

Supra-e Assembly Guide

from

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Supra-e Assembly Guide 1.0.odt

Warning, this is not a toy!

If you are new to the hobby of flying RC model airplanes, DO NOT attempt to fly this model by yourself! There are hundreds of BMFA (British Model Flying Association) clubs in the UK. Ask your local hobby shop for the location of the nearest club in your area, or check out the www.bmfa.org.uk (or your national modelling organisations) web site. Many clubs often have qualified instructors to teach you how to fly. If you are an accomplished pilot then you should have no problem in flying this model. However the Supra-e can fly very fast, and is potentially a lethal object. Do fly responsibly, and make sure your third party liability (eg BMFA) insurance is valid.

Limit of Liability

All Vladimir's Models products are constructed to the highest standard and made strong enough for reasonable usage by an experienced and responsible r/c aircraft pilot. By keeping this model you confirm that the parts have not been structurally damaged and are fit for purpose as received.

The craftsmanship, attention to detail, and actions of the builder/flyer of this model airplane kit will ultimately determine the airworthiness, flight performance, and the safety of the finished model. You confirm that you take full responsibility for the safe usage, construction, and maintenance of the model, and you will not hold HyperFlight.co.uk or its owners, staff, agents, contractors, or helpers in any way responsible for any damages or injury that may occur as a result of operating or flying this model. HyperFlight's sole obligation shall be to replace those parts of the kit proven to be defective or missing. If you are not willing to agree to this binding condition of sale please return the model in as-received condition to Hyperflight for a refund.

Acknowledgement

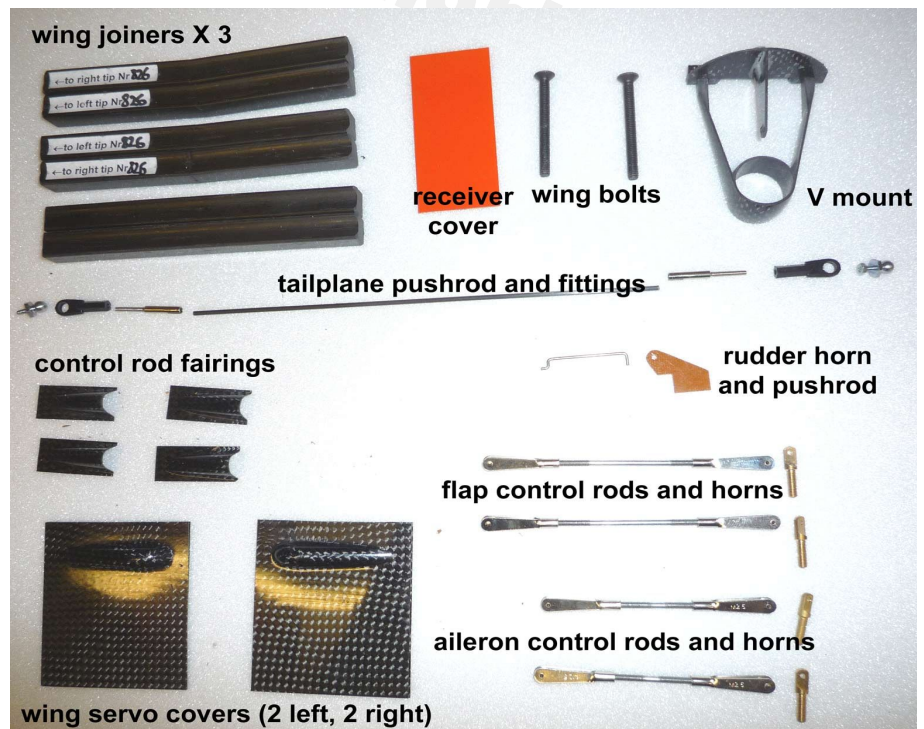
HyperFlight would like to thank Brett Wilson for kindly helping with the wing build text in particular. We would also like to thank Vladimir Gavrylko for designing and building this model to such a high standard, for and manufacturing it at a reasonable cost, so that flyers all over the world can enjoy this high performance model. Finally we pay our respects to Dr Mark Drela, the designer of the optimised airfoils, and inspiration behind many of the innovations that make this model so special.

Research

We recommend you do some homework before starting to build this plane. There is a lot of great info about RC planes at RCGroups.com and other websites. Get the latest info on batteries, r/c gear, building and flying tips. There is often a "build thread" on www.RCGroups.com where you can see many pictures your model and read the questions/answers of other pilots that already built one. Make certain you check out www.HyperFlight.co.uk regularly for any product information updates.

