

Aerobatic Airplanes

Arrow V5

DD
Designed to Win!

Assembly manual

Congratulations on your purchase of Donatas Design, aeromusical plane Arrow V.5. This plane is evolution of famous 4D trainer with variable pitch propeller placed inside fuselage. Arrow V5 is latest version of this plane, that is extremely good choice if you want to learn 3D or 4D flying.

Plane kit come in two versions regular and milled. Regular version is preferred option for beginners, and pilots that plan to fly Arrow outside in light winds. Not milled version is also stronger. Milled kit is made for competition pilots and flying with Variable Pitch propeller. Milling save about 9 grams, and as we know weight and wingloading is very important factor in F3P competition planes.

Arrow V.5 is intended to be powered by 18,5g AXI2203/RACE motor and 2s light lipo battery if you fly indoor. If you plan to fly outdoor AXI 2204/54 with 3s light lipo is recommended. Please have in mind if you select more powerful motor additional reinforcements to airframe will be necessary.

This kit include all items that are necessary to finish kit, depron parts, carbon rods, flat carbon, hi quality fiberglass hardware set, motormount, Z ends for servo attachment, velcro tape for battery fixation and pull pull line.

Equipment selection

Motor: AXI2203/Race (For indoor flying, motor weight 18,5g.)
AXI 2205/54 (For outdoor flying in light wind, motor weight 25,9g.)
AXI 2205/54 EVP (VPP flying, motor weight 25,9g).

ESC: Competition option Castle Creation Phoenix 10a , budget version CC Thunderbird 9.

Battery: Desire Power V8, 35C 300mah, 2S/7,4V , battery weight 16g. (Light indoor)
Desire Power V8, 35C 380mah, 2S/7,4V , battery weight 22g. (Powerfull indoor)
Desire Power V8, 35C 380mah, 3S/11.1V , battery weight 30g. (Powerfull outdoor or VPP)

Servos: Dig. JR 290G single servo for elevator and rudder, 2 servos can be used on ailerons.
Dig. JR 188 single servo for elevator or rudder, 2 servos can be used on ailerons.
Hitec 65hb single servo on ailerons and rudder

Radio: At least 4 ch programmable radio with minimum programming of exponential. My advice would be more advanced radio like JR 9 or JR11 that have travel adjustment, dual rates, trim steps, digital trimmers, mixes and other useful functions, that will help you setup plane fast for best performance.

Receiver : As light as possible, i use with great success: Spectrum 2,4ghz Ar6300 2g.
Duplex 2.4ghz R6G indoor 3.6g

Donatas Design

Aerobatic Appliances
Designed to win



Donatas Design F3P hardware set.

- Elevator control horn for pull push.
- Servo arms for elevator and (double servo) ailerons.
- Elevator reinforcement plates.
- Aileron offset servo arm.
- Elevator and rudder servo arms for pull pull.
- Aileron horns
- Motormount for AXI 2203/52
- Rudder reinforcement plates for pull pull.
- Wheel pants reinforcement plates.
- Wing carbon support center.

Here you can see fiberglass hardware set. It is done to achieve best control of your moving surfaces. Now you can use long servo arms and servo horns, this will allow you to have less pressure on control rod and also use full potential of your servos and not lose resolution. Also few small piece will reinforce areas that face alot of forces.

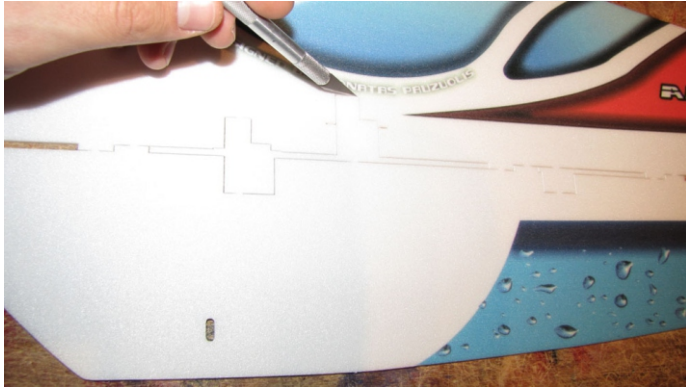
Required tools and adhesives:

You will need just few basic tools and materials to finish your Arrow V.5:

Sharp hobby knife, file ,1.5mm drill, piece of sanding paper, scizors, screwdriver, solder, Donatas Design beveling tool.

Mercury Adhesives foam friendly CA glues (M100F), Mercury Adhesives Accelerator MH 16 M3 medical tape for control surface attachment.

Building:



Using sharp knife split fuselage. Do not throw derpon "trash" (servo cutout holes). For example if you decide to use two aileron servos you can glue back inside fuselage this small piece and avoid having ugly hole.



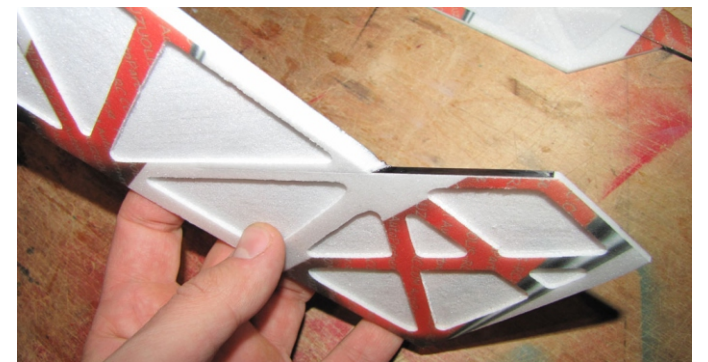
Make sure you remove all steps that were connecting fuselage. Repeat this procedure for all parts.



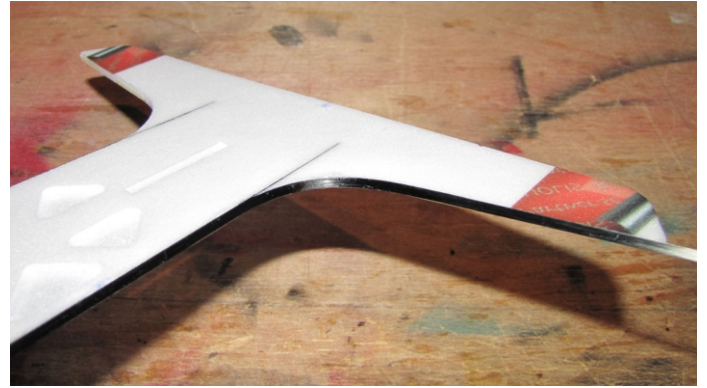
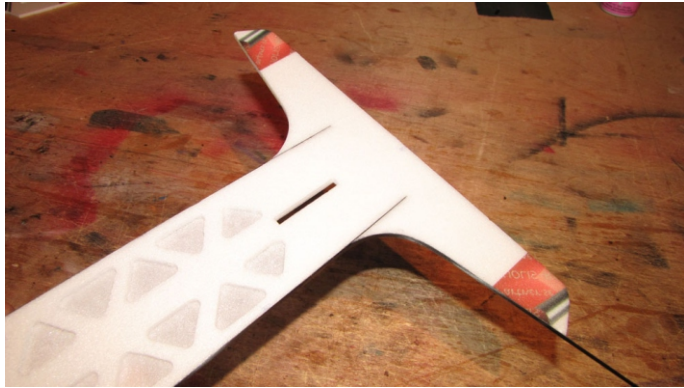
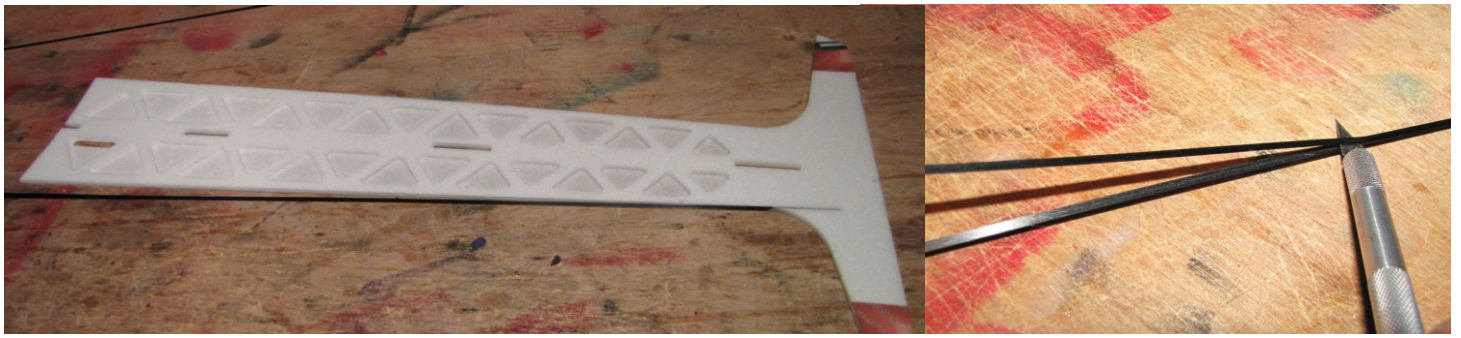
If you try to build plane light, here is one trick. „Shave“, end's of 0,5mm flat carbon. You will save some weight and will have very useful thin carbon for further building.



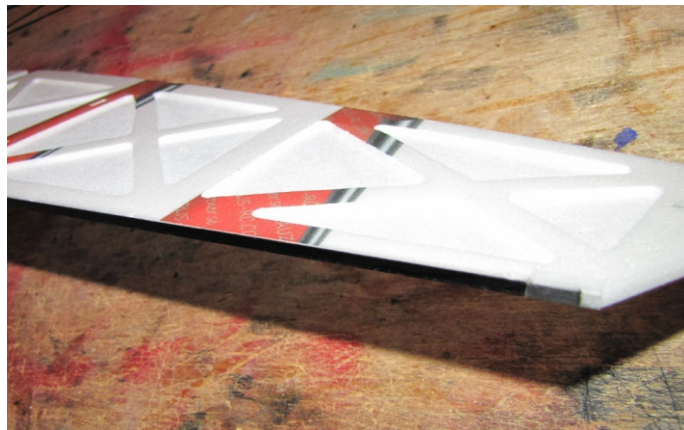
Ussing Donatas Design beveling tool cut aileron edge, for easy deflection down (when it is attached to wing), and great clean look .



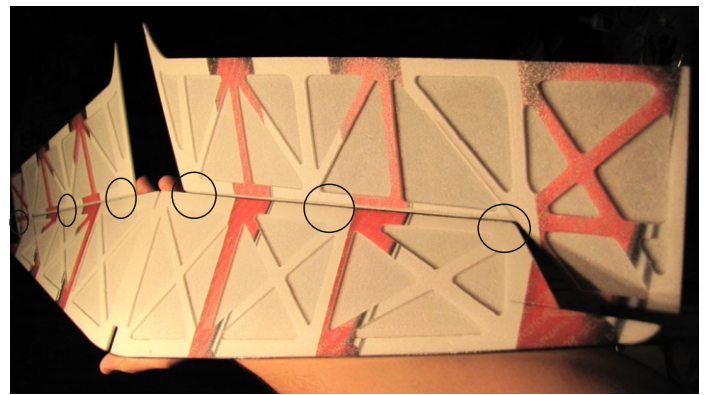
Next thing is reinforcing some critical parts. Here you can see aileron compensator reinforcement with thin carbon.



Optional reinforcement: Glue thin carbon (that is left from „shaving“ main carbon spar) like shown in picture, this give very good strenght for elevator and prevent stabilizer part from cracking.

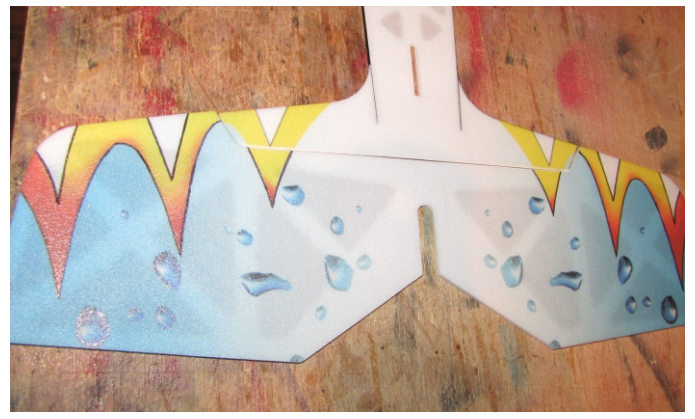
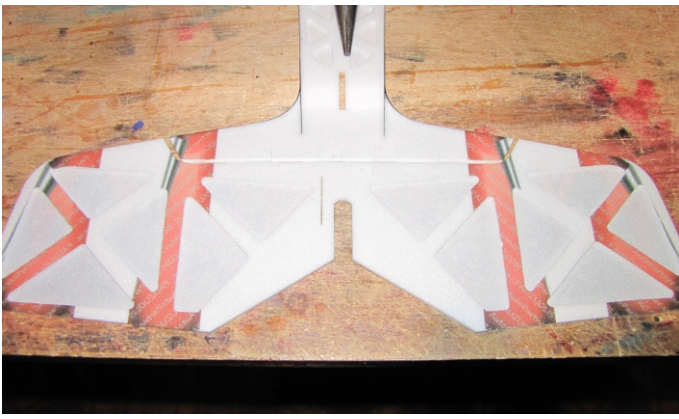


Glue 0.5mm carbon on back and leading edges of the wing. Carbon lenght required for back edge is 70cm, for front we will need 83cm carbon lenght should be. Very end of carbon is fixed with small piece of medical blenderm tape.

