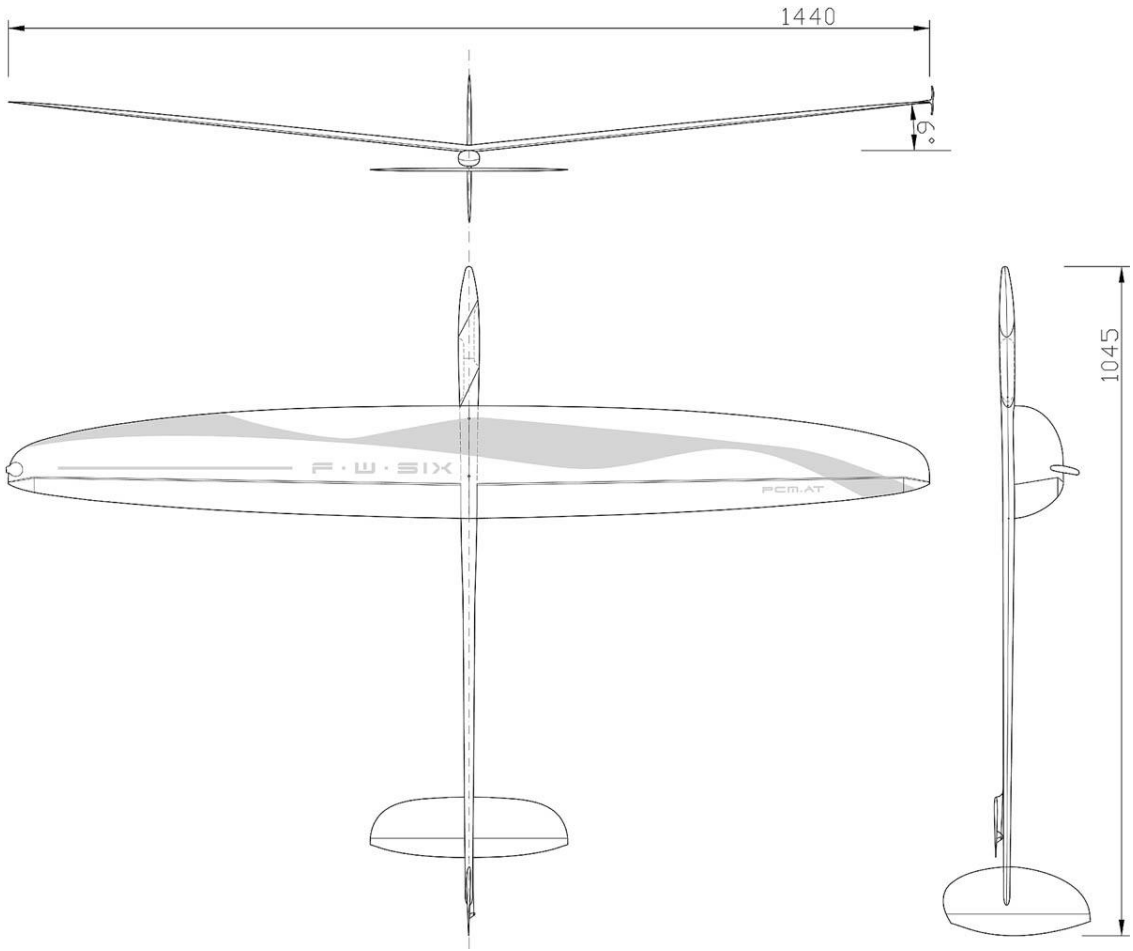
Wing span [mm]:	1440
Wing area [dm2]:	20,5
Aspect ratio:	10,18
Take-off weight [g]:	ab 240
Airfoil:	Zone V2



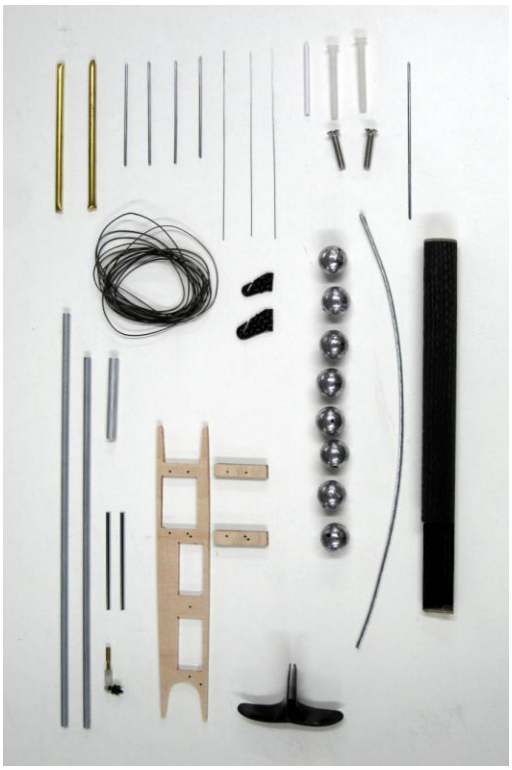
BUILDING INSTRUCTION

SAL-HLG FW6

CONTENTS

DATA

1. Kit – contents



Fuselage + canopy
Wing
Rudder and elevator CFR

Radio board
CFR ballast tube
Lever for controlling rudder, 1 pc.
Lever for controlling elevator, 1 pc.
Kevlar wire for controlling rudder and elevator
Steel wire for torsion springs, 2 pc.
Brass pipes for levers of ailerons, 2 pc.
Aluminium pipes for push rods for ailerons, 2 pc.
1mm steel wire for controlling ailerons, 4 pc.
2mm carbon tubes for controlling ailerons, 2 pc.
Screws for fixing wing, 2 pc.
Nylon screws for fixing elevator, 2 pc.
Throwing blade, 1 Stk.
Lead balls for ballast
1,5mm flexible steel wire for ballast
1,5mm normal steel wire for ballast hook
Bowden cable inner tube, 3cm
D47 Servo support
Micro ball connectors

