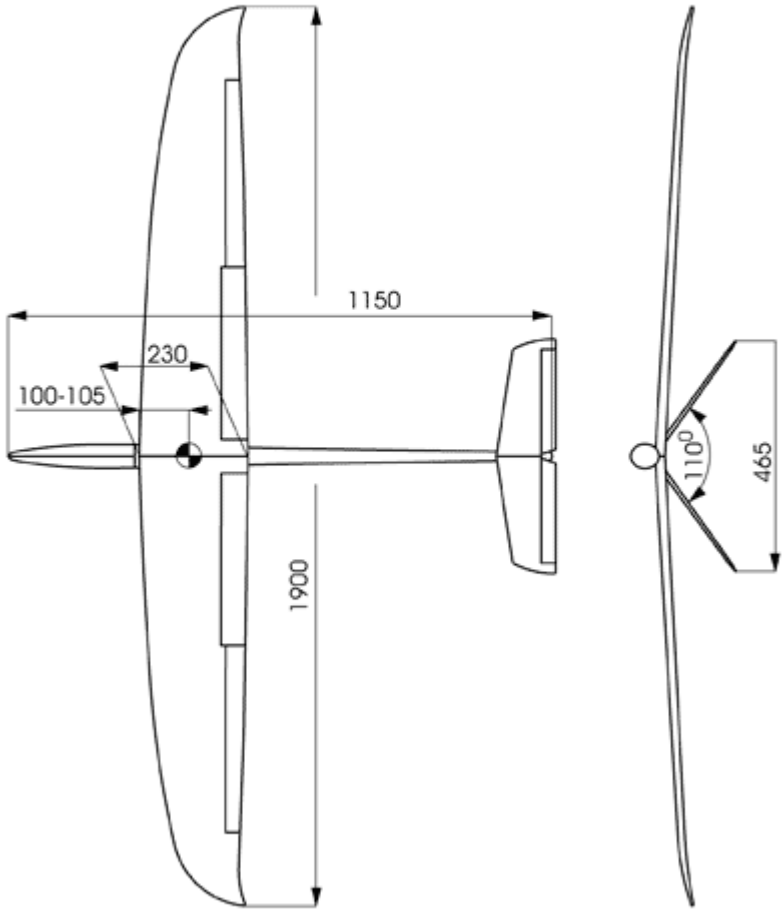
MINI GRAPHITE



Mini Graphite Assembly Guide

from

Hyperflight.co.uk
123 Radford Road
Leamington Spa
Warwickshire UK CV31 1LG

www.HyperFlight.co.uk
sales@HyperFlight.co.uk

Revision 2, 17/04/08, Mini Graphite Assembly Guide R2.odt

Mini Graphite Specifications

Wing span: 1.9m (75 in)
Wing area: 41.5dm2 (643 sq in)
Length: 1.160m (46 in)
Typical flying weight: 1278g (45 oz) - electric
Wing loading: 30.8g/dm2 (10.3 oz/sq ft) - electric
Wing airfoil: MH32
Tail airfoil: NACA 63A 007
Spinner size: 38mm
Firewall to wing LE distance: 225mm (max folding prop approx 19")
Controls: Elevator, rudder, flaps, ailerons
Centre of Gravity: 98 - 102mm from wing leading edge

Control Throws & Mixes

Ailerons: 20mm up / 7mm down
Rudder: 9mm up / 9mm down
Elevator: 8mm up / 7mm down

Thermal

Ailerons Thermal: 2mm down
Elevator Thermal: 1mm up
Flap Thermal: 2 mm down

Speed

Aileron Speed: 1.5mm up
Elevator Speed: 1.5mm down
Flap Speed: 2 mm up

Crow/Butterfly Mixing

Aileron Crow: 11mm up
Elevator Crow: 4-5mm down
Flap Crow: 70-80 degrees down

Flap to aileron Coupling/Mixing

+17% on JR radio. This gives approx 30%-35% movement of flaps to aileron and a quick roll rate.

Dual rate and Exponential

We suggest 100% rates on all controls and 20% - 25% exponential in launch and land modes and 35% exponential in cruise, thermal and speed modes.

