91" LASER EXP ARF

Assembly Manual



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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!

THIS IS NOT A TOY! Serious injury, destruction of property, or even death may result from the misuse of this product. Extreme Flight is providing you, the consumer, with a very high quality model aircraft component kit, from which you, the consumer, will assemble a flying model. It is beyond our control to monitor the finished aircraft you produce. Extreme Flight RC will in no way accept or assume responsibility or liability for damages resulting from the use of this user assembled product. This aircraft should be flown in accordance with the AMA safety code. It is highly recommended that you join the Academy of Model Aeronautics in order to be properly insured and operate your model at AMA sanctioned flying fields only. If you are not willing to accept ALL liability for the use of this product, please return it to the place of purchase immediately.

Extreme Flight RC, Ltd. guarantees this kit to be free of defects in materials and workmanship for a period of 30 DAYS from the date of purchase. All warranty claims must be accompanied by the original dated receipt. This warranty is extended to the original purchaser of the aircraft kit only. Extreme Flight RC in no way warranties its aircraft against flutter. We have put these aircraft through the most grueling flight tests imaginable and have not experienced any control surface flutter. Proper servo selection and linkage set-up is absolutely essential. Inadequate servos or improper linkage set up may result in flutter and possibly the complete destruction of your aircraft. If you are not experienced in this type of linkage set-up or have questions regarding servo choices, please contact us at info@extremeflightrc.com or 770-887-1794. It is *your* responsibility to ensure the airworthiness of your model.

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Experience the evolution in 70cc aircraft design and performance! By far the most technologically advanced aircraft from Extreme Flight in this size, the new 91" Laser EXP is a marvel of modern construction techniques and unbridled aerobatic performance. Weight saving components are used throughout, such as carbon fiber structural reinforcement, carbon fiber wing and stab mounting tubes, carbon fiber landing gear, titanium pushrods and a carbon fiber tail wheel assembly, all ensuring the lightest, most high performance aircraft possible. You will notice there is a box built into the bottom of the Laser fuselage. This is a pipe tunnel and will accommodate most canister mufflers and tuned pipes sold for the current makes of 50-70cc gas engines.

The Laser EXP is quite possibly the best all around aerobat that we produce. It excels in old school low and slow 3D yet flies precision and XA as well as anything in our lineup. If you have shied away from the Laser thinking it is an old outdated design, think again! Extreme Flight has turned the Laser design into a modern fire breathing aerobatic masterpiece!



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Items needed for completion:

- ✓ **Masking tape.**
- ✓ **Hobby knife with #11 blades.**
- ✓ **Thin and medium CA. We highly recommend Mercury M5T thin and M100XF medium formulas as well as the Mercury glue tips.**
- ✓ **30 minute epoxy. Pacer Z-Poxy is a long time favorite.**
- ✓ **Blue and Red Loctite.**
- ✓ **Electric drill with an assortment of small drill bits.**
- ✓ **Small flat head and Phillips head screw drivers.**
- ✓ **Standard and needle nose pliers.**
- ✓ **Side cutters.**
- ✓ **Metric ball driver or allen key set.**
- ✓ **Sanding block and sandpaper.**
- ✓ **5 x MKS HV-777A, HBL-380 X8 or comparable servos.**
- ✓ **1 x standard size servo for the throttle. MKS 1250 is a great choice.**
- ✓ **Extreme Flight Socket Head Servo Screws**
- ✓ **2 x 1.5" Extreme Flight aluminum servo arms for the ailerons**
- ✓ **2 x 2" Extreme Flight aluminum arms for the elevators**
- ✓ **1 x 4" Extreme Flight double aluminum arm for pull-pull rudder.**
- ✓ **1 1.5" Extreme Flight aluminum servo arm if using push-pull rudder**
- ✓ **2 x Extreme Flight 6" 20 awg Servo Extensions.**
- ✓ **2 x Extreme Flight 12" 20 awg Servo Extensions.**
- ✓ **1 24" Extreme Flight 20 awg Servo Extension.**
- ✓ **2 x 36" Extreme Flight 20awg Servo Extensions. If you need to remove the stabs for transport use 48" extensions.**
- ✓ **1 36" Extreme Flight 20 awg servo extensions if using rear mounted rudder servo and push-pull assembly**
- ✓ **Extreme Flight Servo Safety Clips**
- ✓ **4" Spinner.**
- ✓ **60cc-70cc gas engine and preferred muffler/canister/pipe setup.**
- ✓ **JTech DA 70 mufflers with beveled fronts is recommended for the DA 70.**
- ✓ **Blazing Star engine mount**
- ✓ **1/4-20 x 1.75" engine mounting bolts, washers and nuts.**
- ✓ **24 ounce Extreme Flight Flowmaster tank**
- ✓ **Extreme Flight gas tubing and Fuel Dot**
- ✓ **Engine Manufacturer recommended prop.**
- ✓ **Optional-Extreme Flight Anodized Washer sets to add some bling!**

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Tips for Success:

1. **Before starting assembly, take a few minutes to read the entire instruction manual to familiarize yourself with the assembly process.**

2. **Go over all the seams on the aircraft with a covering iron on a medium heat setting. Also, due to climate changes, wrinkles may develop in the covering. These are easily removed with a little bit of heat. Use a 100% cotton tee-shirt and your heat gun and heat the covering while gently rubbing the covering onto the wood with the t-shirt. Be careful not to use too much heat as the covering may shrink too much and begin to lift at the edges. Take your time, and a beautiful, paint-like finish is attainable.**

3. **Apply CA to high stress areas such as servo mounting trays, landing gear mounts, anti-rotation pins, wing and stab root ribs, and motor box joints etc.**

4. **By the time your aircraft arrives at your door step, it will have been handled by a lot of people. Occasionally, there are small dings or imperfections on some of the surfaces. An effective method to restore these imperfections to original condition is to use a very fine tipped hypodermic needle and inject a drop of water under the covering material and into the ding in the wood. Apply heat to the area with a sealing iron and the imperfection will disappear. Deeper marks may require that this process be repeated a couple of times to achieve the desired result, but you will be surprised at how well this technique works.**

5. **Use a high quality epoxy for installing the composite control horns and hinges. We highly recommend Pacer Z-poxy. We are very pleased with the results and ease of application and cleanup of this product.**

6. **Take the time to properly balance and trim your aircraft and set up rates and exponential values. Your flying experience will be greatly enhanced once your plane is properly dialed in.**

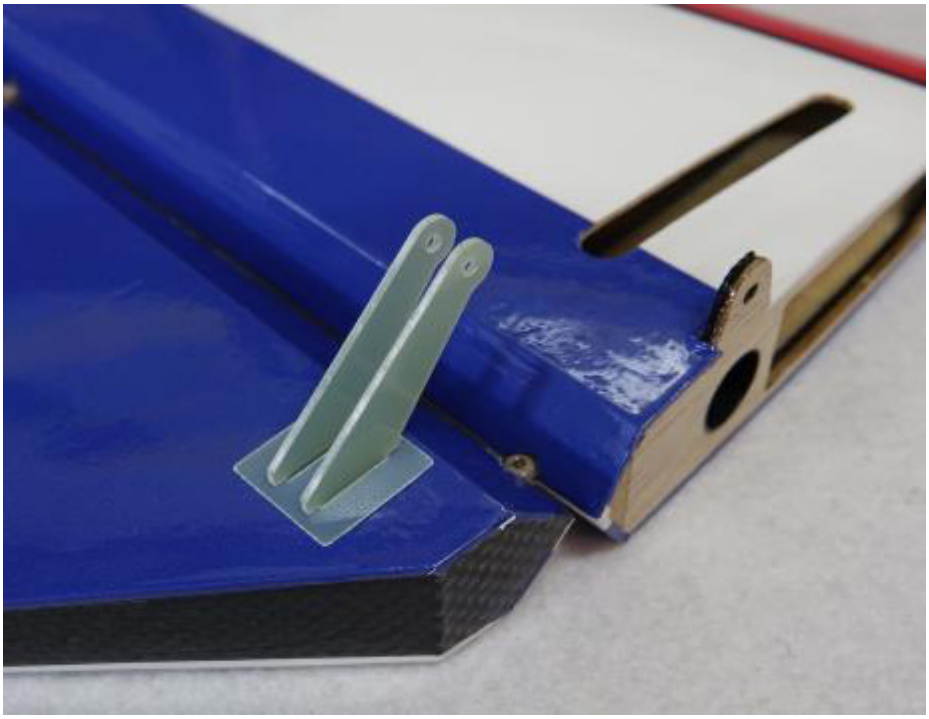
Please Note: **Because the assembly process is basically the same for all of the models in this size, some photos may show parts from another model if it was deemed that these photos better illustrated the assembly step.**

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Let's begin!

Elevator Assembly

1. **Locate the horizontal stabilizer/elevator assemblies as well as the composite control horns and base plates from the elevator hardware package. Trial fit the assembly into the slots in the elevator.**



2. **Trace around the base plate with a felt tipped marker.**



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3. **Remove the horn assembly and use a #11 blade to remove the covering from inside the ink line you traced around the control horn base.**

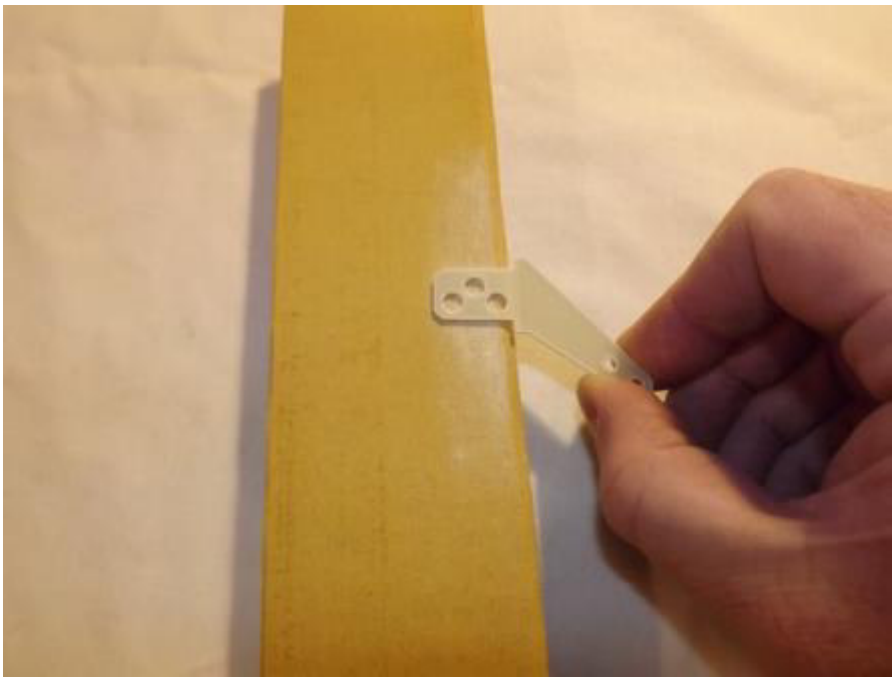


4. **Wipe away the ink line with a cotton cloth or paper towel soaked in denatured alcohol.**

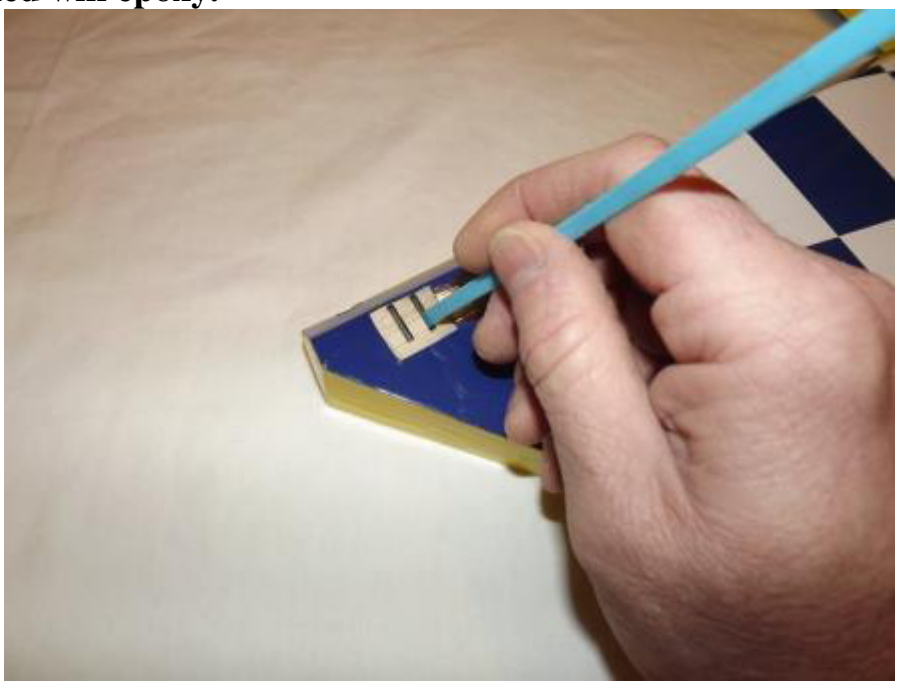


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5. Use sandpaper to scuff the portion of the horns and base plate that will be inserted into the elevator.

