Packing List:

(1) Complete airframe including wing, fuselage, and stabilizer

(1) Wire Harness with green 6pin MPX connector and loose RC connectors

(1) 24” servo extension for elevator

(1) Battery harness Deans x (2) male RC

(1) Servo cover sheet (small for ailerons, large for flaps)

(2) Flap control horns (smaller pair)

(2) Aileron control horns (larger pair)

(1) Elevator control horn (smallest individual horn)

(4) 4-40 Sullivan threaded Gold-n-clevises (for flaps and aileron pushrods)

(1) 2-56 threaded clevis (black) for elevator pushrod

(1) 2mm ball stud and plastic ball link for elevator pushrod

(1) 5mm x 91mm carbon tube for elevator pushrod

(1) 2-56 threaded rod for elevator pushrod

(1) 4-40 threaded rod (cut into (4) small pieces for ailerons and flaps)

(1) 5mm wing screw

(2) 4mm tail screws

(1) 3mm allen wrench (for wing screw)

(1) 2.5mm allen wrench (for tail screws)

(1set) Clear wing servo covers (trace in position and cut with scissors)

(1) Clear elevator servo cover

(1) G10 gear tray

(1) 4mm Phillips screw for gear tray mounting

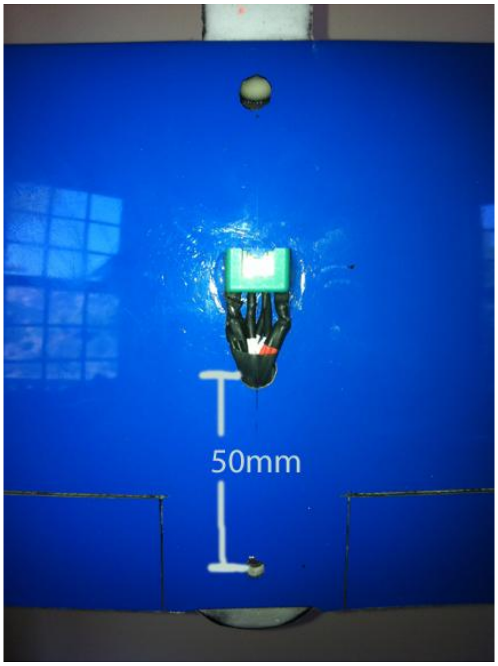
(1) 4mm weld nut for gear tray mounting

Installation Guidelines:

Before proceeding, make certain that you know how to get maximum servo travel from your transmitter… Also, make the decision of what voltage you would like to use. For standard MKS servos, use only a 4cell (2x2 flat) Nimh or higher voltage pack with a regulator set to maximum 5.9v. For high voltage servos (ie MKS HBL6625), a 2s Li-ion 18650 pack is ideal.

Wing

The first step (if not already done) is to make a hole for the wire harness to exit the wing. The ~10mm diameter hole should be made on the centerline and 50mm ahead of the rear wing screw.



The harness is supplied with the plastic servo connectors shipped loose. This allows you to thread the harness through the small hole more easily. Be very careful when assembling the plastic pieces to ensure each wire goes in the correct position. It is helpful to look at the supplied elevator extension wire to confirm orientation is correct. Note that the female plastic piece has a tab inside and beveled corners that indicate the correct orientation. My preference is to cut the servo connectors off and solder the servos to the harness. If you elect to use the servo connectors instead, use a piece of heat shrink over the assembled connectors to help prevent accidental disconnection.

Servo Choices

The flaps and ailerons are bottom hinged and are intended to be top driven. The recommended flap, aileron, and elevator servos are the MKS HV6130 installed with aluminum frames with external bearings. In most cases, depending on the layup, you will need to remove a portion of the drag spar to fit the servo and frame. It is not necessary but if you want ultimate strength, you can fill this gap after installation to restore max strength (I haven't found it necessary) using a piece of epoxy soaked sponge.

