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SMALL ROTORS

THE QUADPOD AND TWO NEW SMALL HELI'S

The QuadPod kit, everything you need is included, even down to tie-wraps and tape

Once seen as a quirky novelty model, quadrotors have now become firmly established on the flying field. Available in a range of sizes from the smallest indoor flyers to monsters capable of carrying DSLR and video cameras, their easy flying characteristics and stability make them the perfect platform for aerial photography and First-Person-View flying. I've been doing some work during my day job on some small quadrotors, so when the opportunity arose to build a Snelflight QuadPod, I thought it would make an excellent Small Rotors feature.

The QuadPod Arrives...

Snelflight have been around for quite a while, since 1997 in fact, and were at the forefront of indoor flying with the innovative Hoverfly. The QuadPod is one of the smallest quadrotors around, with a flying weight of 240 g and just 230 mm across diagonal motors. It comes as a very complete kit, absolutely everything is included, motors and props, speed controllers, a controller board and even tie-wraps and double-sided tape. There's also a very detailed and comprehensive manual, this can be downloaded from the Snelflight website (www.snelflight.co.uk). Snelflight reckon it only needs an hour of your time to build, along with a screwdriver and a pair of scissors, so armed with the requisite tools, and a stopwatch, I set to work!

Assembly starts with the chassis, this is a cruciform cut from 1 mm carbon fibre plate. Eight plastic pillars are screwed into place with nylon screws, which will support the upper parts of the chassis. The four motors are new bolted in place, each using four 2 mm nylon nuts and bolts. The idea of the nylon bolts is that in the event of an accident, the bolts will snap rather than the carbon arms... The brushless motors are unmarked, but I suspect they are something like 2000 kV to 3000 kV.

There's Four Of Eveything!

Next come the four speed controllers, these are FlightPower branded, and rated at 6 amps. The manual suggests strapping them to the chassis with tie-wraps, but I found that the plugs to the motors were too long to cleanly tie them down like that. I ended up with the layout shown in the pictures, turning the ESCs on their sides and winding the excess cables around the outer pillars to keep them out of the way. There's clear instructions on wiring the ESCs to the motors, get it right as the motors need to be going the right way – the motors are numbered relative to the direction of flight, and at this stage the only way of spotting the chassis direction is the curved edge at the rear of the centre disk.

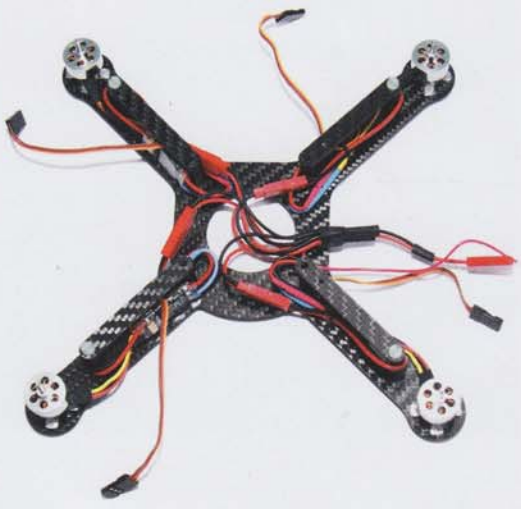
The power leads need to be fitted now, a 1-into-4 adaptor lead is supplied fitted with JST plugs and sockets to suit the ESC power leads. This needs to be fitted carefully around the inner ring of the chassis, leaving room to slide the battery in from the right. There's quite a lot of wire to lose, and although I started off winding the wires up like the instructions say, I eventually changed the layout slightly, feeding the power leads over the outside edge of the chassis. It will all go in, it just took a bit of perseverance.

With the ESCs and power leads in place, the top of the chassis can be fitted, this consists of four short arms and a circular top plate, all screwed into the tops of the pillars fitted at the beginning. This locks the chassis into a rigid framework; it's very simple and effective. With the ESC signal leads led out to the top, the electronics can be fitted. As quadrotors have no inherent or mechanical stability at all, electronics are utilised to provide the required control.

