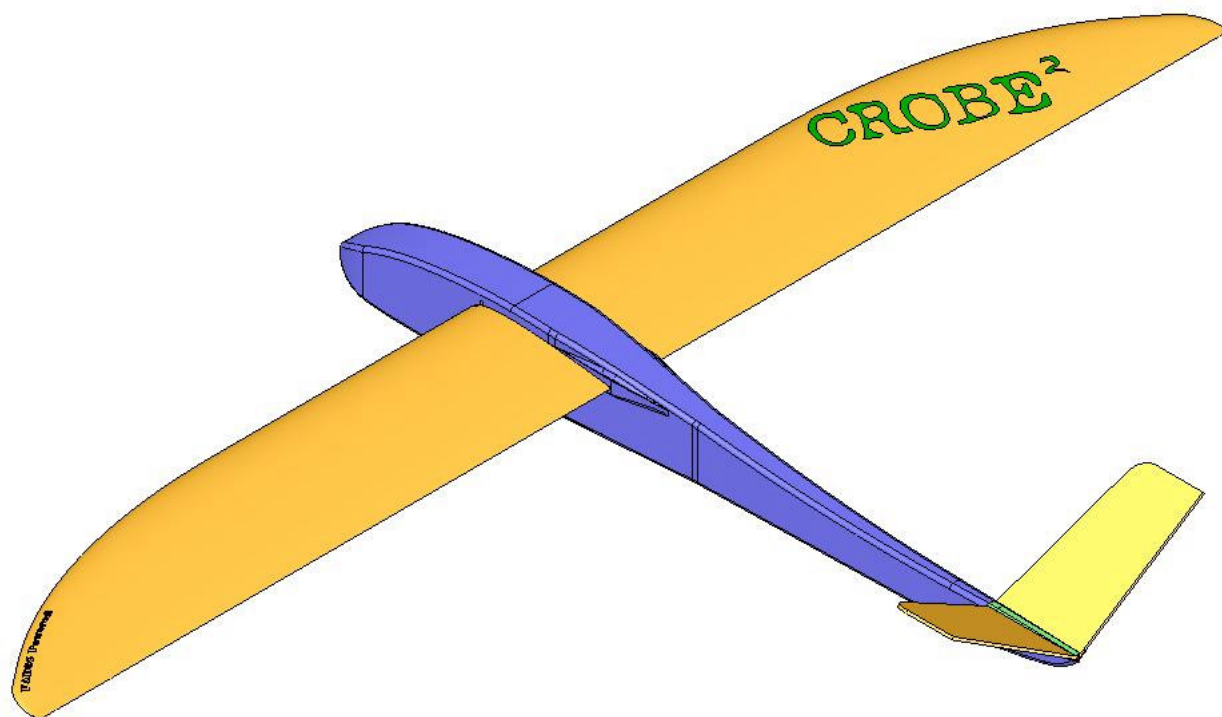
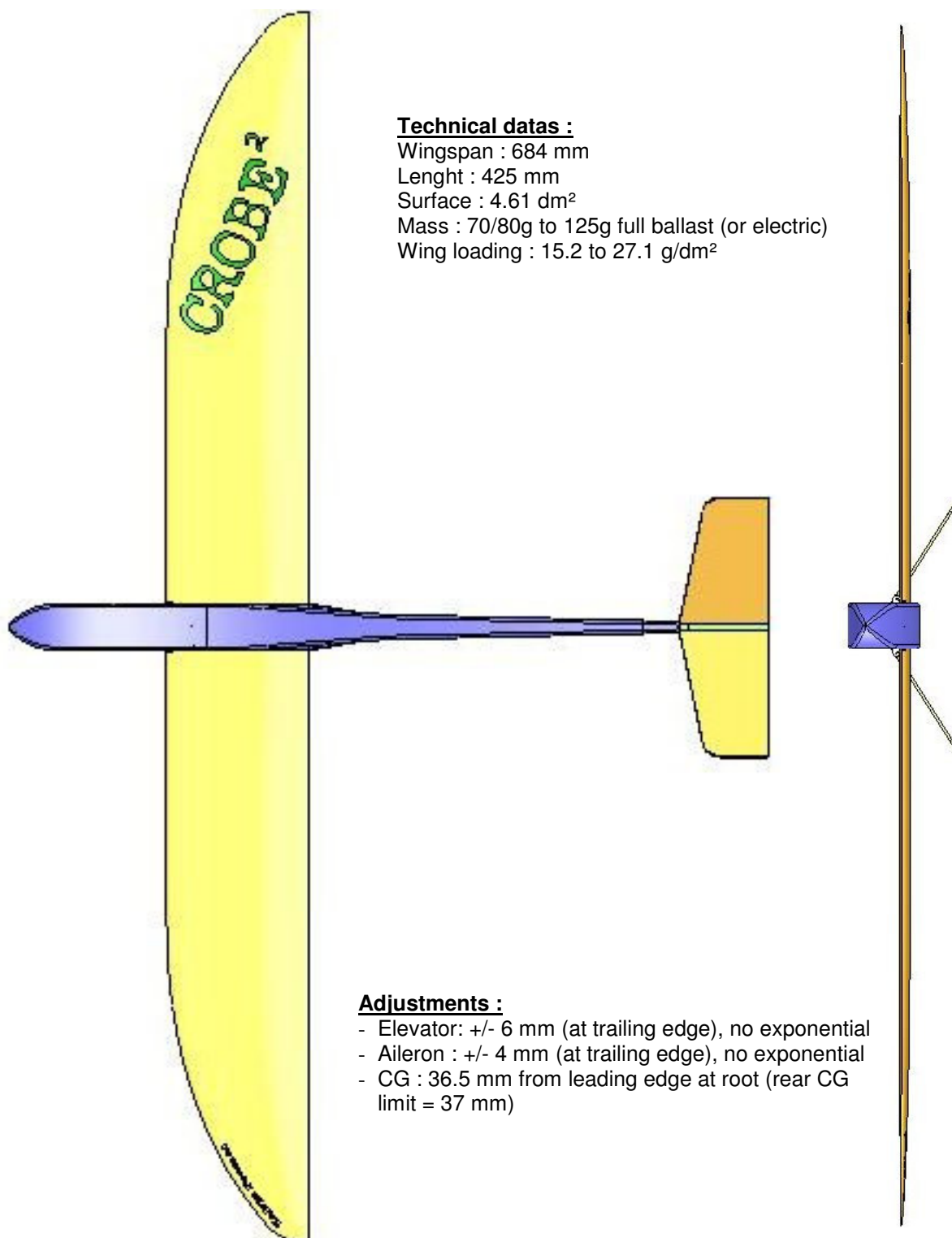
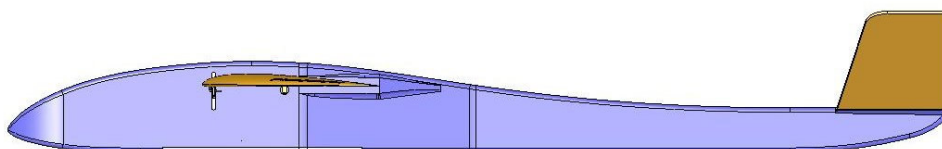