Parts List

- Wing (3 pieces)
- Fuselage pod with canopy hatch
- Tailboom
- Tailplane - horizontal stabiliser
- Fin/rudder - vertical stab
- Accessories bag containing the items shown opposite
- These Instructions



R/C Functions

- Left & right aileron
- Left & right flap
- Elevator
- Rudder
- Throttle

To maximise the model's potential a computer radio is highly recommended.

Suggested R/C

- Aileron servos: Hyperion DS09-AMD
- Flap servos: Hyperion DS095-FMD, Hyperion DS13-TMB
- Tail servos: Hyperion DS09-AMD

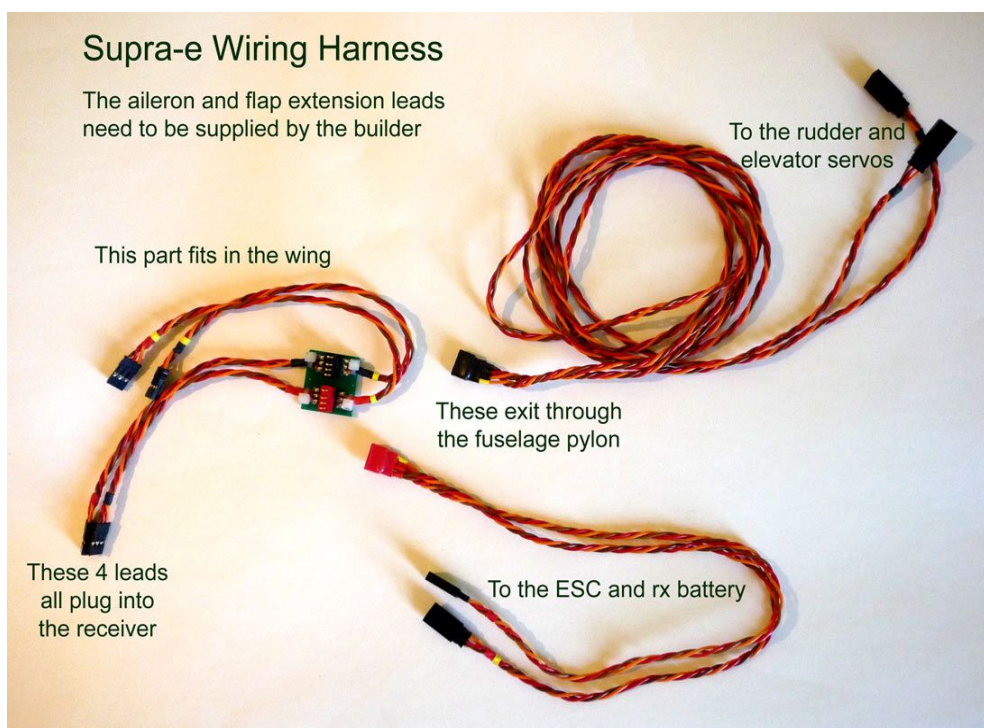
Model Specifications

Wing span	3.4m	134 in
Wing area	66.7dm²	1034 sq in
Flying weight from	1805g	63.7 oz
Wing loading	27g/dm²	8.9 oz/sq ft
Wing airfoil	AG40d, AG41d, AG42d, AG43d	
Stabilizer airfoil	HT14-HT12	
Aspect ratio	17.3	
Spinner size	38mm	
Centre of Gravity	90-103mm from wing leading edge	
Controls	rudder, elevator, flaps, ailerons	

Supra-e Assembly Guide

Planning

1. Fill in the weight and balance spreadsheet to find out if you need to save weight at the back. Alternatively assemble the model with tape and tape the R/C and motor components (or items of a similar weight) in place, and check the centre of gravity. It should be approx 100mm behind the wing LE, which works out at 37mm behind the front wing bolt. If you are using a lightweight motor & gearbox (less than 200g) you will probably need to minimise tail weight. If necessary discard the heavy rear extension leads provided and making up a very lightweight lead using 4 wires (positive, negative, two signal) of PC mouse cable or network/phone CAT6 cabling.
2. Decide if you will build the model with a fixed or a removable fin, and how you will route the tail servo wiring. The wiring can be routed from the boom into the fin internally by drilling holes in the base of the fin and top of the boom or externally by leading the wires through the rear of the boom and back into a cut-out in the fin servo cover. The latter sounds messy but is easier and much more maintainable. I built the model photographed using the internal method but later regretted it when I wanted to remove the fin.
3. If you are using a Vladimir's Models wiring loom check how it works, and confirm that your receiver will fit in the constricted space in the wing. The benefit of the wing mounted receiver is that it leaves the pod almost free of clutter, maximising the battery space and positioning possibilities.



