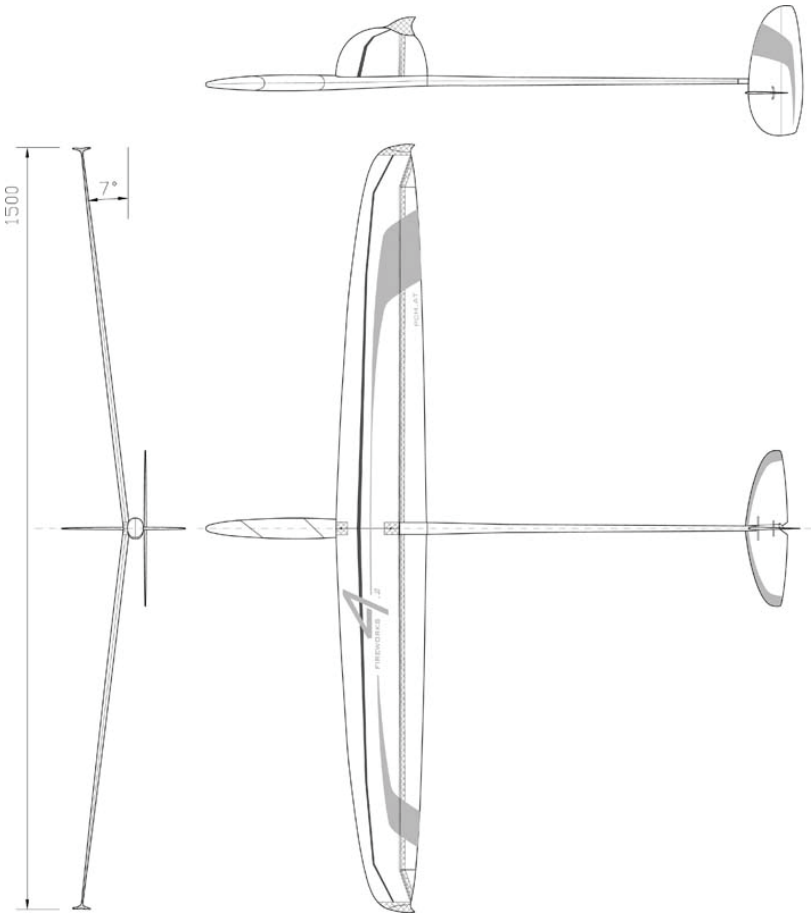
Wing span [mm]:	1500
Wing area [dm2]:	23
Takeoff weight [g]:	260-330
Airfoil:	AG 455ct-02f -47ct-02f from Mark Drela



BUILDING INSTRUCTION

SAL-HLG FIREWORKS 4.2

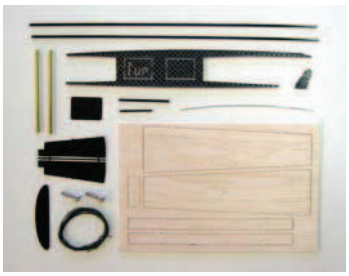
CONTENTS

DATA

1. Kit – contents

Fuselage + canopy
Wing
Elevator and rudder, Balsa (+BL)
Elevator and rudder, GFR (+GL or Carbon lite)

Radioboard
Balsaboards für ballast-/logger-box
Carbon rods for mounting elevator, 2 pieces
Carbon lever for controlling rudder, 1piece
Kevlar wire for controlling rudder
Steel wire for spring (rudder), 1 piece
Brass pipes for levers for ailerons, 2 pieces
Carbon push rods for controlling ailerons, 2 pieces
Screws for fixing wing, 2 pieces
Aerodynamical fences, 2 pieces
Carbon cover for levers of ailerons in fuselage, 1 piece
Throwing blade, 1 piece (version with normal wingtips)



Small parts for kit with GFR-stab

For kit with balsa stabs additionally:
Carbon carrier + loop for mounting elevator, 1 piece each
PVC-pipe leading through wire, 1 piece
Aluminium pipe for mounting elevator, 1 piece
Steel wire for spring (elevator), 1 piece
Kevlar wire for controlling elevator

Building instruction

2. What else do you need:

Iron-on covering film, f.e. Oracover, or indoor foil with glue or pore filler (for coating balsa stabs)

Epoxy-glue (for example UHU 300 endfest or Stabilit, no fast hardening epoxy resin)
Super glue
Cotton flocks (for thickening glue)

Electrical equipment (On/Off-switch, cables, plug, ...)
Electronic equipment
Steel wire, shrinking tube...

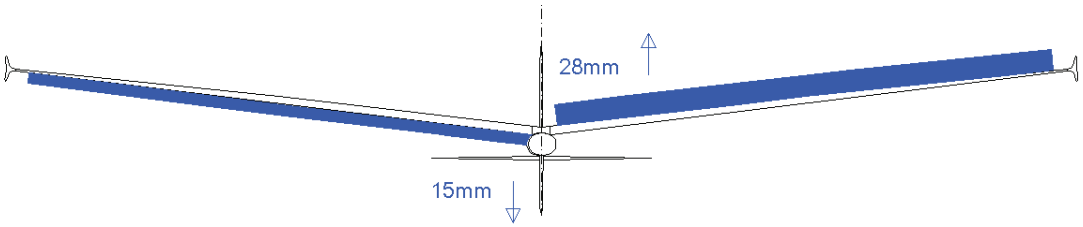
3. Electronic equipment

Servos elevator/rudder	- Dymond D-47 Similar: - Futaba FS31 - Modell Expert X31
Servos aileron	- Graupner C 261 - Graupner DS 281 - Robbe FS 61
Accumulators:	- GP NiMH Accu 35AAAH, weight/cell 6g (1,2 Volt 0,35 Ah 1/2AAA)
Receiver:	- MZK Sexta - Jeti Rex 540MPD - Rx Schulze 835
Logger:	- Logo - Lolo - Ram3 - Z-Log

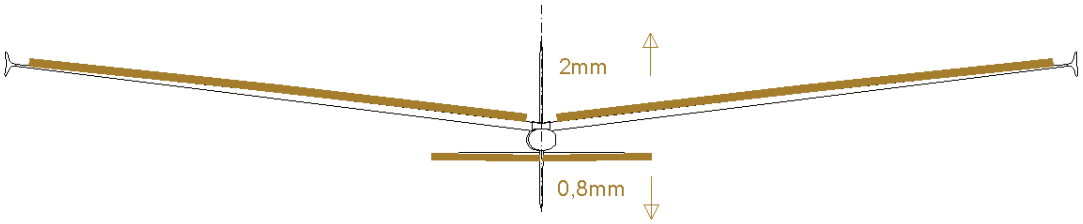
4. Settings for the first flight

Centre of gravity: 68-72mm
(measure from the leading edge of the wing to the back)