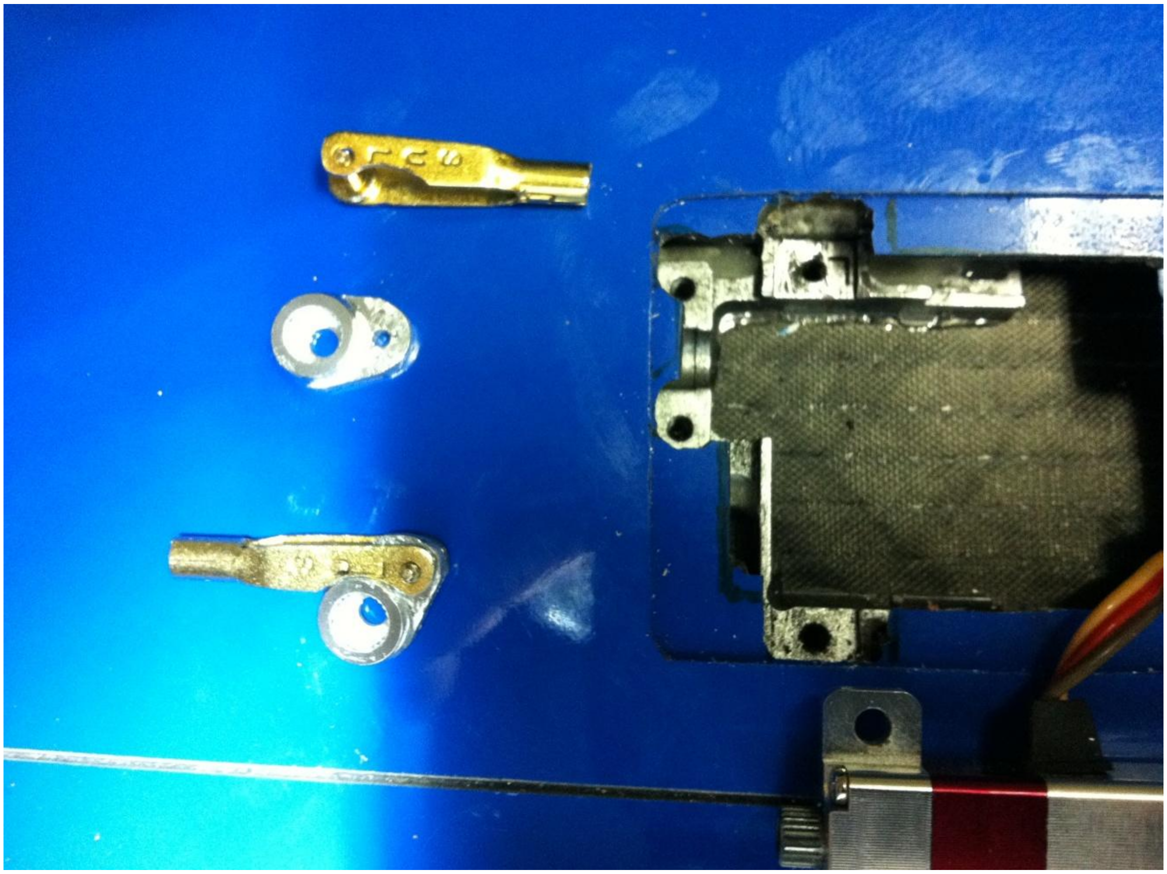
Ailerons

I suggest using aluminum arms regardless of which servo is chosen. The arm should be made to be very short so that all of the servo throw can be used. On the MKS aluminum arms, I drill a 1/16" hole 5-6mm out from the centerline to accept the 4-40 clevis. This will allow about 5mm of up travel (measured at the aileron tips) Remove any excess arm length to ensure it will fit under the servo cover. I also, use a hacksaw blade flush against the inside face of the arm to remove some material on the inner hub of the servo arm. Next use a Dremel to grind out a scallop from the sides of the clevis to allow full forward travel without binding (see photo). You need to remove enough material so that your pushrod can be angled down below the screw head on the rear bottom corner of the servo at full up deflection (see photo). You will also need to remove about 2mm from the end of the threaded barrel of the clevis. I find its easiest to install the servos first and then work on the pushrod and control surface horns. Go ahead snap the modified clevis onto the arm and mount the arm using blue loctite on the splines and on the screw threads.

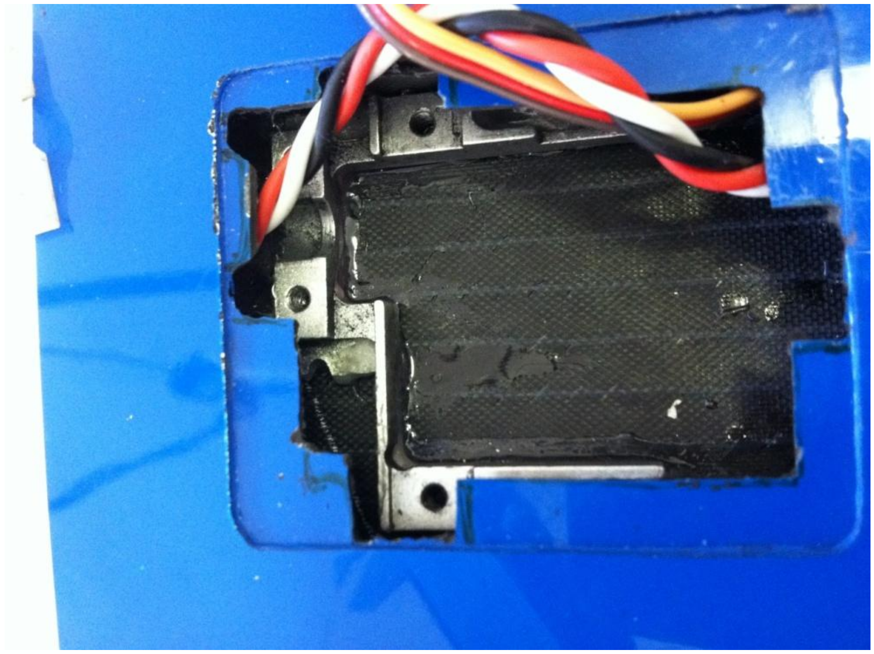

Full Up Aileron


Aileron Neutral


Full Down aileron



If using the MKS servos with aluminum frames, you will have to apply epoxy to the wing skin and bottom of frame, insert the frame first, and then mount the servo as the servo and frame won't fit into the cutout if bolted together. Before glueing, test fit the servo to the frame and ensure full travel is permitted. You can remove some of the excess servo mounting tab length that overhangs the frame using a belt sander. If not using frames, cut all mounting tabs off of the servo before mounting the arm and clevis and then glueing into place with the clevis perpendicular to the hingeline.



Once the servo is mounted and cured, use the templates at the end of this document to layout and cut the opening for the pushrods on the upper wing skin. Once the slot for the control horn is marked, I typically use a small end mill using two hands on a Dremel tool to grind all the way through the top skin, carbon hose stiffener, and wiper. Be careful not to go through the lower skin (there is no balsa core material there).

The control surface horn (larger of the two pairs are for ailerons) should slide into the aileron from the front so that the front edge is just behind the hingeline at the base. Score a line along the horn where the skin intersects and then sand the horn just past this line to prepare for a good bond.

Assemble the sanded control horn with a clevis and 4-40 threaded rod. Fix the rod with a small drop of thin CA. If using frames, you may have to shorten the barrel of the aileron clevises by removing ~1/16" of the threads on a belt sander or with a dremel cutoff wheel. Now is also a good time to apply a very small amount of thin CA to the clevis pin to remove any slop in the fit with the control horn. Once cured, check that there is no play but it shouldn't be difficult to rotate. If it requires any significant force to rotate, you can reduce the friction with a small drop of oil but be very careful not to allow any contamination with the sanded glueing surface. The servo arm should be angled roughly 25-30 degrees aft so that it is perpendicular to the pushrod at the neutral position. Open the control surface completely and thread the pushrod / control horn assembly through the hole in the wing and into the servo arm clevis. Slowly / gently move the servo with the tx (on highest rates) and make sure you can achieve full throw without binding. Remove more material if necessary.

Remove enough material from the upper wing skin ahead of the gap for the pushrod and horn to clear at full up deflection (see attached templates at end of this document).

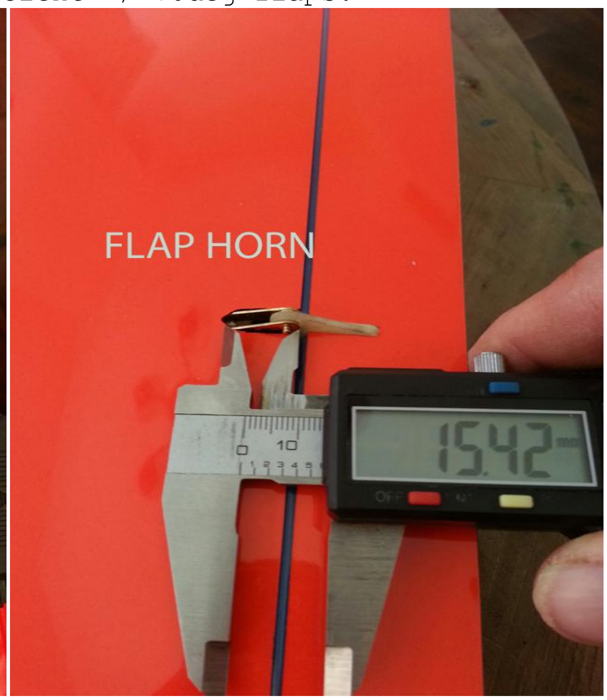
Now, attach the horn to the pushrod and insert into the aileron cut out.

