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FLYERS

# Construction manual



**Rev. 1.0**  
29.12.2014



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## 1

## Summary

---

This construction manual contains next to its main function some advices, hints and much knowledge which comes from many years of experience in RC and FPV engineering and piloting.

***Don't be afraid about the many pages of this document!***

The meaning is to provide a maximum of information in this guide, which is also explained as simple as possible. Inexperienced users for example can profit from the very detailed tutorial or tips and tricks while some more advantaged ones can skip many steps of course and take out here whatever they want.

We strongly recommend to follow the tutorial in any case (specially at the additional building materials and important steps), as we are otherwise unable to guarantee you the flight experience and specifications we provided in this guide and our videos (durability, flight times etc.).

Enjoy planning and building your Wipeout wing!

## 2

## Disclaimer

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## 3

# Specifications

## 3.1 Wing

|   |                                    |
|---|------------------------------------|
| <b>Material</b>                               | EPP                                |
| <b>Wing span</b>                              | 912mm                              |
| <b>Wing area</b>                              | 26.75 dm <sup>2</sup>              |
| <b>Wing profile thickness (middle)</b>        | 40mm (at top cross-bracing)        |
| <b>Total up max weight</b>                    | 1.1 – 1.3 Kg                       |
| <b>Total up min weight</b>                    | 0.6 – 0.8 Kg                       |
| <b>Flight duration max (*)</b>                | ~80 minutes                        |
| <b>Flight duration average (*)</b>            | 30 – 45 minutes                    |
| <b>Speed max (9x5 aeronaut fold prop) (*)</b> | ~110 km/h                          |
| <b>Speed max (8x7 aeronaut fold prop) (*)</b> | ~140 km/h                          |
| <b>Range max</b>                              | Depends on used RC / FPV equipment |
| <b>Altitude max</b>                           | Same as above                      |

(\*) – With our recommended electronic package and building methods!



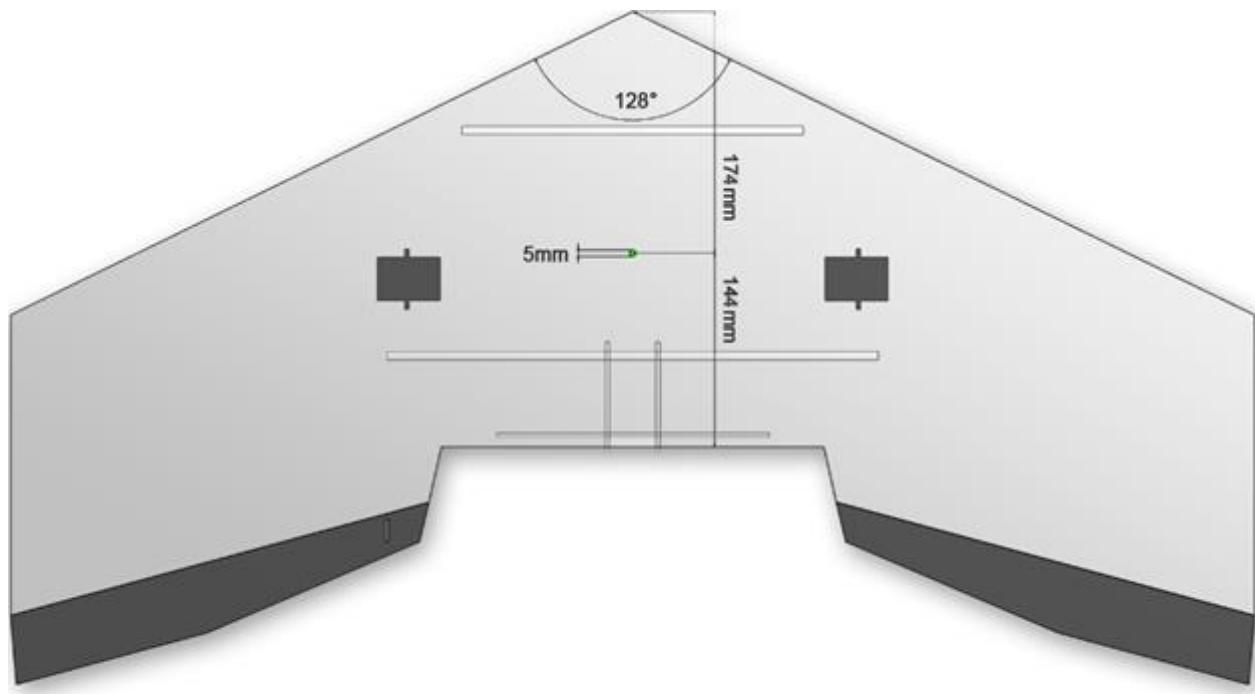
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### 3.1.1

### Center of gravity (COG)

|                               |   |
|-------------------------------|---|
| <b>Measured from top</b>      | 177mm                                   |
| <b>Measured from the back</b> | 142mm                                   |
| <b>COG Range</b>              | + / - 2.5mm from this point (green dot) |





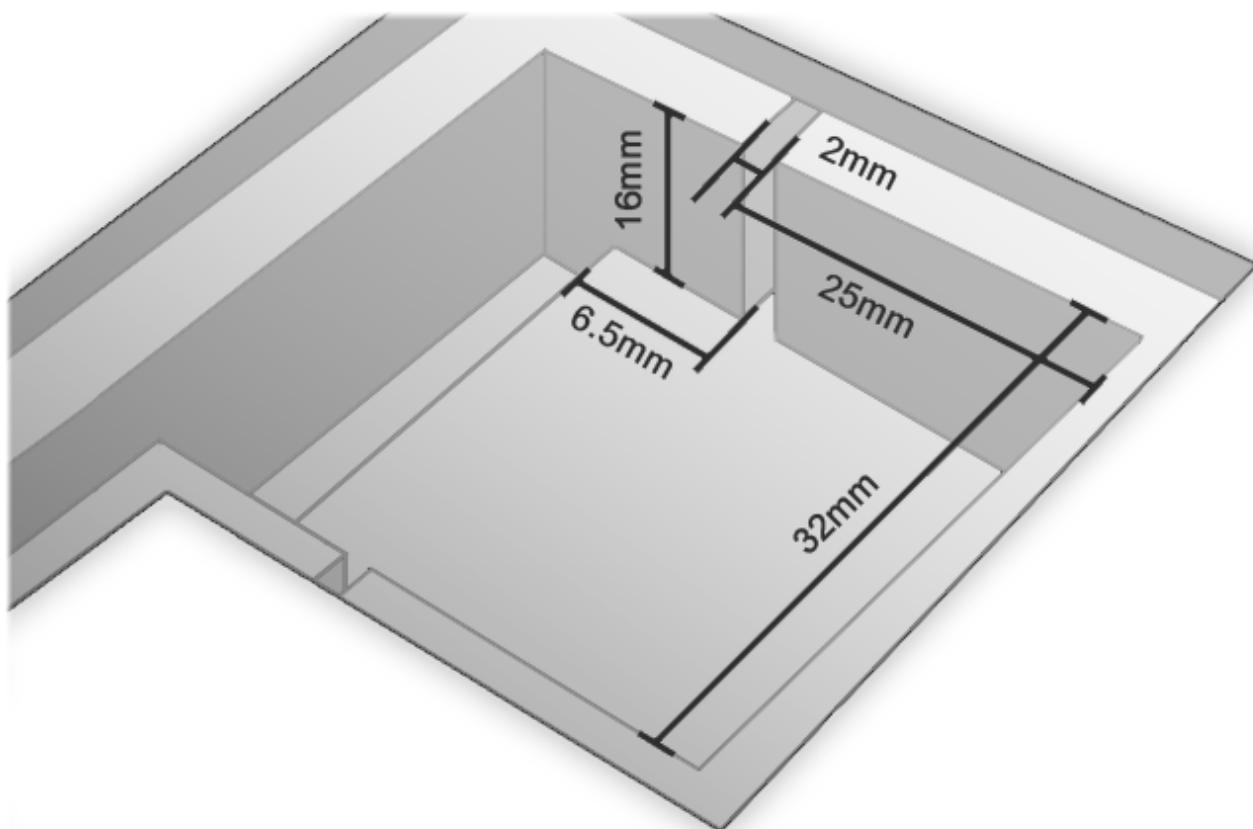
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### 3.1.2

### Servo cut-outs

|                         |         |
|-------------------------|---------|
| <b>Servo max width</b>  | 32 mm   |
| <b>Servo max length</b> | 33.5 mm |
| <b>Servo max height</b> | 16 mm   |

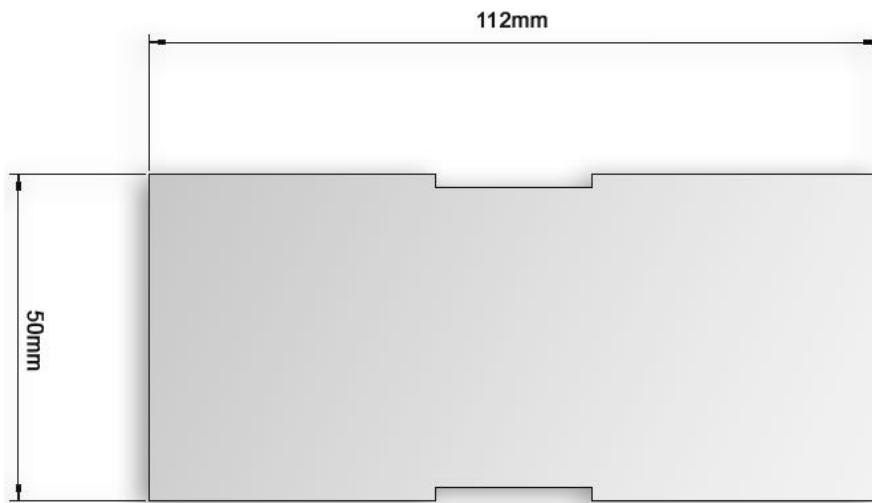




3.2

## Battery bay

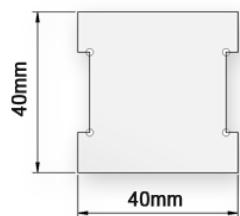
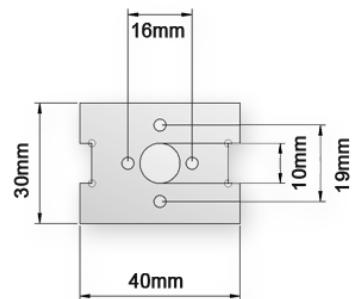
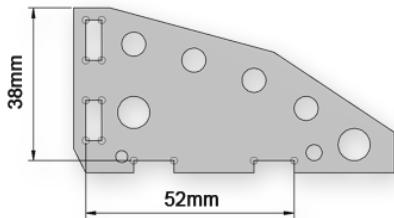
|                  |                          |
|------------------|--------------------------|
| <b>Material</b>  | Plywood (extreme stable) |
| <b>Thickness</b> | 3mm                      |



3.3

## Motor mount

|                  |   |
|------------------|---|
| <b>Material</b>  | Plywood (extreme stable)                  |
| <b>Thickness</b> | 4mm motor mount, 3mm side and bottom part |





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4

## Package content

|  |  |
|--|--|
|  |  |
| 1x EPP Foam in two parts with negative | 1x Plywood motormound in four parts    |
|  |  |
| 2x EPP servohole covers                | 1x Plywood Battery bay, 1x Velcrostrap |



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2x Rudder linkage in seven parts



2x Elevons balsa wood (pre-cutted)



2x Rudder horn 2mm GFK



2x Winglets coroplast 4mm



|   |   |
|---|---|
|   |   |
| 2x Wing stiffening 3mm (470, 500 and 230mm)   | 1x 2m laminating foil 80 micron   |
|  |  |
| 1x Cross-bracing 6/4mm, 8/6mm and 3mm   | 2x Oracover for Winglets 32x12mm  |



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HAPPY-FLYERS.CH

HAPPY-FLYERS.CH

1x Sticker „Wipeout – by Happy Flyers“

2x Sticker “Happy-Flyers.ch”

## 5

## Before we start

### 5.1

### Foreword

There will be some very important points in this construction manual, which are specially marked (the logo at the right) and some, which are less or optional at all (marked with "(optional)").



The "Wipeout – by Happy Flyers" is an open platform, which will be usable for any kind of environment. You can user your full FPV gear with GoPro, or you can go without any FPV equipment at all and fly it classically. We haven't made any pre-cuts for electronics (except Servos of course) so it is completely up to you what to use and where to install it on the wing!

Since RC and FPV electronics brings many questions with it and these parts are one of the most misunderstood things when planning and building a RC and FPV controlled aircraft, we took the time to give some advices, examples and explanations about it.

**Don't rush things!** Take your time and read carefully before you buy, choose, plan or build something.

### 5.2

### Skill level

Of course it is an advantage if you already have some experiences in building RC planes and have some knowledge about the materials EPP, wood, fibre etc. and the necessary glues.

But don't worry. Even if you are new to building foam RC planes, or building an RC aircraft at all, we will guide you step by step through the building tutorial!

Especially for beginners it is very important to read every single step carefully and follow our recommendations because if you do not, it can result in major and probably uncorrectable problems for later steps.



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## 5.3 Required tools

### 5.3.1 Required

1. Cutter
2. Marker / Pen
3. Ruler (30 – 50cm long)
4. Pointed pliers
5. Side cutter
6. Cross-head screwdriver
7. Laminating tool (100 – 150°)
8. Something to spread the glue evenly / mixing glues  
(like cable ties or brushes)
9. Weights (weight the foam during drying)

### 5.3.2 Optional

10. 2.0 mm Imbus / Allen key (for Scorpion Motor)
11. Solder station (if you don't use a plug and play solution)
12. Scissor
13. Small screwdriver (stuffing rods and tubes into the foam)





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## 5.4 Required building materials

### 5.4.1 Required

1. 3M90 spray glue  
(alternatives: 3M77, Tesa ultra strong)
2. Gorilla glue
3. Super glue (low viscosity)
4. Epoxy (two-component, 5- or 30 minutes)
5. Transparent tape
6. Painters tape (covering parts before spraying etc.)

### 5.4.2 Optional

7. Hot glue (for example for optional FPV camera)
8. UHU hard ("UHU hart") or similar slow drying hard glue
9. Fibre tape
10. Super glue activator spray





## 5.5 Electronics

### 5.5.1 Choosing the right equipment

---

We can only say it once: Choose some equipment, which you trust in or some people trust in which you know.

The secret is not only to choose separate components which individually work great, the secret is to choose components which work great **together!**

Here you can follow our recommendations on our Shop site (for example our Products).

Don't save money buying cheap parts from which your control to the plane depends (RC / FPV equipment)!

### 5.5.2 Philosophies

---

Let's think about all the important things, which can cause some serious problems, affecting your range or causing some RF interference.



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### 5.5.2.1

### *Distance*

A very important part when planning an RC / FPV system is distance between the single components.

You can follow one simple rule here: Place RX and RF sensitive components (RC receiver, GPS etc.) as far as possible from any transmitting component (vTX, Tracker etc.) or power part (ESC, BEC etc.) as possible.

But keep in mind not to place these components too far at the back of the wing, since otherwise it will be harder to reach the centre of gravity later!

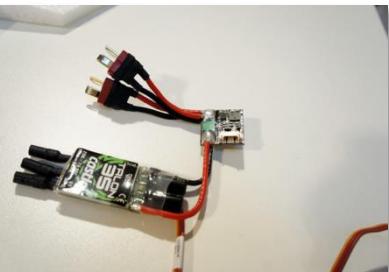
So you see it is not that easy to find the right positions for these components. For your support, there are some examples following later in this construction manual.

### 5.5.2.2

### Wire length

Here we distinguish between two types of wires: Power wires and Data / Signal wires.

**About Power wires:** Keep them as short as possible! The wires coming from the batteries also count! See the picture at the right for an example ESC / Current Sensor.



**About Data / Signal wires:** These wires for example are Servo, ESC signal, Video signal or OSD wires etc.

Of course most of these cables will also provide power to each component. But the amount of current will only be a fraction of the current compared on the main Power wires (ESC – Batteries).

Of course it is also better to keep these wires as short as possible in consideration of the previous chapter. A very important part is the next chapter!



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### 5.5.2.3

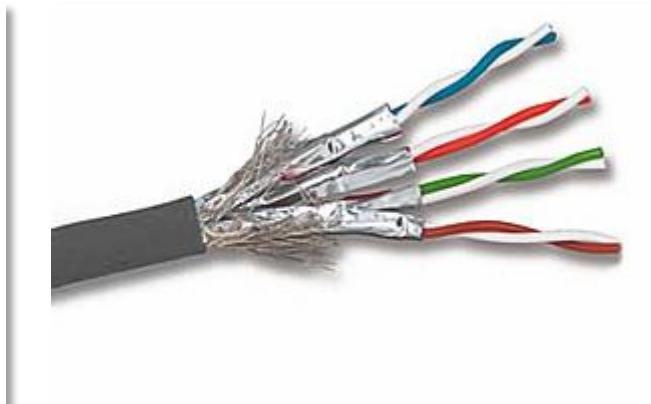
### Wire selection

Wire types for Data / Signal wires (RC receiver, OSD, GPS, vTX etc.) are one of the most underestimated threads when planning a RC / FPV environment.

We strongly recommend using shielded or even shielded AND foiled cables for any of your Data / Signal wires. Possible wires for example are Network cables (CAT 6 or higher), highly shielded multimedia cables or USB cables.



Highly shielded multimedia Cable



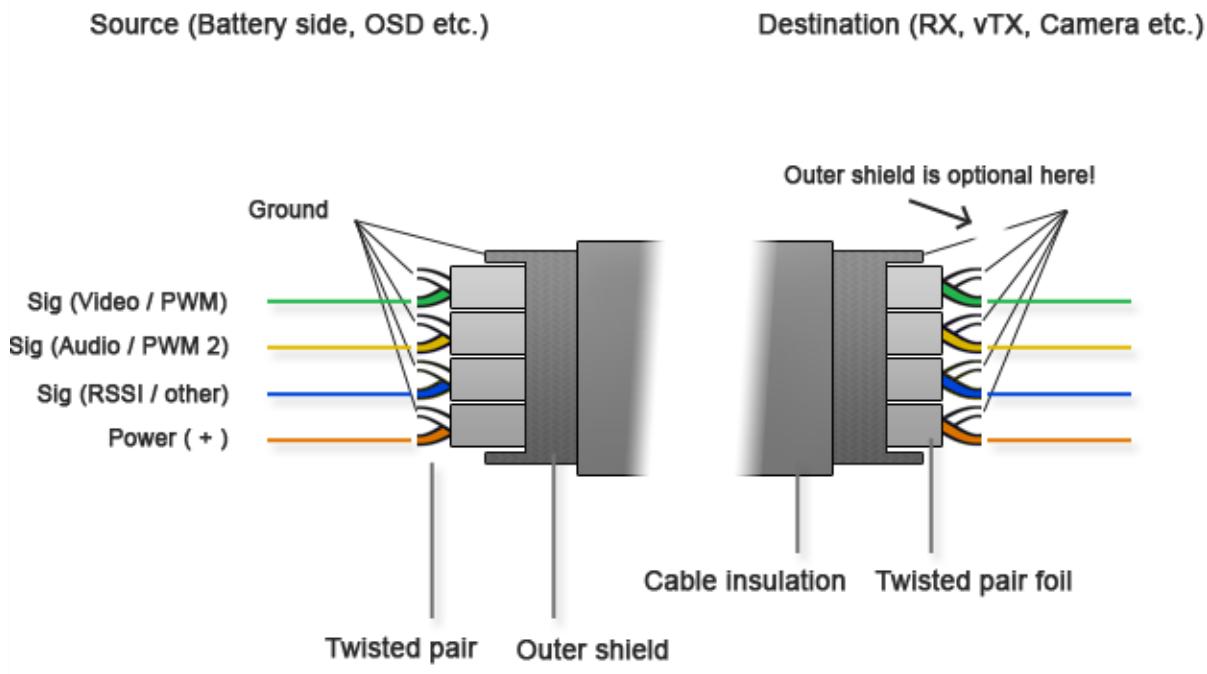
CAT 6 Network cable



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## CAT 6 Cable wiring schema example



### 5.5.2.4

### *Crossing*

When installing wires, especially Data and Signal wires, it is very important not to cross an electronic part which generates some RF interference.

#### **For Example:**

- Do not cross ESC or Current Sensor with a Servo wire
- Do not cross any kind of BEC (specially the TBS Core / TBS PNP Pro) with any Servo, ESC or similar Data / Signal wire (PWM / PPM)

Always keep some distance to electronics when installing wires. You can install all Data / Signal wires at the bottom side of the wing for example (so we will do in the tutorial later) and the electronics at the upper side of the wing. But also pay attention not to cross these electronics any way.

**These can cause some serious RF interference and reduce your range!**



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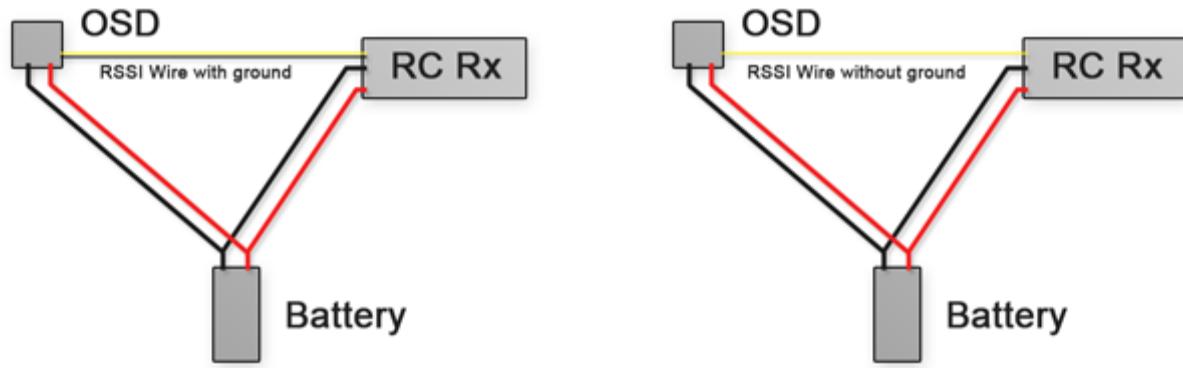
### 5.5.2.5

### *Ground loops*

Ground loops occur when there is more than one direction a ground can take in a wiring schema.

The following example shows a compare between a ground loop with a RSSI link cable between the OSD and the RC receiver and a schema without a ground loop.

Ground loops **can** result in serious problems! So pay attention and try to avoid them!



#### **Ground loop**

There is more than one return point!

#### **No Ground loop**

Grounds are separated!



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## 5.5.3

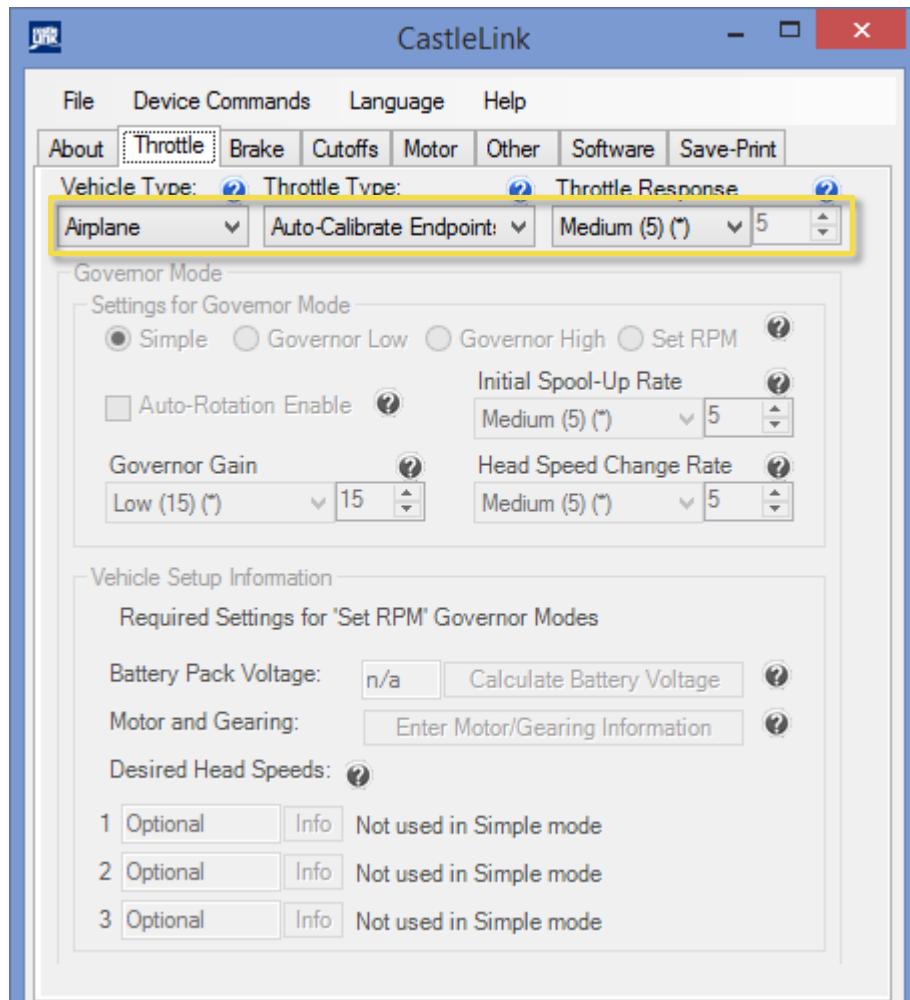
## ESC Settings

In this chapter we provide you the optimal settings for our recommended Castle Talon 35 ESC. These settings are very important if you use our electronic package (Scorpion HKII-2221 1630kV Motor with 9x5 or 8x7 folding prop with 38mm middle part), since otherwise you will not reach the specified flight times.

### 5.5.3.1

### Throttle

|                          |                         |
|--------------------------|-------------------------|
| <b>Vehicle Type</b>      | Airplane                |
| <b>Throttle Type</b>     | Auto-Calibrate Endpoint |
| <b>Throttle Response</b> | Medium (5)              |





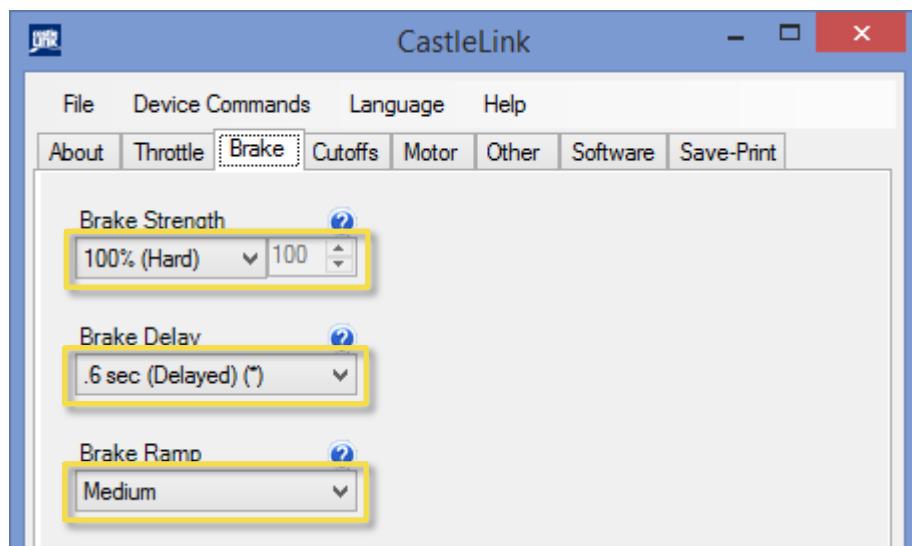
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### 5.5.3.2

### Brake

|                       |                  |
|-----------------------|------------------|
| <b>Brake Strength</b> | 100% (Hard)      |
| <b>Brake Delay</b>    | .6 sec (Delayed) |
| <b>Brake Ramp</b>     | Medium           |





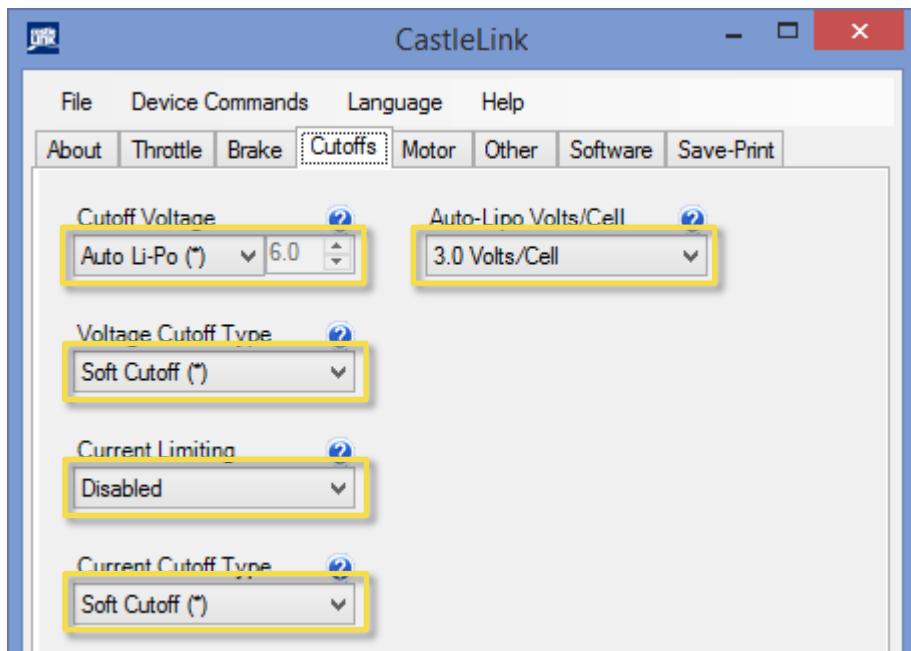
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### 5.5.3.3

### Cutoffs

|                             |                |
|-----------------------------|----------------|
| <b>Cutoff Voltage</b>       | Auto Li-Po     |
| <b>Auto-Lipo Volts/Cell</b> | 3.0 Volts/Cell |
| <b>Voltage Cutoff Type</b>  | Soft Cutoff    |
| <b>Current Limiting</b>     | Disabled       |
| <b>Current Cutoff Type</b>  | Soft Cutoff    |





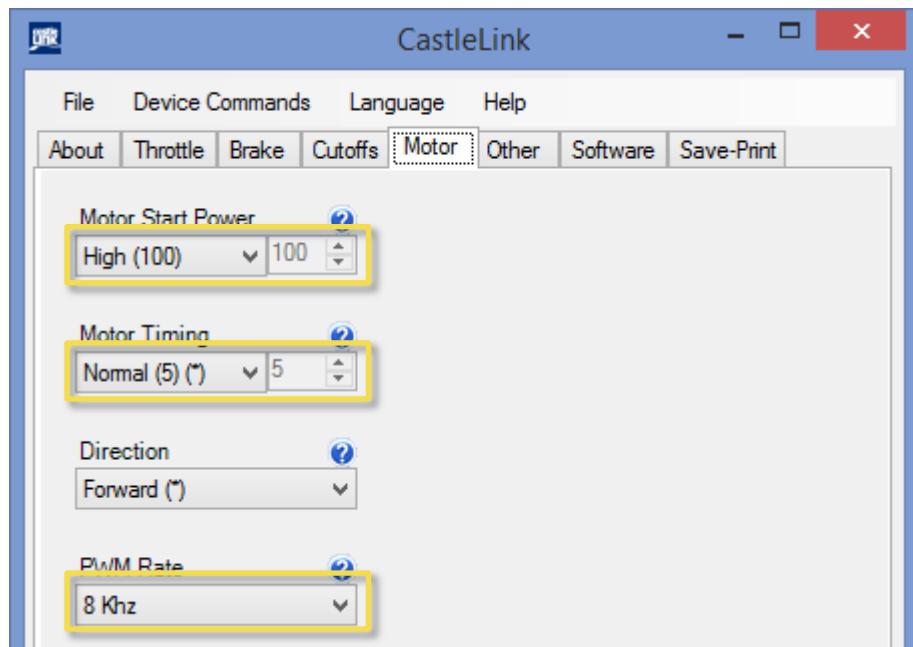
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### 5.5.3.4

### Motor

|                          |            |
|--------------------------|------------|
| <b>Motor Start Power</b> | High (100) |
| <b>Motor Timing</b>      | Normal (5) |
| <b>PWM Rate</b>          | 8 Khz      |





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#### 5.5.4

#### Other electronics

---

If you use other electronics, especially OSD's or any other kind of programmable electronics, we recommend to any programming activities, Firmware flashes etc. before you install the parts in your wing.

Just keep that in mind. Maybe it is not as easy to reach these components later, when they are installed in your finished wing!

#### 5.5.5

#### Have everything ready!

---

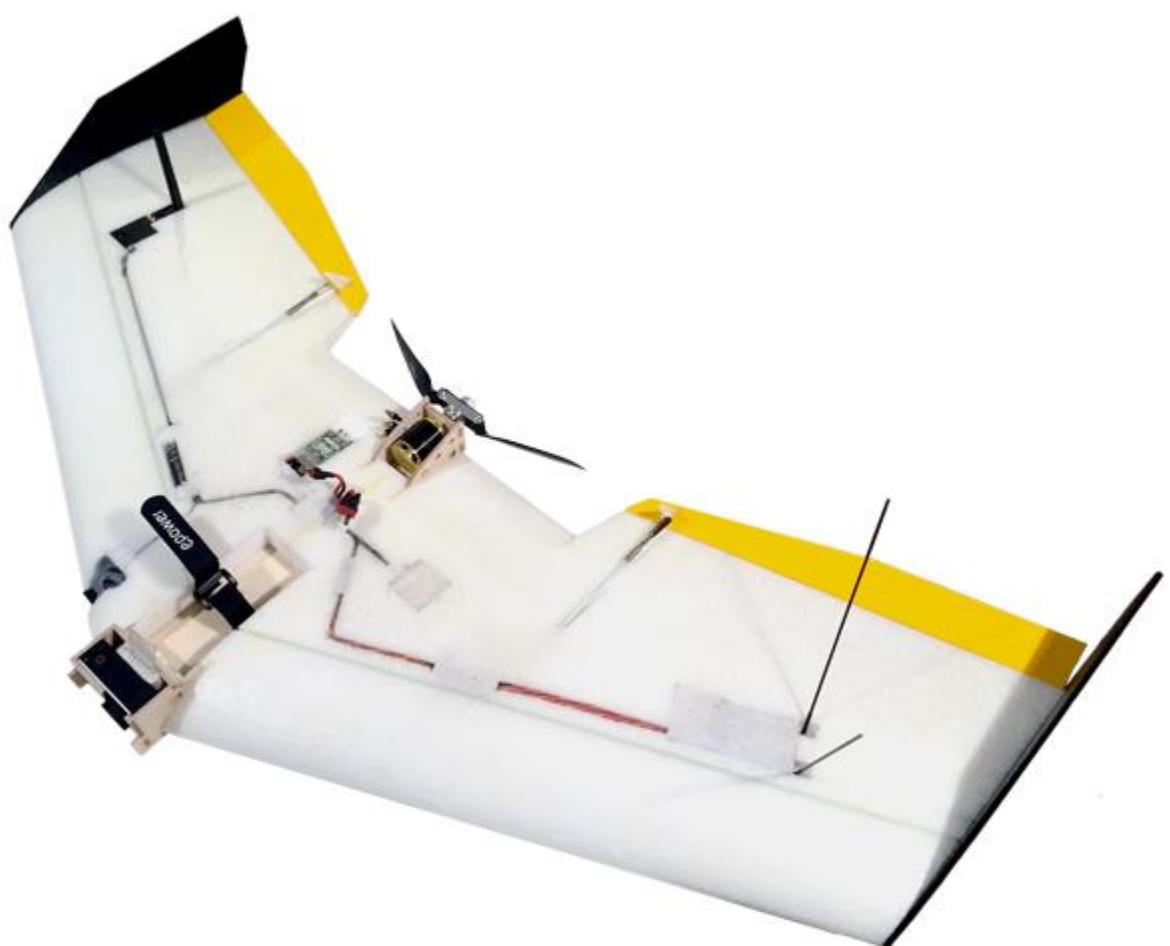
Be sure you have everything ready now! It is very tricky to install some parts when you're almost finished or totally finished at all!