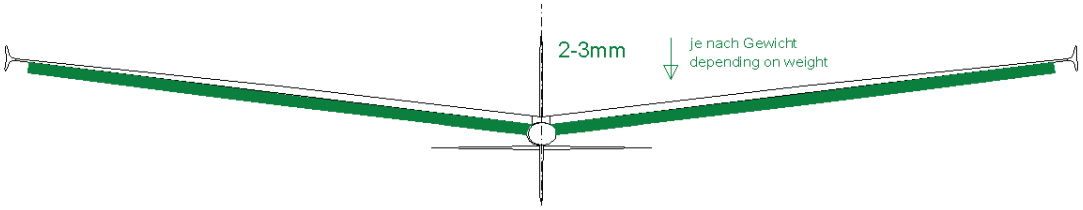
Ailerons (measure near fuselage)



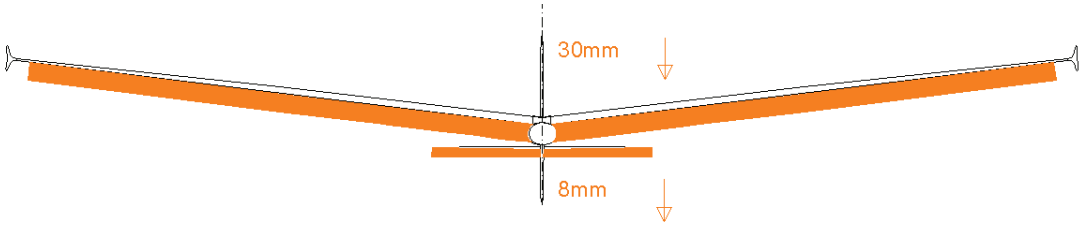
Flaps negative (start, speed) (measure near fuselage)



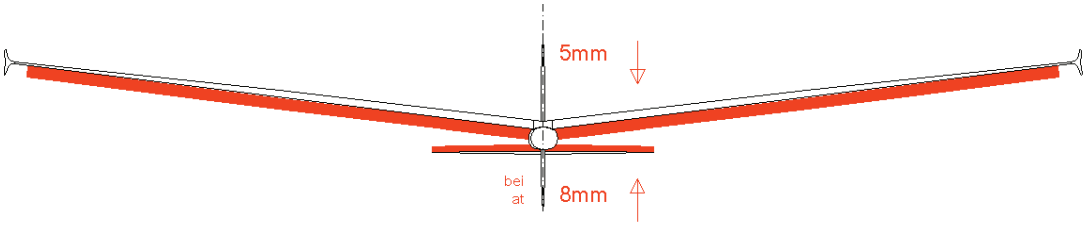
Flaps positive (thermal) (measure near fuselage)



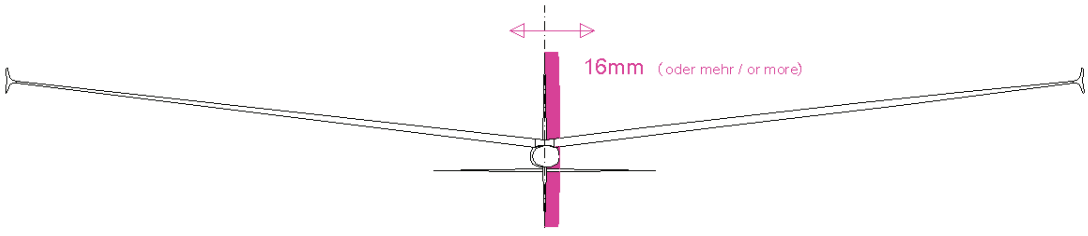
Landing position (measure near fuselage)



Snap Flap (measure near fuselage)



Rudder (measure at deepest point)



Angle of attack of elevator (for first flight): set elevator parallel to axis of boom, slightly pulled

ASSEMBLING THE MODEL

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**.
- If you don't have any experience in working with resin or if you prefer an easier method, you can combine the **carbon rovings and glass fibre with super glue**: Put some drops of super glue on the rovings or the fibre, spread and press it with a (rustling) plastic bag. You will also save one or the other gram with this method.

As Fireworks 4.2 has gone through several modifications and updates, you will find some pictures of older versions of Fireworks 4 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. Stabilizer

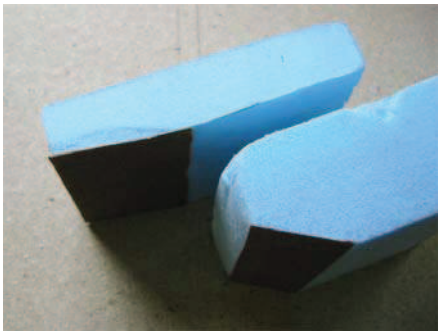
5.1 Stabilizer - Balsa (+BL)

Sanding the airfoil onto the balsa boards

Before you start sanding the elevator, glue the **aluminium pipe** (3mm) into the deepening prepared. (see drawing in appendix)

You can use simple working aids (see drawing in appendix) for easier sanding:

Make simple **grinding blocks** out of material that can be easily worked on.

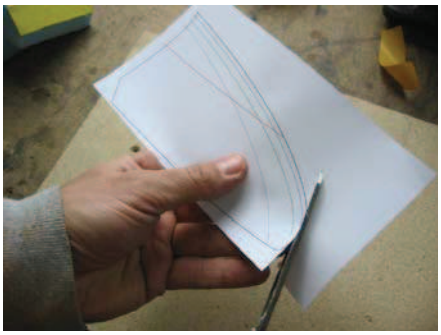


For example, you can cut out the drawings and glue them onto hard foam. Go over the outline with a hot wire or a sharp knife. Glue abrasive paper on the sloping surface.

Then, cut the drawings of the elevator and the rudder along the lines. You can use these templates for **transfering lines of same height** to the balsa boards.

Begin with the **line near the leading edge** and work step by step to the trailing edge.

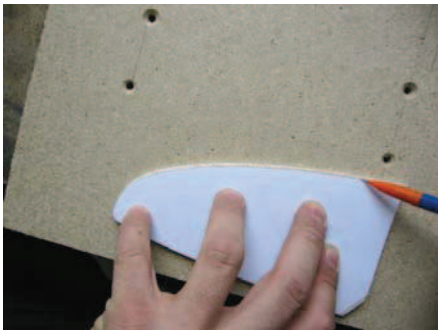
(Here shown at the elevator of Fireworks4.)

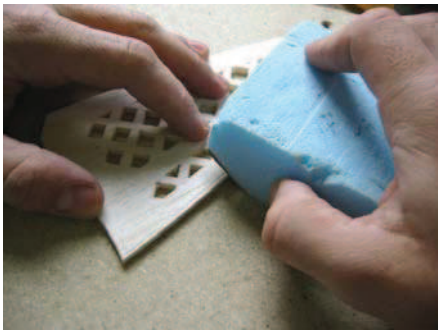


Mark each line on the **upper- and the underside.**

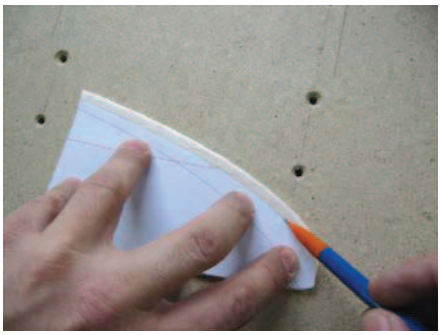
Lay the grinding block on the table.