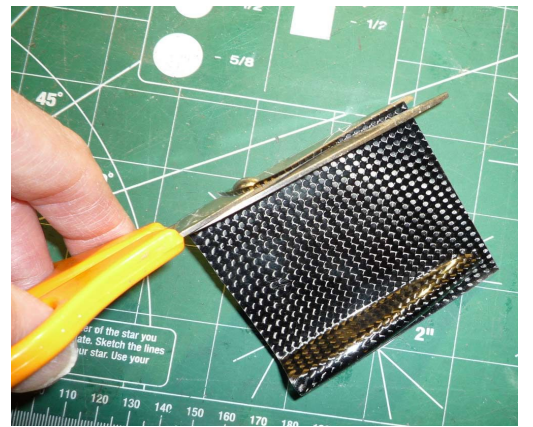
Fuselage and Tail Assembly

If routing the tail servo wires internally drill holes in the bottom of the fin for the servo wires. Extend this to a slot. Drill a hole in the top of the boom to match the fin hole, extend to a slot.

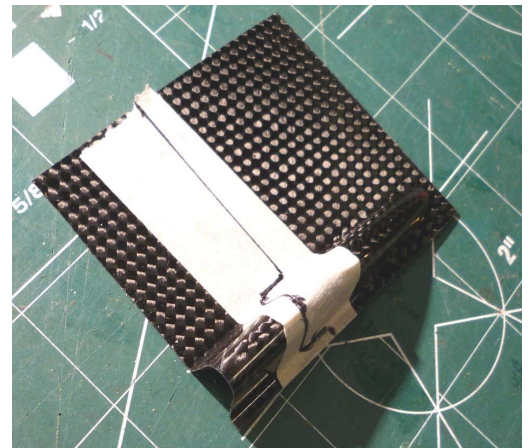
(I used a longer than standard boom and needed to shim the fin mounting hoops to a good fit by adding some tape to the end of the boom, just visible in the photo.)



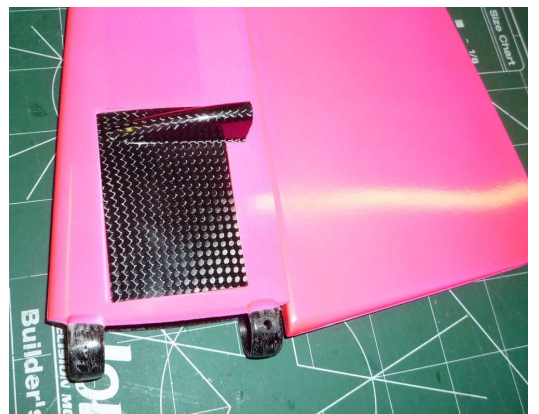
Cut the carbon fin cover to size using sharp scissors.



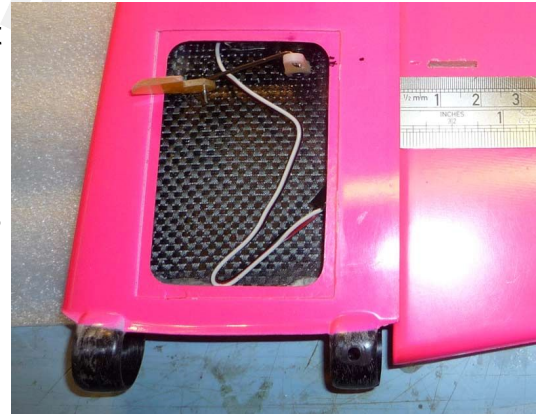
Trial fit to the fin and mark the rear shape on some masking tape. Trim the cover.