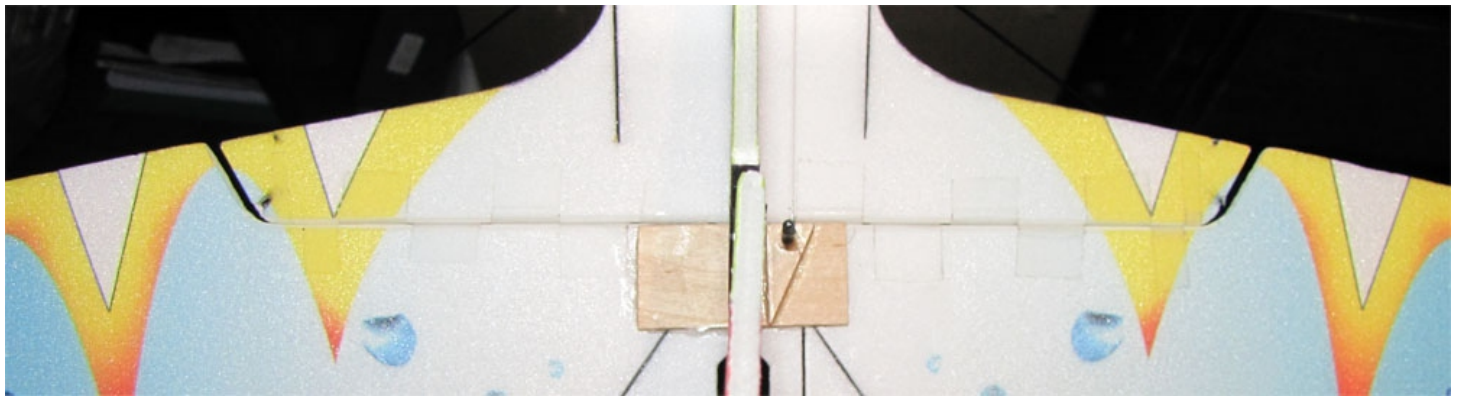


When flat carbon is glued to wing, and aileron edges are beveled, its time to attach these two parts together. I highly recommend to use 3M medical blenderm tape, it stick extremely well to depron surface. Also this tape is not shiny so it does not stand out and change colour sheme of the plane.

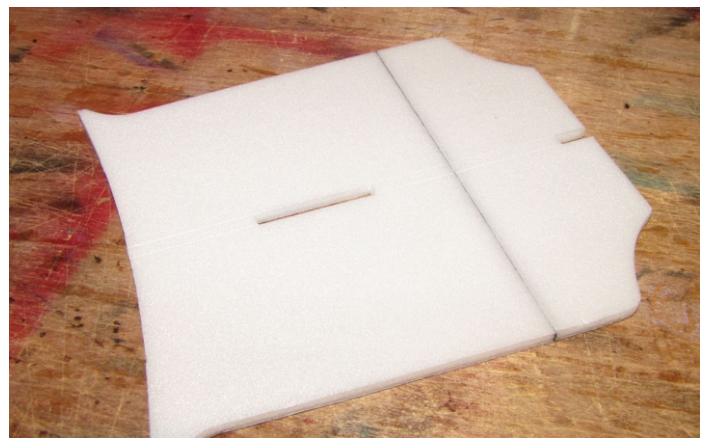
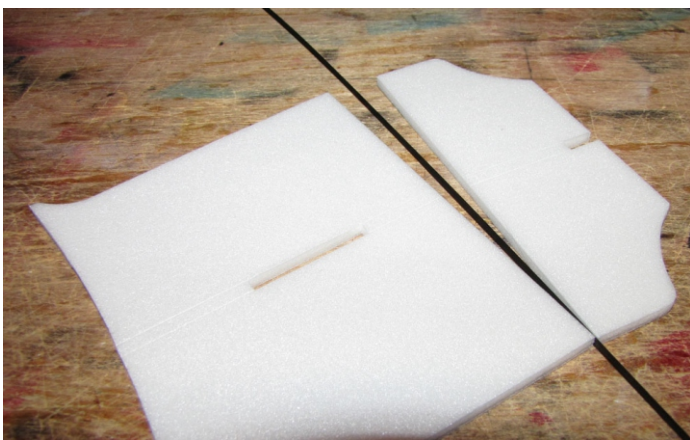
In picture on right you can see black circles, these are areas where small pieces of blenderm tape must be placed. Reinforcement here prevent aileron from moving away from wing, after many hours of flying.



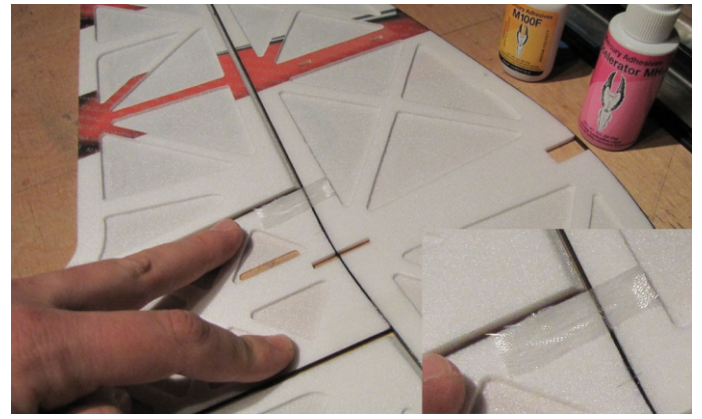
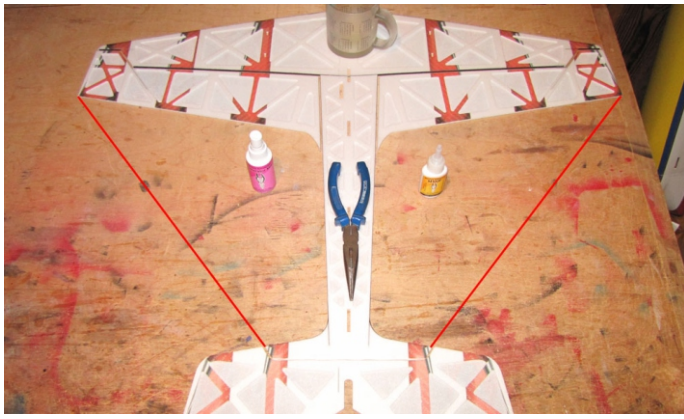
There are few ways how you can attach elevator and rudder. Easier one is to use Donatas Design beveling tool and cut control surface by angle, and then using blendern tape attach it to fuselage (same way ailerons are done). Such method is good when you use solid pull push system. But if you use pull pull cables, tension on hinge line will displace rudder or elevator.



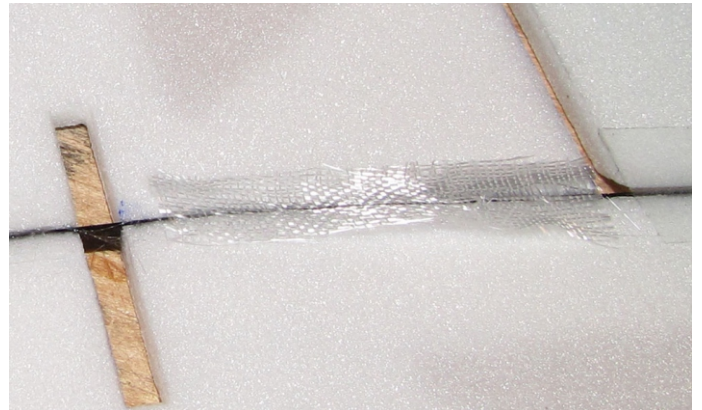
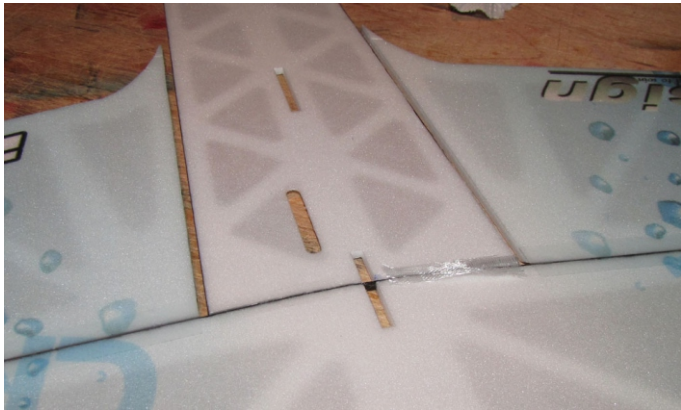
I use so called „8" method. You can see rudder here is connected like old fashion control line surfaces, when people did not had hi quality hinges. Idea here is simple, take two pieces of blendern tape (about 1x1,5cm size). Glue 0,5cm lenght of tape to other tape to sticky areas, this will give you 2,5cm tape that is sticky in front on the bottom and rear on the top, at same time center is neutral from both sides. Having such piece glue one side of it to stabilizer top surface and bottom of elevator, reply same thing just flip over next sticky tape piece. You have to repeat this procedure until elevator is connected from left to right. Such way of connecting surfaces is best for Pull pull cbles. I use this method on my competition models, it allow surface deflect up to 180 degree with no effort, also it can withstand pull pull cable tension forces and stay in place for ever.



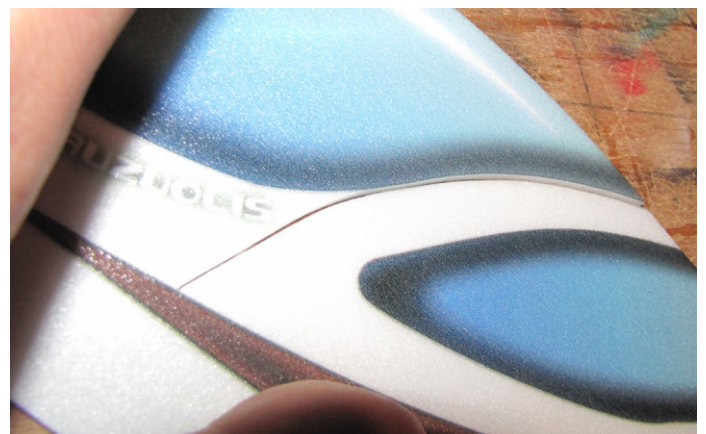
When you use TVR (Trust Vector Control) system, it put allot forces on motormount and nose of plane, here is small trick how to make nose of plane stronger and have less noise. Cut nose about 3cm from front and glue in thin carbon piece. This will help in few areas, plane nose will be much stronger and noise will caused by hi G maneuvers will be smaller.



Now its time for one of most important steps durring building of your Arrow V5. Place tail section to main wing as shown. Use some heavy objects to lock parts on flat table. Measure very carefully distance from each wingtip to stabilizer, it must be exactly the same. Also be sure tap line where bottom of fuselage will be connected is in one line.

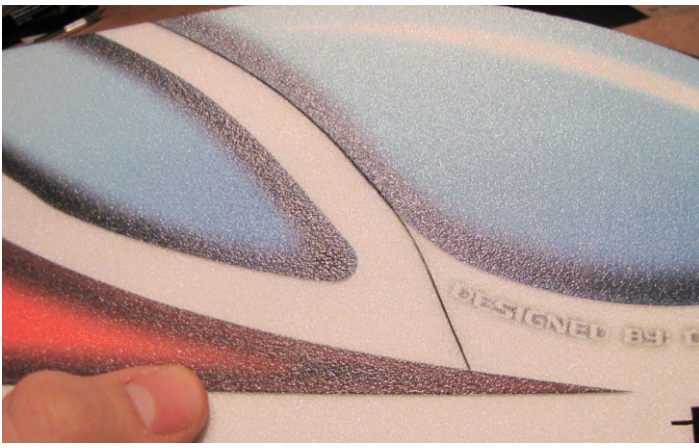


Area behind wing where it is connected to fuselage is weak point of every shockflyer. I recommend to reinforce it with fiberglass cloth. Cut small piece as shown in picture and put few drops of foam friendly CA glue. Make sure it spread even, so all material is wet, but be sure not to clean all axtra CA with paper towel, remember we don't want extra weight. And to much of CA glue is one area where you can collect weight very quickly. For example for building your plane take fresh bottle of CA glue, and check what is the weight of it. When you finish building your plane put bottle of CA on scale you will see how much weight you add to your plane in form of a glue.

