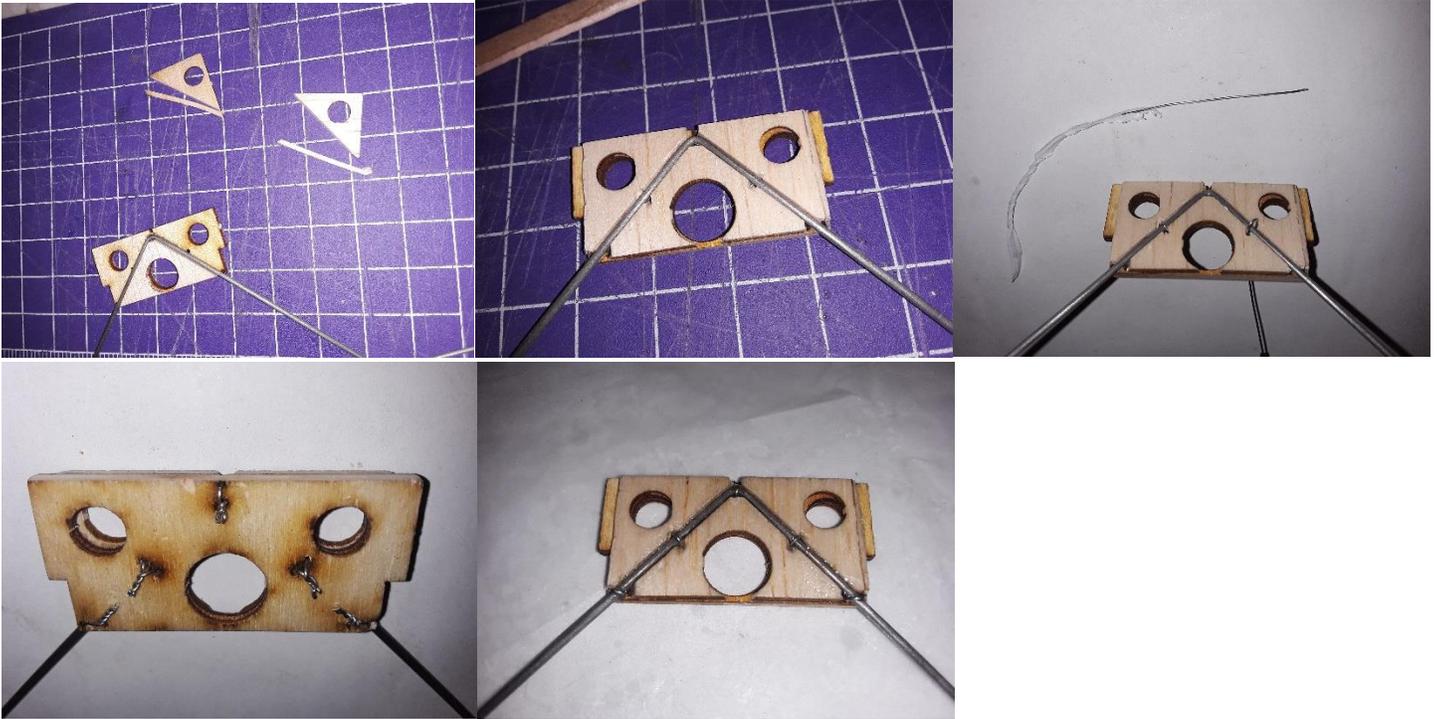


Mark the center bend on your wire leaving a little extra for the Axle where the wheels mounted. Next you can mark the bend locations with tape for an edge to set your Pliers and bend the axles. Bend the Elevator joiner in the same fashion.

Alternately you can use a set of pliers right over the pattern sheet to clamp the wire in the locations needed speeding up the operation.

These are the finished pieces ready to be Installed.

The Landing gear sandwich is prepared by laying the gear legs over the location marking on the tabbed bulkhead and adding Balsa filler pieces. Do not glue in the gear at this time.



Note that the Landing Gear Former has holes in five locations. This is for lacing the Landing gear in place for a lighter assembly. The Balsa fillers are trimmed and placed to give an extra amount of support to the assembly. Once glued in place, the holes are punched through the balsa filler pieces.

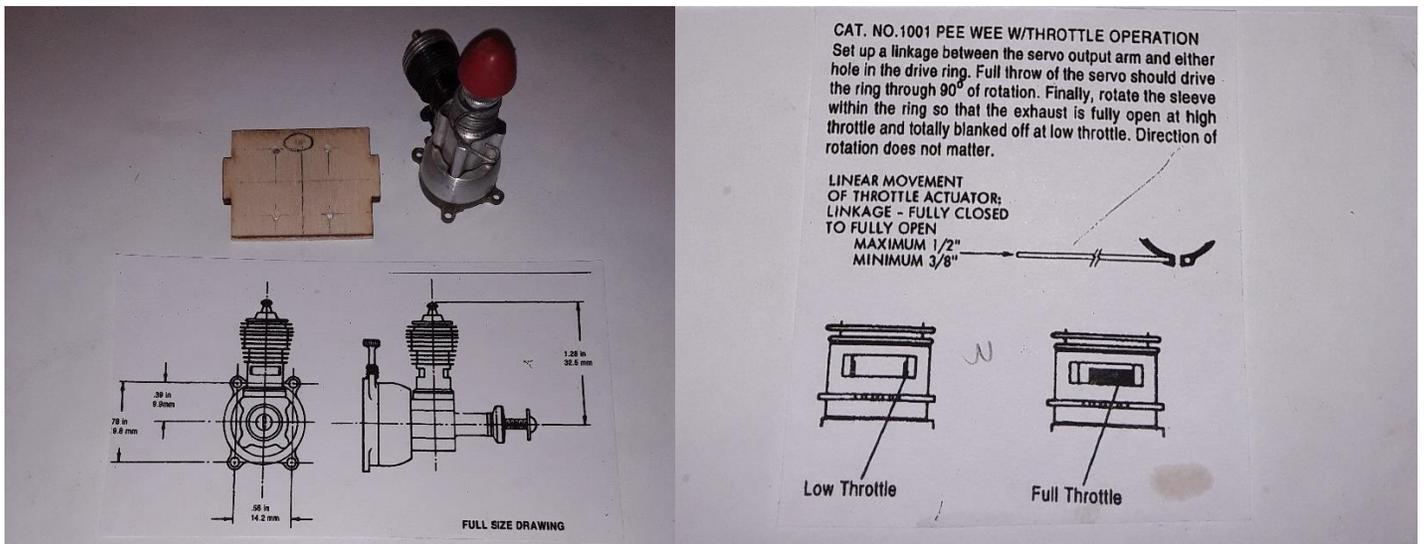
Lacing can be done with Nylon Thread, small Copper wire, safety wire, or Bread ties which are easily found in most homes. Clean off the plastic or paper covering, thread the wire through the holes and twist to secure them. Once finished lacing, trim the twisted ends and use a dab of Epoxy or Med CA and Accelerator. Flip the assembly over and apply Epoxy or Med CA and Accelerator to the wire and in the slot and let it set up. It's that simple.



Punch out the Elevator halves and sand the edges to remove the nubs. Assemble them with the wire joiner using Epoxy and align with a straight edge. Weight or pin down the parts to keep them aligned while the epoxy cures. Note the wax paper over the edge of the scrap Balsa straight edge to keep it from being bonded too.



Punch out and prepare the Firewall. Above is the Firewall for the Brushless motor with the blind nuts installed and a small amount of epoxy applied to secure them in place. Note the small “Up” engraved in the wood. If you are using another motor type, or the Cox .020, the blank Firewall has been provided to allow drilling the needed hole pattern as noted below.



Note that this Firewall blank also is marked “Up” and the hole layout should be made with this in mind.

Laying out the blank Firewall for the .020 is accomplished by positioning the motor and seeing how much needle valve will be above the top of the Fuselage. In the S-Tee the Needle valve has plenty of clearance with the motor centered on the Firewall. The mounting holes are laid out per the dimensions provided in the Cox .020 pamphlet.

The instructions for connecting the throttle barrel are also included if you are setting up the Throttle control.



Install a capillary tube to the Thin Cyanoacrylate glue for precision placement of the glue. A wrap of tape around the joint of the tube and bottle can keep small leaks from happening.



The Servo holes in your tray are cut to accommodate various sizes. You should test fit your servos now and adjust the hole size if needed. In this case we are using the Emax ES 9051 which is a perfect servo for this plane being digital, powerful, and light weight.

Using the scrap from the Servo tray cutout, cut a small section and glue it back in. Additional scraps from the edges of the Plywood sheet can be used on the bottom to support them and give a good base for the servo screws.

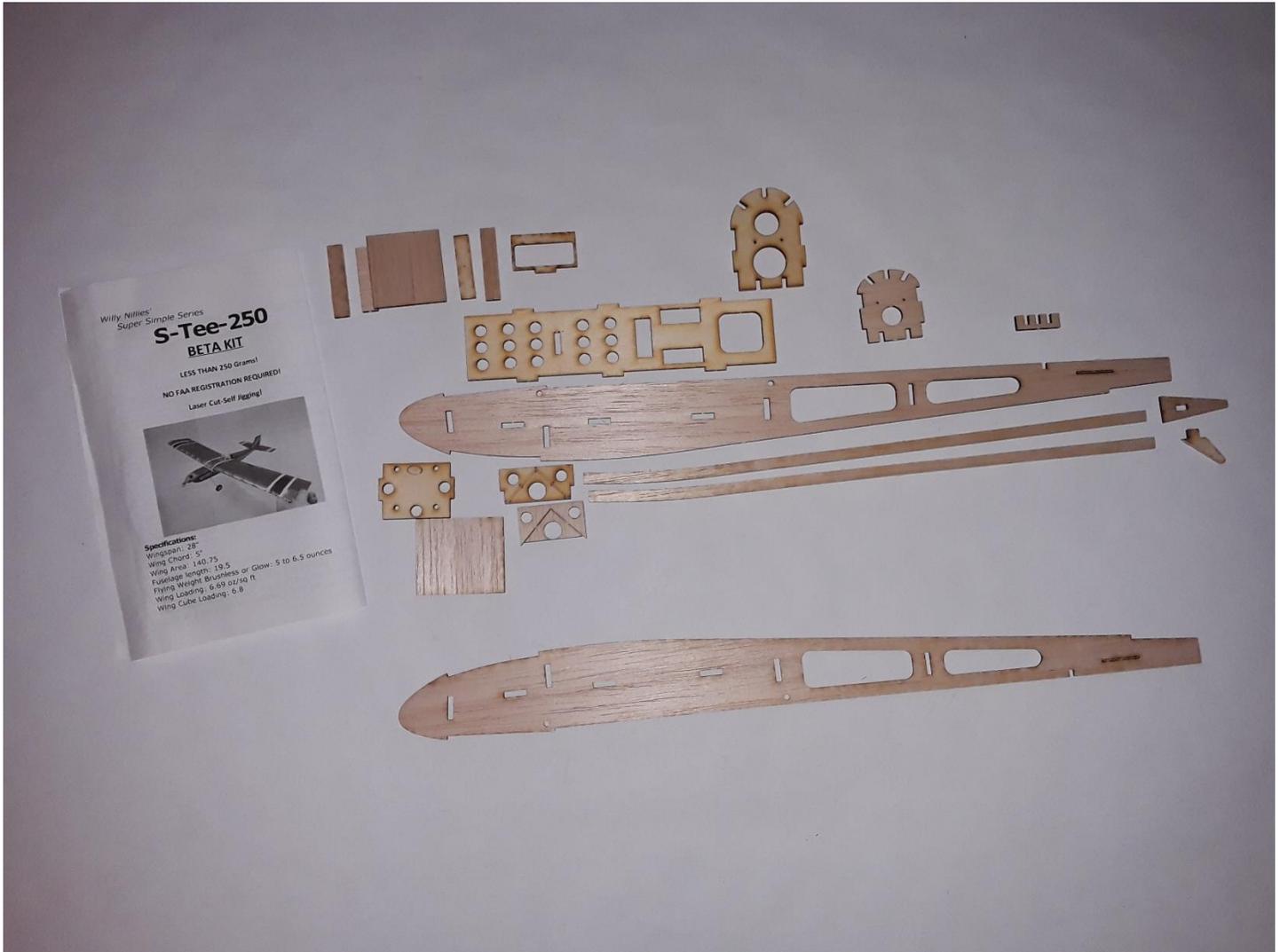
The picture shows the tray from the S-Tee, but this is a common first step for all the Williy Nillies planes with Servo trays.