Aileron differential

Between 2 to1 and 3 to1 depending on flying speed and flight mode.

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 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 Mini Graphite 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 all reasonable powertrains and 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 damage 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 David Bradley for kindly writing this helpful assembly guide and taking the photos. 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.

Research

Do some homework before starting to build this plane. There is a lot of great info about RC planes at www.RCGroups.com and other websites. Get the latest info on batteries, motors, building and flying tips. There is often a "build thread" on RCGroups.com where you can see many pictures your model and read the questions/answers of other pilots that already built one. Try www.MotoCalc.com or one of the online electric motor performance calculators for help in choosing a suitable powertrain. Make certain you check out www.HyperFlight.co.uk regularly for any product information updates.

Parts List

Wing (2 pieces)
Fuselage
Nosecone
V-Tail
Accessories bag
These instructions

Other equipment needed to complete and fly the model

Radio with receiver and 6 servos
Radio battery (glider version)
Plugs & sockets for easy wing servo connection
R/C extension leads for the tail servos and wing servos
3mm play and Velcro for battery and receiver mounting
3mm ply or prefab servo mounts

For the electric version, additionally:
Electronic speed control (ESC)
Battery Eliminator Circuit (BEC)
Flight battery & suitable battery charger
Motor, gearbox & mounting bolts
Prop hub and spinner
Folding prop blades

NOTE: It is your responsibility source suitable components and to check, and if necessary do additional gluing to all critical joints and mounting parts. Parts may come loose during shipping and in operation, so please to eliminate the possibility of model failure and double check and re-glue any loose parts.

Mini Graphite Assembly Guide

by David Bradley, April 2008

Introduction

I was browsing the web looking for a reasonably priced high performance electric moulded glider when I spotted the Mini Graphite being sold by HyperFlight.co.uk. The Mini Graphite-E appeared to be just what I was looking for, a moulded hot liner that would be suitable for big slopes, flat field, blasting around with the motor on and thermaling. Having now flown this ship many times I can confirm that it will do all of the above with ease.

The Mini Graphite has so far proved to be an excellent all-rounder being particularly good on a slope and in all conditions. It displays no bad habits, turns well at low speed and lands really gently with crow mix and those huge flaps deployed at around 80 degrees. The wide chord of the MH32 section wing endows the Mini Graphite with excellent thermaling abilities that are improved further still with a small amount of camber and elevator compensation dialled in.

What follows isn't intended to be a step by step instruction on the assembly or set-up of the Mini Graphite. It's more of a guide based on my experience of the assembly and flying for those who are interested or considering buying. I've included some useful tips along with the methods I used and the choice of equipment I installed during the build.

Some of what follows may only apply to the electric powered version of the Mini Graphite. However the differences all relate to the installation of the power set and therefore most of the notes relating to assembly, set-up and flying should be useful for both the powered and the un-powered versions. Things that are only relevant to the glider version have been marked appropriately.

I installed

Kontronk Fun 480-33 with KK480 heat sink & 4.2:1 gearbox.

Hi-model Pro 60A ESC with 4A switch-mode BEC.

JR RS77S receiver.

2600mAh 3S LiPo and 3200 mAh 4S LiPo batteries.

Ripmax SD100 6g servos in V-tail.

Hitec HS81 MG servos in wings.

Multiplex 6 pin plugs and sockets for wing connections.

X2 700mm servo extension leads.

X8 300mm servo extension leads.

