Hobby King 2.4 m Paramotor: build notes

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Safety: It is best not to put the propellor on to the motor until the setup is complete. Similarly don't fit the long servo arms until you are sure you have got the radio gear set up correctly, or you might break them if they collide with the cart.

Peter Scott © 2021

Last edit 21 August 2021

Intro

I fly on an airfield shared with a variety of full size aircraft including flexwings (powered hang gliders) and paramotors. So when Hobby King released a 2.4 m model paramotor for £145 I decided I must give one a try. It is based on the LuteFisk ('Lootafisk') model design, which you can find using duckduckgo (or google if you don't mind your data being nicked). Use "lutefisk paramotor' or you will finish with a bizarre Norwegian fish dish made using caustic soda. "The end result looks and feels gelatinous. Traditionally, it is served with warm cream or butter sauce and enjoyed with copious amounts of beer or aquavit" [no doubt to fight down the nausea].

The kit comes complete except for receiver and batteries. The only thing missing is the manual. You must download the twenty-seven page pdf from HK's website and print it yourself. At 7p per page on an inkjet printer that adds nearly £2 to the cost so best to use a mono laser printer. Quicker too, though some pictures will be a little muddy.

First impressions were very good. The body of the 'fuselage' (what do they call it?), which is thick aluminium, is very substantial and surprisingly heavy. The name turns out to be 'cart', 'gondola', 'frame', 'chassis' and sometimes 'trike'. I'll use cart. The servos are large so I'll be adding a lipo voltage sensor so I don't run out of juice. HK suggests 3S 5 Ah batteries partly for the weight. Unless I can find a 5 Ah 3S in a box somewhere I'll probably use two 2.2 or 3 Ah batteries in parallel. There is a bag in which to store the sail. You must be very careful not to get it tangled as there are many strings.

I added steel washers to the M3 screws on the undercarriage and motor mounts. These parts are made from plastic and there is just enough thread for thin washers.

Assembly is straightforward. You will need the following tools:
2.5 mm allen key
4 mm allen key
3 mm socket or ring spanner
8 mm socket or ring spanner
Thin tommy bar
Rule at least 700 mm long
Ice pack for the head

And now the manual!

The exclamation mark doesn't bode well does it? And it doesn't. The manual is a quarter of what it should be. It covers assembly of the cart but there is nothing about fitting the sail, how to set up the radio gear nor how to fly the finished model. It is not good enough to say, 'Look at the videos.' These might be fine for a few things but we need pictures, explanations and data in a paper manual.

It does a good job of showing you how to assemble the machine.

For the radio there are a few indistinct pictures of screens on an un-named transmitter that you are unlikely to own. There are no pictures to show you in what position to mount the extended servo arms, only "The top hole of the crank wants to be in line with the top of the flybar or just above." Or just above!!! The required throws are not specified. There is nothing about what needs to be done to create the servo control signals nor how to program a transmitter.

There are no explanations of what part of the sail to connect to what. And worst of all there is nothing about how a paramotor is flown, so there is no guide to how to set up the radio, only “the setting up of your computer radio is quite involved.” For all of this you have to watch videos, which usually is the worst way of learning anything. What is easier than a few diagrams and a couple of paragraphs of text? However in this case the videos were useful.

There is no mention of balance and centre of gravity. The only mention of weight is that “in light wind conditions it is best to put a lighter battery in to keep near the 1.6kg weight. In windy conditions it is better to put a heavier battery in to fly around the 2kg mark.” Again the videos were useful and balance is covered later.