If using the Emax ES 9051 Drill new holes in the F3 Former for the Pushrods 1/8" on center in from the Laser cut holes to give a more direct attachment and reduced drag.

Fuselage assembly:

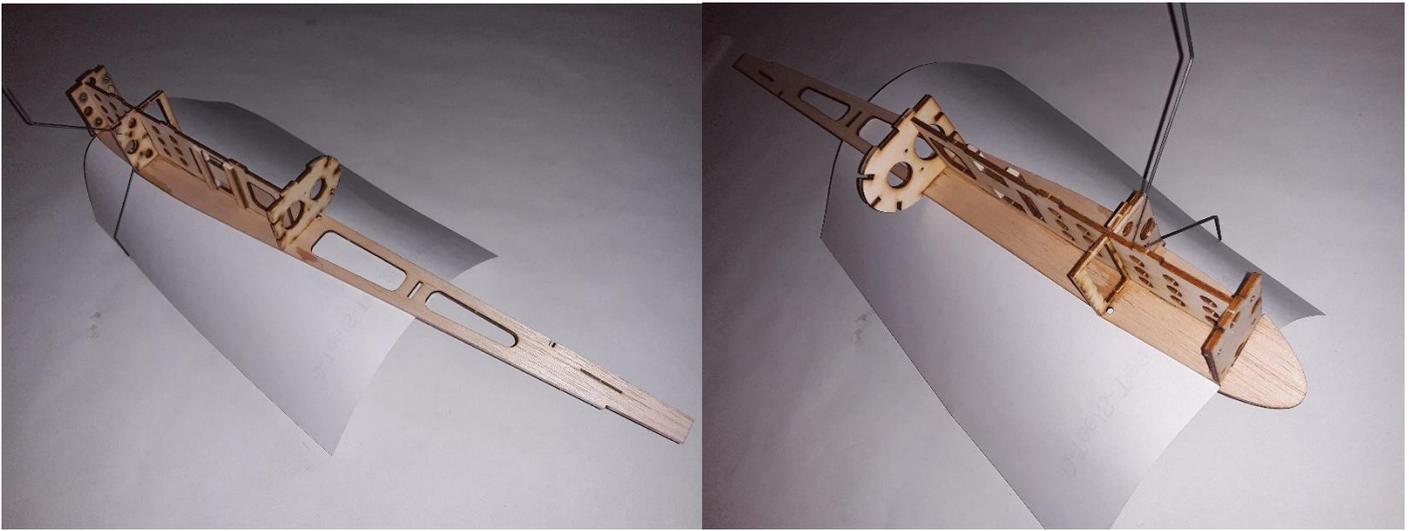
If you haven't already done so, start by punching out the Fuselage sides and formers. Test fit your parts in all the slots before starting to assemble.



Here are the parts required to assemble the S-Tee Fuselage with parts laid out to be installed. Missing from the picture are the 3 Upper Stringers.

As previously noted, if you are planning on using the .020 Motor the blank Firewall would be used in place of the Firewall for the electric motor.

Note that the F3 and F4 Formers have small holes Laser cut in them for the Pushrod guides. Makes sure they are open by sticking the end of a Pushrod through them BEFORE you assemble the Fuselage. If you are adding the hole locations, now is a good time to do it.



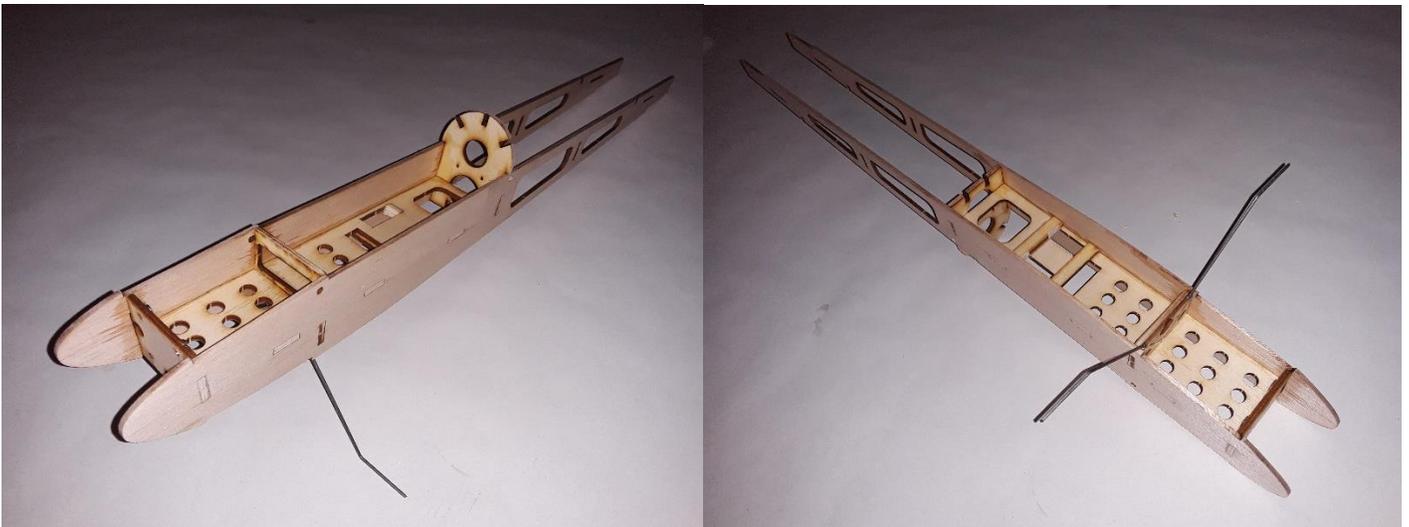
These pictures show the locations and positions of the primary structure parts. Note the orientation of the Landing gear former, by checking fits you will find it needs to have the Balsa filler facing forward.

Note that your Firewall is correct with the printed “Up” toward the top of Fuselage.

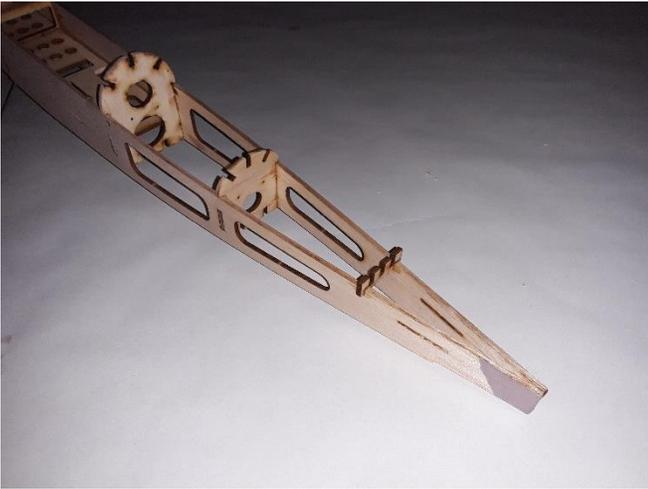
Check your servo tray and make sure the strips are on the bottom or they will raise the Servos and interfere with the wing.

The Upper F2 Former (with the Battery hole) should be even with the notch on the top of Fuselage and tangent to the Dowel hole in the Fuselage.

If you need to adjust fits, a light swipe with fine sandpaper is all it takes. Avoid going overboard as the snug fit of parts is a crucial part of the self-jigging. Occasionally, the balsa tolerance falls thicker, so pinching the tabs may be needed to put them in. Don't force them.



Once you are satisfied with the fits and have checked to make sure it is square you can glue this assembly up using the Thin CA adhesive applied to all the joints and letting it wick in.



With the Motor and Cabin areas glued you can fit the F4 Former. DO NOT GLUE YET. Pinch the tail of the Fuselage together and align the edges to each other. Placing tape to hold them in place. The Ends should be even with each other and the top and bottom of the sides should be even. The Laser cutting process makes them a true duplicate, so when they are even with each other the fuselage will be correct.

Check it anyway! Turn the assembly over and sight down the Fuselage center to ensure that the tail area is centered, shifting them to adjust **IF** needed.

Once you are satisfied that the fuselage is straight and true to the center, glue it together and add the F5 Former.

As you see in the picture F5 Former is oversized to allow for differing bowing of the Fuselage sides due to Balsa density. Align the slots to center it and once again, when satisfied, glue it and F4 Former in place.

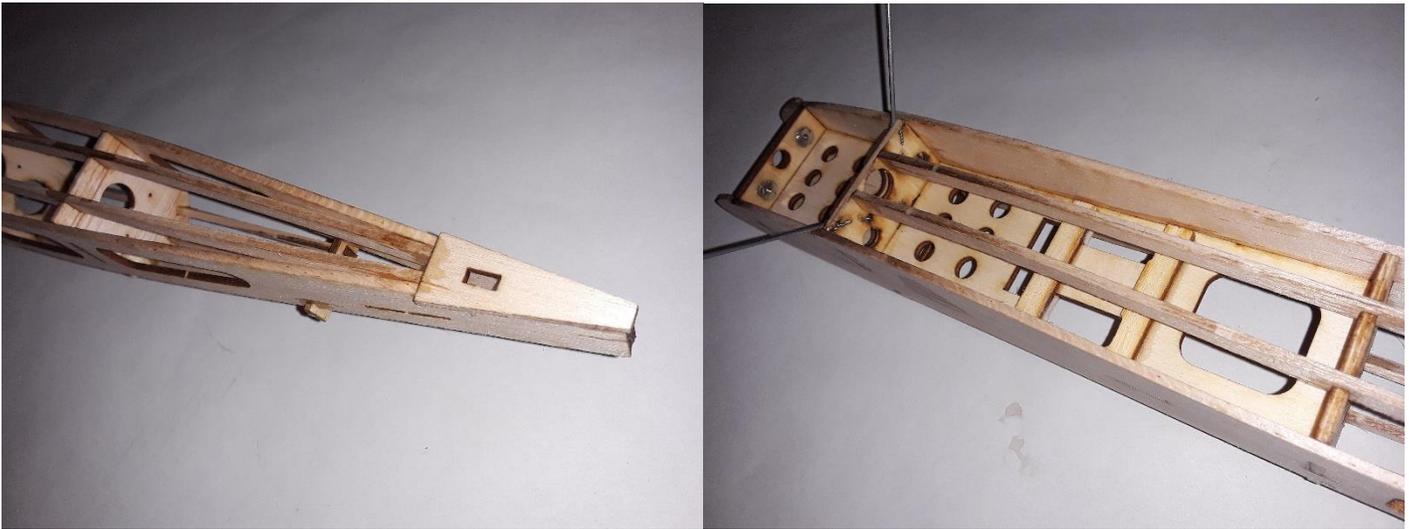


Next fit and install the three top Stringers in the following order:

Center Stringer is first. Fit it and then glue. This helps the F5 Former to keep from breaking the small tabs. Next, carefully fit the first outer Stringer by placing it in the F3 Former and tilting it down into Former #4. This will start the twist.