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6

## Building tutorial





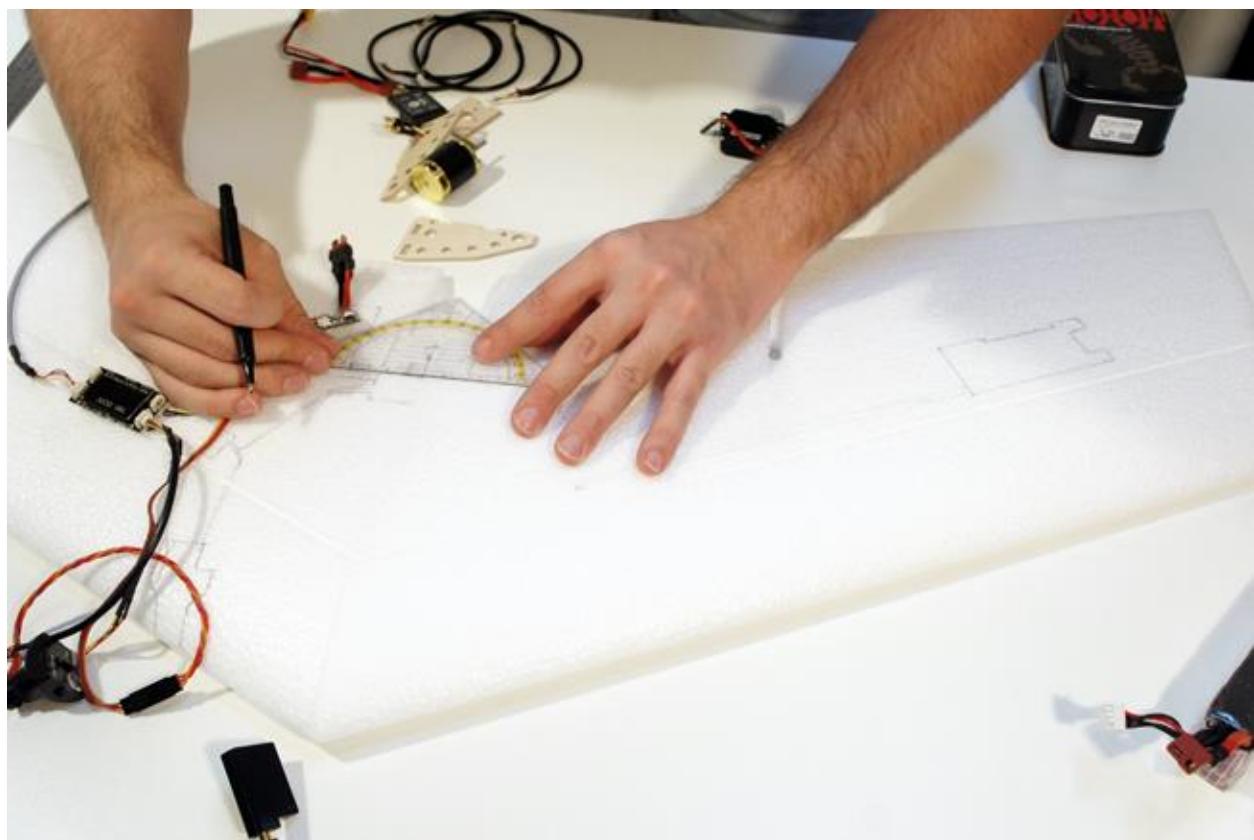
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## 6.1

## Planning and drawing

***Plan everything carefully before you start building!***





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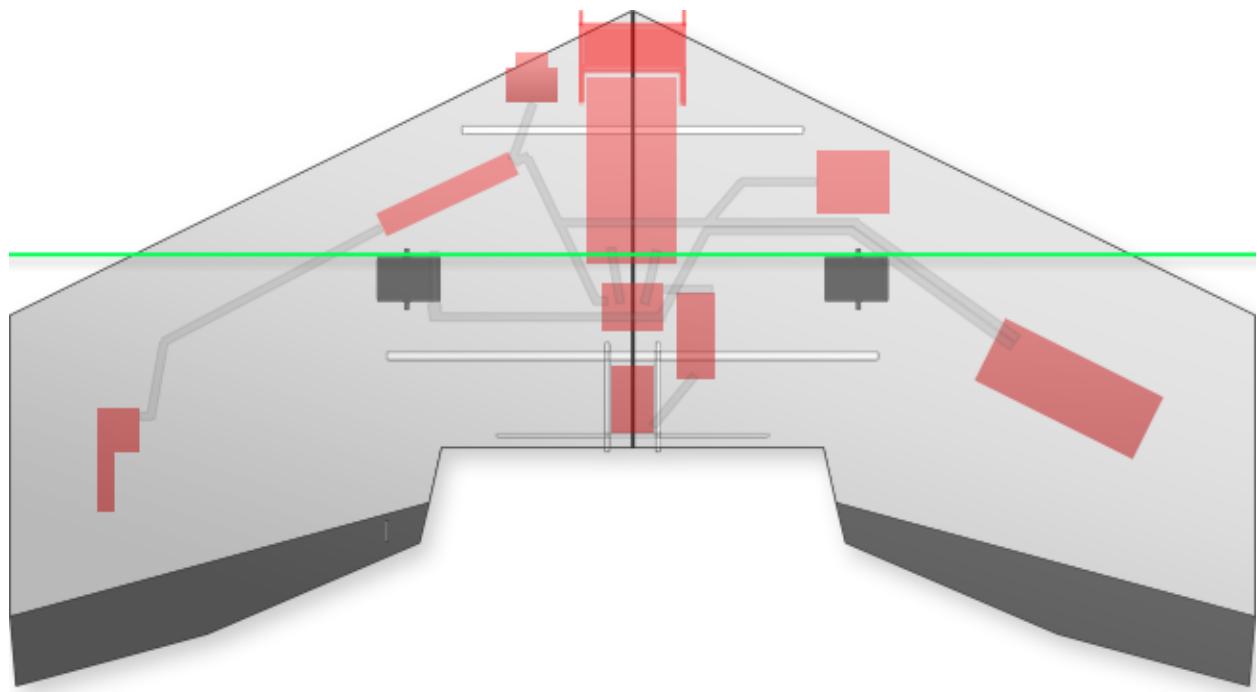
## 6.1.1

## Planning your installation

Ok this part is very important! As you can see on the image below, the centre of gravity is very far at the front. This image shows a direction, in which your installation should go. Since every RC or FPV equipment is individual, you have to find the right place for it on your own.



**One simple rule here:** Place electronics as near as possible at the centre of gravity line (green line) or be sure to create a balance to it with electronic components which are at the front side from that ones which are located on the back side. Batteries, GoPro mount and Motor are separated from this (Battery for example will be installed when the wing is finished to reach the centre of gravity).

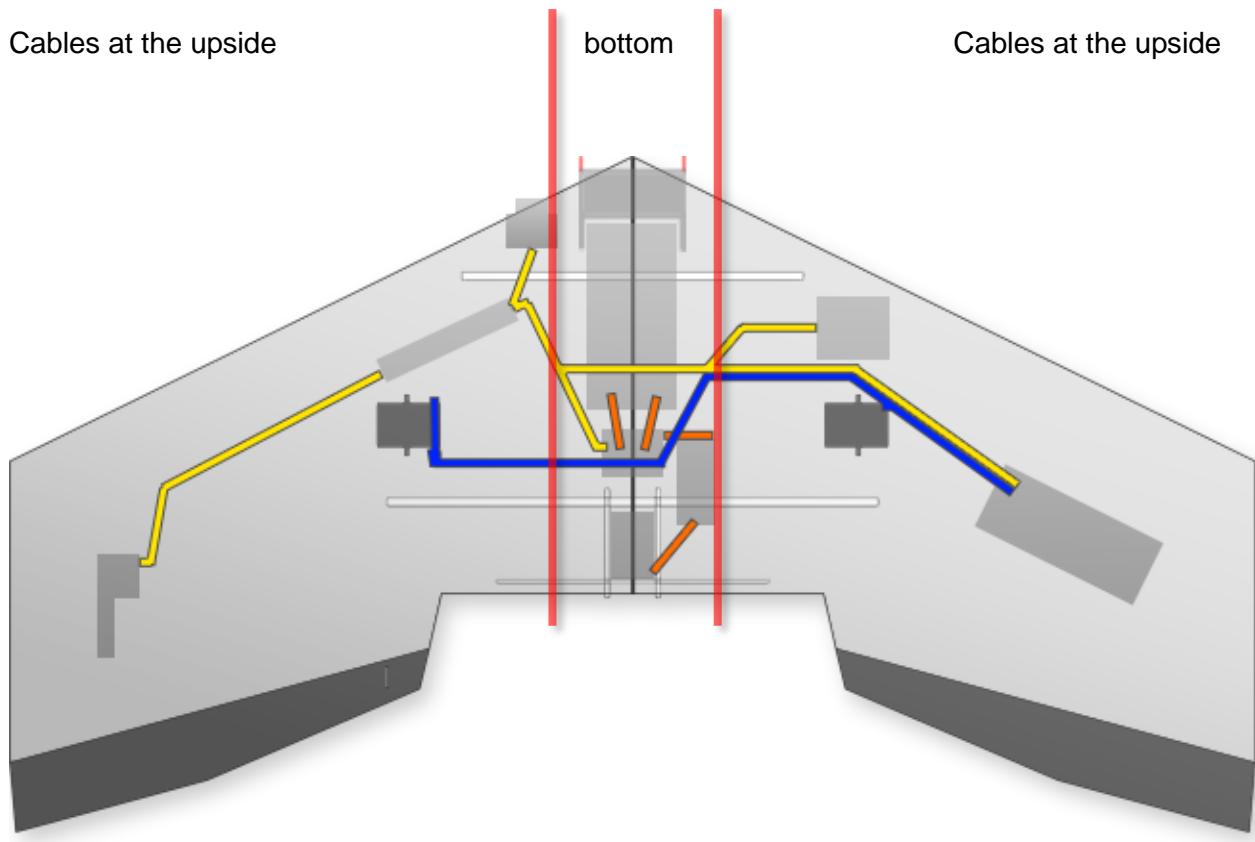




Ok! Now that you have chosen the places for your electronics, you need to determinate the correct cable alignment and cable length. The image below shows an example wiring schema.

- **Yellow wires:** OSD / Video Data and Signal wires
- **Blue wires:** RC wires (PWM or PPM)
- **Orange wires:** Power wires from Battery's / ESC / Current

In the middle part (centred with red marker) the blue and yellow wires are installed at the bottom side of the wing (keeping distance to ESC / Current) and coming out at the upside of the wing on the left and right side of the red marker.



This is only a crude example! You can follow your own recommendations here of course!



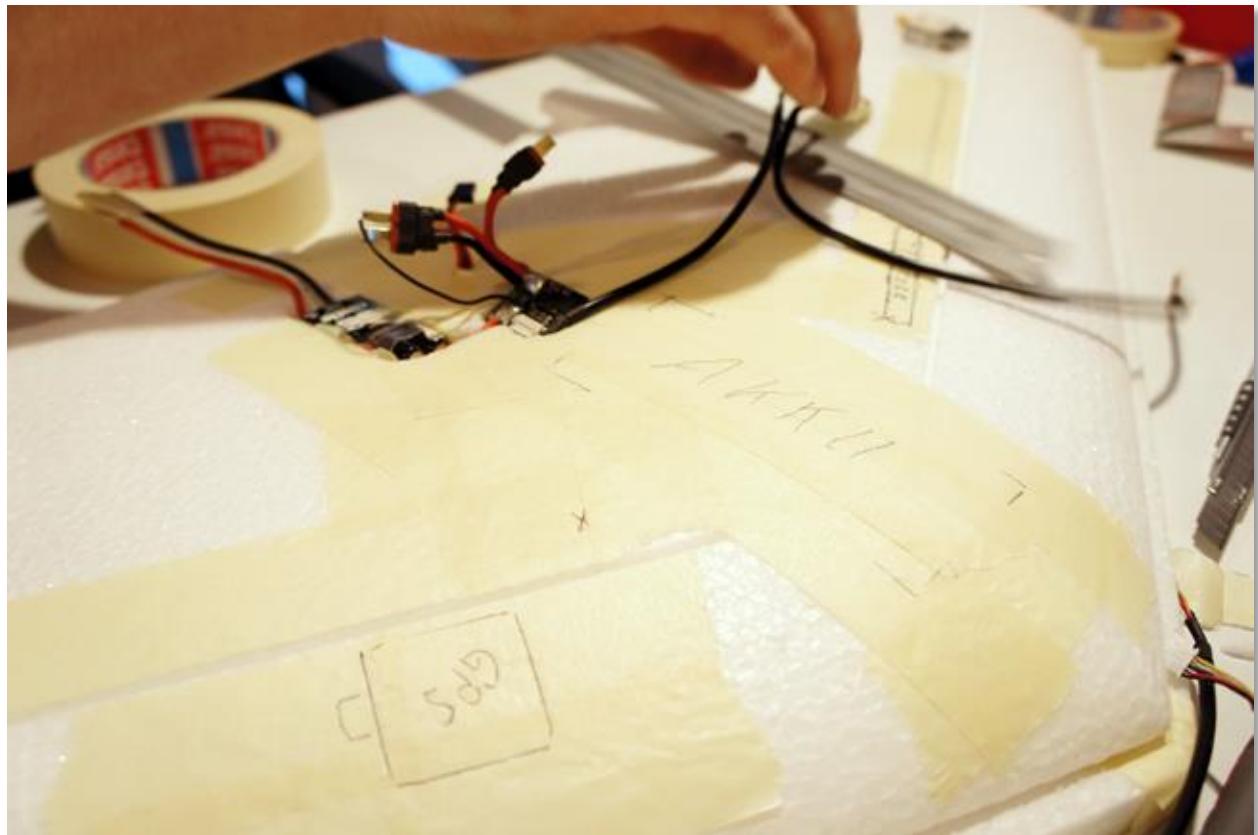
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## 6.1.2

## Drawing borders

It's time now to draw your plan on the wing! Simple take some painters tape (optional) and draw the borders of your electronics and wires on the wing. This will result in great looking cut-outs which will fit perfectly!





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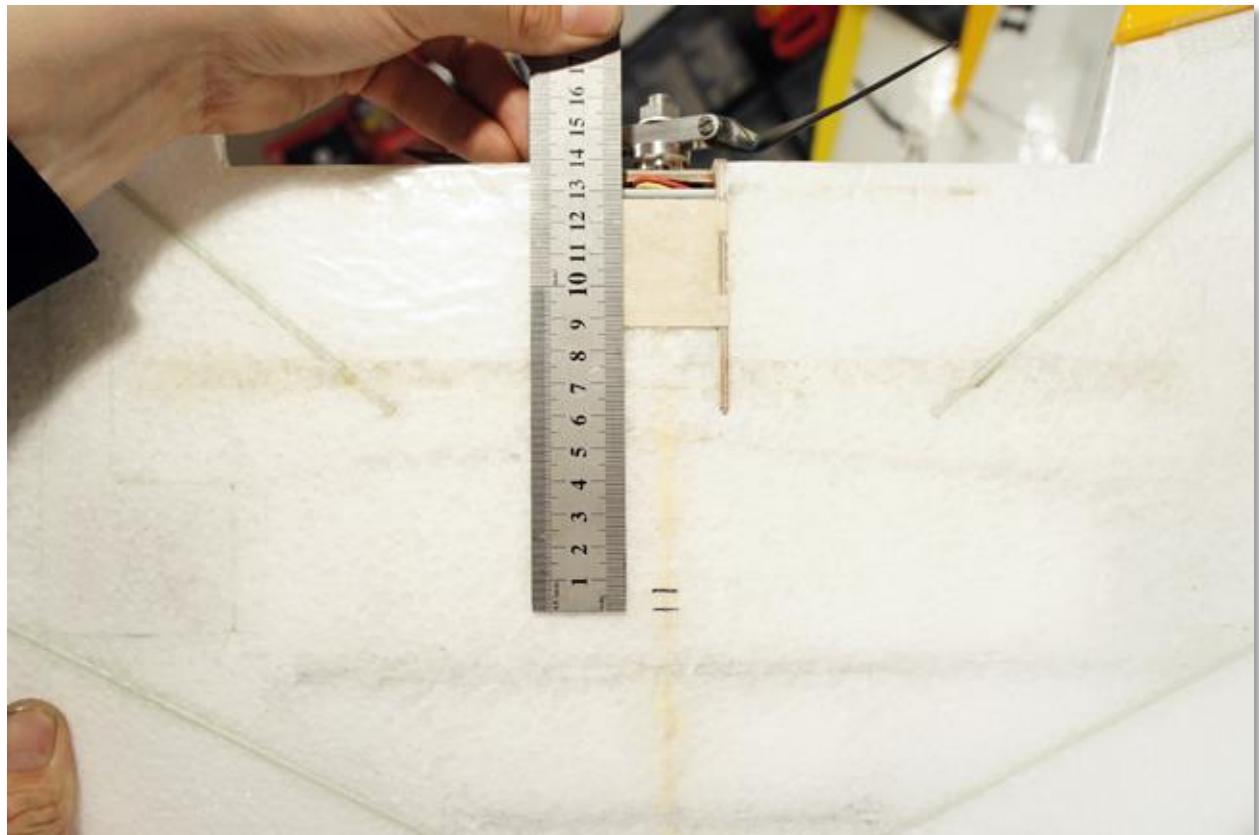
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### 6.1.3

### Drawing CG at bottom

If you wish, you can draw the centre of gravity at this time. You also can do this step later in this tutorial (when you need to determine the CG). Completely up to you!

You find the correct specifications in [chapter 3.1.1!](#)!





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## 6.2 Preparation

### 6.2.1 Foam negative

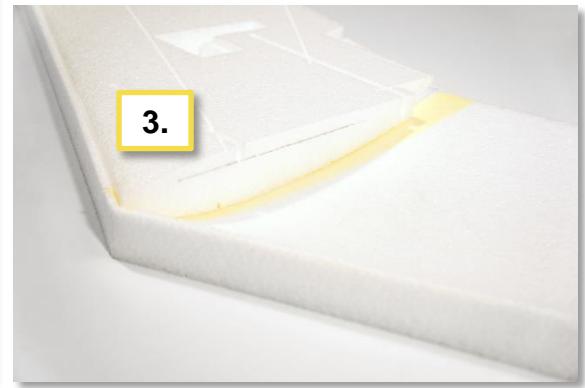
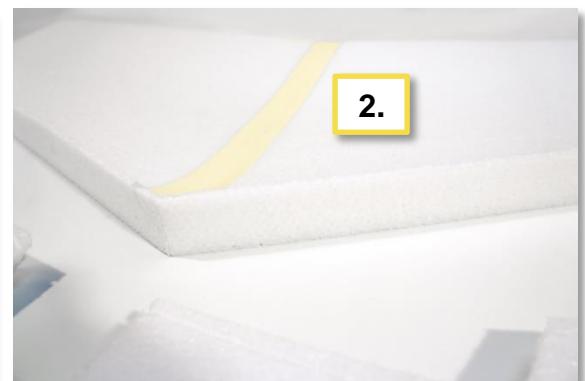
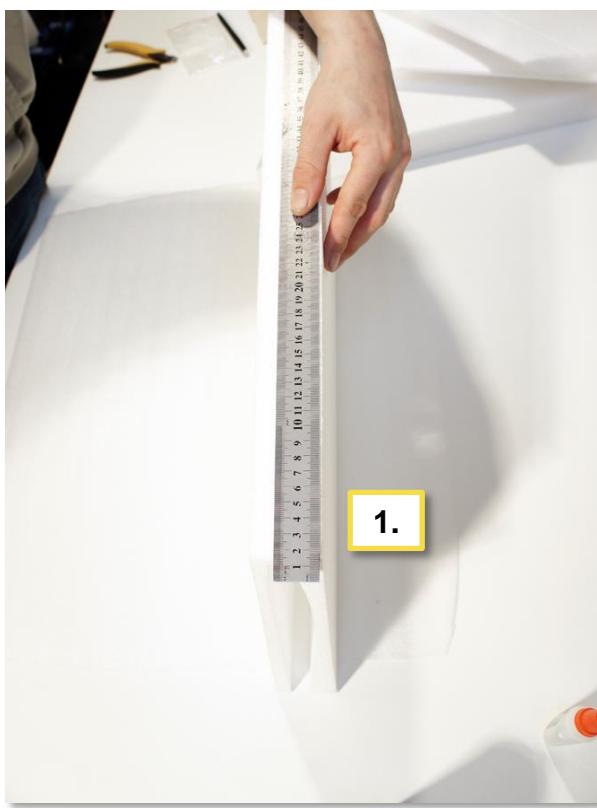
The provided foam negative is the key to success for building your wing! Without it, it is near impossible to build your wing straight and precise! It will help keep your wing in its correct position during drying after you glued the two foams together. It will also help at several other points as you will see later in this tutorial.

**You don't have to make cuts in your wing foam itself here!**



**Prepare your foam negative as follow:**

1. Cut your two foam negatives in two pieces. You can use a ruler or make it by hand. Its not that important...



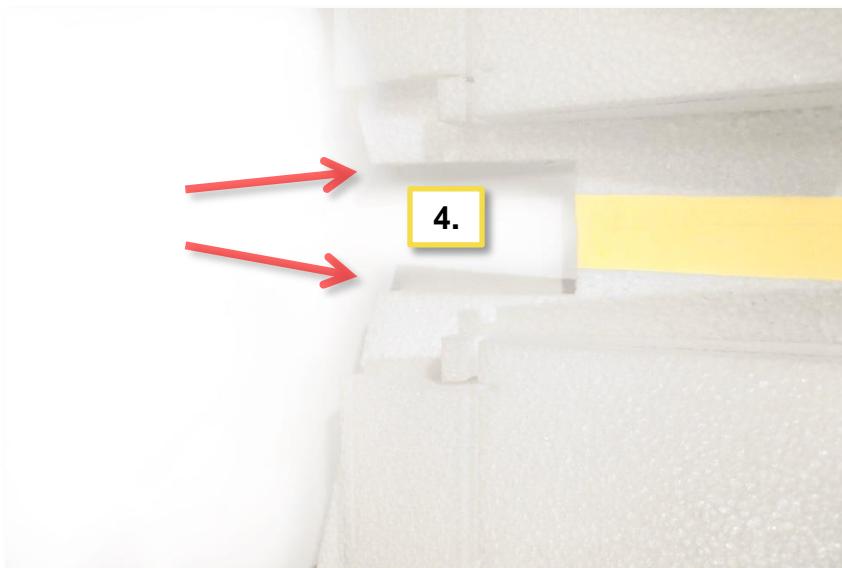
2. Tape both top and both bottom foam negatives together (we recommend to do this on both sides, inner and outer).



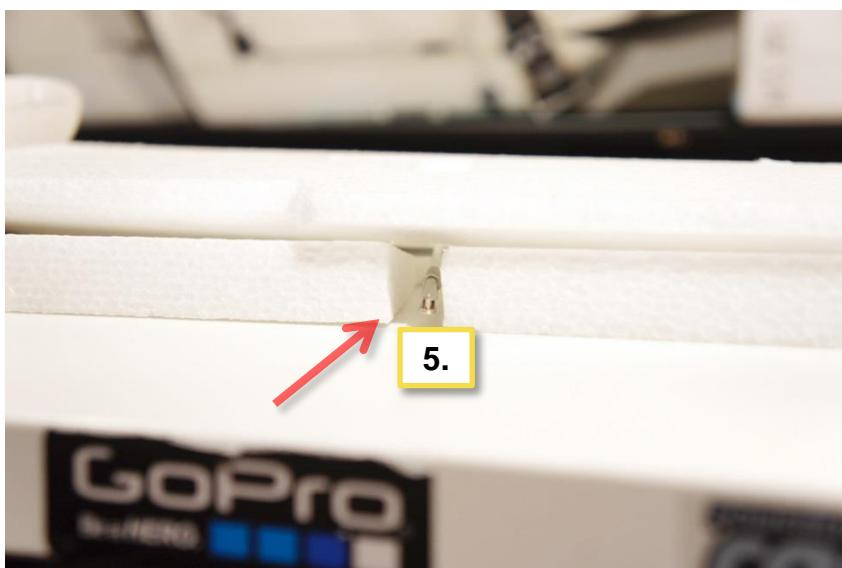
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3. Check if your foam fits in your negative.
4. Make a large cut in the top sided foam negative where the motor mount comes later. It hasn't to precise! But of course a bit larger than the motor mount itself.



5. Also make large cuts in the top sided foam negative, where the rudder linkage will be located later.



**Your foam negative should now be prepared!**



HAPPY

FLYERS

## 6.2.2

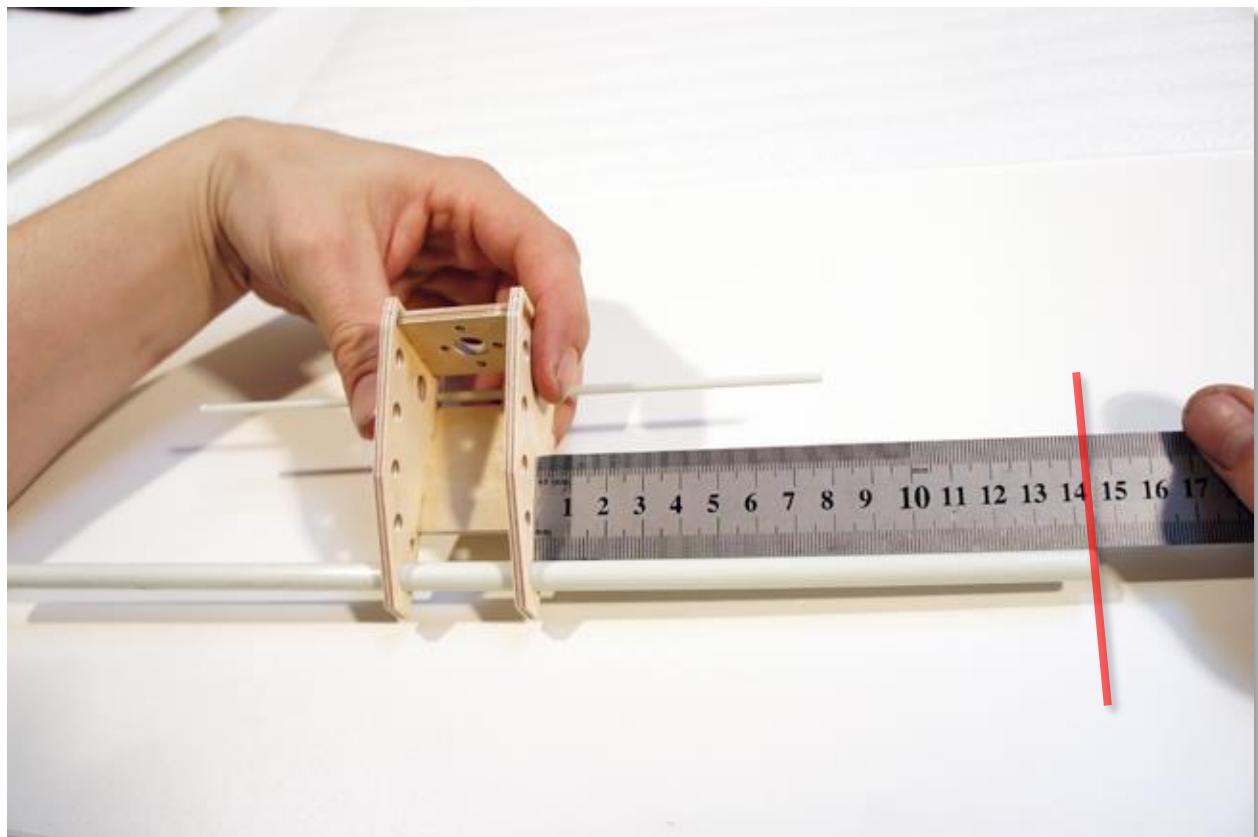
### Kit parts

#### 6.2.2.1

##### *Motor mount*

The four-parted motor mount will perfectly fit together. You can't do anything wrong here.

1. Glue the four parts together (we recommend to use super glue) and let it dry!
2. Insert the 8mm fibre tube and be sure it is centred (measure 145mm from the outside of the motor mount to the end of the tube).

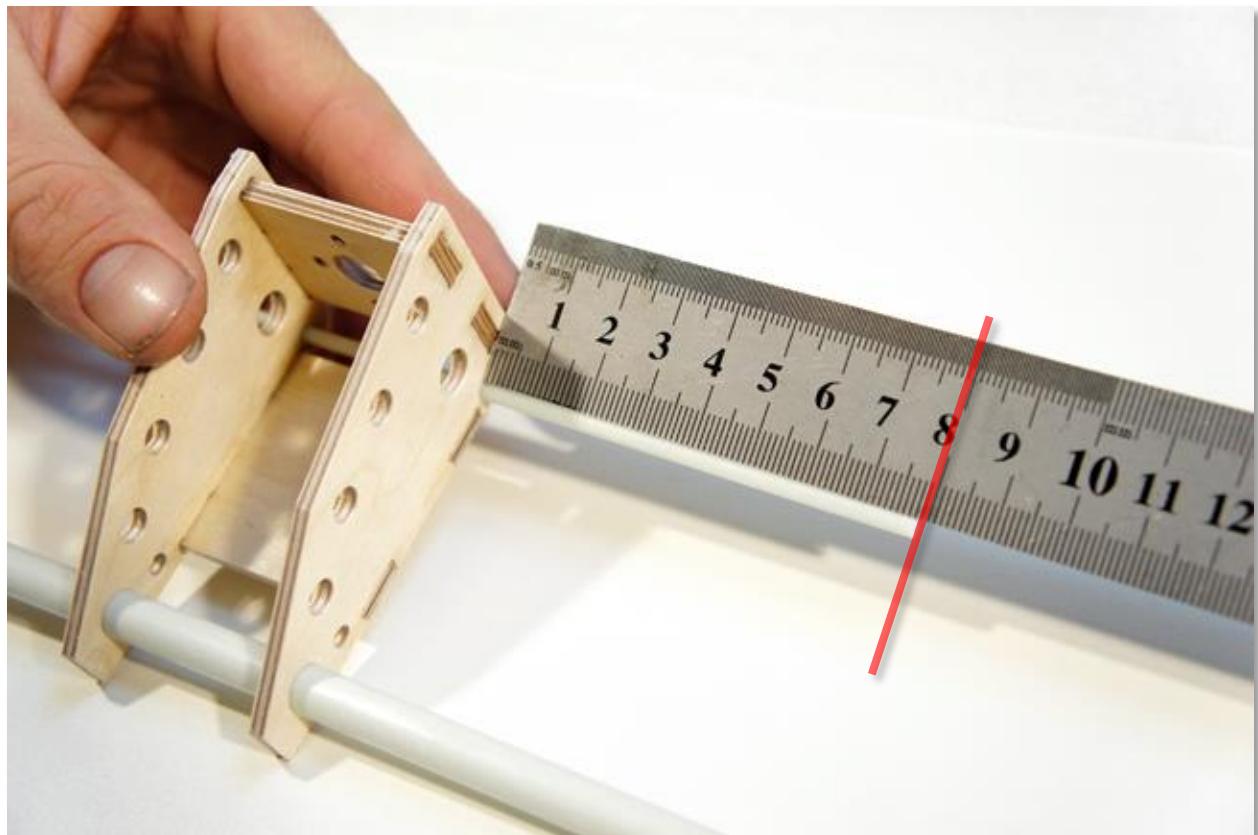




HAPPY

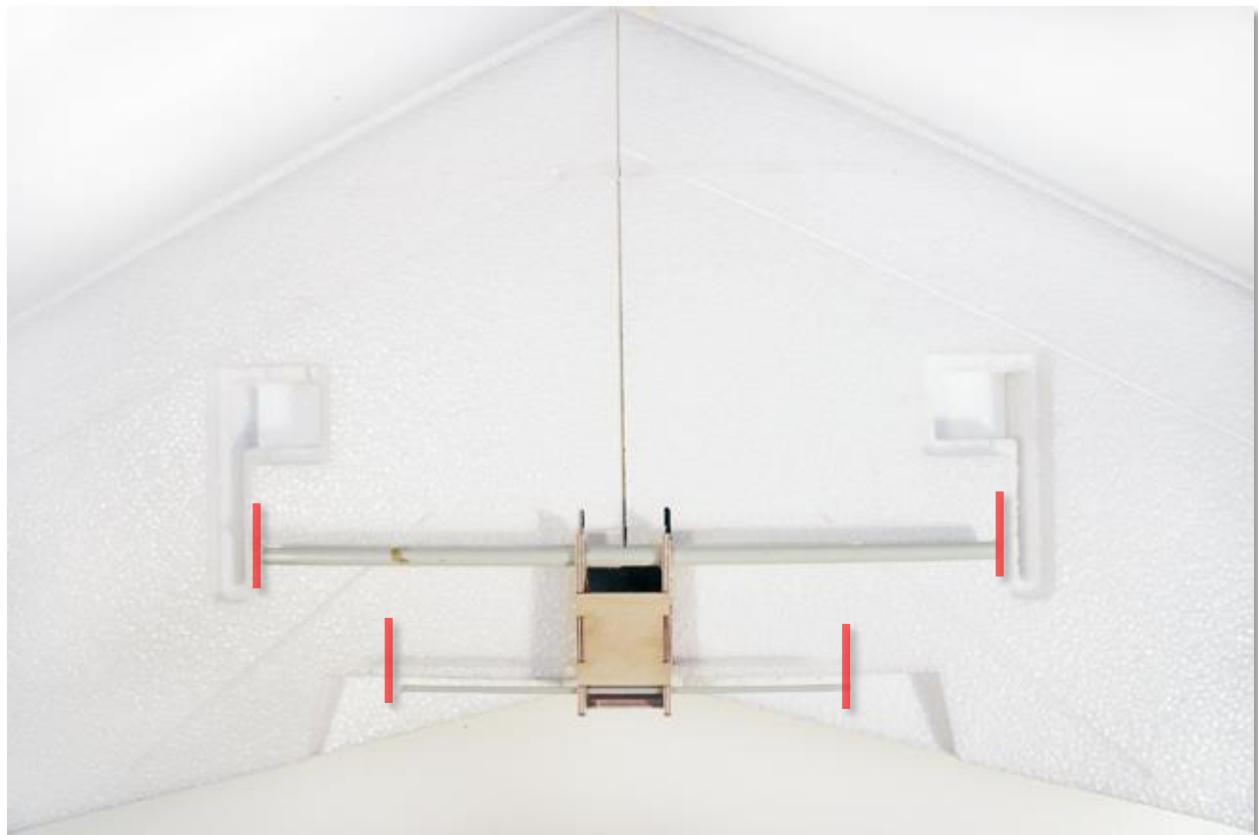
FLYERS

3. Insert the 3mm fibre and also be sure it is centred (measure 80mm from the outside of the motor mount to the end of the tube).





