

# My Arducopter

## Background

I have gained a great deal from posts by others on all sorts of different topics I thought it was time for me to give something back regarding my build of an Arducopter.

I have been a keen 'copter builder for some time and started with a Mikrokopter <http://www.mikrokopter.de/ucwiki/en> and then "graduated" to a Tricopter <http://shrediquette.blogspot.com/> and have now moved on to the Arducopter.

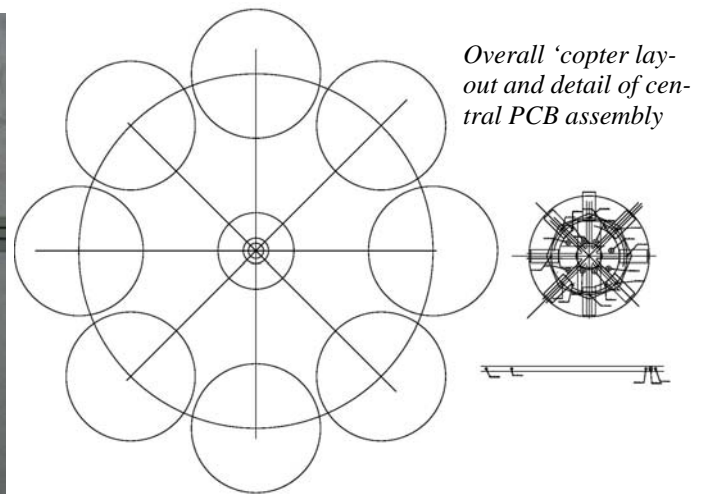
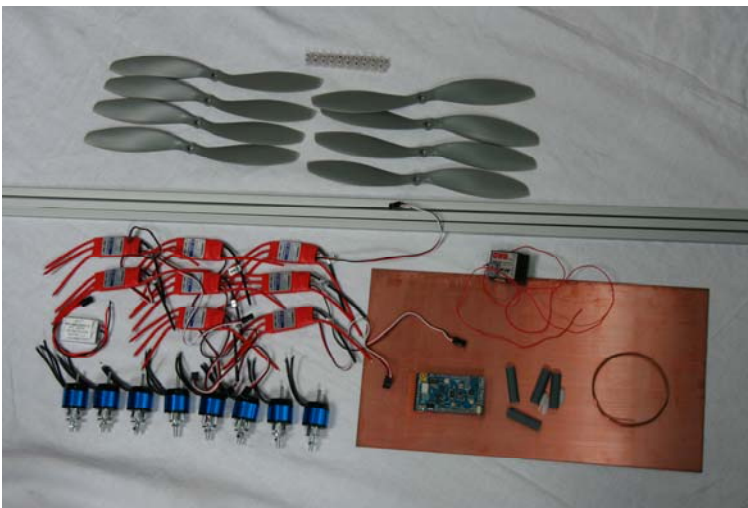


*Arducopter, Tricopter and Mikrokopter. The MK has a magnetometer and GPS on board.*

What attracted me to the AC was that it uses Atmel processors, is open source and uses the Arduino development system.

The AC that I am building is I hope going to be an Oktokopter but as there was no proven software for that I decided to start with a conventional quad but with space and sized to grow to an Okto.

## The Frame



*Overall 'copter layout and detail of central PCB assembly*

I purchased the following items for my Okto:  
 8 - KDA20-22L motors. These come recommended for low vibration.  
 8 - Turnigy Plush ESC's. These were recommended as they should be easily capable of being converted from PWM (the standard) signal input to I2C (required for an Okto). I bought 30A versions but am sure I could have used 18A units.  
 4 - CW and 4 - CCW 10 x 4.7 APC slow flight props  
 1 - 5A BEC. I felt happier to power the electronics from a separate BEC rather than using the BEC built into the ESC.  
 1 - ArdupilotMega and 1 - Oilpan sensor shield.  
 4 - 10mm x 10mm lengths of square section aluminium  
 1 - blank PCB

I intended to use the PCB for the two central panels that secured the aluminium arms on which was mounted the motors. My choice of PCB was that I had a number of sheets available. To ensure that the props would not touch and I had the right dimensions I drew the complete 'copter and detailed the central assembly before using the drawing as a template to drill the arms and PCB.