Finally, use a pair of pliers and gently twist the Stringer to place it in the slot of F5 Former. Press the stringer all the way into the slots. When you have it in place, glue it in. Install the final outer Stringer just as you did the first one and glue in place.

Your Fuselage with the top Stringers installed should look like the second picture. We'll trim the F5 Former soon.



Flipping the Fuselage over we fit and install the Tail Skid Pad with Medium CA. This gives the edge needed to attach the Bottom Stringers.

Just like the top Stringers, test fit them first. These both needed a gentle swipe with the sanding block to fit snugly at the F2 Landing Gear Former and the Tail Skid Pad. Once satisfied, use Thin CA to glue them in place.



Now with all the rough edges hanging over we can start sanding. Start with the bottom Stringers and use the block with 220 grit across the Fuselage to keep the Stringers even, sanding with strokes the length of the Fuselage and sanding back and over the Tail Skid Plate. This will make everything nice and even.

Use the same technique on the sides of the Fuselage and sand down the overhang of F5 Former and the Tail Skid Plate. One or two careful swipes on the end of the fuselage will dress the length of the Skid Plate.

This particular sanding block is made from a 1 x 2 Poplar with nice square edges and is 6" long. The paper is wrapped around tight and stapled to make it easily replaceable. 220 grit paper was used and works well for blending the joints. Use caution as this is aggressive enough to over sand or gouge into the soft Balsa.

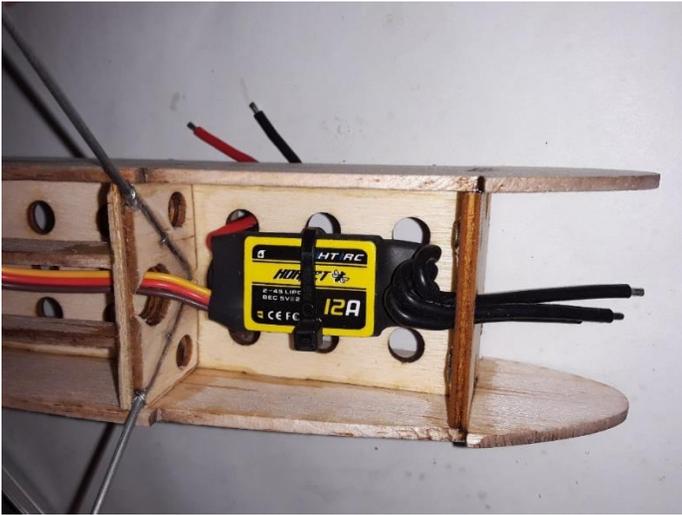


The next task is a little more time consuming because you want to be accurate. Start by sliding the Horizontal Stabilizer up to F5 Former and mark a line. It's hard to see in the picture, but it is there. Again, sanding the length of the Fuselage but only to F4 Former, sand down the top of the F5 Former and fair in the Stringers to the line you made. Once you get to the line, sand the corners from the Fuselage top edge to the edge of the outer Stringers. This makes a nice transition from the Fuselage to the Stabilizer as shown in the second picture.



Finish sanding the stringers from the F4 Former to the F3 Former to bring them down to the formers. A quick swipe or two across the face of F3 Former will dress up the ends of the Stringers.

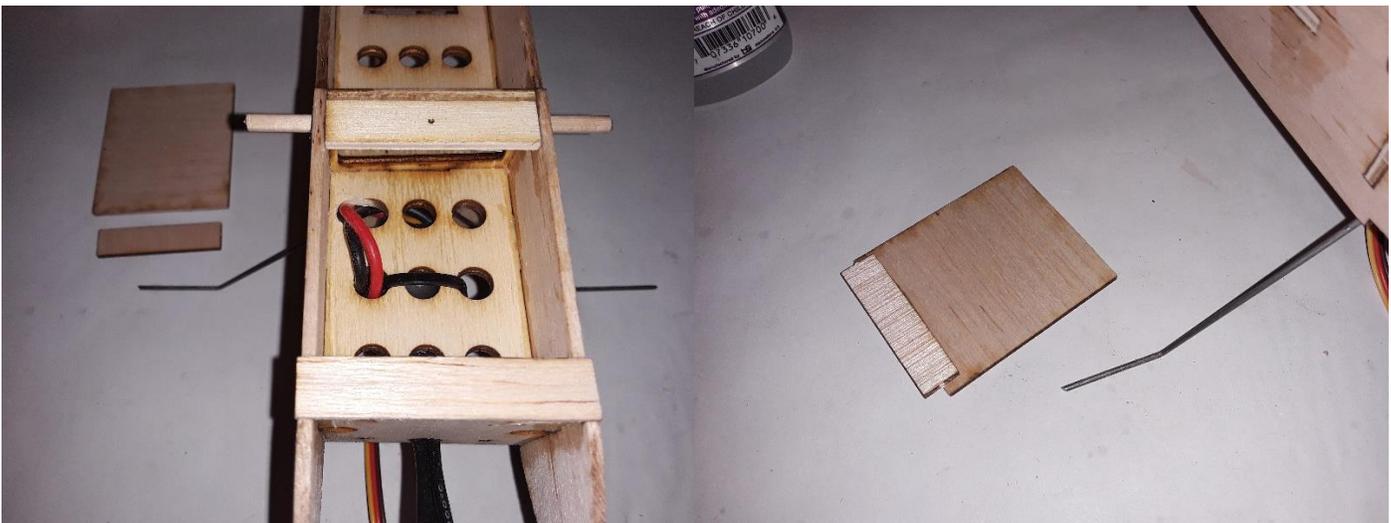
Pro Tip: In the second picture you will see that the F4 Former has been sanded with Scallops. This is a detail area that is often overlooked until the plane is covered, The Scallops allow the covering to flow from one stringer to the other giving you a smooth look after the covering is applied. This is also a feature used on full size aircraft not only for looks but to keep the air flow from being disrupted over the surface. Although not required for the small models, you'll find it is easier to cover, looks nicer, and is one more skill you've added while learning to build.



Although the parts are cut so that you can Hatch the Top and Bottom, this plane is being built with the Top Battery Hatch only.

Before finishing the Battery Hatch and sheeting the bottom forward area we choose to install the ESC. Note that the motor wires are left curled back so they are easy to thread into the hole once attached to the motor wires. The Battery wires are routed through a side hole to the upper battery area of the tray and the receiver line is run back to the radio area. A zip tie was used to keep the ESC from bouncing around loose.

The choice of ESC is left to the builder, using only 2 servos you can opt for the 6 amp ESC with the .5 amp BEC, however, later versions of this kit now include Ailerons as an option and if you are using a throttled .020 you should opt for the larger ESC/BEC with at least a 1 amp rating to ensure it handles the Receiver/Servo current draw requirements.



Setting up the Battery Hatch is straightforward. Fit and glue the Filler Strip to the front over the Firewall with Medium CA. We temporarily install the front dowel and position the Plywood Tiedown Strip. Remove the dowel and glue the Tie Down with Thin CA. It's easier to cover with the Dowels removed and it can be glued in after.

Set the Hatch Lip so half of it's width is on the Hatch. Center the Hatch Lip and glue it to the Hatch. Pretty Simple.

Test fit the hatch and in the next steps we will make adjustments for the covering and placing the Screw hole.



Since we are going to cover the hatch with heat shrink covering, we need to leave room for its thickness. If you were slightly off center with the Hatch Lip, this step will also work perfect to get it fixed. Use the square edge of the sanding block and lightly swipe the edge of the Lip to shorten it slightly on each end. If you were off center a little, do the shortening on the long side only. Check your fit, it should be able to move slightly side to side.

In the second picture, the front of the lip is also sanded lightly to reduced its thickness to allow for the double thickness of covering where it tucks under the Filler Strip.



Use a piece of tape and mark the center location for the Screw hole. Next, measure the distance from the edge of the Filler Strip and transfer that to the Hatch. Again, to leave room for the covering, deduct about $1/32''$ (.5 mm) from your measurement.

Use a pin through the spot you marked and put the Hatch in place to see if the pin is aligned with the small hole mark in the Tie Down Strip. If everything is right, you should have a nice little gap at the front where the Hatch meets the Filler Strip and there should be a small amount of side to side play at the Lip between the Fuselage sides. If not, recheck your measurements and try again with a fresh piece of tape. Using the pin leaves a small hole and makes it easy to correct the hole position.

Once you are happy with the fit, use a small Drill or a Needle File and make the hole for a #2 Screw all the way through both the Hatch and the Tie Down Strip. Install a small #2 wood screw or Servo hold down screw to make the threads in the wood. Remove the screw and hatch and put a drop of Thin CA on the threads in the Tiedown Strip to harden them. Once cured run the screw back through to set the threads. Open the hole on the Hatch so the screw slips through and then use a drop of CA on the hole to toughen it up as well.



As noted, the Sheeting was cut with the option of a Bottom Hatch. So, for the bottom of the Fuselage you have a choice. The sheeting is already cut as a Filler and a Hatch in case you were putting a fuel tank in the battery compartment. After the work accomplished for the Battery Hatch, this would be made the same way. You would just need to make a Tie Down Strip from a piece of the scrap Plywood.

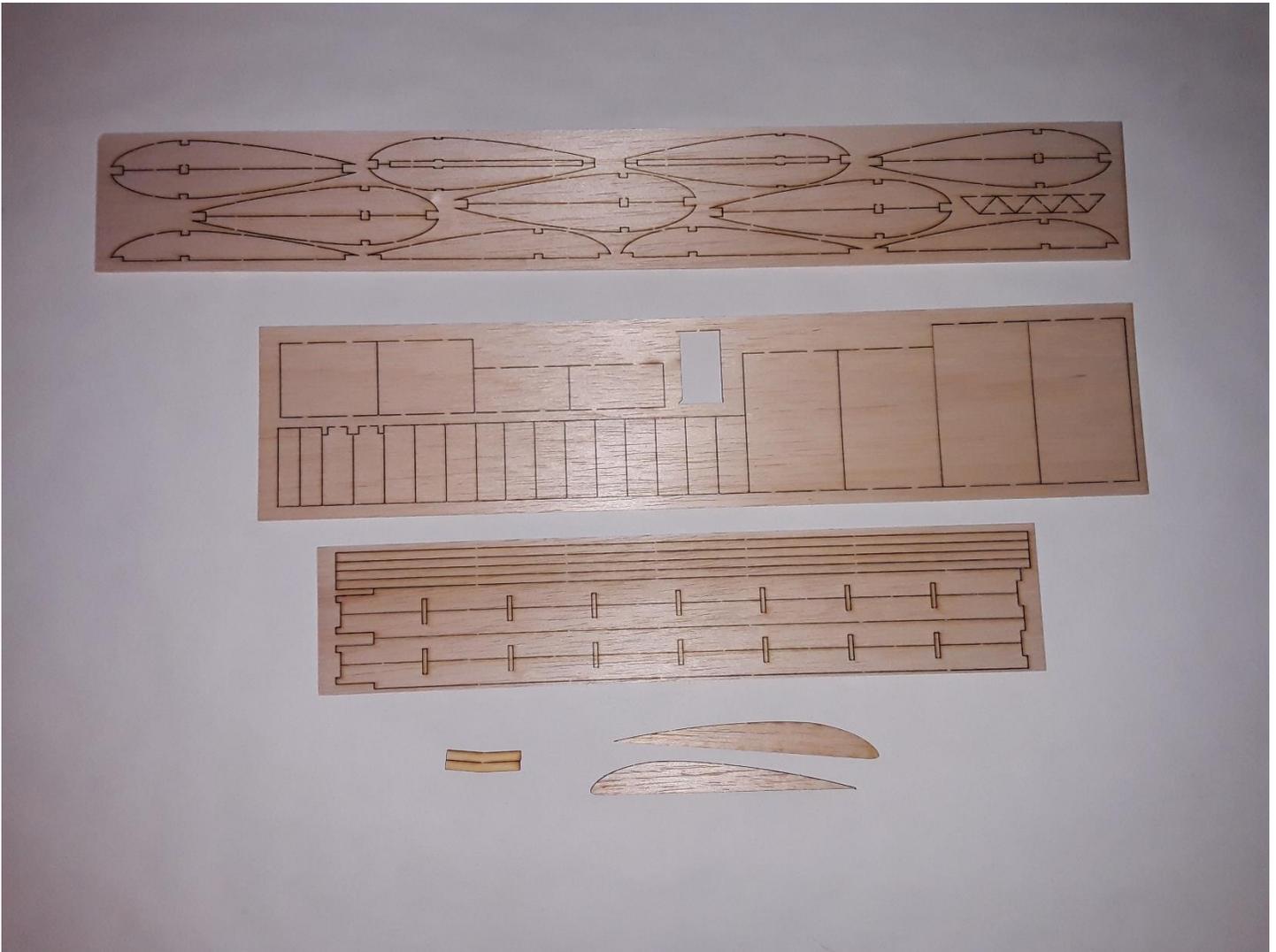
Alternately, as we did with this plane, you can edge glue the pieces together and fit it to the bottom. The gap at the Landing Gear was a slight bit larger than planned so an additional scrap from the sheet of Balsa was added by edge gluing and trimming to fit the gap and length of the opening. Once fit, it was glued using Medium CA.