Then sand with the grinding block along the line **until you touch the line**.

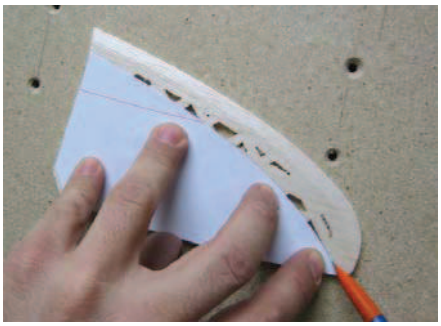




When you have sanded to the first line on both sides, go ahead with the **next line**.

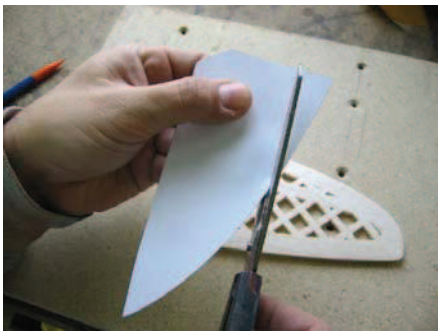


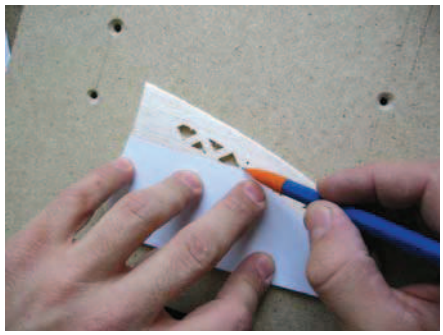
The angle at the third line is rather flat. Therefore you can use a normal grinding block without angle.



The last line serves for sanding to the trailing edge.

Mark the **midline on the trailing edge**.



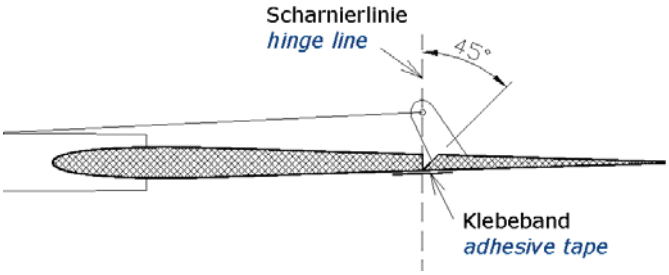


Sand with a normal grinding block until there is a plane between the front line and midline on the trailing edge.

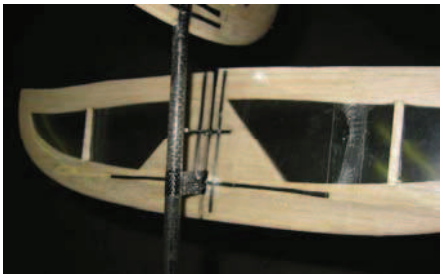
At last, **grind over the edges**, which have resulted from sanding, until there is a smooth airfoil.

Cut rudder and glue lever

Cut the rudder (see drawing in appendix) and sand the rudder **wedge-shaped** on the **hinge line**, so that you can move it in both directions. Note that the **hinge line** must be placed **on the left side** (looking towards flight direction) for **right-handers** and the other way round for left-handed persons.



Strengthen elevator and rudder with carbon rovings on **upper and downside**. (see drawing in appendix) Then cut the elevator **in two halves**.



Surface

Now you can iron the stabs with the **iron-on covering film or indoor foil.** Alternatively, you can varnish the balsa with a **special varnish** to **fill the pores**.

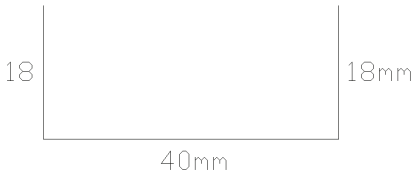

(Glue for indoor foil is applied.)

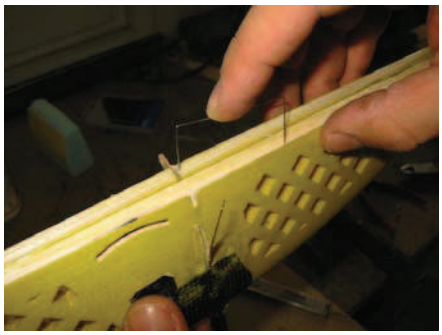

(Foil is ironed on.)

Next, glue the **lever** in extension of the axis of the boom. The **hole of the lever** should be **above the hinge line**. Fix the control surface of the rudder with **adhesive tape**.

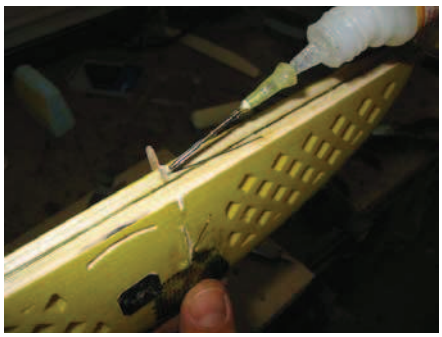
Torsion spring for rudder

Bend the thinner wire according to drawing below. Then, **tip back** the **control surface** of the rudder completely.





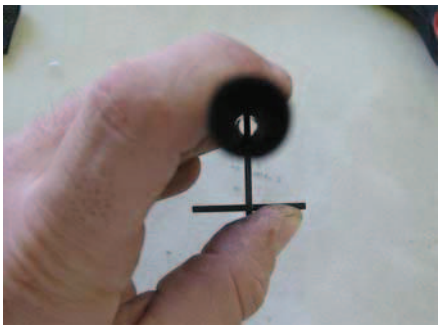
Stick the spring **into the balsa material** and then harden the balsa with super glue.



Mounting of elevator (Balsa)

Cut a **slit of 12cm** length on the downside of the boom for inserting the carrier of the elevator. The position should be **90mm from the end of the boom**.

Push the **carrier into the boom** as far as it will go.

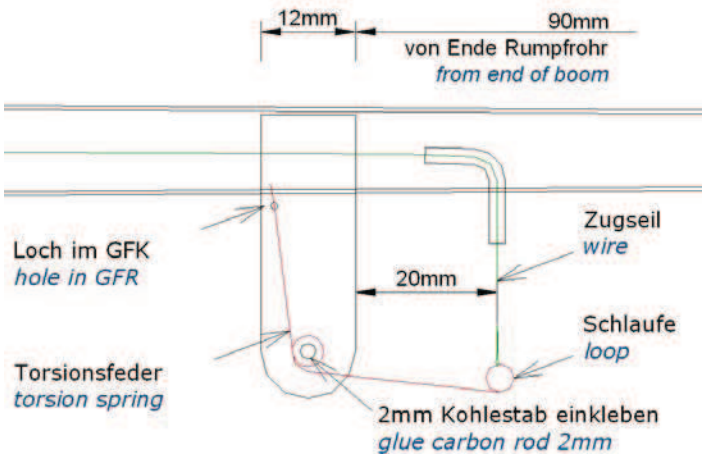


Assemble all parts as shown on the photos.