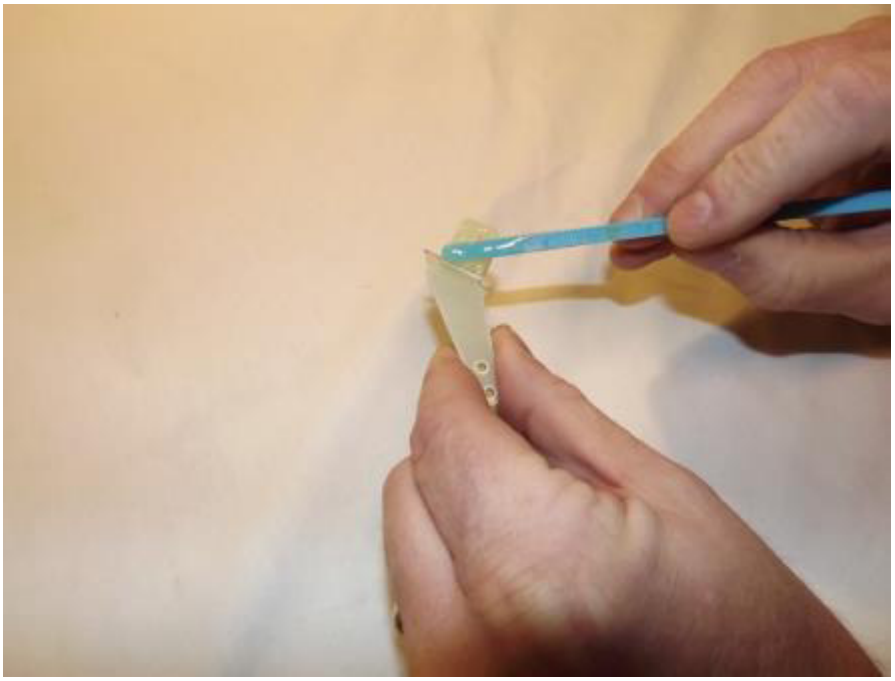


6. Apply 30 minute epoxy to the elevator slots using a zip tie to ensure the slots are filled will epoxy.

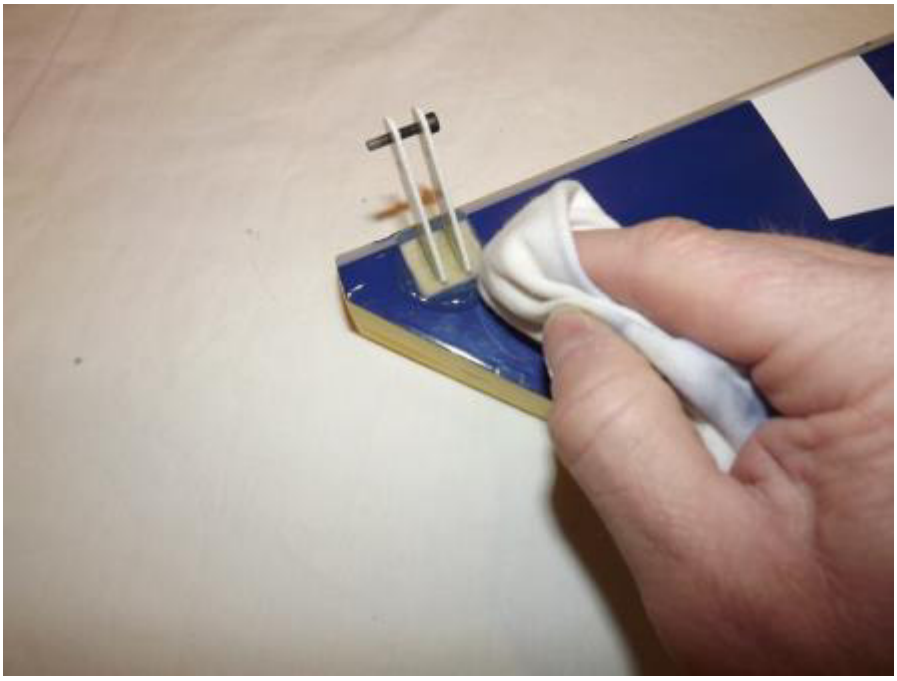


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7. Apply a generous amount of epoxy to the bottom of the G-10 control horns and base plate.



8. Reinsert the assembly into the elevator and wipe away any excess epoxy with a cloth and denatured alcohol. Place a 3mm bolt through the horns to help insure proper alignment and set aside to dry. Repeat for the other elevator half.



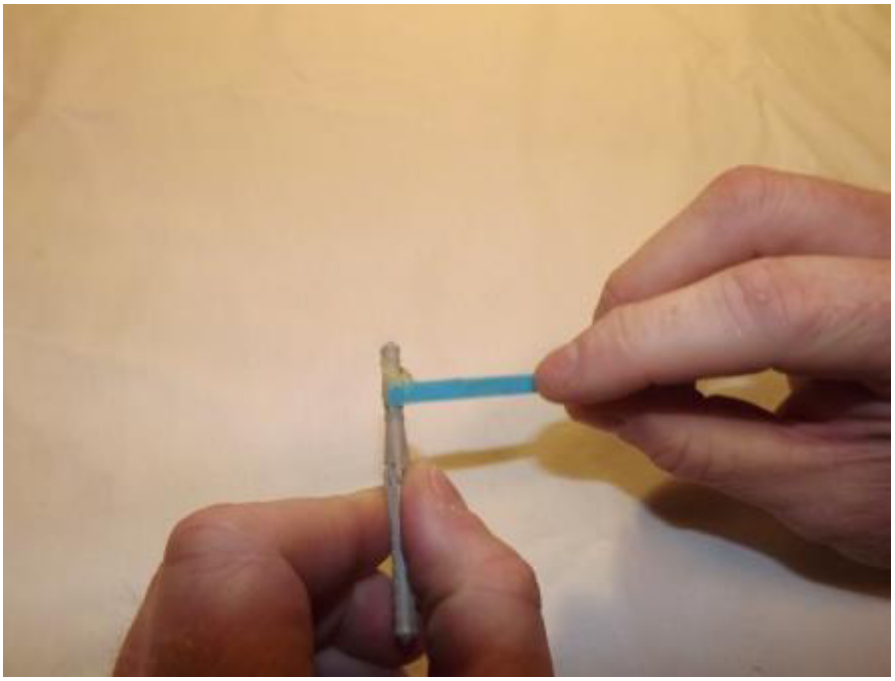
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Note: There are several methods and adhesives that can be used for installing the hinges. We will describe the way we do it as this method has proven itself over many years of model building.

9. Mix a generous batch of 30 minute epoxy. Use a zip tie or an old pushrod to thoroughly coat and fill the hinge holes on the stab with epoxy.



10. Next, coat one side of the hinges with epoxy and push the hinges into the holes of the horizontal stab.

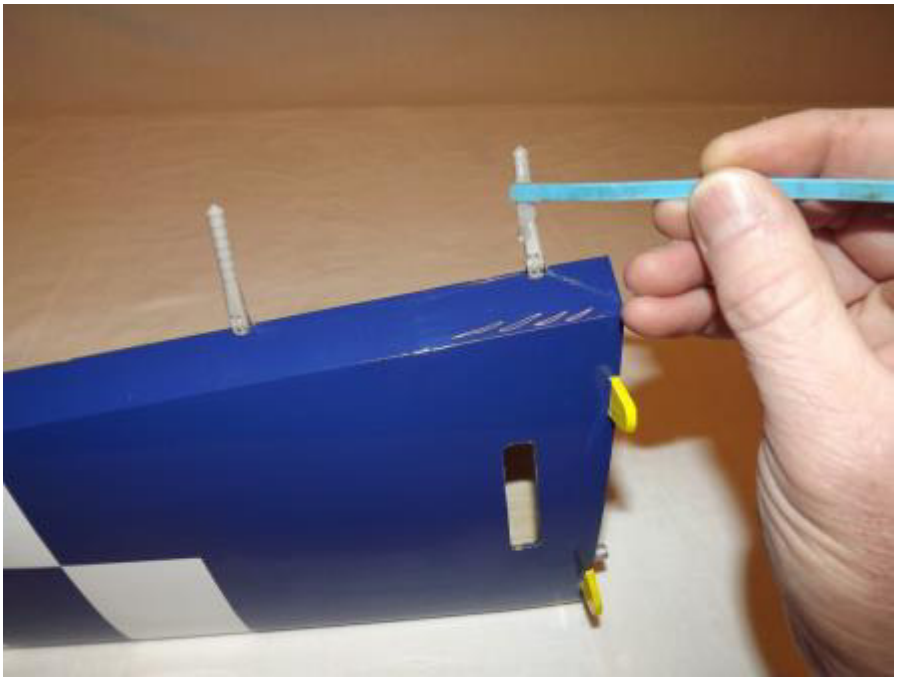


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11. Make sure the hinge pins are centered in the hinge gap and that they pivot 90 degrees to the stab.



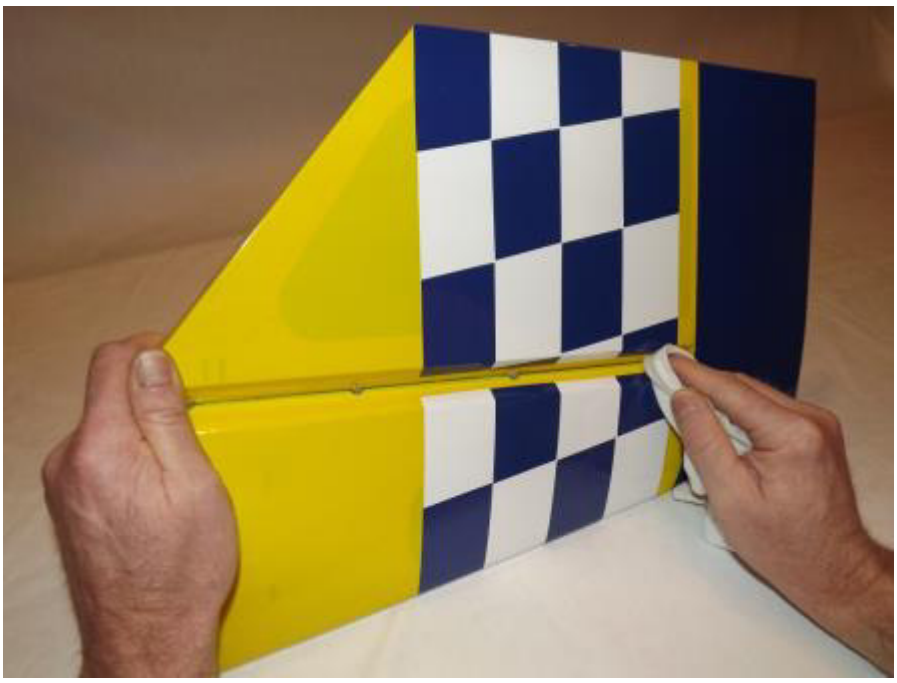
12. Now coat the other side of the hinges as well as the hinge holes in the elevator with epoxy and install the elevator onto the stab. Don't forget to apply epoxy in the hinge holes on the stab before installing the stab to the elevator.