The fully loaded cart weighed 1045 g without a battery
The sail weighed 189 g
Total 1234 g
So I need 366 g for 1.6 kg and 766 g for 2 kg

These are the batteries I plan to use – the first two are a pair connected in parallel:

2.2 Ah 3S	170 g	340 g/two plus adaptor 14 g	354 g	Total 1588 g
3.0 Ah 3S	213 g	426 g/two plus adaptor 14 g	440 g	Total 1660 g
5.0 Ah 3S	431 g			Total 1665 g

How to fly a paramotor

I had to find out about how to do it by a duckduckgo search. The full size paramotor websites revealed the following:

The cart is hung from the sail by two ‘risers’ that connect to a network of lines on the sail. The sail itself is made up of cells that fill with air and form a simple aerofoil. The risers take most of the weight of the model. The two lines that the pilot pulls are called ‘brakes’. The left brake pulls down the rear of the left side of the sail so increasing drag and causing the machine to turn left. This is opposite to how ailerons work. The right brake turns right. For a flare for landing the pilot pulls both brakes, so increasing drag and eventually stalling the sail when close to the ground. Therefore each brake servo must have a mix of elevator for flaring and aileron for right and left brake. There is no explanation of how to set up the mix. Using the elevator stick except for a landing flare can cause a disastrous stall.

Installing up the radio gear

I used a FrSky X8R receiver. There is loads of room for it on the flat plate below the motor mount. I used my own velcro rather than the tiny piece of hook and loop supplied. The manual suggests cable ties as well but it is difficult to see how to fit them.

The ESC is held firmly once the motor screws are tightened. It is plugged into channel 1 as usual.

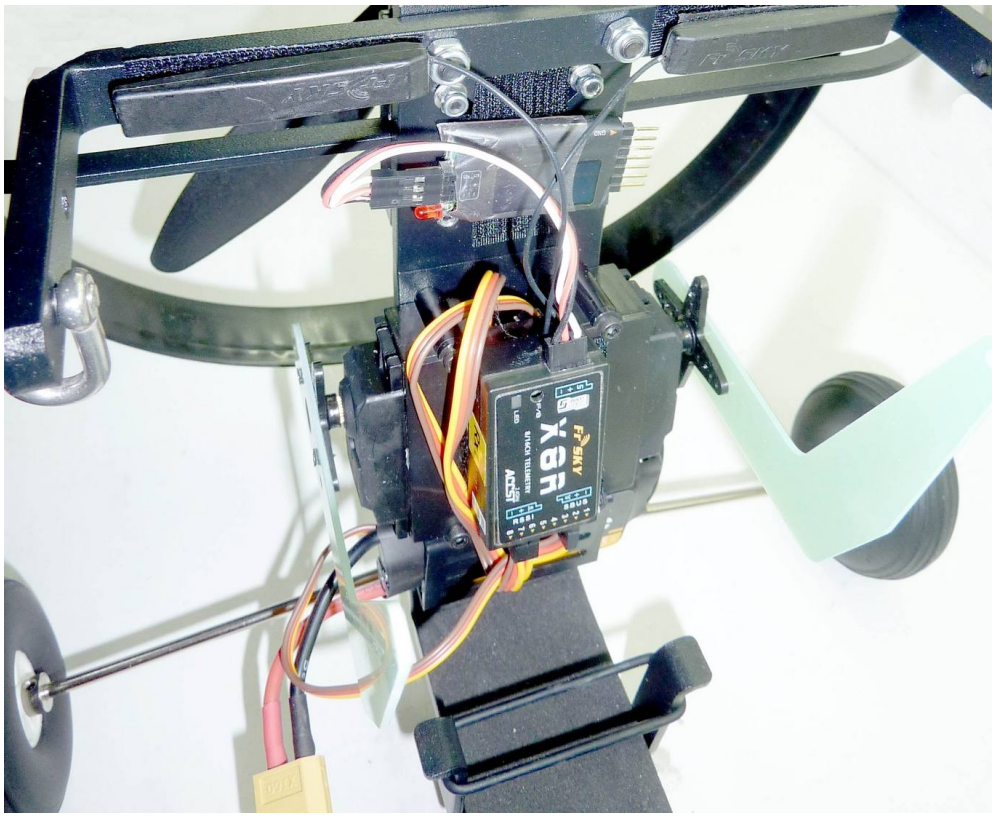
For a reason I don’t understand, and isn’t explained, the manual suggests the following:
Channel 5 Right servo
Channel 6 Left servo
It must be something to do with the oddities of the transmitter pictured.