The chassis is cleanly cut from 1 mm carbon fibre plate. Note the pillars to hold the upper chassis parts

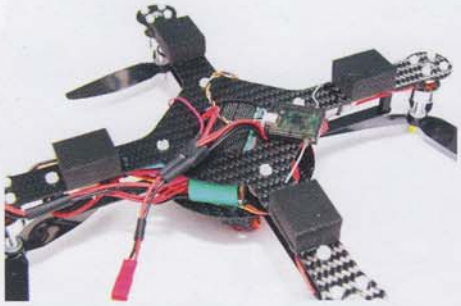
I changed the layout of the ESC wiring slightly, wrapping it around the pillars to keep it neat

Note the nylon bolts holding the motors – in a crash, they'll break rather than the chassis



All the motors and ESCs in place, ready for the top chassis parts

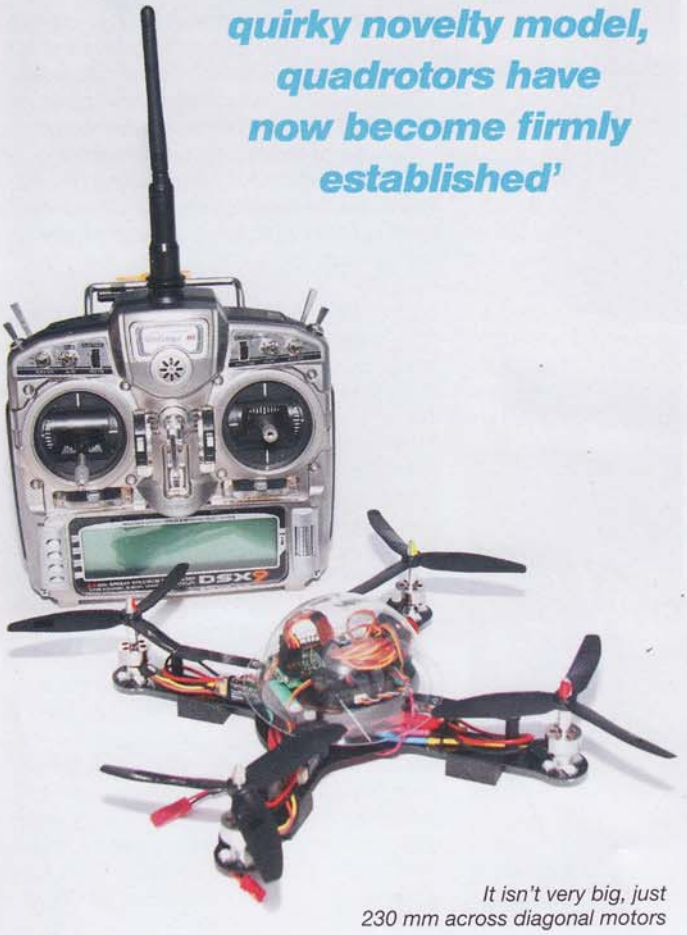
With the top chassis on, the control board is fitted



The power leads are combined with an adaptor lead, I fed it around the outside of the chassis

The QuadPod pretty much built in an evening, just awaiting the clear dome top

'Once seen as a quirky novelty model, quadrotors have now become firmly established'



It isn't very big, just 230 mm across diagonal motors

Custom Control

Snelflight supply a custom control board for the QuadPod, it's very compact at 55 mm x 30 mm. The core of the board is a PIC processor that takes the signals from the receiver and the three gyros, and mixes the signals out to the four ESCs controlling the four motors. The gyros are the three small silver cans, two (pitch and roll) are flat on the board at 90° to each other, while the yaw gyro is fitted to a small daughter board mounted vertically off the main board. It's worth mentioning here that the gain for all three gyros can be adjusted individually. Some quadrotor gyro units only allow one gain adjustment that combines all three axes, which means the gain setting can often be a compromise value. Allowing each axis to be adjusted individually is a real bonus.