Sanding the edges flush for the Hatch and bottom sheeting finishes up the construction of your Fuselage. Now would be a good time to completely sand and put a light rounding to all the edges. Working up to the 600 grit in preparation of covering. Make sure you include a light rounding of the edges on the Stringers so that the covering shrinks easily across them. Remember any imperfections will show up when you cover the aircraft and make it more difficult to achieve a smooth covering job.

Congratulations!

Wing Assembly:

Like all the Willy Nillies kits, the wings have been designed to be self-jigging and can be assembled on a flat surface without pins or weights.



Top Row; Sheet 1, Wing Ribs, Triangle braces. **Second row;** Wing center section sheeting, Shear Webs.

Third row; Spars, Leading and Trailing Edges. **Fourth row;** Dihedral Braces and Wing Tips.

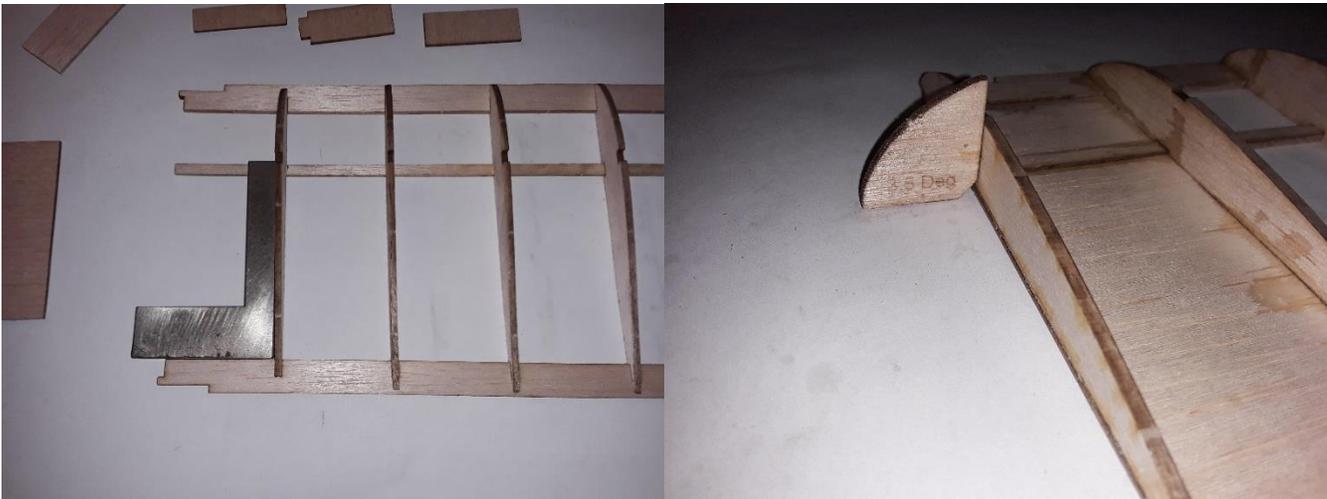
Punch out the parts taking care to sort them into like groups for ease of assembly. A light sanding will remove any nubs from the laser process so that parts will lay flat in position.

The Leading and trailing edges are designed to be identical so there is no need to try and identify one from another. You will need to ensure that when you assemble the wing panels that the notch for the Dihedral brace is at the root (Center) of the wing.



The first picture shows the wing center section sheeting. The pieces on the left are for the bottom of the wing and the pieces on the right are for the top of the wing. They are easy to tell apart since the tops are longer to go around the curve of the Ribs.

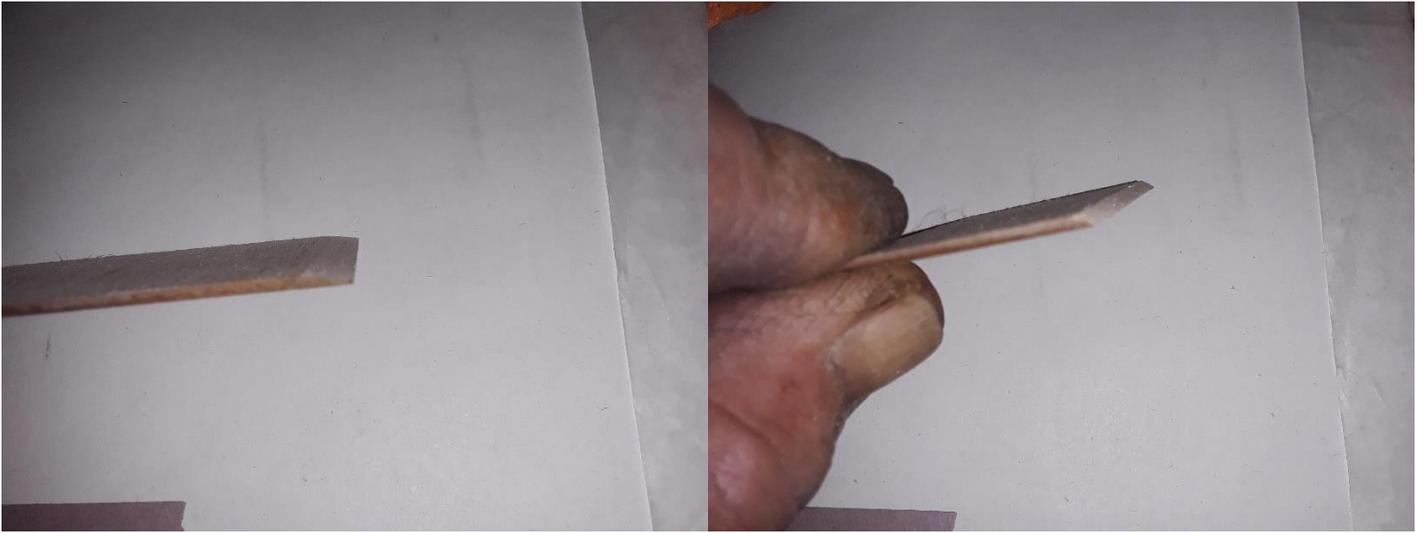
The second picture shows the parts layout of a wing panel, with the 2 smaller ribs for the center section sheeting placed at the notched ends of the Leading and Trailing Edges. The Shear webbing in the upper left corner are for the first three bays. The short one where the sheeting covers the ribs, the notched one where the web meets the sheet extension and a full height for the 3rd bay. There are enough shear webs to go all the way to the tips, however, the wing is plenty strong with only the first three bays shear webbed. **Note: Beginning builders should add all the webs to help keep wing from bowing during covering.**



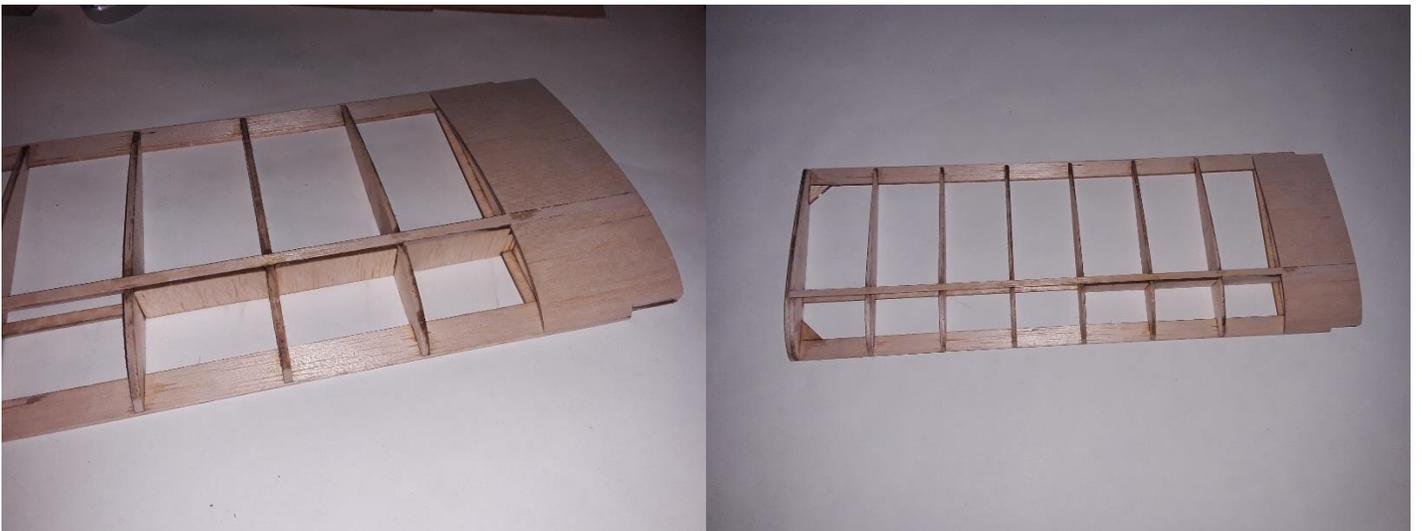
Start by placing the ribs into the slots of the Leading and Trailing edges and over the lower Spar. Checking for square is done as a habit of good building practice. Note that the root rib is left off for this step as well as the Tip Rib. Once you are satisfied with the layout you can apply Thin CA to the joints.

Using the supplied Dihedral gage, place the bottom sheeting in position and set the Root Rib in place. Again, once you are satisfied with the fits, use Thin CA to glue up the assembly. Note that the bottom corner is notched to clear the bottom sheeting to get an accurate setting.

Install the Tip Rib, square it up and glue in place. The Top Spar can now be installed and glued in place.



These pictures show the sanded angle in the top sheeting where it meets the Leading and Trailing Edges. The Rear sheet is on the Left, the Front sheet on the Right.