Building instruction (for download from our website)

2. What else do you need:

Epoxy-glue (for example UHU 300 endfest or Pattex Stabilit)
Super glue, both runny and thick
Carbon rovings

Electrical equipment (On/Off-switch, cables, plug...)
Electronic equipment
Shrinking tube...

3. Electronic equipment

Servo aileron:	- Graupner DS 281 (cuttings on radio board are prepared for this servo)
Servo rudder and elevator:	- Dymond D-47 (cuttings on radio board are prepared for this servo) Same style: - Futaba FS31 - Modell Expert X31
Accumulators:	- GP NiMH Accu 35AAAH, Weight/cell 6g (1,2 Volt 0,35 Ah 1/2AAA)
Receiver:	- 2,4GHz possible due to kevlar fuse cone - Futaba R6106HFC FASST - Multiplex RX-5 light M-link - Mulitplex RX-6 light M-link - Spektrum AR6115e - Orange RX DSM2 Apart from RX-6 all receivers must be removed from their casings and covered with heat shrink tube. See Chapter receiver installation.

ASSEMBLING THE MODEL

4. General information on DLG-models

DLG-models are constructed **strong** enough to withstand the demands of starting, flying and landing and at the same time **light** enough to achieve the least possible flying weight. Each part is dimensioned to its possible minimum and produced using lightest and fewest material.

In order to continue this concept, please account the following when you assemble the model:

- Always **use glue sparingly**. **Grind** all gluing spots **thoroughly**, before you apply the glue.
- **Electronic components** should be **placed as far as possible to the front,** as you normally need additional lead in the nose of the fuselage to achieve the necessary centre of gravity.
- For the same reason try to **save weight** especially when you **finish and mount the stabilizer**.

As FW6 has developed from the Fireworks-family, you will find some pictures of Fireworks 4, FW5 and also Mini-Fireworks in the following instruction. Don’t let yourself be confused by this, the way of building described is quite the same.

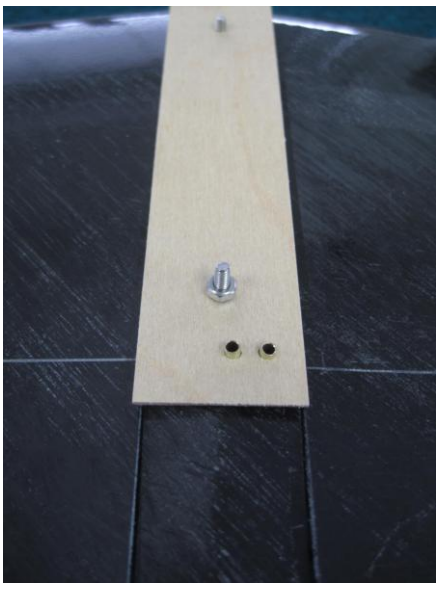
5. FW6 wing

5.1 Controlling the ailerons

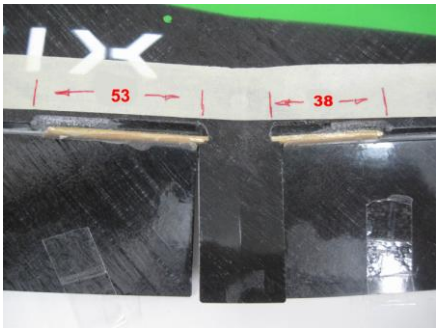
The levers of the ailerons are a **brass tube** and a **brass M2 control horn**.

For exact fixing it into the right position a **plywood template** is enclosed.

The **brass tubes** are **glued directly to the ailerons**. Therefore you have to grind the tubes and the ailerons well to guarantee a good gluing. Use a **good epoxy glue** for a durable connection (UHU 300 Endfest or Stabilith)

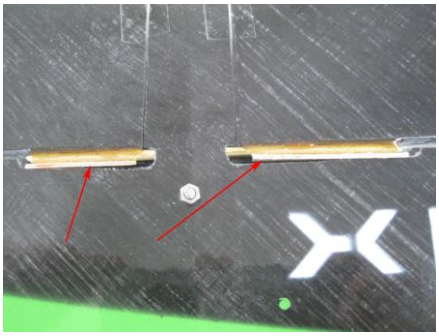


If the **space for the brass tubes** is not long enough, please extend it as shown in the picture.

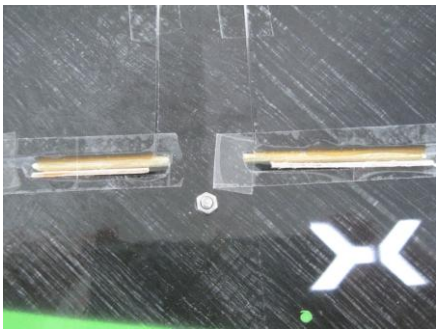


For easy and accurate applying of the glue use the **edge of a plastic bag**.

