

## Launching the UK's first CubeSat mission

***Scottish based business Clyde Space, is exploring new and exciting opportunities using Nano-satellites controlled by brushless dc motors from maxon motor uk.***

UKube-1, built by the groundbreaking company, is the UK's first CubeSat mission and Scotland's first satellite. Its journey into space has been booked on a Russian Soyuz-2 rocket and is expected to launch from the Baikonur Cosmodrome in Kazakhstan in March 2013.

Payloads in UKube-1 include the first GPS device aimed at measuring plasmaspheric space weather, a camera to take images of the Earth and test the effect of radiation on space hardware using a new generation of imaging sensor; an experiment to demonstrate the feasibility of using cosmic radiation to improve the security of communications satellites and flight test lower cost electronic systems. It will also carry five experiments that UK students and the public can interact with and an outreach programme that also allows school children to interact with the spacecraft.

Nano-satellites, or CubeSat's, are miniaturised satellites used in space research and exploration and generally measure 10 cm x 10 cm x 10 cm with a mass of less than 1 kg. The design has been developed to enable workable satellites to be produced at low cost for research purposes.

Clyde Space are working with maxon to improve the future CubeSat attitude control; improvements would open the opportunity to even greater applications for these Nano-satellites, such as earth observation with high resolution camera's or transmitting high bandwidth data, space science, astronomy and verification of new technologies in orbit.

maxon motor uk and Clyde Space together have developed a full 3 axis attitude control system based on torque reaction positioning system that uses a reaction/momentum fly wheel. The reaction wheel is driven by a maxon brushless dc motor. By changing the speed of the flywheel a reactionary torque is applied to rotate the CubeSat around an axis and by maintaining the rotation the CubeSat is stabilised. Several reaction/momentum wheels are used to provide full three axis attitude control and stability. Clyde required a cost effective solution and chose a standard off the shelf maxon brushless DC motor 20mm diameter and maxon motor then modified the product to meet the application environment and supplied and fitted the flywheel, as well as dynamically balancing the complete assembly.

Clyde Space's CEO Craig Clark comments 'We are now able to offer our customers a full 3 axis attitude control system based on off the shelf components. The involvement of maxon motor in this project has been fundamental in developing the torque reaction drive. We have worked with maxon to ensure the brushless dc motors survive the high vibration and shock loads challenges seen on rocket launches and the high thermal cycling and radiation levels experienced in orbit. It is refreshing to see a customised off the shelf (COTS) product meet this demanding environment rather than use a bespoke designed motor with the cost implications involved.'

Paul Williams, senior sales engineer from maxon motor, said that starting with a standard product but customising the motor gives Clyde Space the most cost effective solution. Understanding the application is paramount to finding the right solution. We have a lot of experience in space, having already been a part of the Mars missions, and it is exciting to see the use of our products in this pioneering arena.'

### **About maxon motor**

maxon motor is the world's leading supplier of dc motors, brushless motors, gearheads and controllers. We offer high quality, innovation, competitive pricing and highly specialised solutions.

Where are maxon motors used today?

- Aerospace
- Robotics
- Medical science
- Industrial automation
- Instrumentation & inspection
- Communication
- Surveillance cameras
- Automotive
- Consumer applications

Maxon's motors, gearheads, encoders, brakes and controllers are all perfectly compatible and offer an almost unending number of possible combinations. The maxon modular system gives the ideal combination for the required application.