Holding the horn in place, you can confirm maximum control surface deflections up and down. If all is good, scuff sand the horn and thread the pushrod into the servo clevis. Mask around the cutout and epoxy the horn in place with servo centered and aileron taped flush. You can temporarily put a piece of tape inside the wing over the hingeline to keep epoxy from getting into it during this process.

Before taping the servo covers in place, add a small amount of thin CA to all threads and any clevis pins that have slop / play. Add a small drop of thick CA to the clevis pins to prevent them from flexing under loads.

Flaps

Installation of the flap servos and horns is very similar to the aileron set-up with the exception that the servo arm should be angled as far forward as possible (roughly 40 degrees from vertical) in the neutral position. This allows nearly locked out geometry will still achieving sufficient throw. I recommend using the full length MKS aluminum arms to achieve full 80-90 degree flaps. The distance from the servo output shaft centerline to the clevis pin is ~9mm. They will just fit under the larger blistered servo covers. Alternatively, I can provide custom 7mm flap servo arm that will provide a still sufficient +/-70deg flaps.



The wing servo covers are supplied un-cut so that they can be custom fit you your final servo and pushrod installation. Once everything is completed, place the cover over the recess such that the clevis is centered and aligned with the blister (larger for flaps and smaller for ailerons). Make a small mark on the cover over each corner of the servo cover recess. Then cut with scissors between each mark. Check for clearance throughout the servo range of motion and adjust as necessary. Place a dot of 5min epoxy in the middle of the servo and at each corner of the cover and then tape in place using clear scotch tape. This makes the cover very rigid and the epoxy will easily release from the cover if you need to access the servo. The clear cover allows a visual inspection before every flight to look for any potential damage from the previous landing or hangar rash.

Fuselage / Elevator
The elevator servo should be installed with the output shaft facing up and forward with the arm approximately centered in the cutout.
Use an aluminum servo arm with the supplied M2 ball link. First, mount the horizontal stabilizer to the fuselage and mark the centerline of the pushrod exit hole in the fuselage onto the elevator. Next cut the slot in the elevator being careful not to penetrate the top skin. You will have to cut through the carbon stiffener inside the control surface. The leading edge of the control horn base should be just behind the hinge line. With the servo temporarily positioned in the servo hatch for easy access to the ball link, and the elevator surface deflected 0.5mm down at the tips, measure the distance from the ball to the elevator horn. Using this measurement, its time to assemble the pushrod.

Mark the depth of the plastic ball link threads onto the 2-56 threaded rod and attach making sure it is threaded all the way onto the rod. Now cut the carbon tube to length and assemble the pushrod assembly using a liberal amount of 5min epoxy along the length of the rod before inserting using a twisting motion. I like to use a dremel tool with a small end mill or diamond burr to enlarge the hole on the end of the tube where the clevis barrel can be inserted fully into the carbon tube. This minimizes the amount the pushrod might flex under high G loads. After the rod is glued into the tube with the clevis fully threaded into place, wrap this part of the carbon tube tightly with a fine kevlar or spectra thread and finish using thin CA. This will help prevent the tube from splitting. Make sure to orient the ball link and clevis properly before the epoxy cures! Scuff sand the elevator horn for good bond then attach to the 2-56 clevis. Open the elevator surface and put a small piece of masking tape over the hinge line. Insert the pushrod thru the rear exit hole of the vertical stabilizer and lay the fuselage (with horizontal stabilizer mounted) upside down on the table. Now epoxy the horn into the elevator slot using the fuselage exit hole to dictate the final position of the horn for proper clearances. While this cures, plug the servo in and trim it to zero. Set the aluminum arm at 90 deg and tighten the screw with loctite. Drill and tap the servo arm (M2) at 4mm from the center and thread the 2mm ball onto the arm and apply thin and then thick CA to the threads. Holding the servo in place with your thumb, check to confirm desired elevator throws are possible. Next, tape the elevator surface flush and epoxy the servo in place using a syringe to ensure sufficient epoxy all around the servo. Lastly, add epoxy on top of the servo to tie into the opposite skin. Tape the servo cover in place using thin clear tape.

If you want to add a little insurance for bad landings etc, you can add some carbon fabric across the seams at the base of the vertical stabilizer LE and across the seam of the fuselage just in front of the servo. Lastly, If I know the plane will likely have some rough landings, I like to add a piece of G10 or precured carbon plate roughly 1cm x 4cm long across the bottom corner of the servo hatch.