Crobe²

The success of Crobe never wavered since the first release published in the french "Model Magazine" in April 2007. So giving it a descendant had become indispensable. A real challenge, because the flying qualities and performance of the first title are evident and had already set the bar very high. And, if possible, with improvements in the strength and life of the little monster. So, after some efforts, here is the Crobe2.

Ah yes, for the curious who missed the first episode : What is the Crobe? Well, in a few words: like its bigger brothers F3F or 60" slope racers, the Crobe is a real gliding rocket, but in pocket version... thermal capable, fast, and even accrobatic, the Crobe is a real pleasure, very inexpensive and very easy to drive. And to reassure the most pessimistic, I could also add a stability as good as far bigger gliders.





Technical datas :

Wingspan : 684 mm

Length : 425 mm

Surface : 4.61 dm²

Mass : 70/80g to 125g full ballast (or electric)

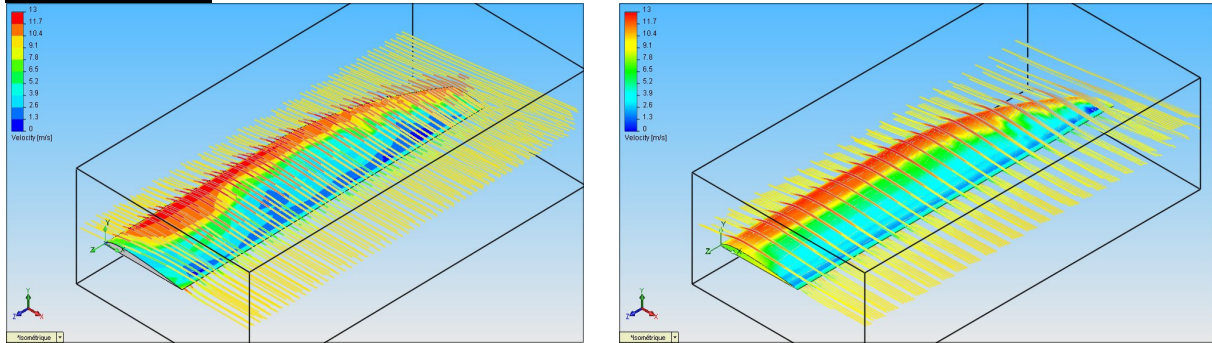
Wing loading : 15.2 to 27.1 g/dm²

Adjustments :