4. Verify everything fits into the foam before you continue!





# HAPPY

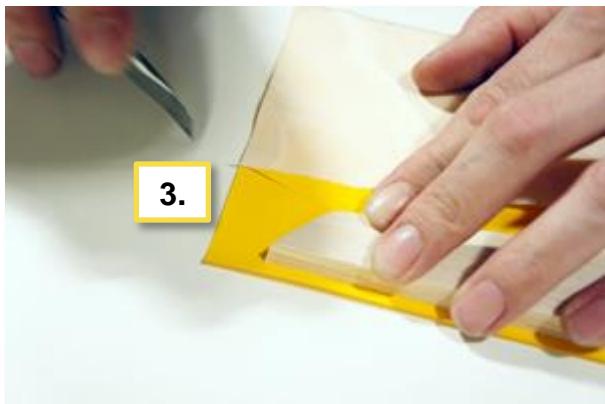
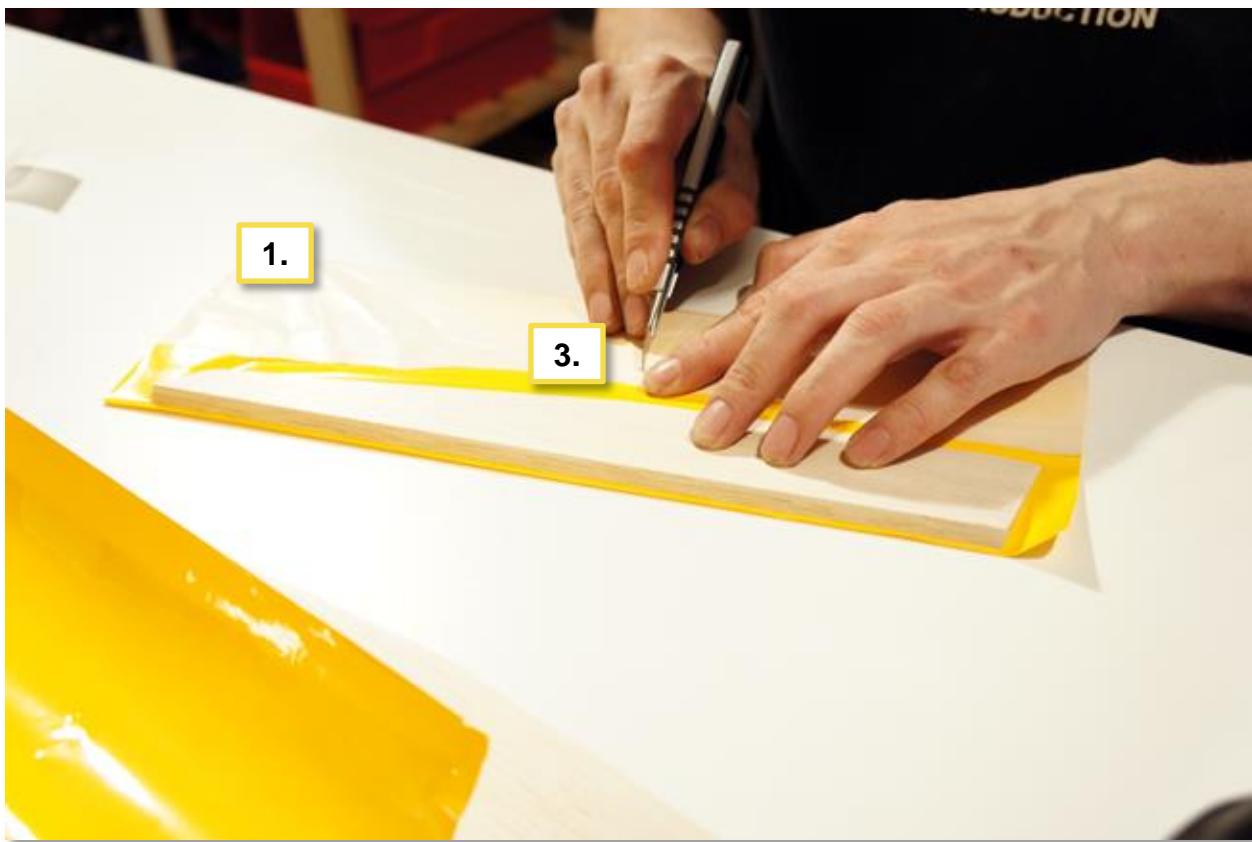
# FLYERS

## 6.2.2.2

## Elevons

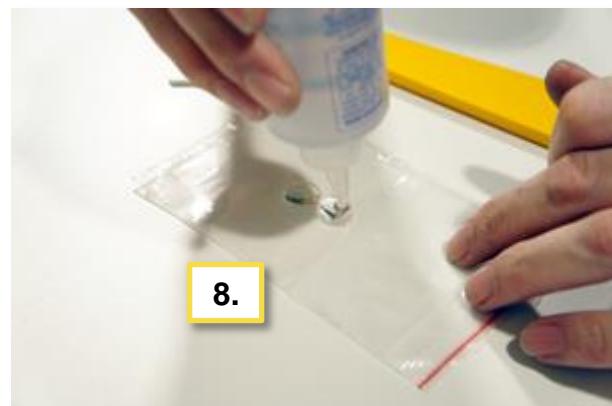
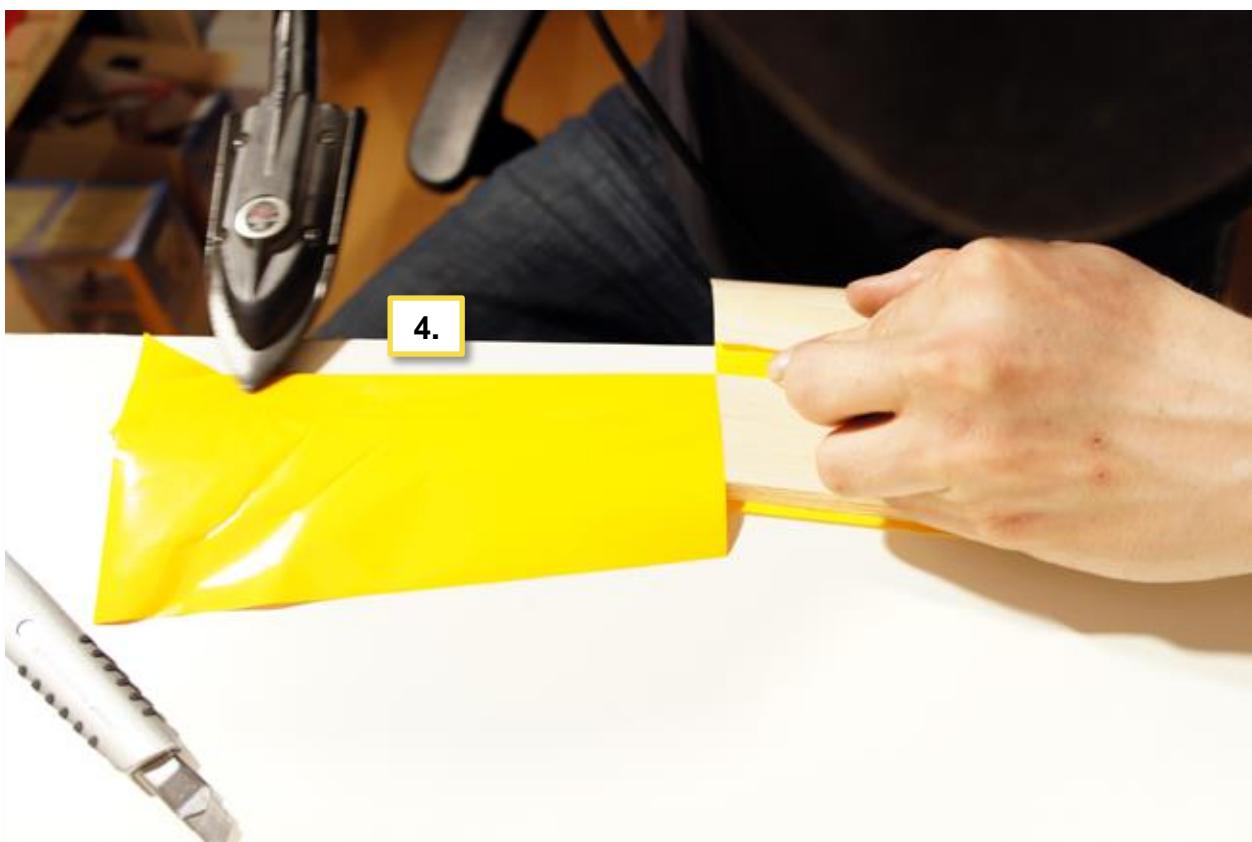
These will look very nice after we are done!

1. Remove the cover paper from the Oracover and prepare your laminating tool with 100° degrees. The matt side contains the glue so this side will be on the wood!
2. Start laminating at the upside of the Elevon (without making any cuts).





3. Lay down the Elevon upside down and make some cuts at any edge of the Elevon, as you would fold it together.
4. Continue laminating on the edges.
5. It is a bit tricky to make the Oracover fit, especially at the borders. But be patient here!
6. After you are done laminating, be sure that the Elevon is still straight and has bent!
7. Make some cuts in the Oracover where the cut-outs for the rudder horns are located. You can easily locate them when pushing a bit around on the Elevon.

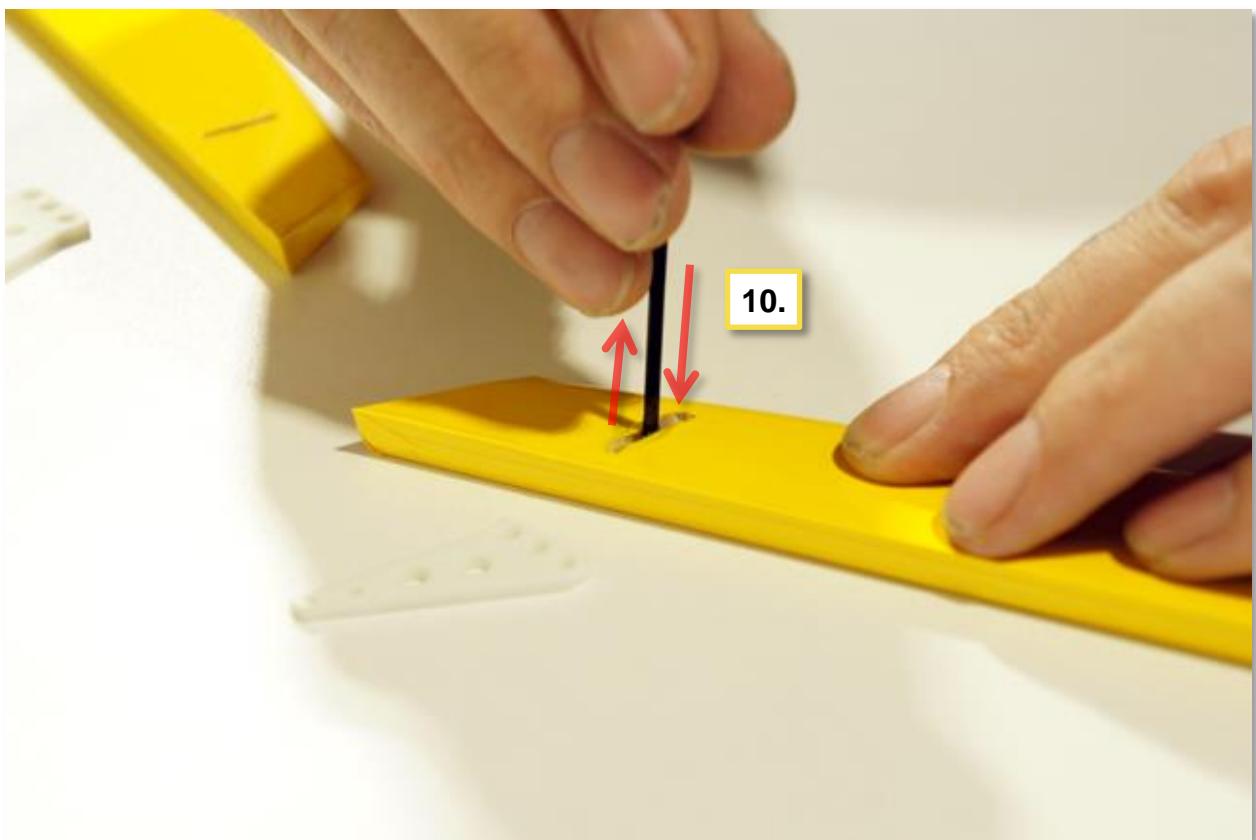
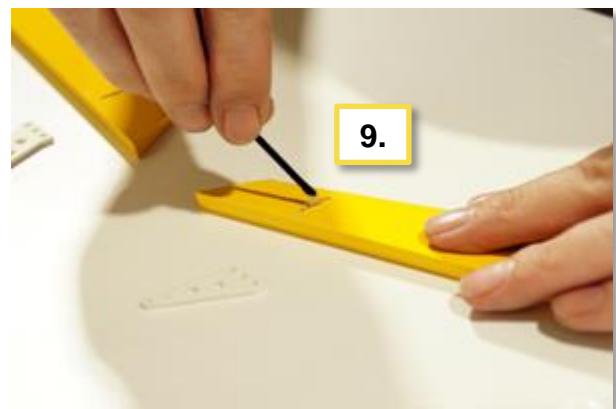




# HAPPY

# FLYERS

8. Prepare the Epoxy glue. Be sure to mix it correctly and good enough!
9. Take the mixed glue and let it drop into the cut-out in the Elevon (use enough glue)!
10. Push the glue into the cut!
11. Take the Rudder horn and also push it with force into the Elevon till it fits correctly!



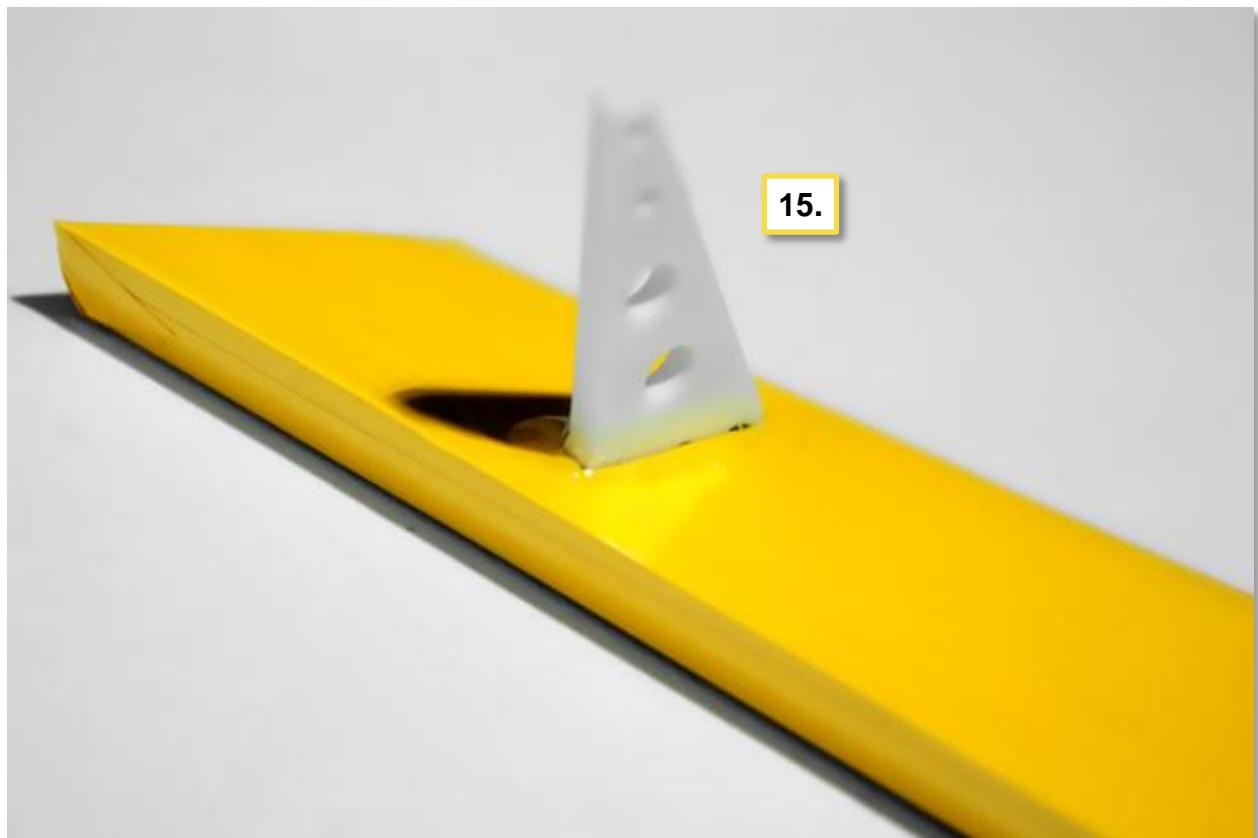
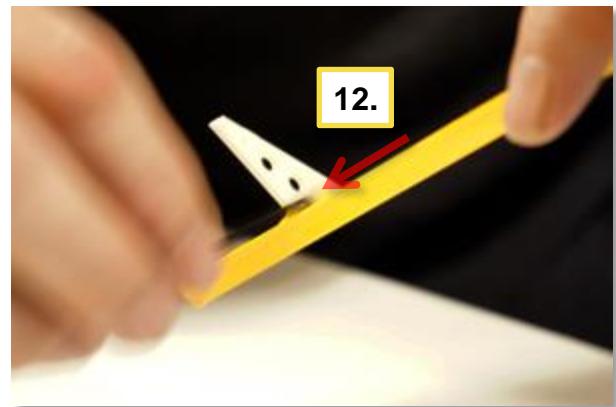
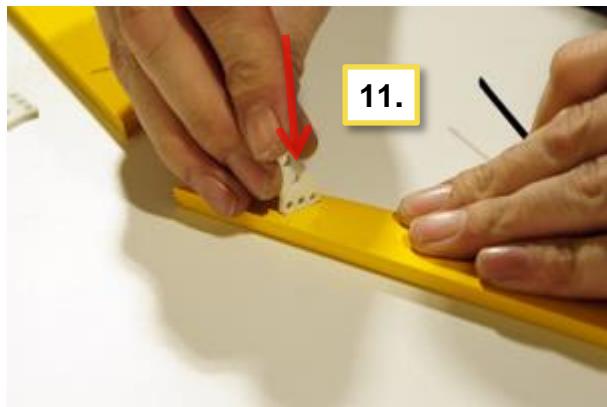


# HAPPY

# FLYERS

12. Apply some glue around the Rudder horn.

13. Let it dry! This is extremely important since the Rudder horn otherwise can move.



Your Elevons should now be ready!

### 6.2.2.3

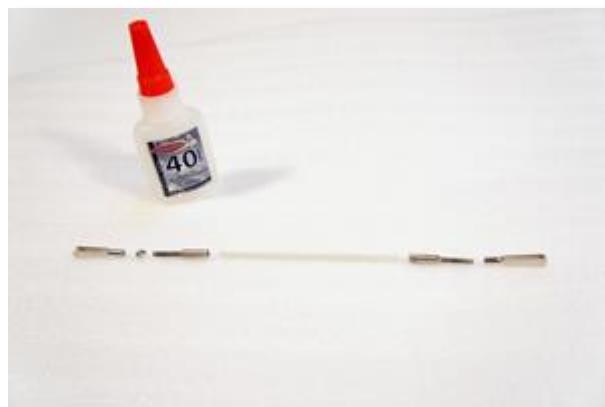
### *Rudder linkage*

There are some very important points here which will be explained at the beginning of this chapter!



- We use superglue here. You have to be very fast when sticking the parts together. When you doing it wrong, you will have no chance to undo this!  
If you are unexperienced, you also can use other, slow drying glues!
- As you remember, we initialized the Servo zero positions and set them to the exactly same positions.  
On the Servo side of the Rudder linkage it is also very important to use the same distance with the clevices! You can tighten the clevices with the provided Nut and / or some super glue.
- Wheter or not which glue or method you choose here, be sure it will hold! After your work here is done and all glues are dry, test it by trying to pulling the Rudder linkage apart.

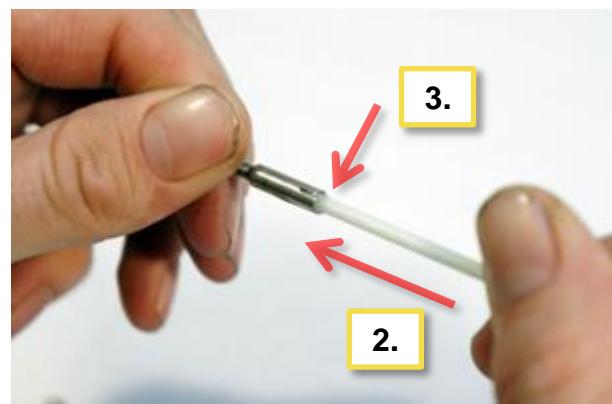
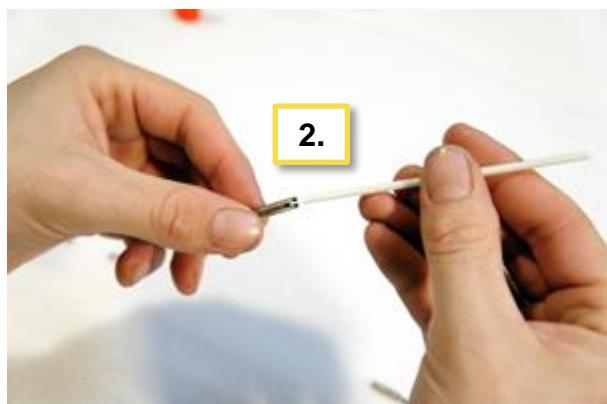
***Prepare all the parts and the glue!***





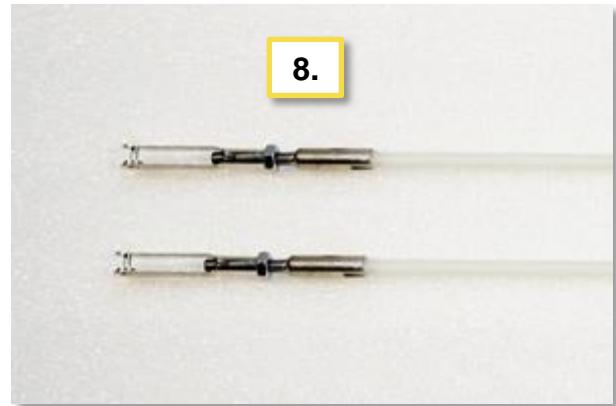
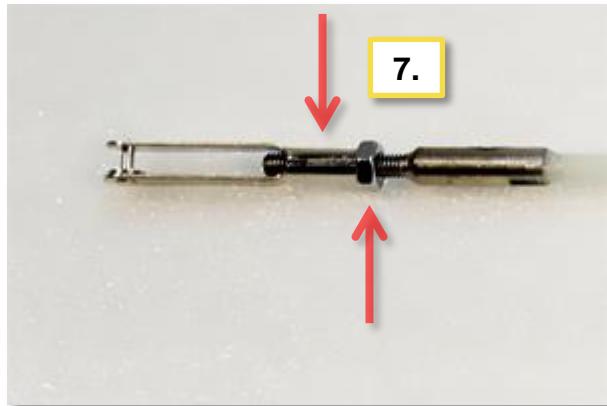
# HAPPY FLYERS

1. Take one the threaded coupler and add a little super into the hole (only 1 – 2 drops).
2. Be fast now! Take the short 105mm fibre rod and push it against the stop into the threaded couple.
3. Add a little super glue (or if you choose another glue take that one) and add it around the fibre rod.





4. Let it dry or use Super glue activator spray!
5. Repeat Steps 1 – 3 for each of the four threaded couplers.
6. Add the Nuts to each Threaded coupler and screw them to the stop.
7. As told at the beginning of this chapter, it is very important that the two Nuts are exactly at the same position at the Servo side of the Rudder linkages.  
We recommend to centre the Nut at the thread and tighten screw it to the clevice.
8. The two ends on the Servo side should now be at exactly the same position.



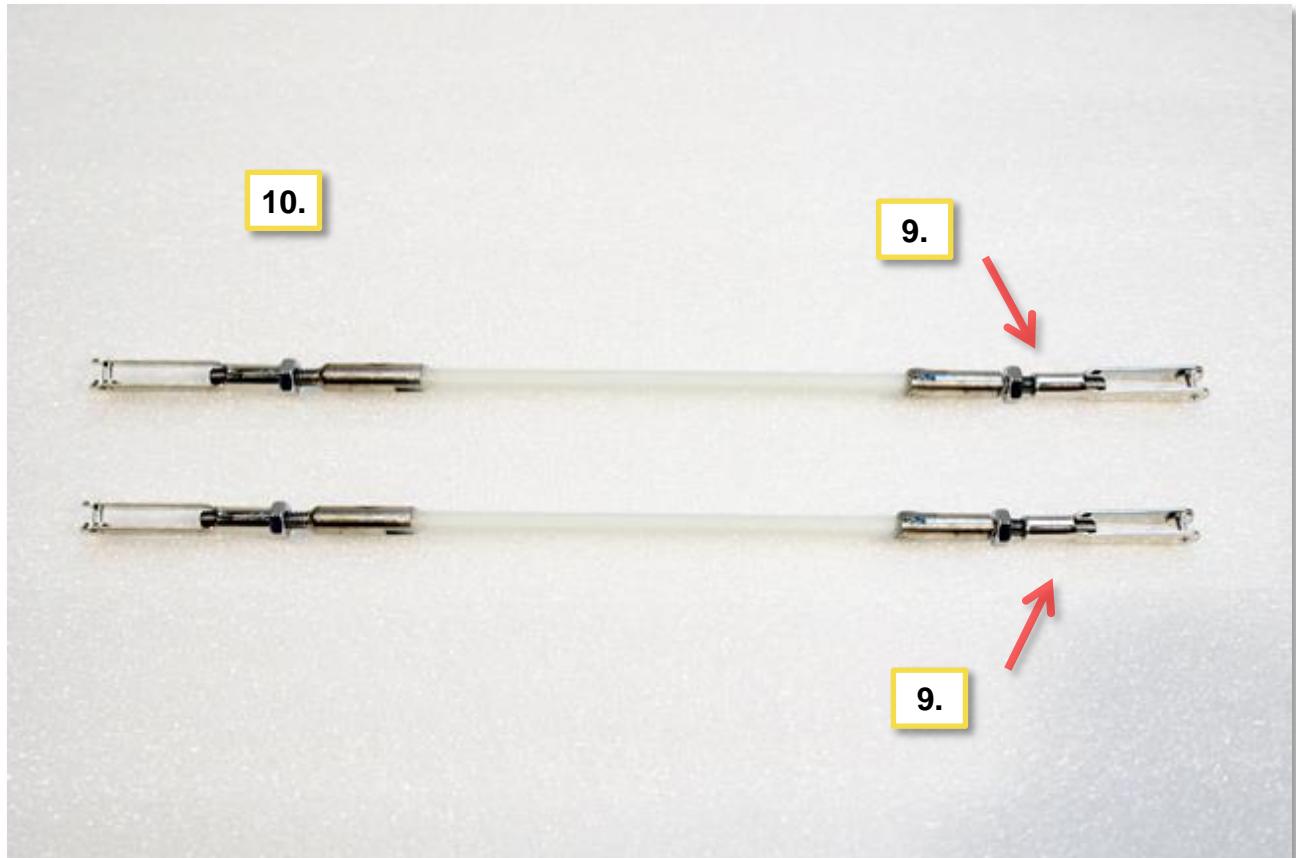


HAPPY

FLYERS

9. Add the other two clevices to the other side of the Rudder linkage.

10. Your Rudder linkage should now look like this.





HAPPY

FLYERS

#### 6.2.2.4

#### *Battery bay pre-cut*

You should already have noticed that our wing kit has no Battery cut-out. Why you maybe asking? That has one simple reason: Every RC / FPV setup is individual. It will be **VERY** hard to reach your centre of gravity when you have no chance to move the heaviest part on such a small wing.

But we have a very simple solution for this. We make two horizontal cuts into the foam, where the Battery bay approx. will be located. Later, when we are finished building, we can easy determine the centre of gravity and make only the four vertical cuts. Then you will have a perfect cutout at the 100% correct place!

1. Measure the point where the premade cut-out for the fibre tube is located. This will be approx. 10 – 11 mm from the bottom of the foam. This is important because the Battery bay will lay exactly over the fibre tube!
2. Mark 2 Points with same distance to the bottom and draw a parallel line to the bottom of the foam. The parallel line should be long enough! It's not that critical you can draw the line from the top to near the back of the foam.
3. Repeat step 2 for the other foam.

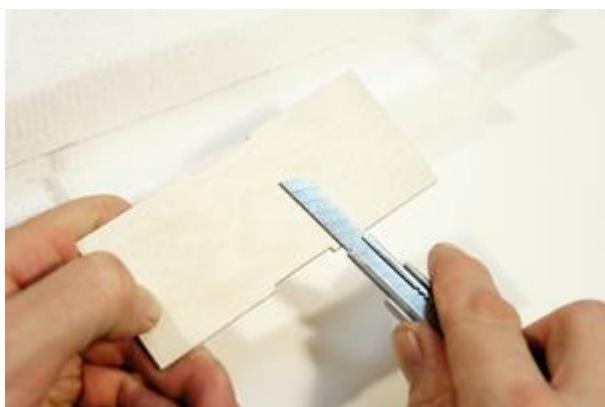




# HAPPY

# FLYERS

4. Take your cutter and your Battery bay and determine how deep you need to cut into each wing foam. We recommend cutting a little bit deeper than the half of the Battery bay wide side.
5. Here you can see how the Battery bay later will fit into the foam.
6. Make now a horizontal cut along your marked border in the foam. Be sure it is straight!
7. Repeat step 6 for the other foam.
8. The pre-cuts should now be done. Don't worry about stability! That doesn't matter later.





HAPPY

FLYERS

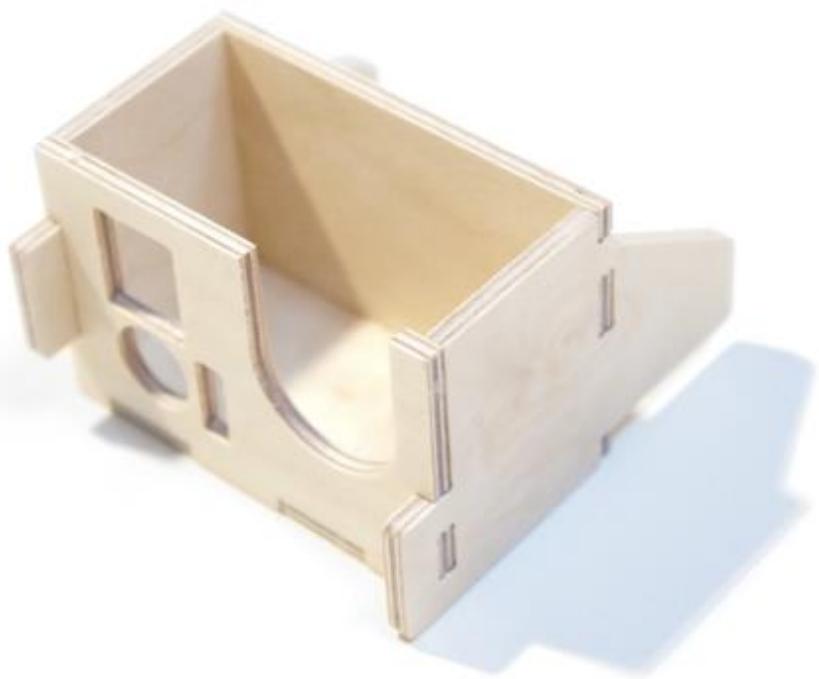
### 6.2.2.5

### *GoPro case (optional)*

You can use different glues to stick our GoPro case together. We recommend Super glue with low viscosity.

Be sure to add enough glue especially at the borders.

***Your GoPro mount should look like this.***





HAPPY

FLYERS

***Your GoPro mount should look like this.***





HAPPY

FLYERS

## 6.2.3

## Electronics

---

Prepare your chosen electronic components as far as possible.

If you're advanced, you can save some weight by removing covers from components or by reducing cable length to exactly the length which is necessary.

### 6.2.3.1

### *Motor*

---

There is not much to do here. If you have another Motor than we recommend you maybe have to solder the gold connectors to it.

**Be sure your chosen Motor will fit into the motor mount!**



HAPPY

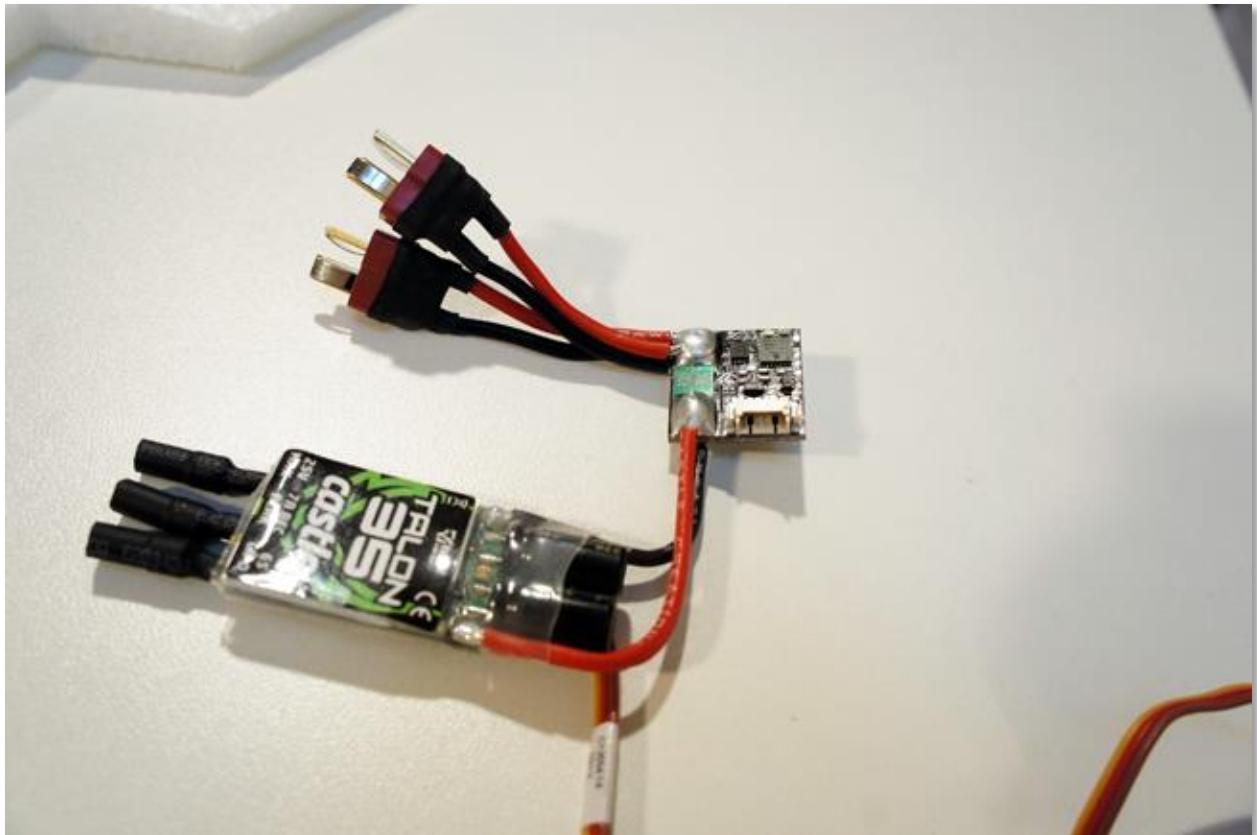
FLYERS

### 6.2.3.2 ESC

You can solder some gold connectors to the ESC (where the Motor will be plused in later), or some advanced users can solder Motor / ESC wires together directly later.

**Be sure your ESC is programmed properly before continue!**

This example show a Castle Talon 35 ESC with gold connectors soldered to it and a unboxed TBS PNP Pro current sensor with some short wires with Deans connectors. This is the setup, we are using in our wings at the moment.





# HAPPY

# FLYERS

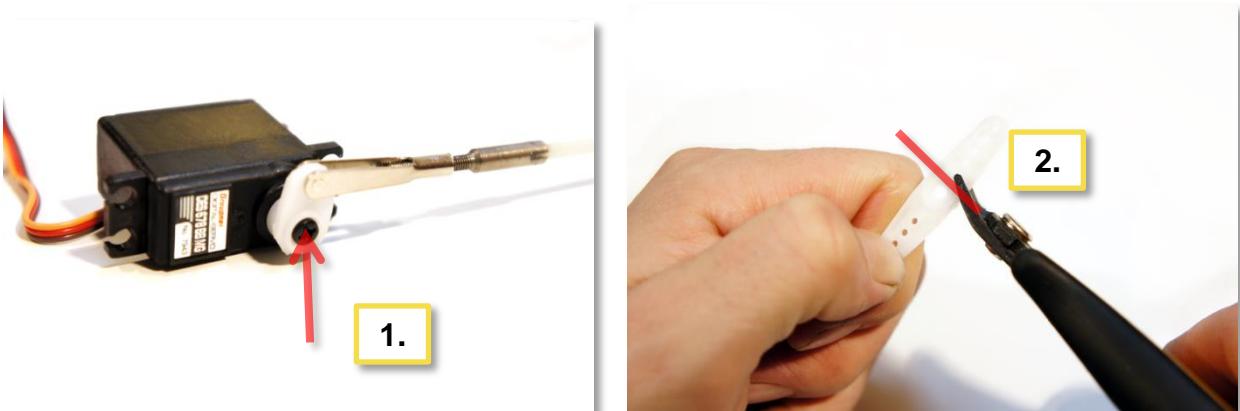
### 6.2.3.3

### Servos

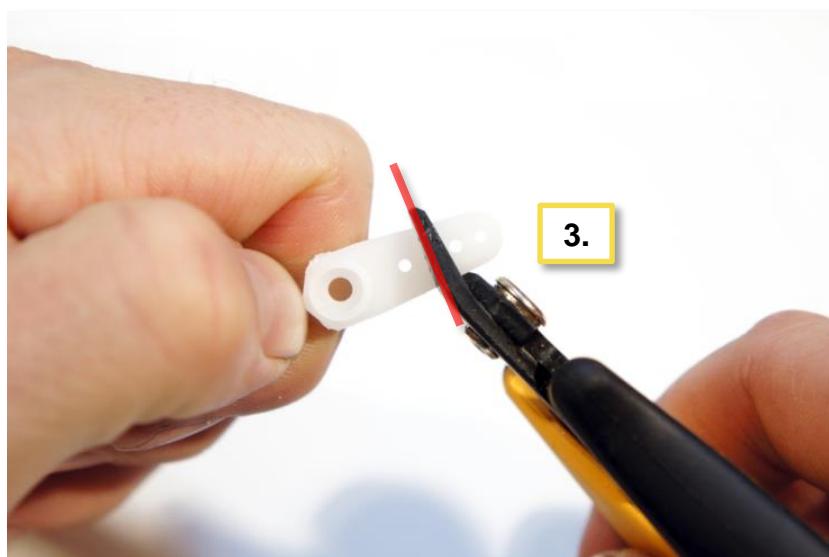
It is very important that you initialize your servos the “zero position”, before you build them into your wing! Otherwise the tiny holes on the top will not fit with your rudder linkage and the Elevons can act asymmetrical on control because of different distance to the rudder horns.



1. Release the screw and unplug the rudder-adapter provided with your servo



2. If your servo provides a one-sided horn you can skip this step. Otherwise you need to cut the servo horn that only one horn will be left on it (there are two, four and six sides on servo horns). Don't use de round horn!
  3. Cut the top of the servo horn so you only have the lowest hole left and fit it as well as possible!
- Repeat step 2 – 3 for the other servo horn too.