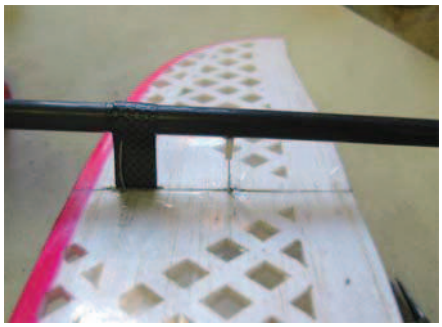
Glue them well with super-glue or epoxy-glue.

Torsion spring for elevator

For bending the wire put one end in a hole of the carbon cover. Then bend the wire with **1¼ windings** around the carbon rod. Form a **loop** on the other end to mount the kevlar rope. Twist the carbon rope and fix it with super glue. In addition, you can push a shrinking tube over it to secure it.



For creating the rear junction **push the carbon rod into the balsa**. **Harden** the resulting holes **with super glue** thoroughly and drill the holes again afterwards.



Attach the rudder **softly** to the boom with some drops of super glue.

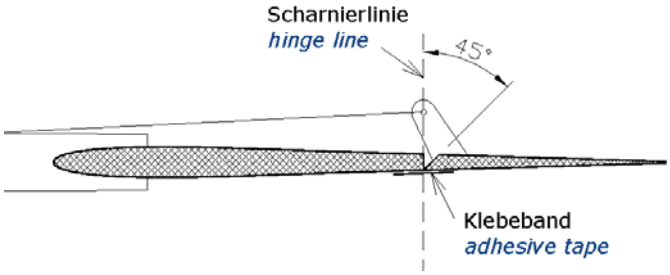
Then check the **exact alignment** on **each axis** and correct it if necessary. If the rudder is positioned correctly, **glue** it carefully with super glue or epoxy glue.

Add some **carbon rovings** for strengthening on both sides **across the axis** of the boom and **in extension of the boom**. You can also strengthen with **glass fibre** (1x 50g/m²).

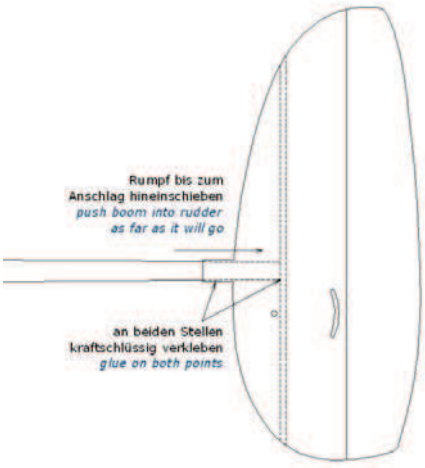
5.2 Stabilizer - GFR

Sand the rudder **wedge-shaped** on the **hinge line**, so that you can move it in both directions. Note that the **hinge line** must be placed **on the left side** (looking towards flight direction) for **right-handers** and the other way round for left-handed persons.

Next, glue the **lever** in extension of the axis of the boom. The **hole of the lever** should be **above the hinge line**. Fix the control surface of the rudder with **adhesive tape**.



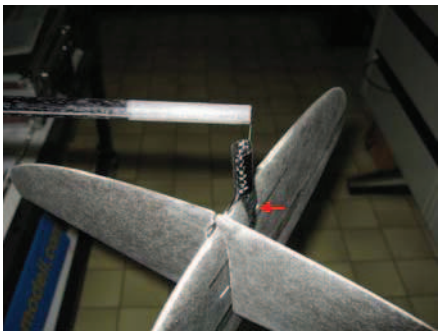
Fix the **carbon rod (2mm)** with superglue **in the rudder**. Now you can mount the elevator. The elevator will keep the distance between the two carbon rods. If you move the spring without the elevator mounted, the spring may disappear inside the rudder. Only when the elevator is mounted, the spring will move along the track cut out. Nevertheless, **check the elevator for free movability**. If necessary, enlarge the hole in the rudder.



Push the boom (first for a test) into the stab until it touches the spar. **Only, if you see it in the check hole**, the boom is on the right position. Remove foam, if necessary. Before gluing, **grease the wire** to avoid that it will also be glued.

For gluing, put a **thin line of epoxy glue** onto the **end of the boom** and push it into the stab as described above.

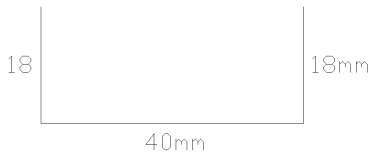
If the stabilizer is **aligned correctly** on each axis, **fix it** with **super glue on the carbon tongue.** Then, you can let **thin super glue** run into the carbon tongue and the check hole on all sides. Pay attention to the kevlar wire, so that it keeps free movable.



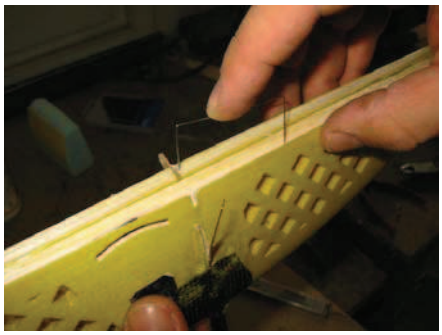
If you want to save weight, you could fix the stab just with super glue – on the carbon tongue and in the check hole.

Torsion spring for rudder

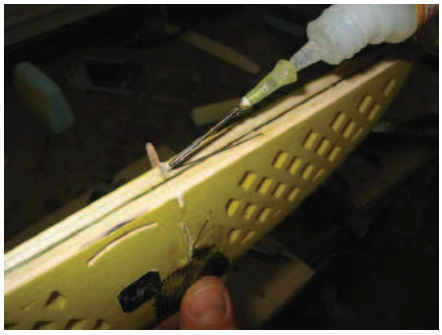
Bend the thinner wire (if there are two) according to drawing below.



Tip back the **control surface** of the rudder completely.



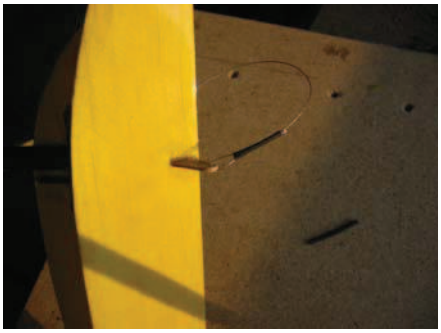
Stick the spring **into the balsa material** and then harden the balsa with super glue.