### **For additional information, contact:**

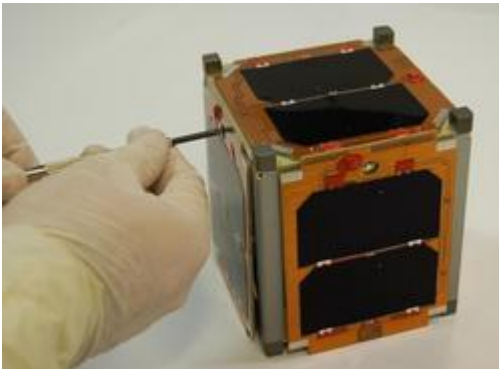
Karen Whittaker

Author: Paul Williams, maxon motor uk ltd

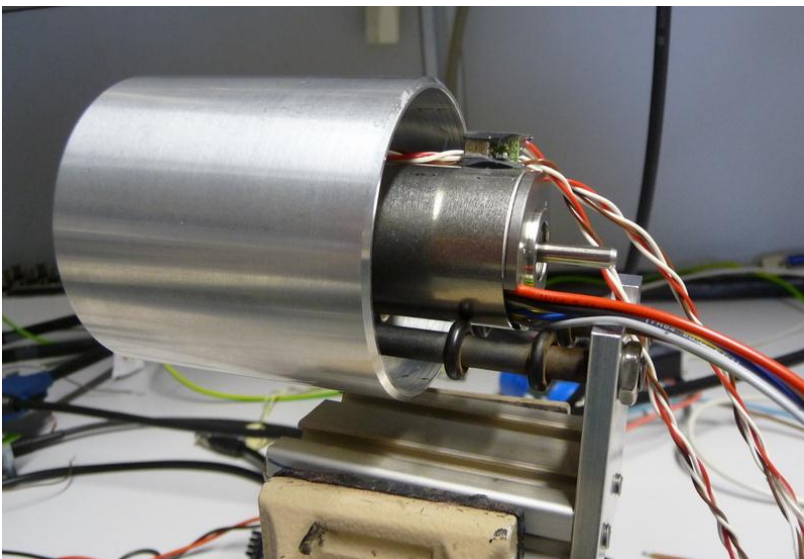
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*Figure 1: Clyde's Cube-sat Nano-satellite*



*Figure 2: Motor and wheel being tested. Using a laser to dynamically balance the disc while the assembly is running at 2000 rpm to give optimal balancing*

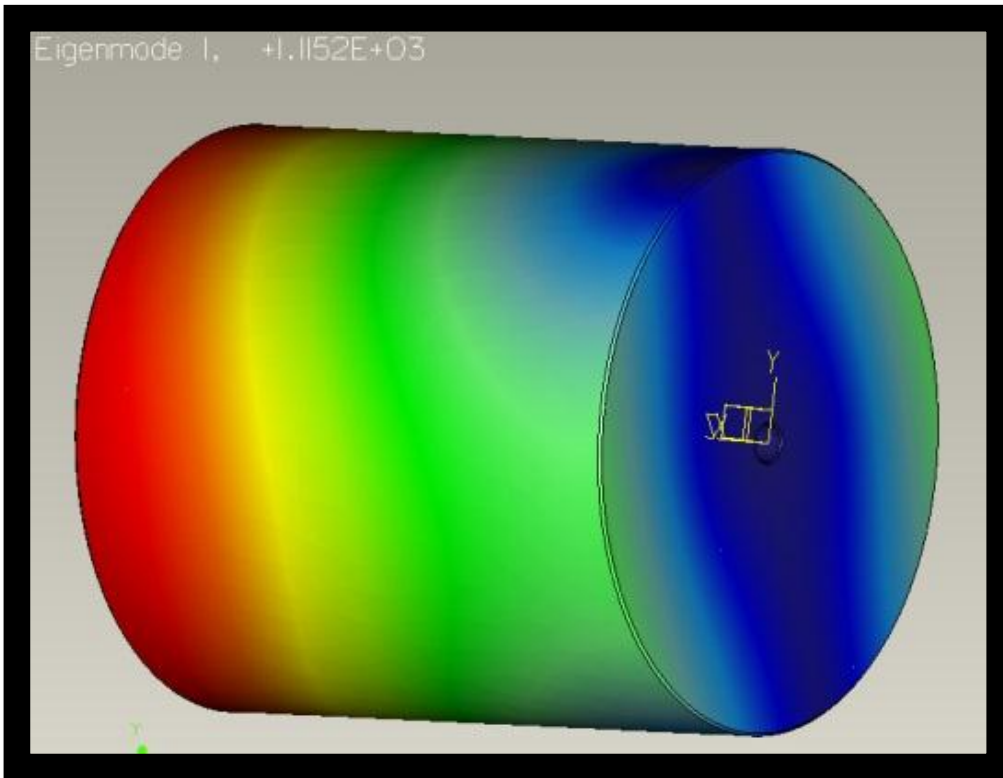


Figure 3: Computer modelling simulation to determine the natural frequency points for the disc