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13. Use denatured alcohol and a cloth to remove all excess epoxy, especially on the hinge pin. Make sure you have full deflection in both directions – once satisfied with the results, set the surface aside to dry. After the hinges have dried thoroughly, pull on the surfaces to make sure they are properly secured.

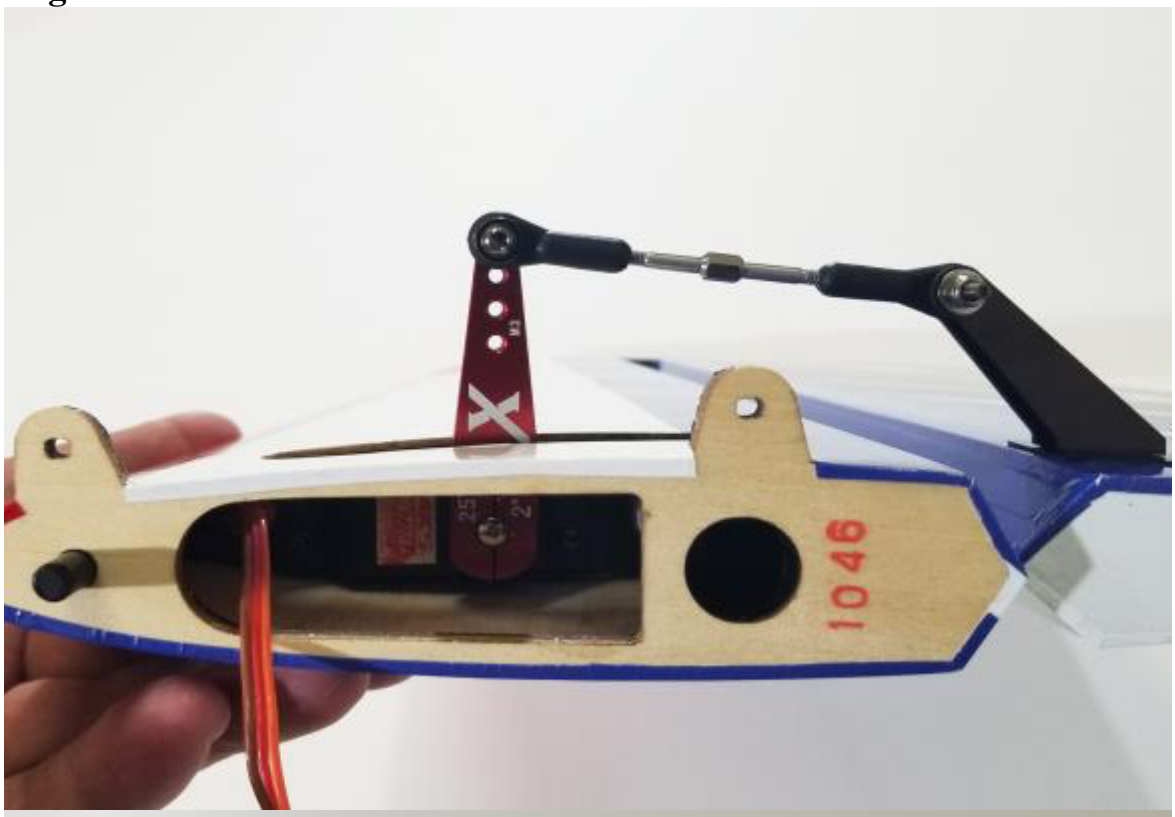


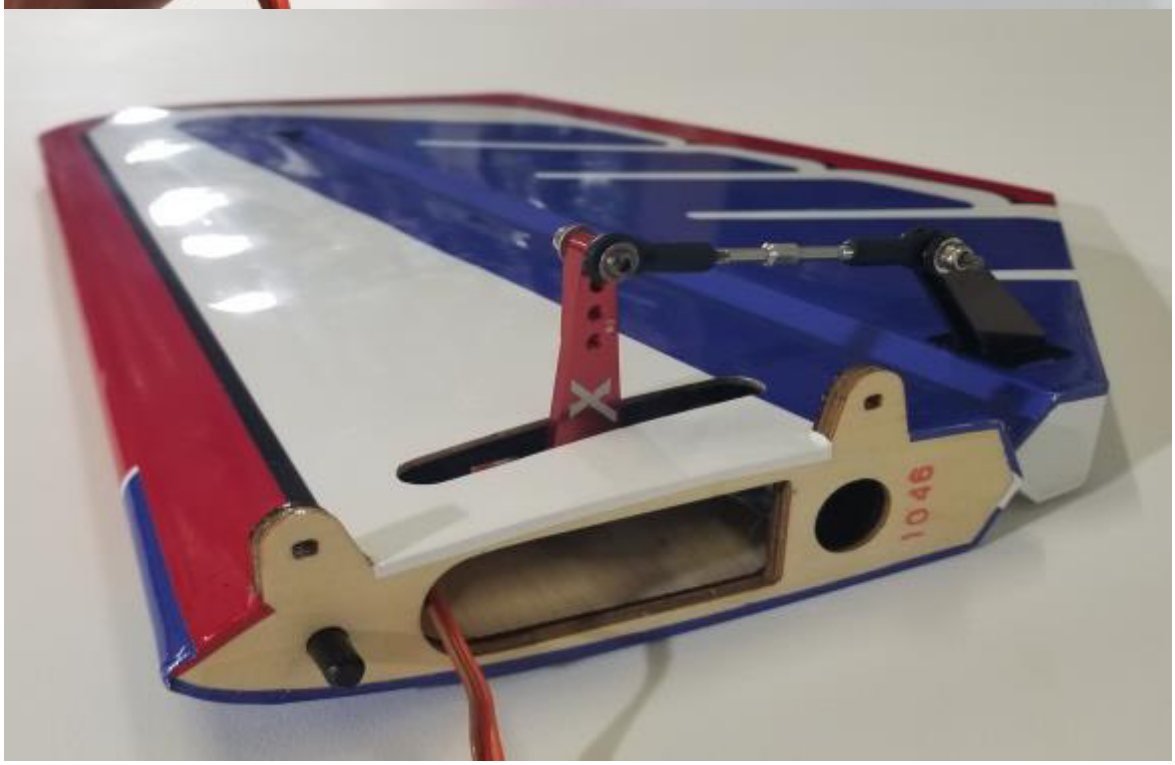
Note: Before installing the servos, it's a good time to seal the hinge gap with a strip of Ultracote or Blenderm tape. Also, I recommend that you thin a small amount of epoxy with a few drops of alcohol and apply a light coat to the inside of the stab and to the servo mounting rib as well as to the root rib and mounting tabs to protect against exhaust residue that can collect in these areas, especially if you plan to run a smoke system.

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14. Before installing the elevator servos, temporarily install the servo arms and electronically center the servos. Using the manufacturer supplied mounting hardware, install the elevator servo with the output shaft toward the rear of the stab and re-attach the servo arm.

15. Assemble the linkage and install as shown in the picture, using an Extreme Flight 2 inch servo arm.

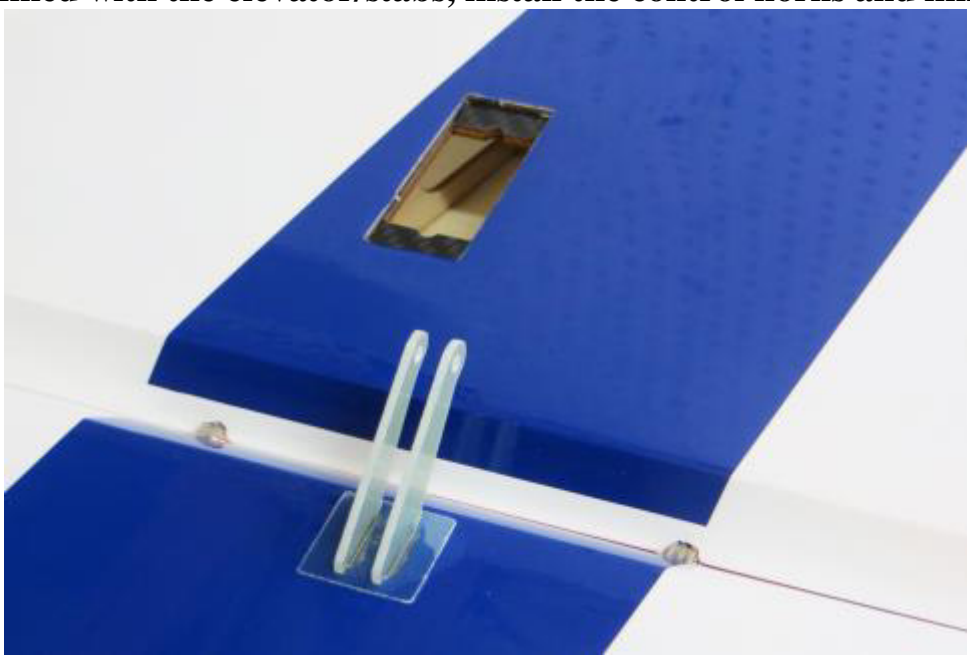




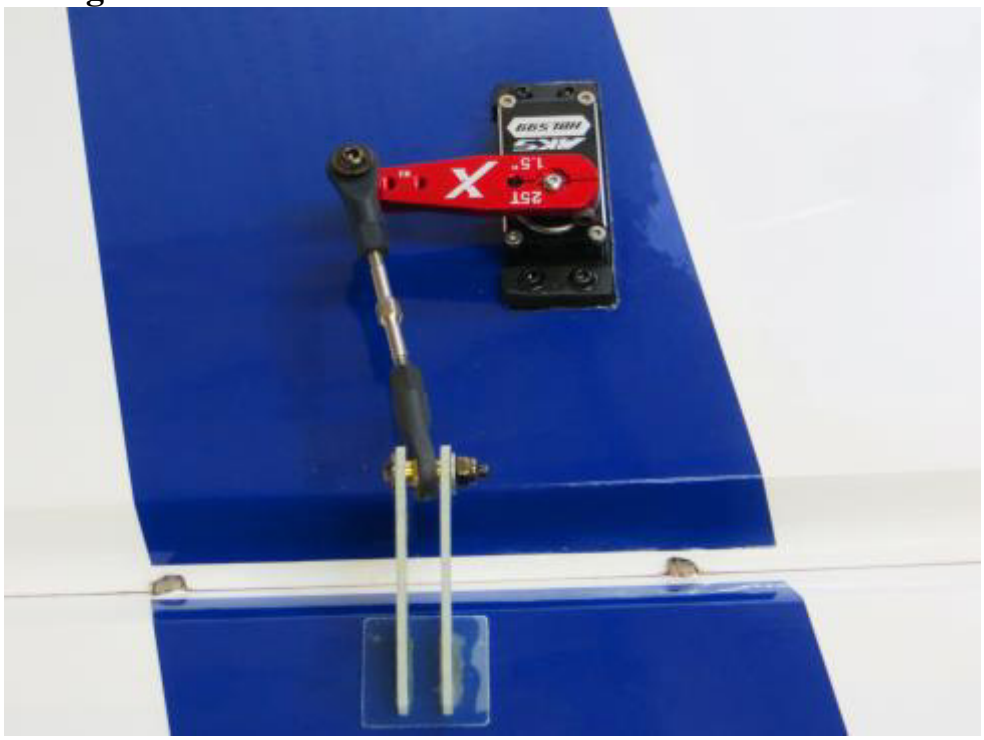
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Wing Assembly

16. Locate the wing/aileron assemblies as well as the composite control horns and base plates from the wing hardware package. Following the same procedure as outlined with the elevator/stabs, install the control horns and hinges for both wings.



17. Attach a 12 inch EF 20 awg servo extension and secure with a servo safety clip or heat shrink tubing. Install the aileron servo using the manufacturer provided hardware with the output shaft oriented toward the trailing edge of the wing. Electronically center your servo and install the 1.5" EF servo arm and linkage as shown.