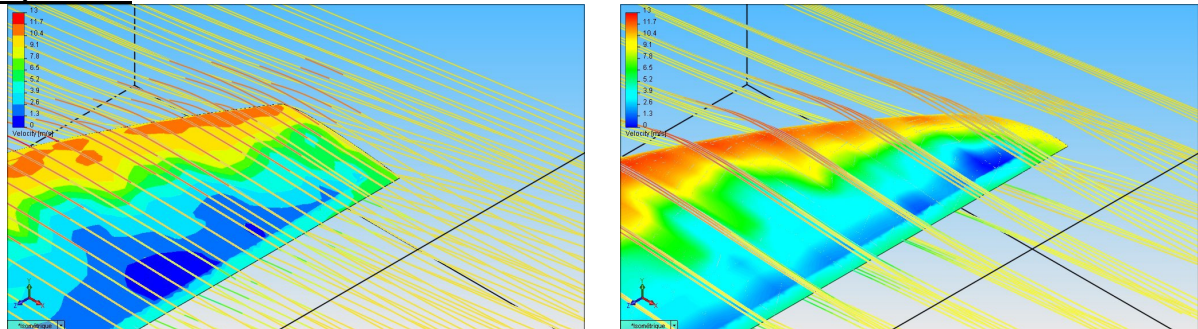
- Elevator: +/- 6 mm (at trailing edge), no exponential
- Aileron : +/- 4 mm (at trailing edge), no exponential
- CG : 36.5 mm from leading edge at root (rear CG limit = 37 mm)

First, just to graphically illustrate all the work of design and calculation to obtain the Crobe2, here are some views of comparative analysis (Navier-Stokes 3D), between the old and new wings. The main aim was to improve the smoothness in the lower speed ranges (6 to 12 m / s) of the flight envelope, which require special effort on improving the flow of the air at the tip and its neighbourhood.

Complete wing :



Tip detail :



A quick summary of the design

At the same time very simple and yet very binding, the choice has been the evolution in continuity. A Crobe must remain a Crobe, the second release should be identifiable without any equivocation. The overall aesthetic has been conserved, with still some minor tuning to make even sexier silhouette. Similarly, the keys to success of Crobe were renewed: flying control by pitcheron, FAD05 airfoil and balsa building.

However, this has not prevented from introducing some important improvements:

- Improved control system, with very linear response, more compact and less drag inducing.
- Fuselage without beam, and with a refined shape.
- Plywood reinforcements incorporated in the fuselage, for better strenght againsts punching effects of the wings when shocks.
- Karmans, shaped to take account of the pitcheron systems.
- Removable stabilizer.

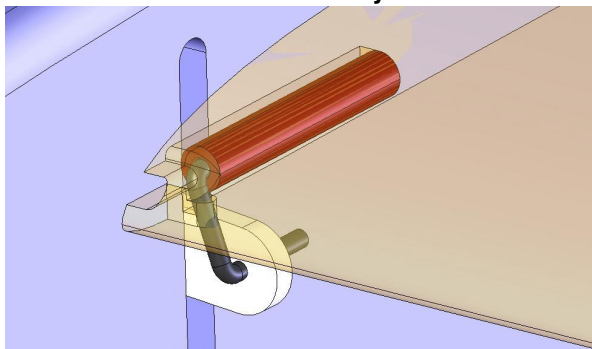
As shown in the introduction, aerodynamics research was pushed to the maximum to maximize glide. The overall gain is estimated at 4%, which in itself is very little compared to the work done. Nevertheless, a good pilot will feel the difference, which

justifies the investment. Caution, all this is true if the construction is right done. Although the Crobe1 has proven good performances despite an approximate achievement, but this is not a reason to rush the version 2!

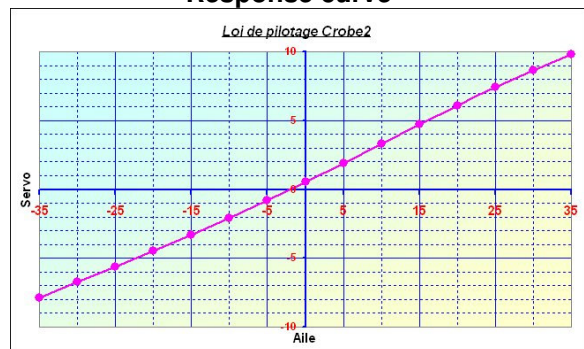
To conclude this quick overview, a word about the construction: for simplicity reasons, it remains entirely of balsa, with some 0.4mm plywood reinforcements. Even if it takes a little more time, the glueing are advised to white glue (vynil) rather than cyanoacrylate (because cyano makes balsa brittle around the glueing) . Likewise, the ideal finish is japanese paper with nitrate dope, very economical in mass while increasing the robustness of the model.

