Build Instructions
XBow²

1Wing
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Disclaimer

Please fully read the build instructions prior to build.
Operating model aircraft may induce risk of harming property and people. Model aircraft built from this kit are no toys. Please follow local law and make sure to have suitable insurance.
1Wing is not able to ensure proper build and safe operation and thus does not take liability for any material or non-material damage resulting from using their products.

Versionshistorie

14.06.2020	V0.9	Pre-release
15.06.2020	V0.91	Auswiegen bebildert
24.06.2020	V0.92	Schwerpunkt und Ausschläge geändert, Anlenkungsausschnitte angepasst
14.03.2021	V1.0	Schwerpunkt und Ausschläge geändert, Dichtlippen hinzugefügt
06.04.2021	V1.1	Hinweis zu lateralem Auswiegen hinzugefügt
17.04.2021	V1.1E	Translated to English

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General information – tips&tricks

The build instructions are setup in a way that the XBow may be build in two evening sessions and curing happens overnight. Final steps may be completed on the third day.

• Especially with flying wings, accurate CG and slop-free linkages are absolutely critical to achieve best performance and handling. Please use the described cross-linkages and no RDS/IDS systems.

• Following the overall concept of an extremely robust model, it is not recommended to install 8mm wing servos. Slop or broken gears during hard landings is just a matter of time.

• KST X10mini in servo frames with counter bearing are highly recommended.

• The recommended antenna position, behind the wing has proven to be very reliable. Any other antenna installation may induce risk of control link issues.

• During build, please make sure to put the wing on a soft surface to avoid scratches.

• Please put tape around all areas where you are working on to avoid damage to the surfaces.

• We highly recommend 24h gluing epoxy (Uhu Endfest, Araldite, etc.). Thickening (e.g. with Thixo) may help with proper installation of the control horns.

• Any glue remains on carbon surfaces should be removed immediately e.g. with Q-tips and Alcohol (Isopropanol). Acetone may render the clear carbon surfaces matte.

There are very different clear tape qualities. We highly recommend “Tesa Kristall”

• Magnetic switches (e.g. Zepsus Nano) make your life easier.

• Clear carbon surfaces heat up significantly in direct sunlight. Installed electronics and battery cells may get damaged. Please protect your model when not in use.

• Flying wings without fuselage should be best launched with a little unconventional grip. Thumb on top, four fingers below the wing. Please see the video:

https://youtu.be/J36w8RoruNk

Inhalt des Bausatzes

1. Wing
2. Tail
3. Carbon tubes for tail boom interface:
   1x 10x9x8mm
   1x 9x8x38mm
   1x 8x6x38mm
4. Tail boom (1 spare)
   2x 10x9x100mm
5. 2x carbon control horns
6. Carbon bungee hook
7. 3x 60g self-adhesive weight
8. Carbon sheet material for hatches

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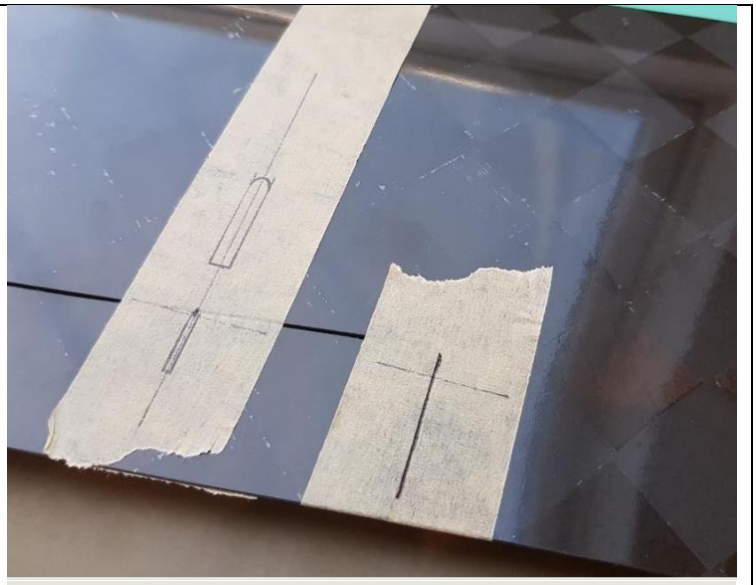
1. Build phase: control horns and tail interface