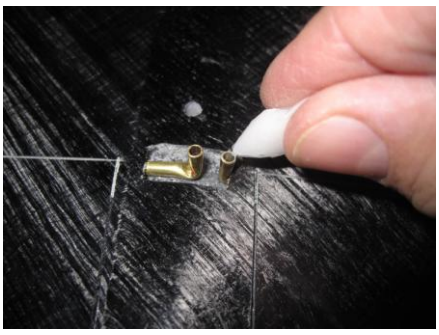
For **holding the right position** during the curing of the glue, prepare **distance sheets**. Use them **under the tube** and **in front of the tube** to place the tube **as high as possible** to the upper edge of the aileron. Note that there is **enough space near the hinge** to guarantee the free movement of the brass tube.

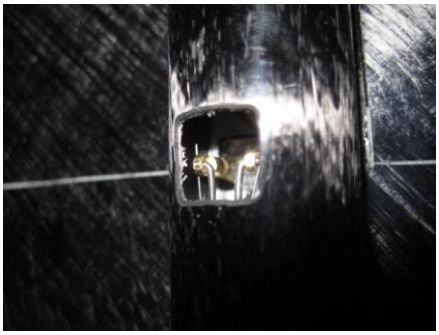


During curing of the glue put a **strip of tape** over everything to secure the correct position of the parts.



Now you can **shorten the control horns** and glue them **into the tube**.





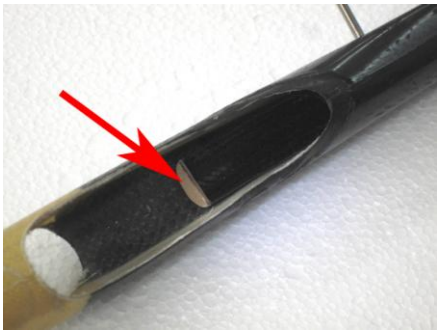
5.2. Installation of throwing blade

The throwing blade has a molded **adhesive flap**. By this, installation is greatly simplified.

Grind the gluing spots on wing and blade well and free them from sanding dust. Then **fix** the throwing peg with **epoxy glue.**

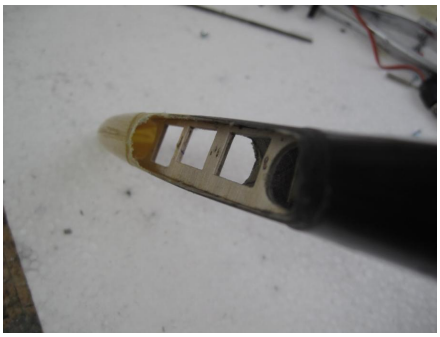
6. Fuselage

6.1 Radio board



First of all, push the ballast tube into the fuselage. For safety, you should only stick it when all parts are well positioned.

At the moment we recommend the servo **Graupner DES 281**. Therefore the radio board which is enclosed in the kit has cuttings prepared for this servo.



In order to utilize the available space optimally, we **tilt the radio board slightly**. (If you look in flight direction, the upper edge is shifted to the right, the lower edge to the left.) In addition, we **bend** the **servo levers easily**. By this, the maximum deflections can be achieved.

For the **rudder** and **elevator** we still recommend **D47 from Dymond**.

The assembly plates of the D47 are situated a bit deeper than the ones of the Graupner servos. Therefore we supply a **U-formed part** to put below the assembly plates and lift the D47 to the same height.

These are the tried and tested **lengths for the levers of the servos**:
Lever for aileron: 13mm
Lever for elevator: 10mm
Lever for rudder: 9mm

6.2 Push rods for ailerons

In contrast to previous models, we have **increased the diameter of the pushrod and avoided bends**. By this, the maximum force can be transmitted without bending of the push rods.

For this we need a special **small ball connector** and a handmade direct **linkage made of aluminum tubes**.

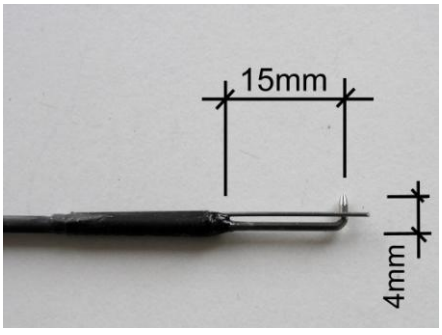
Glue the **brass part** of the ball connector into the **aluminium tube**. We recommend to use epoxy glue, as superglue might be too brittle for this small joint may be too brittle.

At the other end we chose the **standard version with 1mm steel hook** and **securing wire**. At the other servo-connection you can just make an S-hook.

Push the **steel hooks into the carbon tubes** and the **carbon tubes into the aluminium tubes**. Grind all gluing spots and use **epoxy** glue for this bonding.

In order to achieve the correct length of the push rods, let this last bonding **harden in the assembled position**. The servos and ailerons must of course be put in **zero position**.

A **0.3mm steel wire** will serve as **protection** against dismantling. The parts are held together with a shrinking tube. Fix it the wire with a drop of super glue.