Control system

3D view of the system



Response curve

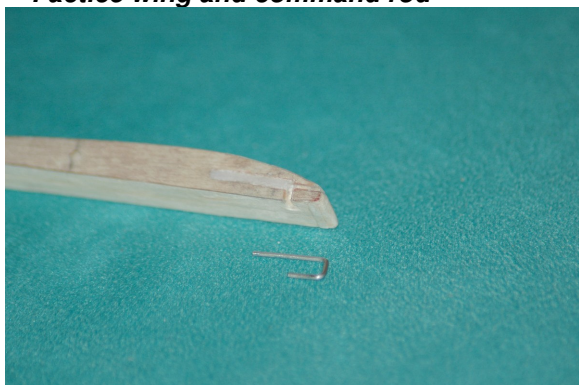


The system is very simple: a 0.8mm piano wire bended in U shape, and a plastic tube glued in the wing. Caution, this simplicity hides a system without any compromise, either in precision or strength. The graph above shows that the size and kinematic chosen give a perfect linear response of the wings in relation to the servos. This, unfortunately, is very rarely the case in most of control systems...

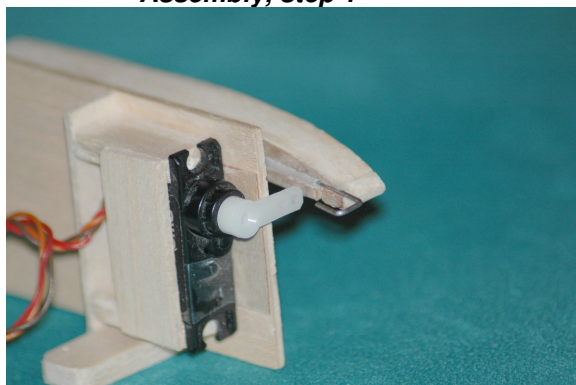
This system, unlike that used in the original Crobe, has become captive: the control rod assembly remains on the wing, with an axial extraction cleft, adjusted a little tight so the rod can't go out alone.

All calculations are very interesting, but nothing is better than practice to identify all problems. A demonstrator has been developed to validate the principle, which allows at the same time to verify the facility of the assembly of wings on the glider:

Factice wing and command rod



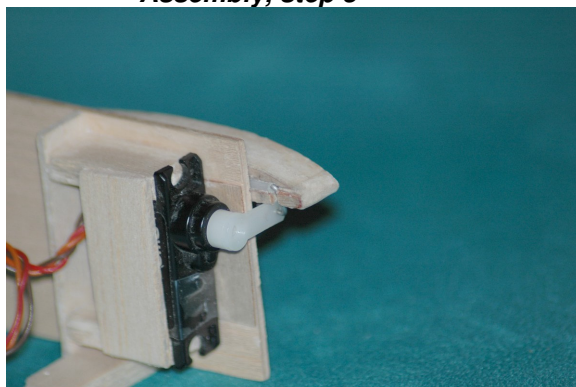
Assembly, step 1



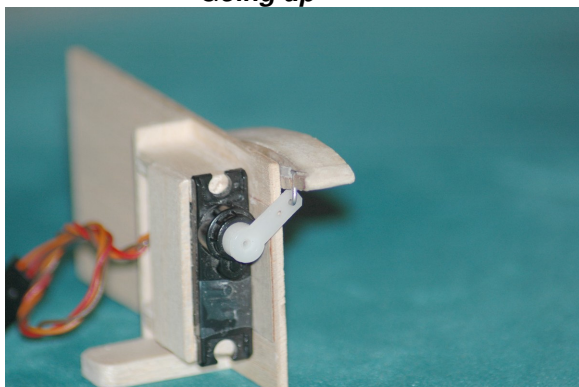
Assembly, step 2



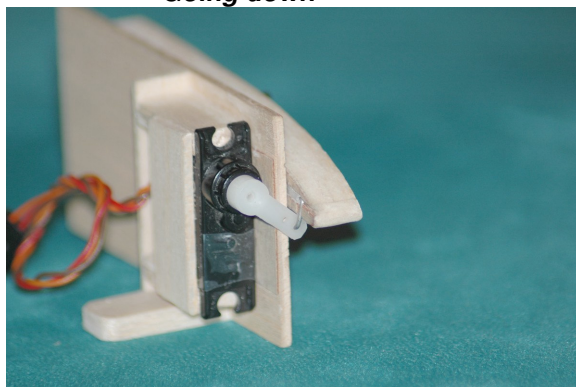
Assembly, step 3



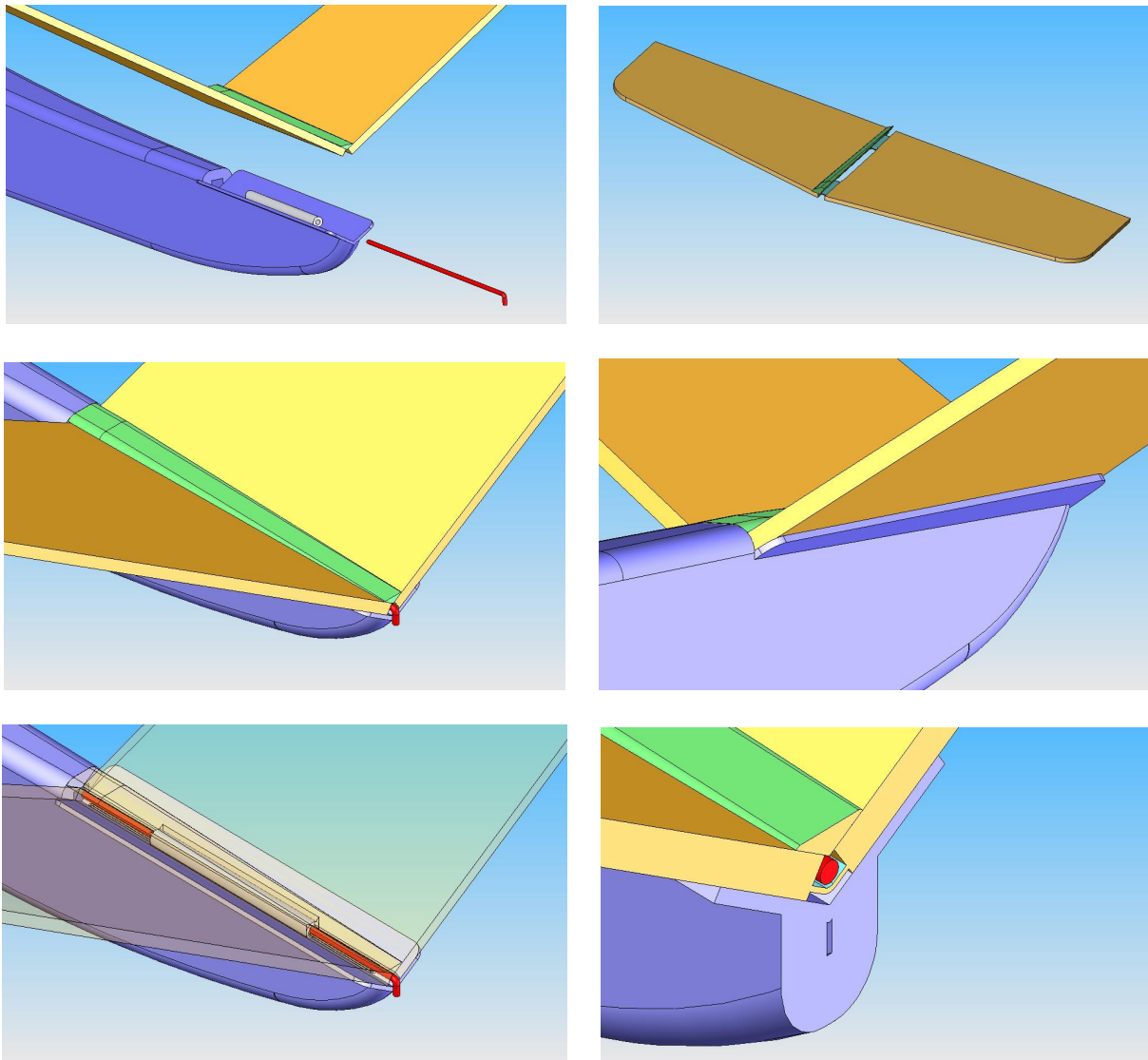
Going up



Going down

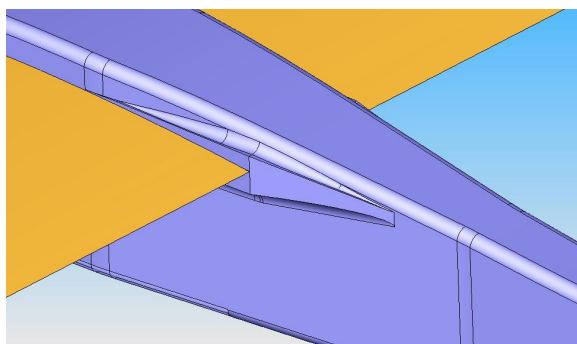


Removable stabilizer



The trick is to link the two half-stabilizers by two textile hinges. Their relative elasticity, which tends to flatten the stabilizer, is used to coerce the system, thus avoiding any play or parasite movement in flight. The whole thing is held by a simple 0.8mm piano wire, which passes over hinges and returned in a plastic sleeve stuck on the bed of stabilizer. To guarantee the system in any event, a small tab (in green on the illustrations) realized at the proper angle is bonded to a half-stabilizer, and locks the system when in place.