The board is fitted to the top of the upper chassis plate with the supplied double-sided tape, taking care to ensure it's perfectly aligned with the fore/aft axis of the model – if it isn't, the gyros will struggle to keep the model level. The chosen receiver sits alongside it, again taped in place with foam tape. Five short extension leads are supplied to link the board to the receiver, these are plugged into the throttle, aileron, elevator and rudder, channels, the fifth goes to the gear channel to switch the dual mode gyro from rate to heading lock mode. The four ESC signal leads are also plugged in now, there's very clear instructions in the manual as to which lead goes where.

You may notice in the pictures a single red lead protruding from the power adaptor harness. This plugs into a tiny socket on the control board and monitors the battery level during flight. Once the system senses at around 90% of the charge has been used, a red LED on the back of the board will flash, then turn on solid. At this point you have around a minute of flight time left before the battery drops to its absolute minimum of 3 V. Go beyond this and you'll be needing a parachute...!

That completes the main construction; the only thing left is to set-up the control board and fit the props. The manual has really clear instructions on set-up; it's very simple but does need to be done properly. With the receiver bound to the transmitter, the board is powered up, whilst at the same time holding down a small button on the board. This calibrates the four ESC to the endpoints used by the control board. The button is then pressed again to calibrate the board to the neutral positions of the sticks. The throttle can then be raised gently to start the motors, just to check they're going the right way, and that the gyros are functioning.

The set-up only takes a few minutes to do, and then the props can be fitted. These are GWS 5" x 3" 3-bladers, two normal rotation and two counter-rotating. They come ready balanced by Snelflight, look carefully and you can see a strip of shiny black tape on one blade of each prop. They come fitted to prop adaptors, and have a red or yellow mark on them to ensure they go on to the right motors. A few final jobs to do, fit the clear dome over the top of the electronics, this protects them in the event of a roll over, and attach the 'tail' a short yellow foam strip which is double-sided to the rear of the chassis and aids orientation in flight. There's no undercarriage, just four foam cubes taped to the bottom of the chassis, very simple, but in practice, very effective.

The Hour's Up!

Snelflight said it would take an hour to build, I spent a bit longer than that, but not much, perhaps I'm slowing with age...! The finished QuadPod weighs in at 168 grams without the battery, 240 grams with a FlightPower 3S 800 mAh pack. Snelflight say the maximum all up weight is 380 grams, leaving us with around 150 grams of payload. With a final check that the motors and gyros are all working the right way, it's time to fly. First hops were in the living room before moving on to the great outdoors.

I fitted a fresh battery, gently brought the throttle up and at about the halfway point, the QuadPod rose cleanly into the air with no drama at all. The four brushless outrunners are very quiet, you can hear the gyros throttling them up and down to keep the model level. The controls are crisp without being over sensitive, the yaw control is particularly good considering it only provides yaw by differential throttling of pairs of motors. Considering it isn't one, the QuadPod flies remarkably like a model heli. The battery lasted out about 8 minutes before the battery light appeared, but I could tell before this point it was time to land, the power was tailing off.

Satisfied that all was well, I then flew the

Next job is to fit a camera!

The 'tail' may be simple, but it's an effective aid to orientation

QuadPod indoors at the Halesowen meeting, then outdoors to get some pics. It's a delight to fly indoors, it'll move quickly in the circuit, but let go of the sticks and it quickly drifts to a halt. The gyro gains are preset by Snelflight, and appear to be a good compromise between allowing the quad to move around and maximising stability in the hover. The day I had free for some pictures ended up very windy, but the QuadPod coped well, just needing forward pitch to stop it being blown backwards. I did notice some hunting in roll outside indicating the roll gain is slightly high, so I tweaked the gain back very slightly which stopped it. This is where having independent gain controls for all three axis is a real bonus, you can tune the controls and response just how you want them. Dual rates and expo can also be used, I ended up with 90% rates on pitch and roll, 100% on yaw and 10% expo all round.

The QuadPod makes an excellent introduction into the world of quadrotors. The kit is totally complete, and goes together easily in an evening, even in an hour if you try hard! The excellent flying qualities and the independent gyro adjustments just add to the experience. It's available online from Snelflight for £199.95, just requiring a receiver and a battery. My next step will be to add a suitable camera and do some aerial photography, so I'll be reporting back at a later date.