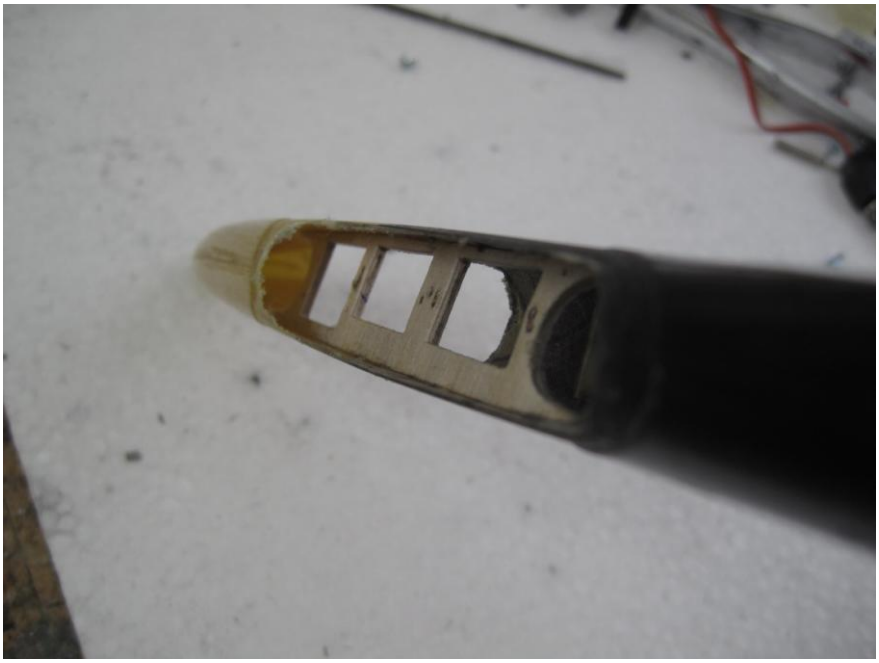


6.3 Gluing the radio board

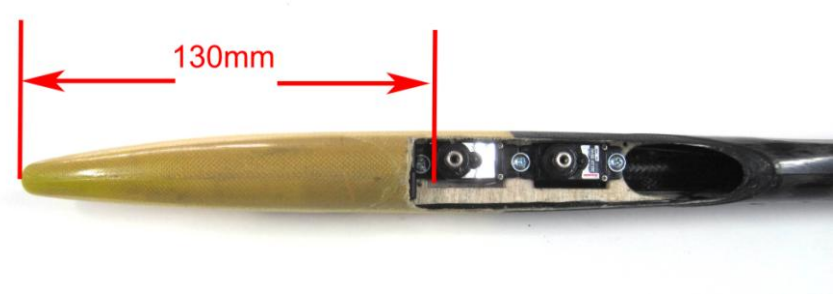
Before you fix the radio board in the fuselage, **grind all gluing spots** thoroughly.

In order to **gain full strength**, it is absolutely necessary to **fix the radio board** in the fuselage!

The fuselage breaks when the servoboard is not glued well. because of that you have to strengthen the gluing also with a carbon roving.



Before you glue the radio board, you should first **find out the optimal position.** To do so, place the radio board inside the fuselage without gluing and mount all servos. The front aileron servo should be situated **130 mm from the fuselage tip**.



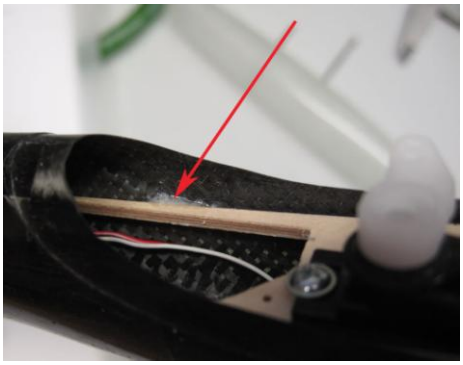
You can fix the radio board with a **drop of super glue** to make the position check easier.

Make sure that all **levers are freely movable** (also with canopy mounted), and that the **deflections** of the levers are big enough.

If necessary, the edges of the servo arms can be ground down a bit.

Only now you can you fix the **ballast tube** with thin **super glue**.

Glue the servo board carefully **with epoxy-glue** (for example UHU 300 endfest or Stabilit, no fast hardening epoxy resin).

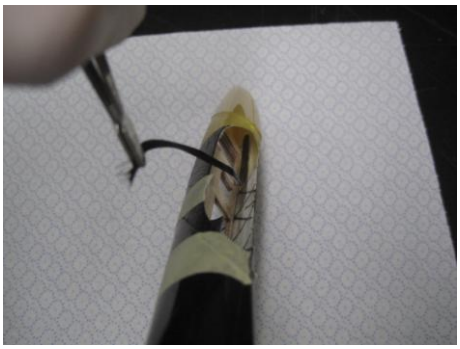


You can fill the **glue into a small plastic bag** and cut a whole on one corner. By this, it will be **easier to apply** the glue exactly.

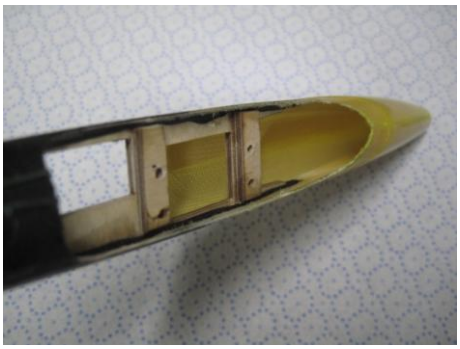
Add carbon rovings left and right of the gluing spots for additional strength. Best way to apply is together with gluing of the board.

If you have a **hard landing**, always **check** if the radio board is still fully glued before you make the next start!

Here you see how the carbon roving is placed.