Karman



This system has been studied to reduce drag at average incidence corresponding to a standard flight, approximately half the maximum wing's travel (higher incidences are used mainly in aerobatics or emergency manoeuvre which can accept a loss of performance). The shaping is essential, it's easy to achieve with epoxy glue filled with micro-balloon, smoothed with a wet finger (surpluses are then removed with denatured alcohol). You can also use balsa putty, much lighter.

Some advices to choose the electronics

Many questions on equipment are often raised. Here is a small selection (extracted from an article in Model Magazine published in February 2007), with a tip: the price should not be the only criterion for choosing... quality is an important, particularly in small equipment.

Servos: mandatory for the 5 g class, thicknesses up to 10mm and a torque at least 600g.cm. Note that HXT500 / TP-SG50 were included in this choice, despite their thickness of 11.5mm, as their very low cost can seduce. This requires an adaptation to enlarge the fuselage. That could be avoided with other servos of Chinese origin, barely more expensive, like SSV distributed by United Hobbies (UH for the intimate).

Manufacturer	Ref.	Mass	Torque	Digit	Plug	Price
Blue Arrow	TS-4.6	4.6 g	700 g.cm	-	UNI / JST	15 €
Blue Arrow	TS-6.4	6.4 g	900 g.cm	-	UNI	15 €
Bluebird	BMS-306BB	6.6 g	800 g.cm	-	UNI	20 €
BMI	MY-6	6 g	800 g.cm	-	UNI	15 €
Cortex	S44	4.4 g	1000 g.cm	-	UNI	20 €
Cortex	S49	4.9 g	1200 g.cm	-	UNI	20 €
Donuts Model	DM-064	6 g	700 g.cm	-	UNI	15 €
Donuts Model	DM-064	6.4 g	900 g.cm	-	UNI	10 €
Dymond	D37	3.7 g	500 g.cm	-	UNI	20 €
Dymond	D44	4.4 g	1000 g.cm	X	UNI	20 €
Dymond	D47	4.7 g	900 g.cm	-	UNI	20 €
Dymond	D50	5 g	1000 g.cm	X	UNI	20 €

Dymond	D54	5.4 g	900 g.cm	-	UNI	20 €
Graupner	C100	4.6 g	800 g.cm	-	UNI	30 €
Graupner	C111	5.9 g	500 g.cm	-	UNI	30 €
Graupner	C141	5.4 g	700 g.cm	-	UNI	20 €
Graupner	C1041	5.6 g	700 g.cm	-	UNI	25 €
Graupner	C1081	6.2 g	1200 g.cm	-	UNI	25 €
GWS	Pico	5.4 g	700 g.cm	-	UNI	20 €
GWS	Pico+BB	6.2 g	1000 g.cm	-	UNI	25 €
Hitec	HS50	6.1 g	600 g.cm	-	UNI	25 €
HXT (UH)	HXT500	5 g	800 g.cm	-	UNI	3 €
Jamara	Atom MiniBlue	4 g	1000 g.cm	-	UNI	15 €
Jamara	XT Atom	4.5 g	1100 g.cm	-	UNI	15 €
Jamara	Pico Low	5 g	1300 g.cm	-	UNI	15 €
Jamara	Atom MiniBlue Metal	5.5 g	1000 g.cm	-	UNI	20 €
Jamara	XS-6G	6 g	1300 g.cm	-	UNI	20 €
Protech	B1044	4.4 g	1300 g.cm	-	UNI	25 €
Protech	B1049	4.9 g	1500 g.cm	-	UNI	25 €
Protech	B1054	5.4 g	1100 g.cm	-	UNI	25 €
Protech	B1062	6.2 g	1300 g.cm	-	UNI	25 €
Protech	B106	4.3 g	800 g.cm	-	UNI	30 €
Protech	B150	5 g	600 g.cm	-	UNI	15 €
Rcmart	Lexi	2.8 g	100 g.cm	-	UNI	35 €
Rcmart	Pino_MG	4.9 g	600 g.cm	-	UNI	25 €
Robbe	FS-31 Pico	4.7 g	900 g.cm	-	UNI	20 €
Robbe	FS-30 Pico	5.5 g	900 g.cm	-	UNI	25 €
SSV	9305	5.4 g	800 g.cm	-	UNI	7 €
SSV	9306-BB	6.2 g	1200 g.cm	-	UNI	8 €
T2M	TS-43	4.6 g	400 g.cm	-	UNI	15 €
T2M	MS-45-Digital	6g	1000 g.cm	X	UNI	20 €
TopModel	TS1118	4,7 g	1100 g.cm	-	UNI	25 €
TopModel	SMS-511	6.5 g	500 g.cm	-	UNI	10 €
Tower Pro	SG-50	5 g	800 g.cm	-	UNI	5 €
VS (UH)	VS9	4.4 g	600 g.cm	-	UNI	5 €
Waypoint	W-038	3.8 g	700 g.cm	-	UNI / JST	20 €
Waypoint	W-060	6 g	800 g.cm	-	UNI	20 €
Waypoint	W-060BB	6.6 g	1000 g.cm	-	UNI	25 €
Waypoint	W-068	6.2 g	900 g.cm	-	UNI	20 €
Waypoint	W-068BB	6.8 g	1100 g.cm	-	UNI	25 €
Wes-Tecnik	Pico 5.4	5.4 g	1200 g.cm	-	JST	20 €