I latter discovered that the motor cables would not fit down the arm and past the motor shaft that projected through the arm unless I cut the shaft off first. This required disassem-



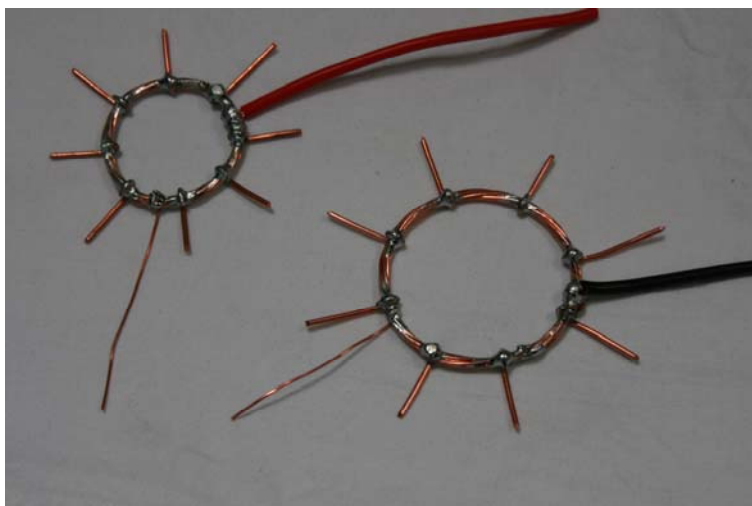
*The central PCB panels, arms drilled to take the motors, and at the top the power distribution assembly*

bling the motors before using a cutting disc in a Dremel to remove the 10mm or so of shaft. The motor housing has to be well protected to prevent steel swarf getting onto the magnets. I placed the housing in a re-sealable plastic bag, cut a hole for the shaft to stick through and then sealed the shaft to the bag with tape. If swarf does get onto the magnets a small stick with some adhesive tape wrapped around it sticky side out proved useful.

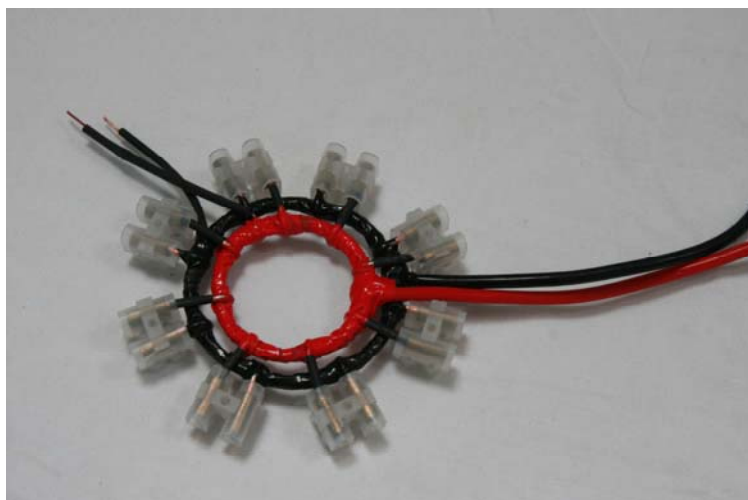
The mounting of the ESC's and wiring them up was always going to be problematic on an Oktokopter so I decided to make a distribution bus out of copper wired stripped from household cable.



*Copper ring and power takeoff points.*



*The two completed rings that will fit inside each other and be connected to the battery and distribute power to the 8 ESC's. The battery cable is connected and the thinner wire is for a connection to the separate BEC.*



*Underside view*



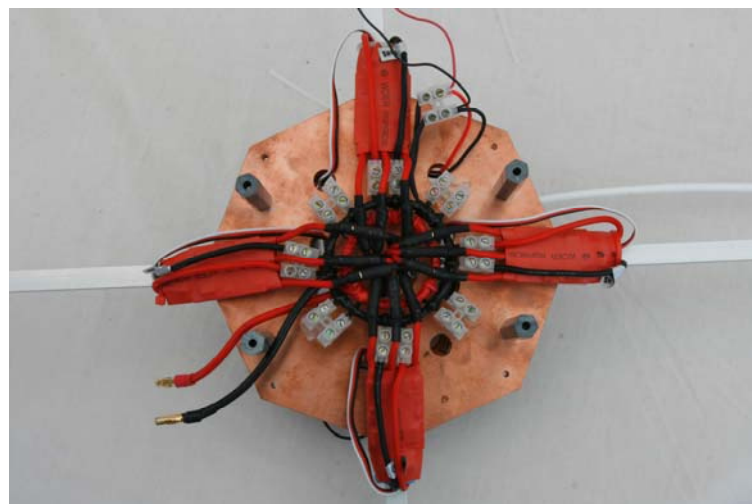
*Top view of the completed assembly after everything had been wrapped in insulating tape and the connectors for the ESC's attached.*

The result is a compact system for connecting the battery side connections of the ESC's to the battery itself. It also allowed easy disconnection should an ESC fail.