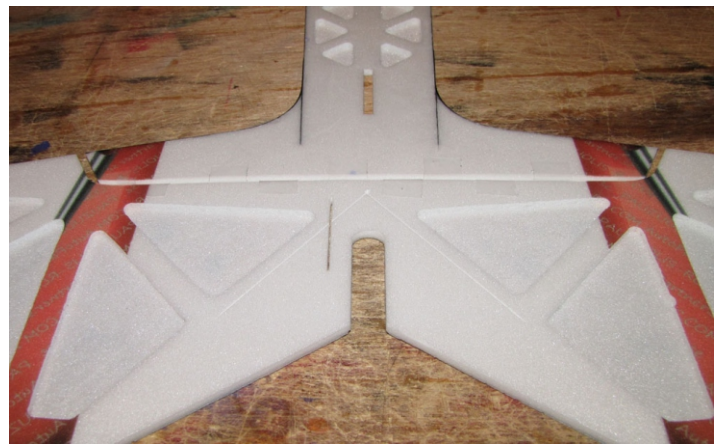


In this stage of building last part you must attach is front of the plane. Glue it as it is shown in picture on the left. Make sure tap line (line where bottom fuselage will be connected) is straight and it match line on tail section and wings.

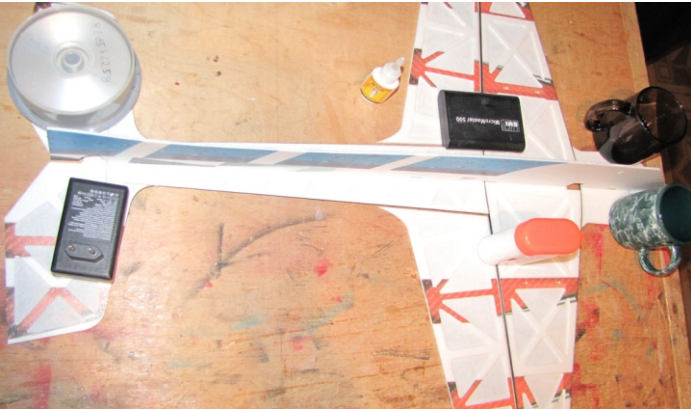
In picture on the right side you can see one more aditional reinforcement for top part of fuselage. Ussing sharp knife carefully cut as shown in picture. Best way is to stick to outline of cockpit, so carbon reinforcement will not stand out.



Glue flat thin carbon piece as shown in picture. This will reinforce top of fuselage and in case of inverted landing will help to protect depron from bending.



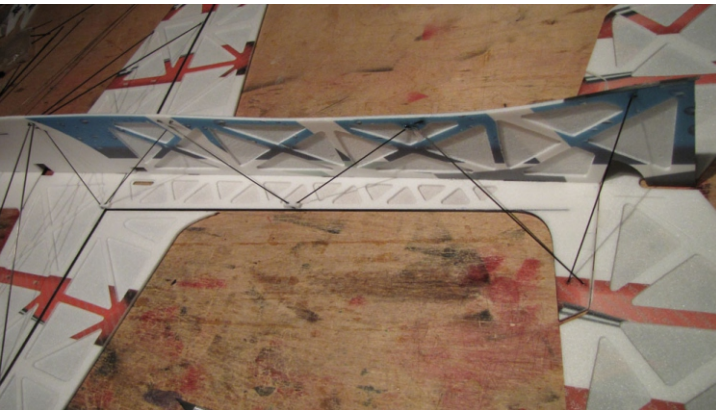
Cut holes for V shape carbon reinforcement. This is necessary step to ensure both sides of elevator deflect exactly the same. Otherwise elevator control will be not precise.



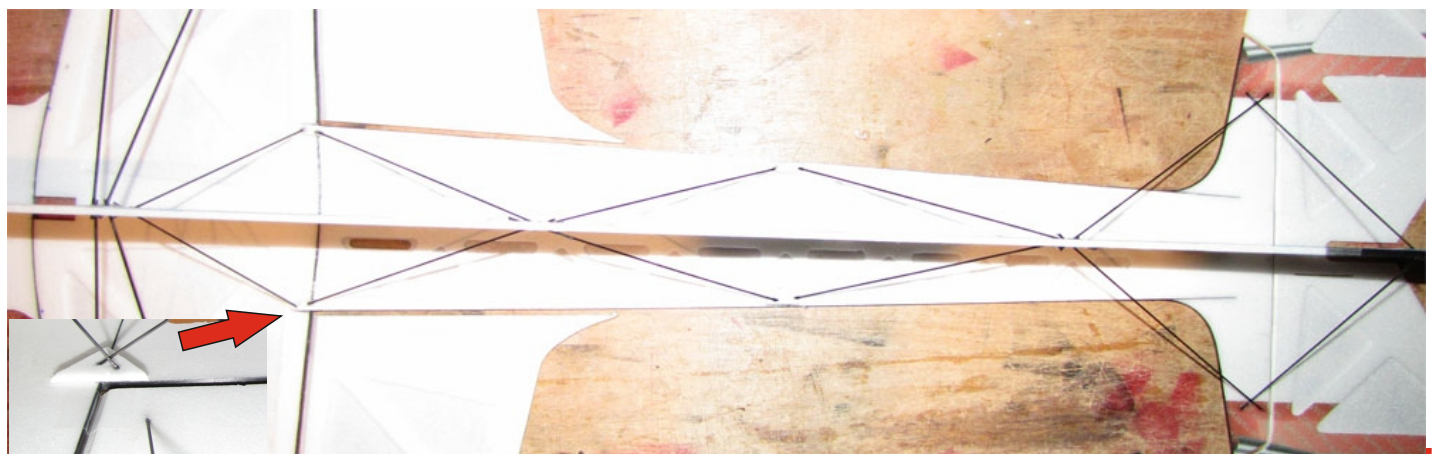
Glue bottom part of fuselage inverted on the flat table. Put some heavy objects on tail and wings, this will help to keep them straight. It is very important for precise flying plane.

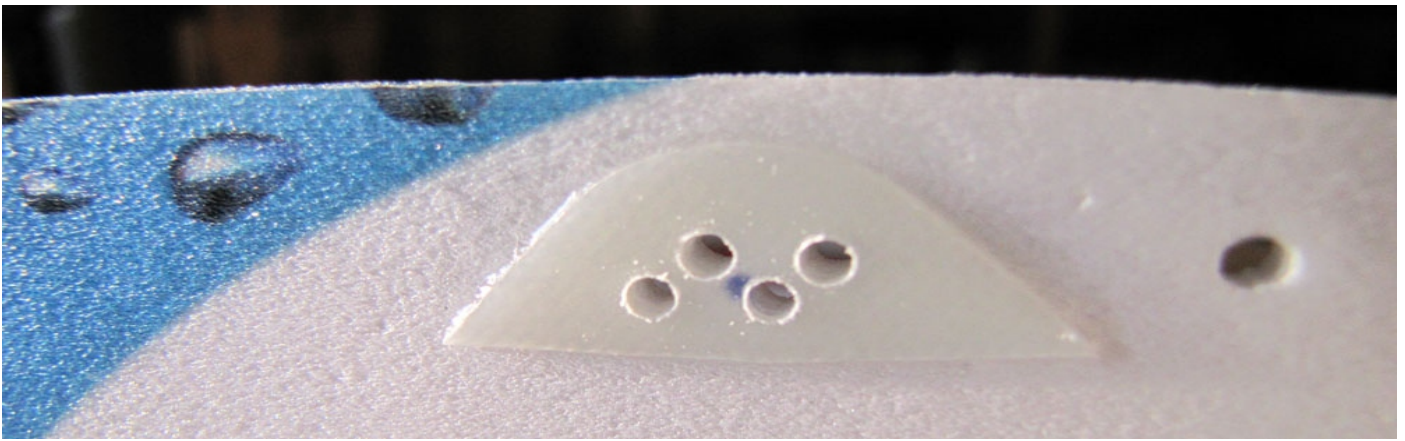


Now lets reinforce bootom fuselage structure by adding 1mm carbon rods. Be sure to take a piece of sanding paper and prepare surface of each tip of carbon rod. This way glues will stick better. For easy setup i recommend use some square helfull tools like CD cover ore credit/phone card. Take two exact same size objects that have 90 degree angle, place these objects (my favorite credit cards) from both sides. This way depron stay straight.

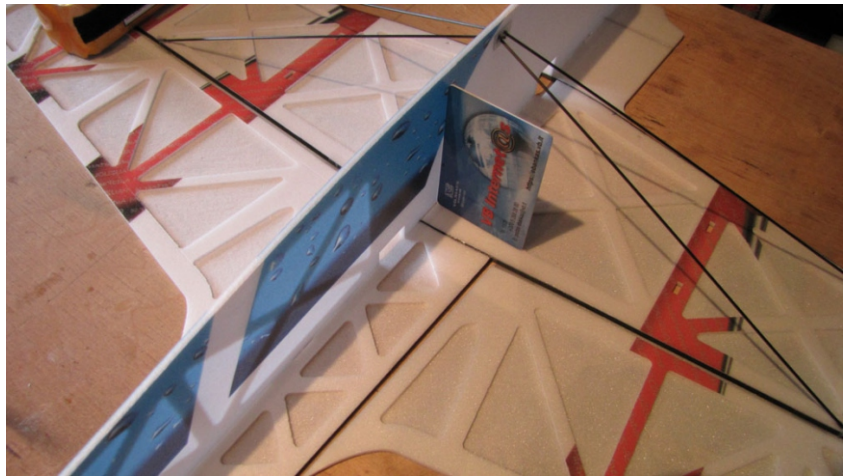
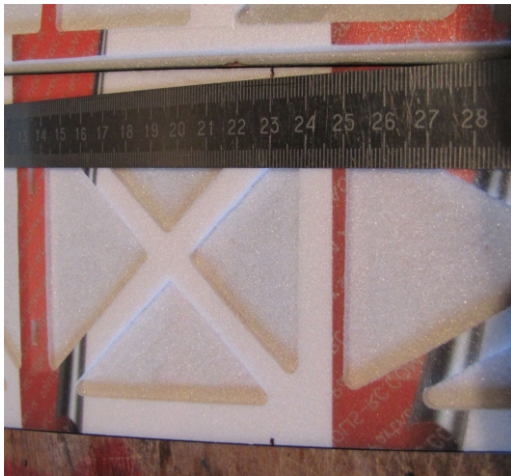


On last picture, you can see all construction reinforced and already assembled in one piece. Such reinforcement way is about 50% lighter than old fashion depron box, that also had some twist during rolls.