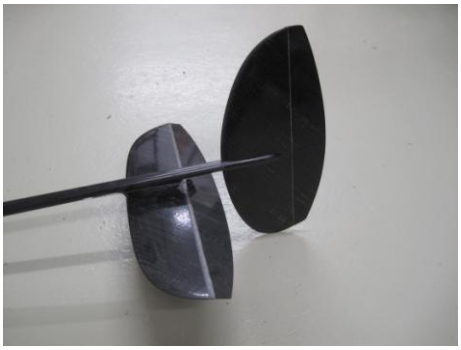


The carbon roving has to be at the left and right and the upper and lower side of the servoboard.



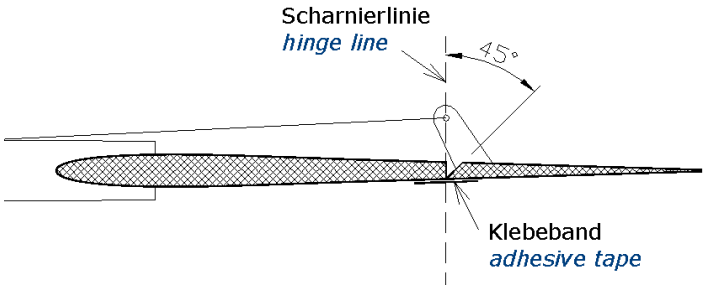
7. Installation of the CFR-stabs

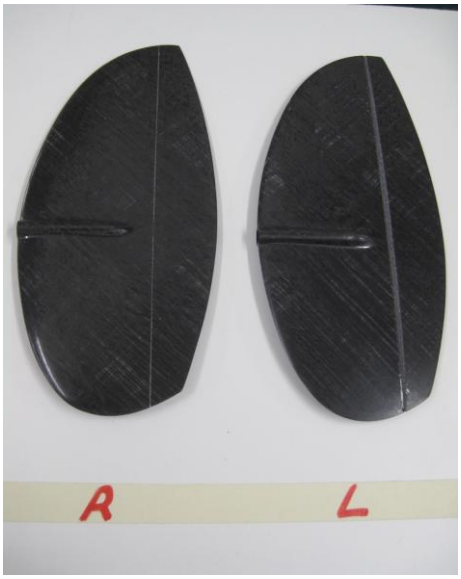
We use an **asymmetric vertikal stab** for FW6. So, first of all, please check, if you have the correct stab for **left- or righthander**.



Vertical stab for right handers: has the hinge line on the left (seen in flight direction), see 3rd picture
Vertical stab for left handers: has the hinge line on the right (seen in flight direction), see 3rd picture

Rudder for **right-handers** (view from above)
Kevlar wire to the right!

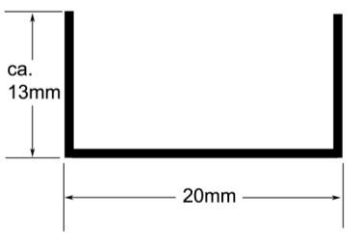




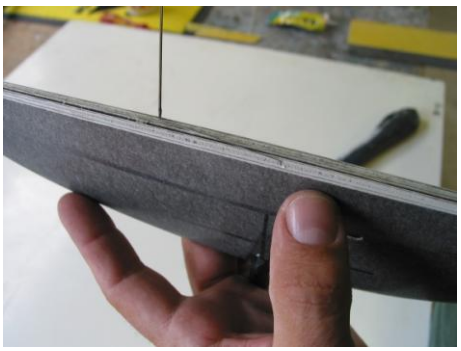
Cut a slot in the rudder in extension of the axis of the fuselage. It is advisable to leave the lower laminate uncut. Next, glue the **lever** into the slot. The **hole of the lever** should be located just **above the hinge line**.

7.1 Installation of torsion springs:

Bend the wire according to the drawing below. Then, **tip back** the **control surface** of the vertical stab completely. **Stick** the spring **into the rudder,** one end into the unmoved part, one end into the control surface near the lever.
The length of the spring should be **20mm**.



Then **harden** the spots **with super glue**.



Push the vertical stab (first for a test) into the oval end of the boom **until ist stops**. Then check, if the stabilizer is **aligned correctly** to the wing.

It has proven to put the entire model in a **supine position** on a **flat surface** and then to set up the stab with an angle meter.

If you want to work quickly and build light, you can stick the stab with thin super glue. But since the super glue is brittle, you will certainly achieve a **better bonding with epoxy glues**. (UHU 300 endfest, Pattex Stabilit or similar .)

7.2 Connection of the wires

Drill a hole in the boom to lead the wire inside the fuselage to the servo.

We stick a **bowden cable** into the hole, so that the rope does not rub against the carbon edge and to reduce the weakening of the fuselage due to the hole. This is the white pipe, which you can see in the picture.

The **small carbon lever** is for the **rudder** and the **long one** for the **elevator**.

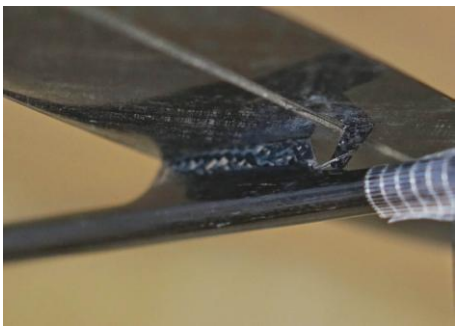
Now you can **hook in the kevlar wire** into the lever.

Make a **loop, twist the end** and fix it with a **drop of super glue**.

Note: Don’t use a shrinking tube, as the kevlar wire could be damaged by the high temperature during shrinking.