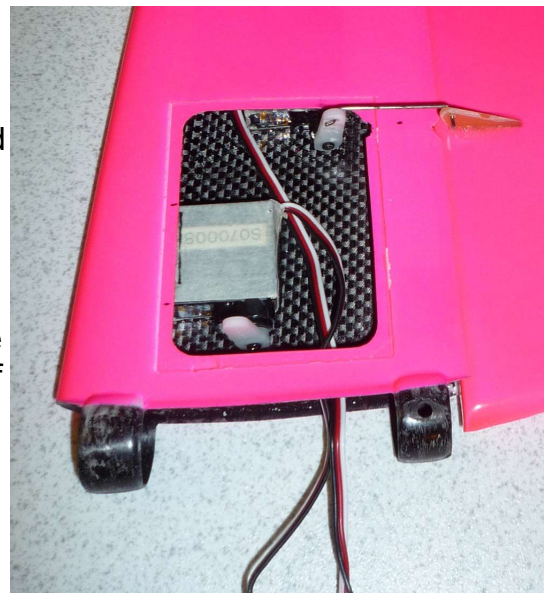
Fit the cut-down fin cover in place and mark the centreline of the rudder pushrod fairing.



Centre the fin & elevator servos, and fit suitable output arms. If necessary open up the output arm holes. If using a lightweight powertrain we suggest extending the servo leads (to allow the lead to extend into the pod) with lightweight mouse cable wire. If using a normal weight powertrain the supplied extension leads can be plugged into the servos after assembly.



Test fit the rudder servo. Cut a slot in the rudder for the rudder horn and epoxy it in place. The slot needs to start about 7mm behind the rudder LE to miss the spar. It may be easiest to fit the small wire pushrod to the servo output arm and the horn before gluing it in place. The pushrod stays in place because the Z bend at the servo end, and the torsional springiness of the servo arm act as a spring to hold the wire against the rudder horn.



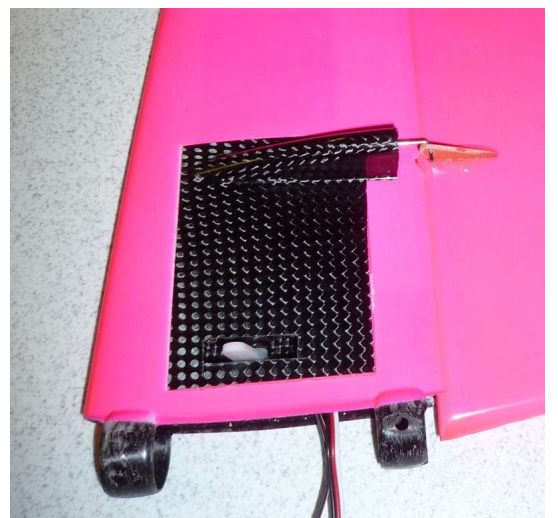
Wrap the rudder servo with good quality masking tape or heat shrink plastic. Clean and roughen the inside of the fin. Epoxy the servo in place. While the epoxy is setting attach the pushrod and centre the rudder, to ensure that no sub-trim will be required.

Test fit the V mount so the elevator servo can be positioned, and epoxy it in place

Cut a slot in the carbon fin cover to clear the elevator servo horn.

If necessary open up the hole for the clevis in the V mount.

The tailplane V mount is supplied ready fitted to the boom in some Supra builds. If your model requires the V mount to be fitted slip on the V mount the correct way round, triple check the orientation with your horizontal stabiliser. It varies depending with the stab type – molded or “competition” built up.



For a fixed fin, epoxy the fin to the end of the boom. Don't be concerned if the fin mounting hoops are too large for the end of the boom, either use the epoxy to fill the gap or make up some shims from tape, carbon sheet or 1/64th ply. It is important to use the complete boom length. (If your kit has the V mount already glued to the boom fit the horizontal stabiliser and ensure the fin is perpendicular to this while the glue is setting.) For a removable fin test fit the 3mm carbon rod retaining dowel in the matching holes in the boom and end fin retaining hoop. If necessary remove any slop by shimming with tape. As the holes in the end of the boom can become elongated with use and vibration the inside of the boom should be reinforced in the area of the holes.

Bolt the horizontal stabiliser to the V mount. Epoxy the V mount to the boom, so the horizontal stabiliser is perpendicular to the fin, and there is 2-3mm clearance between the horizontal stabiliser TE and the fin LE.

Make up and fit the horizontal stabiliser pushrod, if necessary cutting the carbon tube pushrod down to size. The horizontal stabiliser should be parallel to the boom with the stick in the centre.