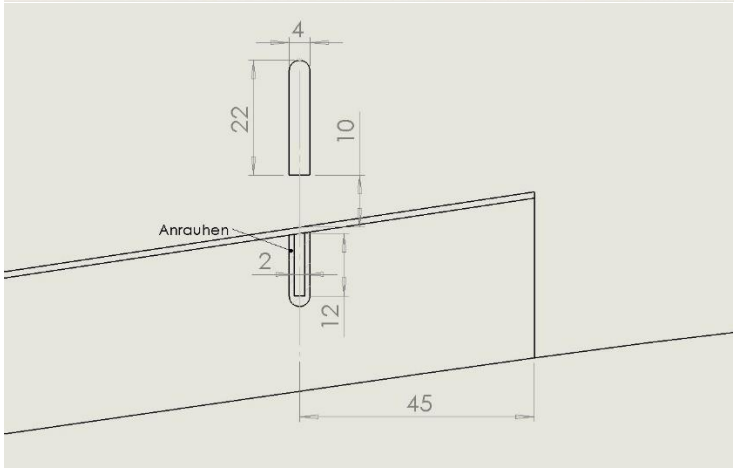
Openings for linkages and control horns

Put tape around the area of interest and draw openings according to drawing. Use the flaps inner edge as reference.
Use e.g. a Dremel to carefully cut out openings.
Roughen the surface area around the horns to improve bonding.



Remove the sandwich material and silicone flap reinforcement in the area of the control horns to ensure proper gluing. All gluing surfaces must be roughened and Cleaned with alcohol.

The main spar needs ~6-8mm holes to rout through the linkages. Mark the positions and carefully manually drill with a long drill or round file.
Install M2.5 clevis and rod to help align the horns.



Glue horns with thickened gluing epoxy.
The front surface of the horn shall be flush with the flaps edge.
The horn shall be directly bond to the lower outer skin of the wing.
Ensure proper alignment and secure with tape.

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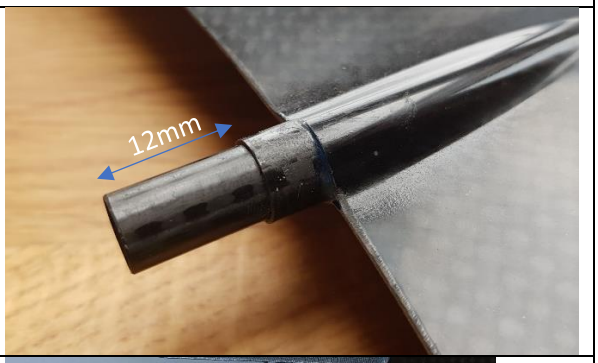
Tail boom interface

Prior to gluing, please make sure to check if the tube may penetrate the wing far enough (>15mm). Rempove excessive material with Dremel or round file.	
Please roughen the tubes surfaces (100-320 sand paper): 8mm Tube: complete outer surface 9mm Tube: complete inner surface and outer surface, leave 12mm untouched 10mm tube: inner surface Clean with alcohol	
Apply thickened gluing epoxy to the wing opening. Make sure to put some epoxy to the radii as well to reinforce the area.	
Glue 8mm tube into 9mm tube. Glue the 10mm tube to the 9mm tube in a way that 12mm remain for the actual connection to the tail boom. Put epoxy to the remaining roughened tube area as well and slide the tube into the wing opening. Remove excessive epoxy with alcohol and Q-tips.	
Slide tail boom onto the interface and align e.g. on tables edge. Make sure the tail boom is straight in longitudinal direction. Up/down is not too important since there is no horizontal stabilizer. Let all adhesions cure over night.	

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2. Build phase bungee hook and servo installation

Bungee hook

Deburr bungee hook edges and add a radius where the bungee cord ring will touch. Roughen gluing surfaces according to picture.	
Cut a ~3-4 by 12-13mm opening, 3mm from the nose with a Dremel. Remove the material al the way to the upper surface skin. Roughen the surface around the cut out to ensure proper bonding.	
Glue bungee hook with gluing epoxy	

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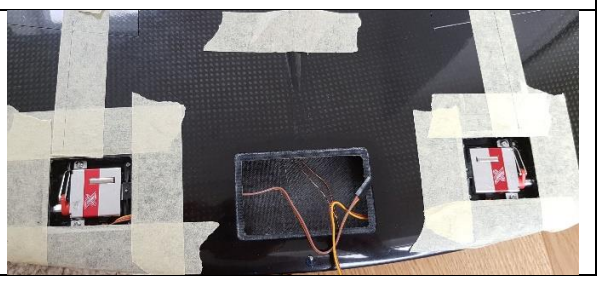
Servo installation

Please do not use alumium servo horns. These will develop slop over time. Cut and drill (1.5mm) servo horns according to picture. Put servo to neutral position and apply horn with approx. 20° tilt towards flap	
Clevis's need to be cut out to allow required throws.	
Put the servos to the planned positions and cut linkages to the appropriate length. Servos need to be slid in from center opening.	
Treat servo surfaces with release agent an install them to the servo frames	
Roughen and clean servo frame and wing gluing areas. Apply gluing epoxy to all gluing surfaces.	
Install linkages and secure servos in positions by tape or weights.	