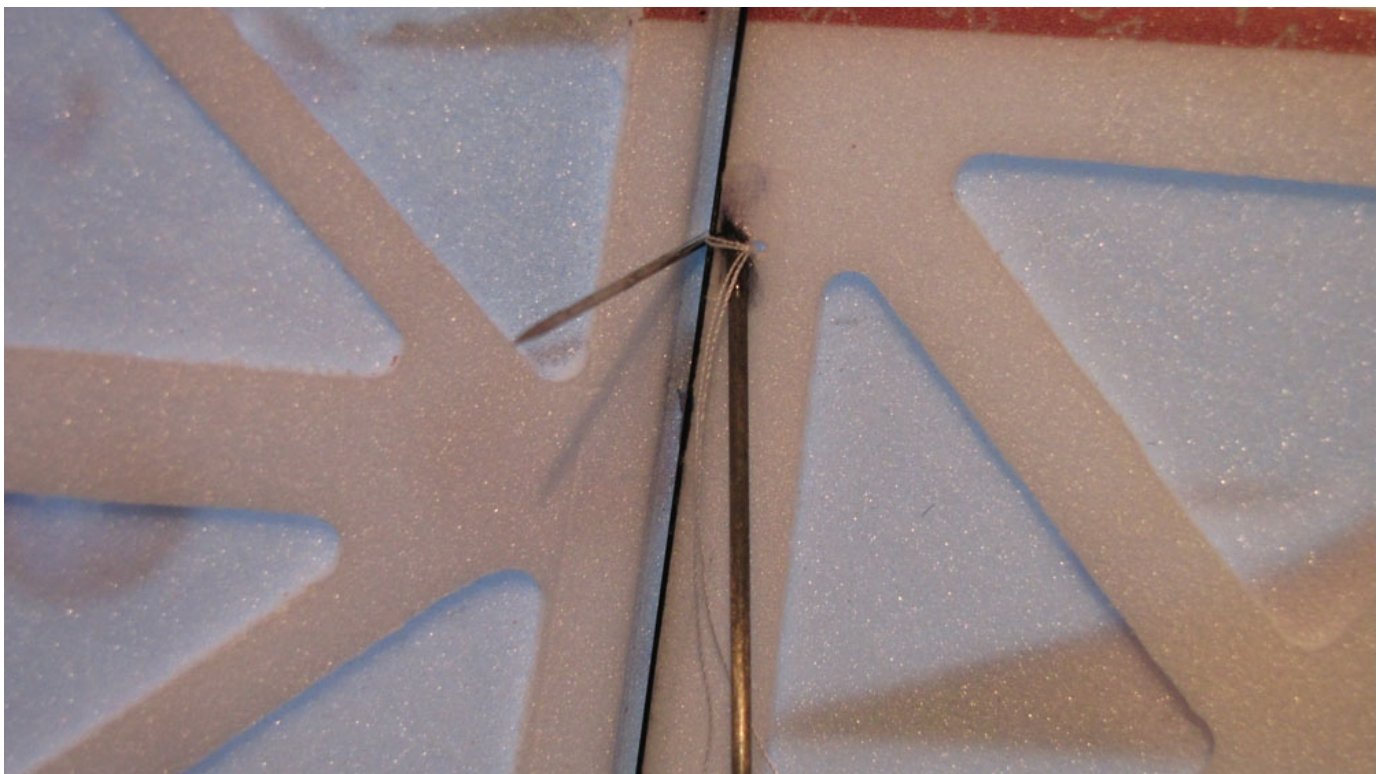




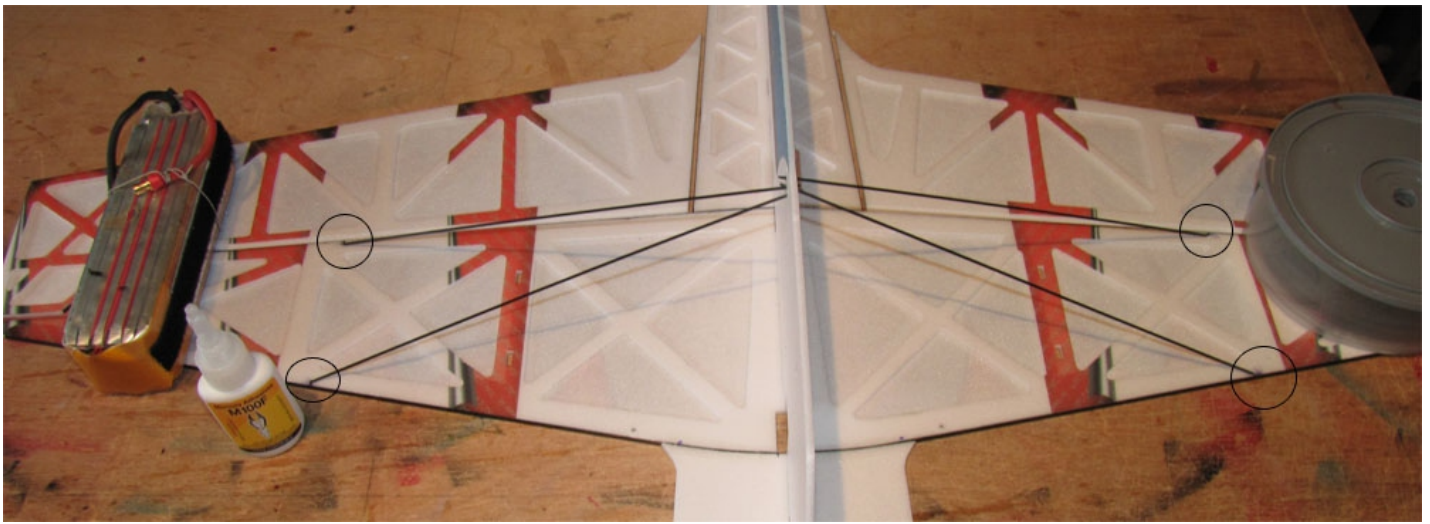
Now we need to prepare main wing support. Here you can see reinforcement piece made from 0.5mm fiberglass. In your Arrow kit you will find similar detail, glue it in center of wing on bottom of fuselage.



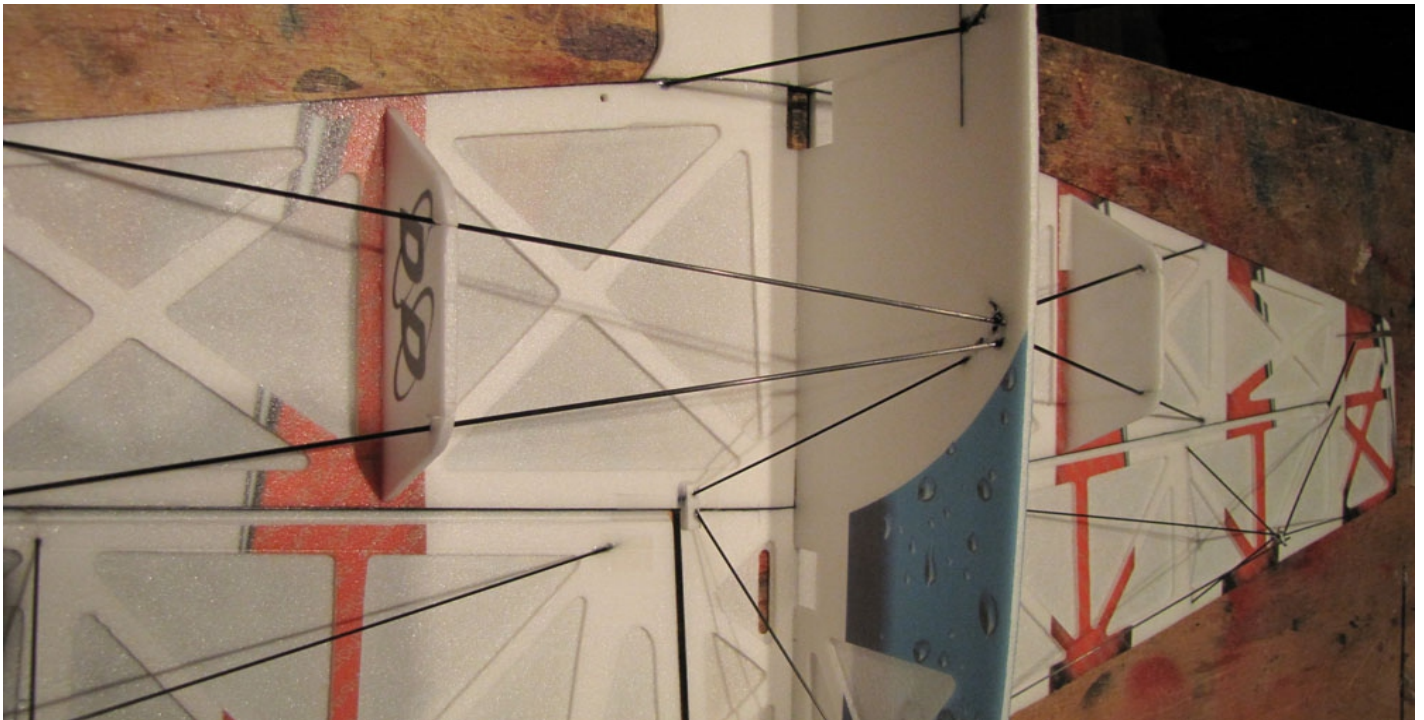
Mark 23 cm distance (measuring from fuselage towards wingtip). This will be point where wing support from 1.5mm will be connected. Wing support carbon rod must be 26 cm long. Also don't forget to use credit card to make sure fuselage is always stand by 90 degree angle. **DO NOT GLUE 4 carbon rods in center yet.** First you need to attach them to flat carbon that is glued to leading and back edge of main wing.



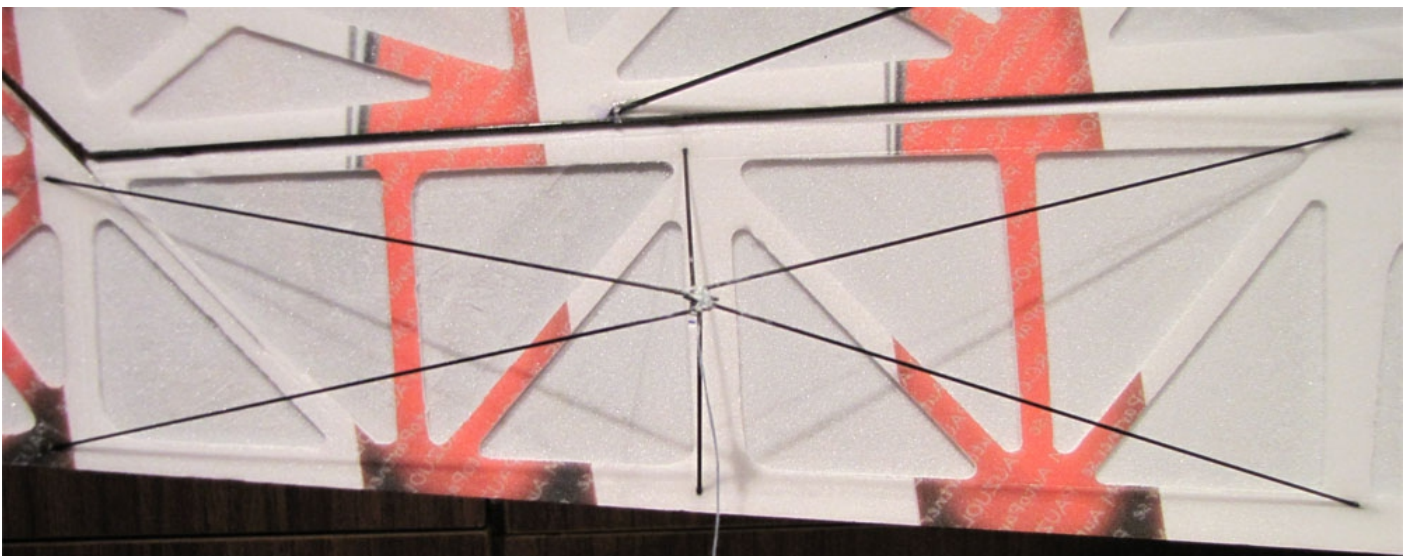
Glue four carbon rods to main wing, and as shown using needle and kevlar thread make couple loops around carbon spar and flat carbon. This will give amazing strenght when you will place drop of foam friendly CA glues on top. This update will keep wings in same position no matter how hard you will fly your plane.



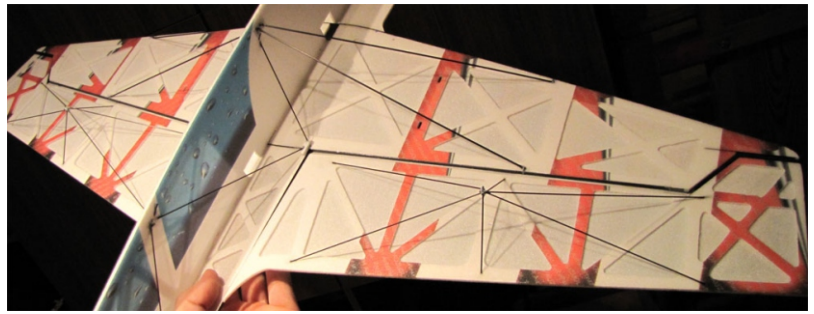
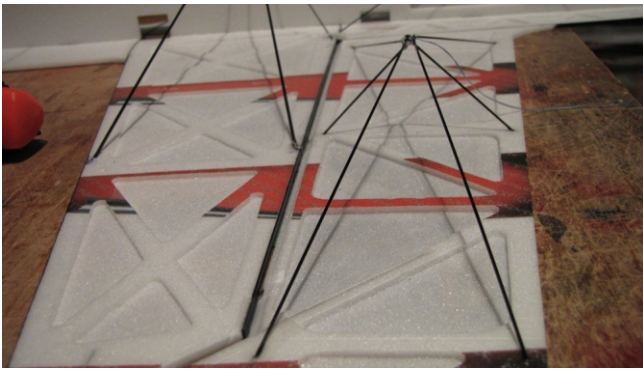
Now when kevlar thread is in place and carbon rods are already glued in place put plane again on flat table. Use some weights to press it down to table. Now double check vertical fuselage position and apply some CA glue in center of fuselage.