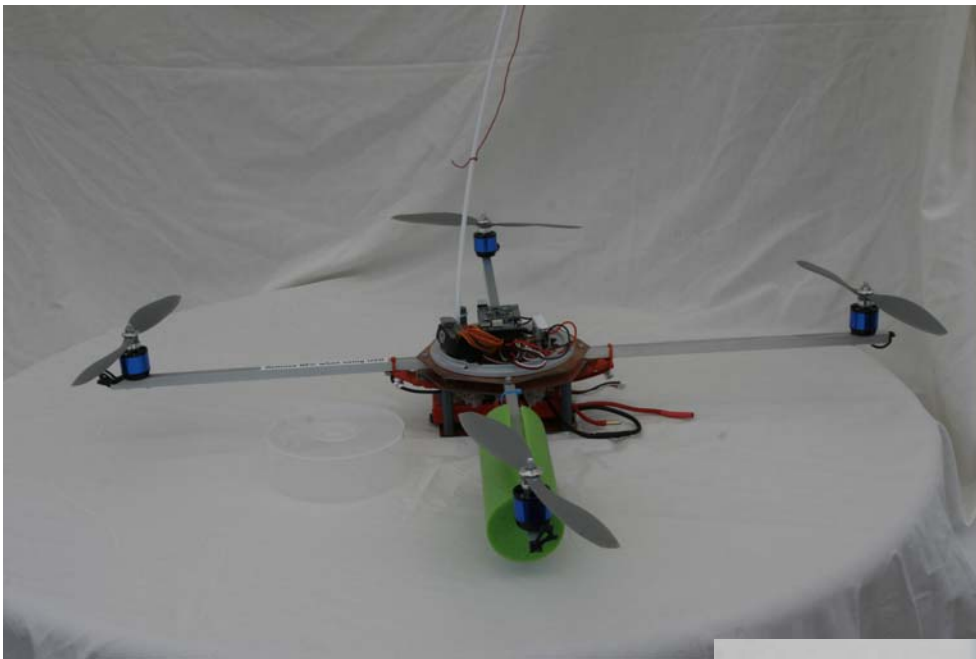
The ESC's were fitted on the motor side with 3.5mm bullet connectors that came with the motors.

The final assembly worked quite well but it will be interesting when adding a further 4 ESC's.

Finally when I assembled the 'copter I put a cover over the electronics but left some airholes.

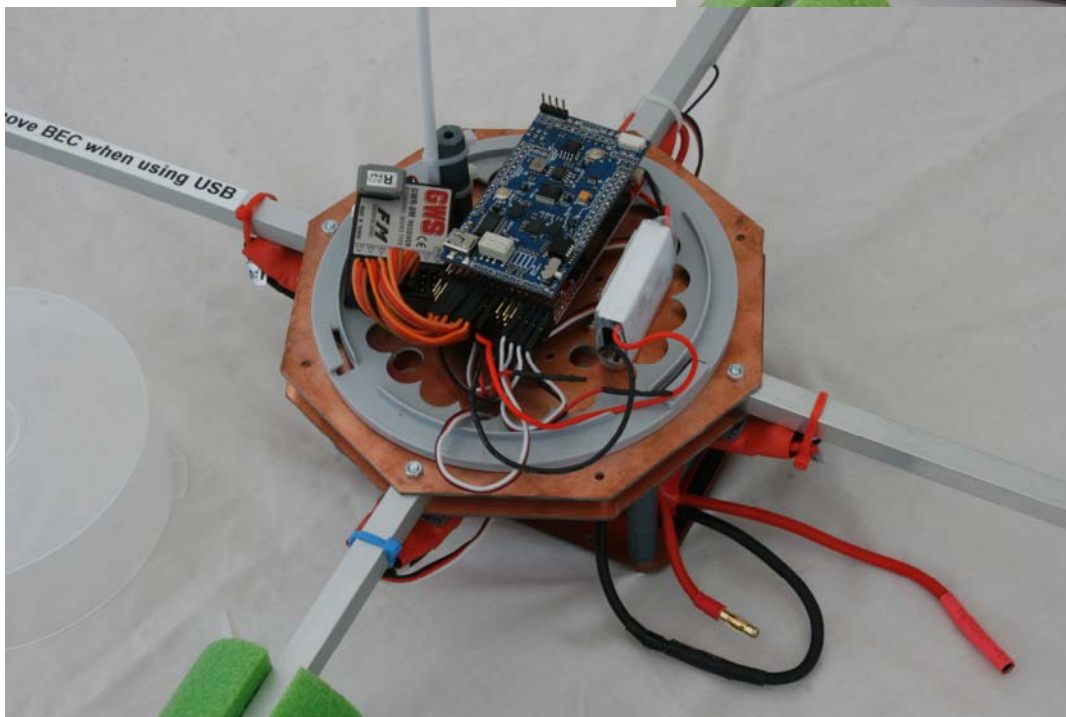
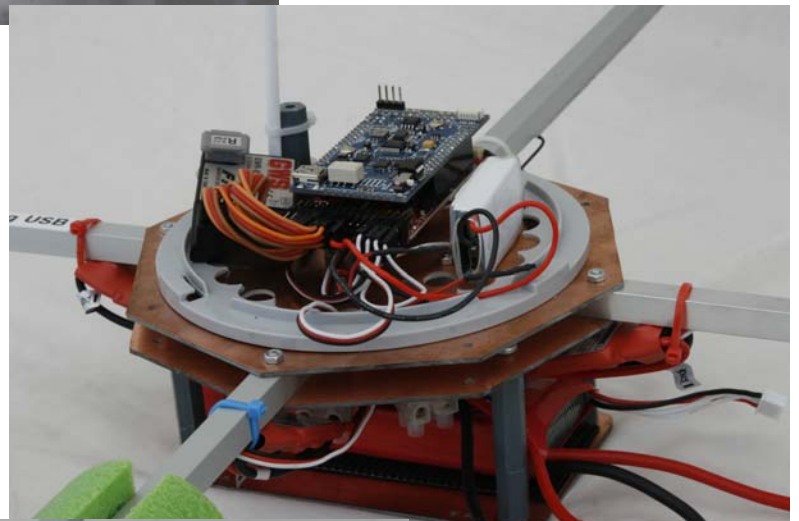