Medium CA is applied to the Ribs, Trailing Edges and the Spar Edge where the sheeting meets. Carefully butt the sheeting to the Spar and roll the sheet down to the Leading or Trailing edge. Holding it in place for a moment to allow the glue to set.

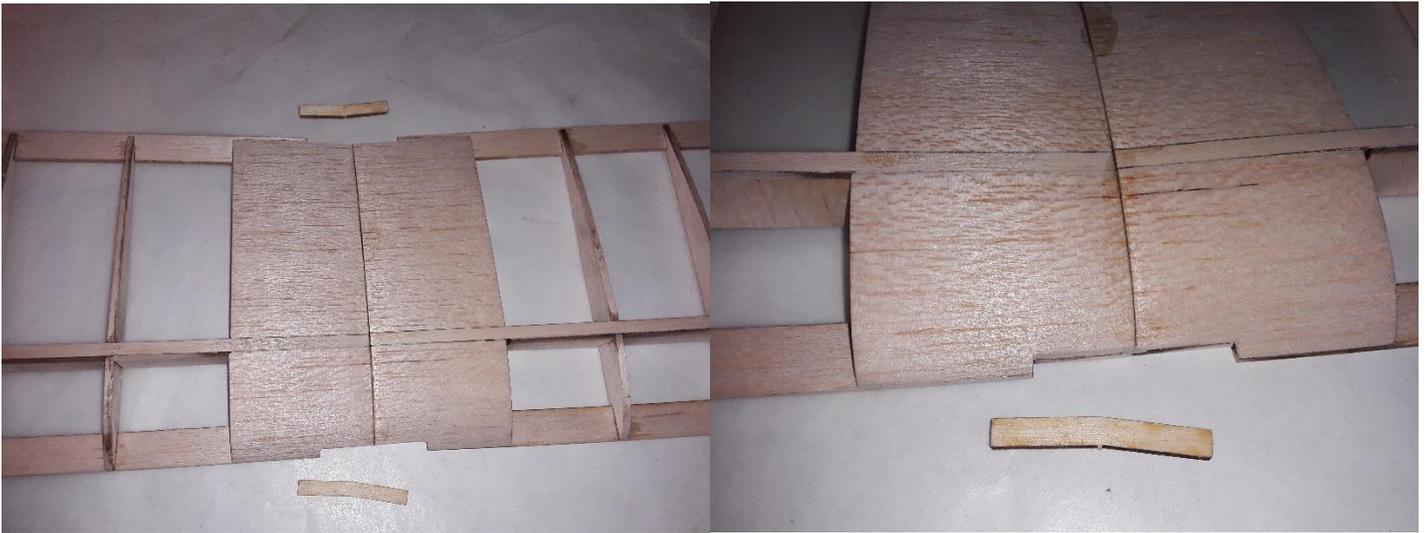
Add the 2 Triangles in the corners of the tip rib as shown in the picture.

Once these steps are completed, trim the Spars as needed and flat sand the sheeting to the Ribs of the Center section and Tip Rib. A sanding block as noted earlier is perfect for this job and will help keep the sanding flat and squared to the Ribs. Note the Notches of the Leading and Trailing edges are at the Wing root. These notches will be used for the Dihedral Braces when joining the wing.

The Wing Tip Plate can now be glued on using the Med CA and finish sanded to shape.

Note: When you lay out the second wing panel, make sure you have a Right and Left. The Tip ribs will be at the opposite end of the Panel.

Take your time and build the second panel the same as the first. This panel will be quicker as you already have one under your belt.



Once you have built both panels, fit them together and check that the center joints are square to each other with your dihedral of 7 degrees. The 7 degrees can be checked by raising one wing tip up 1-11/16" (1.6875"/43mm) total under the one wing tip. Bond the 2 halves together using Med CA or a thin coat of Epoxy applied to each half and putting them together.

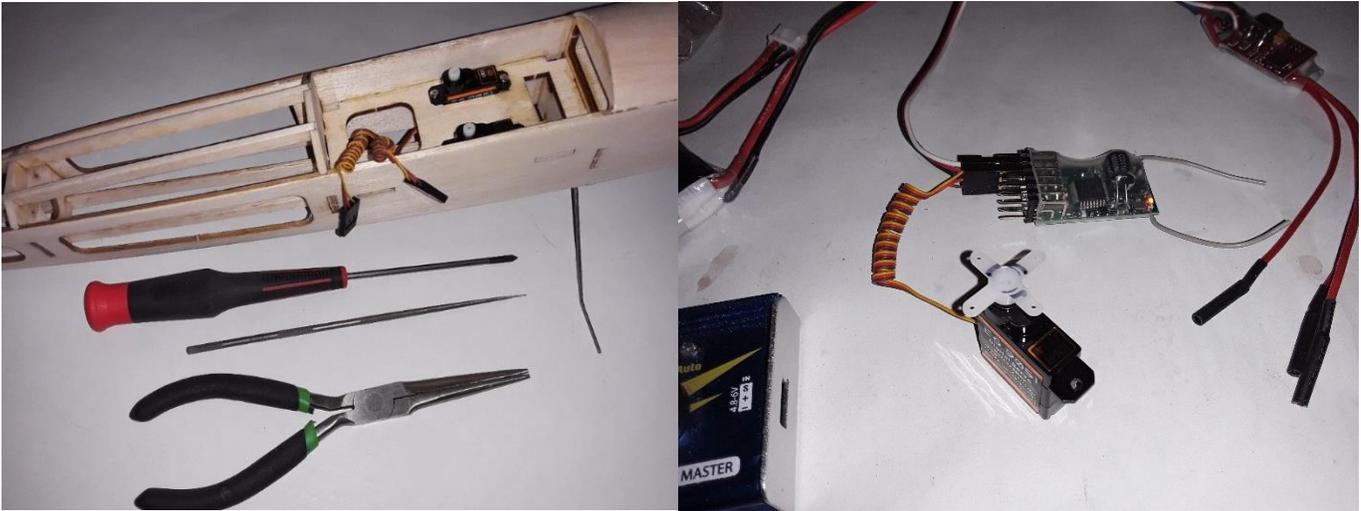
Trim the Sheeting to the notch of the Leading and trailing edges and test fit the Dihedral Braces. Once you are satisfied with the fits, bond them in place using Medium CA or Epoxy.



Once the adhesive has cured sand the braces to the shape of the wing and finish sand your assembly. Congratulations! Your wing is now completed.

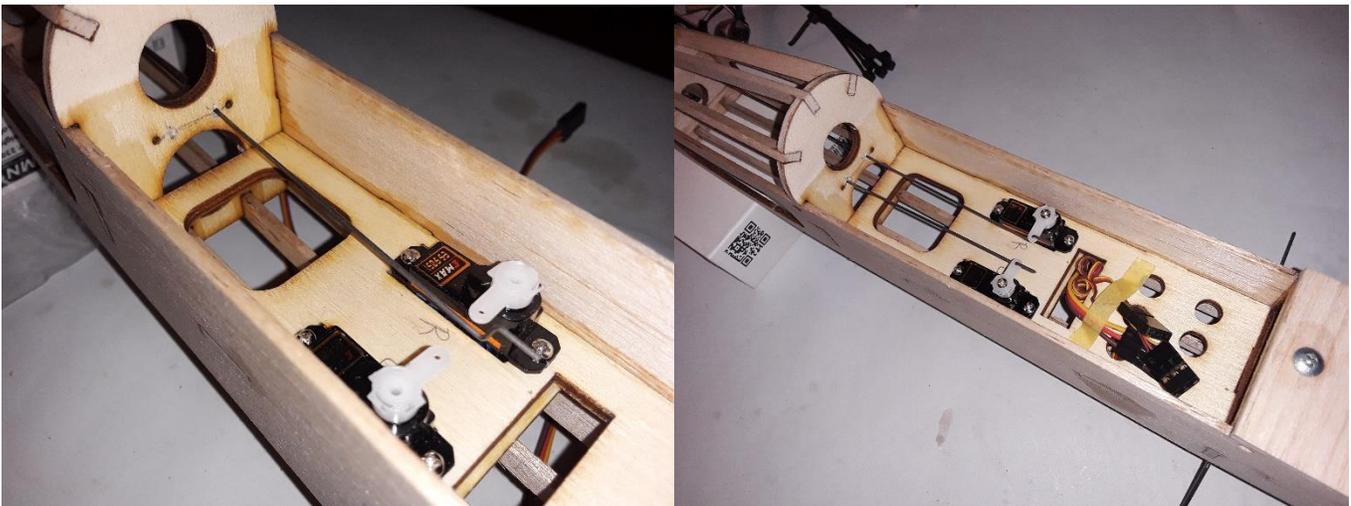
At this point, the construction of your airframe is completed and all that is left is to finish with your choice of covering material and attach the Horizontal Stabilizer and Vertical Tail which we will cover in the next sections as well as Radio installation, Covering, Hinging and Motor installation.

As we did with the Fuselage, completely sand and put a light rounding to all the edges. working up to the 600 grit in preparation of covering. Make sure you include a light rounding of the edges on the Spars so that the covering shrinks easily across them. Remember any imperfections will show up when you cover the aircraft and make it more difficult to achieve a smooth covering job. Don't forget to punch out and sand the Horizontal Stabilizer, Vertical Tail, Rudder and Elevator.



It's much easier at this time to install your servos and check the routing of your Pushrods. Shown are my favorite tools for the job; A Needle File to mark and make the holes, Needle Nose Pliers to place the screw and a #1 Phillips Screwdriver. An option here for the small servos is a dab of hot glue on each tab.

Set up and Bind your Receiver or use a Servo Tester to establish center on your Servos. Using the small cross Servo Arm set it in place on the output splines. If it doesn't line up at 90 degrees take it off and set it to the next Arm. The Splines in the Arms are cut in such a way that you can try the 4 and find the one that lines up closest to the 90 degrees. Mark the other 3 arms and trim them off. Note the marks on the Servo arm in the second picture. I rolled the Servo leads on the Screwdriver to make things neater. Keep this Servo and Arm together as a pair and set up the next Servo.

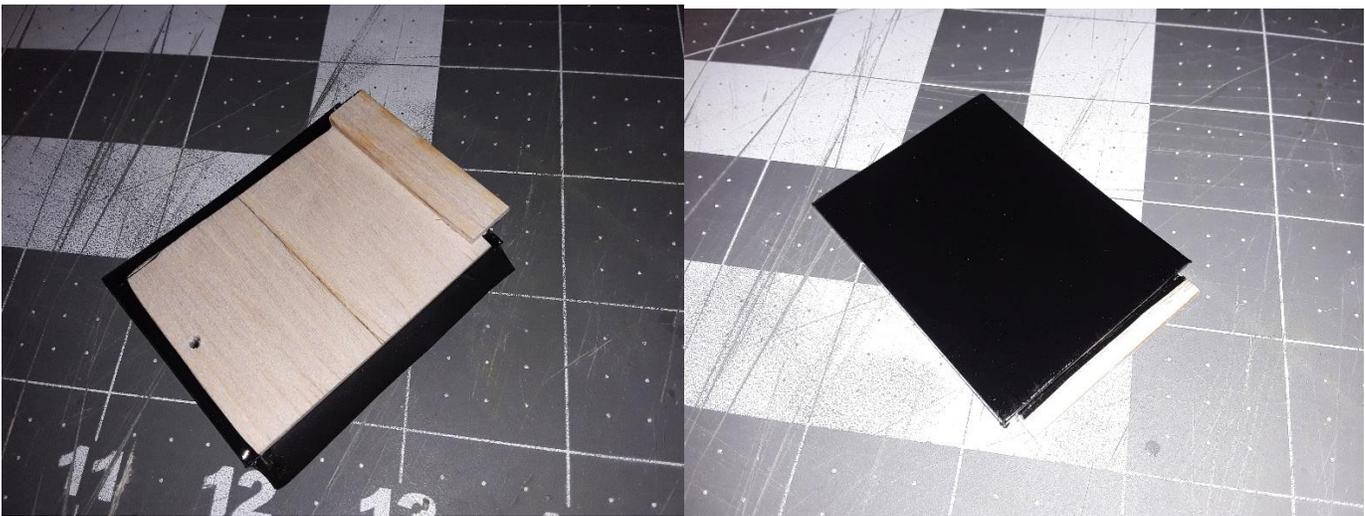


With the Servos and Arms installed in the plane, run the Pushrods through the guide holes of the Formers and out the Slots in the rear of the Fuselage sides. You can see in the first picture that we added 2 new holes approximately 1/8" over from the Laser cut holes to better Align the Pushrods. Note the "Z" bend is now aligned at a relaxed position with the hole in the Servo Arm.