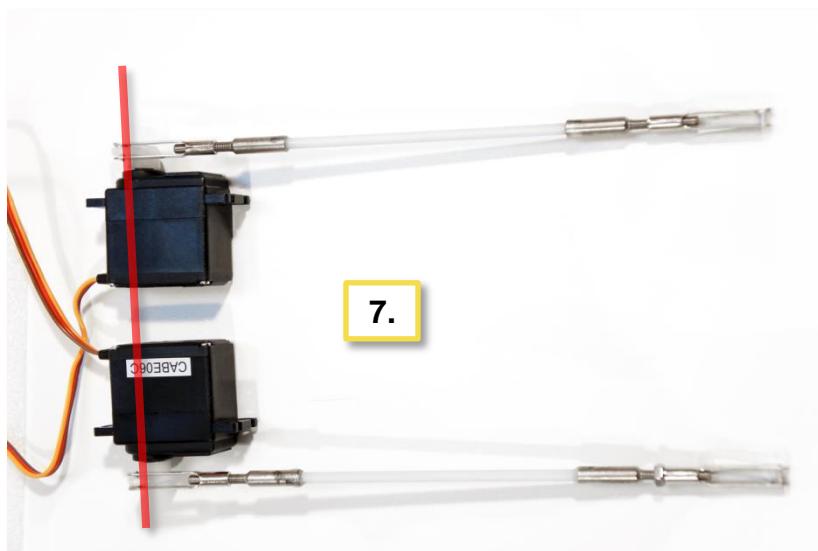




# HAPPY

# FLYERS

4. Turn on your Transmitter and be sure your Servo channels are trimmed in their initial position.
5. Plug your Servos the correct channels on your receiver and power on your receiver.
6. Wait for your RC system to initialize and check if the servos are moving correctly. Lay down the RC controller now. Servos should now be in their zero positions.



7. With everything still turned on, take your prepared servo horns and fit them on to the toothings of the servo top. It is very important, that both servos have now the same direction with these horns when they are positioned like they were installed in the wing.
8. Screw on again the servo horns (not extremely hard).
9. Turn off your RC equipment

**Your servos should now be correctly prepared!**



### 6.2.3.4

### *RC Receiver*

---

Nothing much to say here. Just be sure your RC Receiver is binded properly to you your RC Controller!

### 6.2.3.5

### *FPV equipment (optional)*

---

If you need to make some modifications at your FPV equipment, better do this now.

For example you can remove some cases (OSD, GPS etc.) to save some weight. This is only recommended for advanced users.

### 6.2.3.6

### *Wires*

---

Keep in mind the stuff we mentioned at [\*\*chapter 5.5.2\*\*](#) (Philosophies about RC and FPV electronics).

If you have Plug and Play wires go on! Else you maybe have to shorten, lengthen or customize your needed wires.

### 6.2.4

### *Other stuff*

---

It is always hard if you find something out later in this tutorial, which you better have done at the beginning. So be sure you have everything done and are ready for the next chapter!



HAPPY

FLYERS

## 6.3 Cut-outs

Follow this simple rule when making cut-outs: Don't make them too deep, since the wing will lose stability and covering will be harder, and don't make them too high, since the parts will look out of the wing which will result in drastically reduced flight times and some other serious issues

Use a cutter to make the cuts vertically in the correct depth on your marked boarders and use some pliers (nose pliers) to pull out the EPP after you have made your cuts.

### 6.3.1 Electronics

#### 6.3.1.1 Generally

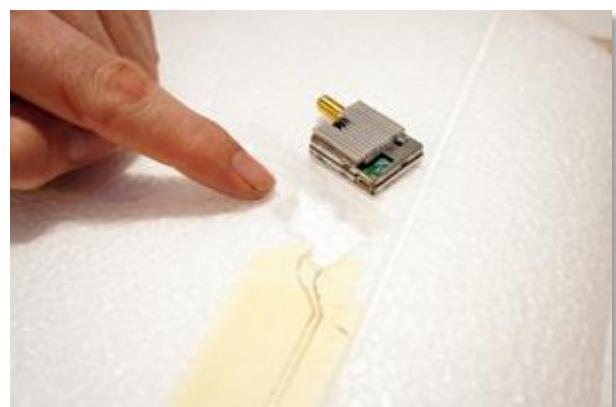
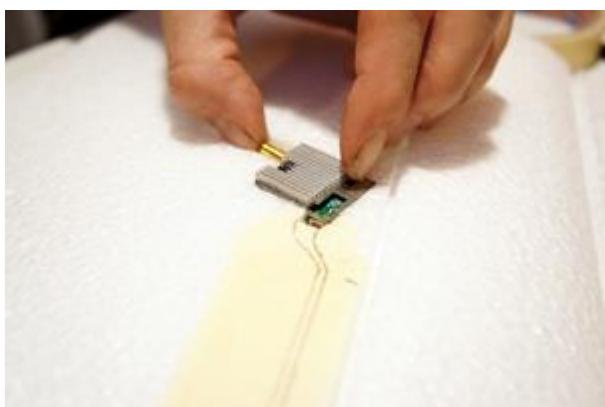
We distinguish here between parts that need airflow (for cooling) and some which don't. First ones (for example vTX or ESC) are easy. Just measure the height of the component and then make the cut-out just a little bit deeper.

Second ones are a bit tricky (GPS, OSD, Current sensor etc.). If you are unsure in cutting EPP and sanding, you can make the cut-outs for these exactly like the first ones.

Advanced users can make the cut-outs approx. 2-5mm deeper than needed, so they can make later individual covers for the cut-outs. Will look great and aerodynamics are better as well.

See here some impressions about this topic.

***Video transmitters are cooling critical. They always should be installed flat in the foam.***

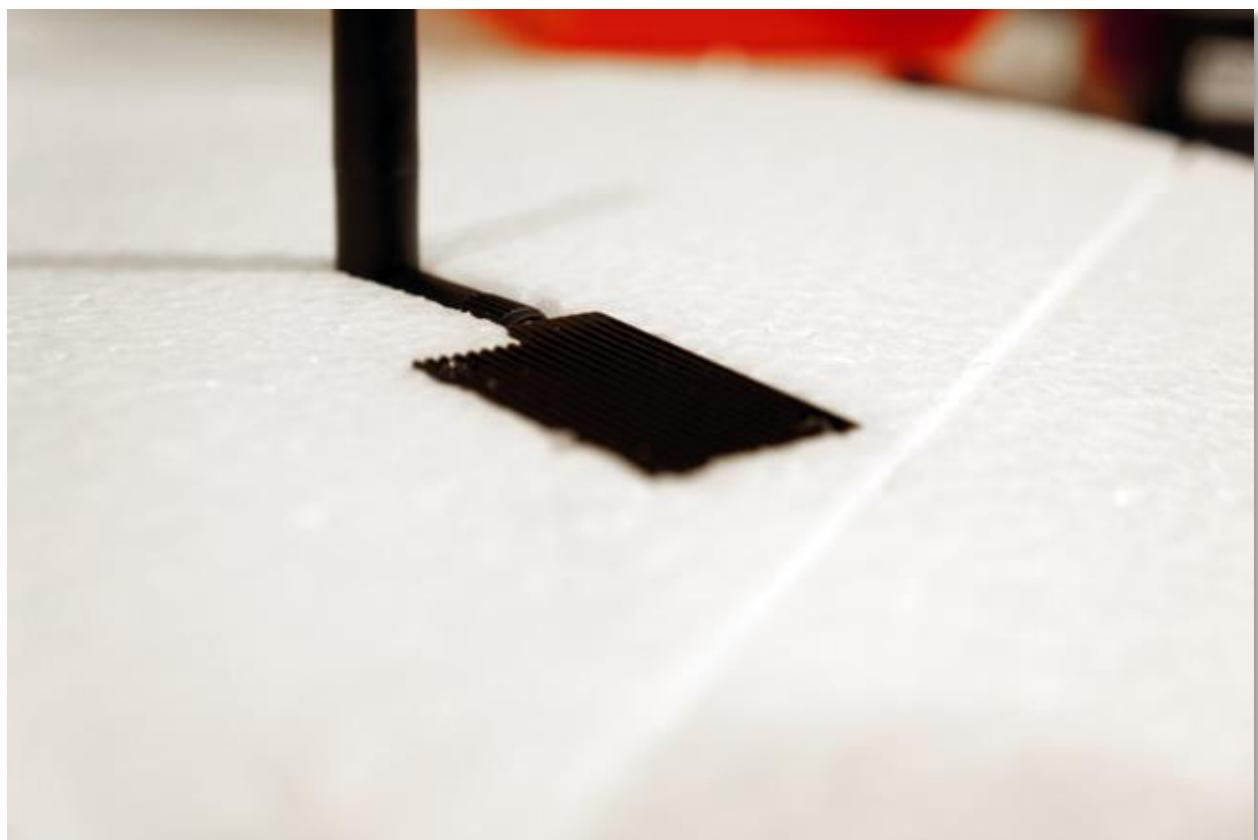




HAPPY

FLYERS

***Cut-out perfectly matched to the surface of the wing. Go like this with your Stuff as well!***





HAPPY

FLYERS

*Some empty cut-outs for GPS and RC receiver in the background.*





# HAPPY

# FLYERS

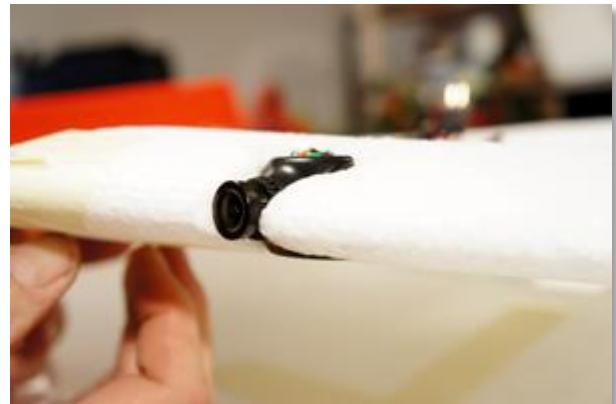
### 6.3.1.2

### FPV Camera

This is one of the secrets at our Wipeout wing kit! Take a look at the pictures below and you will see that the camera fits perfectly into the foam! This will improve flight times and flight characteristics compared to other installation methods.



You can choose your own FPV camera but we strongly recommend not using dimensions greater than 25x25 mm when installing the FPV camera at the side.



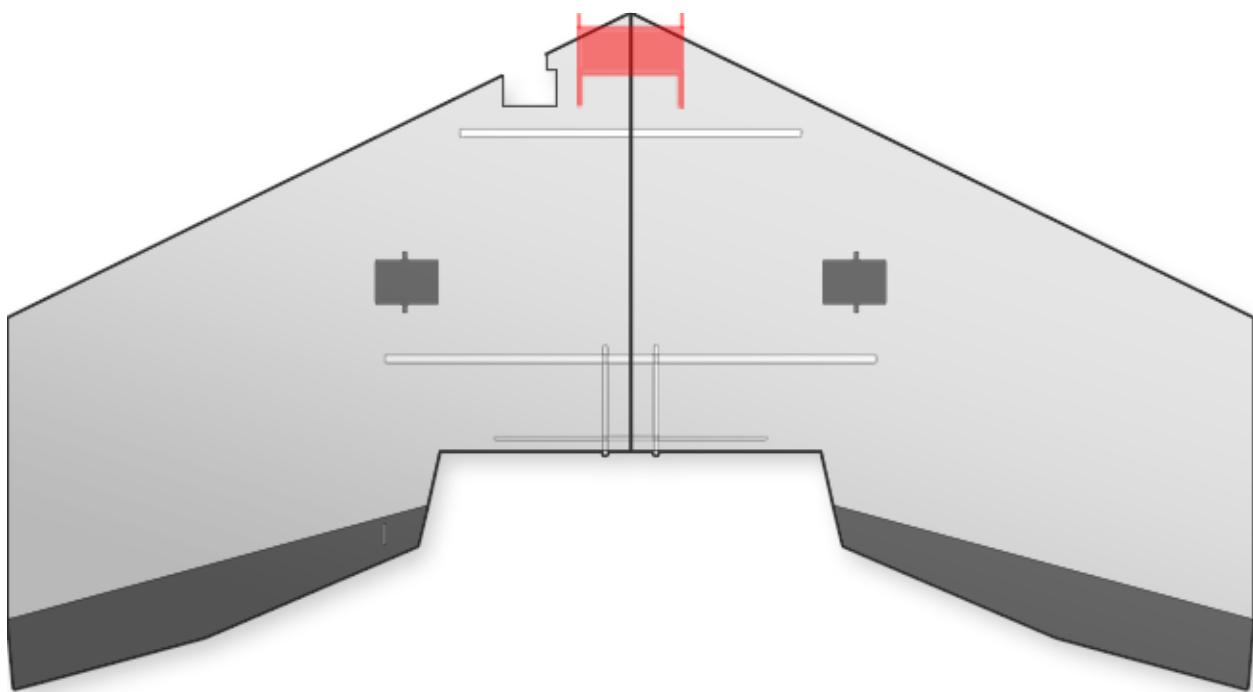
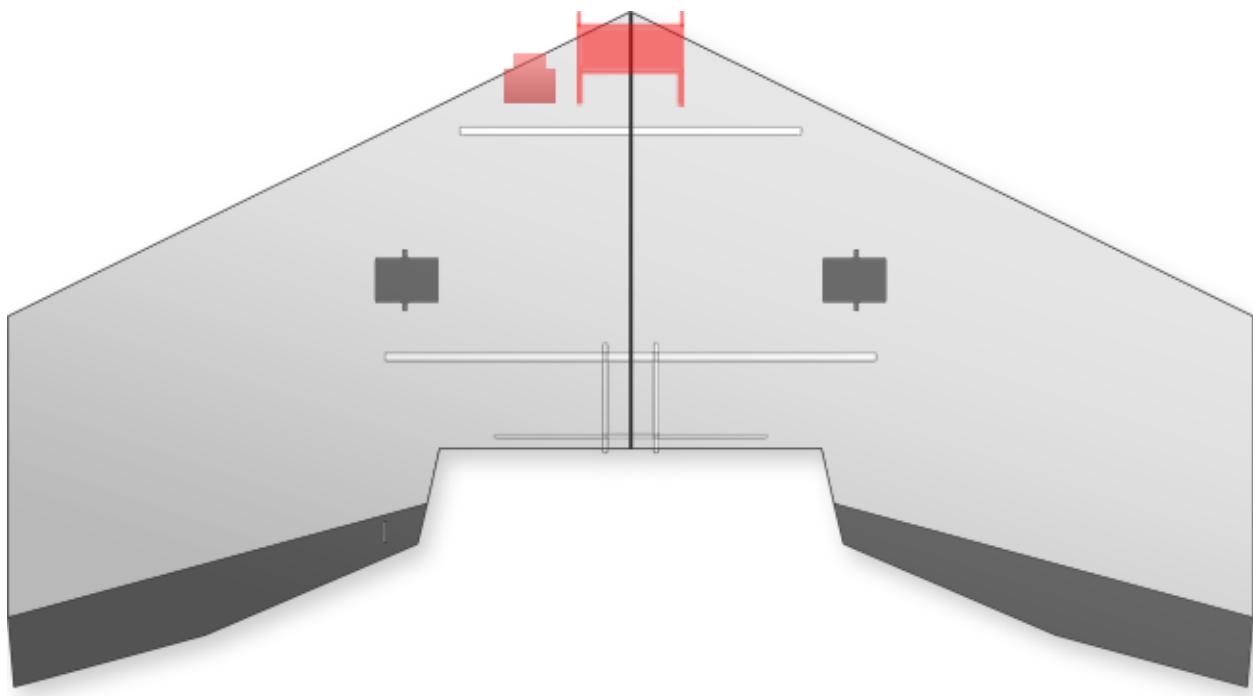
**If you don't plan to install a GoPro case and install the FPV camera in the middle instead, it will not be critical which size of camera you use there!**



HAPPY

FLYERS

***Example for the FPV Camera cut-out when using a GoPro mount.***

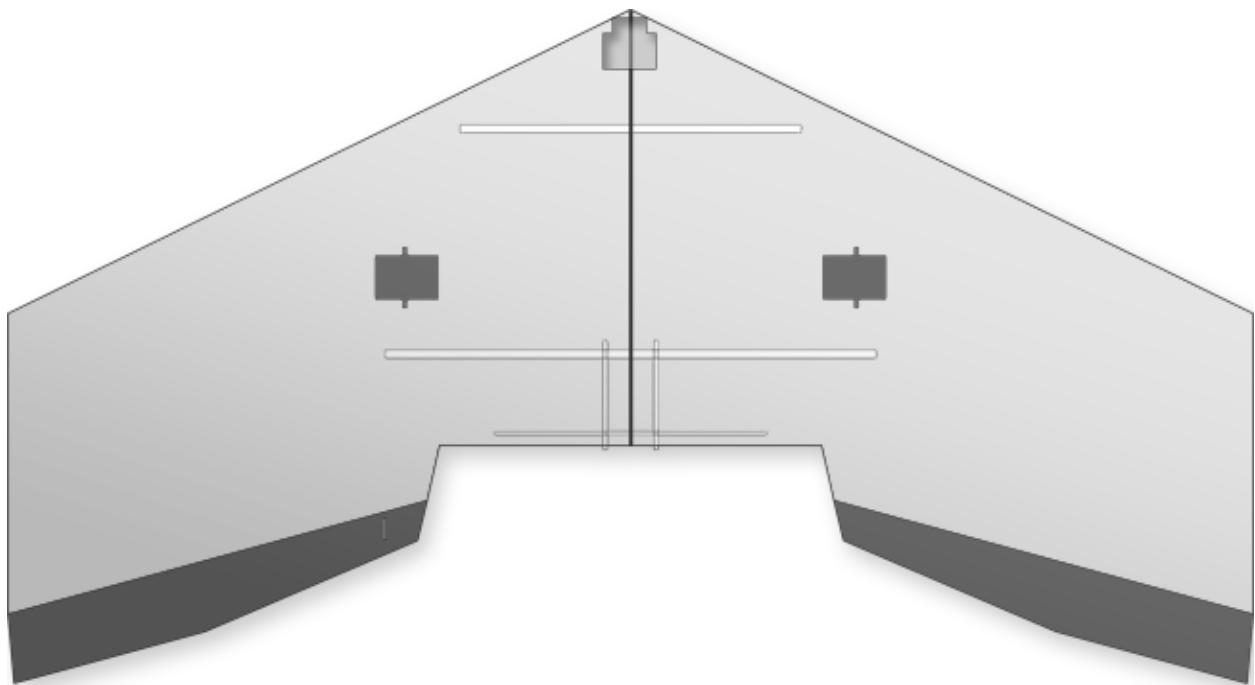
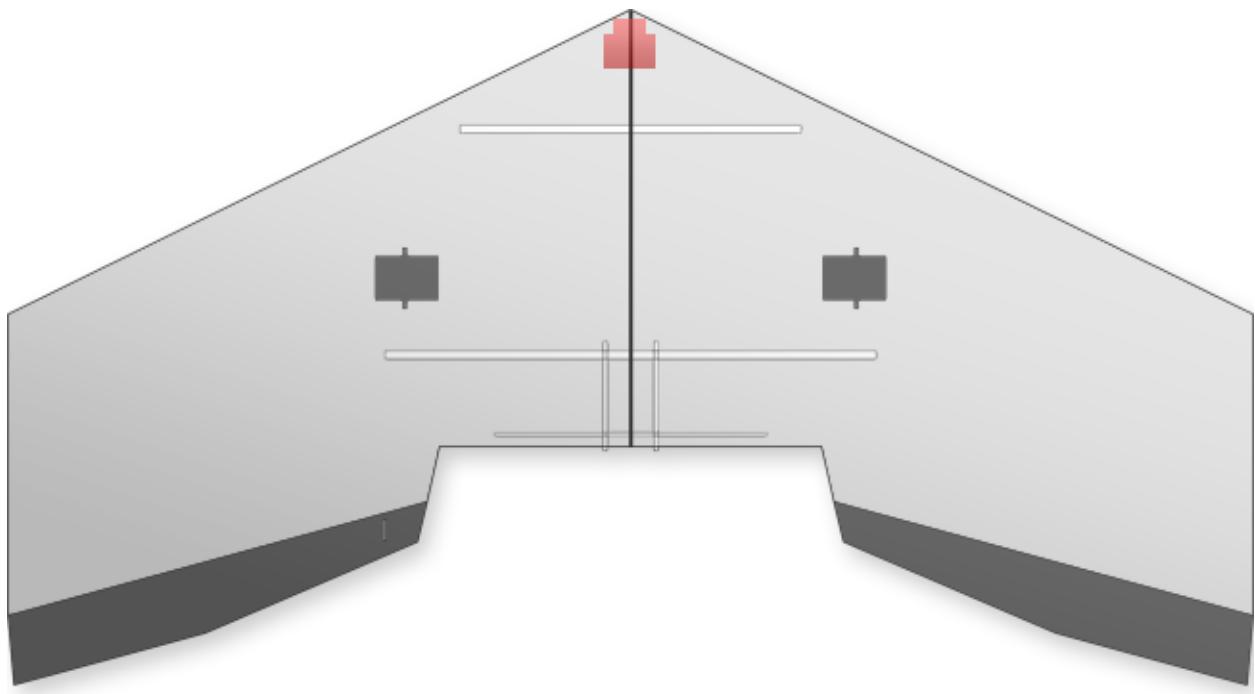




HAPPY

FLYERS

***Example for the FPV camera cut-out when not using a GoPro mount.***





HAPPY

FLYERS

### 6.3.2

### Wires

For the most wires like twisted servo wires, a CAT 6 Network cables etc. we use the same method as for the most electronic. Determine the width of the cable(s) which run along the marked boarder and cut this width vertically in the foam. You can pull the EPP out easily with the nose plier.

Try fitting your cable(s) into the conduit. If these looking out at the top side, cut a little bit deeper!

See here some impressions about this topic.

***Example for a cable conduit which fits perfectly to the top surface of the wing.***





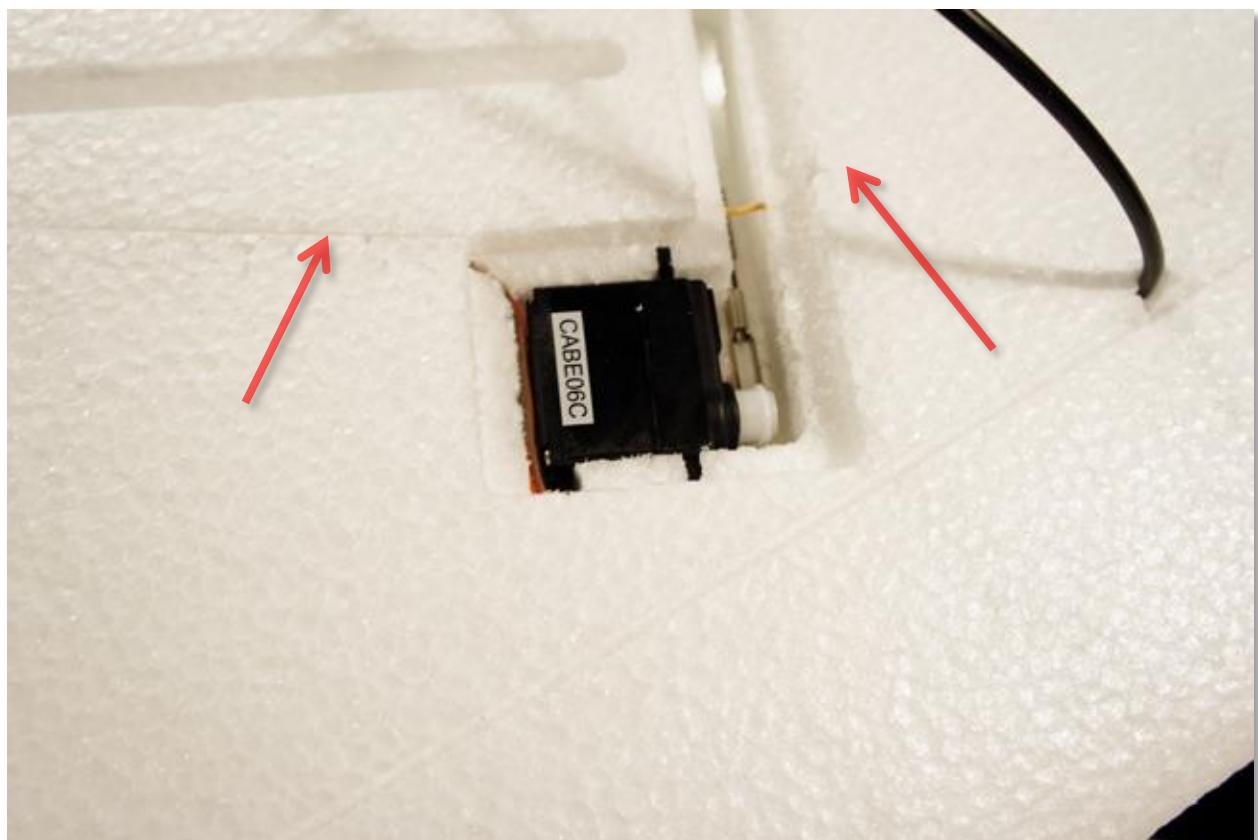
HAPPY

FLYERS

*Another example viewing from the top.*



*Some small wires like servo wires can fit directly in to one single vertical cut!*





HAPPY

FLYERS

### 6.3.3

### GoPro mount (optional)

---

You can make the cut-out for the GoPro mount at this point or later, when finished with laminating. This is completely up to you!

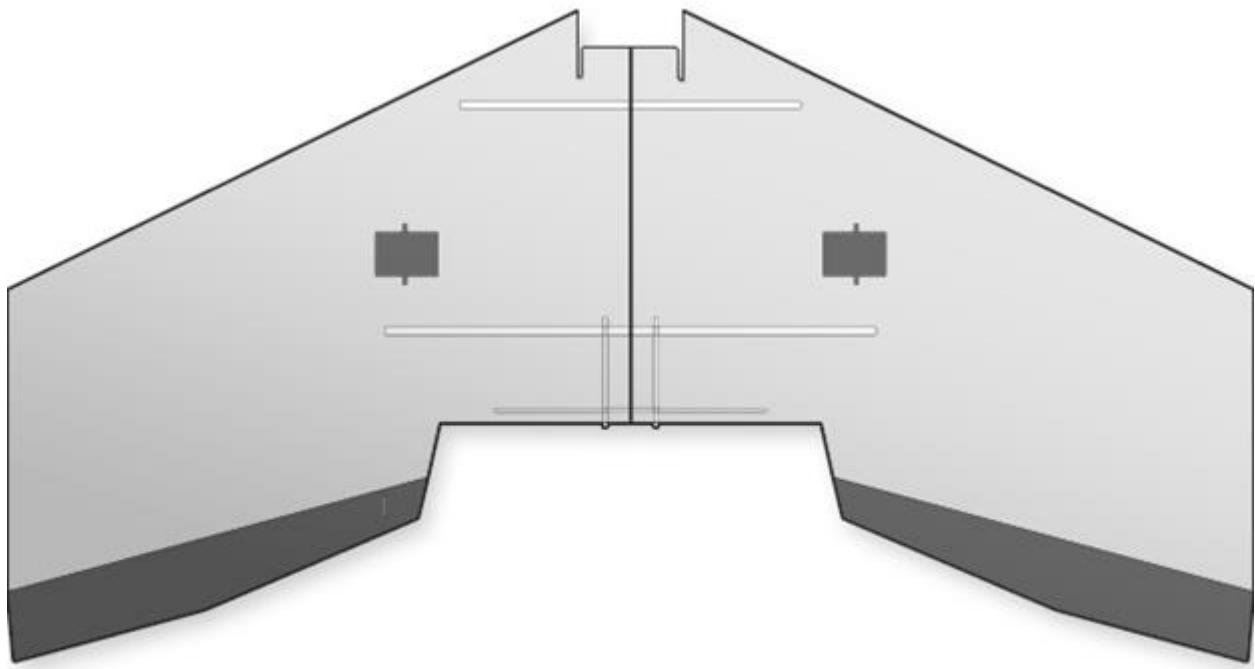
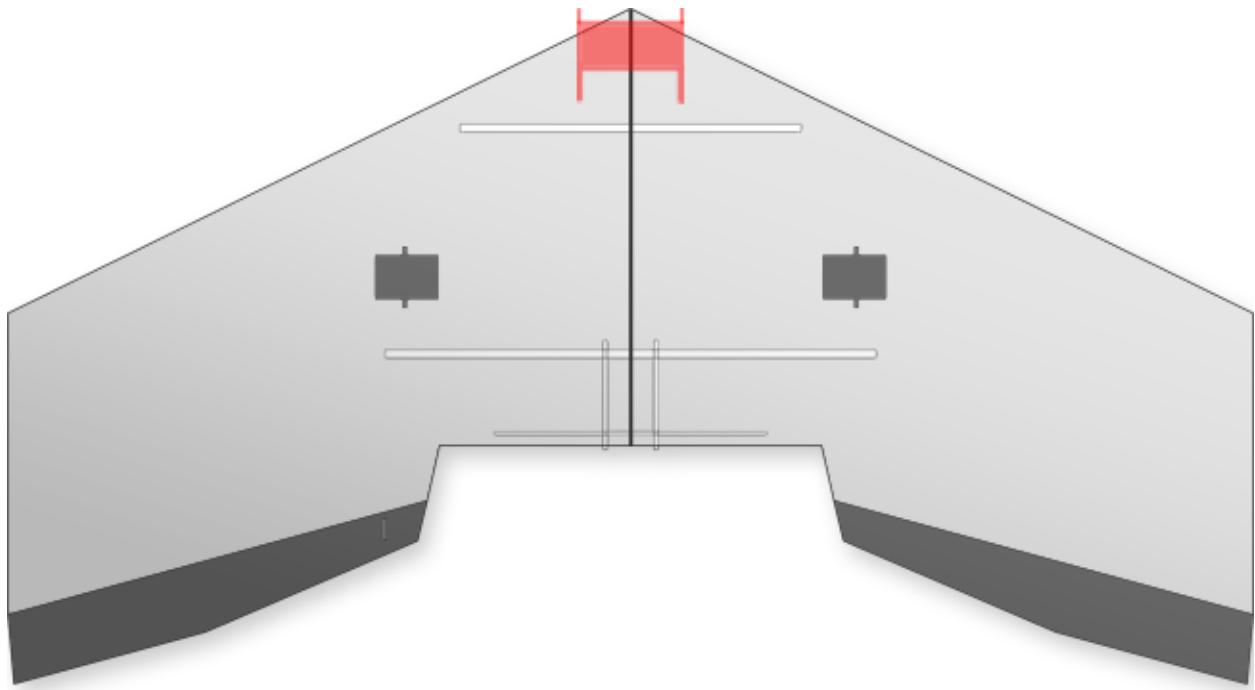
**Be sure the GoPro bottom plate is the same level as the bottom foam!**

It can rise outside the wing at the top, that's no problem since the Batteries, motor mount etc. also rise outside of the wing at the top side. **But it should not raise outside at the bottom side!**



HAPPY

FLYERS





HAPPY

FLYERS

## 6.4

## Checking and testing

***At this point it is extremely important to check everything is working before you continue!***

### 6.4.1

### Checking

Temporary install all the parts (electronics, wires etc.) into your cut-outs and see if everything fits correctly!

If not, correct it!

### 6.4.2

### Testing

Now plug everything together and be very sure everything is working properly!

- RC Control with Servos and Motor
- FPV equipment (check if video reception is working)

Correct some issues if necessary!

### 6.4.3

### Removing

Remove all the parts again from your wing (except servos and servo wires and, if you want, the FPV camera).

You are now ready for the next steps!

## 6.5 Glue

### 6.5.1 Covering (optional)

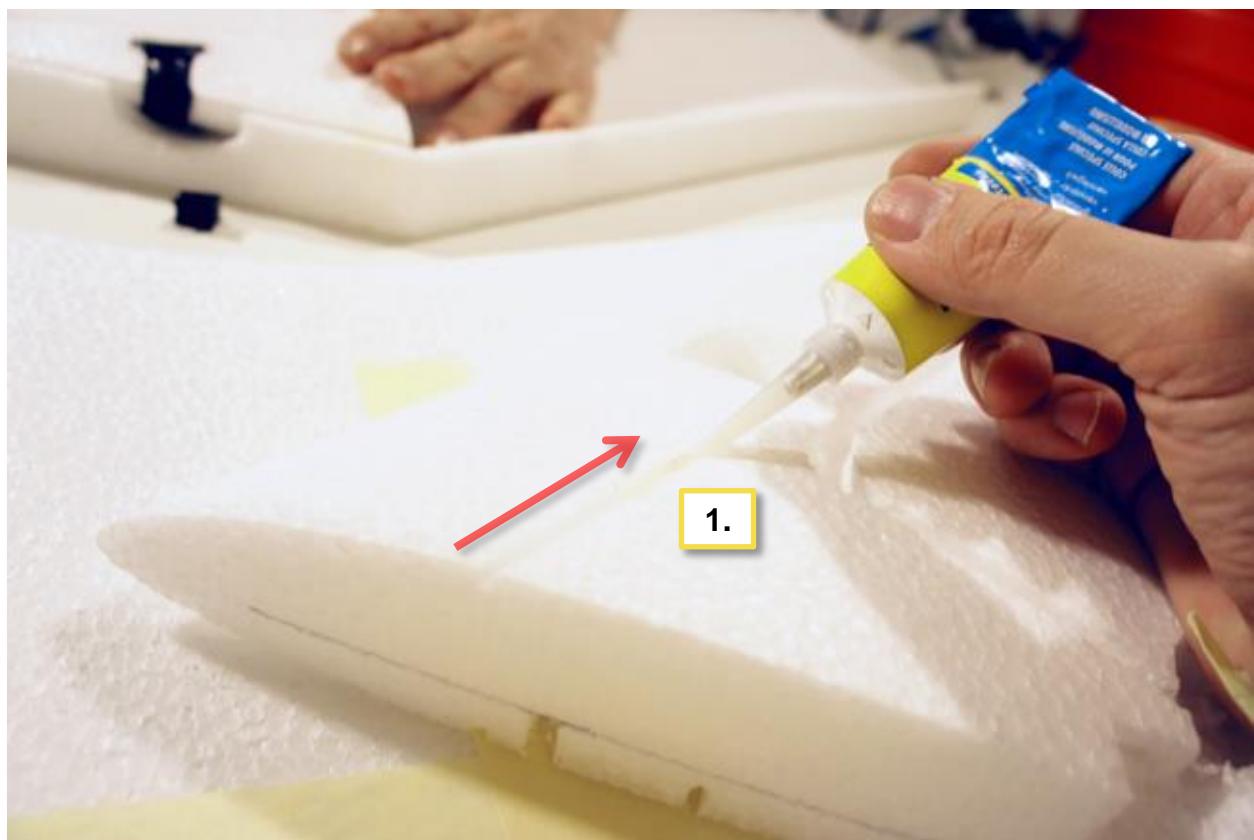
Before you start working with glues, it is wise to cover some critical cut-outs with painters tape. This way we will ensure that no glue from the outside will enter our cut-outs.

### 6.5.2 Wing stiffening

We now glue the long 3mm fibre rods in our wing. Prepare your foam negative, the 2x 500mm and 2x 470mm fibre rod and your preferred glue.

We recommend some slow drying, hard glue like the “UHU hard”. We also strongly recommend not using super glue when first pushing the rods into the foam! Use any other slow drying glue!

1. Add the glue in premade cut-outs for the long fibre rods at the top. You can glue the top side of the other Foam right after!