Remove the unnecessary ballast tube holders below the pylon by inserting a long blunt object (1cm diameter dowel, chisel, large screwdriver, etc) into the pod and pushing on the hoops. They break off easily as they have been almost sawed through. Don't worry about the half hoops remaining.

Bolt the wing centre panel or some scrap wood to the pod. Draw a centreline along the workbench to ensure the boom is orientated straight with respect to the pod.

Epoxy the boom to the rear of the pod. If there is any looseness thicken the epoxy with micro-balloons. Sight along the centre panel and the horizontal stabiliser and along the workbench sight line while the epoxy is setting to ensure the surfaces are parallel and the pod and boom are straight. Don't get caught out by using fast epoxy!

Drill the nosecone for the motor bolts. Remove as much material as necessary to allow the gearbox bearing boss to penetrate through the firewall, even if this results in a gap between the rear of the spinner and the front of the pod. The firewall already has downthrust built into it.

Bolt in the motor and speed controller, bolt together the nosecone to the pod, and connect up the short Vladimir supplied extension lead. Either power the RC from the UBEC (also called switching Battery Eliminator Circuit) in the speed control, or from a separate UBEC, or use the other short lead for a receiver battery. At least a 3A UBEC is required. For safety do not install a propeller until after the radio had been programmed.

Thread the rear servo extension leads up the boom. This is fiddly, but is made easier if you extend a length of wire down through the fin/boom hole and through the boom. Attach the servo wires to this and pull them up. Tape the extension lead sockets to the servo plugs to stop them becoming disconnected on a hard arrival – and subsequent launch disaster.

Tape the fin servo cover in place.

Leave the wing connection black and red plugs loose in the top of the pylon for manual connection to the wing wiring loom PCB.

Wing

A major concern is to avoid hanger rash while fitting out the wing. It is extremely easy to catch and damage the flap or aileron corners. Tape them up for protection, even if you think you're a very careful builder! Another tip is to carefully vacuum/brush your work surface to clear all debris, and then to cover the working area with foam.

The supplied plug PCB board is mounted in the central wing aperture, and the flyleads are curved round to plug into the wing mounted receiver.

Receiver

Cut out the receiver access panel and test fit the receiver.

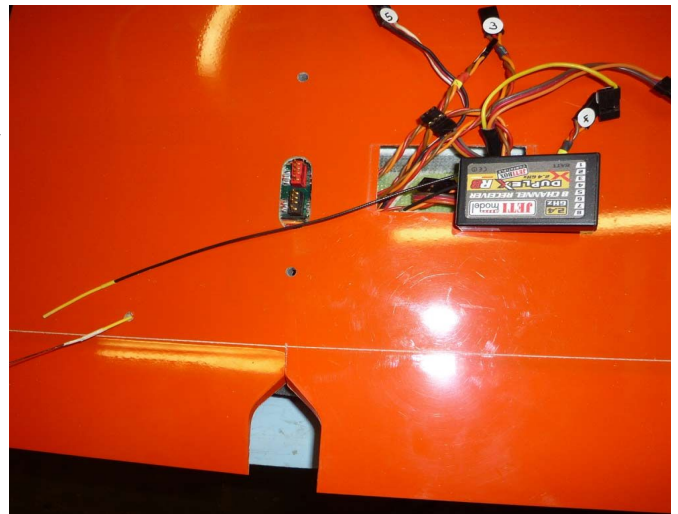
Make up extension leads to connect the flap and aileron servos to the receiver.

If using 2.4GHz drill holes for the aerials as shown.



Attach the plug PCB in place, I used thick servo tape and cyano, but this lifts the plug prongs above the wing surface, where they could cause damage to other components in transit. Probably hot glueing the PCB directly to the wing upper skin is best.

Install the receiver, extension leads and aerials. When installing the wing servos they can be setup using a servo tester, or from the receiver if a battery is inserted into a spare channel (to power it up without fitting the fuselage).



On final assembly tape the supplied receiver access hatch cover in place.

The aerial positions shown were tested and where not perfect when the model was far away, low, and returning straight to the pilot. I have now changed them so they don't sweep back at all – they are aligned pointing to the wing tip, but angled down at 45 degrees. This gives good reception at all times.



Servo Mounting

On moulded models some builders add small foam pads between the wing skins near the servo cut-outs to add a little extra strength in these regions. Foaming PU adhesive is good here as you can cut the foam to be a sloppy fit so as not to distort the wing section, relying on the adhesive's gap-filling properties to give a good bond.