Once you have the Servos and Arms set up and the Pushrods installed, tuck the wires up in the Fuselage in preparation of the covering. Doing it this way allows you to reach through the Fuselage with the Needle Nose Pliers to get the pushrods threaded through. It also allows for any adjustments you may need like moving the guide holes.

Covering Your Plane:

The following pictures are representative and may not necessarily be the plane you are building.



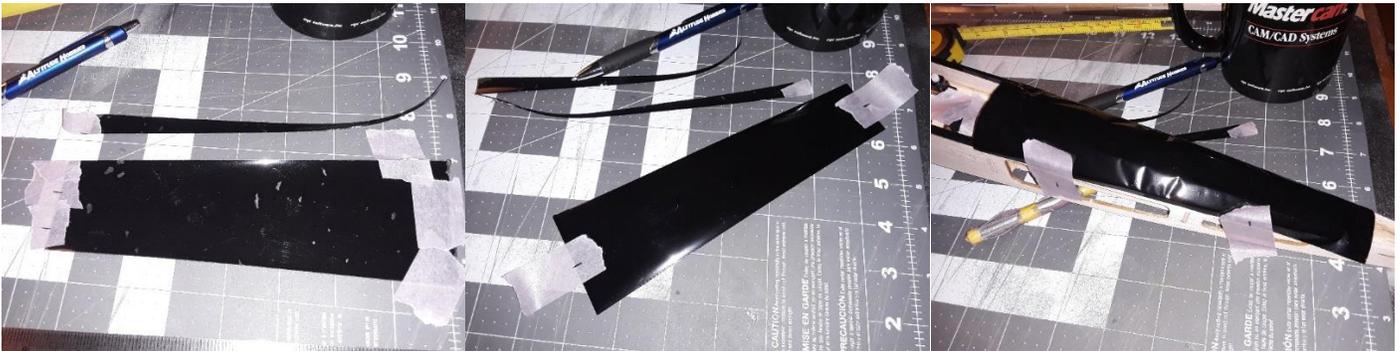
- (1) Setting up the Iron using a temp gage you need to be right around 310-315 degrees F. This is the Average temperture setting used with the Willie Nillies coverings. Other covering materials may vary so be sure to read the instructions before setting up your Iron.
- (2) With the Hatch as the first piece you are starting with something small and easy to peel off and start over.
- (3) Start by cutting your piece about a ¼ inch over size. Remove the clear backing sheet exposing the dull adhesive side and center it on the Hatch with the the dull side to the wood. Iron the corner of the edge olny using a quick tap about 45 degrees to the surface and work your way down the edges, tacking as you go.
- (4) Once you've tacked the edges, roll the covering around the edge using the iron and seal it on the back side. Do this to each edge, relieving the corners with a sharp knife or small scissors.
- (5) With the edges sealed lightly swipe the iron across the surface to shrink out the wrinkles. Don't press down, you just need to shrink the material, not seal it to the surface. This will leave you with a nice wrinkle free stretch. Ta-Da!

Pro Tip: Using a cotton Baby Sock on one of the Iron socks available through a hobby outlet will reduce the dust scratching that may occur during covering.

Poking a few pin holes through the hatch before you start keeps air from being trapped and ballooning the covering.

This series of pictures gives you an overview covering the Fuselage as a larger area, much like covering the Tail surfaces and the Wing. Always start small and work your way up to build confidence while reducing waste created by mistakes.

We start by covering the top and bottom of the Fuselage. In this manner the edges will be covered by the side covering concealing any ragged edges that you may have.



(1) Start by measuring over the front and rear formers and added $\frac{1}{4}$ " to each side for overlap. Measure the length as well and add a $\frac{1}{4}$ " as well.

(2) Lay out and trim this section using a straight edge and a sharp knife. Leave the center marking on the tapes as it allows you to lay it in place centered on the formers.

(3) Tack it at the tops of the F3 and F5 formers, it's ok to heat through the tape. You can take them off once tacked in place.

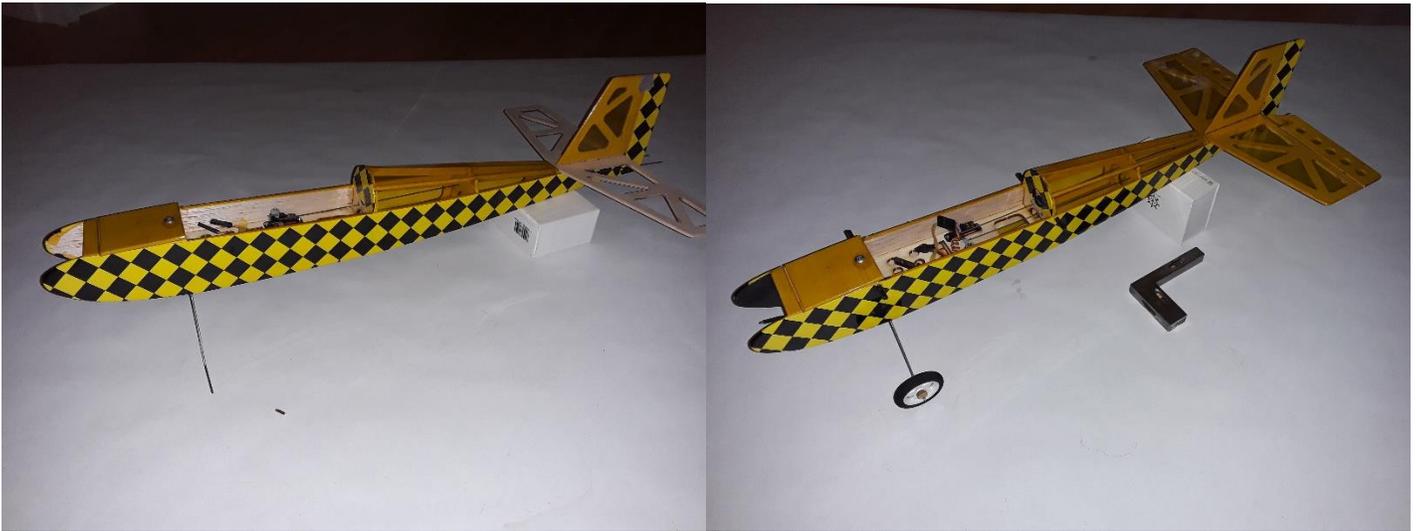


(4) Pull the covering down snug in the middle and tack the edge. Pull the covering down at the end Formers, add a couple pieces of tape to hold the edges down, then tack along the edge. Do the same with the opposite side and then finish tacking to the edges of the front and rear Formers. Don't tack to the middle, you want the covering to be able to move with the shrink to keep the covering shrinking evenly.

(5) Go around all the edges to seal them down to about a $\frac{1}{4}$ " in, trimming as needed and rolling the edge around to the face of the F3 Former. Once the covering is securely tacked lightly pass the Iron over the surface to shrink, making a few passes to get it shrunk evenly. Don't get in a hurry and hold the hot iron over the surface. It will cause uneven shrinking and to close to an edge can cause the edge to pull.

(6) Finish the sides in the same manner. Mark your covering where the Pushrods exit and cut a small slit to slide them through. Align the covering along the top edge and tack to the Tail Post, then tack the front. Using the edge of the Iron, start tack the top edge of the covering along the Wing Saddle. Work your way along the edge to the back and then work up to the nose. Gently pulling the cover down, tack along the bottom edge in the same way as the top.

(7) Once you have finished tacking the side, again, go around the edge to seal it down. Trim the excess covering leaving an edge around the nose and Tail Post to roll over and seal down. With the sealing completed, run your iron lightly over the surface to shrink it, working out any small wrinkles you may get.



As you can see in the picture, we have used a very contrasting covering to show the difference from the Top, Bottom, and Side covering and the results you are shooting for. The face of the F3 Former was covered with a separate piece where it is exposed above the wing.

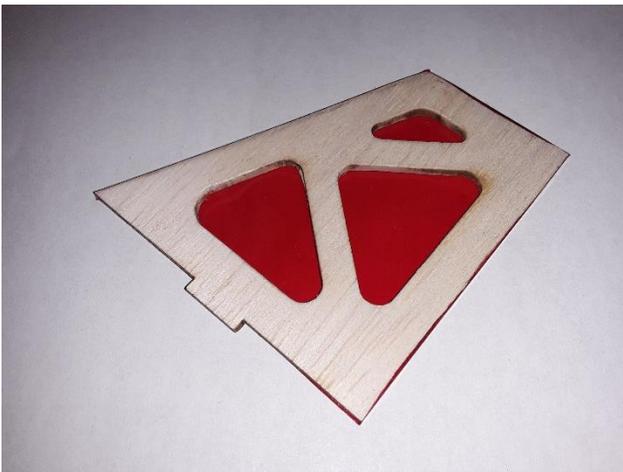
Note the covering rolled around the Nose and sealed in place. Another detail to point out is the use of 3/8" wide strips used along the Wing Saddle and the top and bottom of the nose allowing the covering to be rolled in and give a good transition without notching the long straight edge of the side covering.

The second picture shows the motor bay painted with Acrylic and sealed with EZ Dope for a clean look. If using a Nitro motor, a fuel proof paint or thinned Epoxy seal is a must. The Tail Skid and Wing Dowels are also installed and sealed.