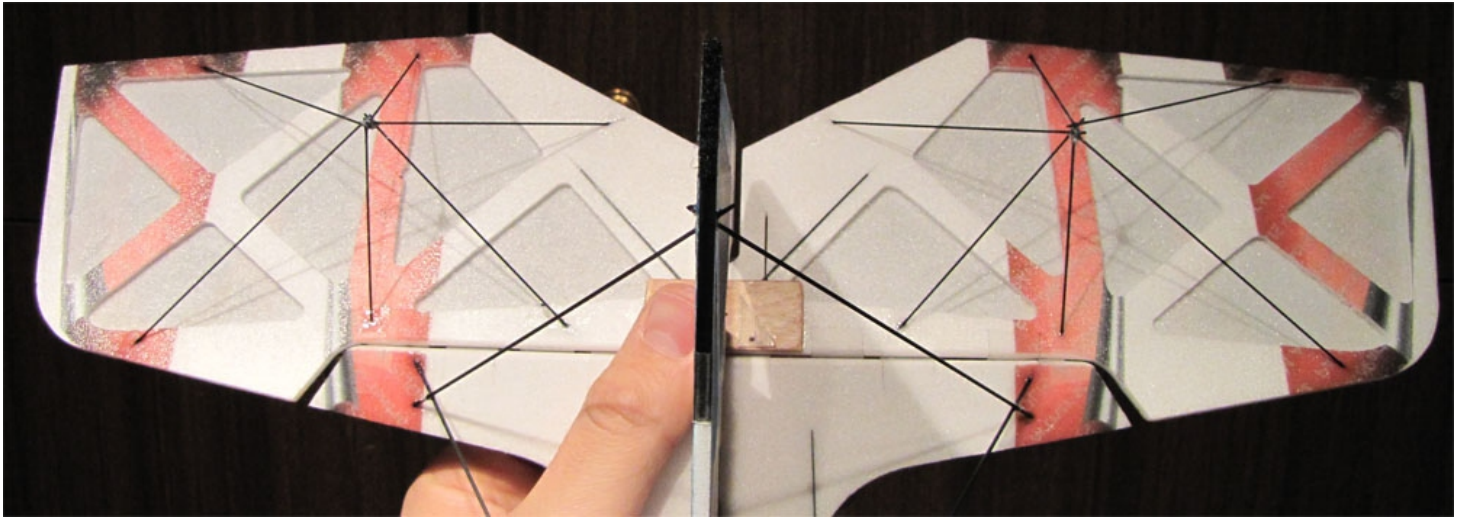
Now you can glue two support SFG's from depron to wing support carbon rod.



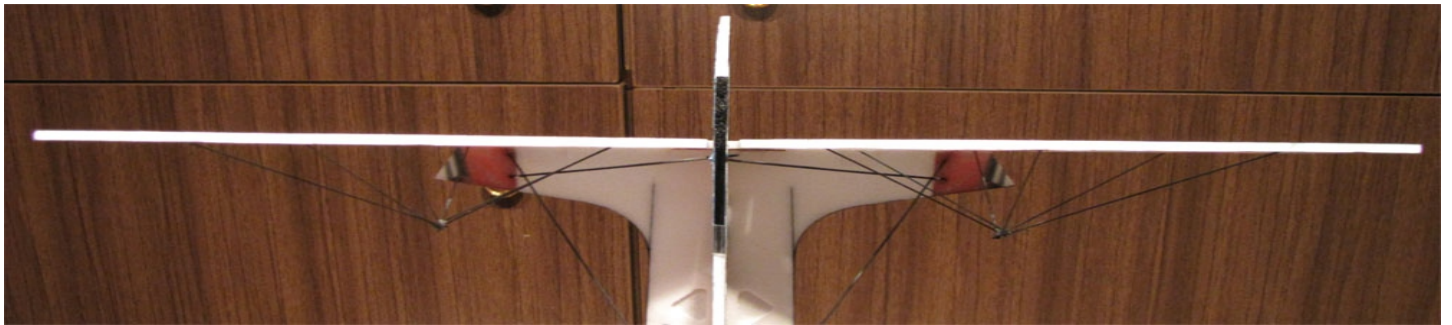
This is optional aileron reinforcement .This upgrade make ailerons much stronger and roll control become little more precise. For milled version of Arrow this is highly recommended. But if you have regular Arrow version and don't have time skills to do this upgrade, its not necessary. Your Arrow will fly just fine.



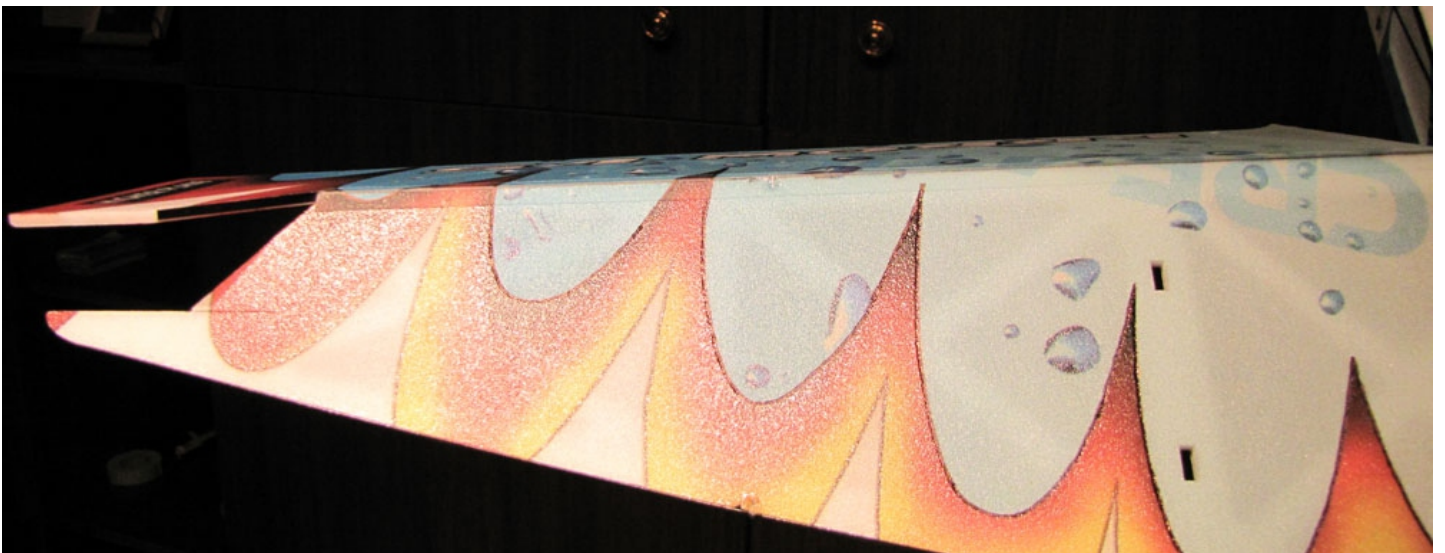
Carbon structure from different angle.



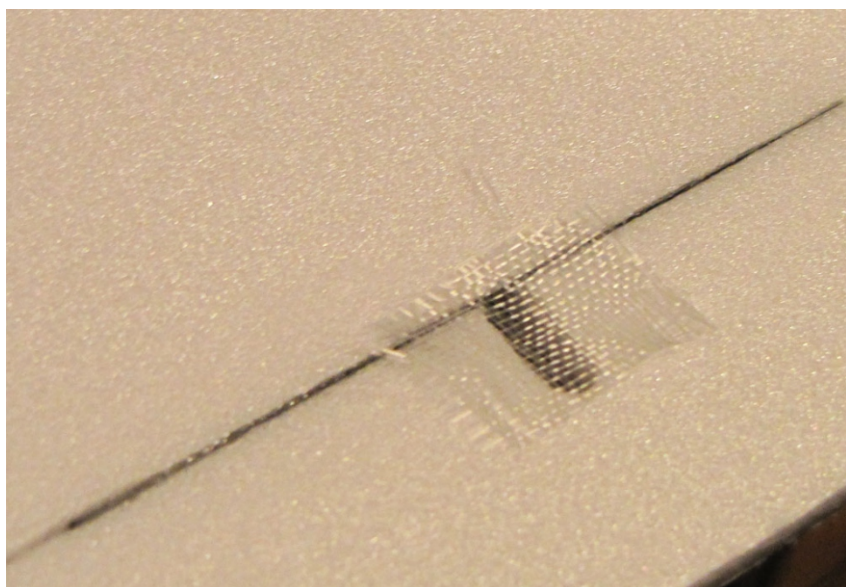
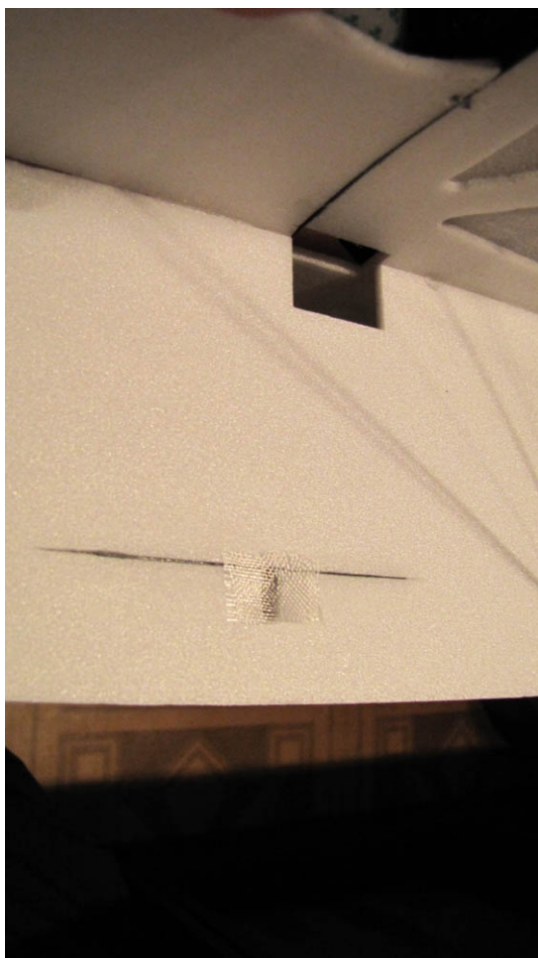
Now it is good time to glue in flat carbon pieces to V shape opening we cut earlier. When you glue flat carbon inside depron, glue fiberglass square plate on top and bottom of elevator as shown in picture. Same optional reinforcement update with carbon can be done on milled elevator. For Wing reinforcement I use 1mm carbon rods and for elevator I use 0.7mm carbon rod (0.7mm carbon does not come with kit).



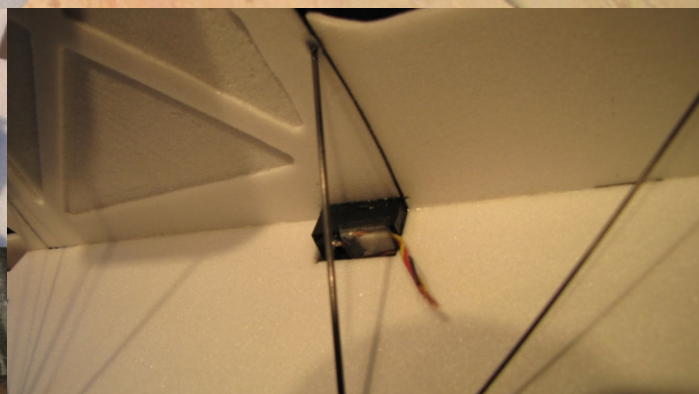
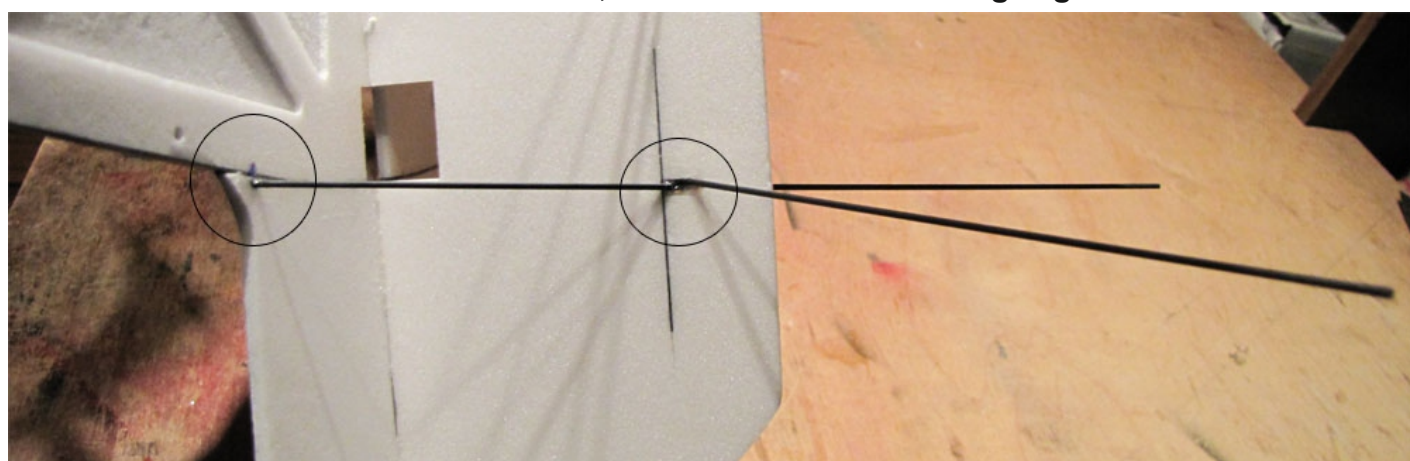
When all updates are installed, make sure elevator is flat and deflect easy to both sides.