*Underside view of completed 'copter. The wires from the motor come up the arms to exit in the centre and are terminated in bullet connectors.*



*Ready to Fly*

*The battery underslung on pillars. This also acts as a footplate that the 'copter rests on.*



*The white device on the right is the separate BEC.*



With the Arducopter flying as a Quad I set about converting it to an OktoKopter. The central hub was already equipped to take the extra arms and so it was a question of adding them on with their motors mounted and wired. The power distribution was also ready to accept the extra ESC's. Everything was designed for a + type configuration with the green foam on the back arm.

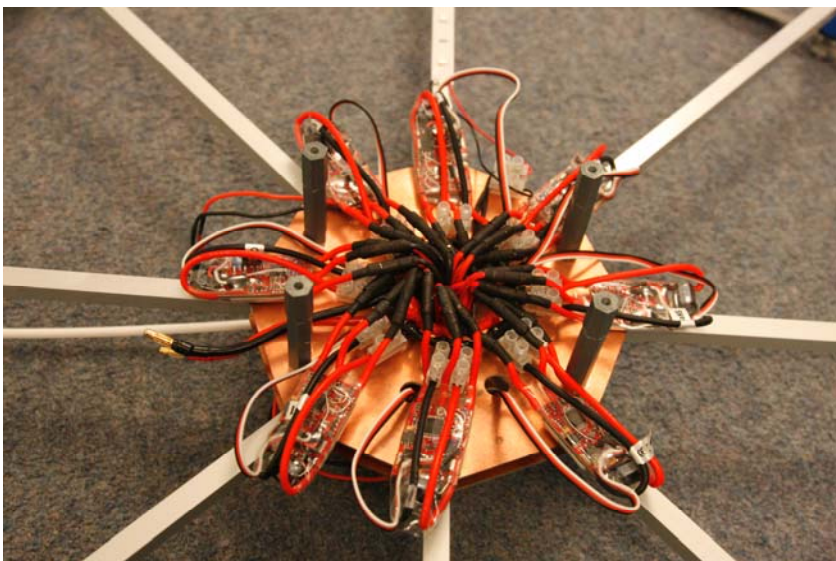
The motor opposite the green foam tube (the back arm) is motor 1, and turns clockwise viewed from above, whilst the rest of the motors are numbered sequentially clockwise, each with opposite rotation to its neighbour.



The other major item was to convert the Turnigy Plush ESC's from PWM control to I2C control. I used software from Quax (Bernard Konze) and his instructions. The Turnigy pcb's I had were laid out as per the picture on page 5 of Quax's instructions.

The following steps in the process were:

1. Remove heatshrink from ESC
2. Cut two tracks on pcb
3. Unsolder the red and white control signal wires to the pcb and secure with glue from a gluegun to the pcb.
4. Add two new wire links to the pcb.
5. Connect the red and white control wires to new points on the pcb.
6. Load the software
7. Test the ESC
8. Apply a new label to the heatsink and enclose in



The new ESC control cables were all paralleled using pin headers on a stripboard and then connected to the I2C header on the oilpan.

The software used was the Arducopter RC1 version but with the necessary additions for the I2C ESC's and a mix-ertable to sort out which motor gets which control signal.

And it Flies!!!!