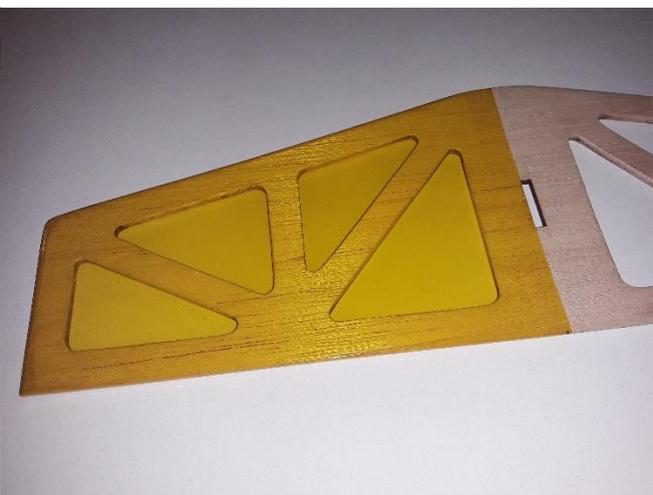
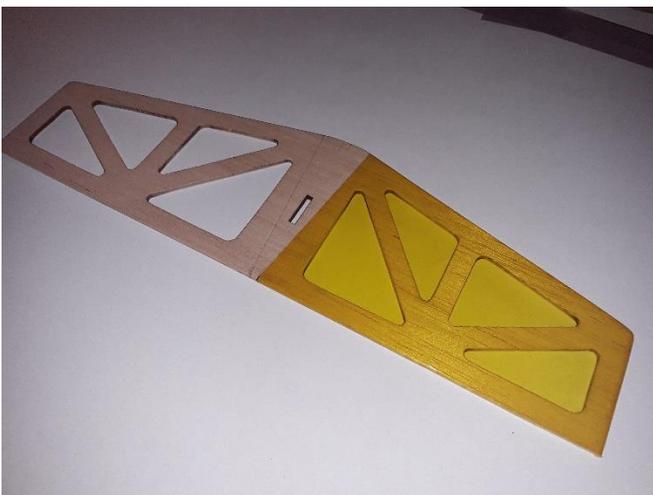
If you got carried away and covered the whole fuselage before running Pushrods, don't panic. Cut about a 1/2" hole just in front of Former #4 so you can reach through with small Needle nose Pliers or Hemostats to guide the pushrods through the holes. You can put a patch on or leave it open for air circulation. A steady hand and a heated-up Pin or a very sharp knife will do the trick.

Pushrods through the guides in the rear require a small hole punch or slit through the covering while you Tack and Shrink it in place. Once you've finished, use a sharp Knife or a heated-up Pin is used to cut the covering. The rods are trimmed off a little long at this point.



Covering is the same on the Tail and Stabilizer, tack down the edges, trim excess and relieve corners, roll around the edge and trim. Do BOTH sides before shrinking. You may want to iron in about $\frac{1}{4}$ " on the perimeter of the mating edge before shrinking so there is less chance of pulling loose.

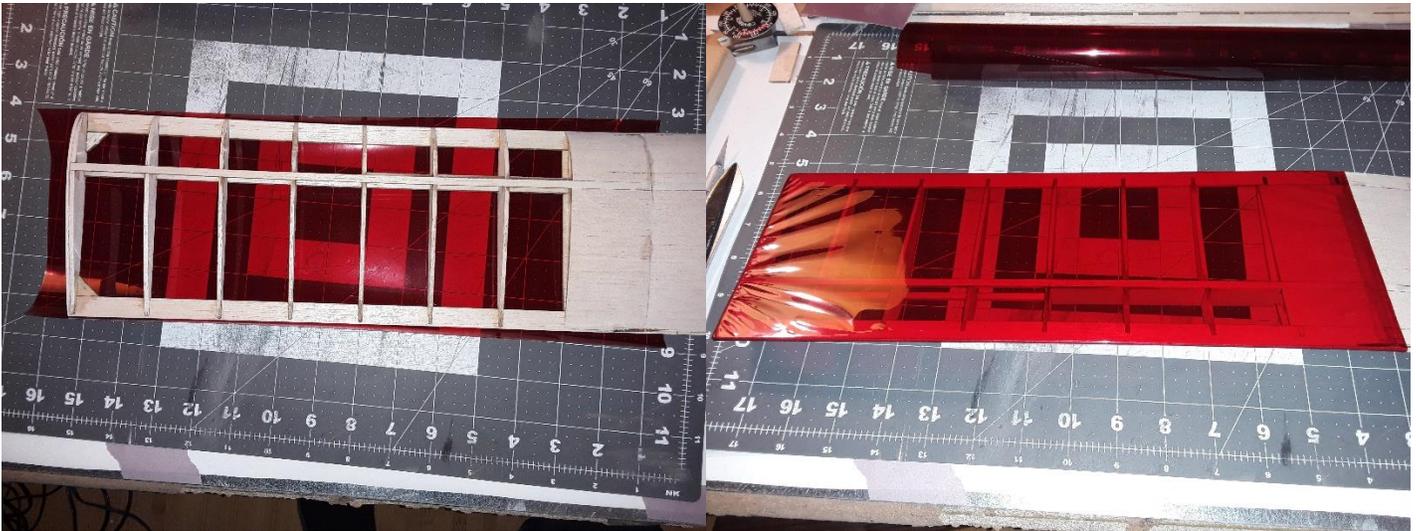
Note the tab is left bare so no trimming is required before gluing.



The Horizontal Tail was marked for locating the Vertical Tail and the Fuselage.

Start covering from the bottom so that the Edge Seam will end up on bottom. You can either cover your marks and cut the covering away or tack your first edge slightly inside the lines so that no cutting is required once you are finished.

Covering Tips for the Wing:

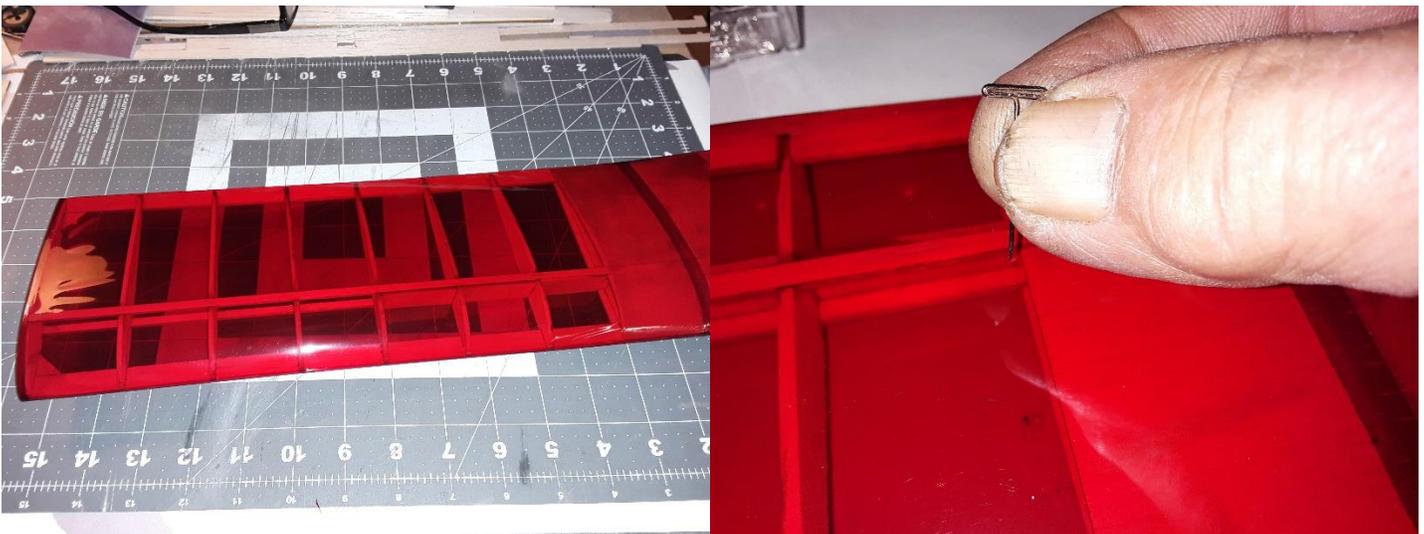


Cut your covering in panels leaving enough edge to pull and wrap around the surface edges. Note there is extra at the wing tip so we can cover it at the same time.

Tack the covering down at the wing root first, then the wing tip gently pulling the covering to take up the big wrinkles. If you need to reposition an area, a little heat over it allows you to pull it away.

Start by tacking on the leading or trailing edge from the center working your way to the ends, gently pulling the covering to maintain its placement. Do the same to the opposite edge, again working from center to the ends.

The Second picture above shows how it should look when it is tacked down. DO NOT Shrink it at this time.



Finish the 3 remaining panels using the same technique and your wing should look similar to the first picture above. Poke a pin hole in the bottom covering of each wing panel near the root sheeting and spar. You only need the one hole in each panel to allow the heated air to escape from the inside of the wing.

Go over the panels with your Iron lightly, work the top, then the bottom of each panel shrinking them a little at a time. This will help keep from shrinking a curl into the wing by evenly shrinking all the covering. Take your time, you'll do fine.

We'll add Washout to the wing in the next step.

Adding washout to the wing helps reduce tip stalling associated with Rudder and Elevator only planes and has been used on many designs with Ailerons as well. These wings are flexible this process is fairly easy. Twist the wing up slightly at the trailing edge of the Wing Tip and running the iron over the top covering to shrink and set the Washout. You may need a helper to twist while you iron. No matter the amount you get, shoot for between $1/8''$ and $1/4''$. Most importantly, make both sides the SAME!

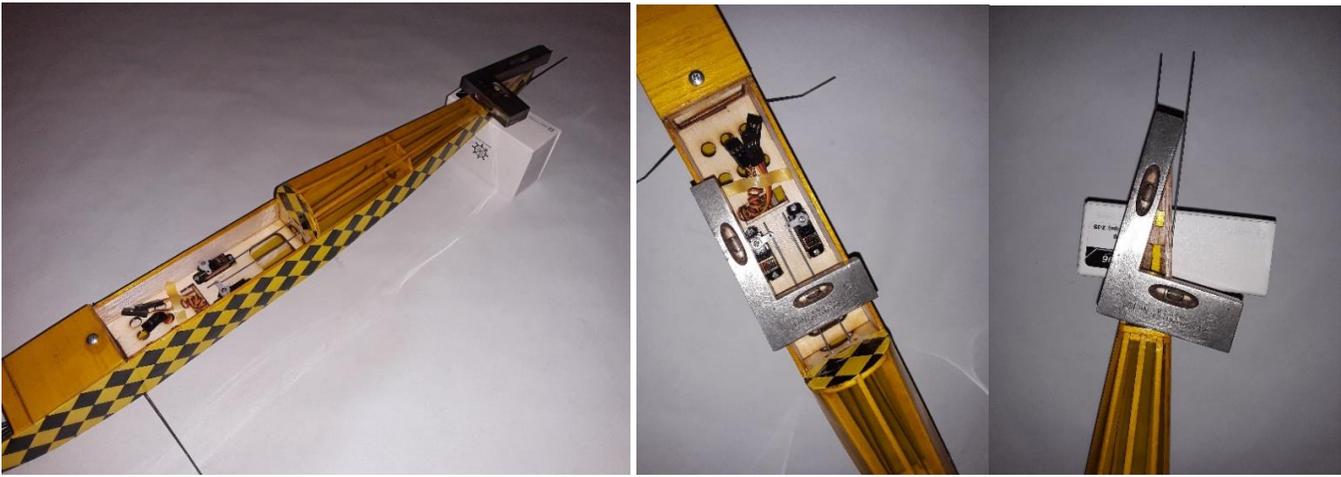
Hinging:



Install the Control Horns by trimming the holes and covering as needed the length of the Horn. Glue with Medium CA. The fishing line included in the kit is for making hinges. Start by marking the locations with the two surfaces aligned. For the Horizontal Tail the marks are $3/4''$ and $3-1/4''$ from the ends on each side. For the Vertical Tail they are marked $1/2''$ and $2-1/4''$ from the tip. Use a Tee Pin to make the holes about $1/2''$ deep in each location. The line is cut to $3/4''$ long and pushed into the surface to $3/8''$ deep. A drop of CA is used to secure them. It's best to wait and glue the Hinges in the moving surfaces once the Tails are installed on the Fuselage.



This photo shows the surfaces mocked in place and the arrangement of the control horns.