I use a straightforward Taranis X9D and the stuff you need to set one up appears later. Reviewers stress that you should not set up the servos with the long arms on. If you get

anything wrong the arms might crash into the cart and break or wreck the servo. I used 25 spline short arms until I was sure it was correct. I came across the usual problem with 25 spline servos, namely that, with servos aligned 180 degrees out, you can't line the arms up exactly when they have an odd number of splines. They are 7.5 degrees different and you have to correct with offset.

This is the temporary servo arm.

Here is the receiver with the lipo voltage telemetry sensor just above it. The telemetry balance lead to the battery is yet to be installed and the leads will need to be tied up.



Setting up the radio gear

This is general information. I cover the use of the Taranis later.

In many ways the setup is a bit like a V-tail. The difference is that the servo movements are only in one direction.

Each servo is at maximum in the upgoing direction when the aileron and elevator sticks are central. Both servo arms are high. As the aileron stick is moved left, only the left servo arm moves down. The right does not move. Vice versa for the aileron stick moving right. When the elevator stick is pulled back both servo arms move down.

This is what is needed:

- Half the movement of the sticks must be ignored.
- The half that is not ignored must give full servo travel.
- There must be trim that applies equally to both servos.
- There must be trim that varies one servo compared with the other.

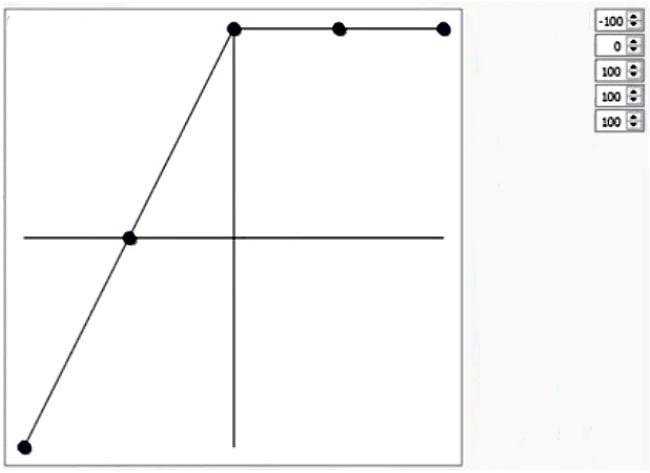
This requires some clever mixing and the use of curves. How you do it – or even if you can do it - depends on what radio you use. I have watched a video where a separate mixer device was used so don't despair if your radio can't do it.

Setting up a Taranis X9D transmitter for the HK paramotor

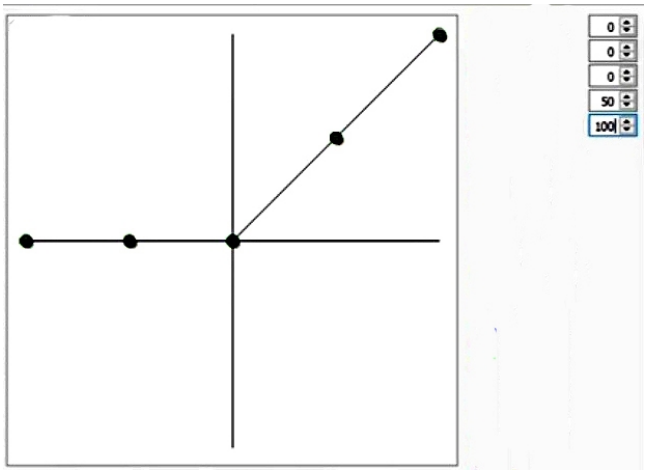
I do love the Taranis. Normally you think what you want to do and then do it using the three screens : INPUTS, MIXER and OUTPUTS. However in this case it was more complicated, requiring curves. So I'll cover them first.