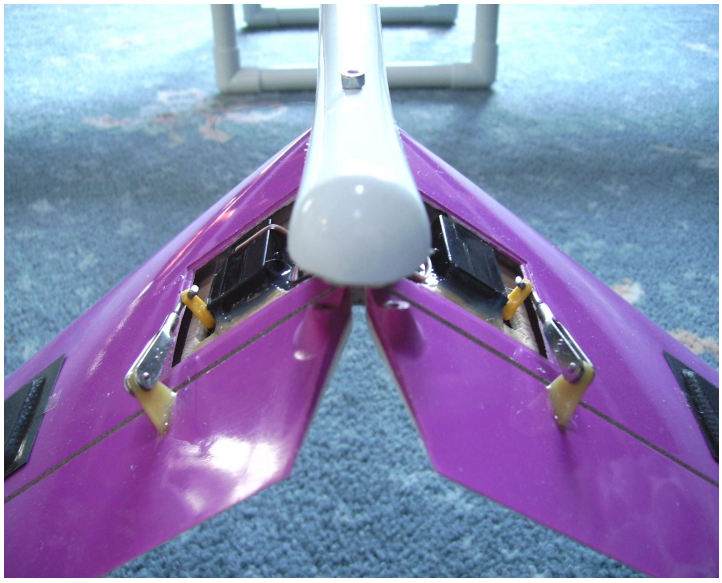
38mm Aeronaut precision spinner and 38mm HM spinner.

Aeronaut folding Cam prop blades.

On 3S LiPo battery and Aeronaut 13X8 CAM prop blades at 7700 rpm the Mini Graphite climbs vertically and effortlessly to 500 ft in just a few seconds. 15-20 climbs are easily achieved from a 2600mAh 3S LiPo. From a flat field flights of well over an hour are possible in the right conditions from one charge.

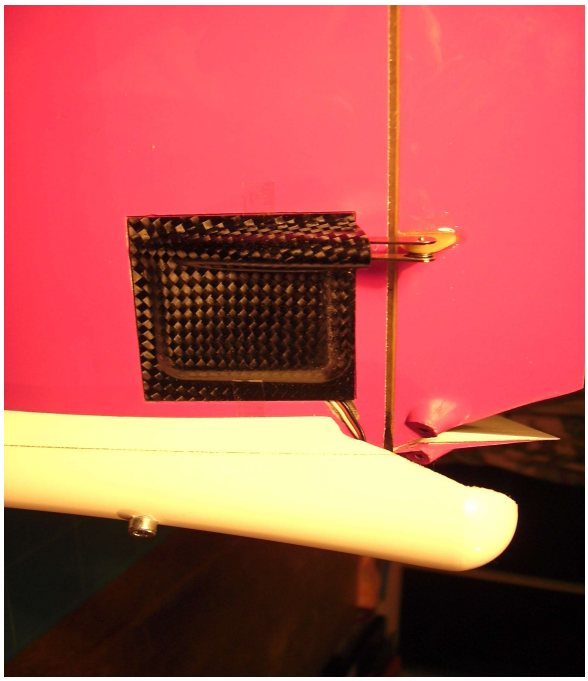
If you enjoy tearing up the sky the Mini Graphite does this extremely well too. With a 4S LiPo and Aeronaut 12X11 CAM prop blades the Mini Graphite really moves, the pitch speed at 9400 rpm is well over 100mph giving warp speed performance and a huge grin!

V-tail



The fibreglass control horns are fixed with epoxy into small slots cut into the bottom of the rudders with a Dremel cutting disc. Trial fit the servos to ensure that the control horns are aligned before cutting. With a little trimming of the bottom edge of the horn the clevis hole can be placed almost directly over the hinge line.

The choice of servos for the V-tail is limited by the thickness of the aerofoil section and this must be taken into account when choosing servos. Following a thorough web search I had a list of possibles, however most were rejected for being too delicate, of poor quality or just too thick. Some 9 gram micro's were tried but at 9.5mm thick they prevented the carbon servo covers from sitting flush on the V-tail. I also tried some "high quality" 8mm thick digital, ball raced metal gear servos but these had too much slack in the gear train. I looked again at some Ripmax SD100's, at over a kilo of torque and being only 8mm thick these were chosen. They have proved to be of very good quality, they're not the fastest I've seen but they are suitable, they don't sound gritty and have no slack in the gear train.



To mount the servos they can be epoxied directly to the inner top skin of the V-tail. I used a similar method that enables subsequent removal of the servos without having to resort to the use of a Dremel, which is the usual method for removal when servos are epoxied directly to the top skin. First I carefully remove the mounting lugs from each end of the servo before marking the profile and cutting out a 3mm thick lite-ply one piece frame. With care the frames can be made to fit tightly around the servo providing a very secure mounting. Centre and sub-trim the servos and trial fit them with the frames into the V-tail and adjust the linkage clevises to the required length. Wrap the lower face of the servo with cling film and push it into the frame before finally gluing the frame with servo into position with epoxy and micro balloons.