When all updates are installed, make sure aileron is flat and deflect easy to both sides.



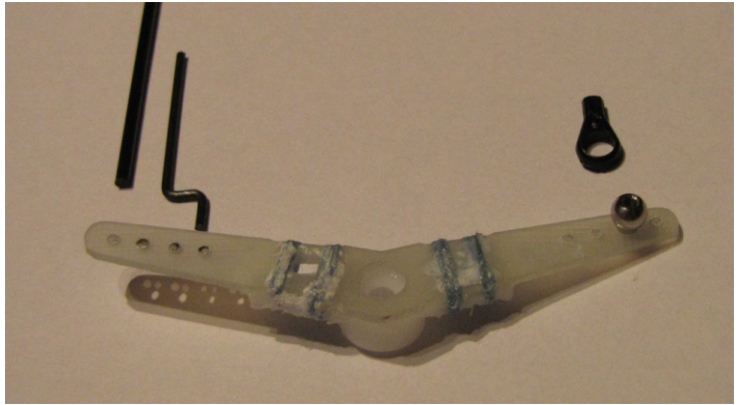
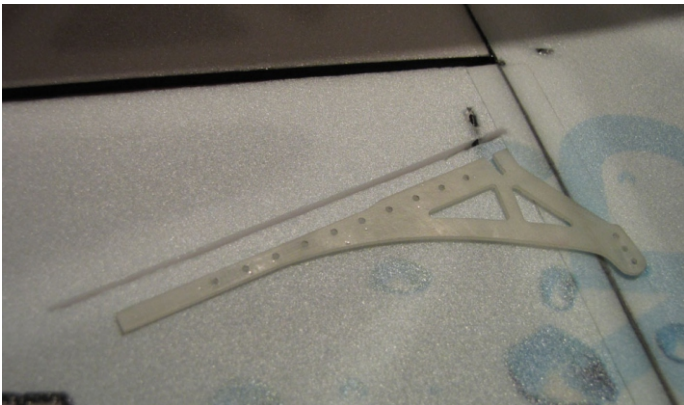
While we did not attach top of fuselage, now it is good time to prepare and install landing gear. First of all i like to reinforce stresfull areas near landing gear. For this task i use some 6 cm piece of thin carbon and fiberglass cloth. Now lets prepare and mount landing gear. Take 24 cm long 1,5mm diameter carbon rod. Mount it as it is shown in picture, with small angle toward engine. This will provide stable standing on the ground. I also highly recommend to take kevlar thread and nedle, and repeat same procedure like we did with main wing support. Tie 1,5 mm carbon rod to leading edge flat carbon.



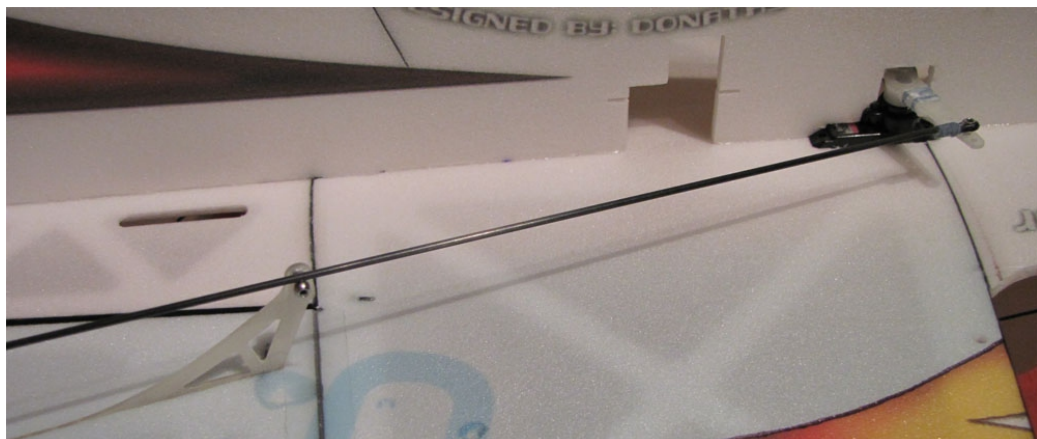
Now it is time to decide how many servos you will use for ailerons. Arrow V.5 have really big and powerfull ailerons, so it require strong servos. Single servo option would be Hitec 65HB connected to 6 volts. (Do not try dirrect connection to 2S battery, eventually will burn after ~50 flights.) If you want to use two servos, i recommend JR290G ore Jr188. Jr290 is heavier option, but it have better gears that will stay tight for hundrets of flights. In other hand JR188 is lighter. All these servos are good quality but they all are quite heavy, but this is not a problem, here is example how i cut down weight from Hitec 65HB servo. Screws and bottom case removed. Rest servo parts hold together thanks to blenderm tape. Please have in mind that such modiffications will void warranty from servo manufacturer.



If you decide to use single servo, glue servo in, and after that glue top of fuselage as shown.

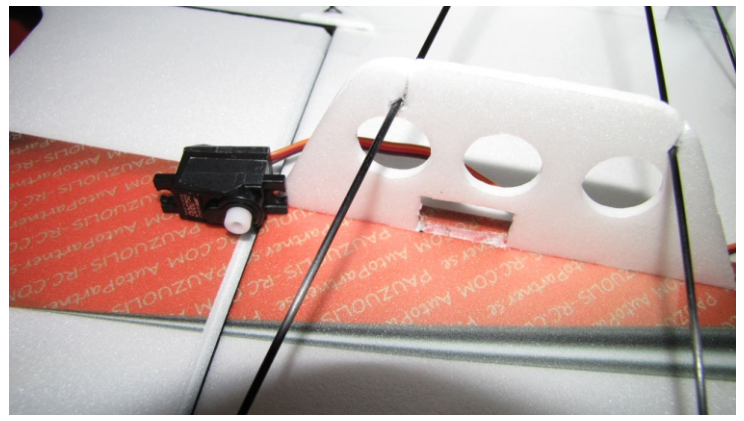


Cut holle for aileron horn as shown. Try to do it exactly same on both ailerons. Next picture show aileron servo arm , Take original servo arm and put it on servo trim and sub trim on your radio must be 0. When you make such setup on your radio, glue fiberglass servo arm to plastic servo arm, now you have perfect center and dont lose resolution when you try to achieve maximal equal deflection to both sides. Next to the servo arm you can see Z bend, this is part included in kit and it work just fine for regular use. On my competition planes i try to have perfect setup in each detail. To achieve control linkage without slope (play), i use tiny ball links from Trex-250 helicopter. I learn this trick from top USA pilot and builder Devin McGrath. Ball links are not included in kit, so if you want this upgrade you can purchase it by yourself. I buy mine from Horizon Hobby.

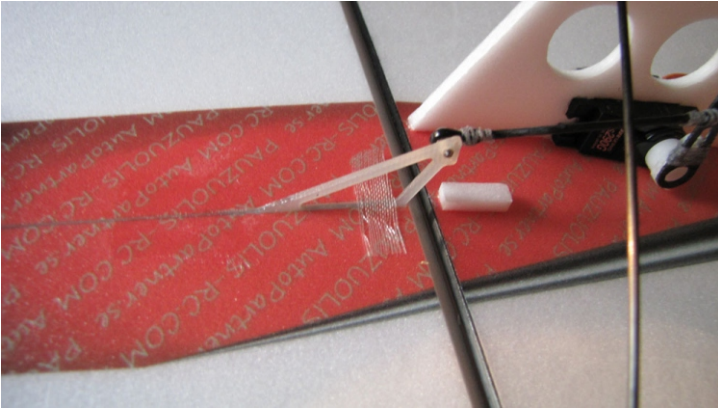


Here you can see pushrod connected to servo arm. It is ready for final adjustment and attachment to aileron control horn. This is difficult part because there is no god way to adjust lenght of pushrod, so you have to measure few times to be sure it will be right size.

I use top holle on servo horn and on servo arm i use second from side.



If you decide to use double servo, glue hole in wing front. And prepare location for servos, cut servo size hole in both SFG's as shown. Having two aileron servos will require little more work to setup but in my opinion it worth time spending time, because you will receive few obvious advantages. First it will be much easier to place battery where ever you want. And our goal is to place all equipment as best as we can to achieve right center of gravity without battery. In this case we can cut holle above center of gravity and this way we can use different size and weight batteries without changing CG. Second advantage of double servo is ability to have flaps. Flaps/elevator mix can give some unique and crazy maneuvers. And last but not least when you use two servos for ailerons control horn is located in middle of aileron so end of aileron does not twist that much.



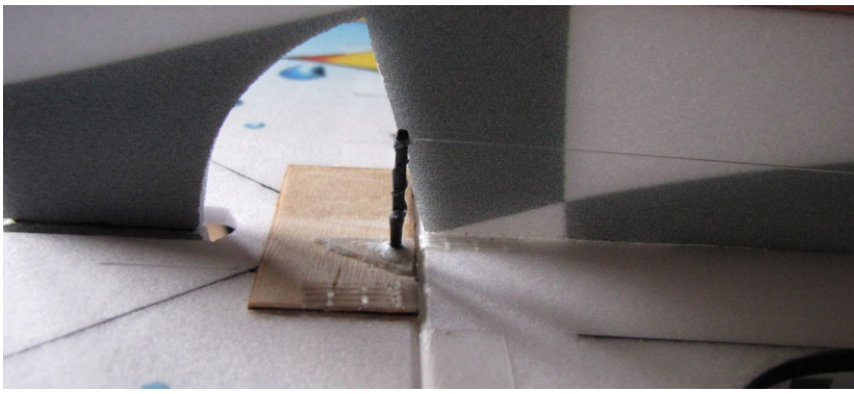
Fiberglass cloth is used to reinforce are where control horn will be located. Try to have short carbon rod and precise attachment of servo to aileron with no play. Picture show ball link connected to first version of hardware. Same as with single servo there are two options ofr connection of carbon rod to horn. You can use Z bends, ore option that i recommend to buy by yourself (Trex 250 ball links.)
NOTE: Hardware is picture is slightly different from one you receive in kit.