CURVES

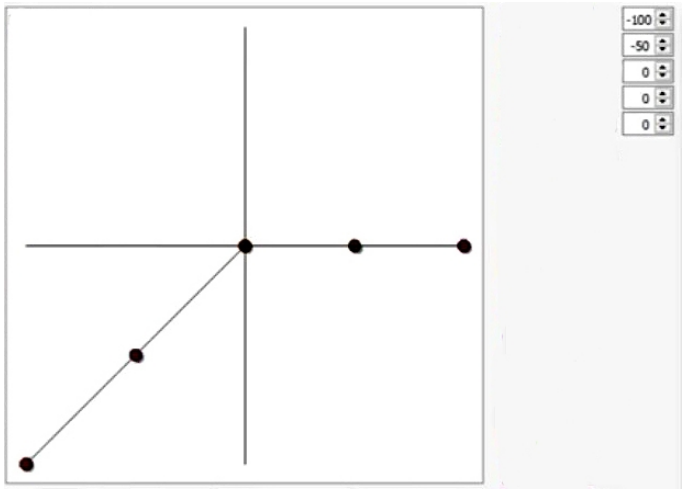
Elevator Curve 1 **Name: Ele**



Aileron Curve 2 **Name: CV2**



Aileron Curve 3 **Name: CV3**



INPUTS

Thr	100		Thr			
Ail	100		Ail	CV2		
Ele	100		Ele			
Rud	100		Rud			(not used)
Ail2	100		Ail	CV3		
Trim	100		S1	CV3		(or your choice of rotary)

MIXER

Ch1	100	I	Thr			
CH2	100	I	Ele	Ele	LBrk	
+=	200	I	Ail2			(double as only half stick is used)
+=	50	I	Trim			
CH3	-100	I	Ele	Ele	RBrk	
+=	200	I	Ail			
+=	-50	I	Trim			

OUTPUTS

In **MODEL SETUP**
Tick '**Extended limits**'
Then set throw to 125%

CH2	-125.0	125.0

Special functions and logical switches

If you are using a lipo voltage sensor these special functions will warn you when you hit a low voltage. They will also allow you to set engine off with switch SC.

SF1	SC-	OverrideCH1	-100	✓	Throttle cut
SF2	SC↓	OverrideCH1	-100	✓	
SF3	SC-	Play Track	engoff	1X	Say 'engine off'
SF4	SC↓	Play Track	engoff	1X	
SF5	L01	Play Value	Cels	10s	Speaks lipo volts every 10s
L01	a<x	Cels	10.8 V		Switches when battery getting low

Other settings

Don’t forget to set failsafe to throttle zero and everything neutral.
A suitable picture for your screen is Paraglider.

Balancing the model

The battery suggested probably won’t be heavy enough for windy days. The model should be about 1700 g. A bit lighter for calm days and up to 1800 g for windy days. The manual suggests up to 2000 g but users suggest 1800. The model cart should be level or slightly nose up when hung up by the holes in the flybar, that is by the risers. You move the battery and/or add weight until this happens. It **must never** be nose down.

Setting the supplied ESC to brake the propellor

A free wheeling prop might catch the lines after landing and tangle them. I use an OpenTx special function to zero the throttle but the motor can still freewheel. A better additional method is to set the motor brake on in the ESC as follows:

- Switch the Tx on at full throttle
- Power up the ESC
- You get Beep Beep Beep Beeepp HighBeeeep. This means brake is OFF
- Pull throttle to zero.
- You get Beep Beep Beep Beeep (and no highBeeeep) Brake is now ON.
- When you power off and on again you just get three beeps, showing that the brake is ON.

It worked. Provided you don’t switch on at full throttle it will stay like that.

Dimensional data

I have summarised the positional data from the videos here:

The holes in the servo arms need to be about 10 mm above the bar.
The throw should be 100 to 120 mm measured vertically.
However there is no need to reduce it from its possible 150 mm maximum.
The servo arms must line up exactly at the top and bottom of the throw. Adjust with offset and/or trim (or I suppose by tweaking the curves).
The upright part of the arms should be horizontal at the bottom of the throw.

Setting up the sail

There are four lines from the sail to the cart, two on each side. These are the sail lines called ‘risers’ and the control lines ‘brake lines’. The risers are fixed in length and go to the D shackles in the main bar called the ‘flybar’. The brake line goes through the D ring in the riser to the servo arm and must be set to the correct length.