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Note: Before moving to the next step – it would be a good time to seal the hinge gap with a strip of Ultracote or Blenderm tape. Be sure to fully deflect the control surface when sealing the gap to allow for full deflection once the gap is sealed.

Also, take a few minutes to go over the wings with a trim iron on a medium heat setting to seal all the trim seams and remove any wrinkles in the covering. Use caution and avoid excessive heat as this may cause the Ultracote to shrink too much and lift at the seams.

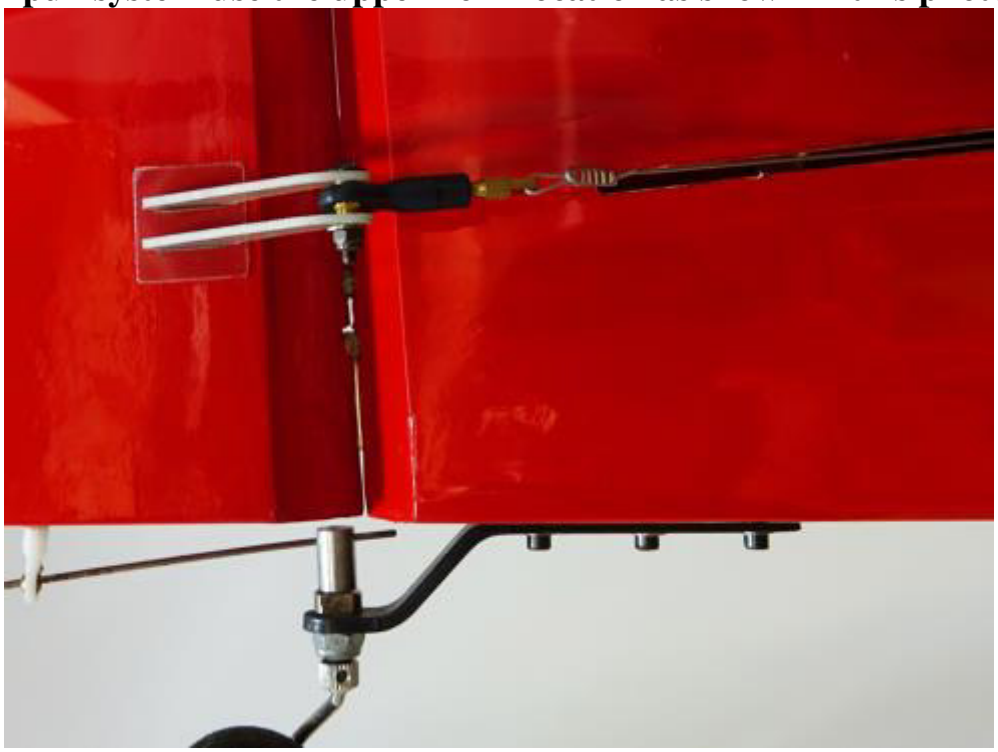
Rudder and Tailwheel Assembly

18. Locate the rudder, the rudder control horns and the 2 slotted base plates as shown in the picture below. Use sandpaper to scuff the bottom of the control arms as well as the side of the base plates that will attach to the rudder.



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19. There are two locations available to install the rudder control horns. If using the pull-pull system use the upper horn location as shown in this photo.

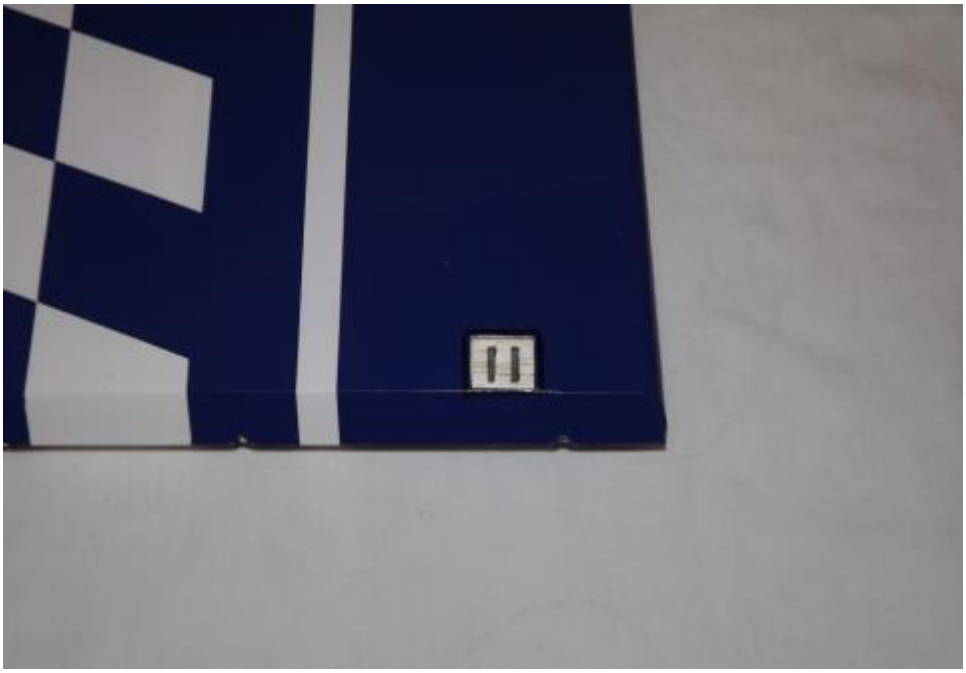


If using the push-pull system use the lower horn location as in this photo

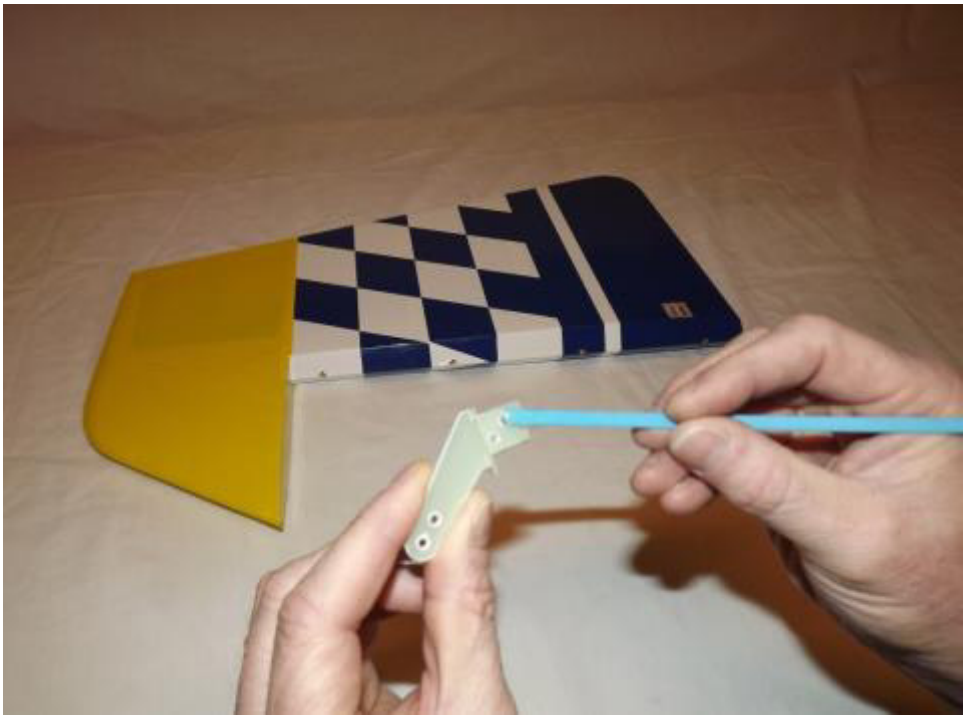


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20. Trace around the baseplate with a fine tipped felt marker. Use a sharp #11 blade to remove the covering in this area for the best bond. <u>If using the push-pull system with the rear mounted servo you will only need to glue in the horn assembly on the right side of the rudder (pilot's perspective)</u>. If using pull-pull you will need to use both horn sets.



21. Mix a generous batch of epoxy and completely fill the two slots as well as the areas on the control horns and base plates that will glue into both sides of the rudder.

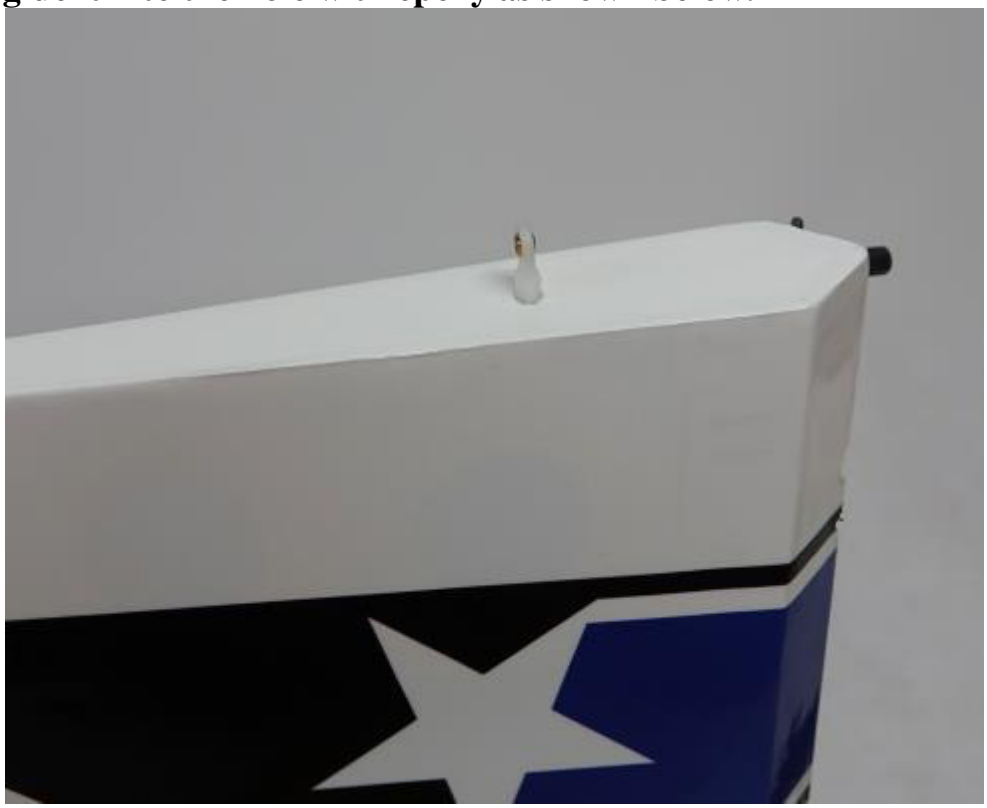


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22. Install the rudder horns and base plates into the rudder one side at a time. Clean any excess epoxy from the rudder, recheck the alignment and set the assembly aside to dry. <u>Remember to only install the right side horn if using push-pull!</u>



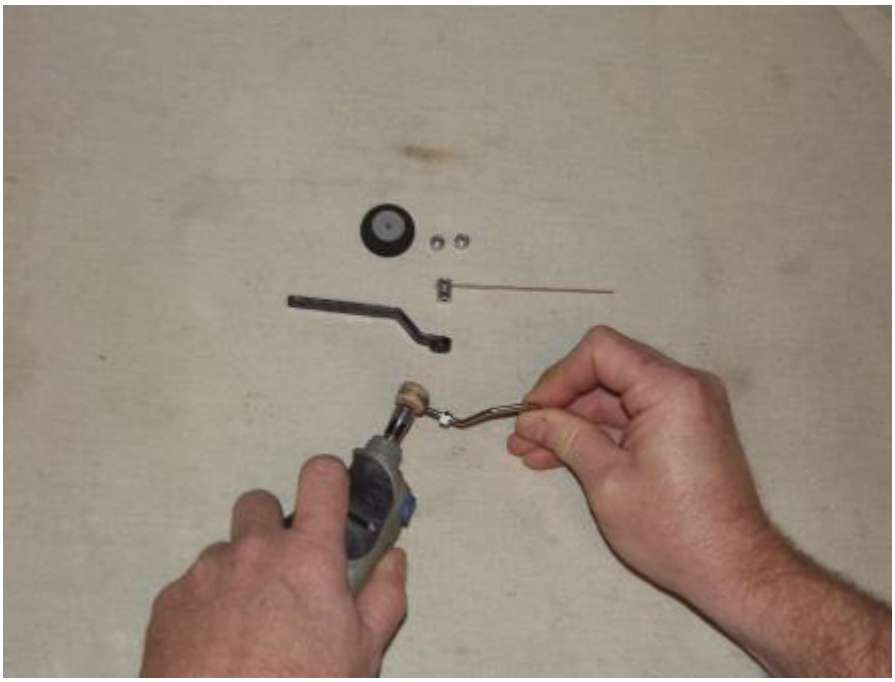
23. Locate the 2mm ball link from the tailwheel hardware bag. There is a pre-drilled hole to accept the shaft of the ball link. Scuff the shaft of the ball link and glue it into the hole with epoxy as shown below.