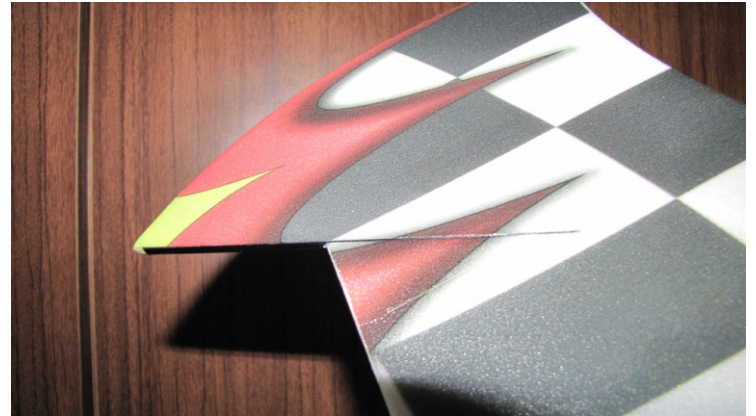
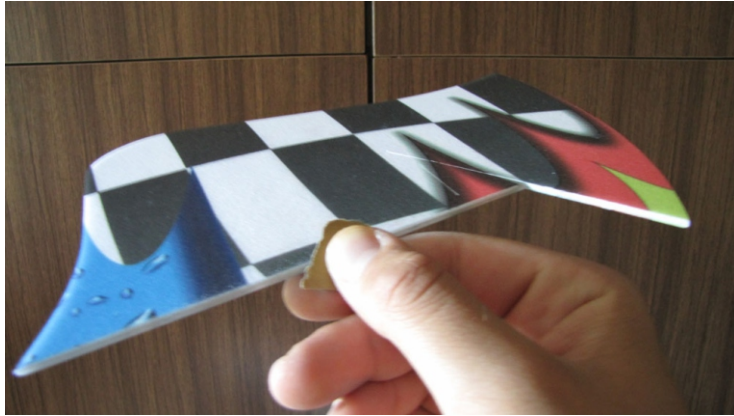
Now it's time to prepare elevator servo. Here is example how you can save wight on Jr290 G, again bolts of servo case is removed, same as plastic bottom part. Beforre making this change use hi quality tape (my favorite is 3D blenderm tape) to locktip servo cases together. You can cut down weight to 7,4g, and that is very good weight for such level digital servo. This JR servo have very goodset of gears that provide long life time, and no play for many flights. I use and recommend this servo for both elevator and rudder control.



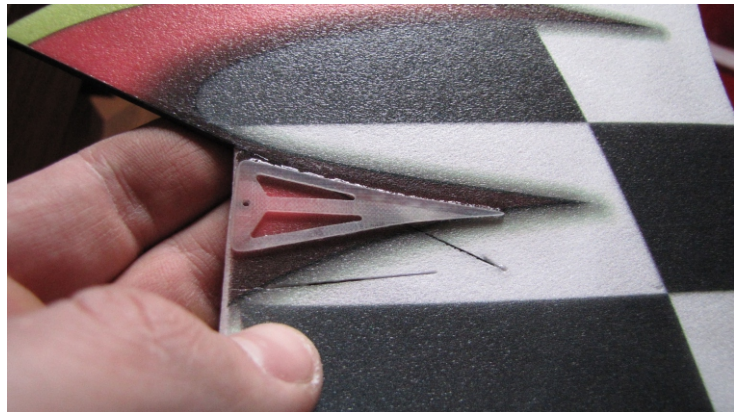
Here you can see servo arm prepared for elevator pull pull. I take original servo arm from Jr290, cut 50mm x 1,5mm carbon rod and glue it to servo arm. Same as with aileron servo before gluing carbon rod to servo arm first i put 0 sub trim and trim on my radio. This way you will have same traveling to both sides.



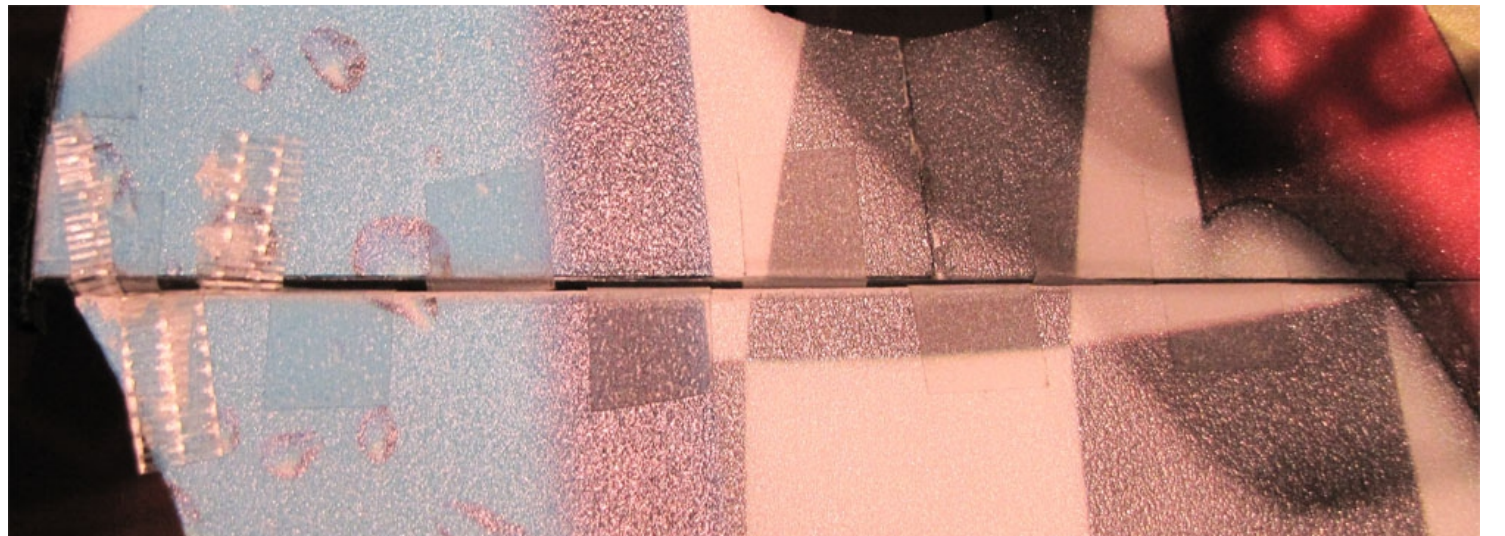
Here you can see 40mm x 1.5mm carbon rod installed to elevator. It must be exactly same length on both sides. Cable that is provided with kit will work fine, but same as with ball links I prefer to use slightly different material for my competition models. I use 5KG fishing line, and on top of the line I wind kevlar thread. Together they provide extremely good control with no „spring effect“, also tension stays the same no matter what weather you have.

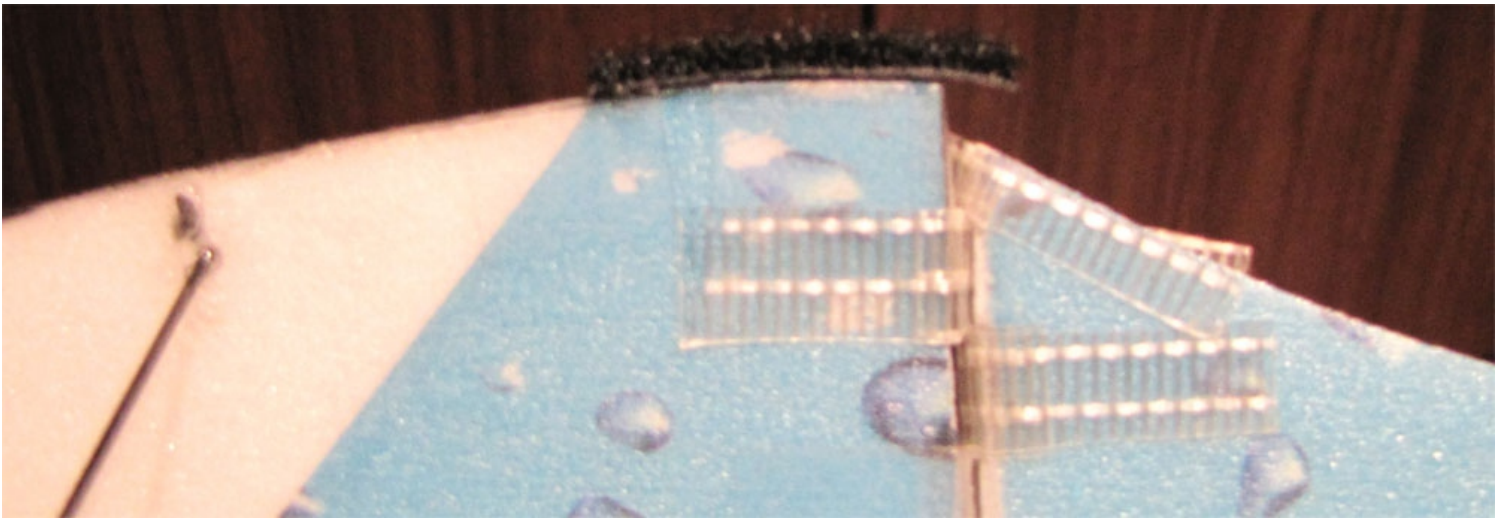


Last surface left to do is rudder. Same as with elevator I recommend to use pull pull system to control it. Same as with elevator I recommend „8“ hinging method. In order to have smooth movement, using sandpaper make edge of elevator round. Also very important upgrade for rudder strength and long life is a piece of thin flat carbon going from compensator to middle of

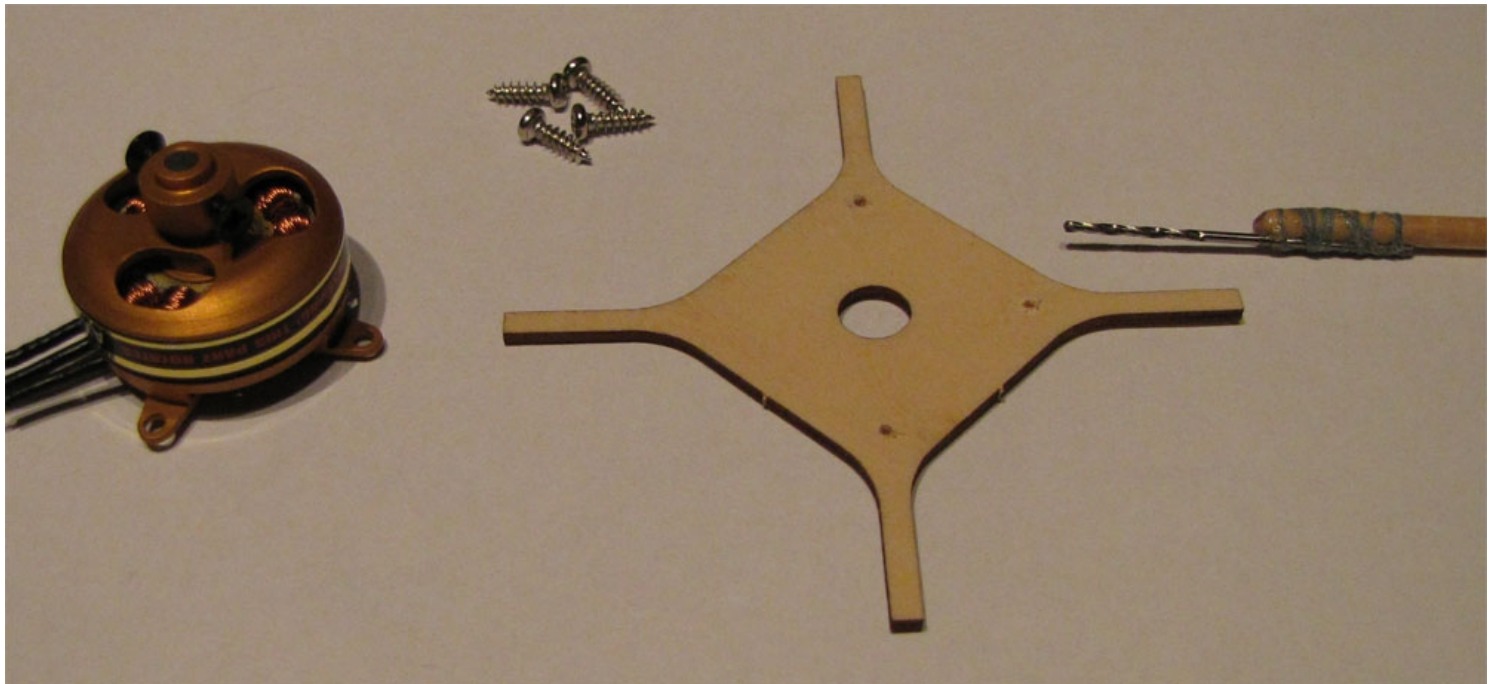


Using foam friendly CA glue attach triangle piece to rudder as shown in picture. Make sure triangle piece is „connected“ to reinforcement carbon. Later glue in 45mm x 1.5mm carbon rod, in the hole close to bending edge, make sure distance on both sides is equal.