Complete the elevator in the same way.

If you want to make the most beautiful solution, you can lead the wire out of the pylon and place the lever right behind. But you have to shorten the lever a little for that.

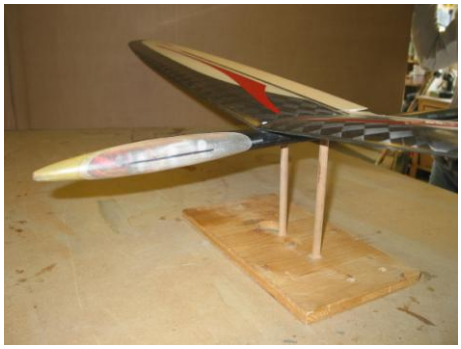


8. Ballast:

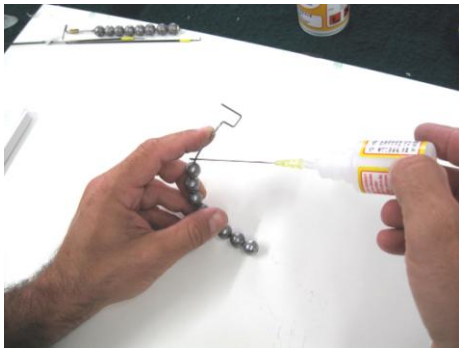
As ballast we use lead **balls** from the **fishing shop**. You can easily assemble and vary this kind of ballast.

The balls are strung on a **steel wire of 1,0mm diameter**. Bend the end of the wire to a small hook. With this **hook** the ballast pack can be **locked** on the radio board.

To locate the exact position of the ballast inside the fuselage, lay the model on a **device for measuring the centre of gravity** (see picture). Move the ballast until you get the desired centre of gravity.
When bending the wire you should make sure that you **don't create 180 ° curves**, as the wire may break then.

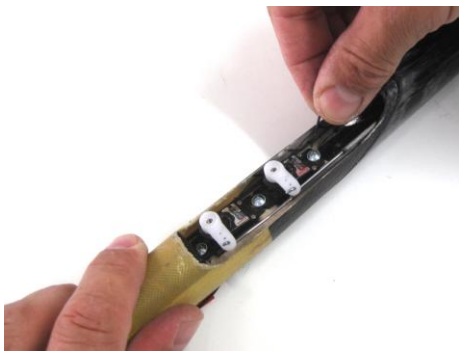


Put a drop of thin **super glue onto the first and the last lead ball** to fix their position. As you must curve the ball chain for threading it into the ballast tube, bend the wire in the desired curvature when you glue the balls.



Insert the ballast through the left opening of the fuselage **into the ballast tube**.
.

The **hook** of the ballast package is **locked in the servo board**.



9. Battery shape and installation of receiver

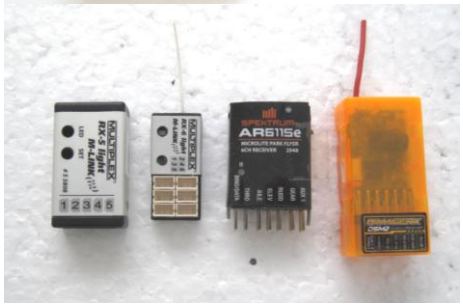
Depending on the size of battery and receiver different shapes of battery packs are possible.

In any case we recommend to **assemble the battery with tape** and make a **test for fitting** with the receiver inside the fuselage before you solder the battery pack.

On the right side you see two possible battery shapes

If you absolutely want to install a **great 8 channel 2.4GHz** receiver, it is also possible to remove the power strip and solder the servos **directly to the board**. This is quite normal with our indoor-colleagues.

To the right a few **receivers that fit well** in the fuselage (without housing):



From left to right:
- Multiplex RX-5 light M-link
- Multiplex RX-6 light M-link
- Spektrum AR 6115e
- Orange RX DSM2

Here once again these receivers, partly **without housing**:

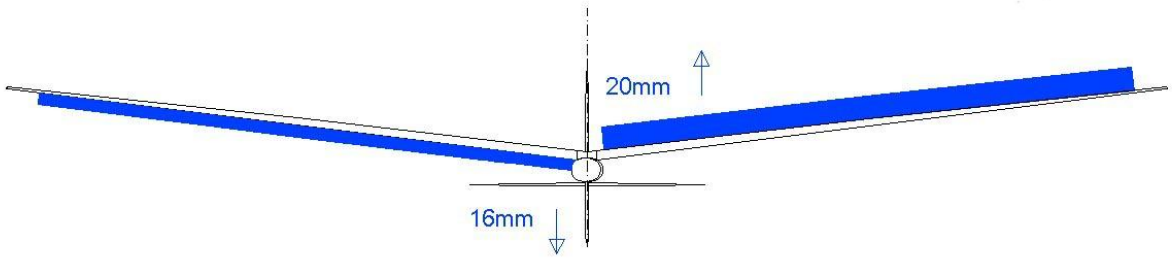
- Multiplex RX-5 light M-link (without housing, housing right next to it)
- Multiplex RX-6 light M-link
- Spektrum AR 6115e (without housing)
- Orange RX DSM2 (without housing, housing right next to it)

-Futaba R 6106HFC FASST (with and without housing)