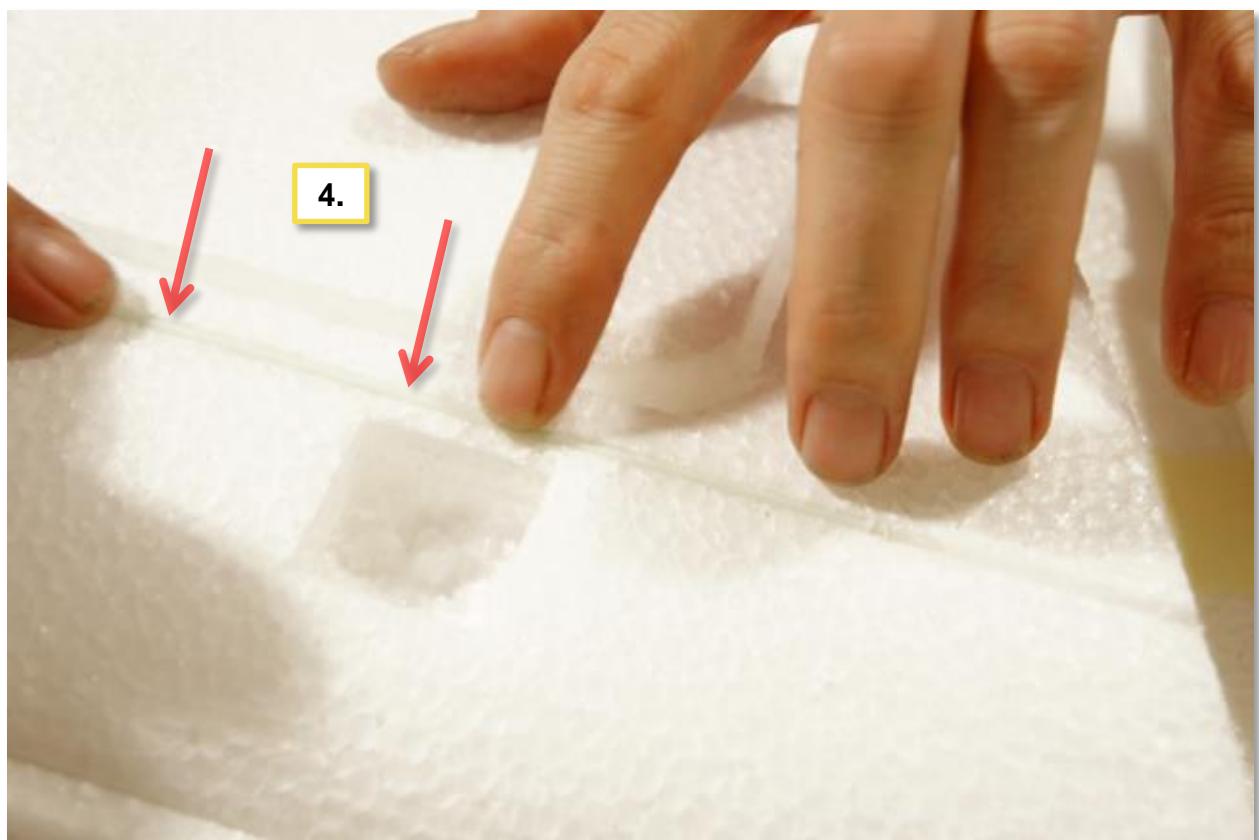
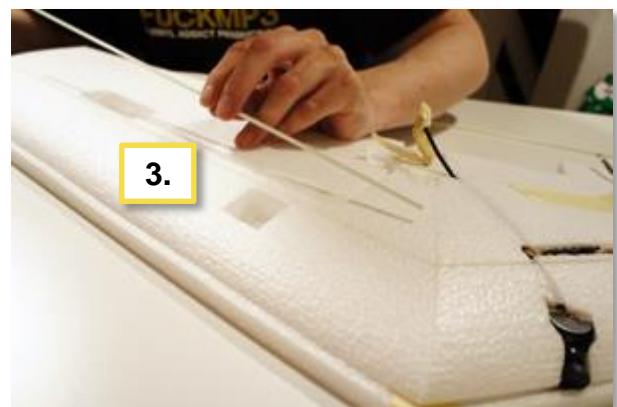
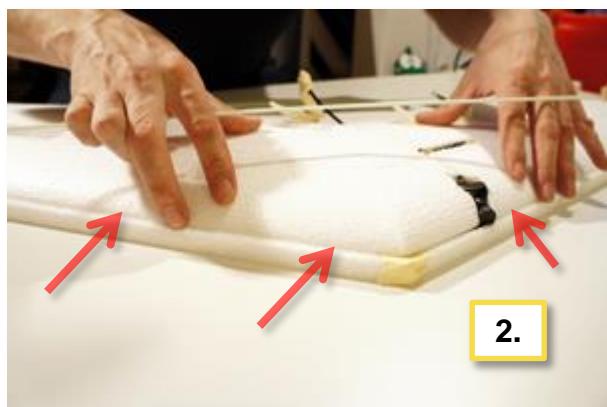




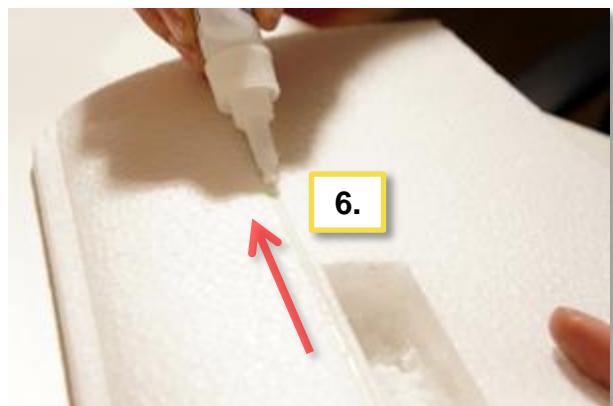
# HAPPY

# FLYERS

2. Place your foam correctly in your foam negative, so it will fit at the top not at the back of the wing!
3. Insert the short fibre rod (470mm) at the top of the wing.
4. Push it carefully into the foam so it will perfectly fit with the surface of the wing.



5. Now push the whole wing with force into the foam negative. This will guarantee that it is straight!
6. You now can let this side dry or add a little super at the top of the installed fibre rod. This will also guarantee that the rod can't move during drying.
7. Repeat step 3 to 6 for the other foam part.
8. The rods for the bottom side will be installed later, since they cross the fibre tubes at the bottom.
9. You are now finished with the top side.





# HAPPY

# FLYERS

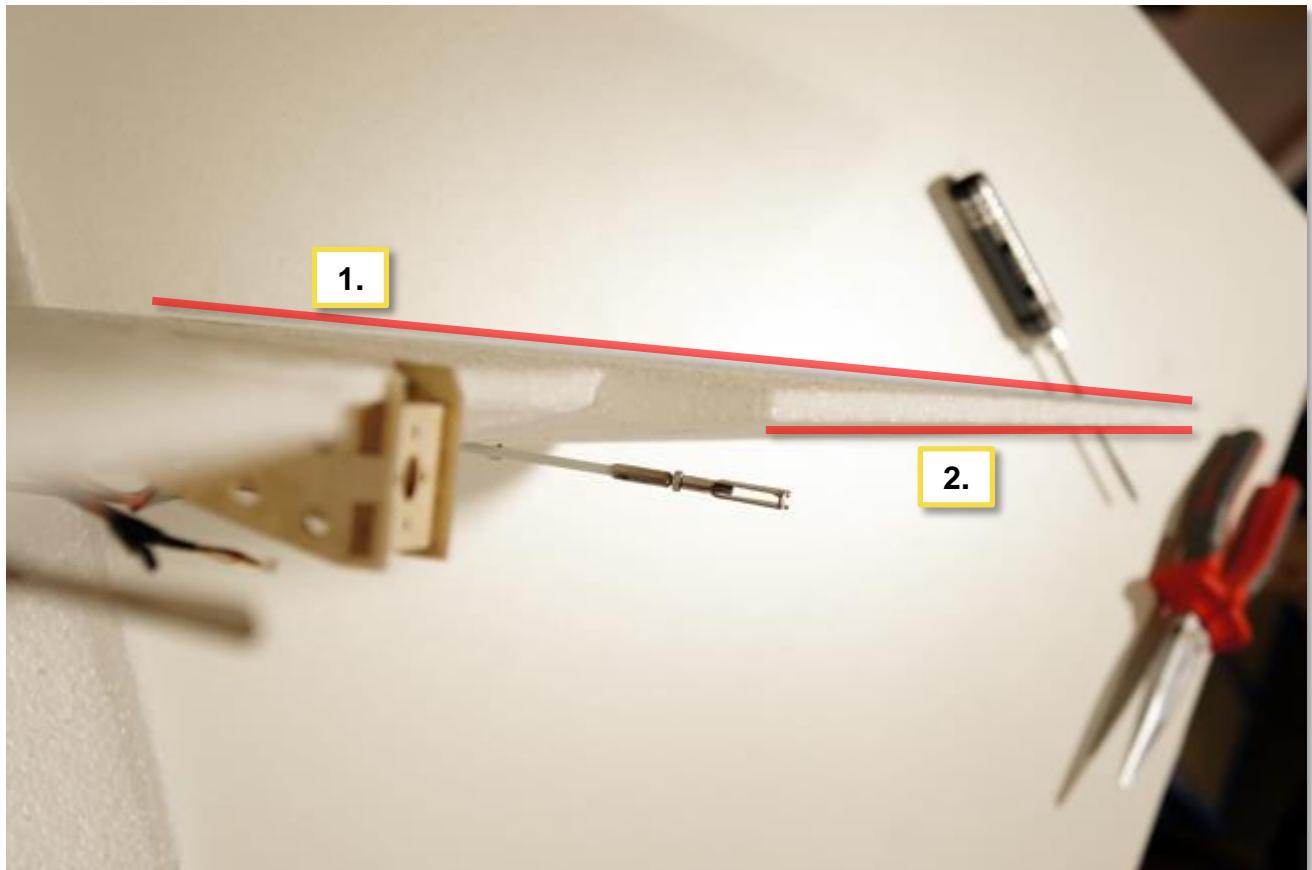
### 6.5.3

### Check straightness

If your glue at the top fibre rods has dried, check if your wing part is still straight! You can add temporary add the motor mount of course for simplify this step.



It is very important that the bottom of the foam (1.) and the back side (2.) are completely straight!

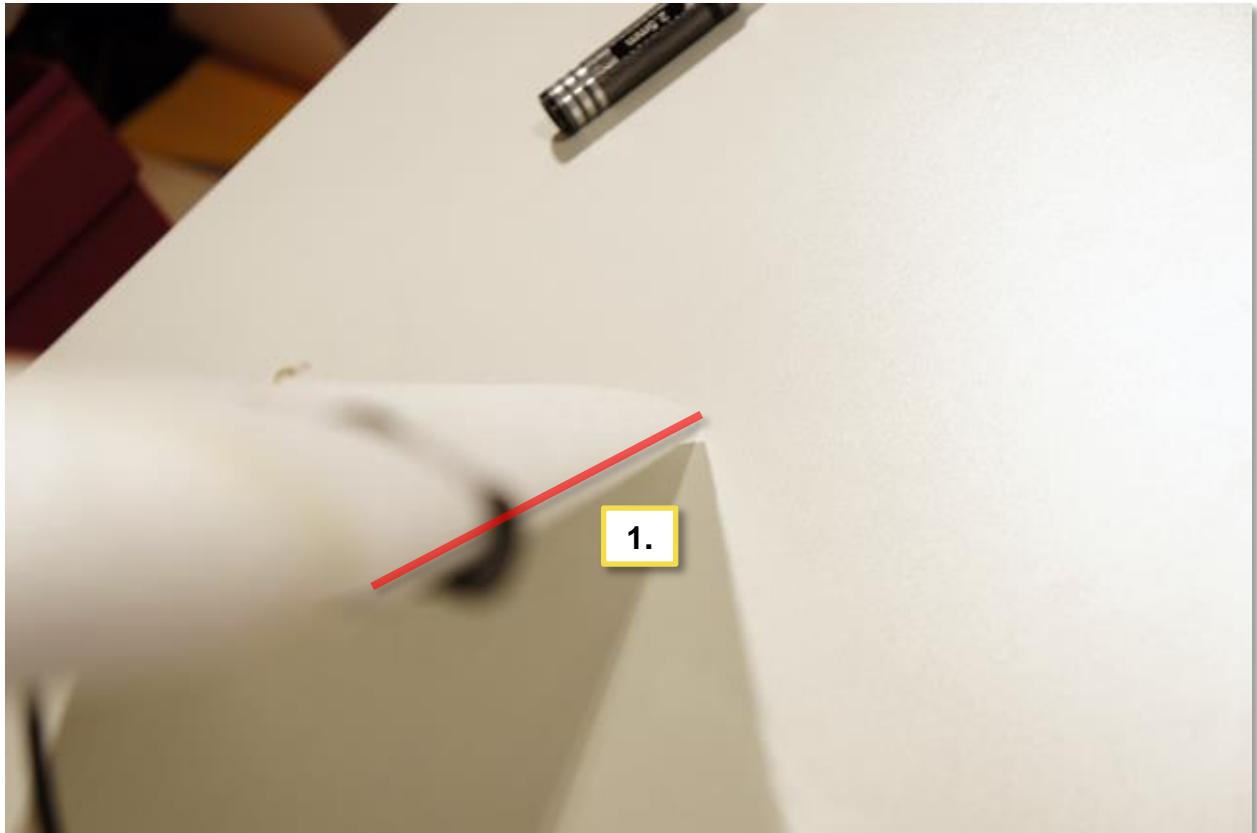




# HAPPY

# FLYERS

Now check the same thing at the top side of the wing (3.)!



If one of the two wings is bent or not completely straight, you can correct this now by bending by hand (needs a bit power). But still be careful not to break anything!

***Do not continue until your two foam parts are completely straight!***



# HAPPY

# FLYERS

## 6.5.4

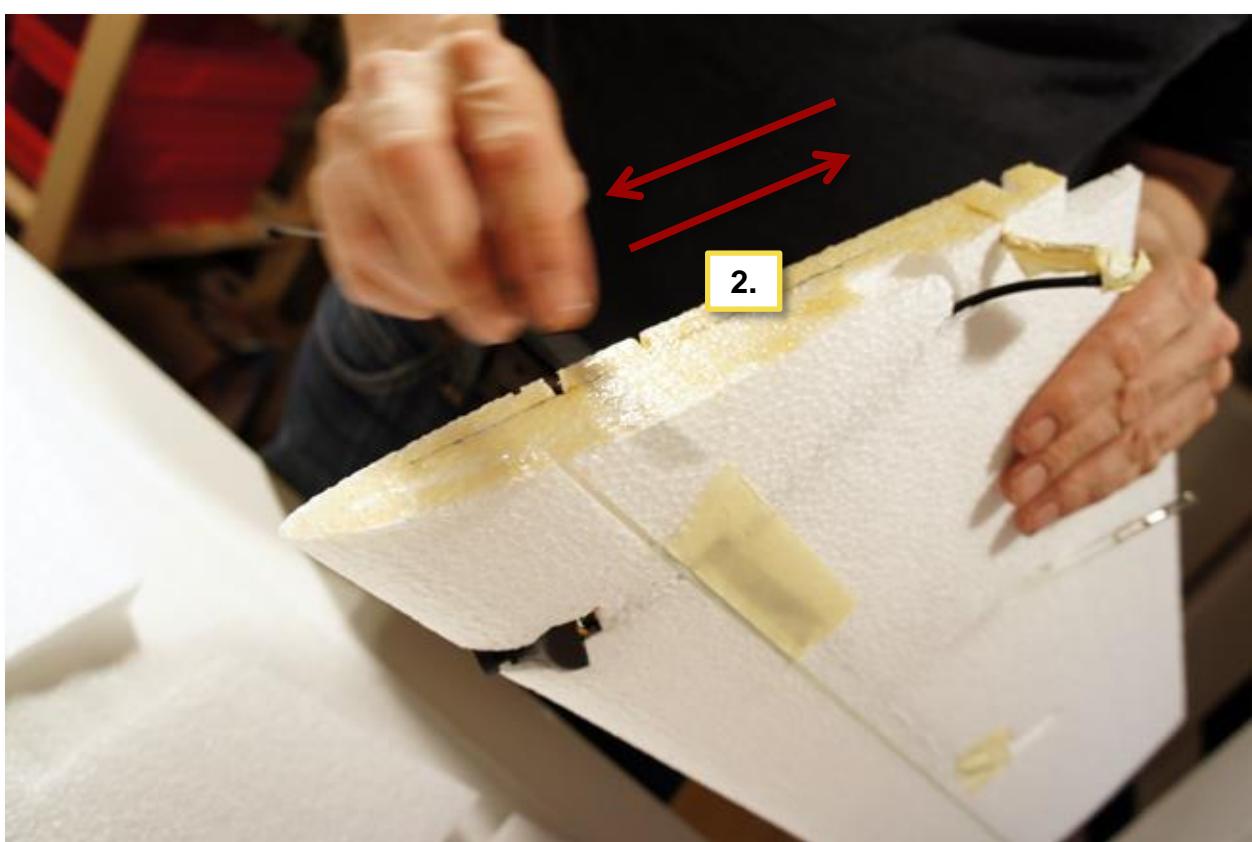
## Foam and motor mount

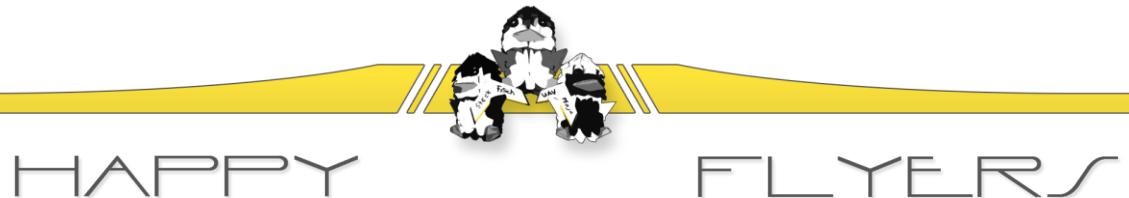
Ok, now it's time to glue this together! Take your Gorilla glue and start with one of the foam parts.

***Work fast here! Gorilla glue will start getting hard soon!***



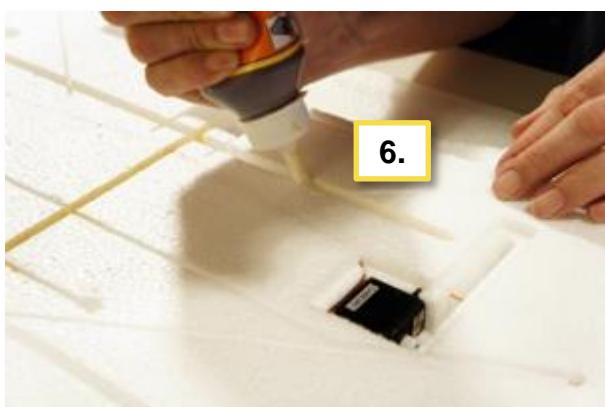
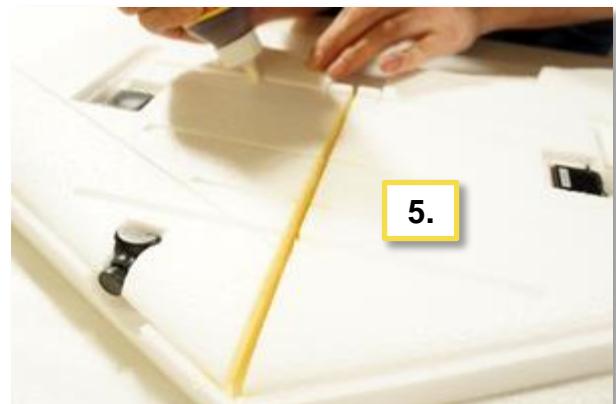
1. Add some Gorilla glue in the inner part of the foam. Don't use too much glue!
2. Roll the glue evenly with a cable tie or something similar. Only left a thin layer of the glue!





# HAPPY FLYERS

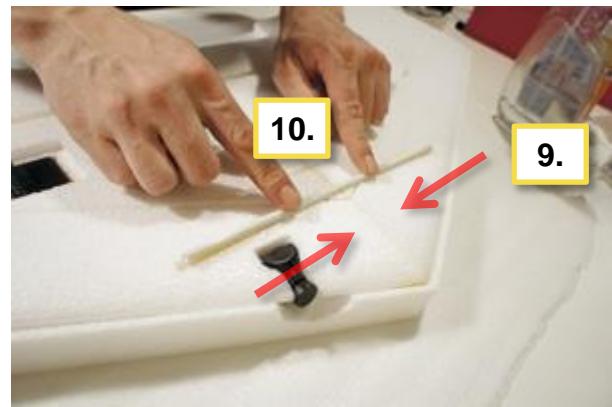
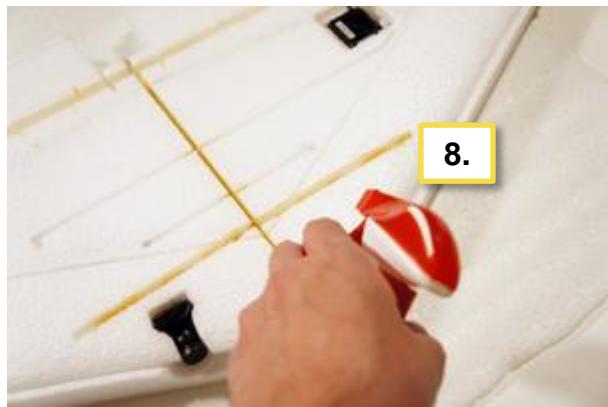
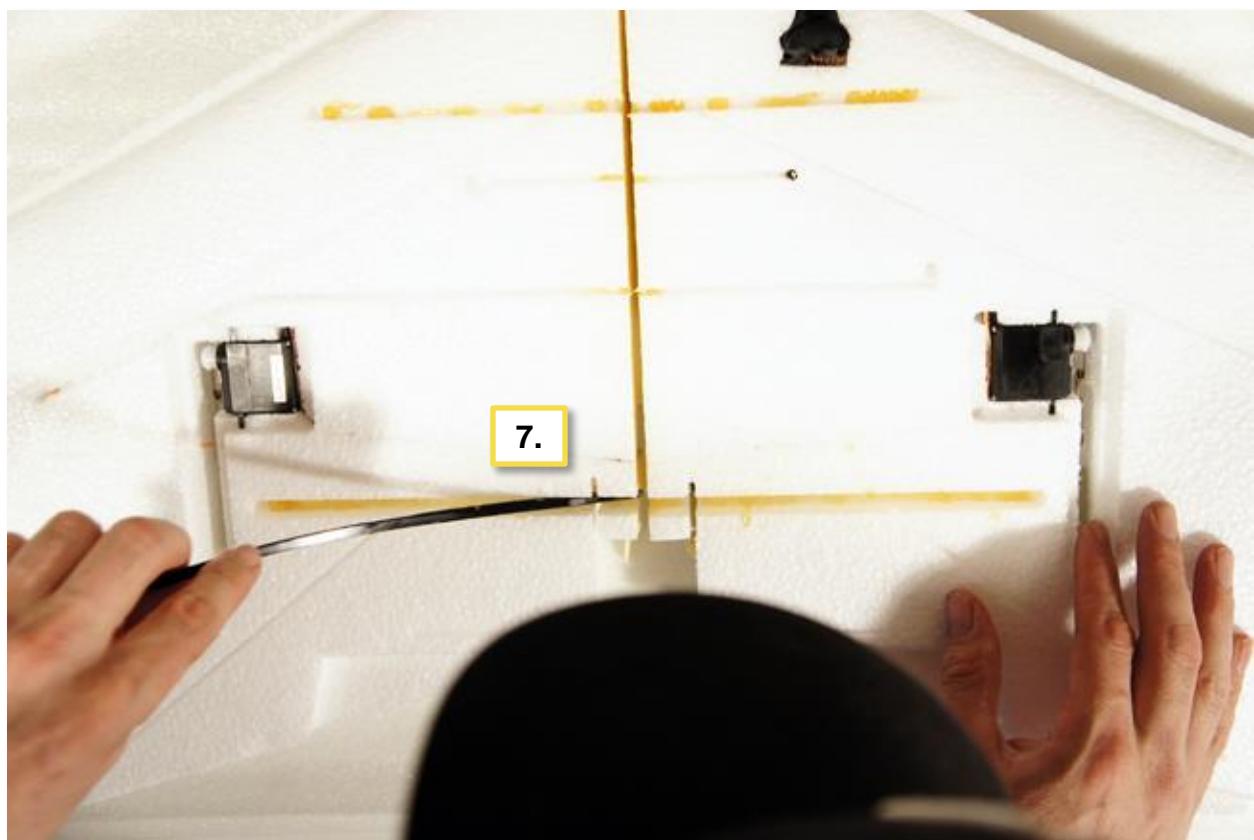
3. Repeat step 1 – 2 for the other foam part.
4. Now add a little water to the glue for each of the foam parts. This step is optional. It will also work without water but will take much longer!
5. Lay down your two foam parts upside down into the foam negative. Again be sure to align it at the top!
6. Add some Gorilla glue into the premade cut-outs for the 8mm and the 6mm fibre tube.  
**Add not too much glue! It will expand during drying!**





# HAPPY FLYERS

7. Take again a cable tier and spread the glue into the cut-outs.
8. You can add some water to the cut-outs, where you just appended some glue. This is also optional.
9. Push the two foam parts together by hand.
10. Push the 6mm fibre tube at the top of the foam into the cut-out.

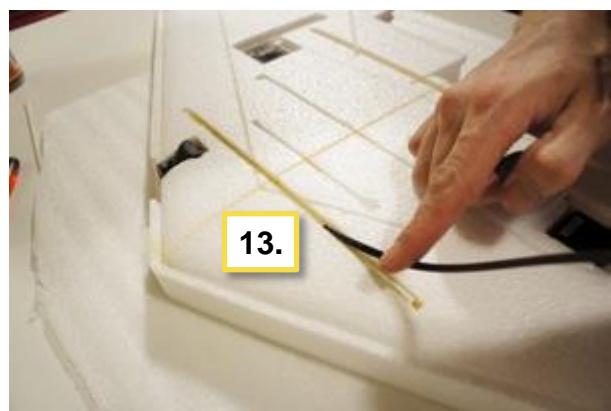
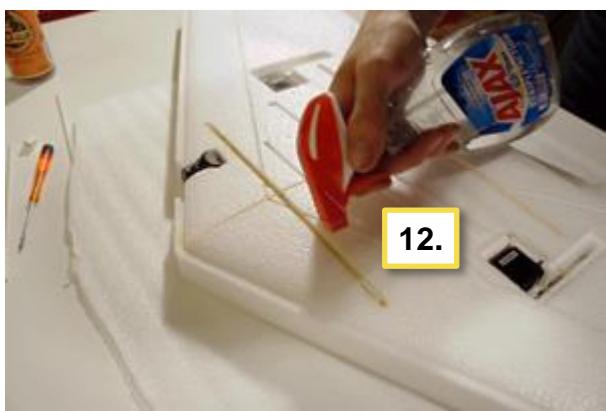
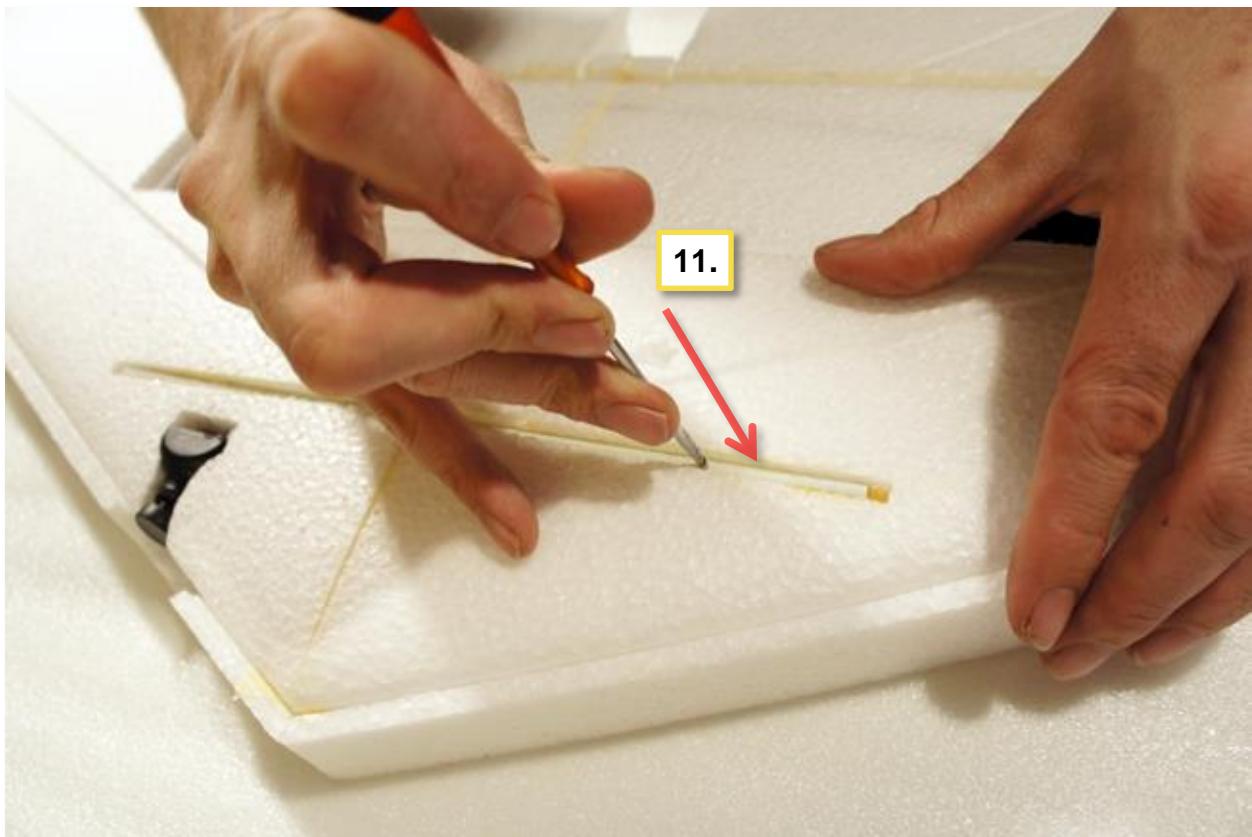




# HAPPY

# FLYERS

11. Take a screwdriver or any similair tool to push the tube into to the cut-out to the stop.
12. Add again some glue at the cut-out where now also the fibre tube is locatet in (water again optional).
13. Spread the glue again and also mix the water into it.





HAPPY

FLYERS

14. Now take the two 500mm fibre rods and glue it exactly the same way into the foam like described in the last **chapter 6.5.2** (Wing stiffening).

**Pay attention!** These two rods will cross the 6mm fibre tube we just glued in!



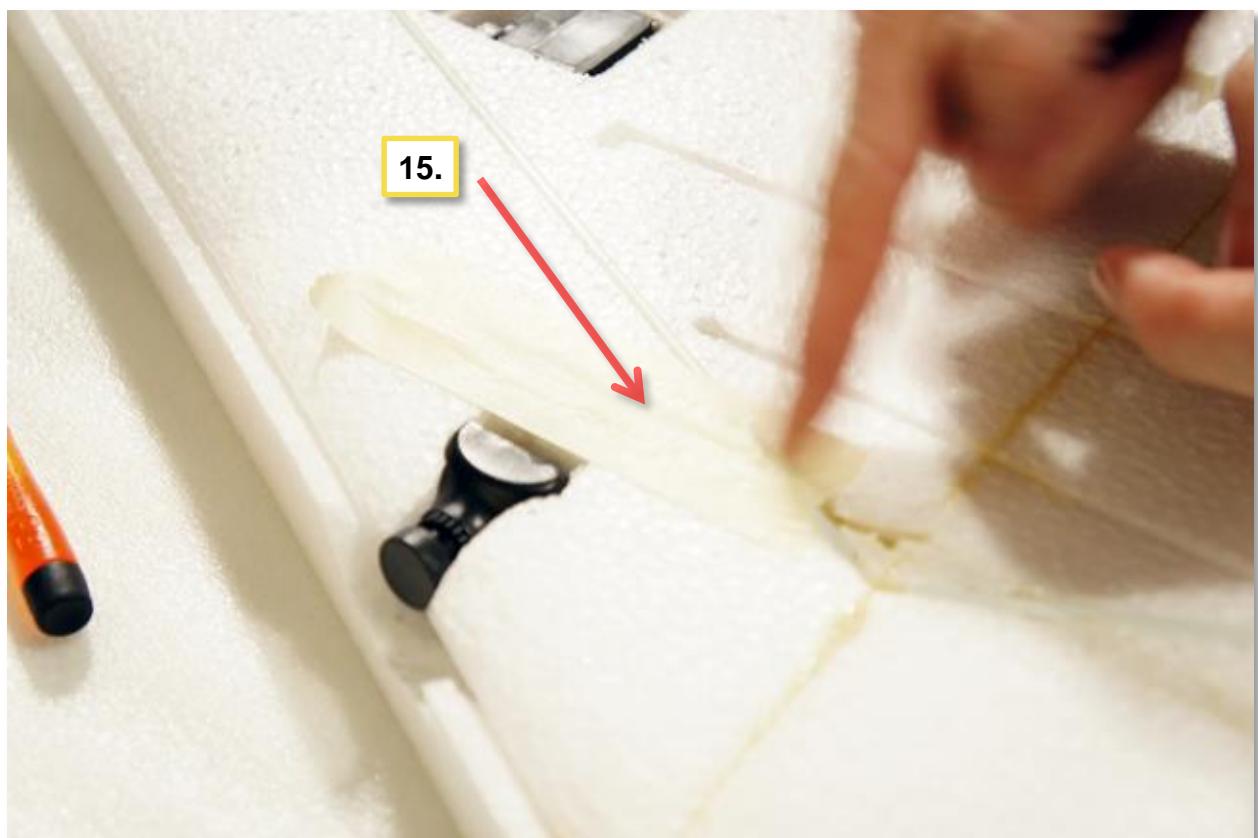


# HAPPY

# FLYERS

15. You can cover the cut-out with some painters tape.

***Better cover the cut-outs with the glue inside with some painters tape. This will help keep the glue inside the cut-out when it expands during drying!***



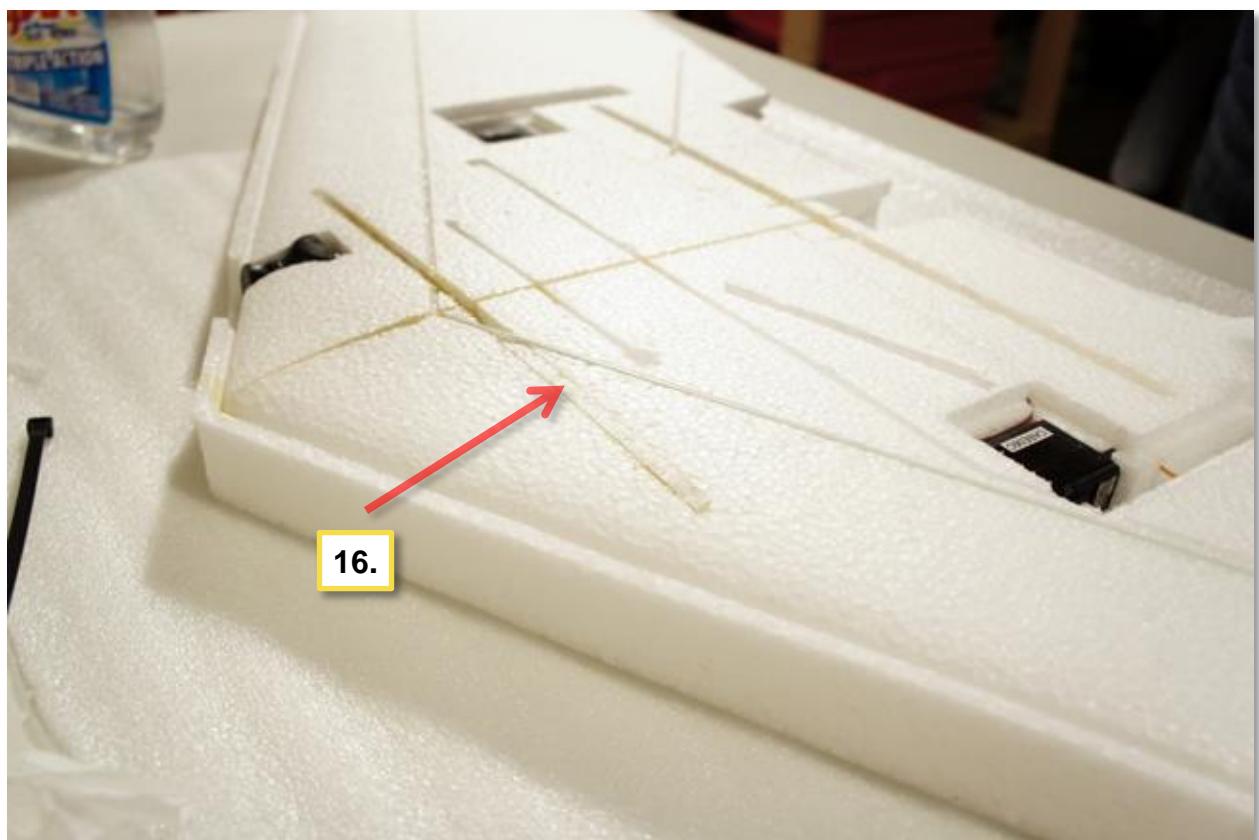


# HAPPY

# FLYERS

16. You can also cover the cut-out with some EPP material from your foam negative.

***It is only recommended for advanced users to cover it with some EPP since you need to sand much more later!***





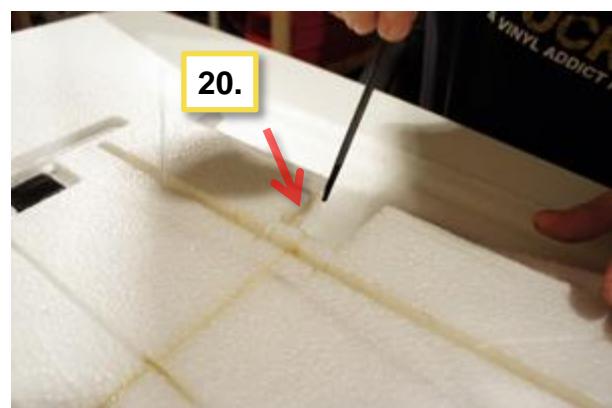
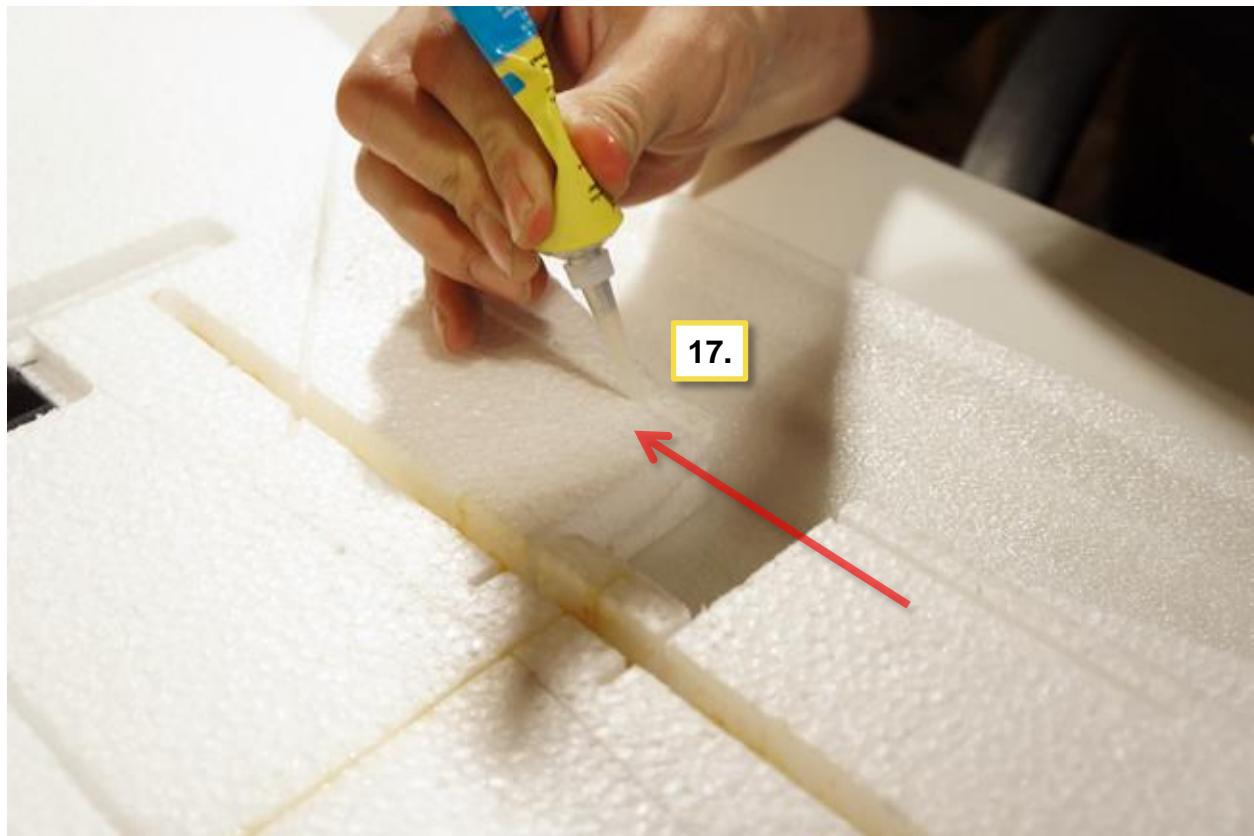
# HAPPY