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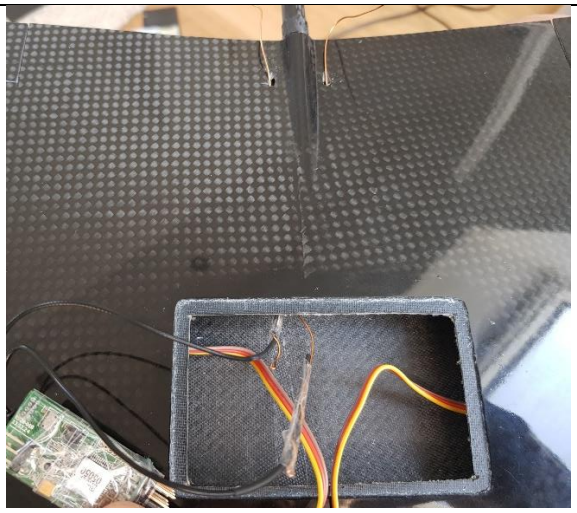
3. Build phase: final steps

Cut outs for antennas may be drilled (2mm) approx 20mm from trailing edge. Start drilling perpendicular to surface, then tilt the drill. Use a round file or manually drill a 6-8mm hole in the center. Route the antennas using a thin wire.	
Tail boom and tail may be installed with 4-5 tight wraps with Tesa Kristall (clear tape). During hard landings, this allows the tail to rotate and prevents damage.	
The carbon sheet is laminated in a mold. Please use the designated positions of the openings to get perfectly rounded hatches following the original surface. RC and servo openings may be copied to tape with a pencil. Cut out the template with scissors and apply to the carbon sheet. Cut out the hatches with scissors and sand the edges to fit. Apply openings by Dremel for the slightly excessing servo horns	
Apply hatches with silicone or clear tape	

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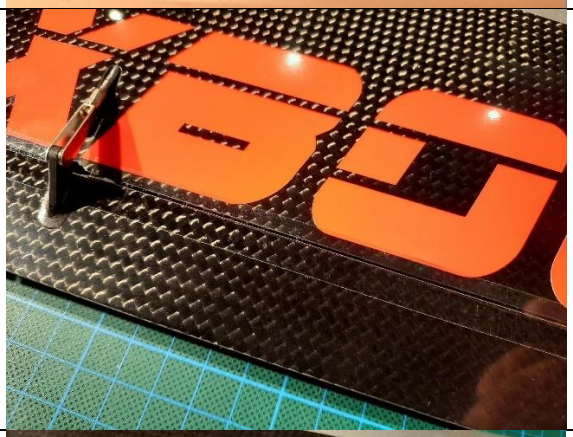
Wipers

Use two strips of double-sided tape in sufficient distance (flap +5cm) to secure the clear tape on your table. Put Tesa Kristall (15 oder 20mm) with the sticky side on up to the table. Put a second strip of tape with sticky side down offset to achieve a remaining sticky strip of ~6mm.	
Cut the doubled up side to ~5mm	
Install the wiper to the flap side, cut to flaps edges.	
Move flaps to lower positions and slide in the wiper.	