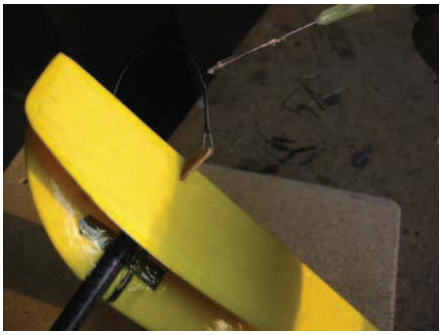


You can stick the 2 halves of the elevator to each other **on the leading edge** with an **adhesive tape** to avoid unintended demounting.

5.3 Connection of the wire

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



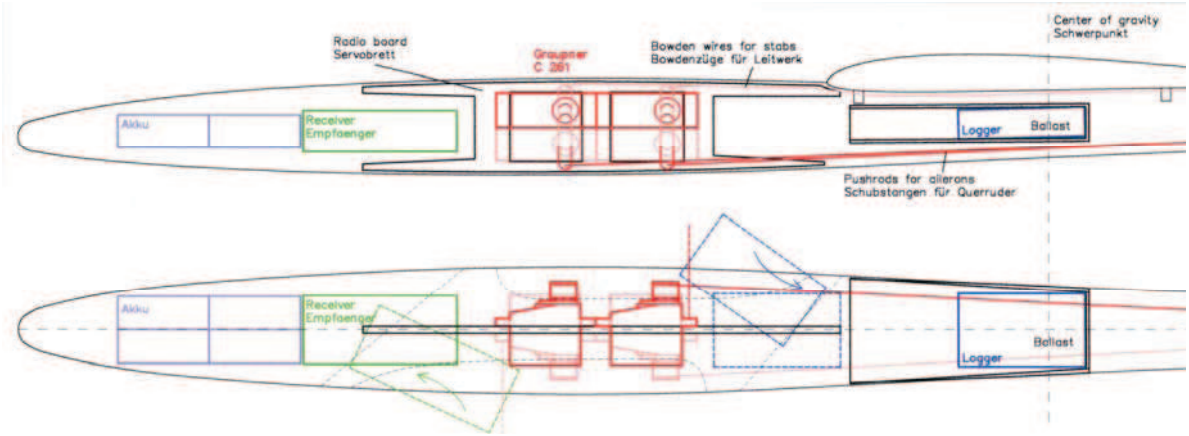


Make a **loop, twist the end** and put the end of the wire into a **shrinking tube**. Shrink it and fix it with a **drop of super glue**.

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

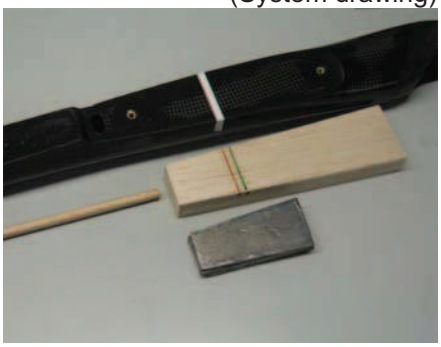
(Here shown at Mini-Fireworks)

6. Fuselage structure



(System drawing)

Ballast box



In order to ensure **full strength** of the fuselage, you must **stick the ballast box** into the fuz.

Glue the **balsa parts together** with super glue and sand the edges.

The ballast should be placed **exactly in the centre of gravity**. To do so, push the box into the fuselage, make some marks on a **rod**, which you lead inside the fuse from the rear. Push the ballast box into the fuselage from the front until it touches the rod.

Push the ballast box into the fuselage. It should **touch** the **fuselage on the sides** and the **screwing insets on the top**.

Note, that there must be **enough space** between the bottom of the fuselage and the downside of the balsa box **for the pushrods of the ailerons**. Glue the balsa box **as far upwards as possible**. If necessary, grind the resin round the screwing insets.

Fix the ballast box in this position with **super glue**. Grind the gluing spots thoroughly before gluing.

Radio board

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

Before you glue the radioboard, you should first **find out the optimal position.** To do so, place the radioboard inside the fuselage without gluing and mount all servos.

Make sure that all **levers are freely movable** (also with canopy mounted), and that the **deflections** of the levers are big enough. Note that the pushrods for the **ailerons need space below the ballast box**. Note, that the holes in the radioboard are accessible and that the **servos can be screwed** without problems from outside. The rear upper end of the radioboard should touch the front screw inset.

You can variate the position of the servos with small **blocks of wood**.

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

Before you fix the radioboard in the fuselage, grind the gluing spots thoroughly and strengthen the edges of the servo board with super glue.

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

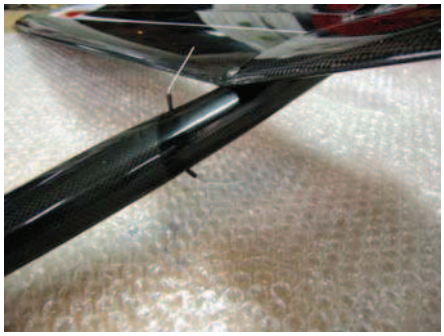
You can add **carbon rovings** left and right of the gluing spots for additional strength.

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

Installing 2,4 GHz

One of the 2 antennas is lead out **on the top** side of the fuselage behind the canopy. Secure it against sliding down with a drop of glue. Fix the **other antenna** on the **downside** with adhesive tape to the fuselage in an **angle of 90° to the first antenna**.

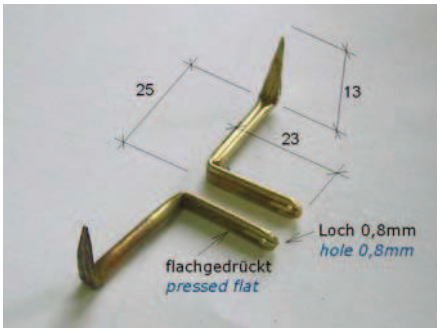
The antennas should have a **length of at least 15cm**. Lead them backwards along the servos, push the through a hole in the carbon fuse and let them jut out app. 3,5cm. Protect the antenna from being cut by the sharp carbon by using a rubber spout in the hole.

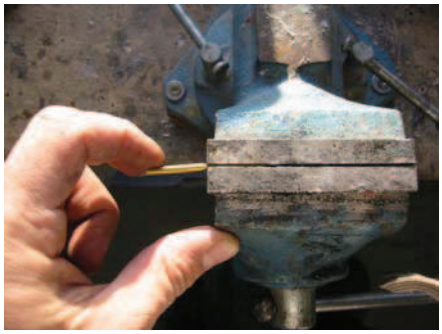


7. Controlling the ailerons

Bend, press and grind the **brass pipes** according to the picture.