# FLYERS

17. Add some slow drying glue (like UHU hard) to the bottom pre-made 3mm cut out. Here the motor mount will fit later.

18. Add some Gorilla glue at the cut-out for the motor mount

19. Roll the glue there evenly with a cable tier.





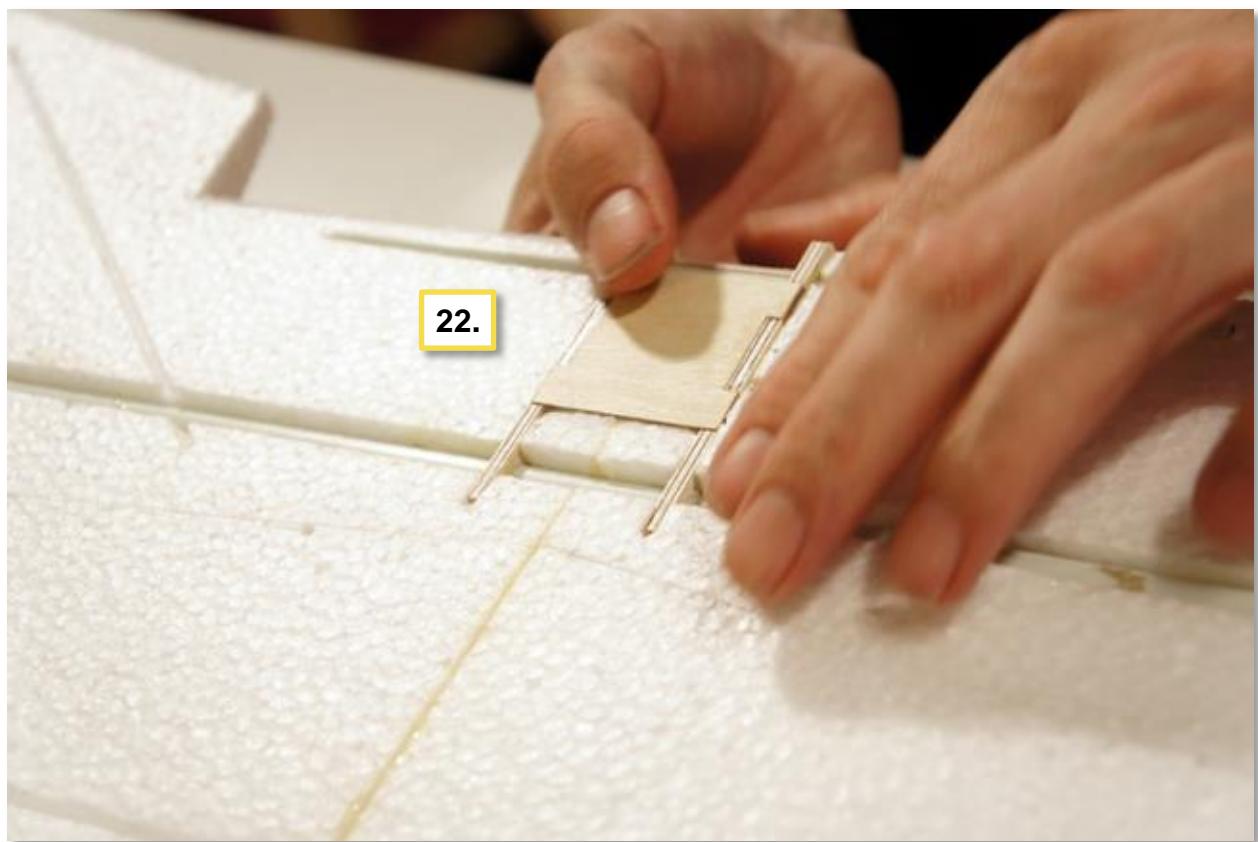
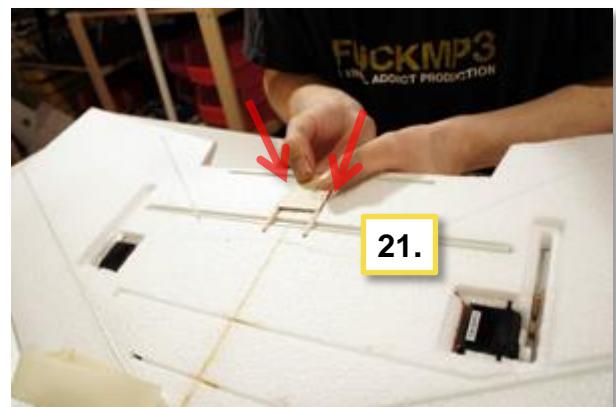
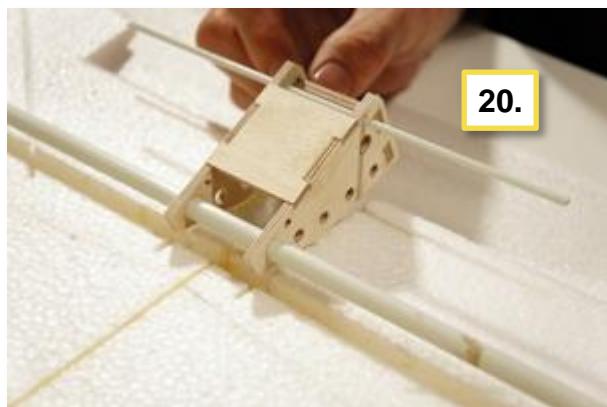
# HAPPY

# FLYERS

**20.** Now push the complete assembled motor mount into the cut-out!

**21.** Push it at the borders carefully. Do not use excessive force here to prevent the wing bending.

**22.** Level the motor mount to the bottom surface of the foam.

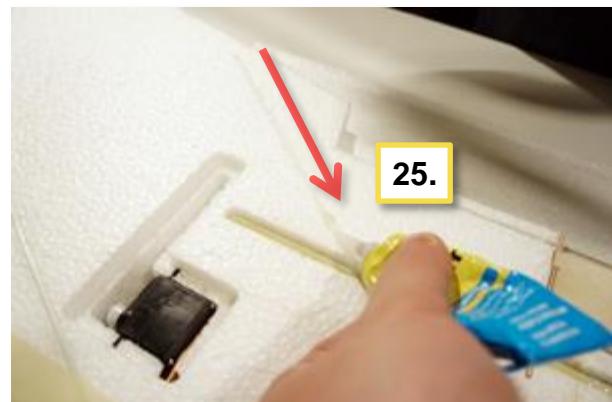




HAPPY

FLYERS

23. Your inserted motor mount should now look like this. Don't pay attention to the EPP covers in this picture. There are optional at all and are only well-looking.
24. Now we start preparing the wing for drying. Add some painters tape on the bottom side for pulling the two foam ports together. You can use a little bit force here. We will stretch up the other side later.
25. Add again some slow drying glue (like UHU hard) to the two short fibre rods at the bottom of the wing.





# HAPPY

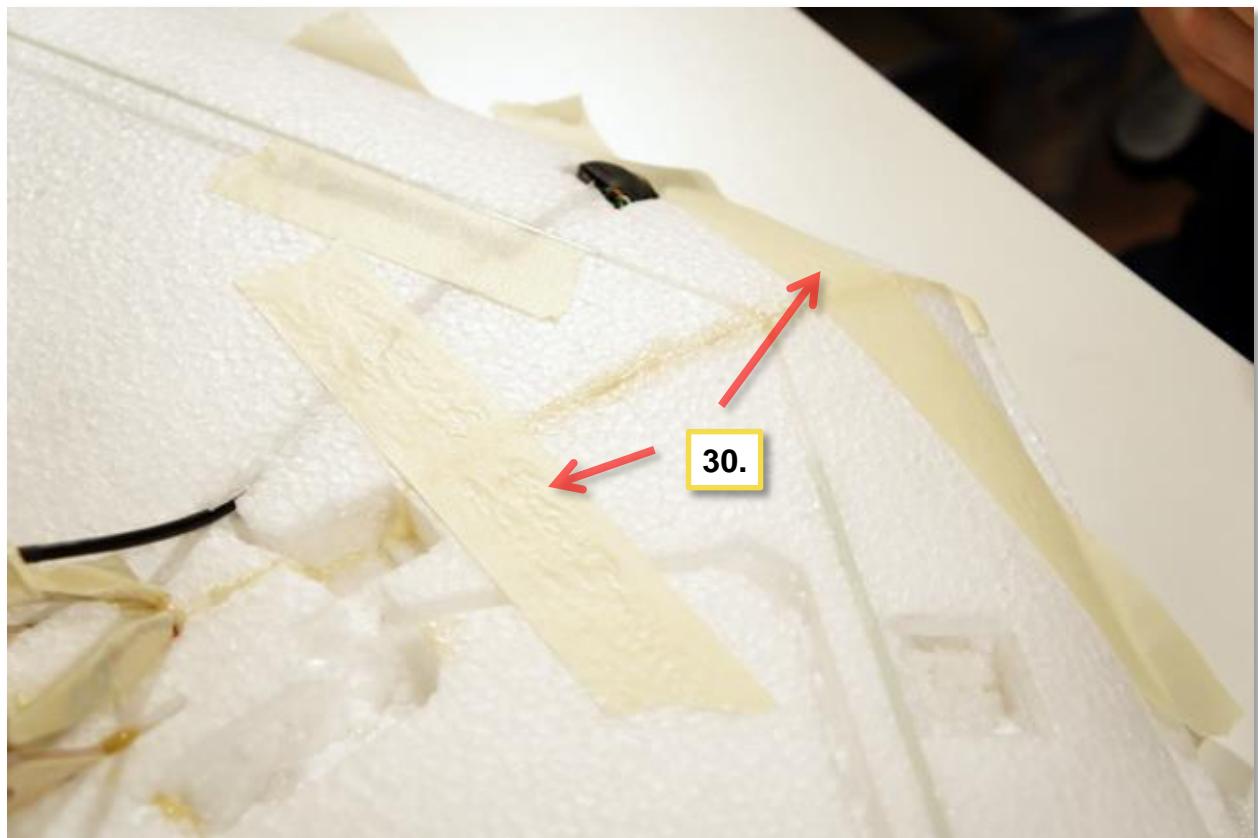
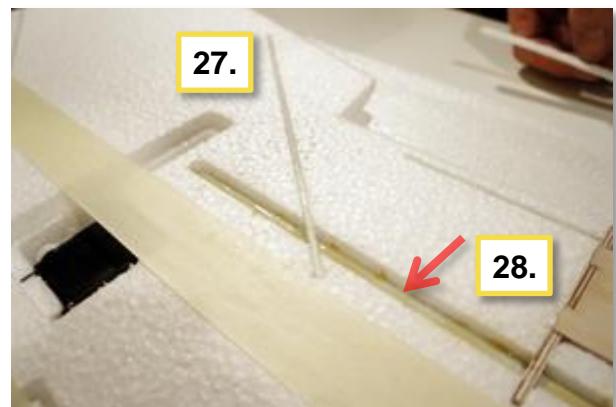
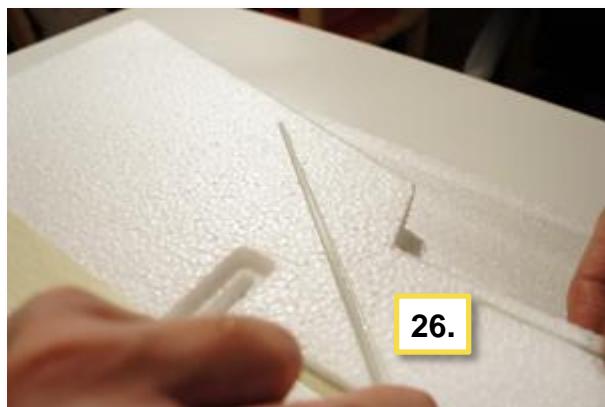
# FLYERS

26. Take the two 250mm fibre rods and add them to each of the foam part.  
**Pay attention!** This two rods will cross the 8mm fibre tube we just glued in.

27. This should now look like this.

28. Add a little Gorilla glue into the cut-out where now the 8mm fibre tube is located in. You can add a little water also.

29. Take the other foam negative because we turn around the wing now.

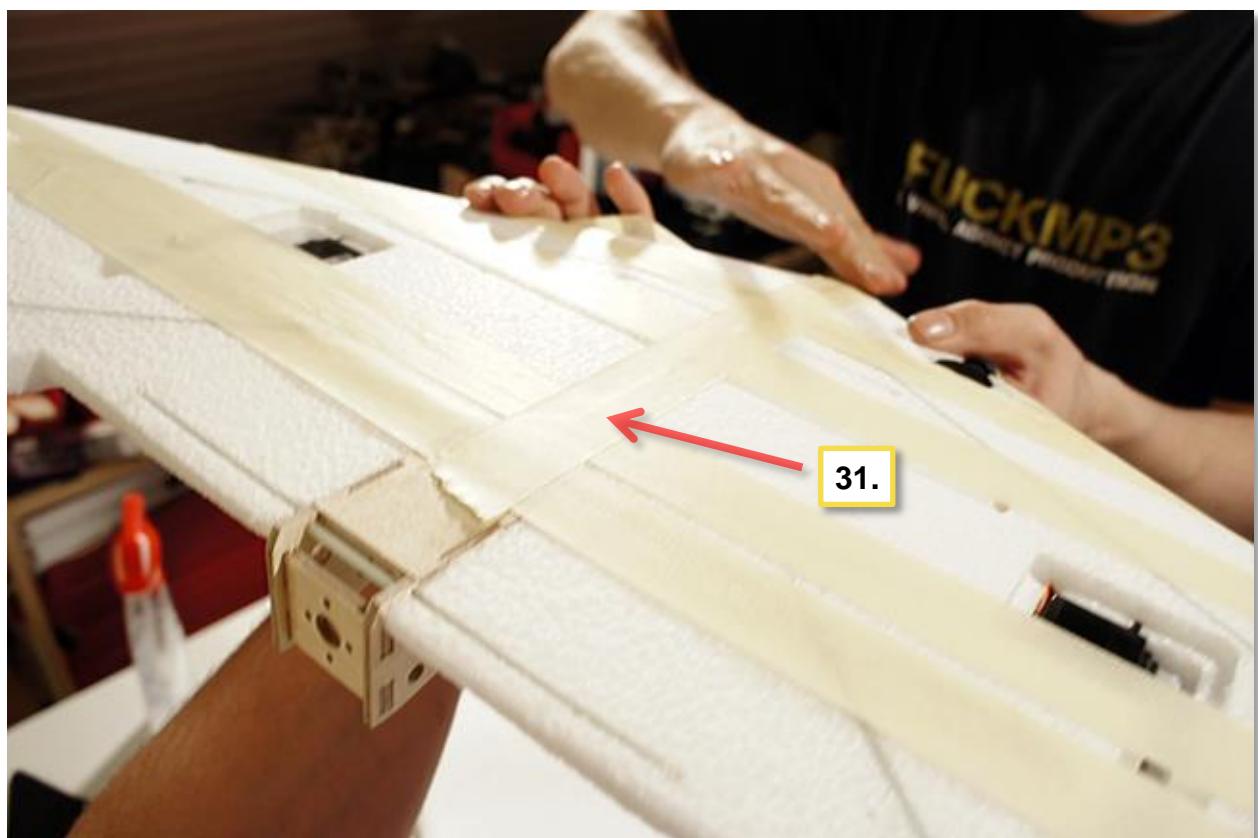




HAPPY

FLYERS

30. We now also stretch some painters tape at the top of the foam to prevent movement during drying.
31. Add some painters tape also along the middle part of the foam. This will prevent the glue a bit from expanding.
32. You should now be ready for weighting and drying your wing.



### 6.5.5

### Weighting and drying

Take your bottom foam negative and lay down the wing on the bottom side into the foam negative (so you don't see the servos).

It is very important, that you verify the Wing itself fits absolutely straight and correct into the foam negative (1.). Because now we are adding some serious weight to the foam!



You can take here whatever you want (water bottles, bricks, weights etc.). About 1 - 2 Kg per marked point (2.) in the picture below should working good.

***Let it dry for approx. 3 – 6 hours (depends on how much water you used).***



After the glue is dry (hard), you can carefully remove the weights and the negative foam and continue with the next step!



# HAPPY

# FLYERS

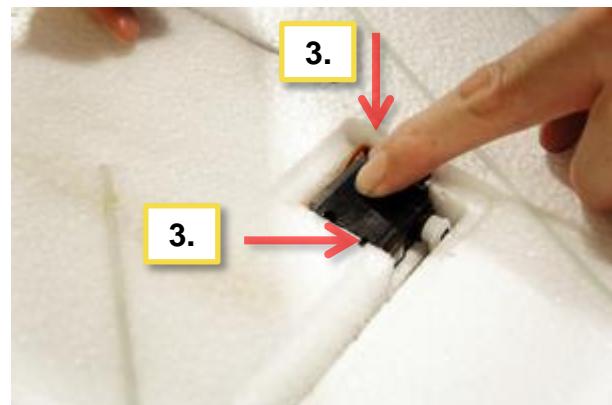
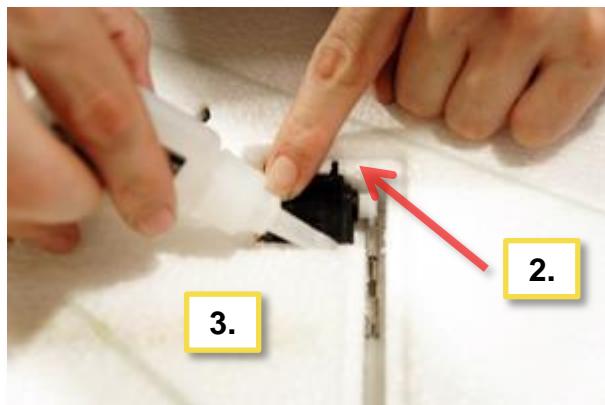
## 6.5.6

## Servos

You can work with super glue for stick your servos in your foam. Hot glue will also work great. Landings, impacts or motor vibrations can loosen the servo!

**Be sure to doing this step right so the servo sticks very strong in his cut-out.**

1. Remove the servo from the cut-out and add some glue in the cut-out. Don't apply glue at the top side where the rudder linkage is located!
2. Push the servo again in the cut-out and be sure the servo top is level with the second cut-out surface.
3. Use super glue with low viscosity, and add a few drops at the borders of the servo.
4. Repeat step 1 – 3 for the other servo.
5. Let the glue dry!





HAPPY



FLYERS

### 6.5.7

### Glueing in GoPro mount (optional)

---

If not done yet, you need to make a cut out for your GoPro mount as described in [chapter 6.3.3](#) (Cut-out for GoPro mount).

As described there, it is extremely important to level the bottom side of the GoPro Mount with the bottom surface of the bottom foam! It does not matter that the GoPro mount will rise at the top side of the foam. Batteries and motor mount will also.

Use Gorilla glue to glue your GoPro mount into your cut-out! Verify you glue the GoPro mount straight in the flight direction. You can use the bottom surface again for levelling the direction of your GoPro mount.

After you're done, let the glue dry before continue!



HAPPY

FLYERS

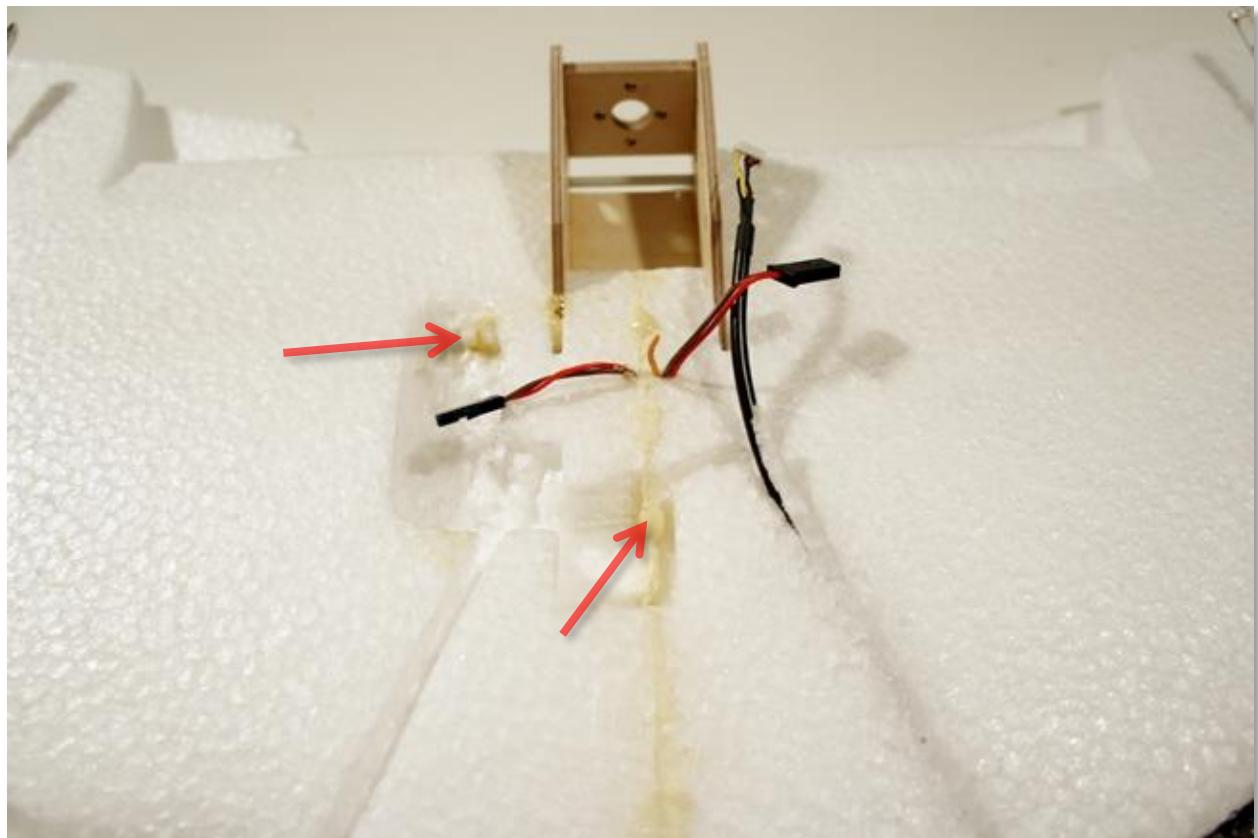
### 6.5.8

### Remove surplus glue

Since Gorilla glue expands everywhere during drying, you now have to remove the surplus glue everywhere.

On the surface itself, especially at the bottom where the fibre tubes were glued in, you can use a cutter to remove the expanded glue.

***Be careful not to damage your foam when removing surplus glue on it!***





HAPPY

FLYERS

## 6.6

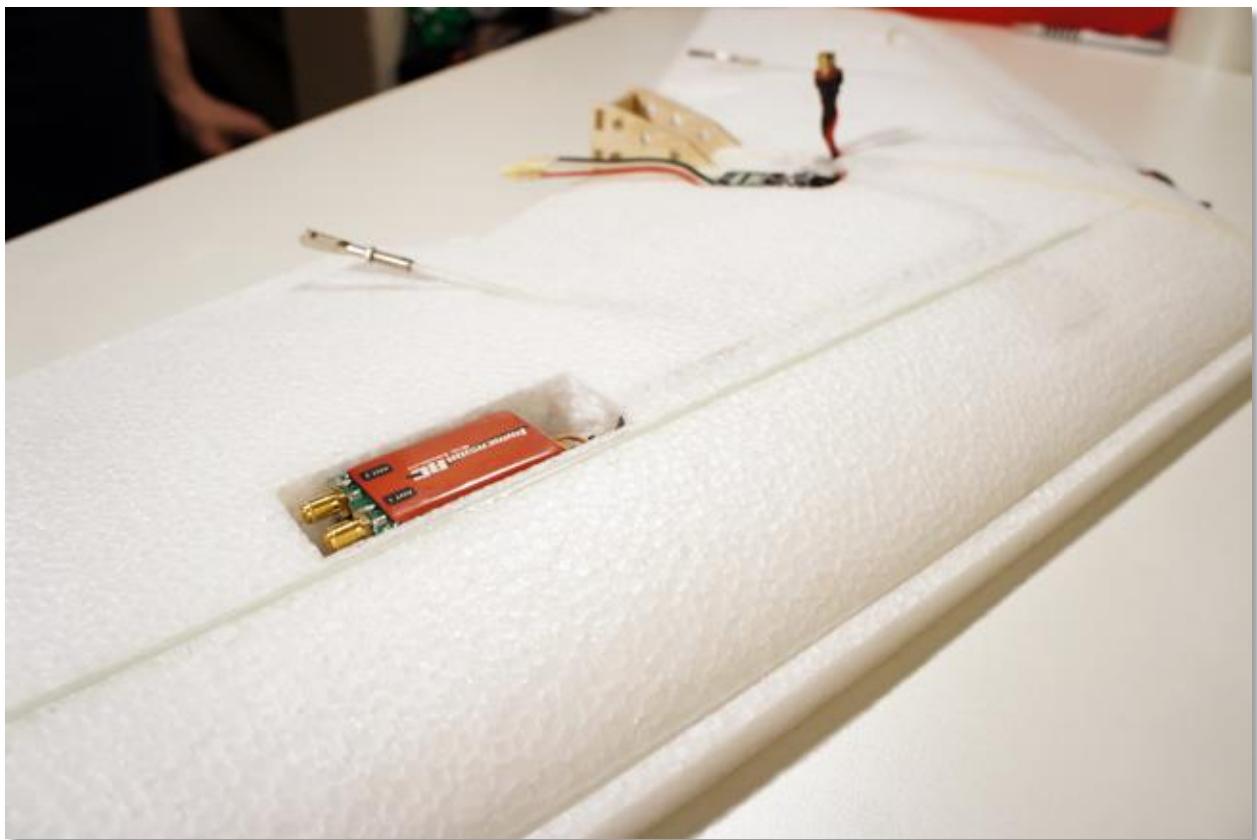
## Installation

This is a more pleasant part in this Tutorial – The Installation of your parts! Because we are just about to laminate the wing, the definitive installation of all parts is now necessary.

There is no state of the art here. Just be sure your components can't move in your cut-outs and don't fly away on hard impacts.

If you want you can use super glue to fix your electronic components like your RC Receiver, your ESC or your Video Transmitter.

***Don't use too much glue anyway! Glue = weight! And we can save weight here as well.***





If you are using a FPV camera, we strongly recommend to use super glue to stick into the foam. There is definitely no better method! Add some serious glue at the top **AND** the bottom side.

***Super glue is needed here since the FPV camera at the front is a very critical part.***





HAPPY

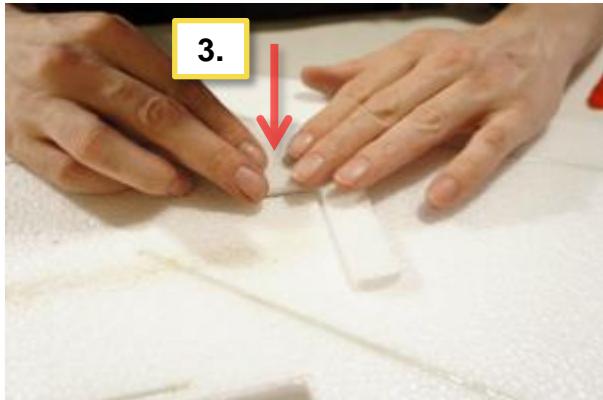
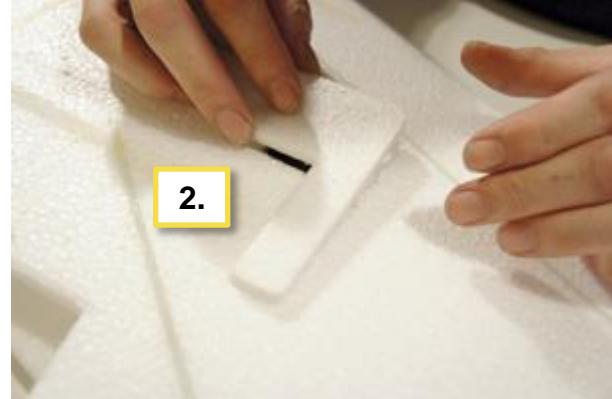
FLYERS

## 6.7 Covering and sanding

### 6.7.1 Covering servo cut-outs

We provide some very nice and precise pre-cutted servo-covers. Follow these simple steps to let these cut-outs become totally invisible!

1. Add some super glue inside the cut out where the cover comes in later. Also add some glue at the vertical borders.
2. **Be fast now!** Take the cover and begin to carefully push the cover into the cut-out!
3. Use your fingers to make the cover perfectly level with the surface of the wing. Start at the big part of the cover.
4. Continue fast with the small part of the cover.



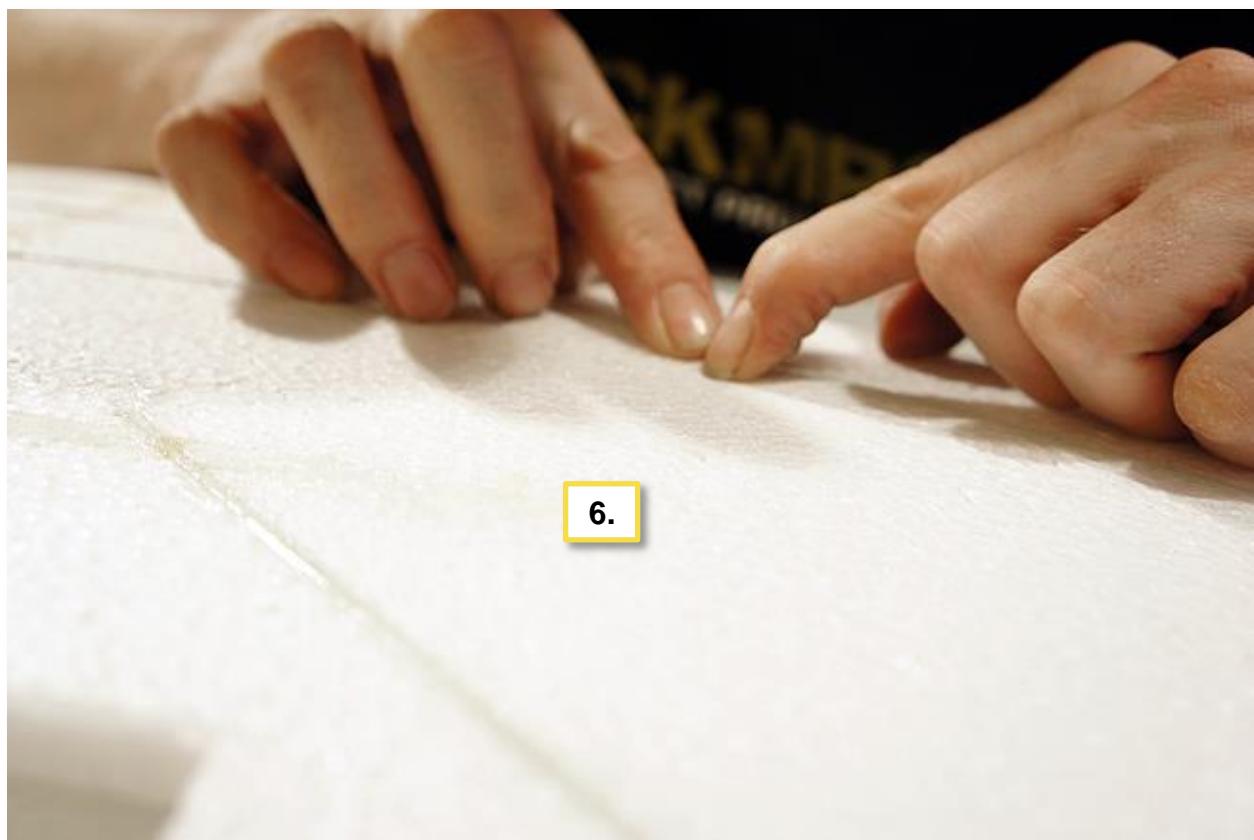


# HAPPY

# FLYERS

5. When looking on the bottom of your wing, you should now have a perfect level surface.
6. Repeat the steps 1- 5 for the other servo cover.

If something from the cover raise out a bit, don't worry! You can use the cutter or sanding paper to correct this!





## 6.7.2

## Covering cut-outs (optional)

If you have experience in cutting some EPP very precisely, you can timber yourself some very nice looking covers for every cut-out (parts, wires etc.) you have made before.

Next to the absolutely nice looking result, this will also optimize airflow and increase your flight times!

See here some impressions about this topic.