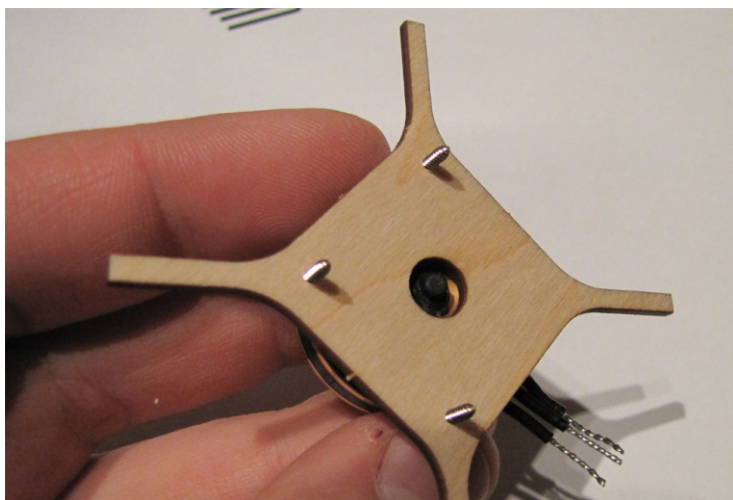




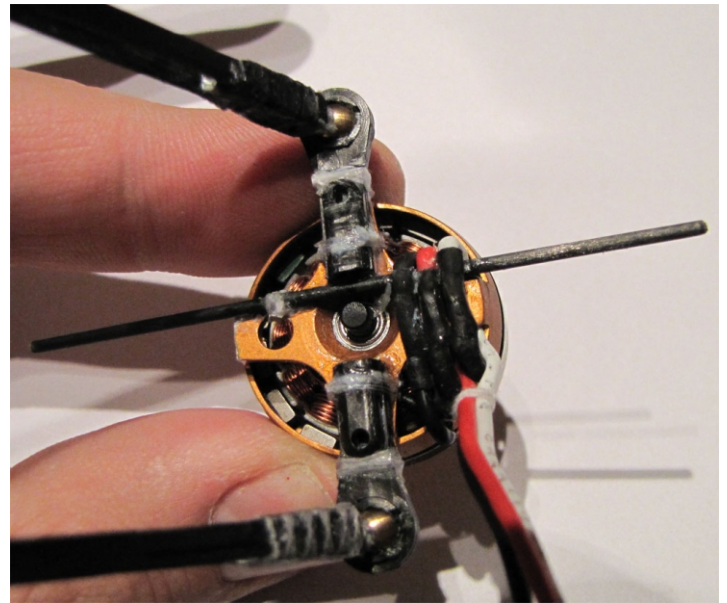
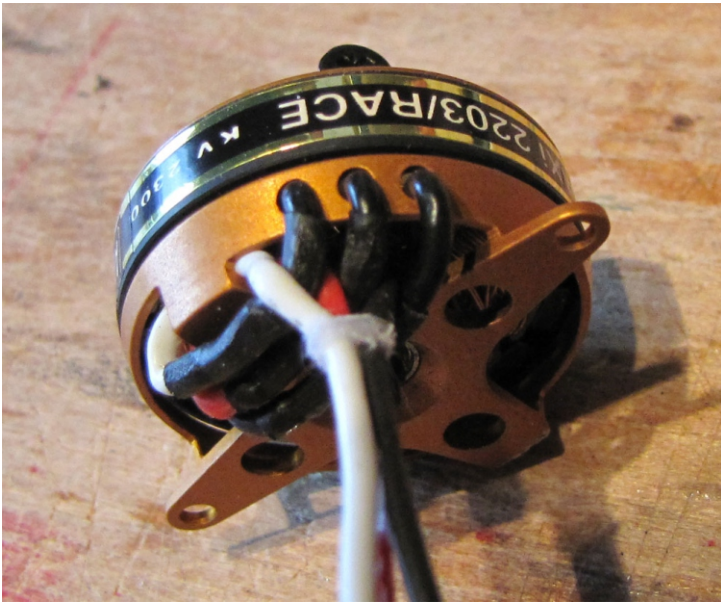
Very end of connection is done with stronger fiberglass tape. Also i put soft velcro on point where tail will be touching ground, this will remove noise durring take off and landing.



Next step will be motor mounting. If you decide to go with regular motormount, this process will be very easy, you can use wooden ore fiberglass motormount. Take your motor drill holles and ussing few screws attach motor to motormount. Now you can glue motormount with motor to plane nose. There should be 1-2 degree offset to right side and 0 in vertical axis. If you will need to change angle after few testflights, i recoment unscrew motor and and place small piece of glow fuel line between motormount and motor.



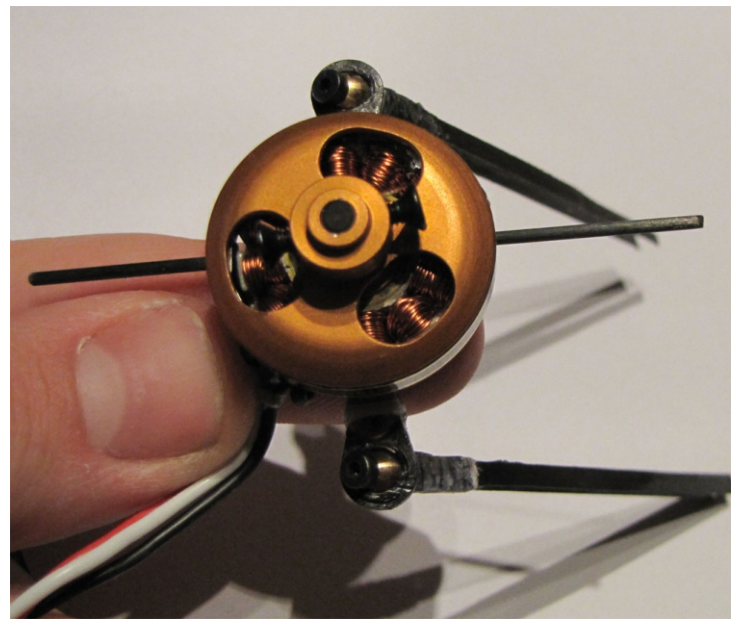
When you glue wooden ore fiberglass motormount to depron nose, i recoment to use 4 pieces of blenderm tape and put it on top of each „motormount leg“.



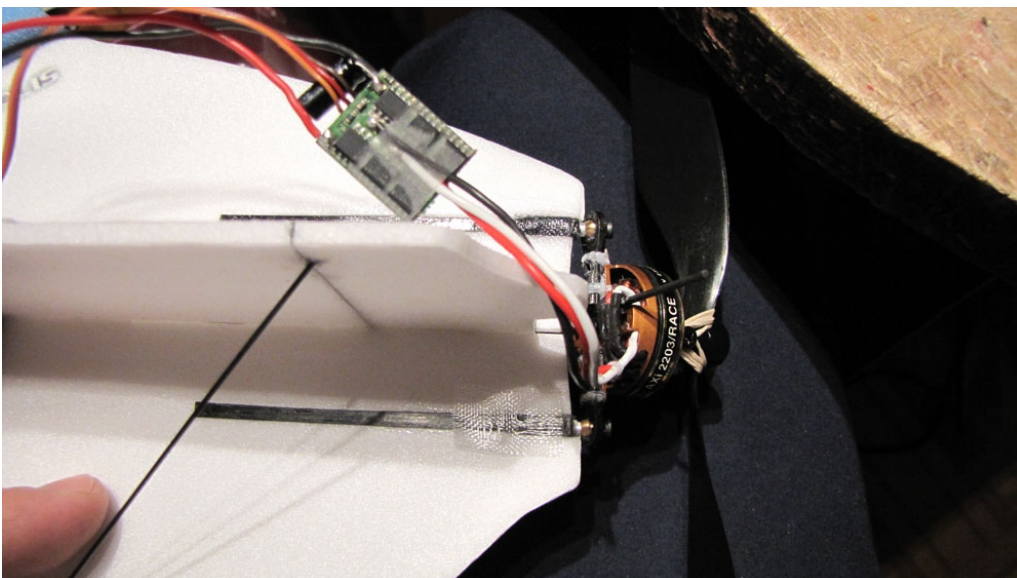
Optional: For more advanced pilots i would recommend to try to called TV (Trust vector control) system. This mean motor will be moving to sides mixed ore connected ro rudder. Such upgrade will allow you to make some crazy maneuvers. Here you can see construction of such system. I use ball links connected to motor for smoth and noise free system. Please have in mind that ussualy motor wirres do not hold constant bending. Please wind wirres as shown in picture, this way much more flexible wirre from Castle Creation Phoenix 10A esc will be bending. I had none problems so far with such mounting of wirres.



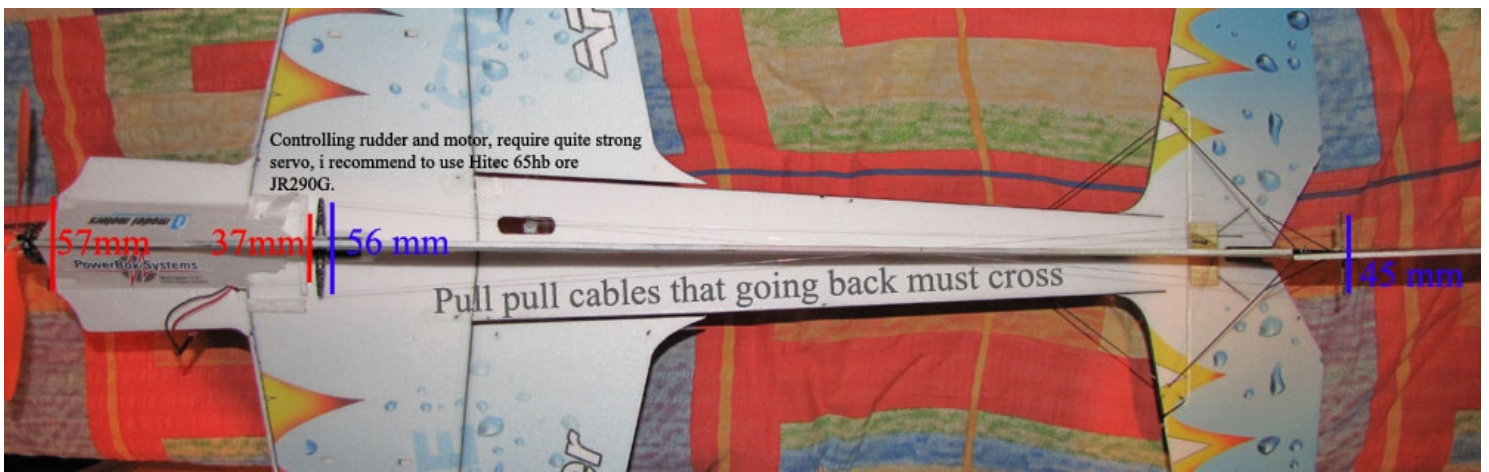
Depron cut out for motor with TVR system.



AXI2203/Race motor, view from front.



Here you can see motor already installed in place. TV system add allot of forces to motormount area, so as you can see i use fiberglas clot to increase strenght in this place. Also you can see Castle Creation controller ready for final instalation. Mount Controller about 5cm from motormount. Move engine full way to left and only then attach ESC, this will allow wirres be without tension.



Here you can see exact dimensions for each side connection. Notice there are two ways to control TV, with same servo as you use for rudder ore with separate servo. Ussing one servo will save you weight, but TV willrequire powerfull servo such as JR 290G ore Hitec 65hb. If you gonna use one servo pull pull cables must be crossed in one side of the plane, otherwise motor will move to oposite dirrection than rudder, and there will be no benefit. Motor and rudder must move to same position. If you use two servos you will need to mix rud to TV controlling servo. This way it will b eeasier to make precise setup of engine angle. Also you will be able to fly plane as with and without engine movement.

Last step in your plane assembly is also very important. Here you can see my personal setting on my JR9X radio. Arrow very easy and neutral flying airplane, therefore no mixes are necessary. I just put thr curve to 90 percents, to limit amp draw. I have to do this because i use slightly to big propeller (GWS 8x4,3) than AXI recommends for AXI2203/Race motor.



Last step in your plane assembly is also very important. Here you can see my personal setting on my JR9X radio. Sp far we did building as best as we could to keep plane straight and strong, now its time to use one feature of radio that will help you to have precise flying plane. Many pilots do not pay so much attention to trimming of plane. Beffore each flight in competition i make short flight just to be sure plane fly straight and perfect. For this i ned to have precise trims. Arrow surfaces are really big, and you need to make trim steps as small as possible. Original setup in radio is for 4 steps on each trim click, this is to much for precise adjustments. Here you can see i put trim step to lowest number possible, one click of trim mean just one step in servo movement.



Here you can see dual rate and exponential setup for all surfaces. I use full deflection of all surfaces all the time, and therefore I prefer more expo's. For competition flying 2 minutes aeromusical routine goes by very fast and during two minutes switching flight modes for different control surface deflection would be not wise. However when you fly for fun, it is quite interesting to set up low rates and fly plane outside in light wind conditions. It is very interesting to see how agile plane like Arrow can perform some IMAC/F3A type of flying.