After the epoxy has fully cured the servos and cling film can be removed. The servos are then refitted into the frames for final fixing with a few blobs of hot melt glue on either side fixing them securely to the wooden frame.

To remove the servos just warm the hot melt glue with a hair drier and peel it away and the servo will then lift out of the lite-ply frame.

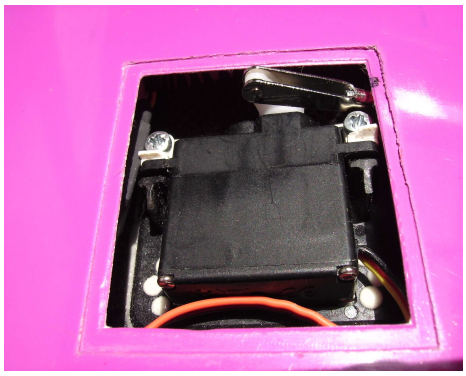
I decided not to cut holes in the tail and fuselage to route the servo wires through the base of the V-tail. Instead I secured the servo wires to the outer surface with a tiny spot of cyano and brought them in through the opening in the rear of the fuselage. This allows for speedy rigging and connection at the flying field or slope.

Glider version: To minimise weight in the tail you may prefer to mount the V tail servos in the fuselage in the glider version, and use Bowden cables to actuate the control surfaces. In this case just tape the servo covers in place, and fit the brass servo horns into the moulded threaded hard point in the elevators.

Wings

Preparation of the wings is quite straight forward as there are only the four servos with associated wiring and linkages to install.

The first job is to fit the brass servo horns into the moulded threaded inserts in both the ailerons and the flaps. The aileron horns were set to 8mm from the aileron surface to the centre of the clevis hole and the flap horns were set to 6mm from the surface of the moulded flap horn boss to the centre of clevis hole. These measurements are only a guide, as the final setting will depend on servo arm length and linkage geometry.

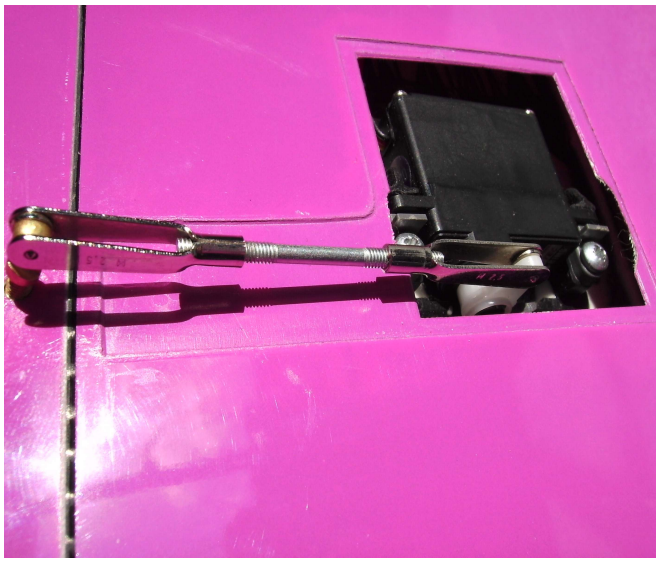


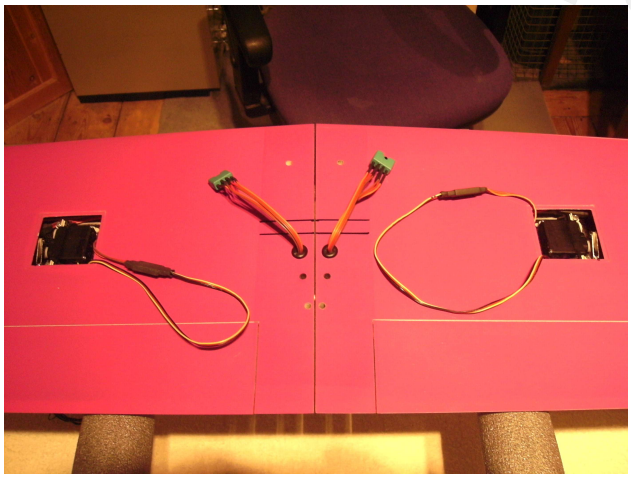
I fitted Hi-tec HS-81/82 MG servos for both aileron and flap operation and installed them on Cubitts Models Solid-tec HT 1 servo mounts.