***Top view on the wing where mostly all cut-outs were covered.***





HAPPY

FLYERS

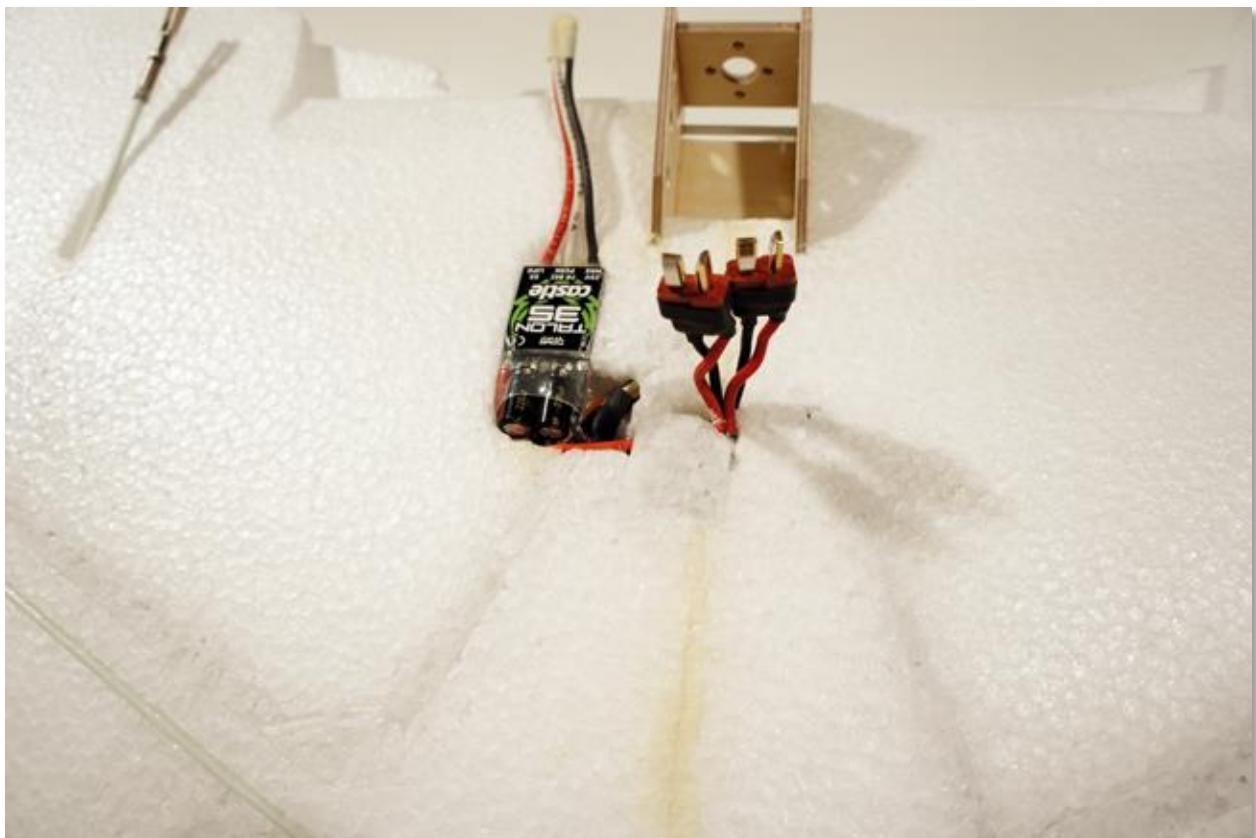
***Bottom view on the wing where mostly all cut outs were covered.***





HAPPY

FLYERS

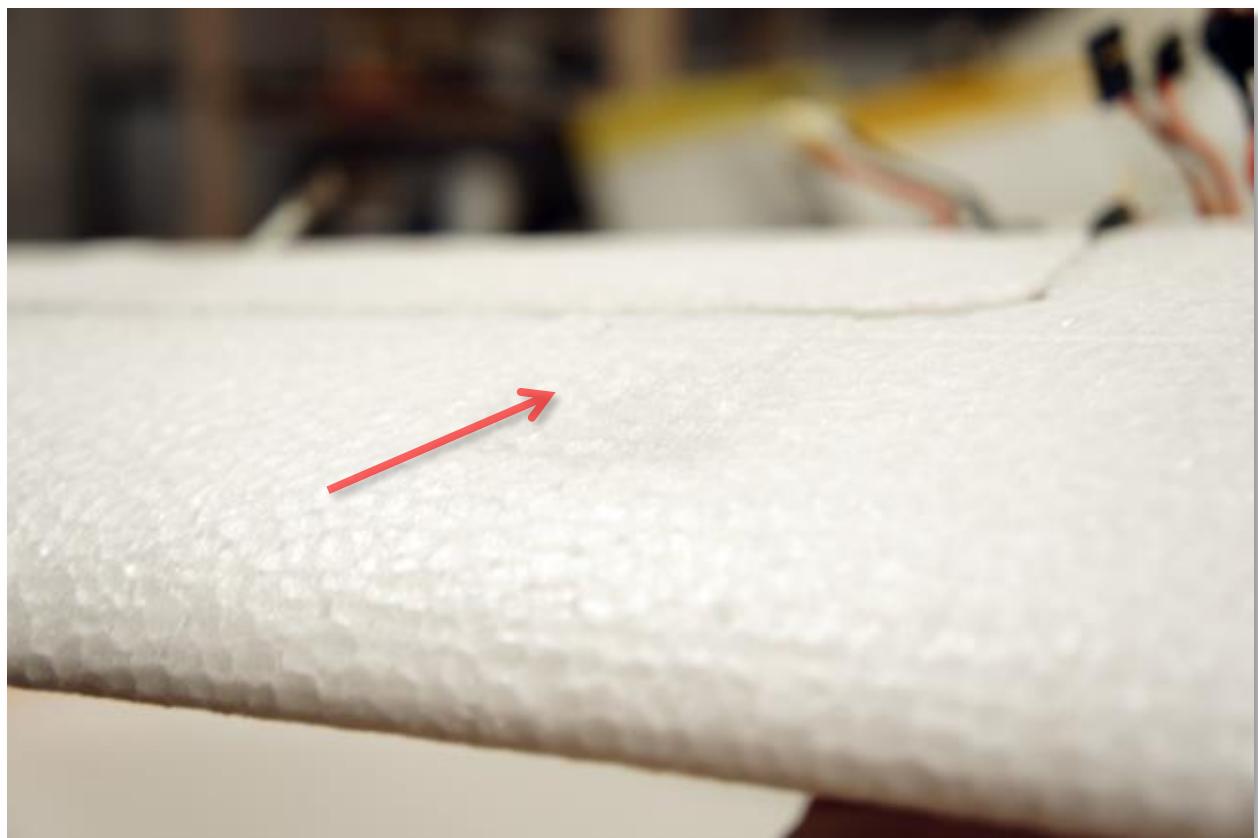




HAPPY

FLYERS

**Near invisible: There is a GPS module under this cut out!**





HAPPY

FLYERS

### 6.7.3

### Sanding (recommended)

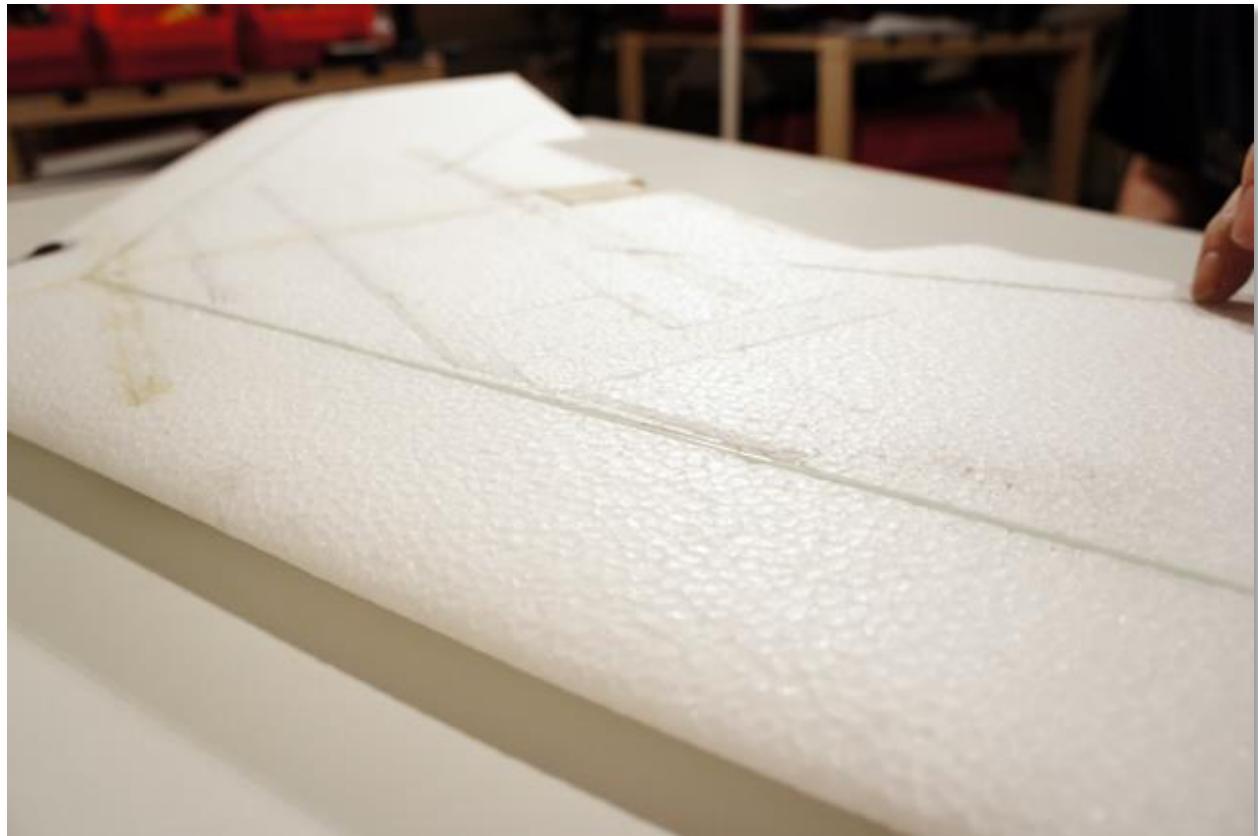
We strongly recommend using some sanding paper with strength of about 120 to soft and smooth the surface of your wing and remove any slight unevenness.

**Be careful when sanding your foam! Too fast or too strong will result in damages on the surface!**

It is always a good idea to follow the direction of the fibre rods when sanding. Feel the surface with your hand and you will recognize any unevenness. Sand your wing until everything is soft and smooth.

See here some impressions about this topic.

***A perfect sanded surface. You will be rewarded with great flight times!***





HAPPY

FLYERS

*A closer look the one of the fibre rods. You also can see a servo cover in the back.*





HAPPY

FLYERS

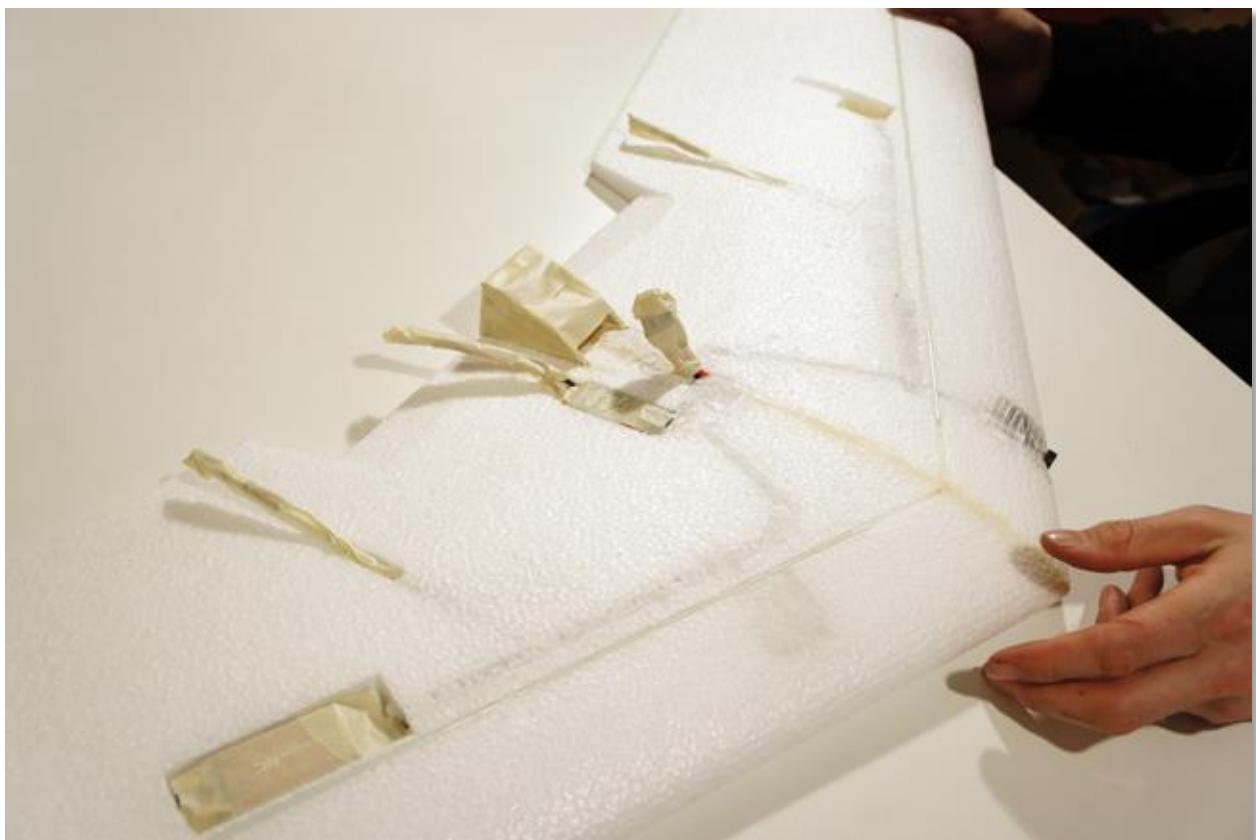
## 6.8 Laminating

Some like it, some not. But laminating your wing will result in much better durability, stiffness and last but not least better aerodynamics which – yes you got it – will also result in longer flight times!

### 6.8.1 Covering critical parts

So we are going to spray some glue on our wing. Before we can do that you need to cover every part which is not made from EPP with some painters tape.

***A completely with painters tape covered wing – ready for the spraying glue.***





## 6.8.2

## Spray glue

Take your spray glue and your prepared wing and go outside or to a location were nobody cares about glue on the ground.

**Don't use too much spray glue! Distribute the glue evenly while spraying! Always keep enough distance from the spray to the foam (approx. 20-25cm should work well).**

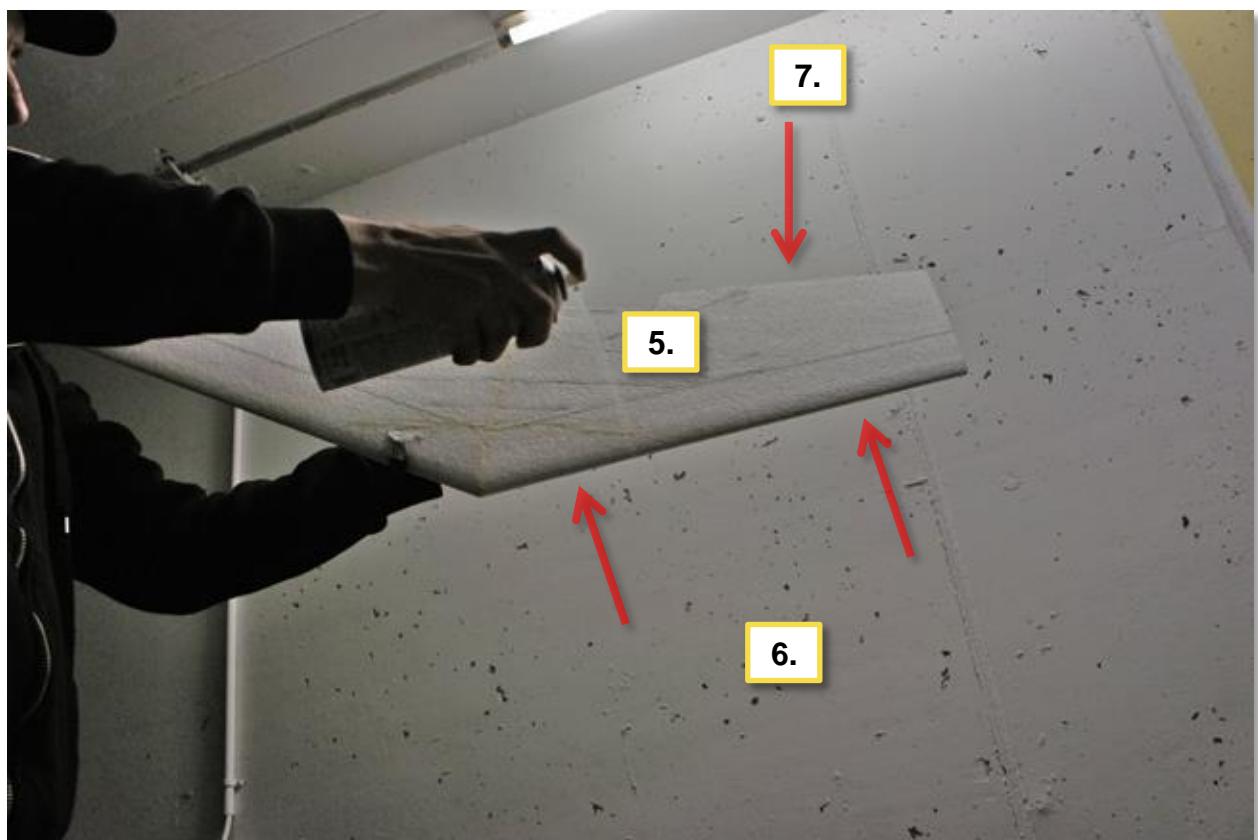
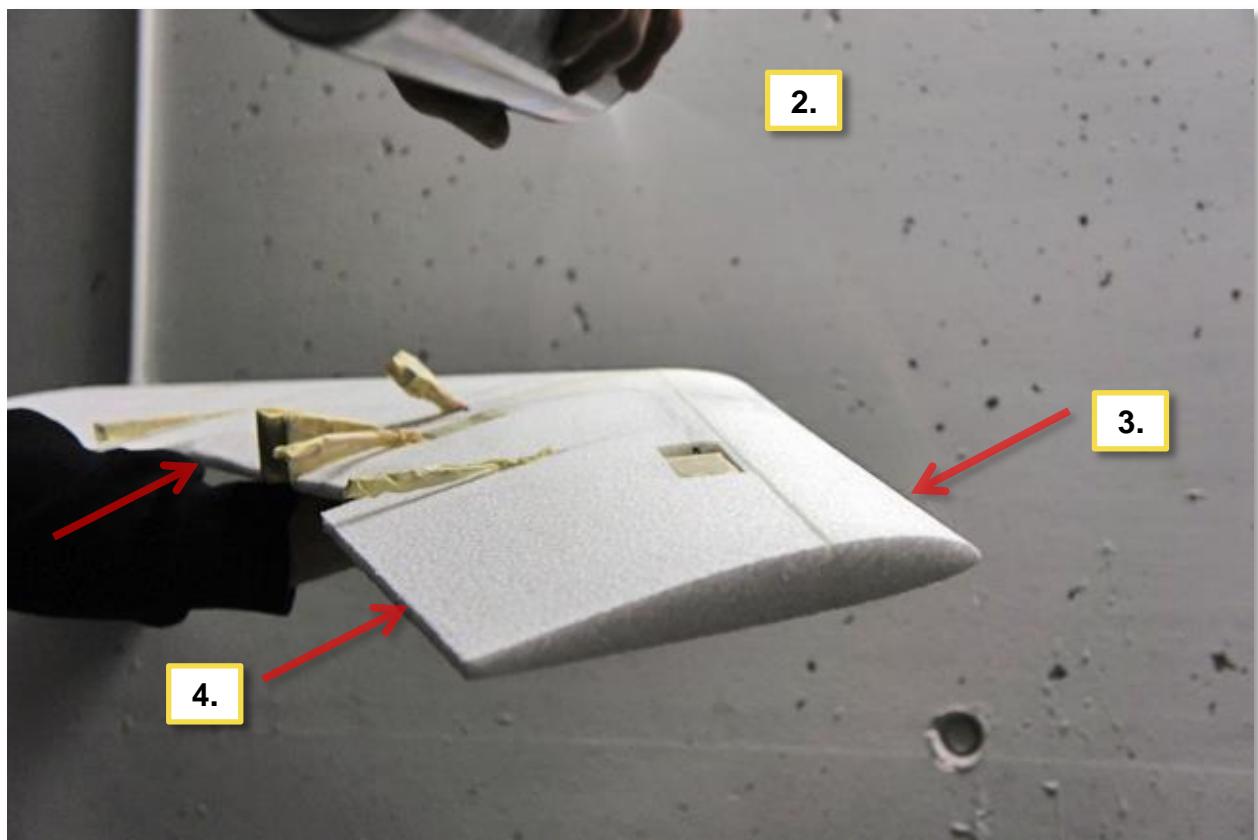
1. Shake your spray glue very well before starting!
2. Hold your wing at the motor mount and start spraying the top of the wing.  
**Attention!** Do not add some glue inside the outer profile, where the winglets are located later! Leave them clean!
3. Be sure to add glue at the front border.
4. Add glue also at the back borders of the wing.





HAPPY

FLYERS





# HAPPY

# FLYERS

5. Turn around the wing and continue spraying on the back side.
6. Also don't forget the top borders.
7. Add some glue at the back borders too.
8. Your wing should now be covered well and evenly with spray glue.





HAPPY

FLYERS

9. Lay down your wing upside down on a **clean** surface and let the spray glue dry for about 15 – 20 minutes.





## 6.8.3

## Laminating

Prepare your laminating tool and setting the temperature to about 130 – 140°.

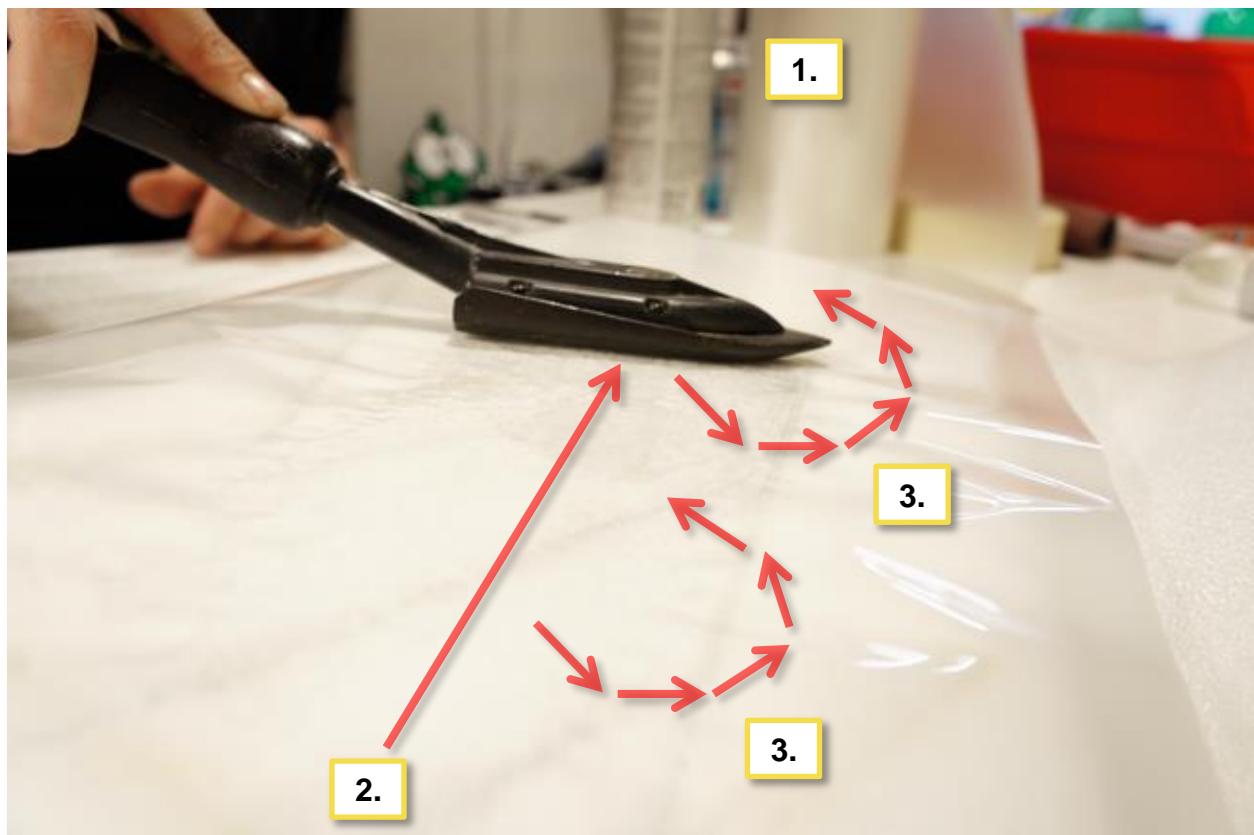
We provide more than enough laminating foil in our wing kit. It is also width enough so you can use one 1m piece to cover a complete side of your foam.



**Don't use multiple layers of the laminating foil if possible. Of course there will be some parts where the foil overlaps the other but don't cover a complete site twice for example!**

Let's start laminating at the bottom side of the wing.

1. Lay down the laminating foil flat on your foam so it will cover the complete side.
2. When laminating, always use the same direction. Also try to use the complete surface of your laminating tool (not only the nose for example).
3. Make some circular motions when laminating in a direction. Adjust these motions to the same directory you are laminating to.

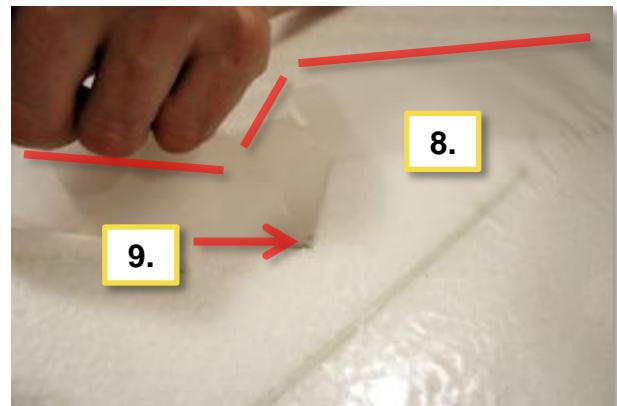
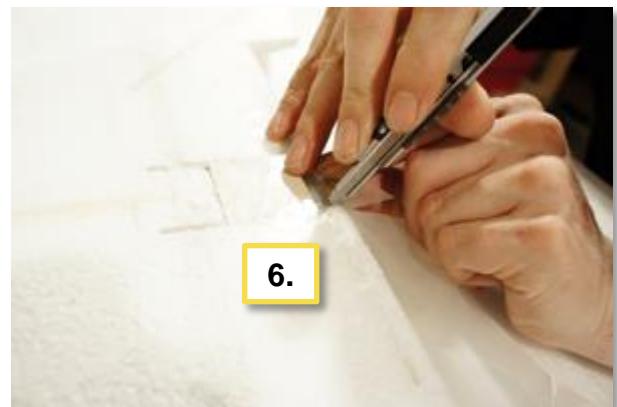




# HAPPY

# FLYERS

4. Be extra careful at the borders on your wing! Don't use any pressure here! Also don't stay long times at one point with your laminating tool or else your wing can bend!
5. Continue laminating the complete bottom side.
6. Take your cutter and make some cuts at the motor mount since we don't want the back of it to be laminated.
7. Remove the surplus foil (also at the outside of the wing where the winglets will be located later).
8. Cut the foil approx. 10 cm along every border (front and back).
9. Make some cuts at any edge at the front and at the back. This is very tricky at the front side in the middle part and, if you are using one, at the FPV camera. Be patient there!

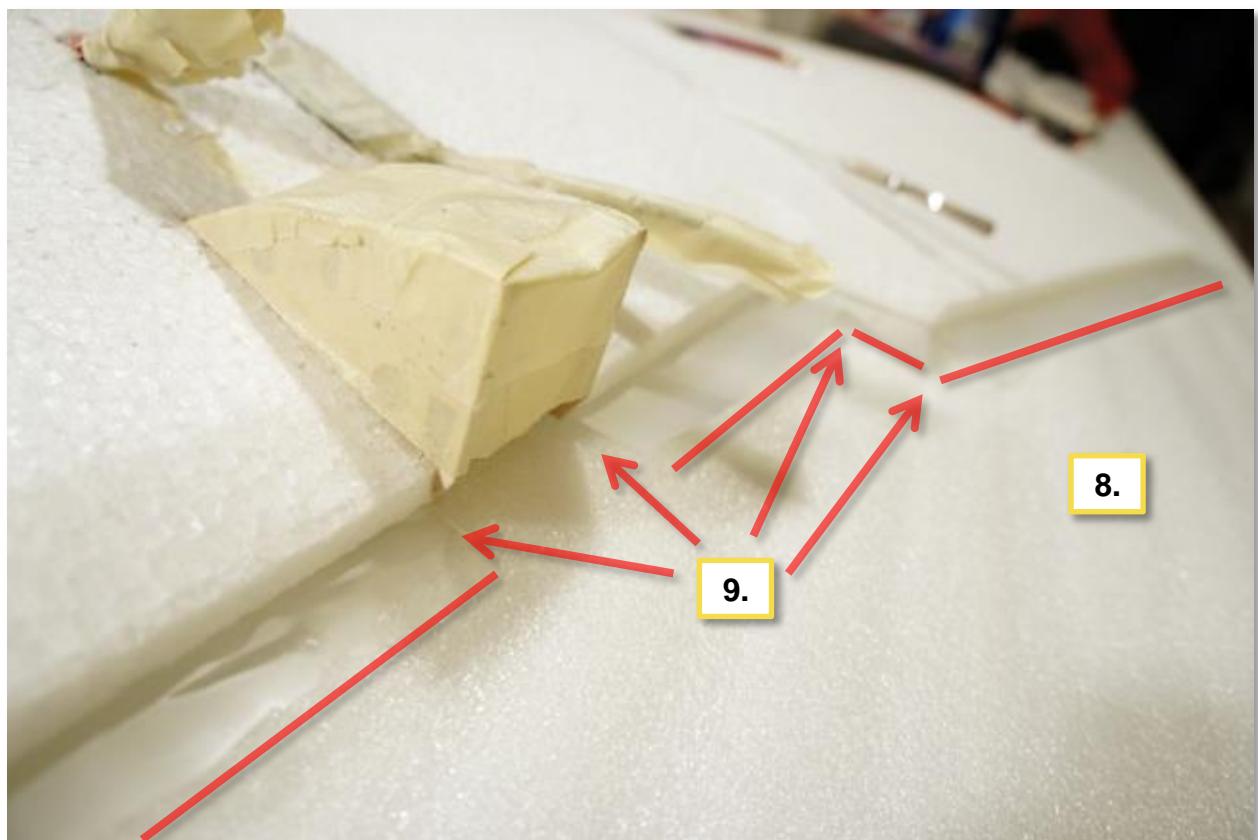




HAPPY

FLYERS

***Here you also can see the cutted foil with the cuts at every edge.***

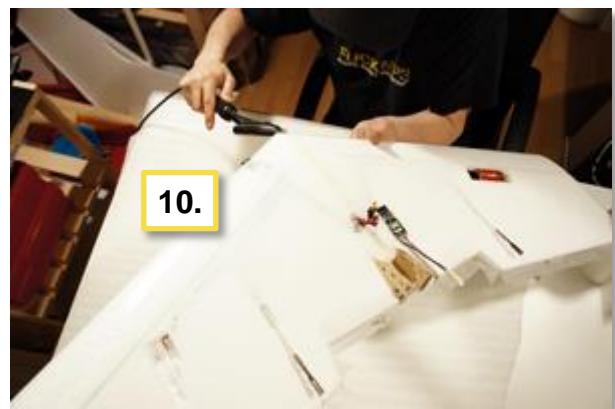
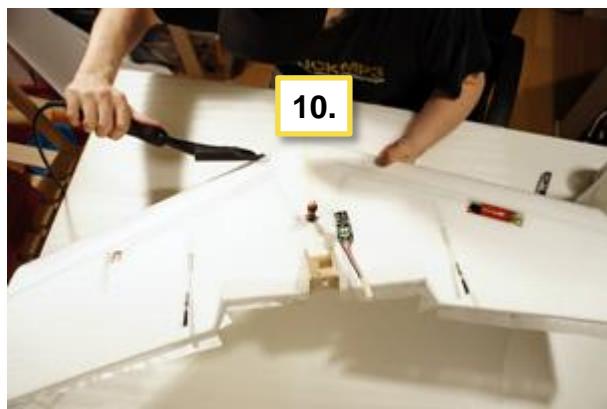
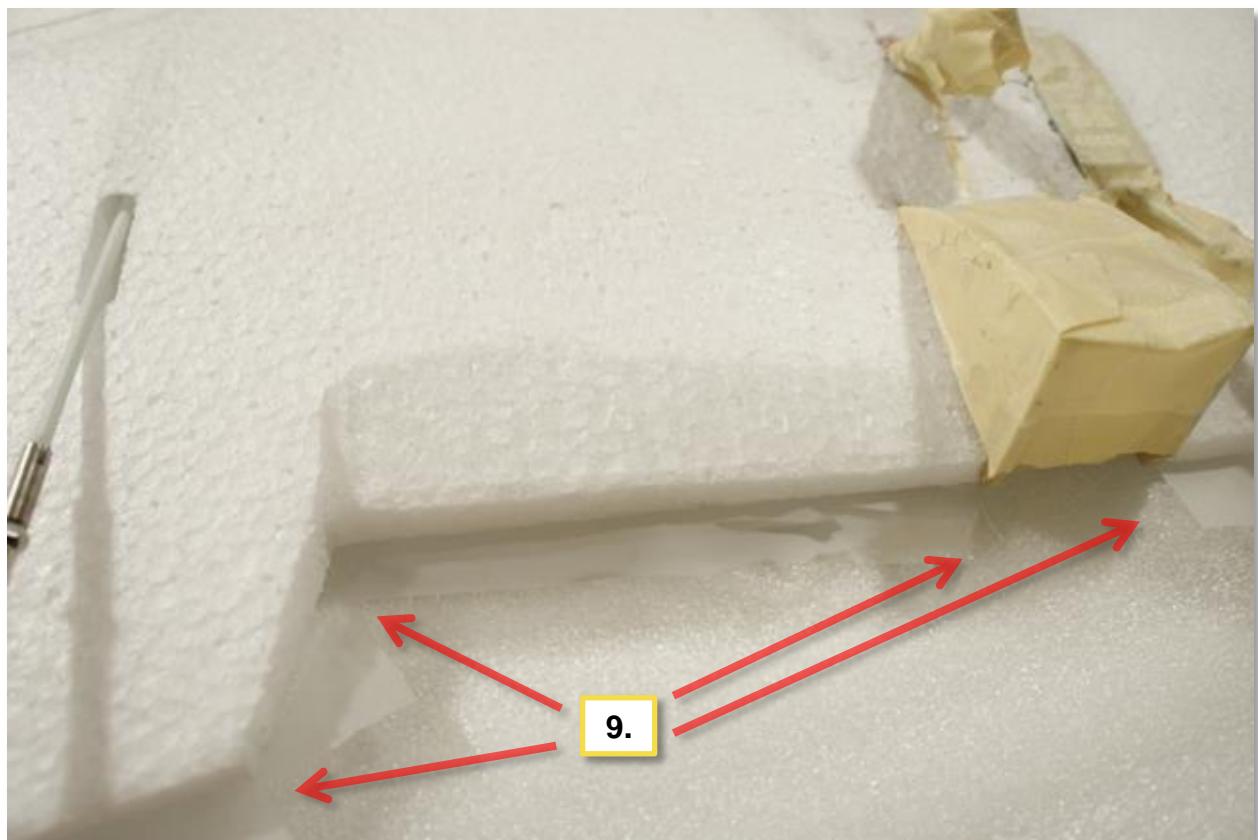




# HAPPY

# FLYERS

**Another view to the cutted foil. This should look near the same at the front of the wing!**



10. Laminating at the borders is a bit more difficult. You can work with a bit pressure here and tighten the foil around the border.



# HAPPY

# FLYERS

11. Remove all the painters tape at the top side of the wing.
12. After you are finished at the borders you can add the top laminating foil to it. Make everything exactly the same way as on the bottom side (includes the 10cm along each border).
13. You need to laminate over several parts (ESC, RC Controller etc.). That's normal! Don't use any pressure when laminating over these parts!
14. When you're done your wing should now look like this.

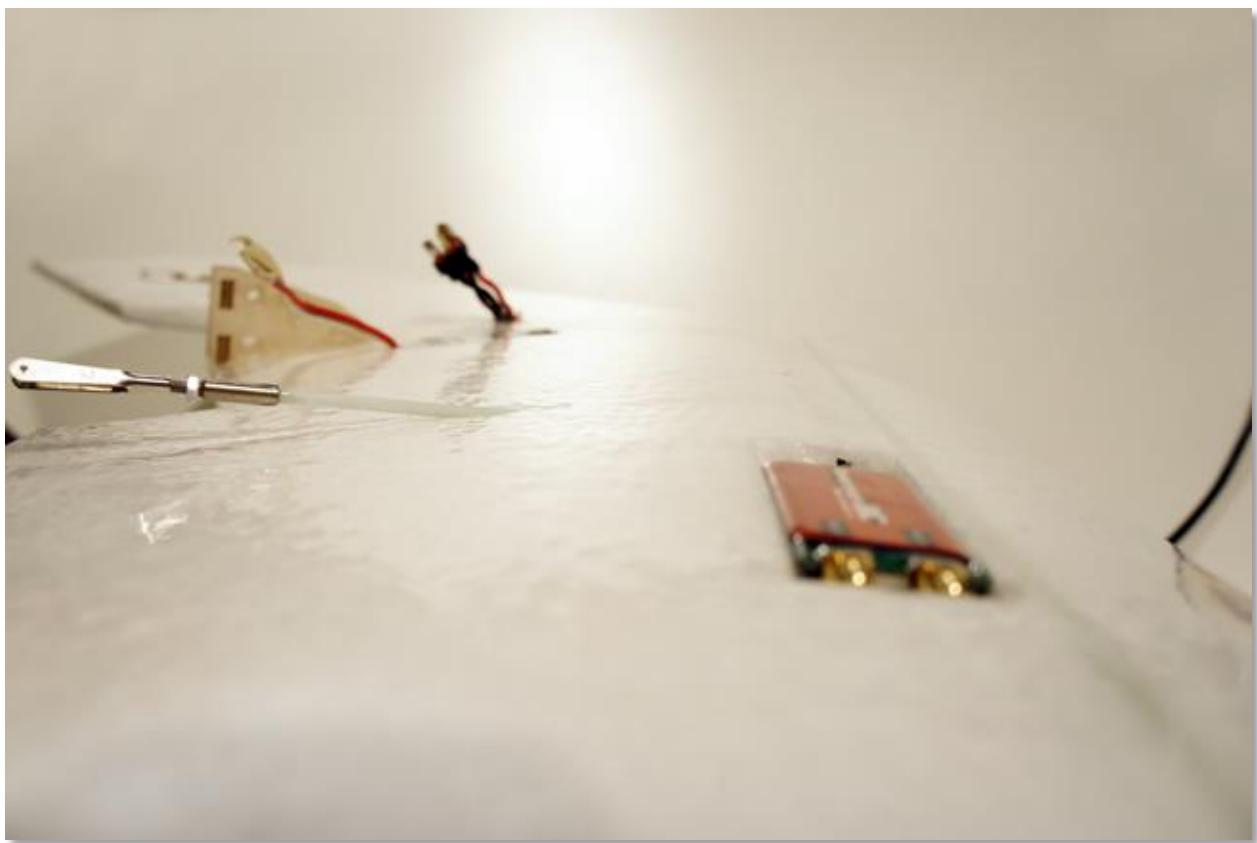




HAPPY

FLYERS

***Complete laminated wing. Looks so nice...***



**Very important!** Verify the wing has not bend! You can use the method provided in [chapter 6.5.2](#) (Wing stiffening).