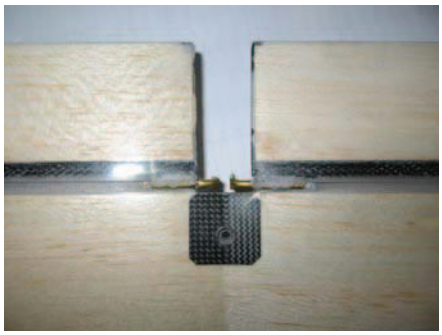
Drill holes with a diameter of **0,8mm** for hooking in the push rods.

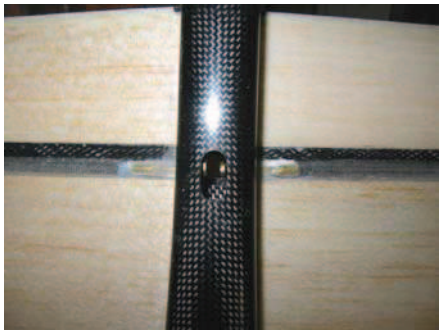




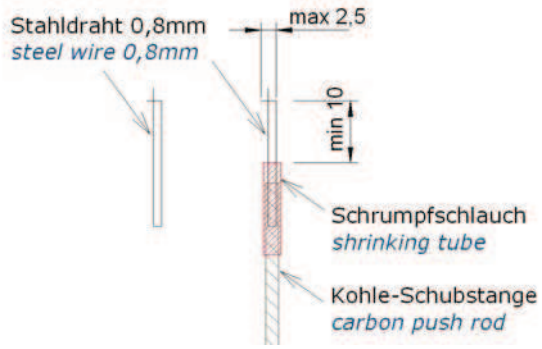
Glue the brass levers **with thickened epoxy glue or epoxy resin** to the wing.

The levers should be situated as **near** as possible **to the turning axis** of the aileron.





To **avoid unintentional demounting** glue little steel **hooks** (0,8mm steel) to the ends of the carbon pushrods.



Fix the hooks with a drop of **super glue**.

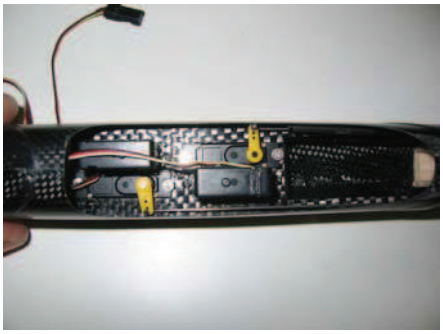
Hook the push rods with a pair of **tweezers** from the downside of the fuselage into the brass levers.

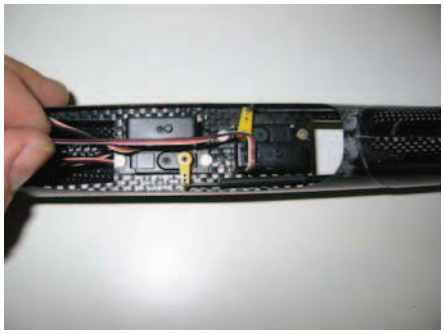
Attaching the servos

Shorten the pushrods to the right length and mount a hook against demounting on this side, too.

Fix the lever after trimming with switched on radio control **in the right position** with **super glue**.

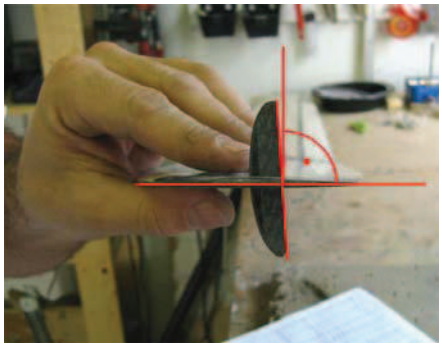
Fuselage from the left and from the right





8. Installation of the throwing blade

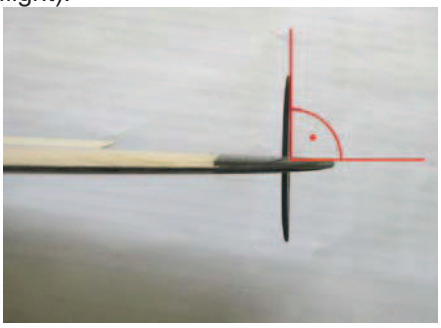
Alignment

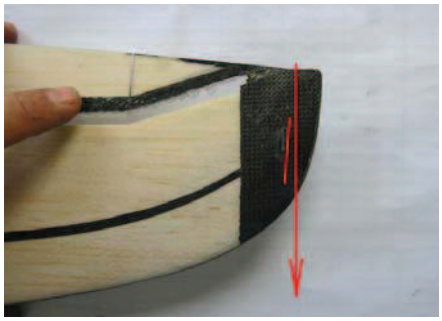


Side view:
Tilt the blade **on the upper side** of the wing a little bit **in the direction of flight.**

Front view:
Mount the blade **right-angled to the wing**.

View **from above**:
Turn the axis of the blade a little bit **to the fuselage** (looking in direction of flight).





Grind the blade, so that it gets an **aerodynamical cross-section** and it **feels handy** when you hold it in your fingers. Don't make the trailing edge too sharp, you might injure yourself when throwing your DLG.

Lay the **paper template** on the wingtip and **thrill a hole at the marked spot.**

(Both wingtips - left and right - are prepared for the installation of a throwing pin or blade.)

Mark the length of the blade.

Remember, that the axis of the blade should be turned a little bit to the fuselage (looking in direction of flight).

Now **cut an opening** into the wing with a small driller or a milling cutter.

If the cut is big enough, **put the blade through** and **align** it in all directions (see above).

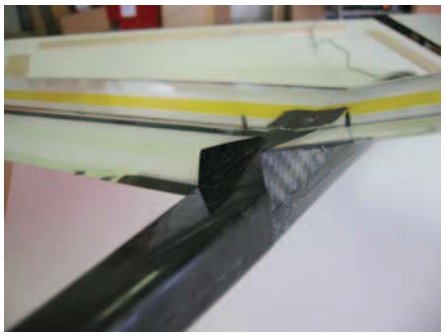
When the position is correct, **fix** the blade **with super glue**.

Ready mounted throwing blade

9. Optimizing

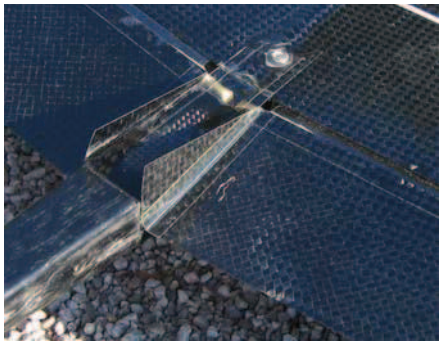
In order to **optimize the aerodynamical transition** between aileron and fuselage, you can glue the aerodynamical **fences** enclosed.