Other people use commercial or home built servo mounts. These certainly make servo maintenance easier. When building this model I was short of time and I epoxied the servos directly to the upper wing skin, so this is what the photos show. It has proven successful so far (for one season).

Ailerons

It is probably best to start with the ailerons as these are easiest to install. The aileron servos use the shorter of the supplied threaded linkage rods and, depending upon the servos used fit comfortably about 6mm (1/4") aft of the main spar. 8mm servo arms are adequate to obtain sufficient throw with the brass horn screwed fully into the aileron. You should be able to obtain full aileron movement without further filing away the rear spar. As the ailerons are bottom hinged there will be less 'up' movement than 'down'. Check that you can get 18mm up and down before any binding sets in so that you can accommodate the suggested throws of +/- 15mm without stalling the servos.



Set up with servo arm at 90 degrees to the servo body when centred and ailerons in normal cruise position. There is sufficient space such that you can add the linkages after mounting the servos so that you can adjust for best length once all the glue sets. Don't forget to use some CA or threadlock on the linkages to stop everything rattling and backing off. Depending on precise details of hardware, you might just need to trim slightly the rear clevis, wing surface apertures and separate small hinge cover to avoid minor binding.

If gluing the servo degrease and roughen up the case (or heatshrink the servo or wrap it in good quality masking tape). Roughen the wing gluing surface with course sandpaper. Masking tape a straight wooden batten to the wing underside and aileron to hold the aileron in the correct neutral position. Attach the aileron pushrod to the aileron servo output arm. Apply epoxy to the servo and apply a weight to hold it in place, ensuring the output arm stays in the centre, and the aileron stays in line with the underside of the wing.



The aileron servo leads should be lengthened if necessary, threaded though the slot in the tip panel root rib, and left loose. They don't get lost in the void, and are easily connected to the extension lead sockets mounted at the end of the centre panel.

Flaps

The substantial flap servos need to be very firmly fixed in place with the torque transmitted as much as possible to the main spar and not to the wing skin. Arrange for the flap servo to abut the wing spar if mounting servos directly. If using servo frames ensure they are butted up firmly to the spar with a generous surface area for gluing. Firmly attaching flap servos is not an area of the model where you should worry too much about a little extra weight – leave that concern for the extremities!

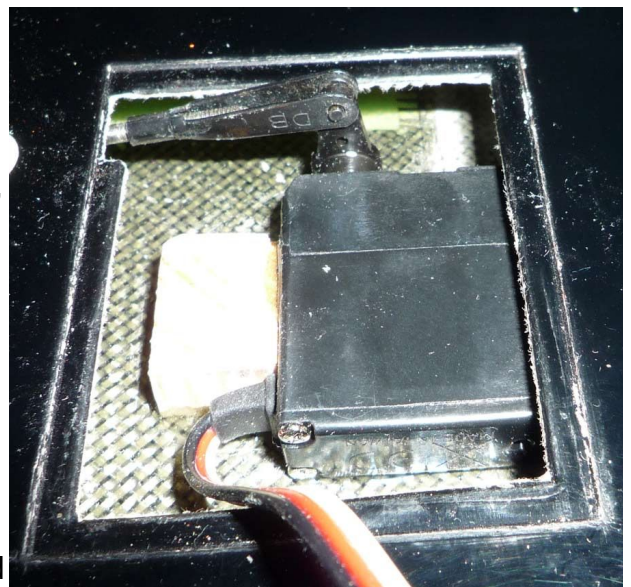
Flap servos should give adequate throw using 10mm arms and the brass horns screwed out about 3-5 turns (CA them in place). Use the longer threaded rods. The flaps are bottom hinged to get max 'down' deflection and you will almost certainly need to trim away the rear spar a little more to get best deflection approaching 90 degrees. (You should certainly be able to get good flap movement of well over 70 degrees without having to resort to bending the pushrod linkage.) Again, upwards deflection is limited by the top surface wiper and may be no more than 10mm – so be very careful when setting up any subsequent aileron/flap mix.

When setting up the servo arm and the flap linkage remember that you need to introduce a neutral offset to get the most advantageous operating geometry, as nearly all your surface movement is in one direction - down. A little bit of trial and error is needed to give the best result, and this is where a servo tester is invaluable.