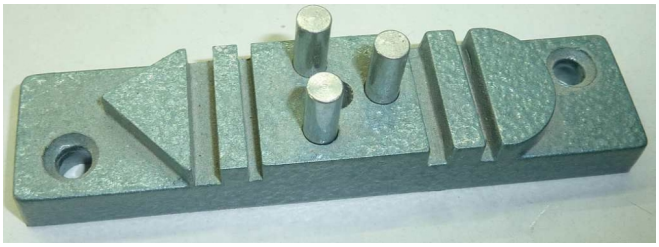
It is important not to tangle the lines. Grasp the sail lines with one hand and run the other hand down the lines to bundle the sail. Put the bundled sail on your bench, perhaps in the bag.

First mark the front sides of the risers R and L. The rear of the riser has the D ring halfway down it. The front of the sail turns over to form a crude aerofoil.

You now have to find the ‘neutral brake point’. This makes sure that when the servo arms are in their neutral (top) position the brake line is pulling correctly on the sail compared with the risers to keep the rear of the sail flat. You now make a mark on the brake line 648 mm from its top knot. Do not stretch the line as you do it. Just hold it lightly taut.

I realised that I would have to repeat this on the field as the brake lines would have to be untied to remove the sail. Videos show the model with the sail permanently attached. That seemed a recipe for trouble so I decided to make some fittings for clipping it on and off.

Using my wire bending jig, wire cutters and pliers...



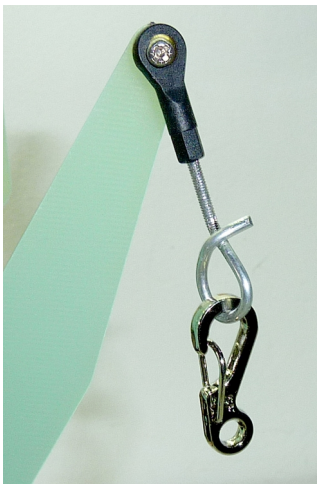
… I bent 2 mm threaded pushrods and screwed them into balljoints.

I then fixed the balljoints to the servo arms using M2 screws. I used nyloc nuts, which turned out to be astonishingly expensive, though you could use thread locker liquid. Again I used washers though they are not shown here.

Here is one in position. I could loop the brake line onto the circular loop or use a clip. I decided to go with the clip idea.

Clip showing small size

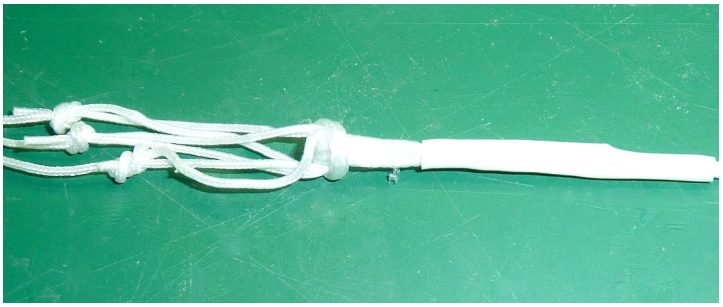
Clip in place



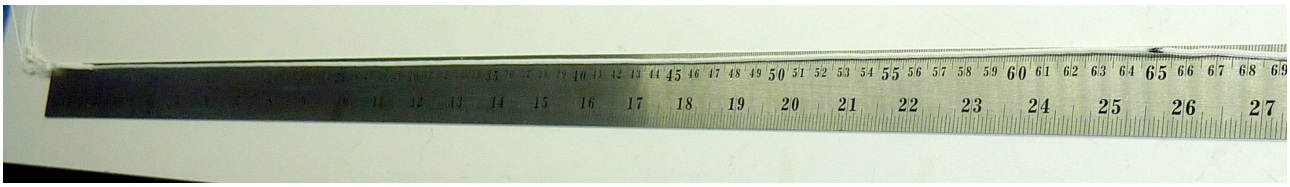
The small extra weight won't matter as the battery will be too light anyway.