Ready mounted fences



Sealing the fences

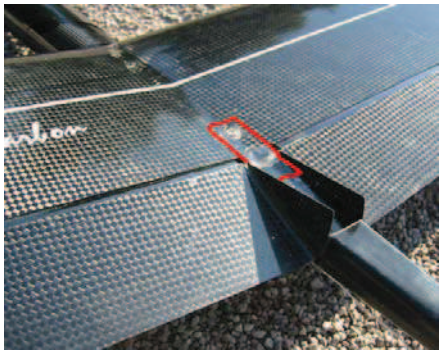
You can make a **sealing lip between aileron and fence** out of adhesive tape. This will avoid negative currents, that influence the performance of you glider.

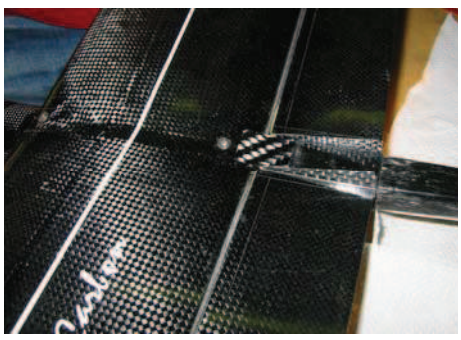


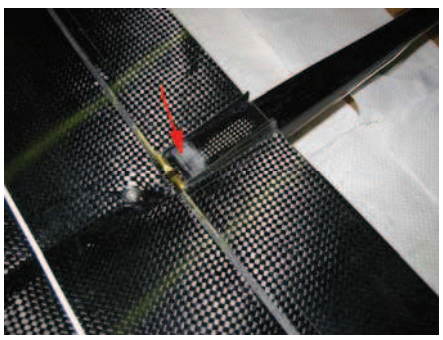
Covering the levers in the fuselage

Cover the **gap behind the rear screw** with the **little carbon tile** enclosed. Glue it on the part of the fuselage that is placed between the two ailerons. You can thread in the wing from the front when mounting the wing on the fuselage.

Cover the **screws** with a piece of tape.







Controlling the ends of the ailerons

In order to move the triangular ends of the ailerons, you can bend a piece of **steel wire (1mm)** and glue it into the end of the aileron as shown. Let the wire jut out about 6mm. You can bend the end of the wire to ensure not to cause damage to the shell on the inside.

The easier way is to connect the control surfaces with **adhesive tape** (see picture).

Leading edge of the wing

As you nearly don't recognize a damage of the leading edge of the wing (f.e. after hard landing), we advise to put a **strip of adhesive tape over the leading edge**.

The film is thin enough not to disturb the aerodynamic, but it surely will extend the lifetime of your Fireworks4.

Voltage control

We recommend **DLG-saver from Simprop** against power failure of your Fireworks.

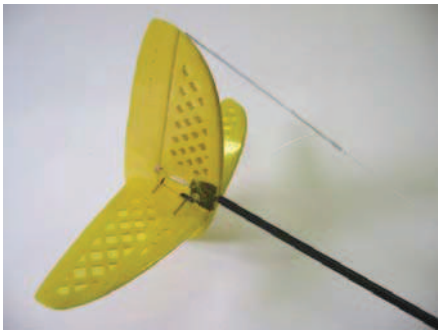
Installing ballast

You can build your **own custom ballast** or for example buy weight in a **shop for fishing tackles**. A useful grading is f.e. 30g and 60g weights.

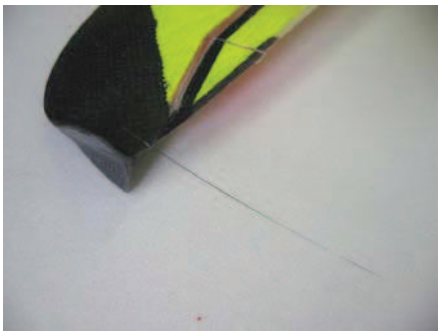
Fix a **steel wire** on the ballast and bend the front end 90°. You can lock the front steel end in a small block of wood with a hole.

10. Installation of antenna

In order to have an undisturbed reception a **part of the antenna** must be situated **outside the model**.



An easy solution is to **fix the antenna to the end of the elevator**. Lead the antenna inside the fuse behind the wing and then leave the fuselage.



Another possibility is to lay the antenna **inside the gap of the aileron**. For improving reception on **carbon wings** you can solder the antenna to a steel wire, d=0,3mm, which you fix at the end of the wing and let stand out to the back about 10-15cm.

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

For installing 2,4 GHz: look at chapter “fuselage structure”

OTHER

11. 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**:
   Leave the antenna inside the radio control and go away from the glider up to a distance of about 60m. The control surfaces should not tremble.

12. Notes for the use

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

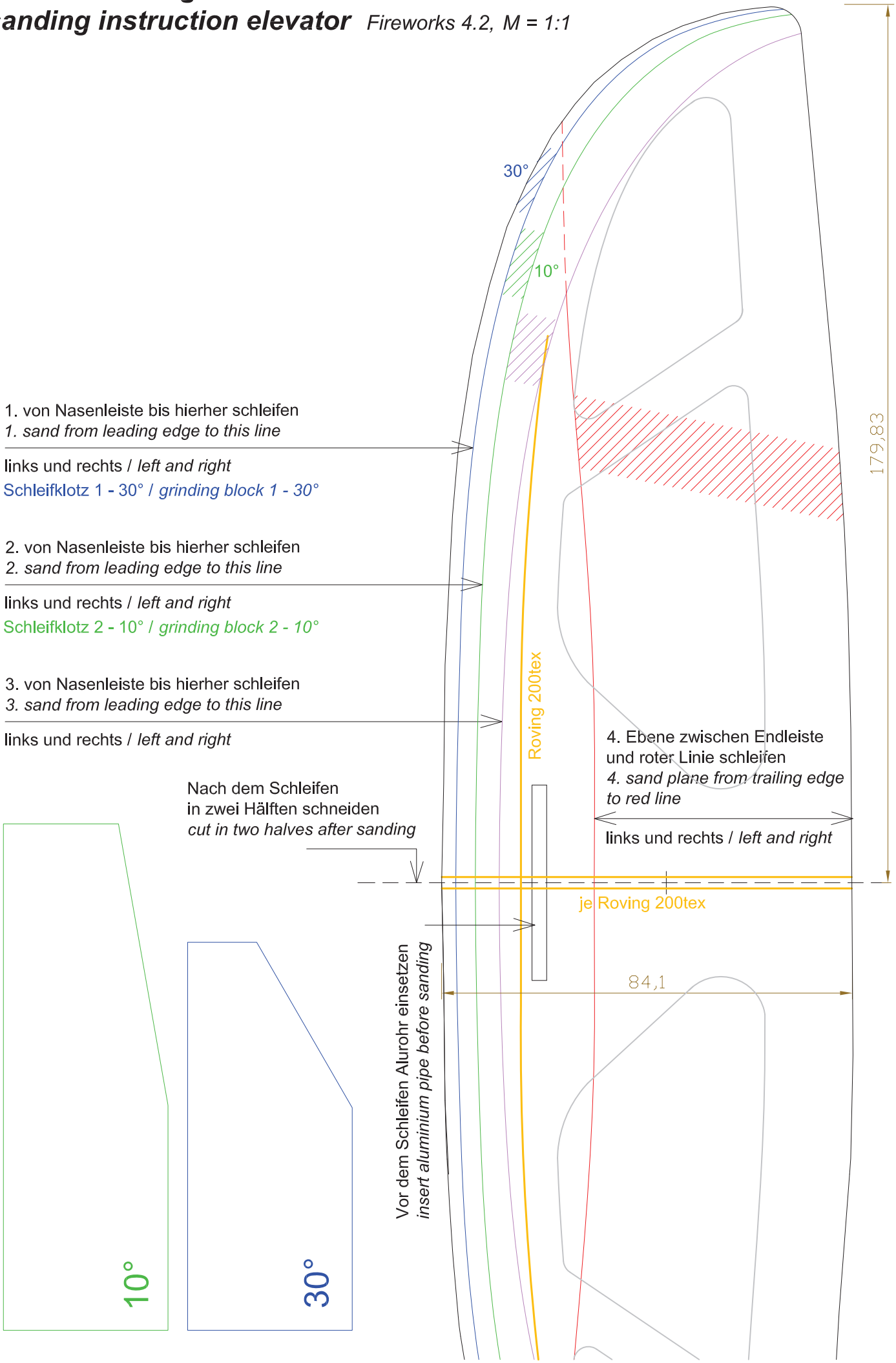
During flight heating by the sun is no problem, as the model is **cooled by the wind. On ground** the glider should be kept **inside protective bags** or **in the shade.**