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24. Next install the rudder hinges using the same procedure as with the Ailerons and Elevators. Use painters tape to hold the rudder in place while the epoxy dries.

25. Disassemble the tailwheel assembly and use a rotary tool or a small file to create a flat spot on the tailwheel wire for the set screws in the aluminum cap to seat against. Reassemble the unit and apply Loctite to the threads on the setscrews. Slide the tailwheel onto the wire and secure with the included wheel collars.



26. Use a sharp hobby knife to open the 3 holes in the bottom rear of the fuselage to expose the 3 pre-installed 3mm blind nuts. Slide the tiller arm of the tailwheel into the hole in the ball link and attach the tailwheel assembly to the bottom of the fuselage with 3 3mm bolts. Be sure to apply blue Loctite to ALL bolts!



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27. If using the pull-pull setup now is the time to install the pull-pull rudder cables. Install the cable onto the brass threaded connector as shown, using the aluminum crimp tube to secure.



28. Install the rudder servo in the designated location in the rudder tray. Electronically center the servo and install the EF 4" pull-pull arm. Secure the cables to the arm as show using 3mm bolts. As you'll notice in this picture we used the SWB Pull-Pull Tensioning Kit which makes getting the proper tension on the cables very easy and is a worthwhile investment. Please also note we are using the holes at the 3.5" location for best geometry. The cables should be crossed in a X pattern before exiting the rear of the fuselage.

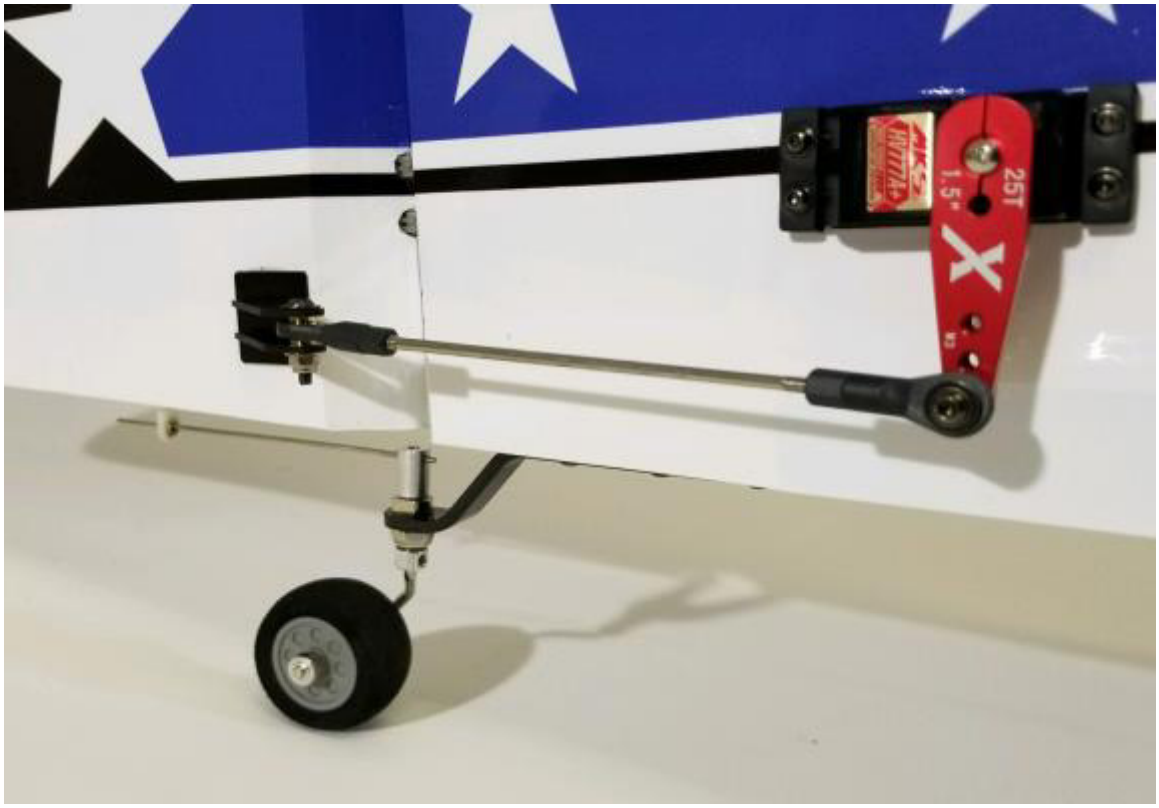


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29. This picture shows the exit location of the pull-pull cables as well as the attachment to the rudder horns.



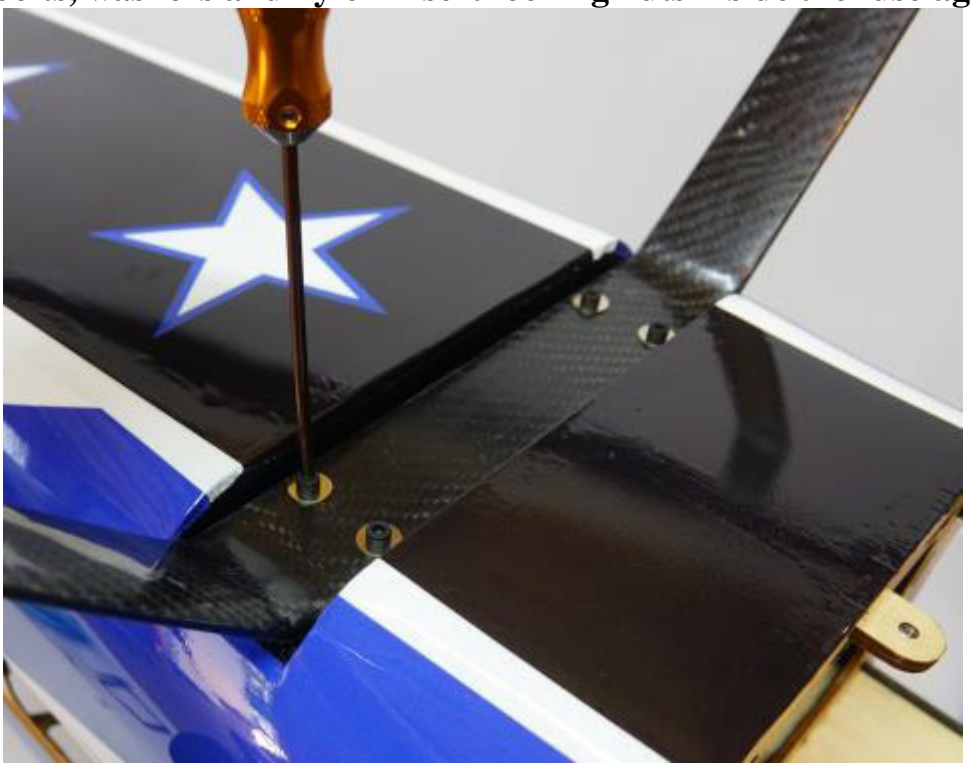
30. Here is a photo of the alternate push-pull assembly using the supplied hardware and an EF 1.5" servo arm.



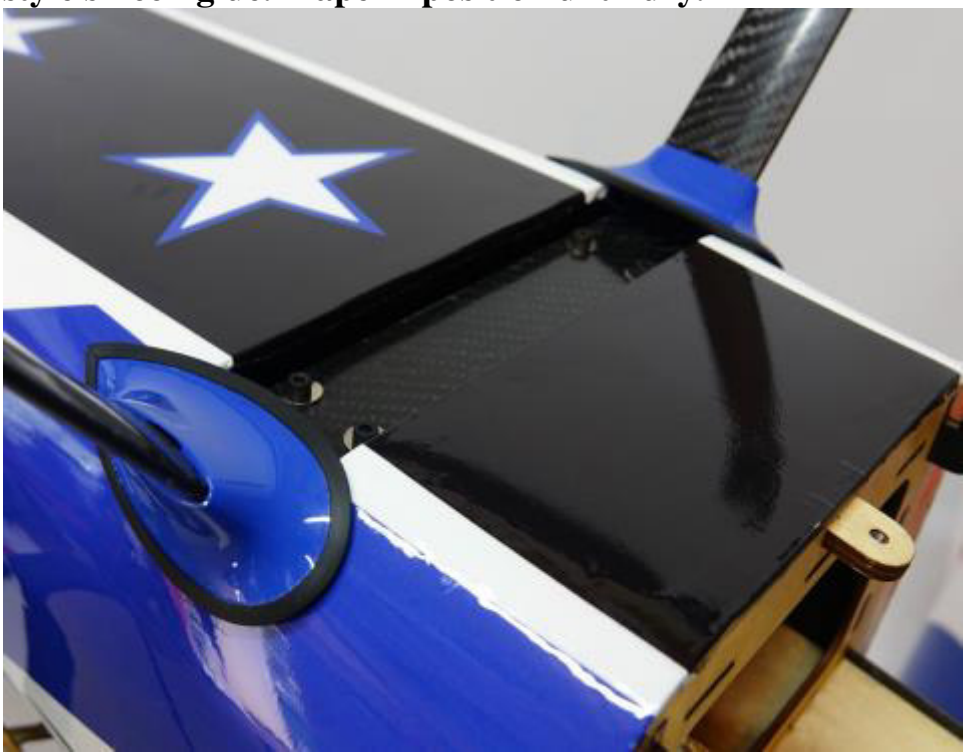
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Fuselage Assembly

31. Locate the Carbon Fiber main landing gear, 4 x 4mm bolts, lock nuts and washers. Place the landing gear onto the landing gear plate on the bottom of the fuse and align the 4 holes. Use a metric driver to attach the gear, securing with the 4 bolts, washers and nylon insert locking nuts inside the fuselage.