Now set the brake lines to the correct length. First mark the lines. Unknot the line from the D ring on the riser. Find the knot at the top of the brake line.

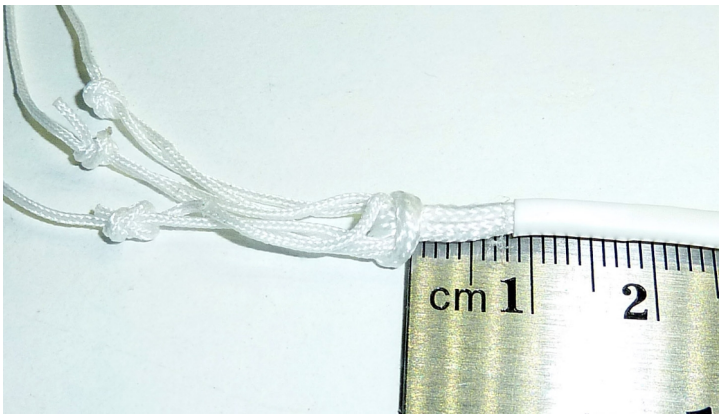
Top knot on brake line



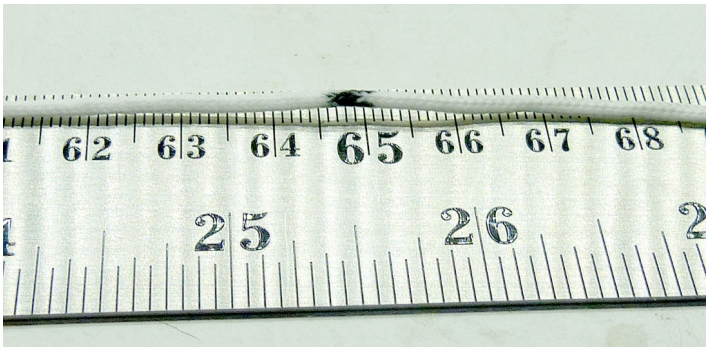
Line on rule



Knot set at rule end

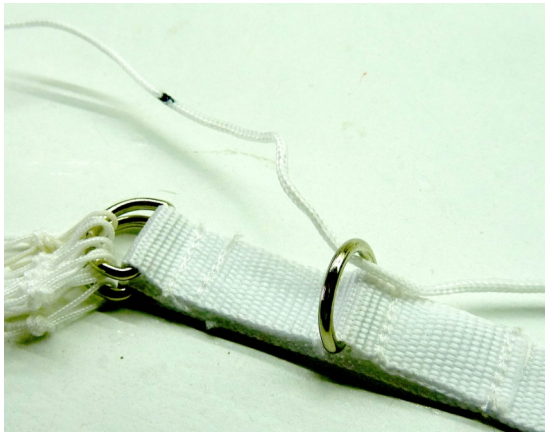


Mark the spot with a permanent marker



Pull the brake line through the lower D-ring on the riser then through the clip. Knot it loosely.

Brake line through D ring



Knot it loosely

Now attach the two risers to the flybar using the D clamps and clip the brake lines onto the wire loops on the servo arms. I put a little grease on the D clamp screws.

Hold the brake lines and risers taut as shown in the picture, at the angle they will have when flying. The mark on the brake line must line up with the top of the riser D rings. Firmly knot the brake lines on their clips. I looped them three times through the clip before tieing them. This made it more difficult for the lines to slip whilst tieing. Don't trim the lines until you have had a few flights.

PIC needed here

Last checks

It is easy to forget this stage. Go round every screwed fitting – servo arms, propellor nut, undercarriage and motor mounts, brake line clips, D rings on the flybar etc – and check that they are tight.

Pilot

You might like to strap a model pilot into the seat, especially if a daughter or son nags you to.

Flying

There are no instructions in the manual on how to fly the thing. There are videos in HK's website and elsewhere. A good one is in the list at the end.