After every **ungentle landing**, you must **check your model for possible damage**, such as:
- Is the radioboard still glued thoroughly?
- Did the leading edge of wing burst open?
- Did rudder or elevator get damaged?

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

Schleifanleitung Höhenleitwerk Fireworks 4.2, M = 1:1

sanding instruction elevator *Fireworks 4.2, M = 1:1*



1. von Nasenleiste bis hierher schleifen
1. sand from leading edge to this line

links und rechts / *left and right*

Schleifklotz 1 - 30° / *grinding block 1 - 30°*

2. von Nasenleiste bis hierher schleifen
2. sand from leading edge to this line

links und rechts / *left and right*

Schleifklotz 2 - 10° / *grinding block 2 - 10°*

3. von Nasenleiste bis hierher schleifen
3. sand from leading edge to this line

links und rechts / *left and right*

4. Ebene zwischen Endleiste und roter Linie schleifen
4. sand plane from trailing edge to red line

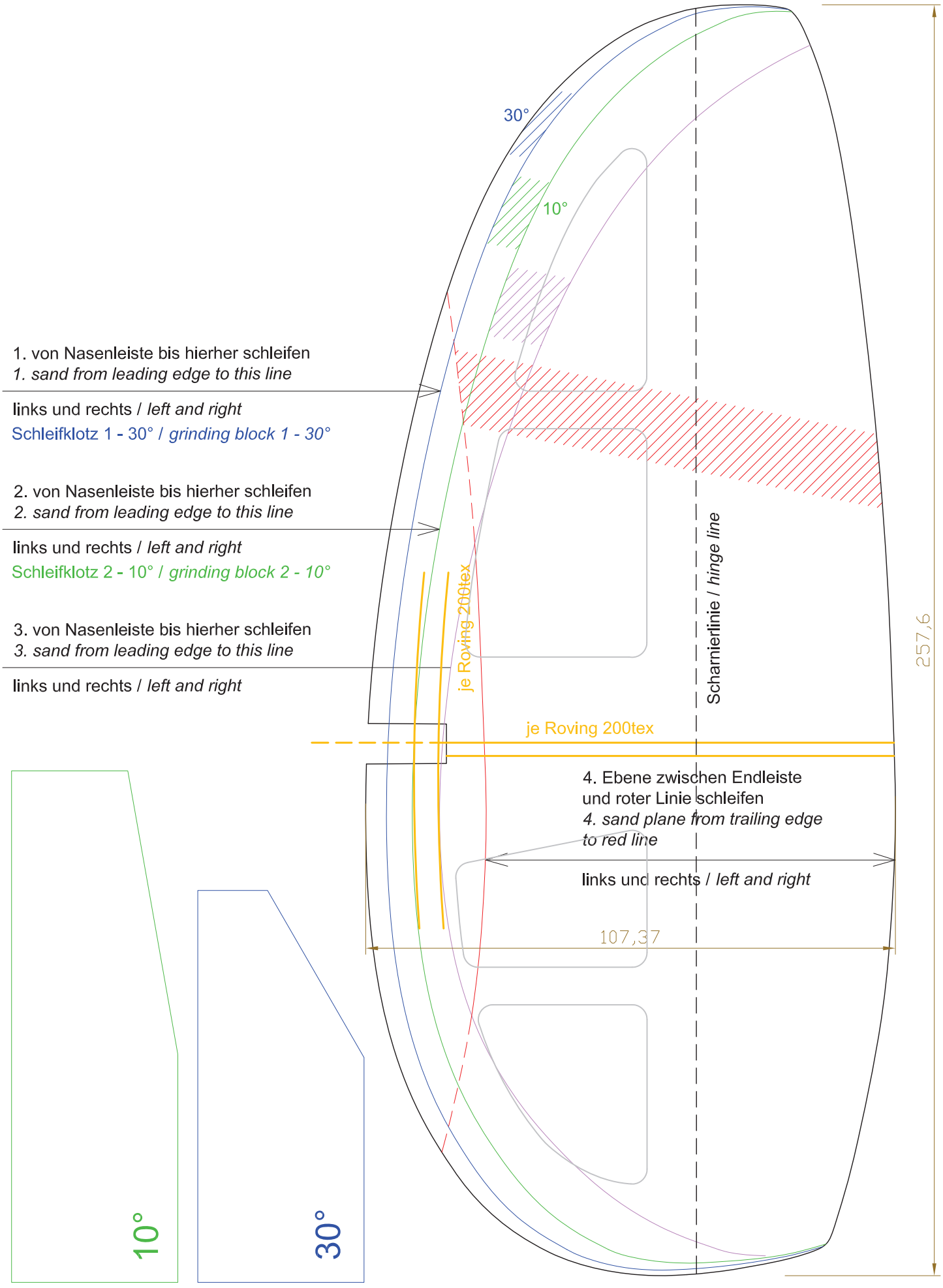
links und rechts / *left and right*

Nach dem Schleifen in zwei Hälften schneiden
cut in two halves after sanding

Vor dem Schleifen Alurohr einsetzen
insert aluminium pipe before sanding

Schleifanleitung Seitenleitwerk Fireworks 4.2, M = 1:1

sanding instruction rudder *Fireworks 4.2, M = 1:1*



Stiftposition 1:1
Blade position 1:1