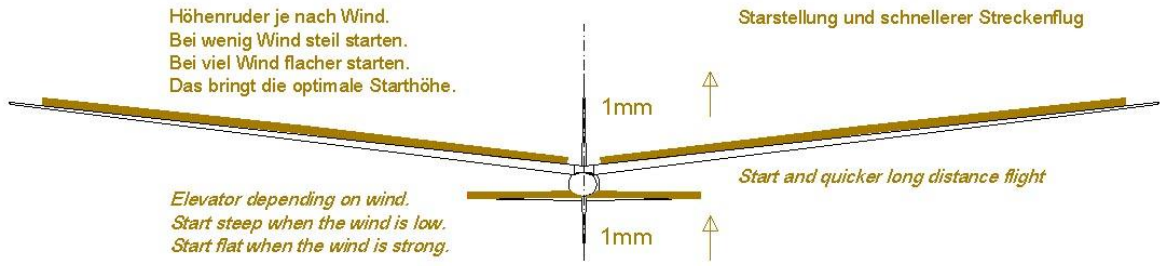
10. Settings for the first flight

Centre of gravity: 68-70mm (measure from the leading edge of the wing to the back)
Expo at app. 50%

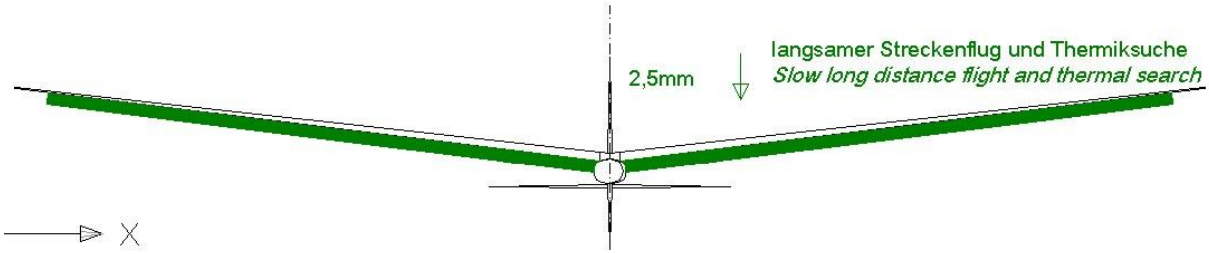
Ailerons (measure near fuselage)



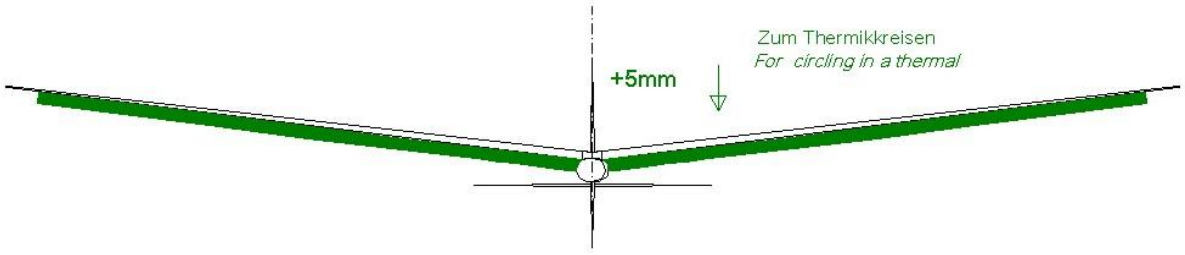
Flaps negative (start, speed, fast thermal search) (measure near fuselage)



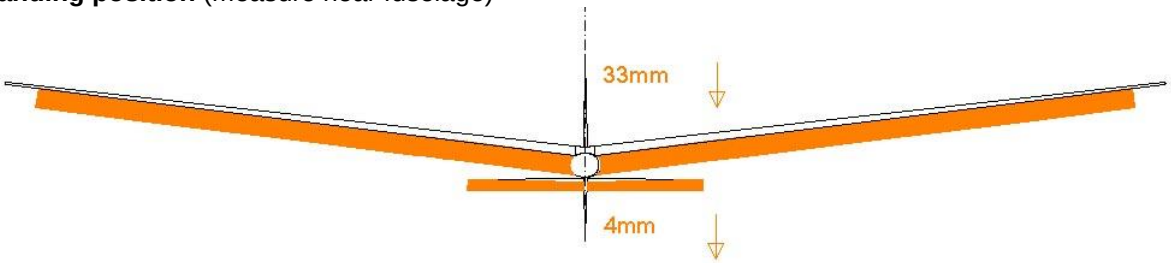
Flaps positive (fast thermal search, gentle circling) (measure near fuselage)



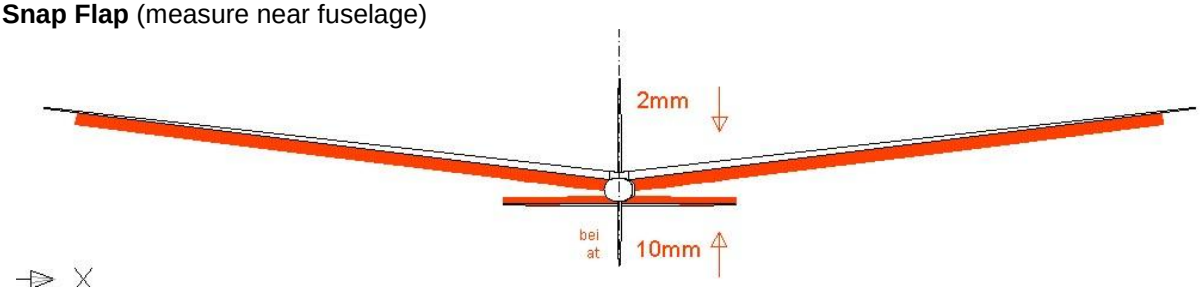
Flaps positive (thermalling) (measure near fuselage)