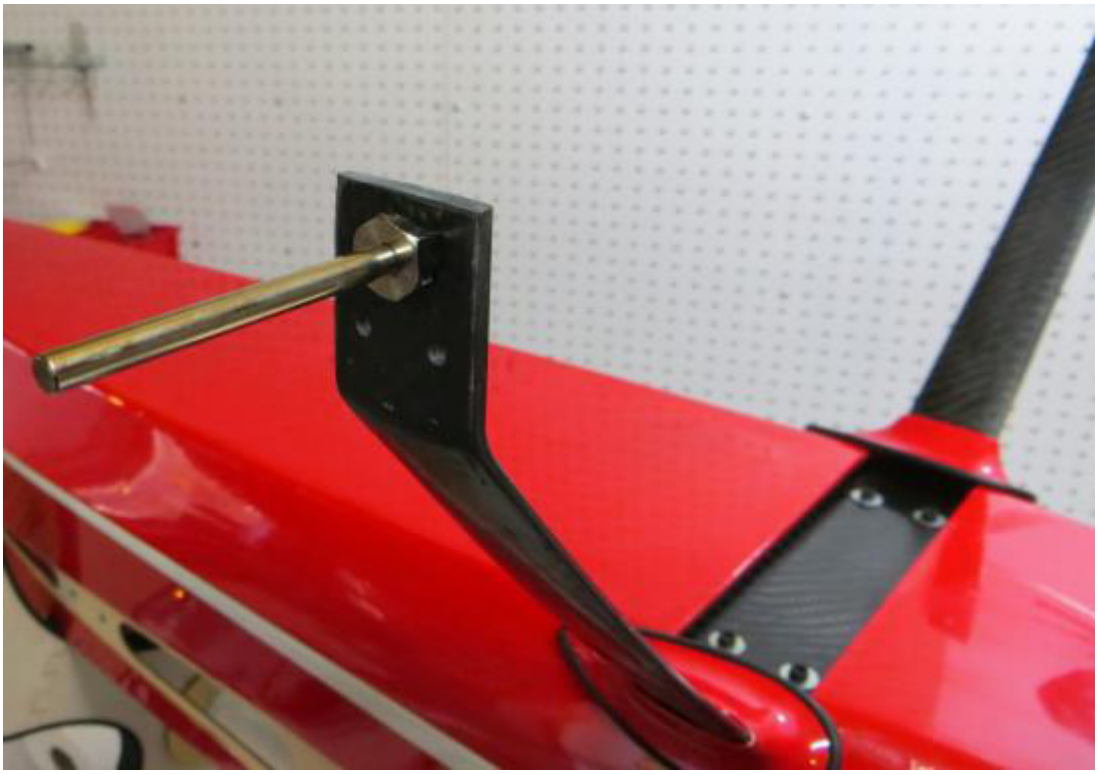


32. Trail fit the landing gear fairings and when satisfied with fit secure with Goop style silicon glue. Tape in position until dry.



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33. Locate the 2 axles, 2 locking nuts, 2 washers, 2 wheels, 4 wheel collars and 2 wheel pants. Place the threaded portion of the axle through the hole in the landing gear, place a washer onto the axle and secure the axle with a locking nut. Repeat this process for the second wheel axle.



34. Install one wheel collar on the axel first in order to center the wheel in the wheel pant. Next, slide the wheel onto the axel and secure the wheel with the second wheel collar. Repeat this process for the remaining wheel.



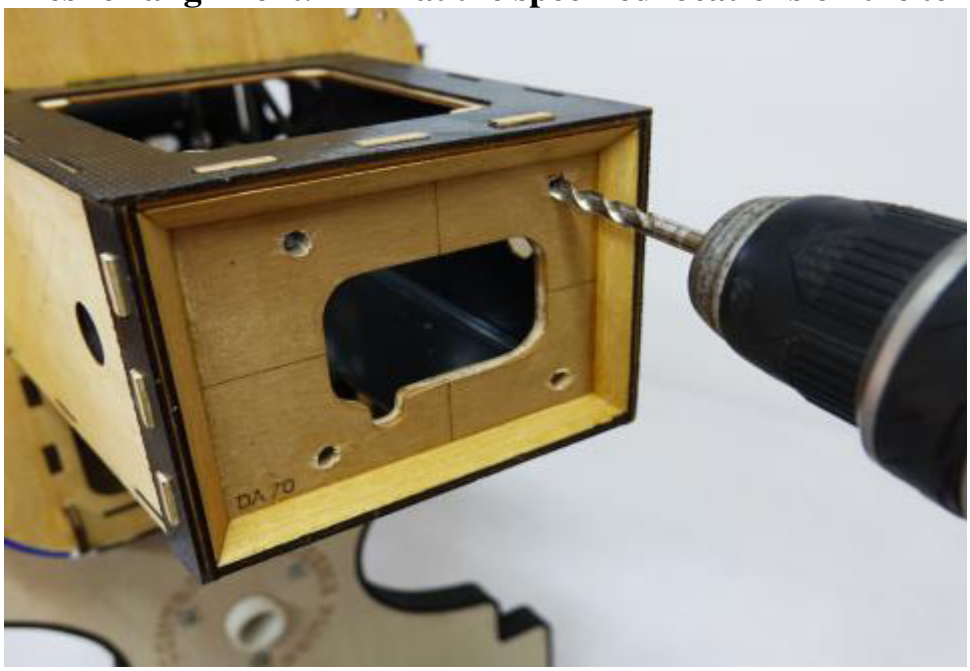
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35. Install the wheel pant using the supplied 3mm bolts and washers as shown in the picture below. As always, use blue Loctite on ALL bolts! Repeat this process for the remaining wheel pant.

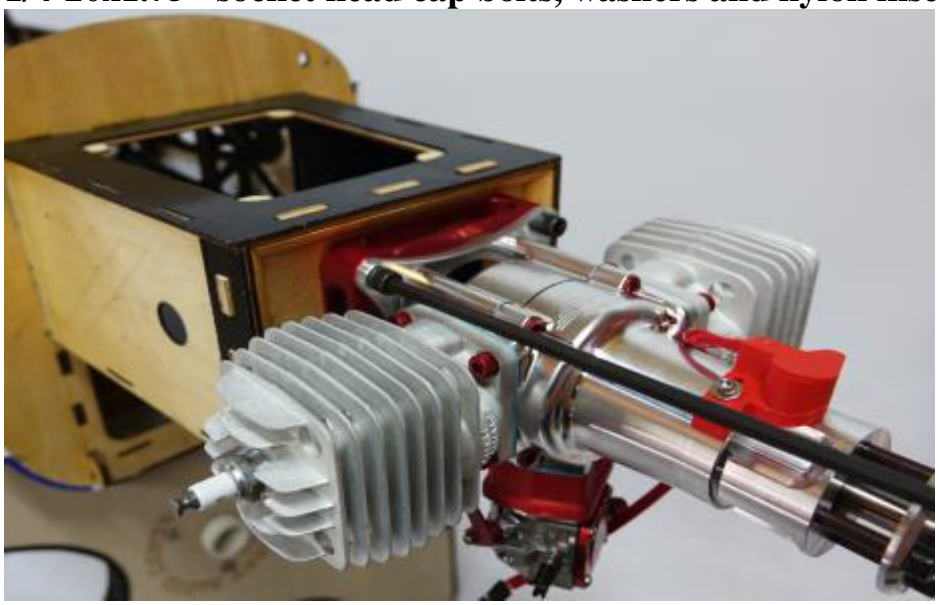


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36. Next we'll install the engine. We have made this process very easy, especially if using the recommended DA-70. There are laser scribed marks for mounting the DA-70, only requiring that you drill to accept 1/4-20 mounting bolts. The center and offset marks have been scribed into the front of the firewall with a laser to align mounting templates for other makes of engine. Print out the engine mounting template for your chosen engine (typically available on the manufacturer's website) and tape it in place using the horizontal and vertical lines for alignment. Drill at the specified locations on the template.

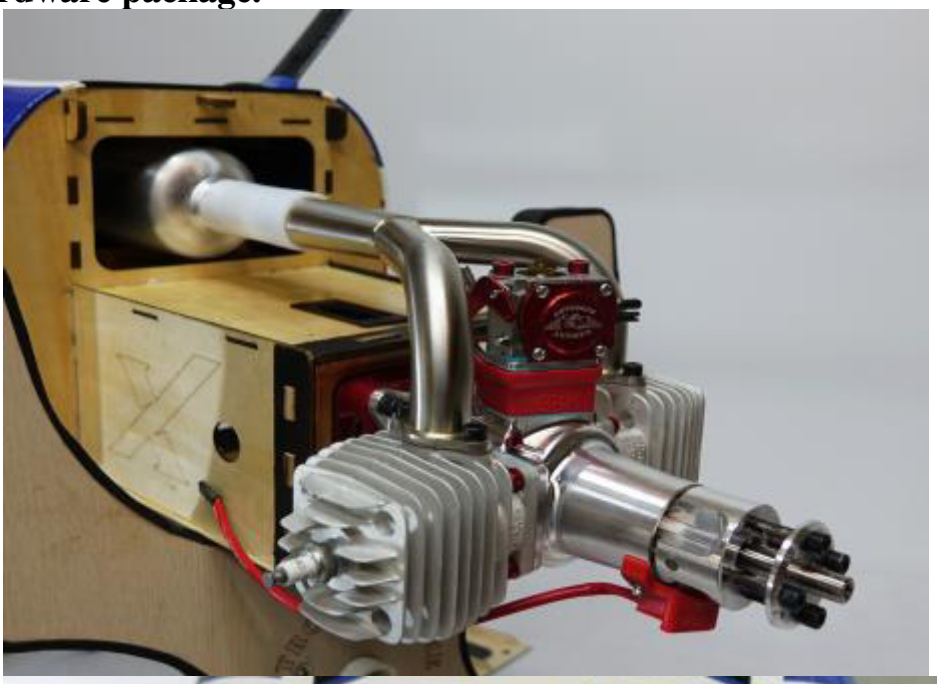


37. If using the DA-70 we highly recommend using our Blazing Star mount for proper engine spacing and cowl-to-spinner clearance. You may find that you need to use the 2mm Delrin spacer for proper clearance. The distance from the motorbox face to the spinner backplate is 6 5/8". If using the spacer be sure it goes between the mount and plywood motorbox face. Mount the engine using 1/4-20x1.75" socket head cap bolts, washers and nylon insert locking nuts.



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38. Install your choice of muffler system. Below are photos of a 2 into 1 canister install and stock muffler install. Plywood canister mounts are included in the hardware package.