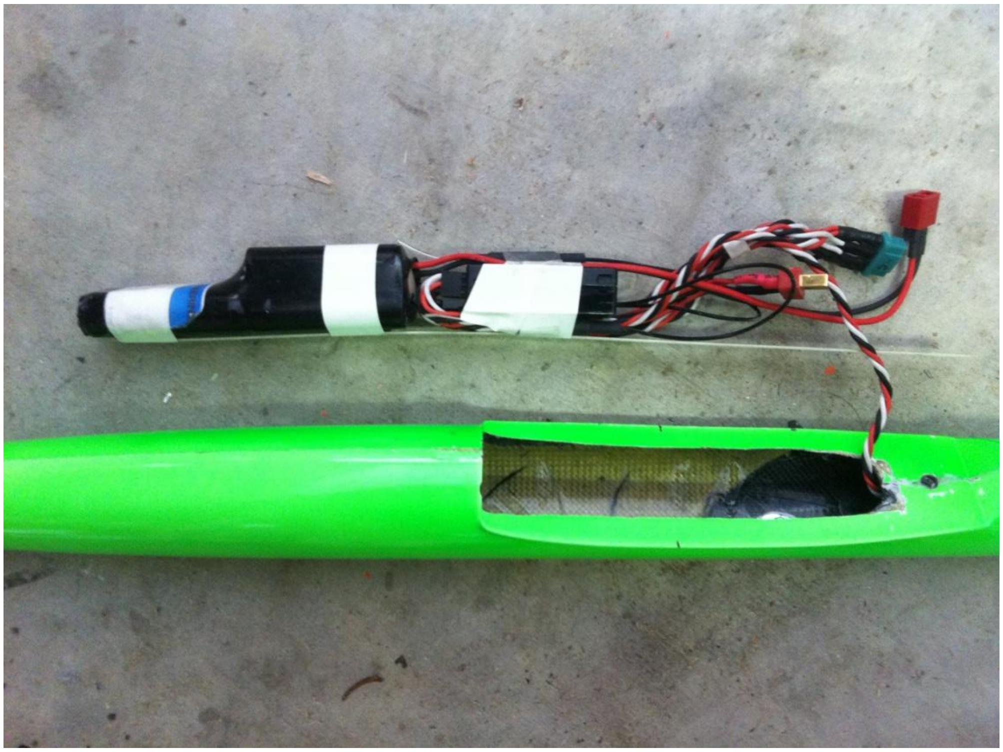

Attach the 24” servo extension to the servo either by soldering (preferred) or the connectors with heat shrink tube as before. I recommend using an aluminum arm for the elevator regardless of servo choice. Aluminum bearing frames are not needed on the elevator and in fact can’t be easily used because of the ball link connection. The ideal arm length is 4mm to achieve the necessary control surface deflection. This also allows the ball link to clear under the servo cover without interference. For the MKS arms, this will mean drilling a 1/16” hole partially into the hub of the arm. Tap for M2. After threading the ball partially onto the arm, add thin CA and tighten the rest of the way. Add more CA to the exposed portion of the threads and spray with kicker.

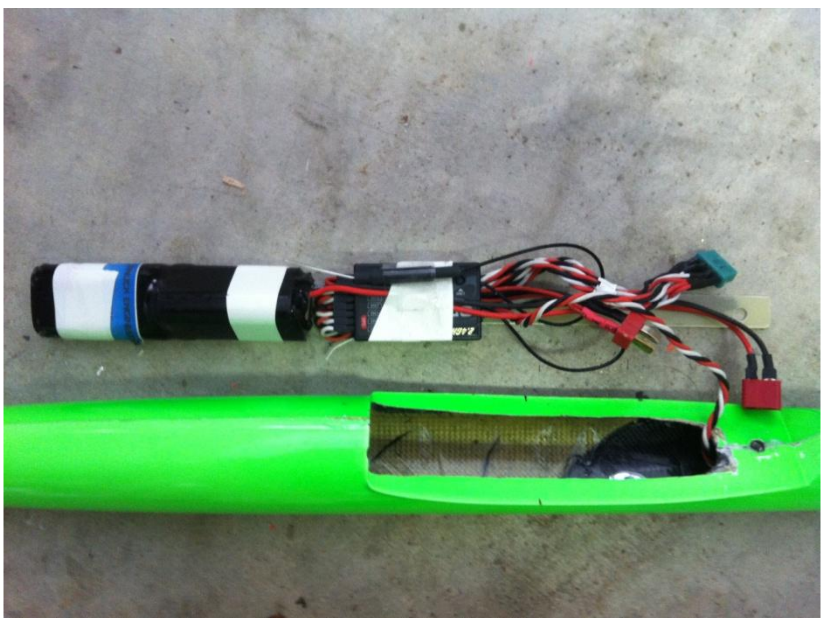
Before installing the servo, inspect the area where the pushrod will travel for any excess epoxy that may interfere. Remove with a file if necessary. Check the area where the clevis will exit the vertical stabilizer for necessary clearance. Also remove any excess epoxy where the lower aft corner of the servo will be. Position the servo in the cutout so that the ball link can easily be attached and detached. Now attach the pushrod to both the servo and the control horn. With the servo centered, the surface should be deflected slightly down by approximately one trailing edge thickness (0.5mm). This is the normal trimmed position for the elevator surface.

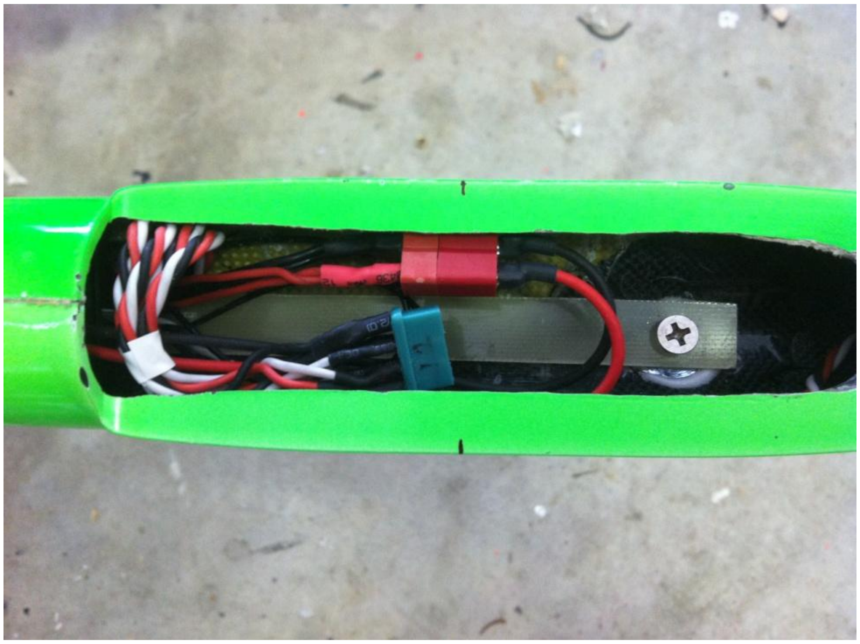
Before glueing the servo in place, you can hold the servo firmly to get a rough check of control surface throws. When glueing, be sure to get sufficient epoxy under and behind the servo but apply sparingly near the output arm. I've seen many servos damaged by unknowingly allowing epoxy to make contact to the underside of the servo arm. This will cause a slow and weak control surface movement and over time will cause premature motor failure. Maintain correct control surface position and servo alignment while the epoxy cures enough to hold in place. Later, add epoxy on top of the servo to bridge to the upper skin and also to support the middle of the servo cover if desired.

The nose of the fuselage is 2.4Ghz friendly (free of any carbon) from about 1" ahead of the wing leading edge forward. Depending on your RC equipment, there are numerous ways of installing the gear into the nose. The fuselage is supplied in it's strongest possible configuration. In this configuration, you will be limited to using slender batteries. A 2s 18650 style Li-ion battery is my preferred pack. It allows 3500mah, fits easily, and weighs ~100g. If you prefer a larger battery, or if your receiver is somewhat wide, you can easily remove some material on either side of the opening without losing much strength.