If it has bend, you can correct it a bit with your laminating tool. You need to apply your laminating tool on that side, which has bend upside! Push against it with your other hand and try to bend it straight.



HAPPY

FLYERS

## 6.8.4

### Cutting surplus foil

---

Cut some surplus foil wherever you find it. For example:

- The ESC will be covered with foil – free it so it can breath
- Some foil around the motor mount can also be cutted so it will look nicer
- Free any other components you want (of course not the covered ones if you have done this)



# HAPPY

# FLYERS

## 6.9 Assembling parts

### 6.9.1 Winglets

There are two reference points for the correct alignment of the winglets. First, the pointed end of the winglet needs to fit the point of the foam (1.). And second, the bottom line of the winglet needs to be aligned parallel to the bottom surface of the wing (2.).

Glue your winglets on the foam with super glue.

***Check the correct alignment with a ruler.***





HAPPY

FLYERS

**You can add a little bit extra super glue along the border at the top and bottom side.**





HAPPY

FLYERS

6.9.2

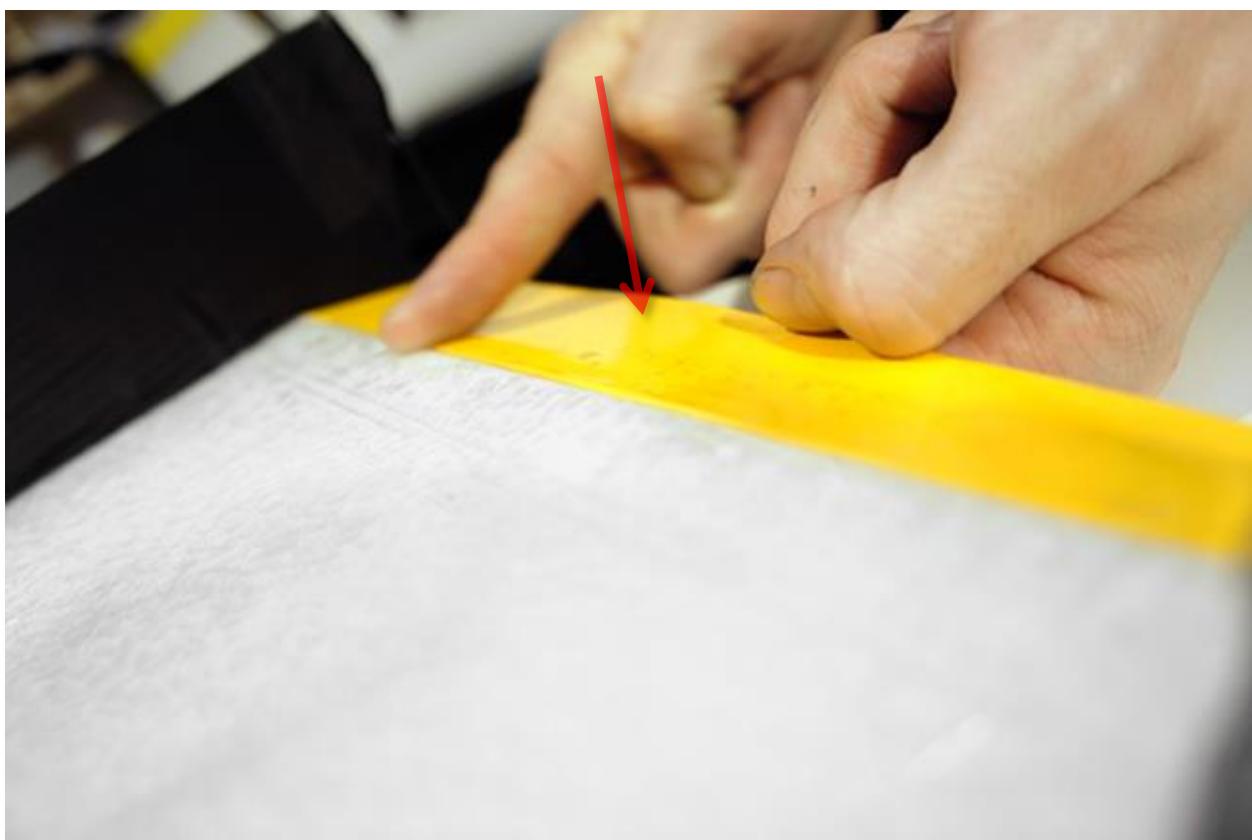
Elevons





HAPPY

FLYERS





HAPPY

FLYERS



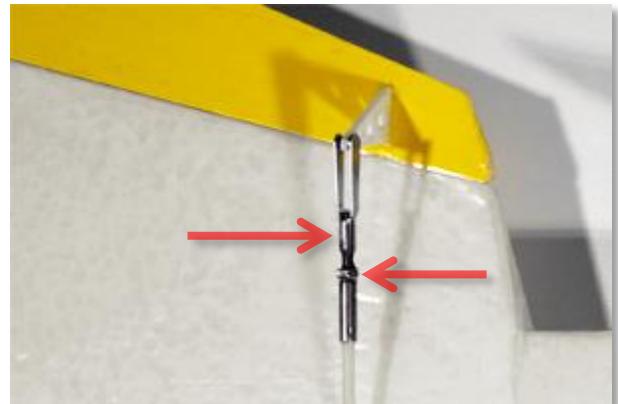


HAPPY

FLYERS

6.9.3

Rudder linkage

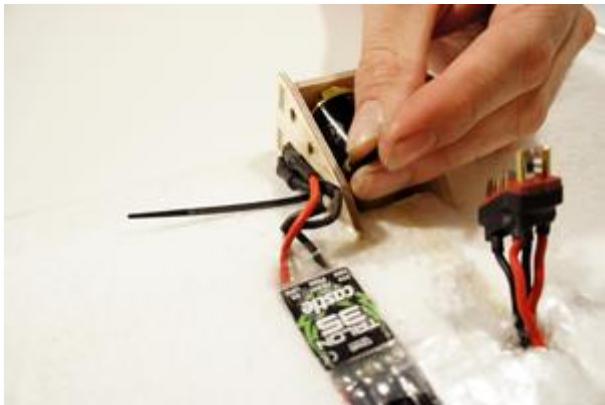
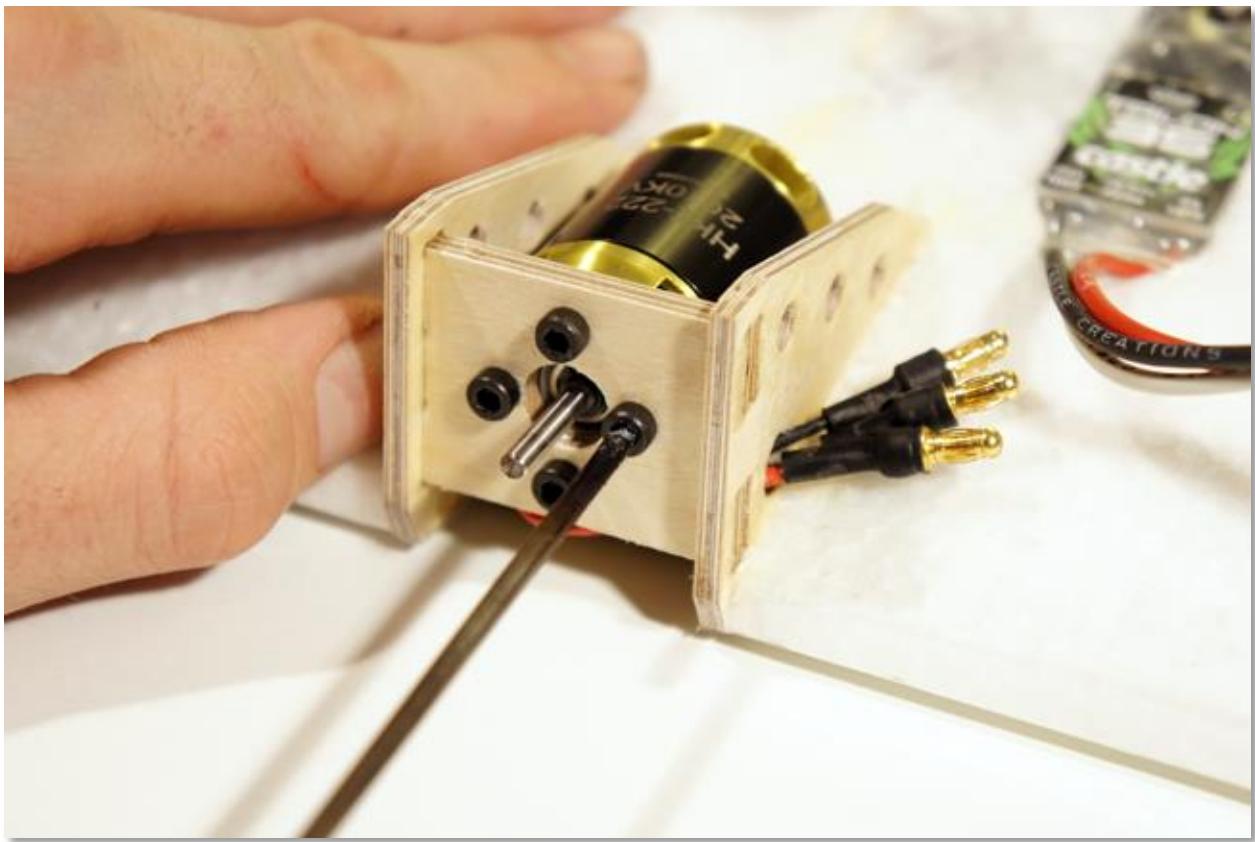


## 6.9.4

## Motor and ESC

Mount the motor and tighten the screws. We have made two big holes, where you can pass through the cables. Connect your ESC and use a cable plier to tighten the wires to the motor mount.

When you are done, also mount the complete propeller to the motor shaft, since this is necessary for the next two chapters. You can remove it again later of course.





HAPPY

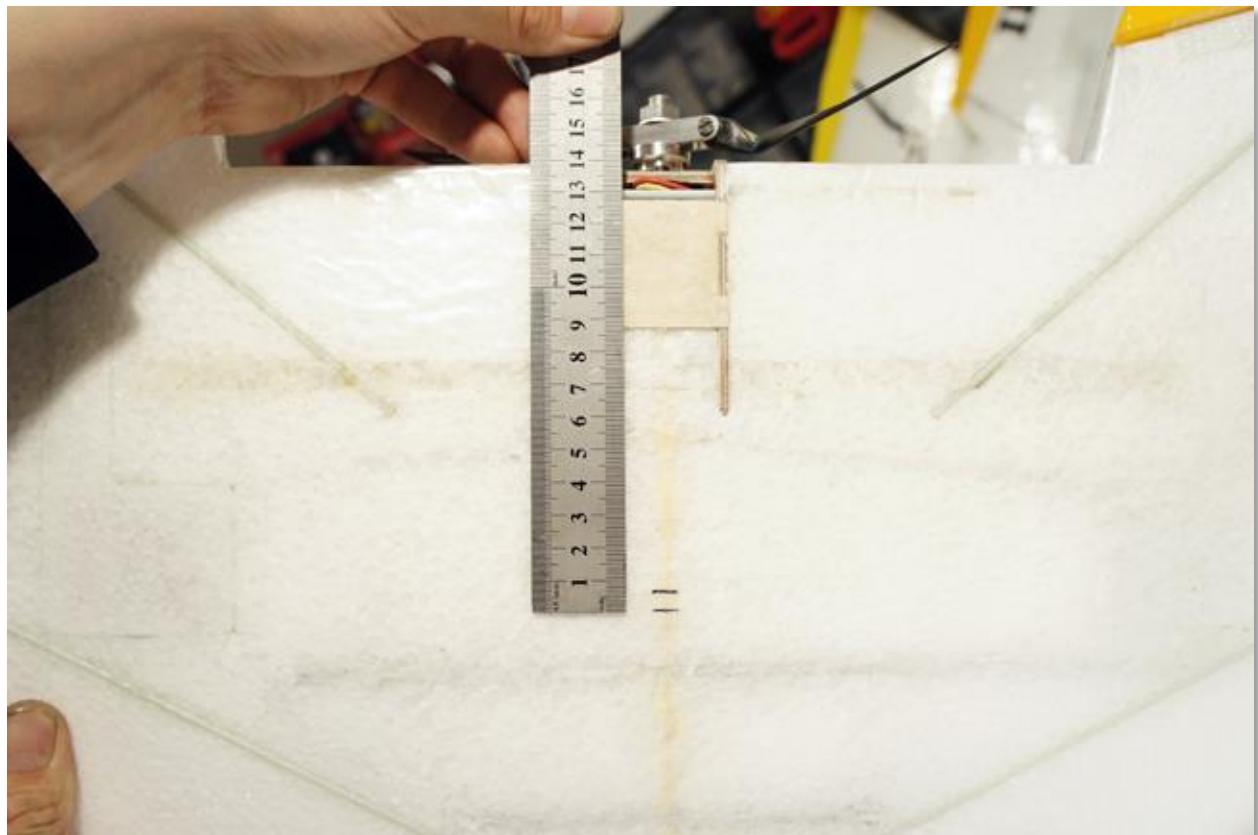
FLYERS

## 6.10

### Determine CG

#### 6.10.1

##### Draw CG (if not done yet)



#### 6.10.2

##### Positioning battery bay with tape

Until the CG fits

#### 6.10.3

##### Mark borders



HAPPY

FLYERS

6.10.4

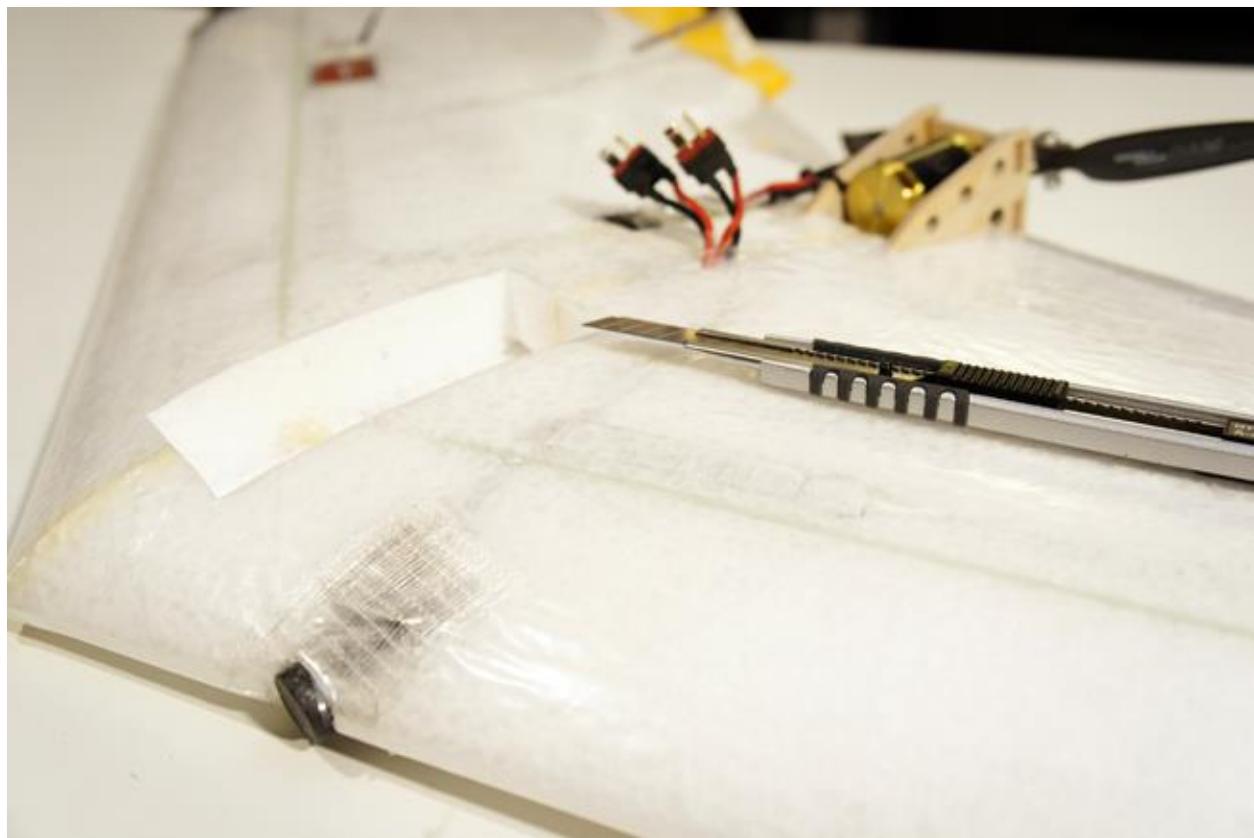
Cut-out





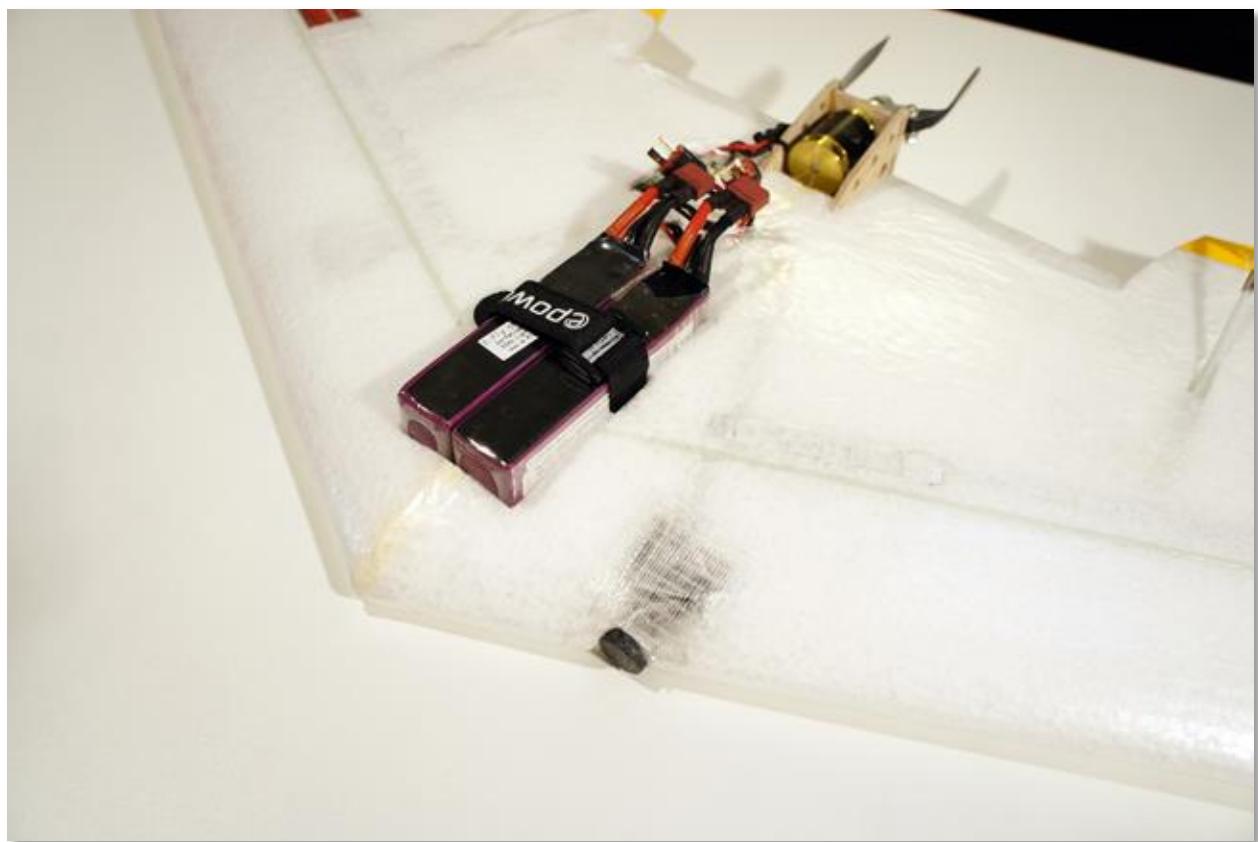
HAPPY

FLYERS



6.10.5

Glueing



### 6.10.6 Taping borders



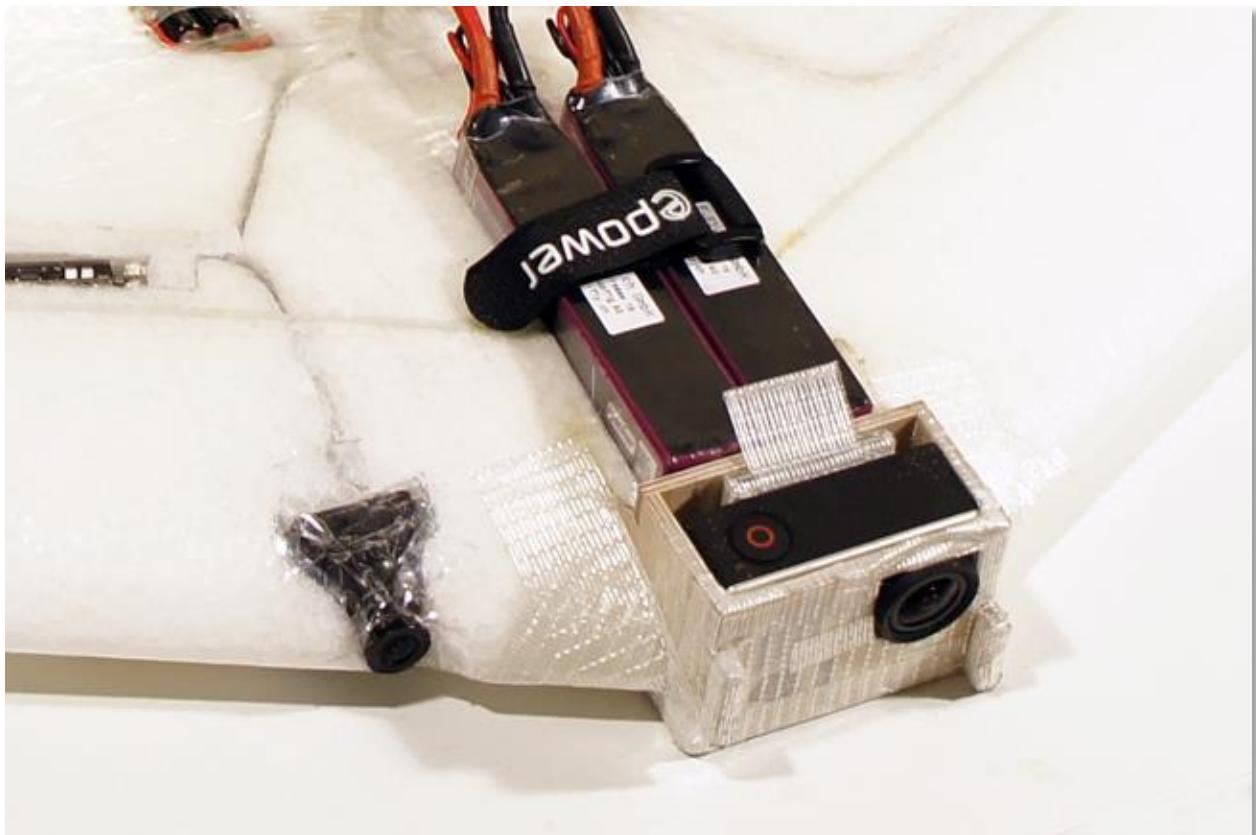
HAPPY

FLYERS

## 6.11 Finalize

### 6.11.1 Taping critical parts

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### 6.11.2 Check straightness

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Can fix it a bit with laminating tool

### 6.11.3 Testing electronics

---

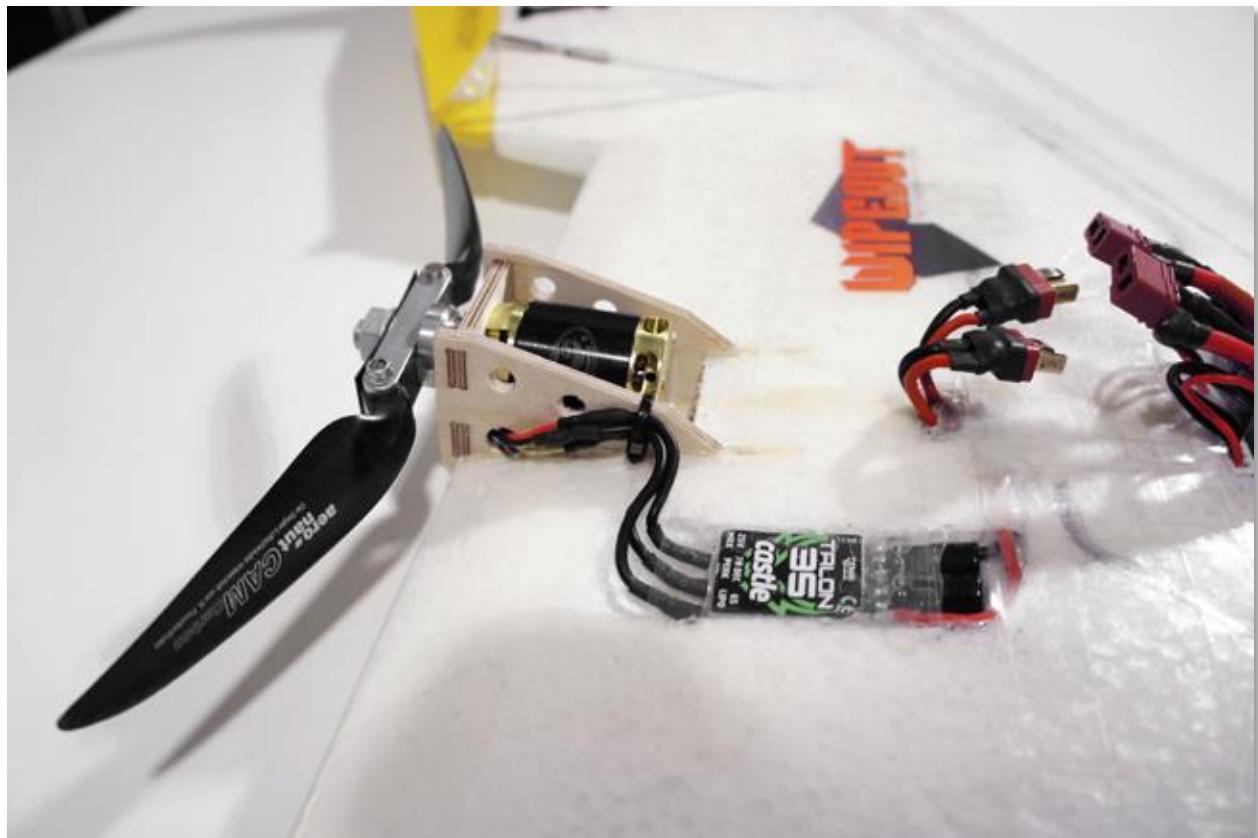


HAPPY

FLYERS

6.12

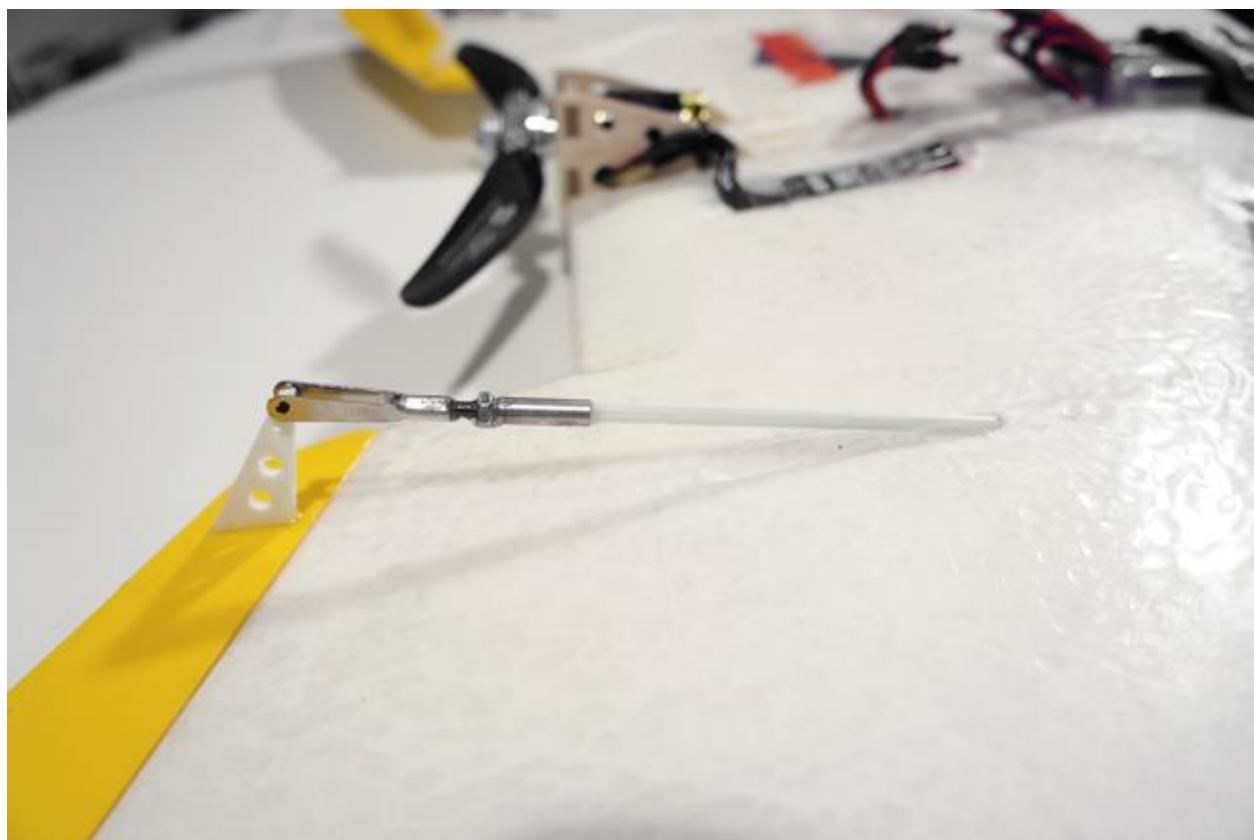
Impressions





HAPPY

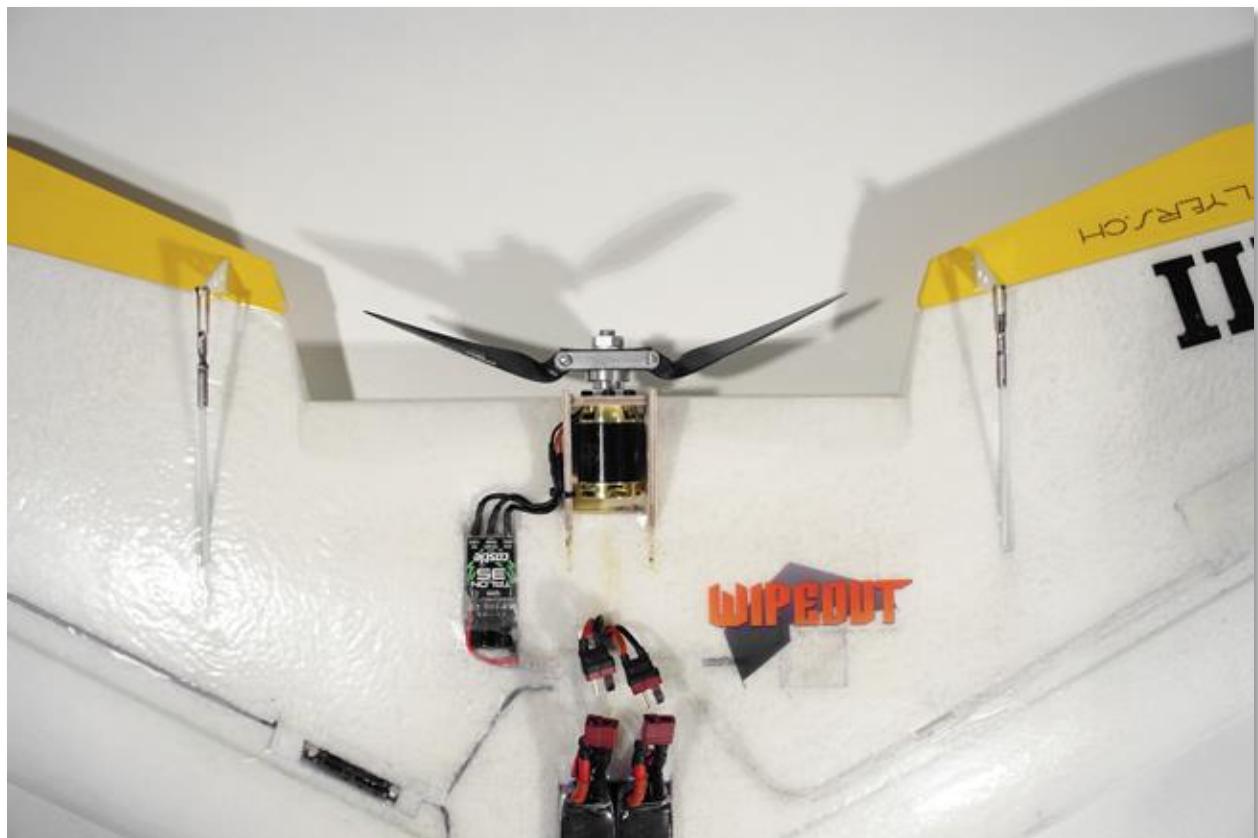
FLYERS





HAPPY

FLYERS





HAPPY

FLYERS





HAPPY

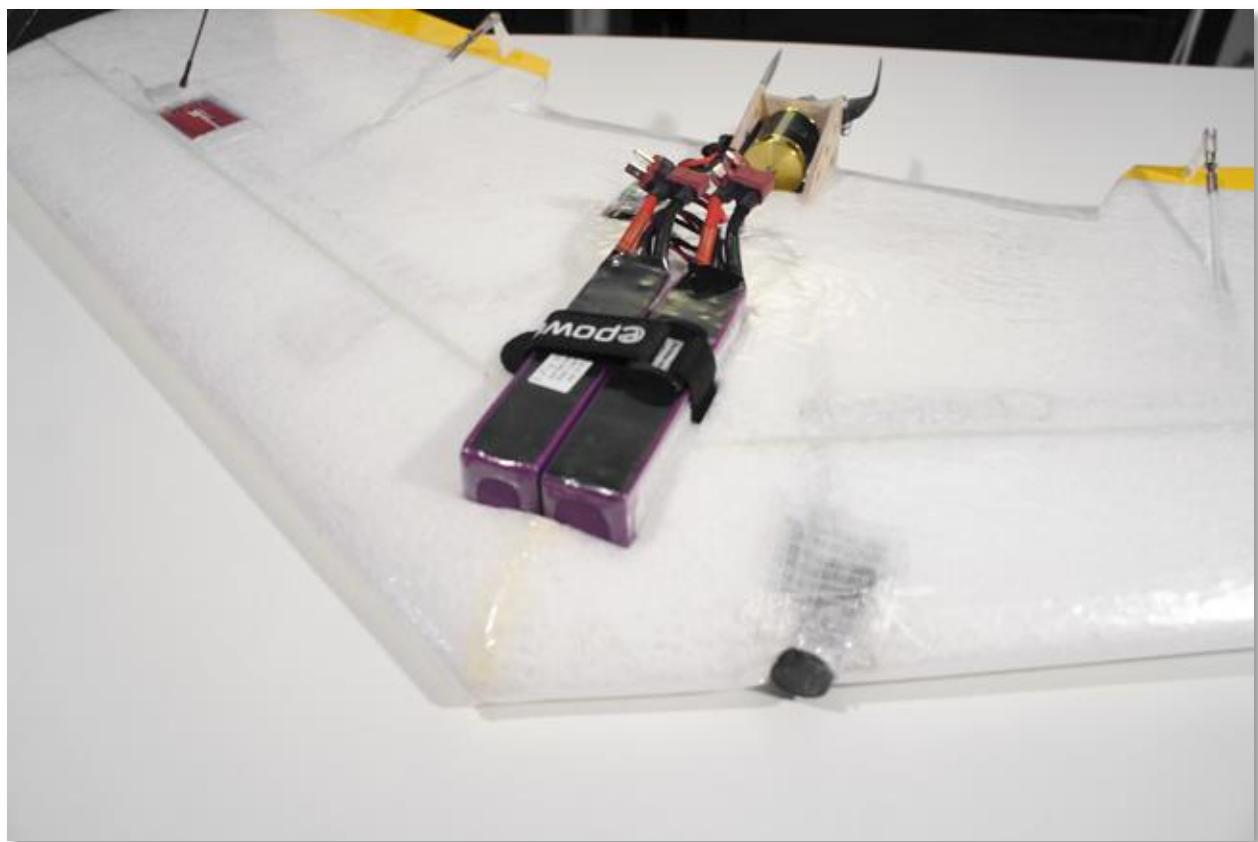
FLYERS





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FLYERS





HAPPY

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## 7

## Settings and configuration

### 7.1

### Rudder linkage

### 7.2

### RC control



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## 8

## First flight

8.1

Preparations

8.2

Hints

8.3

Tips and tricks



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9

## Recommended Electronics