Receiver: Less than 6g recommended. Avoid absolutely receivers which have not narrow-band and / or whose range is poor (BlueArrow, GWS...). The majority of receivers shown here use micro crystal, which is found at unbeatable prices (around € 2.5) under the brands Xpower / Corona or BlueArrow.

<i>Manufacturer</i>	<i>Ref.</i>	<i>Mass</i>	<i>CH</i>	<i>Range</i>	<i>DSP/BERG</i>	<i>TSR</i>	<i>Plugs</i>	<i>Price</i>
ACT	Pico 4 µP	4.5 g	4	800 m	X	-	UNI	35 €
Graupner	XP8	5.5 g	4	500 m	-	-	UNI	35 €
JETI	Rex4 MPD	6 g	4	1000 m	X	-	UNI	40 €

MPS	V2.5	1.9 g	4/5	500 m	X	-	- / JST	45 €
MZK	Penta5 light	1.8 g	5	500 m	X	-	-	30 €
MZK	Penta5	2.9 g	5	500 m	X	-	lighted UNI	35 €
MZK	Penta5 Profi	4 g	5	1000 m	X	X	lighted UNI	50 €
Potensky	Pico Smart 5	3 g	5	500 m	X	-	UNI	35 €
Potensky	Nano Smart 5	5.3 g	5	600 m	X	-	UNI	30 €
Potensky	Nano Smart 7	5.6 g	7	600 m	X	-	UNI	35 €
Potensky	Micro Smart 5	5.9 g	5	600 m	X	-	UNI	30 €
Protech	Pico 4	5.8 g	4	500 m	-	-	UNI	45 €
Protech	Pico 5	6.5 g	5	500 m	-	-	UNI	45 €
XPower / Corona	RS410	4.7 g	4	1000 m	X	-	UNI	15 €
XPower / Corona	RP4S1 (synth)	4.7 g	4	1800 m	X	-	UNI	25 €

Battery : For the reception, one lipo cell is enough, to choose at less than 12g equipped with its plugs, and a width of less than 25mm. For information, the vast majority of pico electronics (in the case of all the material presented here) is compatible with this voltage level slightly lower than the usual 4 Nixx cells, although some dealers / manufacturers don't know other than the basic 4.8V-6V... Concerning consumption, we can expect an average off 100 mAh per flying hour. For small capacity (<200 mAh), it is possible to double the autonomy putting two cells in parallel.

For a battery for electric flight, care to the maximum permissible current.

<i>Manufacturer</i>	<i>Capacity</i>	<i>Mass</i>	<i>Max continuous current</i>	<i>Price</i>
E-Tec	250 mAh	6 g	8C (2 A)	8 €
E-Tec	300 mAh	9 g	20C (6 A)	9 €
E-Tec	450 mAh	11 g	10C (4.5 A)	9 €
Hyperion LVX	300 mAh	10 g	20C (6 A)	10 €
Kokam	145 mAh	3.5 g	8C (1.2 A)	8 €
MPS	160 mAh	4 g	12C (1.9 A)	5 €
MPS	220 mAh	5.5 g	17C (3.7 A)	12 €
Polyquest XP	300 mAh	10 g	15C (4.5 A)	9 €
United Hobbies (HXT)	180 mAh	6g	12C (1.9 A)	2 €
United Hobbies (HXT)	200 mAh	6 g	12C (2.4 A)	2 €
United Hobbies (HXT)	250 mAh	6 g	12C (2.4 A)	2 €
United Hobbies (HXT)	300 mAh	7 g	12C (3.6 A)	2.50 €
United Hobbies (HXT)	360 mAh	12 g	10C (3.6 A)	2.50 €

Motor: To be chosen in less than 18g, and able to accept at least 3A. HXT offers a great range of good motors, at unbeatable prices. Regarding the propellers, GWS is the first manufacturer for non-folding versions, while Graupner has a great 4.7x2.4 folding prop (equivalent to a GWS 4x4 or 5x3 in terms of engine load). The propellers proposed are indicative. As with any electric motor, it is wise to use a Wattmeter to verify the proper functioning of the motorization chain.