If you anticipate needing to significantly change the amount of noseweight (ie, to accommodate using removable ballast in the wing D-box), it is beneficial to use the supplied G10 gear stick with a removable piece of noseweight (roughly 6.5oz for entire D-box to be filled with lead shot) to maintain the correct CG. Total nose weight without tip or d-box ballast will likely be around 12-13oz. I recommend using a combination of solid chunks of lead along with 2 different sizes of lead shot and epoxy to achieve the greatest density. Best CG can be a matter of personal preference. I fly my K2mDP at ~58mm behind the root leading edge measured at either side of the mounted fuselage. I have heard of some flying as far forward as 52mm. 56mm is a safe starting point. I would consider 58.5mm to be the aft end of the acceptable range.







<u>Transmitter Settings</u>

If you anticipate flying heavy in light lift, I recommend setting up your transmitter to allow for flaps to be cambered during launch (approximately 2mm at root edge of flap). Reflex is marginally beneficial (up to 1mm) for hands off flight but the benefit is so small that I typically don't allow for it. Instead, I prefer to reserve all available servo throw for flap deployment. Snap flap is not particularly beneficial for performance in typical DS flight conditions but it can be used very effectively to produce a gentle center stall rather than a violent tip stall. I recommend setting up snapflap only on the flaps (no ailerons). You can use as much as 3-4mm at the root of the flap at max elevator deflection. If your tx allows, it is best if the snapflap begins at roughly 40-50% elevator deflection. This setup will allow for a nice gentle center stall that is very helpful if you might be scratching for lift in lighter conditions. By beginning late in the stick travel, the performance still maximized in all but extreme situations where preservation of the plane is more important than ultimate efficiency anyway.

Setting maximum elevator deflection is also a personal preference but I recommend avoiding throws large enough to stall the model. Follow this procedure to prevent tip stalls:

Begin with your model trimmed neutrally (elevator 0.5mm down) and flying with lots of altitude and into the wind. Make a small dive to gain airspeed and then smoothly pull full elevator. If your throws are too large, and you haven't programmed snapflap yet, you will tip stall the model and must release the sticks letting the model dive until it regains airspeed and can be controlled again (this is why you begin with lots of altitude). If your elevator throw is small enough, the model will pull a tight loop and continue flying normally. You can increase the elevator throw until just before the point where the model flicks out of the loop at full elevator. Depending on your CG, this typically ends up around 1.6-1.7mm measured at the tip of the elevator control surface versus the adjacent fixed trailing edge. This may seem like a small deflection but remember that the chord length of the elevator is so small (11mm) that even large angles of deflection result in small amounts of travel (for example, 1.7mm deflection = 9 degrees). See chart below for other control surface throws and positions. All measurements are made between the trailing edge of the control surface and the adjacent fixed trailing edge (ie, flaps at root and ailerons at tips). I find that aileron to flap coupling can be helpful if you want a higher roll rate at low speeds but not necessary at higher speeds. For landing, I allow the ailerons to reflex approximately 1mm at full flap deployment (butterfly). With this set up, roughly 0.8mm of down elevator compensation is needed to maintain steady attitude thru full flap deployment. As a matter of personal preference, I like to use 25-30% exponential in slow speed modes to tame the throws around center but still have a larger throw in reserve if needed. For the smaller high speed throws, expo is not needed.

	SLOW SPEEDS / LANDING		FAST SPEEDS	
	UP	DOWN	UP	DOWN
Ailerons	6mm	4mm	3.5mm	2.5mm
Elevator	2.5mm	3mm	1.7mm	1.7mm

Flaps: 70-90 degree down for landing
** Note that 2.5mm of elevator throw must be used cautiously as it is enough to stall the model. I use it in landing mode only in case of bad turbulence in the landing area.

Ballast

Adding ballast is an effective way to increase the roll inertia of the model as well as to help it achieve the ideal lift coefficients without having to fly such tight circles. Permanent ballast should ideally be added to the wingtips by pouring lead shot and epoxy into the aileron servo opening and letting it run to the wingtip against the rear of the spar shearweb. This will provide the maximum roll stabilization and reduce bending loads on the wing spar. I prefer to add (5)ounces to each wingtip in this way. Temporary ballast may be added two ways: In the D-box of the wing ahead of the spar, or in the belly of the fuselage. I prefer to use the d-box as it adds less to the wing bending loads and has a theoretically stabilizing effect on the aeroelasticity of the wing (assuming you can ever make it flex!) The skin of the D-box is a very heavy layup and should be stiff enough to hold the lead shot dry (with no epoxy) without deforming. This allows you to fly the model with the d-box empty for lighter air of completely full of lead shot if the conditions are very strong. CG is maintained either by removing noseweight when the box is filled (roughly 6.5 oz) or by adding a stick of lead in the fuselage boom aft of the CG. To access the D-box ahead of the spar, a 6-7mm dia hole can be made at the root of the wing 15mm behind the wing leading edge. Inside you will find a spanwise tube leading to either side of the d-box. I have found that smaller #9 lead shot is the most easy to add and remove thru the small opening.
Adding ballast to the belly of the fuselage is the last option and with careful planning and routing of wires, it is possible to fit 10oz or more inside. Be sure to secure it strongly as it might slide in an impact and damage your radio gear and/or the airframe. The heaviest I have flown to date with a K2mDP is 150oz and it flew fine in 40mph winds and was very stable through turbulence.

Other Considerations

If your Kinetic isn't 'locking in' or feels unsettled in the air, move the CG slightly farther forward and give it a click of up elevator trim. Depending on your CGing method, its likely that you have the CG farther aft than intended.

I recommend using loctite on the wing and stabilizer mounting screws and always do a pre / post flight check to make sure that they haven't loosened. In actuality, it is very seldom that I ever remove the stab from the fuselage. I have recently begun laying a thin string of 5min epoxy on the saddle before mounting it after the servo install is 100% completed. Mount the stabilizer and smooth any excess epoxy with a gloved finger and clean up with alchohol.

Always take the utmost care when building and flying your Kinetic. Attention to detail will result in the safest, most capable, and most enjoyable plane. Remember to maintain your plane and always give a thorough check before and after each flight.

Dynamic soaring is dangerous. Always position yourself behind a suitable bunker and advise all present to do the same when you are flying as all DS planes will fail at some point and no one knows exactly when that will be. Have fun and go fast and be careful ;o)!!!!!

Don't hesitate to call or email me with any questions.