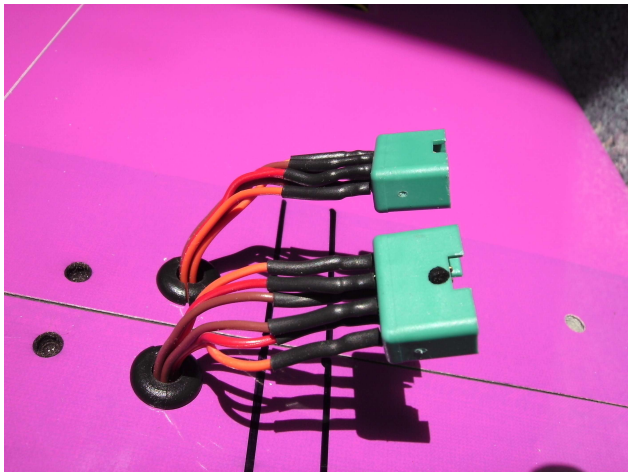
These mounts are invaluable in applications such as this as it's possible to easily remove the servos in just a few seconds for servicing or replacement.

Centre and sub-trim the servos and trial fit them (with the mounts if used) into the wing and adjust the linkages to the required length. Prepare the reinforced carbon area where the servos are to be attached by keying with abrasive paper and wipe with acetone or other suitable solvent to clean the surface and remove grease. If the control surfaces are taped in their neutral/centred positions before gluing the servos, with or without mounts, the already adjusted linkages will preset the correct position of the servos meaning little or no further sub-trim adjustment will be required in the final set up. If using the HT-1 mounts wrap the lower face of the servo with cling film and fit it into the mount before glueing the mount and/or servo into position with epoxy and micro balloons. If using the mounts, after the epoxy has fully cured, the servos and cling film can be removed, the servos are then finally refitted into the frames.

The next job is to make the exit holes for the wiring in the bottom surface of the wing as close to the wing root as possible. Before making the holes check through the flap servo opening with a small mirror or a probe that the wing joiner and internal reinforcing web are not beneath where you want to drill! I found the best place was 120mm back from the leading edge and 10-12mm in from the wing root. I fitted rubber grommets to the exit holes to protect the wiring, as cut carbon can be very sharp on the edges.