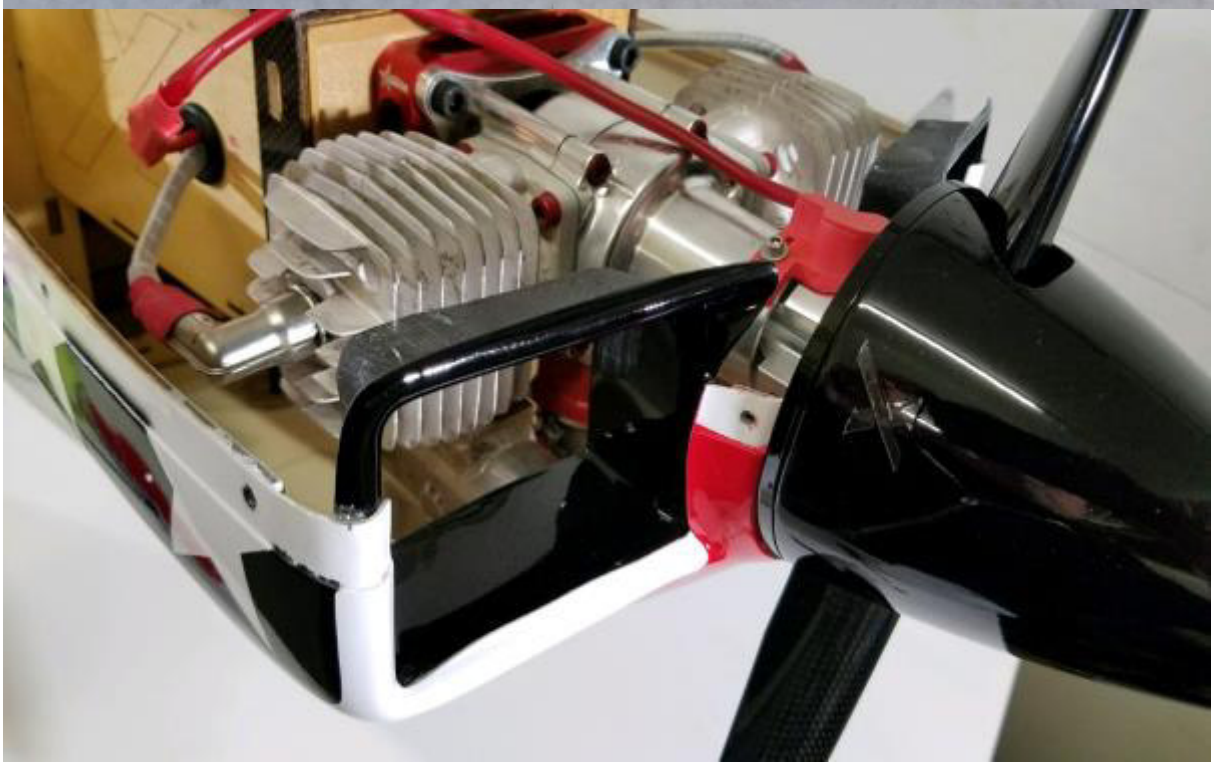




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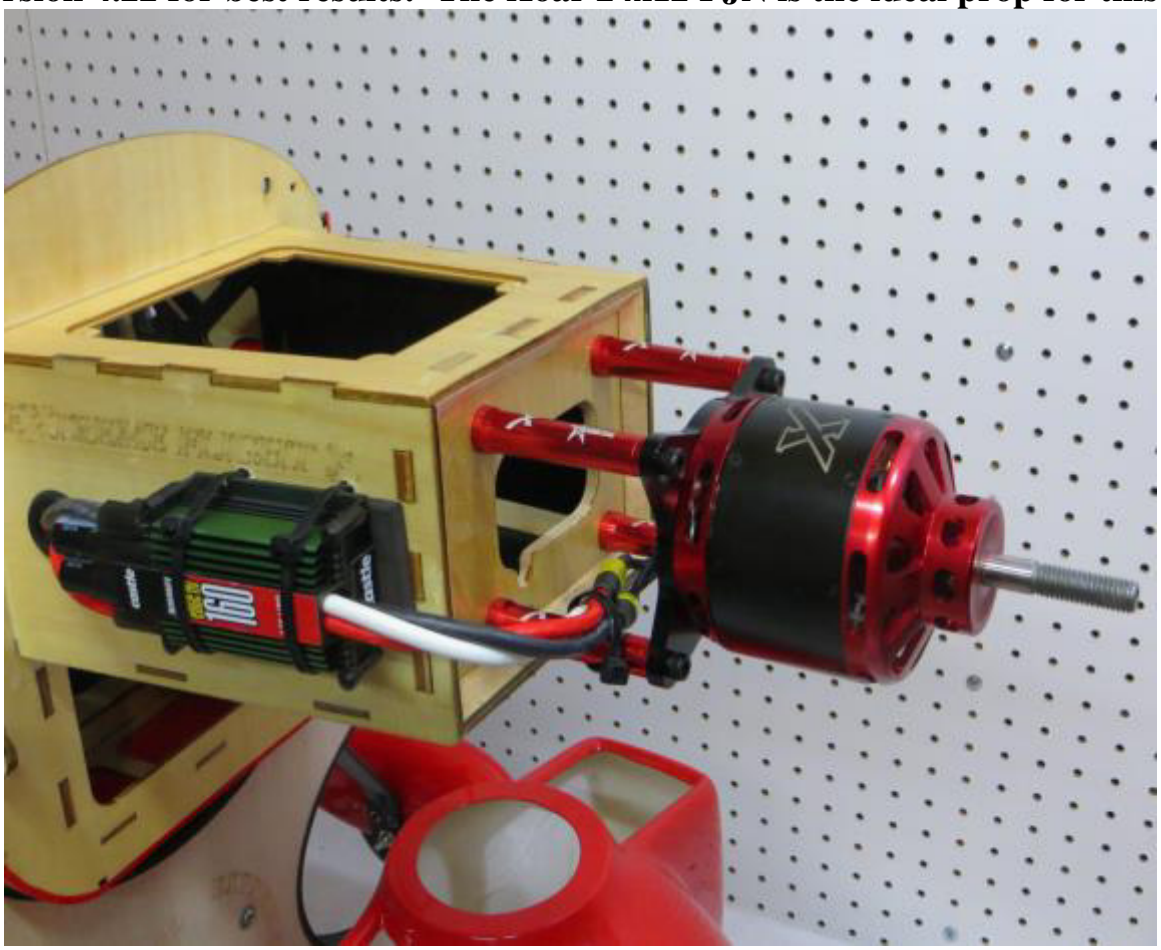
39. The Laser includea a set of fiberglass baffles that are to be installed in the lower half of the cowl. Scuff the exterioir edges of the baffle and glue in place with epoxy or Goop.





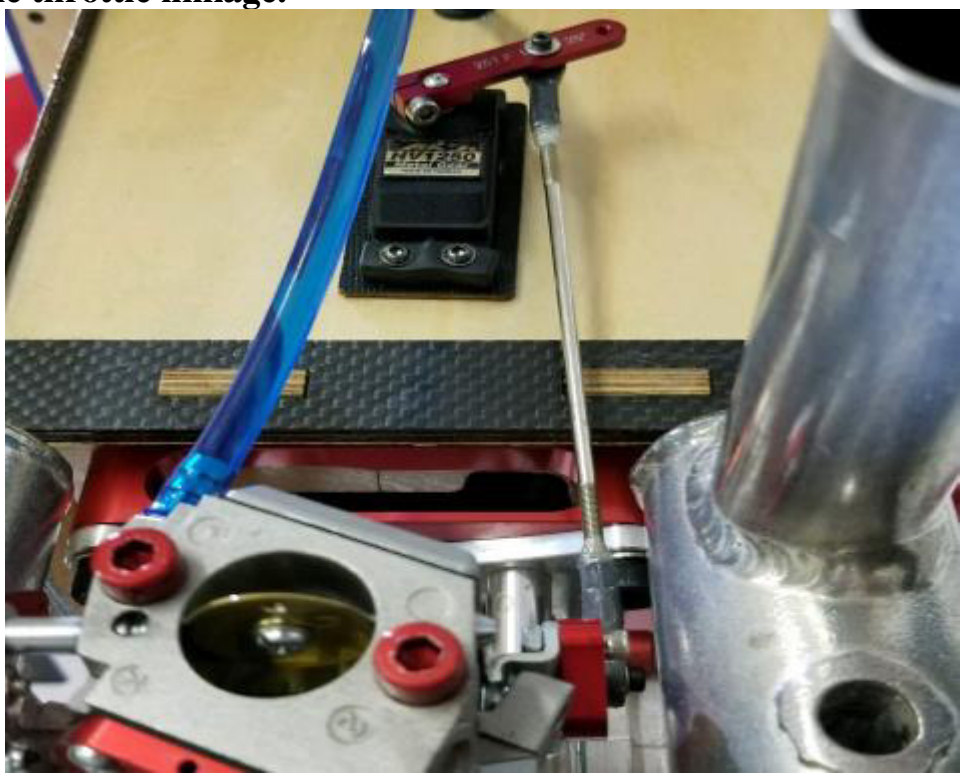
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The Xpwr 60 Brushless Electric Outrunner from Extreme Flight is also an excellent powerplant for the Laser, producing gobs of clean quiet power rivaling that of the DA-70. We sell a set of Blazing Star XL standoffs that make mounting the Xpwr 60 very easy. Below is a photo of the Xpwr 60 installed in the Laser along with our recommended ESC, the Castle Creations HV160. Make sure to use firmware version 4.22 for best results! The Xoar 24x12 PJN is the ideal prop for this setup.



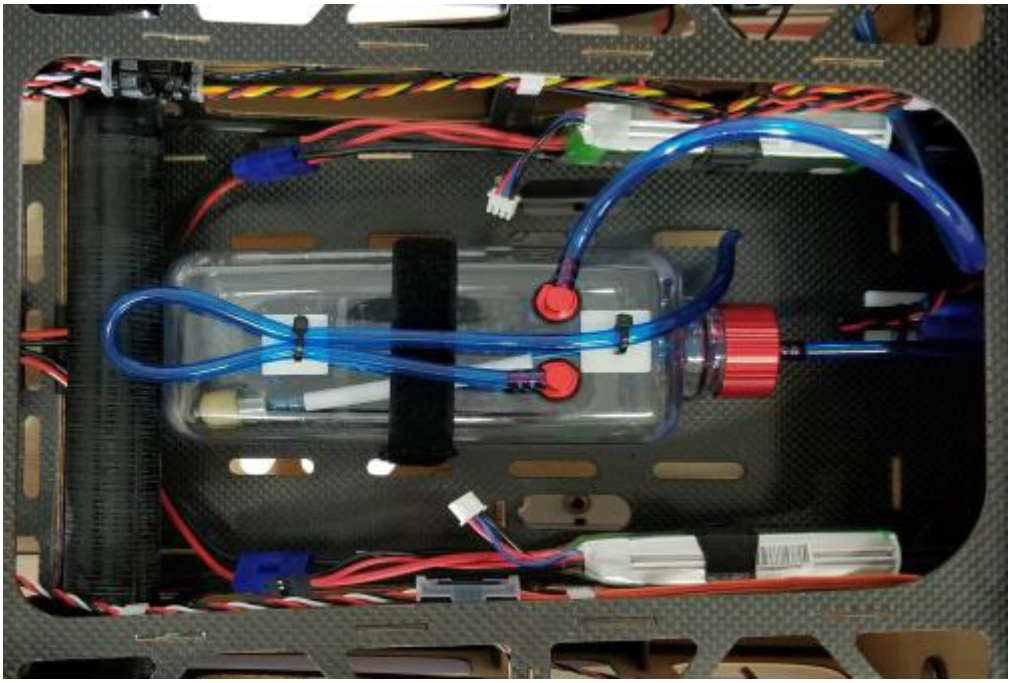
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40. Next, install the throttle servo in the pre-cut servo hole located in the bottom of the motor box. Locate the 2mm pushrod and ball link and EZ connector to fabricate the throttle linkage.



41. Install the ignition unit and regulator on the side of the engine box or under the engine box lid using Velcro or nylon cable ties. Make sure to put a piece of foam under the unit to prevent damage from vibration.

42. Install an Extreme Flight Flowmaster 24 oz. tank using Velcro Straps or nylon cable ties to secure the tank to the tank tray. Install foam between the tank and tray to protect against vibration.