Initially, set the servo arm so that it is pointing about 10 degrees forward towards the main spar and the flap about 30 degrees 'down' before adjusting the linkage to length and trial fitting. With any luck you'll now find that as the servo is exercised over its full range the flap will move from full down (very close to 90 degrees) to full up (about 10mm above normal cruise position). Adjust linkage length to obtain this behaviour and check for binding. Remember to dial in whatever offset is required in your Tx software to adjust the flap into its normal cruise position before programming flight modes etc. Depending on precise details of your servo arms you may also need to file away a small crescent of material from the inboard clevis in order to be able to take best advantage of full servo travel.

I made some small plywood blocks with slots to mount the aileron extension leads, and epoxied these in the end of centre panel.

Cut the carbon pushrod exit fairings to size and lightly CA them into place.



Transmitter Programming

Although the model could be flown without any mixes or flight modes it would be much harder to land in a small space, and a considerable amount of performance would be lost. If you haven't programmed a model like this before you may find programming the transmitter takes longer (and is harder) than making the model. Do not make light of this important final step.

The flight modes I use are:

Launch – camber is set to speed, the throttle stick “deploys” the electric motor, up stick = power on.

Normal – the throttle stick “deploys” camber, up stick = max camber.

Landing – the throttle stick “deploys” brake, up stick = max braking.

The benefit of this setup is that with the throttle stick down the motor is off, the brake is off, and the wing is in the min camber “speed” position, irrespective of the flight mode.

I use a three position switch on the end of the right hand transmitter stick to switch between modes, so I never have to take my fingers from the sticks to fiddle with switches.

Terminology

Flight Modes (also called *Modes*) – these change the way the plane flies and responds to the transmitter control sticks, depending upon what you are currently doing

Camber – moving the flaps and ailerons in synchronisation up or down a few degrees to make the wing more efficient when flying fast (reduced camber), or when thermaling (increased camber).

Crow Brakes – moving the flaps down and the ailerons up to add drag and reduce the chance of tip stalling, so the model can be landed more easily.

Snap Flap – increasing the wing camber slightly with up elevator, and vice versa. Both the flaps and ailerons are moved. The purpose of this is to adjust the wing camber as appropriate.

When Dr Drela published the plans and build info for the Supra glider he included a *supra_throws.txt* and *supra_wing.pdf* documents that listed the recommended throws for all flight modes – for the glider only. I have adapted them for the electric version as below.

All control throws measured at TE of the moving surface at the largest-chord location. Positive throw is TE down. Negative throw is TE up.

Control/ Function	Normal Mode	Launch Mode	Landing Mode	Notes
Elevator (1mm = 0.70°)	+9mm (down) -12mm (up)	+9mm -12mm	+11mm -14mm	I use modes instead of dual rates
Rudder (1mm = 0.49°)	+/- 40mm	+/-30mm	+/- 62mm	Max rudder for landing
Aileron/Roll (1mm = 1.05°)	+10mm -10mm	+8mm -8mm	+14mm -14mm	I use modes instead of dual rates
Aileron/ Camber (1mm = 1.05°)	0mm (-2° camb) +2mm (0° camb) +5mm (+3° camb)	0mm	0mm	0mm is flat underside = -2° camber setting
Aileron/ Crow (1mm = 1.05°)	N/A	N/A	-10mm	-10mm for full crow braking
Flap/Roll (1mm = 0.92°)	+8mm -8mm	+7mm -7mm	+0mm -50mm	Flaps follow ailerons but with lower throws
Flap/Camber (1mm = 0.92°)	0mm (-2° camb) +2.2mm (0°camb) +5.5mm (+3°camb)	0mm	0mm	0mm is flat underside. This is the -2° camber setting
Flap/Crow (1mm = 0.92°)	N/A	N/A	+54mm (max possible)	Deflect flaps down as far as possible for max braking
Camber mix	On	Off	Off	Camber mix allows trimming wing TE when searching & thermalling
Crow mix	Off	Off	On	
Snap Flap mix	+3mm up elevator -2mm down elevator	Off	Off	Flap & aileron deflect down with up elevator
Aileron -> Rudder mix	+/- 15mm	Off	+/- 30mm	
Throttle -> Elevator mix	Off	On	Off	Use as required to allow straight climb
Camber -> Elevator mix	1mm down elev with max camber	Off	Off	

Make control surface setup templates by printing this [PDF](#) onto card, and cutting round the various wing profiles.