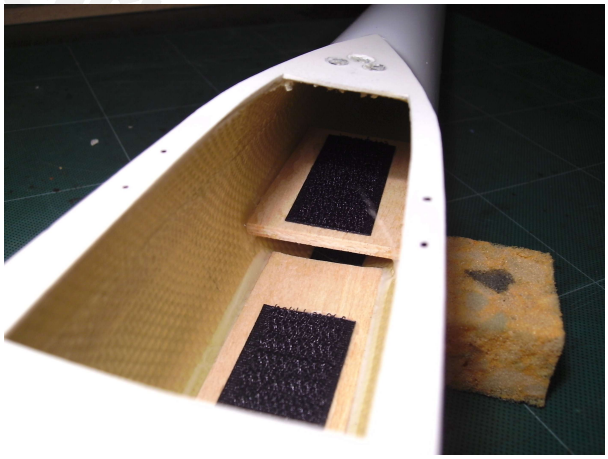






Fuselage

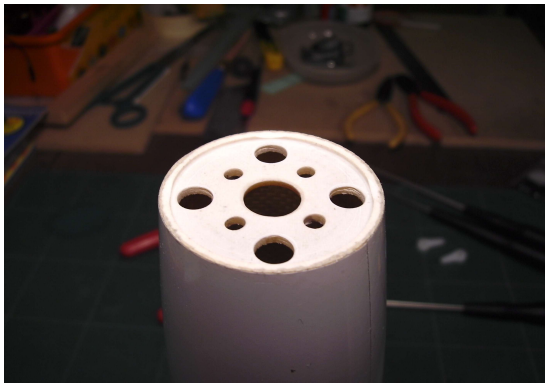
The fuselage is a strong two-piece epoxy Kevlar moulding with carbon reinforcement. Little work is required here but, any trimming or cutting requires the use of diamond or tungsten carbide grit tools if frayed edges are to be avoided. I started with the motor and ESC installation as this makes the C of G easier to achieve when deciding on the location of the other components. As the V-tail servos are located in the tail, there's plenty of room for positioning the battery and receiver in an ideal location.



The receiver tray was installed behind the battery tray under the rear of the wing seat. Battery and receiver trays were cut from 3mm lite-ply and dry fitted before assembling the whole glider for a balance check. Everything was installed in its final position including extension leads, prop and spinner. With wings fitted and the C of G range of 98-102mm marked on the bottom of the wing the Mini Graphite was checked for balance with both 3S and 4S LiPo batteries. The wing has to be removed to gain access each time the battery is moved for fine tuning the balance point. I had no problems in achieving the correct C of G and marked the appropriate battery positions inside the fuselage with a marker pen for easy visual future reference. The battery and receiver trays were then permanently installed with epoxy and micro balloons, allowing enough length in the battery tray to provide sufficient movement of the battery for adjustment in flight tests.

Drive Set

I fitted a Kontronk Fun 480-33 with 4.2:1 gearbox and a KK480 heat sink, a very powerful combination. At 50Amps and over 500 watts it'll provide more than enough performance for most flyers with vertical rocket like climbs at little more than half throttle! A heat sink and good cooling airflow are very important with any high power set up and provision should be made for adequate cooling when installing the motor.



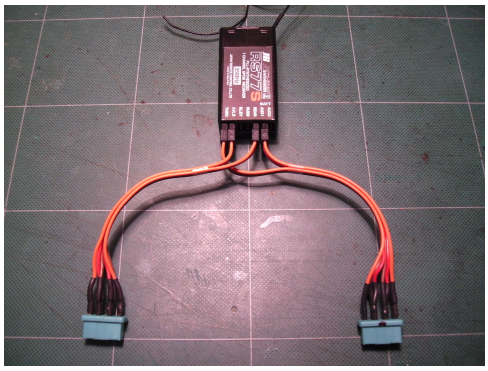
The motor bulkhead in the nose section was carefully marked out to match the mounting bolt pattern of the gearbox before drilling and trial fitting the motor and gearbox. I also marked and drilled four 6mm diameter cooling air holes in the bulkhead as the nose section as supplied has no factory cut cooling air holes.

To ensure the ESC has adequate cooling I wanted the cooling air to flow around both sides of the circuitry to avoid any excessive heat build up that sometimes occurs if adhesive Velcro or tape is used. This was achieved by gluing two small diameter carbon tubes inside the nose section with a hand formed wire clip that slides into the carbon tubes to hold it securely in place. I also fitted two strips of wing seat tape to cushion the ESC where it touches the Kevlar wall of the nose section.

The two types of LiPo I have been using in my Mini Graphite are 3S 11.1V 2600 mAh and 4S 14.8V 3200 mAh. The physical size of a LiPo or NiMH pack will be the only limiting factor in your choice of flight battery. The approximate size of the opening in the fuselage is 38mm wide and 42mm top to bottom or 48mm top to bottom if you chose not to install a battery tray.