Thanks,
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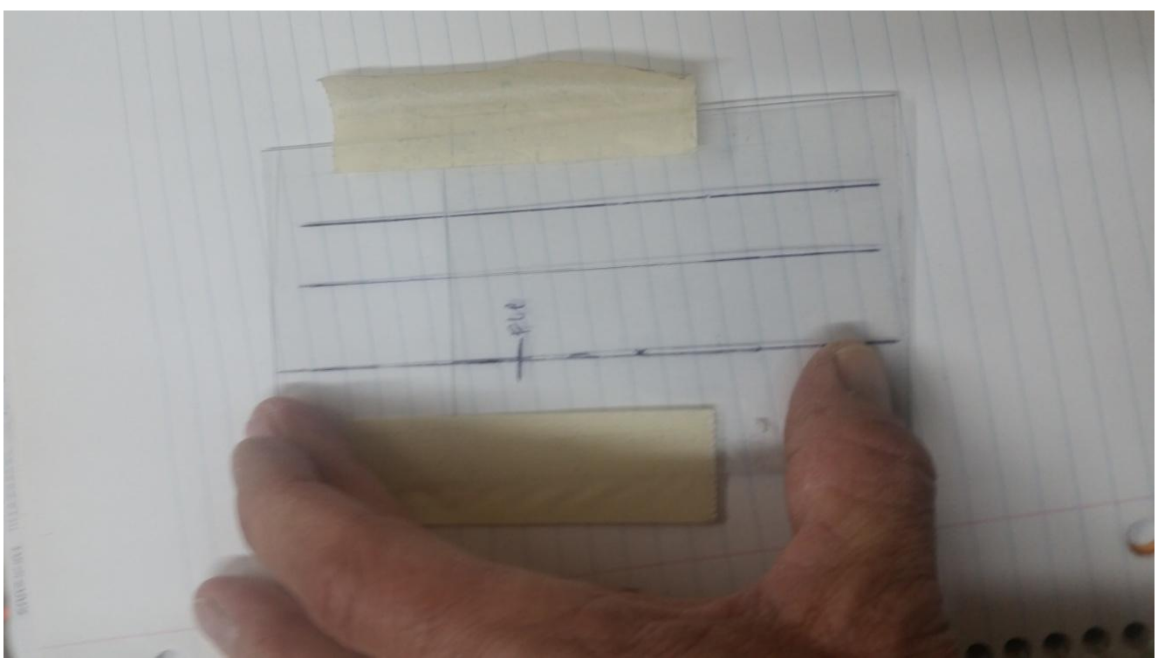
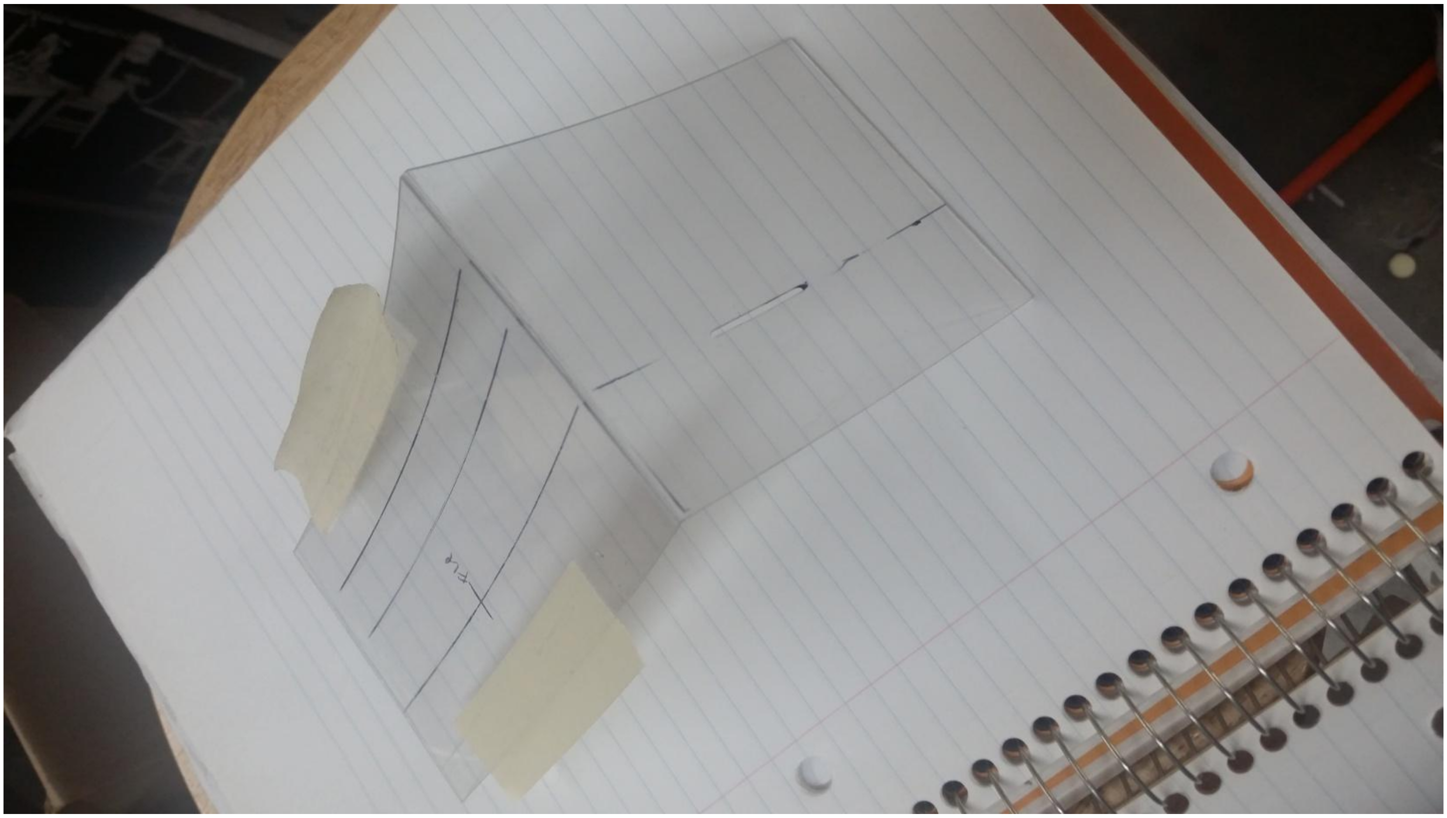
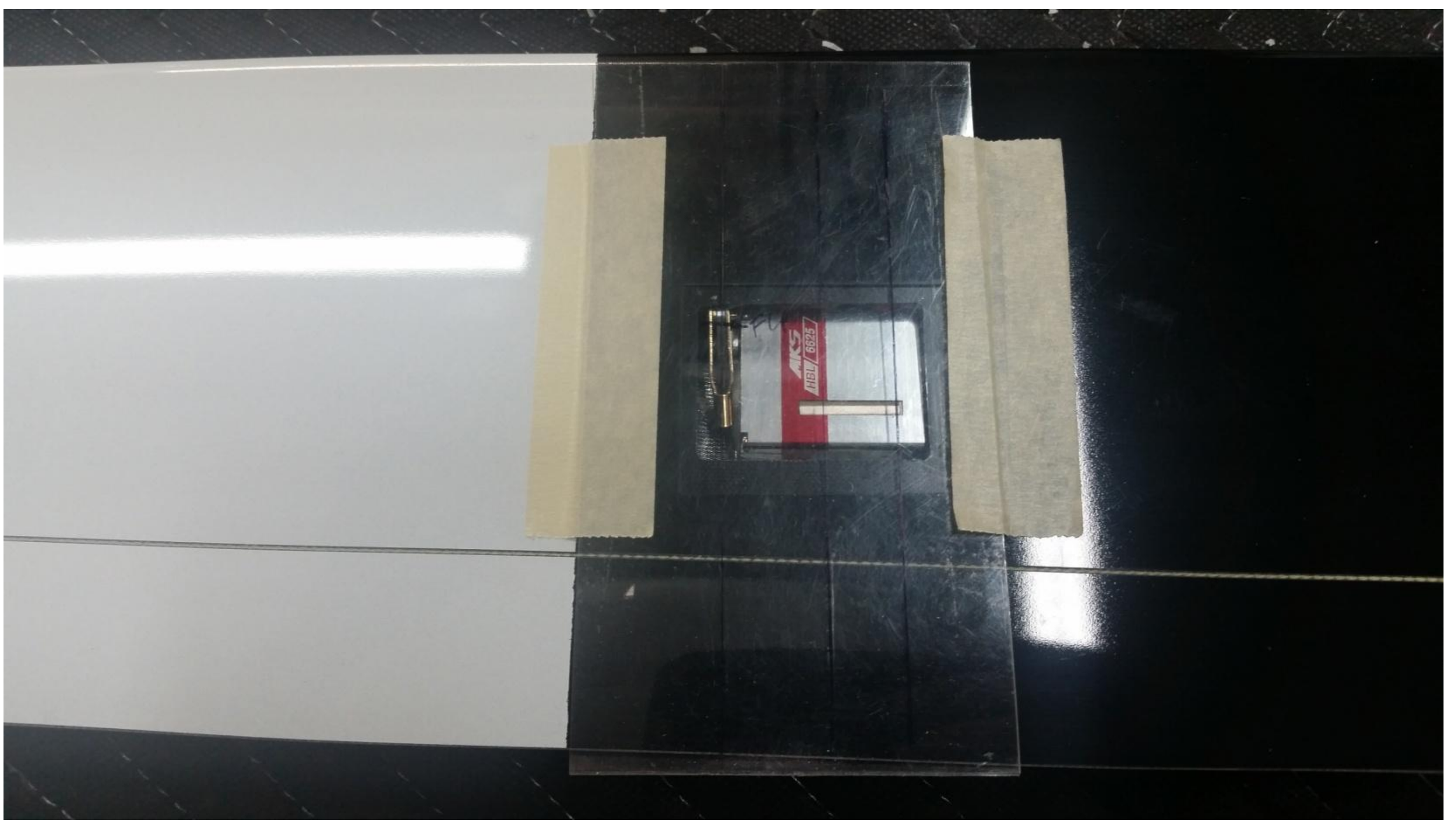
APPENDIX