<i>Manufacturer</i>	<i>Ref.</i>	<i>Mass</i>	<i>Max A</i>	<i>KV</i>	<i>Lipo</i>	<i>Propeller</i>	<i>Price</i>
DC Enterprises	Mighty Midget Gold 13/4	6.2 g	3 A	-	2-3	5x3 - 6x3	75 €
DC Enterprises	Mighty Midget Gold 13/6	8 g	4 A	-	2-3	5x3 - 6x3	80 €
Electronic Model	Nano Cyclon CPLR	17 g	7 A	2000	3	6x3	50 €

Feigao	120L KV4100	17 g	4.5 A	4100	2-3	3x2	35 €
Feigao	120L KV5300	17 g	5 A	5300	2	3x2	35 €
Flyware	Rex 220-3-3200	11 g	6 A	3200	2	4x4 - 6x3	60 €
HXT	C1818	9 g	4.5 A	3500	2	4x4 - 5x3	11 €
HXT	C1822	14 g	5 A	2100	2-3	4x4 - 5x3	9 €
HXT	C1826	18 g	6.5 A	2400	2-3	4x4 - 5x3	13 €
HXT	C2020	11 g	6 A	3500	2-3	4x4 - 5x3	12 €
HXT	C2024	17 g	7 A	1600	3	4x4 - 6x3	12 €
HXT	C2222	15 g	6 A	2850	2-3	4x4 - 5x3	13 €
MicroDan	2003-F3P	12 g	6 A	2300	2-3	4x4 - 5x3	70 €
Model Motors	AXI 2203 /52	18.5 g	5.5 A	1500	3	5x5 - 6x3	55 €
Model Motors	AXI 2203 /46	18.5 g	7 A	1700	3	5x5 - 6x3	55 €
MP Jet	AC 22/4-40D	17 g	8 A	2800	2-3	4x4 - 5x3	50 €
Potensky	POT 10W	7 g	3.5 A	1800	2	5x5 - 6x3	60 €
Potensky	POT 20W	14 g	6 A	1600	2-3	5x5 - 6x3	35 €
Potensky	POT 30W	17 g	7 A	1600	2-3	5x5 - 6x3	30 €
RS-LRK	160.05 Slo	12 g	3.5 A	1500	3	5x5 - 6x3	150 €
RS-LRK	195.03 Slo	12 g	4 A	1500	3	5x5 - 6x3	130 €
Stout-Aero	10G	11.4 g	3.5 A	1800	2-3	5x5 - 6x3	60 €

Controller : should be less then 7g.

Manufacturer	Ref.	Mass	Max A	Lipo	Prog.	BEC	Plug	Price
ACT	Skybrush4	3 g	4 A	1-2-3	X	1 A	UNI	75 €
ACT	Skybrush8	4.9 g	8 A	2-3	X	2 A	UNI	55 €
ACT	Skybrush12	6 g	12 A	2-3	X	2 A	UNI	55 €
Blue Arrow	BL-6	5 g	6 A	2-3	X	1 A	UNI	11 €
Castle Creation	Phoenix 10	6 g	10 A	2-3	X	3 A	UNI	60 €
Electronic Model	Pilot 08	7 g	8 A	2-3	-	1 A	UNI	45 €
Falcon	4A	1.8 g	4 A	1-2-3	X	1 A	JST	60 €
Falcon	8A	2.6 g	8 A	2-3	X	1 A	JST	60 €
Jeti / Hacker	Advance 4	6 g	4 A	2-3	X	1 A	UNI	50 €
MPS	VARBL2	1.1 g	4 A	1-2-3	-	1 A	-	55 €
Potensky	AC7A	6.7 g	7 A	2-3	-	1 A	UNI	45 €
StormPower	12A	7 g	12 A	2-3	X	2 A	UNI	20 €
TMM	0710-3 Expert	5.5 g	7 A	1-2-3	X	4 A	UNI	60 €
TMM	Easy 7	5.5 g	7 A	2-3	X	1.5 A	UNI	45 €
Xpower / HW	Pentium 6	6 g	6 A	2	X	0.8 A	UNI	10 €
YGE	4 BL	2.2 g	4 A	1-2-3	X	1 A	UNI	70 €
YGE	8 BL	4.9 g	8 A	2-3	X	2 A	UNI	40 €
YGE	12 BL	6 g	12 A	2-3	X	2 A	UNI	50 €