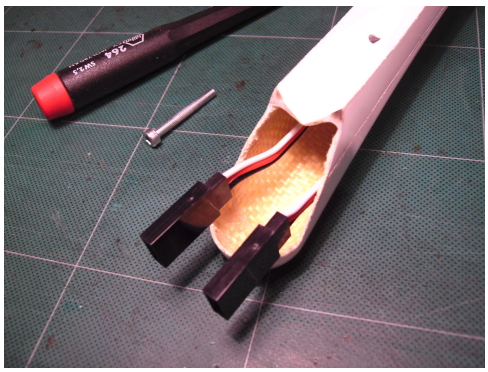
The prop blade pitch range I've used on 3S is 12X10 - 14X8 and on 4S 11X11 - 12X11, the absolute maximum on this power-set with 4S Lipo. Some of the pitch settings were achieved by using a 38mm Aeronaut precision spinner with a +2.5 degree centrepiece. For climb-outs and general use I use a 13X8 on 3S and for blasting around 12X11 on 4S with full power used in short bursts of 5 to 10 seconds only.

Wiring



The wiring harness for the wings was made up from X8 300mm servo extension leads cut to the appropriate length. They were arranged 4 between the receiver and 6 pin socket and 4 between the 6 pin plug and the servos. The soldered 6 pin plug and socket connections if used should be insulated with heat shrink tubing.

Ensure that enough slack wire remains within the wing to enable disconnection of the servo plugs through the flap servo opening. It's important to secure the servo lead connectors with heat shrink or similar to ensure no accidental disconnection occurs in high-g manoeuvres. The wiring to the V-tail servos consists of just two servo extension leads. The length required is dependant on where you decide to mount your receiver and how much slack you need at the back to allow easy connection and disconnection of the V-tail. I found that 700mm - 800mm leads were adequate here.



Centre of Gravity

I found the information for C of G to be accurate and started with the C of G at around 95mm for the first flight to avoid any surprises. After a few more test flights I found that at 102mm the Mini Graphite pulls out of a dive test gently and needs only a small amount of down elevator when flying inverted. At this C of G setting (102mm) control response in pitch is predictable and precise but not too sharp at any speed. The wing halves were exactly the same weight when I put them on the scales however when assembled to the fuselage I found the lateral C of G to be very slightly out balance. To remedy this I epoxied a small piece of lead onto the carbon reinforcing through the flap servo opening in the light wing to restore lateral balance

Finally

The V-tail servo covers are carbon, the aileron and flap servo covers are epoxy glass, both will need to be trimmed to fit snugly in the moulded recesses before fixing in place with clear tape or with small drops of cyano. The carbon flap linkage fairings were trimmed to fit and fixed in place with cyano adhesive.

The receiver aerial was routed through a hole and grommet out of the fuselage just below and to the rear of the wing seat. Alternatively you can route the aerial through and out of the rear of the fuselage. I chose the external method to avoid any possible blanking of the transmitter signal by the adjacent V-tail servo leads in the narrow rear section of the fuselage.

I use clear tape as well as the screw fixing when assembling the nose section to the fuselage before flight. This is common practice on powered and un-powered moulded gliders, particularly when high power electric drive sets are installed.

I programmed the transmitter for five different flight modes, launch, cruise, thermal, speed and land. The throttle stick on my JR PCM9XII was programmed with the use of mixers, to function as a throttle stick in launch, cruise and speed flight modes and as a spoiler/crow brake stick in landing mode.

My Mini Graphite-E with a high power setup has a ready to fly all up weight of 1480g (52oz) with a 3S Lipo and1590g (56oz) with the larger 4S pack. The weights shown in the specification are for a less strong powertrain.

Before flying the model remember to do a range check, with the power on and off.

First flights are best made in an approx 10mph wing, to ease launch and landing. I found my model needed a bit of down elevator trim, but other than that it flew off the board.

After the last few flights with my Mini Graphite I was a little concerned with motor cooling at high currents of 55amps plus and have made two further cooling holes in the cheeks of the nose section, one each side. They're oval in shape approx 6mm x 12mm and made with a round 6mm, fine grit, Permagrit file. I started the cut with a Dremel bit and then inserted the file and slowly elongated the hole by leaning the file progressively forward while filing. I had my doubts about how effective behind the spinner cooling would be, the new holes have certainly improved the air flow around the motor etc. The bare fibres and frayed kevlar edges were removed by wetting them with thin cyano and setting with activator, they can then be removed more easily with a file or Dremel tool.

My Mini Graphite-E has given me loads of fun, I hope yours gives you a lot of pleasure too.

David Bradley

15th April 2008