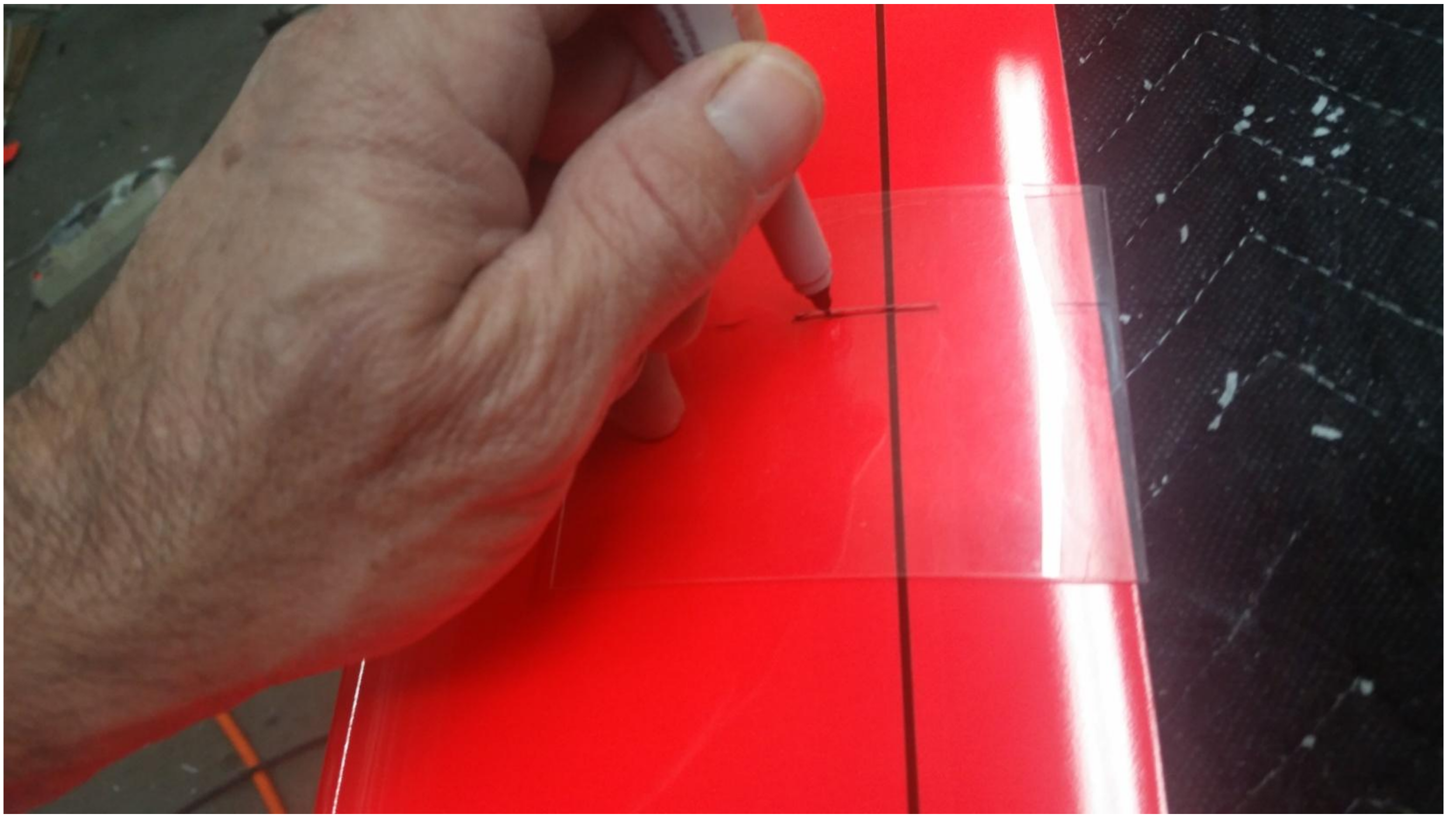
Use the following templates to assist with laying out the pushrod exit holes in the upper wing skin.