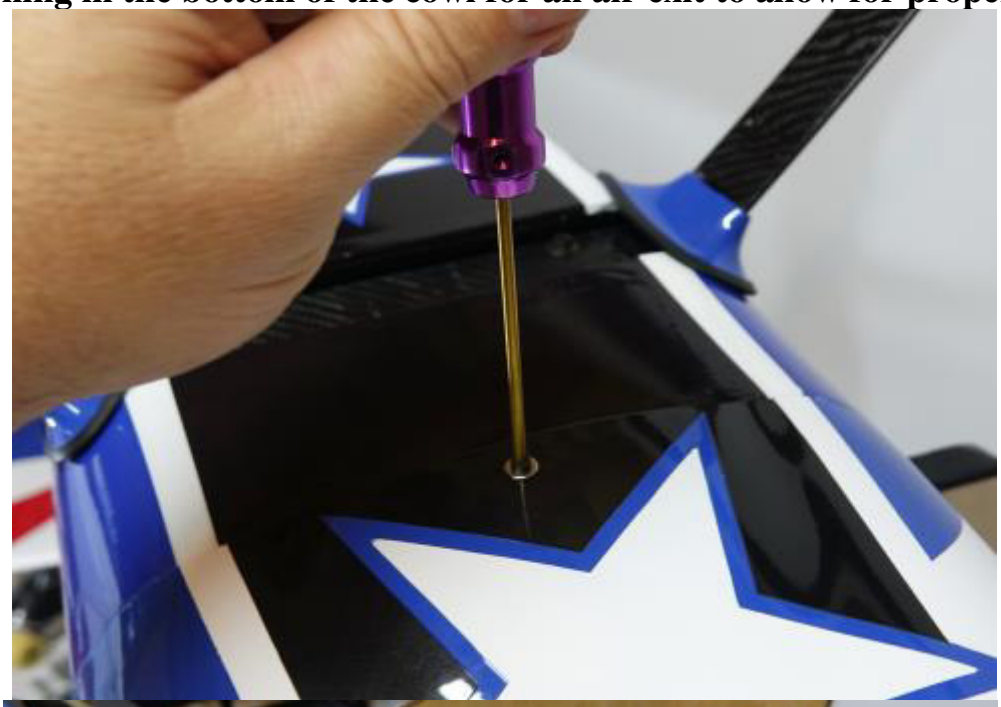


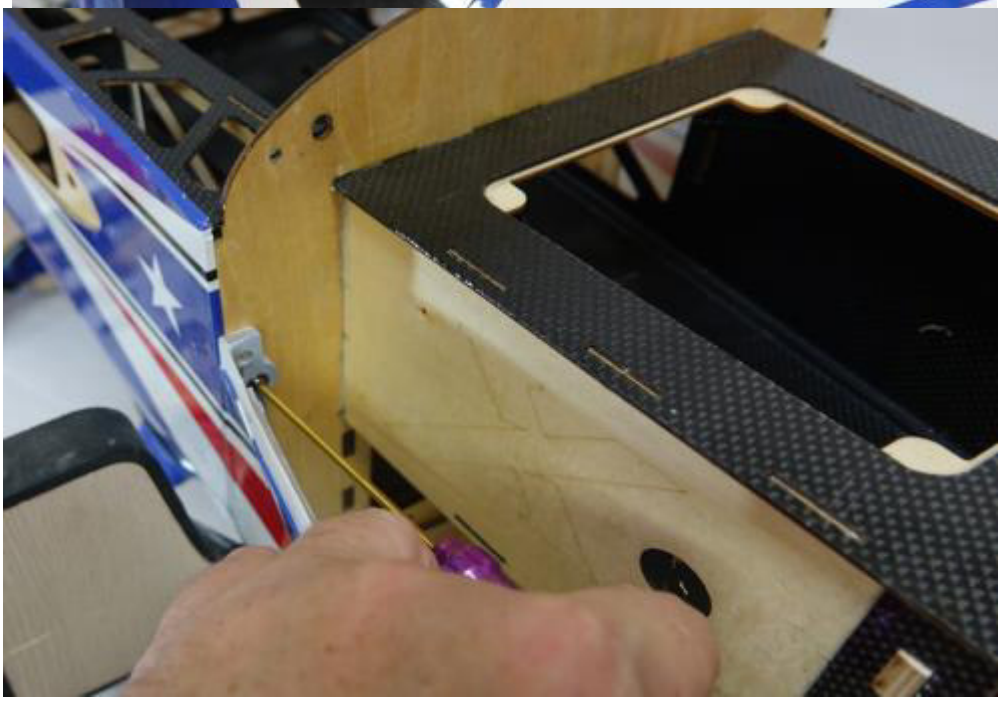
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43. Install your switches, batteries and receiver. There are suggested switch mounting locations laser scribed in the fuselage sides visible from the interior of the fuselage. Since switch sizes vary, use a template to ensure you cut the proper size hole for your specific switch. Also, carefully choose the locations to mount your batteries to help achieve correct center of gravity.

44. Once all tank plumbing is finished install the motor box lid with 4 screws.

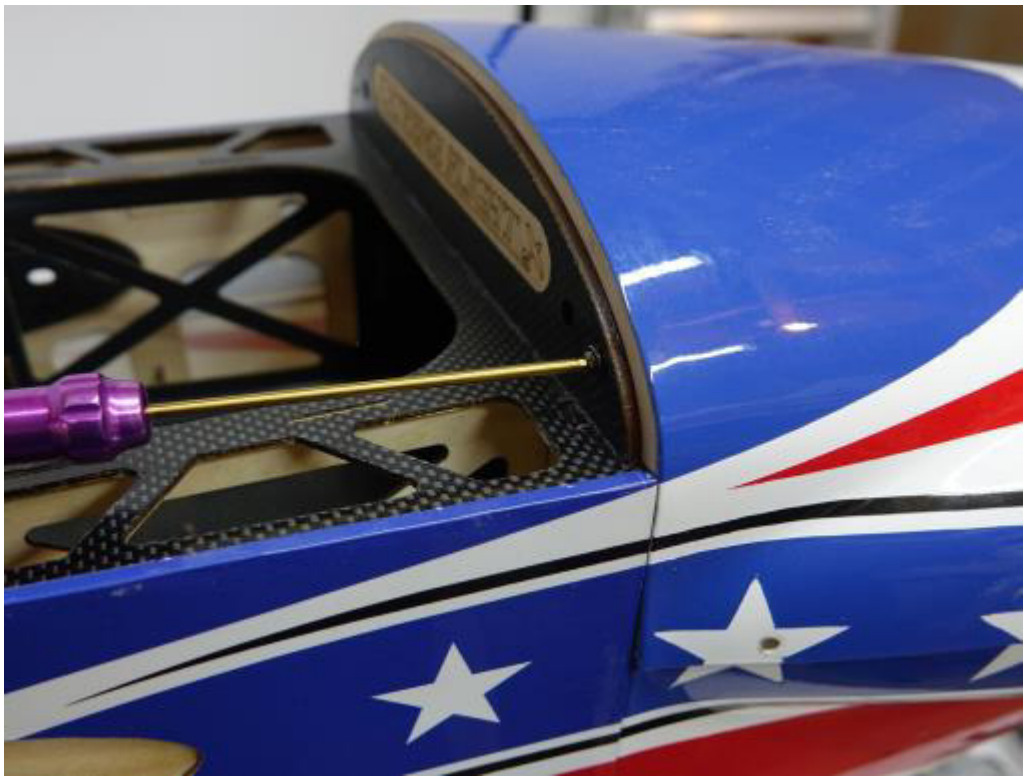
45. Slide the lower cowl into position and secure with the long 3mm bolt from the cowl hardware bag inserted into the hole on the bottom of the cowl and into the blind nut in the lower mounting tab. Install the other two 3mm bolts in their respective locations as shown. Cut the cowl to clear the muffler exhaust pipes. Also it's a good idea to cut an opening in the bottom of the cowl for an air exit to allow for proper cooling.



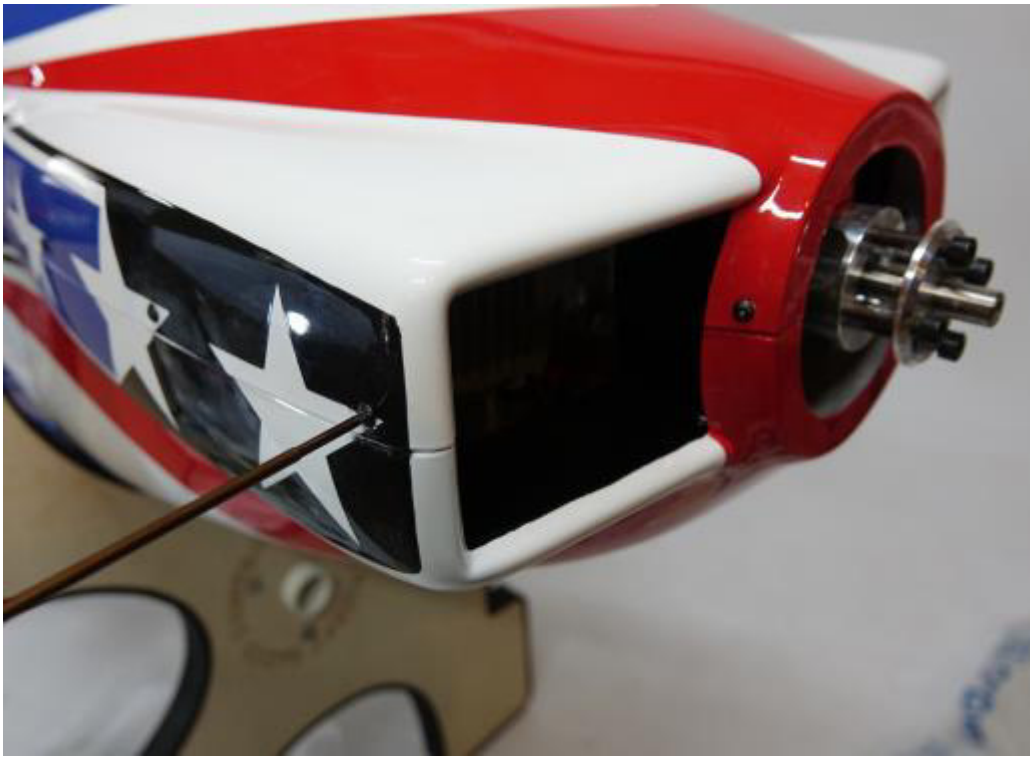


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46. Secure the top portion of the cowl to the airframe using 2 3mm bolts inserted through the F1 former and into the blind nuts in the cowl ring.



47. Add the remaining bolts to secure the top of the cowl to the lower portion. Use blue Loctite on all bolts!



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48. Attach a 36 inch EF 20 awg servo extensions to each elevator servo lead. If you plan to remove the stabs for transport, you will need to use 48 inch extensions. Secure with EF Servo Safety Clips or heat shrink tubing. Slide the stab halves onto the carbon fiber stab tube and secure with a 3mm bolt and washer inserted through the mounting tabs and into the pre-mounted blind nuts. Make sure to use a drop of blue Loctite on these bolts.

49. The wings are mounted on the provided carbon fiber wing tube and retained by inserting the nylon bolt through the hole in the fuselage and into the preinstalled blind nut in the root rib of the wing. Be careful not to cross thread the bolts and inspect them periodically to insure thread integrity. Also, included with your LASER is a set of side force generators (SFGs). They are secured to each wingtip with 3mm thumb screws inserted into pre-installed blind nuts in each wing tip.

50. The canopy is retained by 2 spring loaded latches. There are also 2 tabs for additional 3mm bolt retention. If flying the Laser with electric power the 2 spring loaded latches are sufficient. Be sure the pins are fully engaged in the former! <u>If using a gas engine you MUST use the additional 3mm bolts for canopy retention!!!</u>

Install your favorite prop and a 4" spinner.



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Set-up and trimming

Besides basic assembly, this is the most important part of preparing your airplane for flight. It can also be the most time consuming, but once your plane is properly dialed in you will agree it was time well spent. One of the most practical ways to check the CG on an aircraft this size is to insert the carbon fiber wing tube into its sleeve in the fuselage and tie a length of rope around the tube on each side of the fuselage, forming a loop that you can pick the aircraft up with. Slide the wings into position, install the canopy and pick up the plane with the rope. The Laser should balance in a horizontal position. Move your batteries and radio equipment to achieve this condition. This will give you a safe starting place for the first flights. One of the best ways to fine tune the CG for your aircraft is the 45 degree line test. Fly the aircraft in front of you from left to right (or right to left if you prefer) at full throttle. Pull the aircraft into a 45 degree up line and establish this line. Roll the aircraft inverted, neutralize the elevator and pay close attention to what the plane does. Ideally the plane will continue on this line for several hundred feet before it starts to slowly level off. If the airplane immediately drops the nose and dives toward the ground it is nose heavy. If it begins to climb inverted toward the gear it is tail heavy. There is no need to have the Laser excessively tail heavy to perform 3D maneuvers.

Control surface throws

I highly recommend that you purchase a throw meter that measures in degrees. There are several units available commercially. These units are a great aid in set-up and definitely beat the "that looks about right" method. For any type of precision flying, surfaces that travel equal distances are a must. The following control surface travels are what I use on my own Laser. These are a good starting point, but are by no means the only way to set up the Laser. Start here and then adjust to fit your own preferences and style of flying.

Elevator: 8-10 degrees low rate, 20% exponential; all you can get high rate, 60-65% exponential

Aileron: 20 degrees low rate, 30-40% exponential; 38-45 degrees high rate, 50-60% exponential

Rudder: 20 degrees low rate, 50% exponential; all you can get for high rate, 50-60% exponential.

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This completes the assembly of the 91 inch Laser EXP. As a final step clean the entire aircraft with glass cleaner, then apply a coat of spray-on wax and buff the finish to a high gloss. My favorite product for this is Eagle One Wet Wax AS-U-DRY, available in the automotive section of most Wal-Marts, K-marts, Sears, Targets, etc. People often ask me at trade shows how I get the planes to look so shiny, this is my secret. You may wish to apply all of your graphics before applying the coat of wax.

Thanks again for your purchase of the Extreme Flight RC 91 inch Laser EXP ARF. I hope you enjoy assembling and flying yours as much as I have mine.

See you at the flying field!
Chris Hinson
EXTREME FLIGHT

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