Check that the sail is laid out flat, especially the tips. Check that no lines are snagged anywhere. Do a few practise swings, directly into wind, without powering the motor. Pick up the cart and check the wind direction. Push the throttle up to about one third. Swing the sail up and over your head from behind to fill it and then let go. Immediately put throttle up to full. Don't be afraid to abort the launch if anything goes wrong. Just zero the throttle and put up with the teasing.

Once in the air pull on the brake line for the direction you want to turn. Don't pull on more than one brake line and don't pull back on the elevator stick.

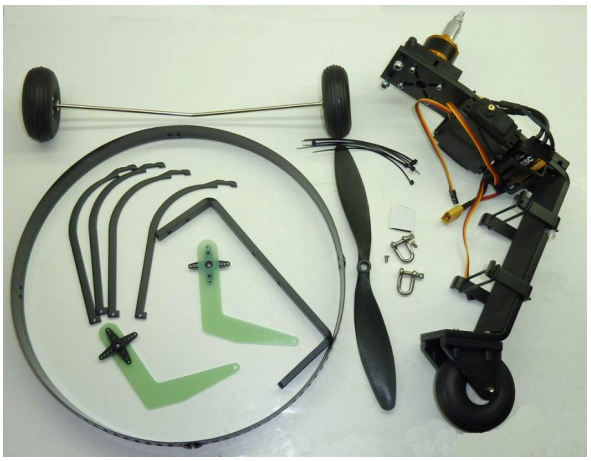
It can't be stressed enough that the elevator stick should not be used to change height, only for landing. Use the throttle for height. Increasing the throttle pushes the cart forwards and upwards and increases the angle of attack and lift. In level flight the angle is about -2º. If you pull back on the elevator stick during normal flight the model will stall, the sail will deflate and the model will plummet to the ground. Only flare when you are just above the ground. If the model starts to rock or swing in flight one possible solution is to make a turn.

Aerobatics

I like aerobatic models. Flying videos show the paramotor doing loops and other manoevres. I will experiment and report if I have any success. Three mistakes high of course.

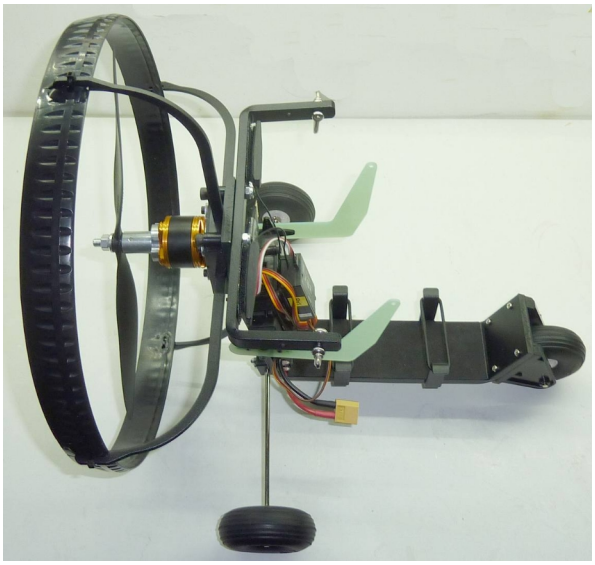
Contents of the box

Hardware as supplied



Sail and bag as supplied

Here is the completed cart from above.



List of good videos

Building

Good one on HK website
https://hobbyking.com/en_us/hobbykingtm-high-performance-paramotor-pnf-2250mm.html? Go to videos.

Good and amusing.
https://www.youtube.com/watch?v=n5QamBgCbH8

https://www.racer.lt/play/2515267/h-king-high-performance-paramotor-unboxing-and-assembly-spektrum-setup-from-hobbyking.html Good if you don't mind inches

Setting up Taranis

To see more, watch the excellent video on RC Air Adventures
https://www.youtube.com/watch?v=tt0rvGD81Io

Summary

This is an excellent machine spoiled somewhat by a poor manual. Thank goodness for people willing to fill in the gaps. Please sort it out Hobby King!