First, using any scrap piece of clear plastic you may have (ie, blister packaging) and a straight edge, draw a line about 10cm long and label it 'Servo Arm'. Fold the plastic near the middle roughly perpendicular to the line. Lay the folded template on a table with the line side down and trace over the line using a straight edge. Open up the plastic clamshell and slide it onto the trailing edge of the wing with the central line directly above the servo arm. Align the template so your marked line is perpendicular to the hingeline. Tape in place and flip the wing over. You can now use the transposed line to mark the wing in the proper location for the cutout. If you want to perfect your template, mark the hinge location and remove from the wing. Using a dremel, trace the transposed line with a small dremel endmill to make a slot for marking the wing with a fine tipped Sharpie.

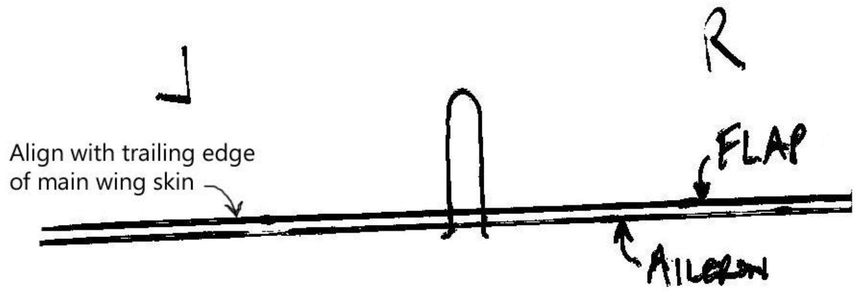




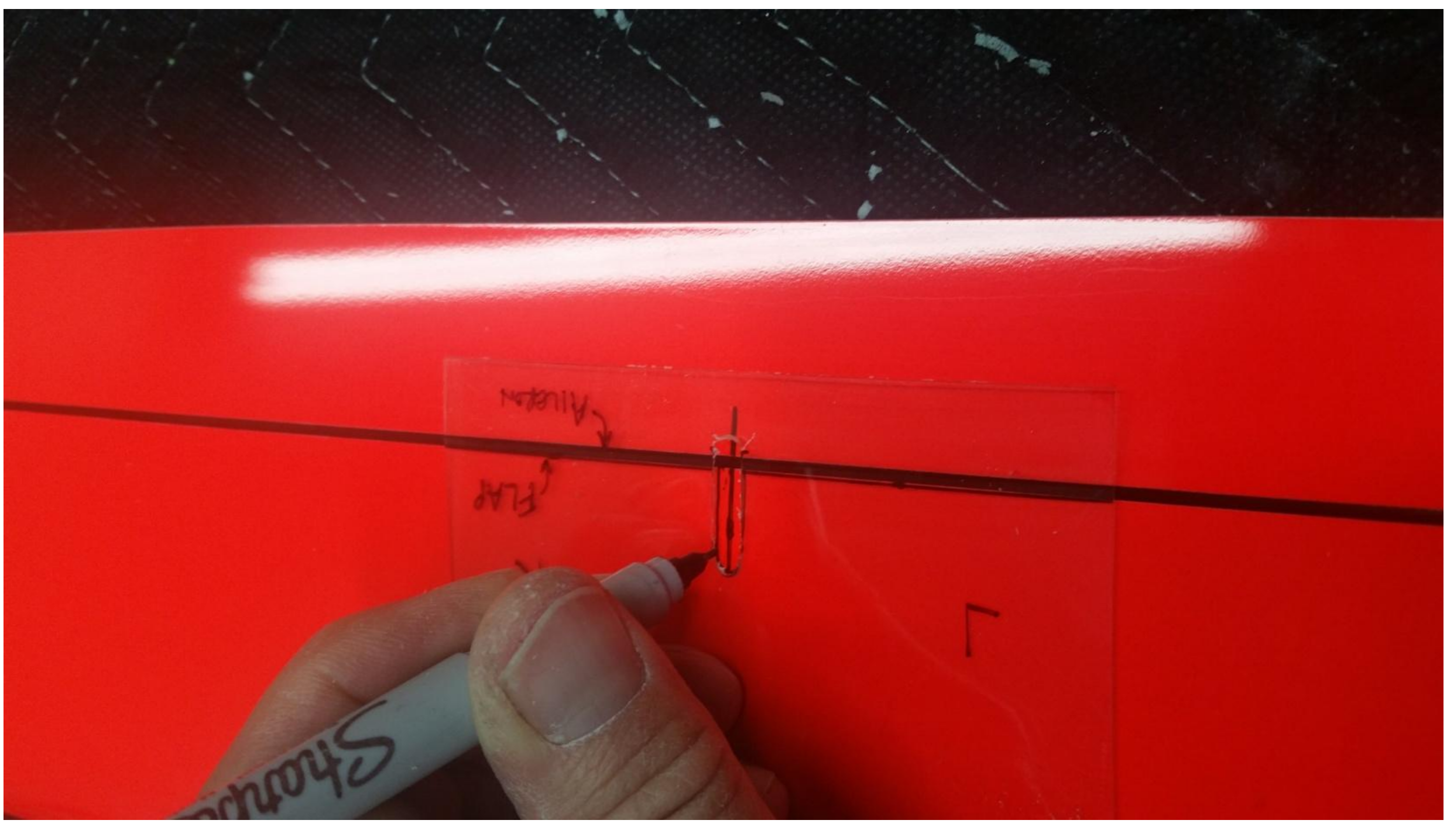

HBL 6625



Now you are ready to print the following sketch and affix it to another piece of scrap plastic. Dremel out the horseshoe shaped cutout just removing all of the ink for the correct sized opening. Center this template over your previous mark and align the aileron or flap lines with the trailing edge of the main wing skin. You can now mark the cutout onto the wing. The cutout for the aileron is slightly longer than the cutout for the flap. Flip the template for the opposite side of the wing(R of L should be legible if you are on the correct side.



L
R
Align with trailing edge of main wing skin
FLAP
AILERON




AILERON
FLAP
R
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