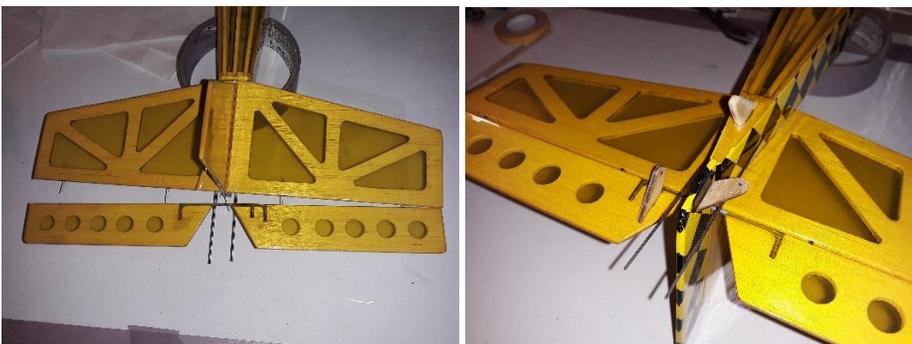


Check the Tail saddle for squareness to the Wing Saddle, blocking it up as shown. Again, with the way these are designed and the laser cutting being precise, this should just be a habit check. Since the wing saddle is covered do any adjustment you may need to the Horizontal Tail Saddle. Remember, a little goes a long way.



Test fit the Tails to the Fuselage prior to glue up. We found the tails needed to be moved back $3/32$ " to be flush with the Tail Post (end of Fuselage) and a scrap was added to compensate. The surrounding areas were taped off to keep from marring with sandpaper and the piece faired in with light sanding. A small strip of covering was added.

Once you are satisfied with the alignments, you can choose to do the gluing with Thin CA, Medium CA, or an Epoxy. The Epoxy is the most forgiving because it gives you time to ensure the alignment and adjust if needed.



The surfaces can now be attached. Start one hinge and then tilt into each of the rest. Start with the Elevator and push the surface up tight. Flex it about 30 degrees to set the gap. Add a drop of Thin CA to each of the hinges to secure them in place. Continue with the Rudder following the same sequence. Make sure that when you flex the Rudder there is no binding with the Elevator Joiner. Make adjustment if needed and finish by using the Thin CA on your hinges. Test your surfaces by flexing them back and forth. If you need to, clean any CA residue on the surfaces with Acetone. Attach your Tail Skid the same as the Control Horns by trimming the covering and gluing in place.

Attaching the pushrods to the surfaces:



In the first photo, the pushrod is bent at a 45-60-degree angle near the point where it exits the slot. You may want to mark the wire and remove the Servo arm to slide the rod back. Be careful to bend it in the right direction if you do. Once the first bend is made, you can re-install the arm and center the servo again. The second bend is made to align the rod with the control horn.

Trim the pushrod to length and rough up the surface with 400 grit sandpaper. Slide the heat shrink tube up the rod. Rough up the control link the same as the pushrod and install it into the Control Horn. You may need to trim the length but keep it long as possible. Carefully slide the heat shrink tube over the link. Place a piece of card stock or equivalent behind the junction and shrink the tube with a lighter, soldering iron or your covering iron. Using the Heat gun will blow too much hot air and possibly pull the edges of your covering.

Check your Servo Arm has not moved, then align the two tail surfaces so they are even. Apply Thin CA to the ends of the heat shrink letting it wick into the joint.

This makes a very secure joint and the pushrod can be bent slightly at the bends to adjust length if needed.

Note: Most newer radios allow you to use Sub Trim if you need to make a small adjustment but it's best to start as straight as possible.

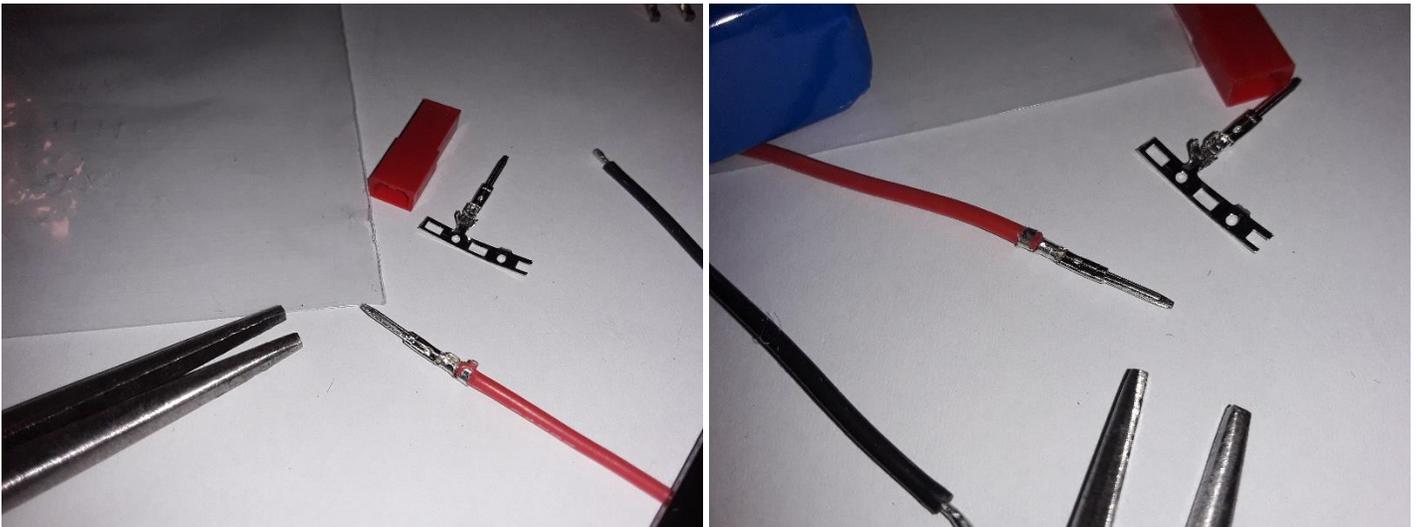


Details and Finishing up:



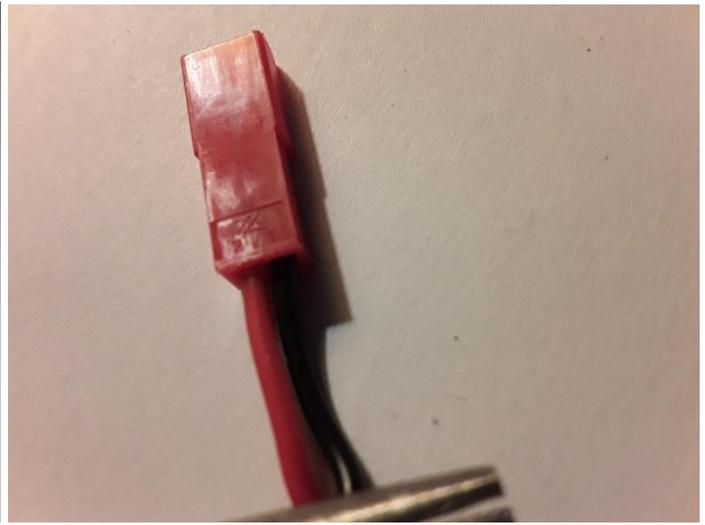
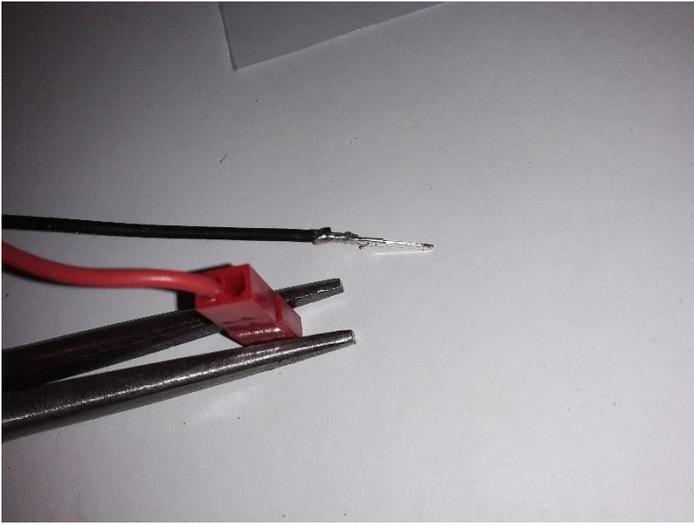
The motor is attached to the mount by applying a small dab of Blue Loctite to the supplied 2mm screws and using a 1.5mm Hex Driver. Snug the screws in a criss-cross pattern to ensure even tightening. Do NOT over tighten or you may crack the plastic mount.

Alternately you can use the mount supplied in the kit. This assembly will need to be spaced from the Firewall using the Spacer plates supplied.



Connecting the JST connector to the ESC for the Battery can be completed in or out of the plane and is easy to accomplish using a small tight pair of Needle Nose Pliers.

Turn the pin to about 45 degrees and start the crimp of the tab over the stripped wire. The flat on the bottom of the connector will roll in on the tab and wire as you squeeze. The first picture shows one tab rolled over, crimped to the stripped wire. The second picture shows the completed crimp on the bare wire and the insulation. Take your time and make tight crimps.



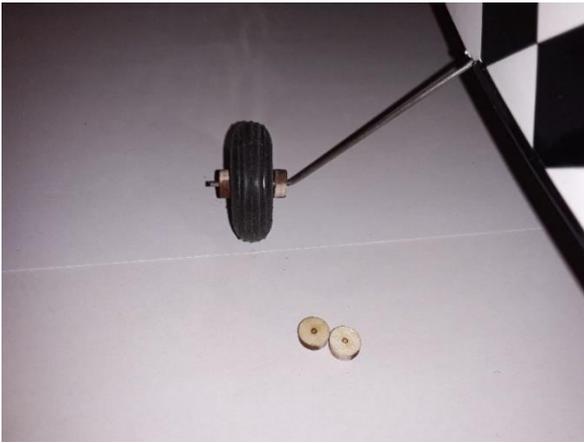
The small, raised tab on the pin you see on the black wire is aligned to the small notch in the hole of the connector. Slide the pin in until it locks in place. Give a tug to ensure it is locked. The second picture shows the Red wire in hole #2 and Black Wire in hole #1, if in doubt, put the connector housing on the battery before installing the pins to double check the positions for polarity.



Alternately, if you are confident in your soldering abilities, there are connectors available with pigtailed installed that can be soldered directly to the PCB of the ESC in place of the wires installed. If not, there are Crimping Pliers designed for this specific job that are available online for around \$20. They are a good investment if you use them for more than one plane. They will also crimp the pins for the common Servo Connectors. This pair is made by IWISS and is part # IWS-2820M.

Use a Servo Tester, or, setup and Bind the Receiver to determine the motor direction so the wires for the ESC can be marked for soldering or installing Bullet Connectors before the installation in the plane. If you have installed the ESC and sheeted the bottom of the forward Fuselage as we did, this step is the same, just a smaller working area.

The Receiver location in the aircraft depends on the space needed and the balance of the aircraft. If built as shown in this instruction, the light weight Receiver available through Willy Nillies will normally be placed forward of the servos for the Electric powered version.



The Wheel Collars are the round Plywood discs and are installed as shown using a dab of 5-minute Epoxy on the outer sides where they meet the wire. Depending on the hole size of the wheel you use, you may need a wrap or two of cellophane tape wrapped around the axle to take up the slop.



The supplied Pilot with this kit sitting on a mounting plate from a Q-Tee for painting. Sometimes the Laser cutting causes the pilot to fall out in pieces. Tape the back of the Pilot before popping out of the Plywood so it comes out as one piece. Use Medium CA to fill the cuts and then sand the surfaces of both sides lightly. You can choose to retain the mounting tab or flush mount it on the wing in the pilot area.

Windscreen: We will be adding this info in a later Revision.