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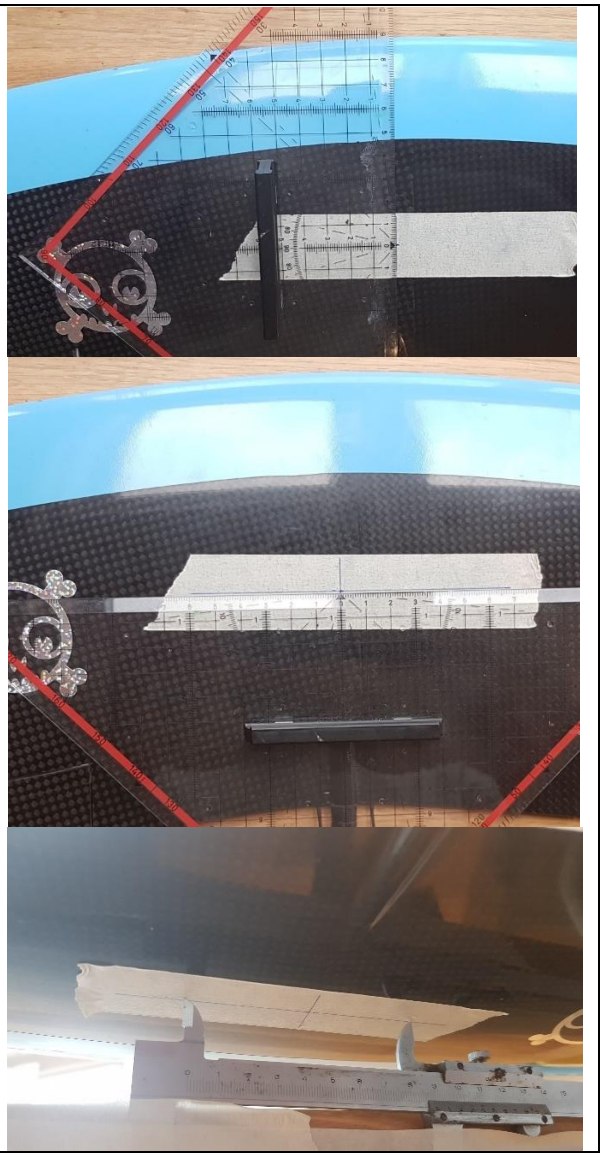
Center of Gravity adjustment

Due to the short levers, the CG on flying wings requires to be balanced more accurately than on regular planes. Please take your time and also plan for a few trim flights to get the CG perfectly right. You will get rewarded with perfect flight performance. You may use an accurate digital CG scale as wel. However, the rounded leading edge is to be compensated for. Thus, these instructions show a manual way to adjust CG

Caution: Please also balance the model in lateral direction. A CG to the right or left may lead to a more unfriendly stall behavior.

Apply tape approx. at 87mm as seen on the picture. Align with the tail boom and mark **87mm(+-0.5mm)** from the nose. Draw line perpendicular to centerline. Balance the finished model e.g. on caliper tips upside down. Use trim weights until the model is balanced perfectly horizontal. All trim weight need to be sticked/glued/secured inside the model to avoid CG changes due to hard landings or high accelerations during bungee launch. Final CG shall be achieved during trim flights. Remove weight from the front in 5g steps until flying gets more nervous on the elevator and it gets harder to fly a straight line. Reduce elevator throws to achieve a stable flight again. Iterate until elevator gets to nervous. Add 5-10g to the nose again and you are done. The ideal CG will be around the 88mm mark, depending on your preferences.	

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Flight phases and throws

Ideal control surface deflections are highly dependent on center of gravity, pilot preferences and conditions. The recommendations below are to be considered as initial starting point for first flights

All deflections to be measured on inner flaps edge

Phase/Function	Elevator	Aileron
First flights (CG rather front heavy)	Basic setting: Elevator up 1mm hoch Elevator deflection: 4mm up / 3mm down 30% expo	8mm up / 7mm down 40% expo
Thermik	Basic setting: Elevator up 1mm hoch Elevator deflection: 4mm up / 3mm down 30% expo	8mm up / 7mm down 40% expo
Speed/very agile	Basic setting: Elevator up 1mm hoch Elevator deflection: 4mm up / 3mm down 30% expo	10mm up / 8mm down 40% expo
DS	Basic setting: Elevator up 0.5mm hoch Elevator deflection: 3.5mm up / 3mm down 30% expo	5mm up / 4mm down 30% expo

Recommendations to optimize the maximum elevator deflections:

Go for a dive and still in safe height (>50m) gently pull the elevator to max deflection for looping. When a stall happens (snap roll), reduce the max. deflection. When you find the point where the model goes through the looping without stalling, further reduce the max deflection by 5-10%. That's a setting where the model is suffiently robust against stalls, also in turns while maintaining agile flight behavior. You can still initiate stalls/snap rolls by combinated aileron/elevator inputs, which is desired for slope aerobatics.

Recommendations to optimize differential aileron deflections:

Optimal aileron deflections are quite subjective and also dependent on CG.

Easiest way to get to optimized aileron deflections and a neutral roll behavior ist o test and optimize in vertical flight phases e.g. in bungee start.

Adjsut the settings till the model rolls without pitching up or down. You may have slightly different settings rolling left and right, as linkage geometry is never 100% the same left and right.

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1Wing wishes you great fun on the slopes with your XBow² and always happy landings!

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