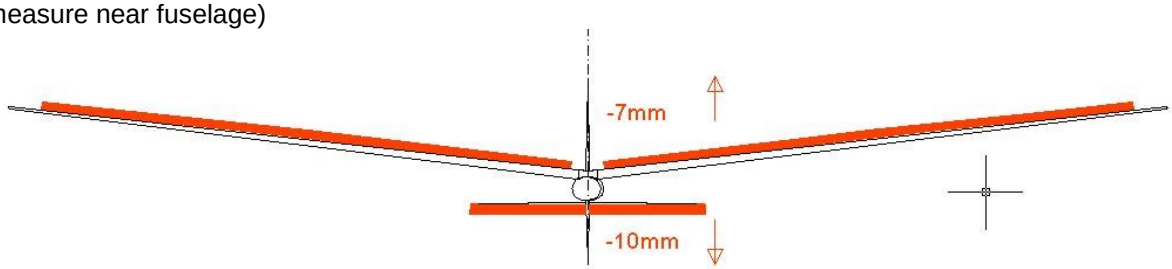
Landing position (measure near fuselage)



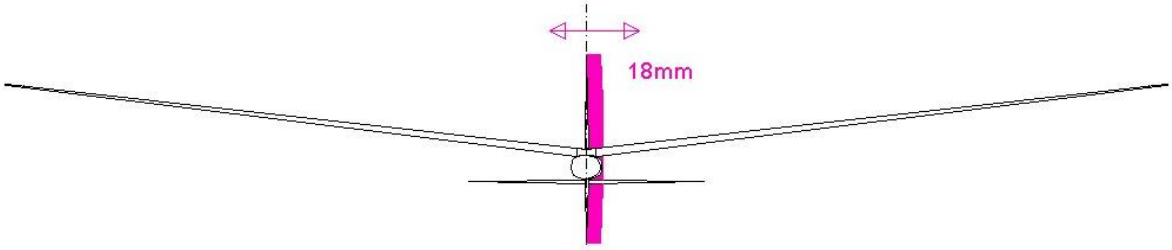
Snap Flap (measure near fuselage)



Snap Flap negative (for better leveling out of the flight path at the highest point of the launch) (measure near fuselage)



Rudder (measure at deepest point)



Set the elevator on 0 at your first flight.
Don't make a SAL-start at your first flight. Hold the glider on the fuselage and throw it gently.

11. Tuning and tips

11.1 Flying weight and centering the masses

Our long experience has shown that the **take-off weight** and **centering of the masses** are the most important factors to **optimize the starting height**.

The model should be light.
The mass of the model should be well centered.

A lower mass can be accelerated to a higher top speed during the discus rotation. The higher top speed, in turn, has a significantly higher impact on the resulting kinetic energy than the mass of the airplane. To be precise a square. Ekin = m * v^2

Due to the good mass centering the oscillation of the model after release is reduced. This means, the better the centering of masses is, the less it slows down.
The centering of masses is also improved by loading more ballast. This increases the flying weight, but everyone should try out, what is his personal optimum. Every pilot has his own optimal weight of glider, which he can accelerate best.

In addition, the amount of ballast depends of course on the strength of wind and thermals. The Zone V2 can tolerate ballast very good, and you should not fly with too little weight at higher wind speeds.

As you can see, there is still plenty of room to optimize.

To put it into numbers, **Mark Drela** has developed a method to **measure the yaw of gyration**. This defines how good or bad a glider has centred its masses:
Hang your model upside down on two 1,5m long threads, which you fix 30mm from the centre of gravity. Now move the glider for 45° and the let it swing. Take the time of 5 swings. Repeat this process several times to get an average value.
The faster the model swings, the faster it will stabilize after the launch and the higher it will start.

11.1.1 Flightpath during start

You could reach more starting height when you **adjust the flightpath to the wind strength**. When the wind is weak you should start very steep into the sky. And when the wind is strong the flightpath should be much more flat.

11.2 Gigaflaps (triangular ends)

In order to move the triangular ends of the ailerons , use a piece of adhesive tape to connect the triangle to the aileron.

Always **TEST THE RECEPTION** on ground before you fly!

OTHER

12. Check list before starting:

1. Check **centre of gravity**
2. Check **control surfaces**:
   Do control surfaces move in the correct direction?
   Check the greatest swings
3. Check **reception**
4. Check **control surfaces before each flight.**
   Do all control surfaces still move correctly?
   Is there enough power in the accumulator?
   Are the brakes retracted?
   You can save the retraction of the brakes in your start setting. By this, you can never start with extended brakes.
5. **Gentle launch** from the fuselage. No DLG-launch at your first flight. If there are some wrong settings, everything will go too fast at the disc-launch to correct these failures by steering.

13. Notes for the use

To avoid heating of the carbon surface, models with carbon wings should **not** lie **in the sun**.

During flight heating by the sun is no problem, as the model is **cooled by the wind. On ground** the glider should be kept **inside protective bags** or **in the shade.**

After every **ungentle landing**, you must **check your model for possible damage**, such as:

- Is the radio board still glued thoroughly?
- Did the leading edge of the wing burst open?
- Did rudder or elevator get damaged?

Even a small damage could lead to write-off at your next launch!