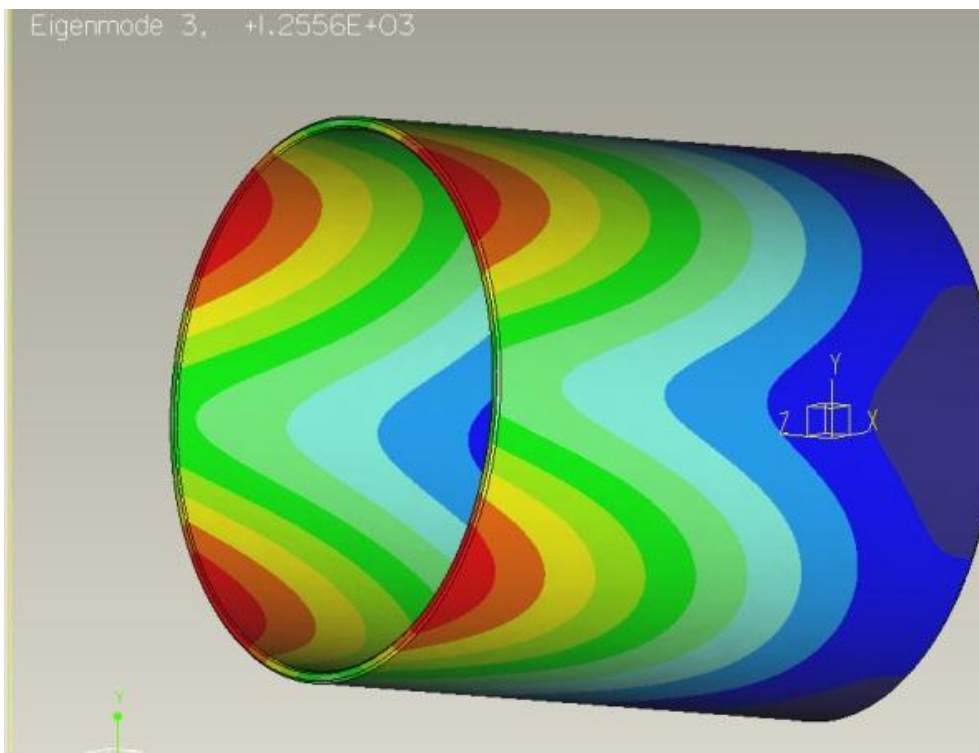
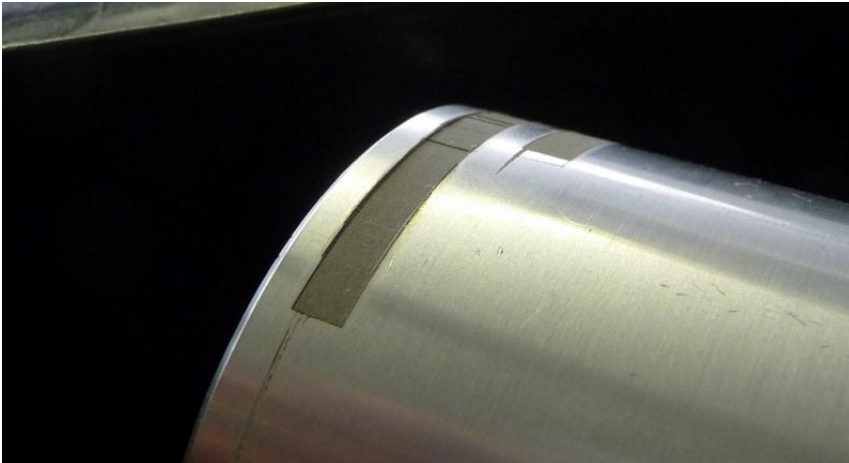
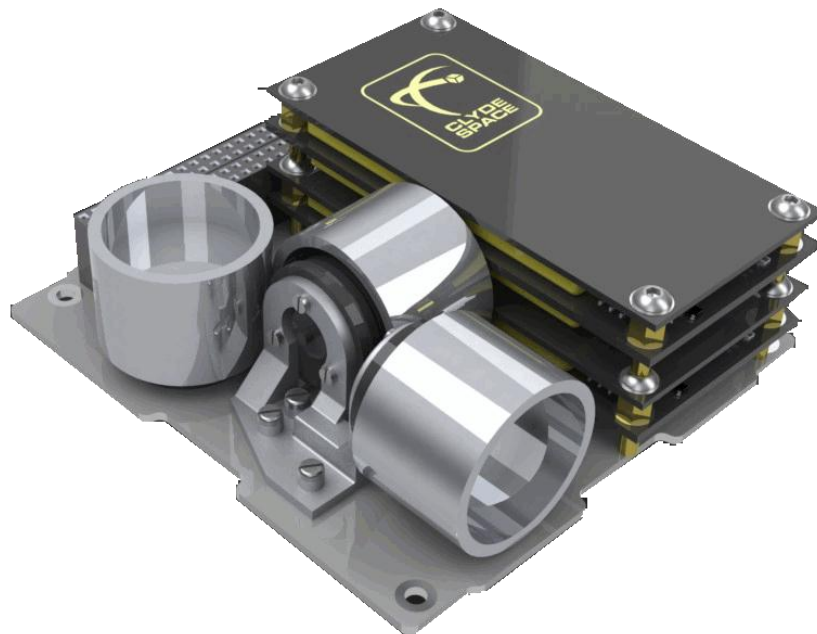


Figure 4: Removal of material off the disc

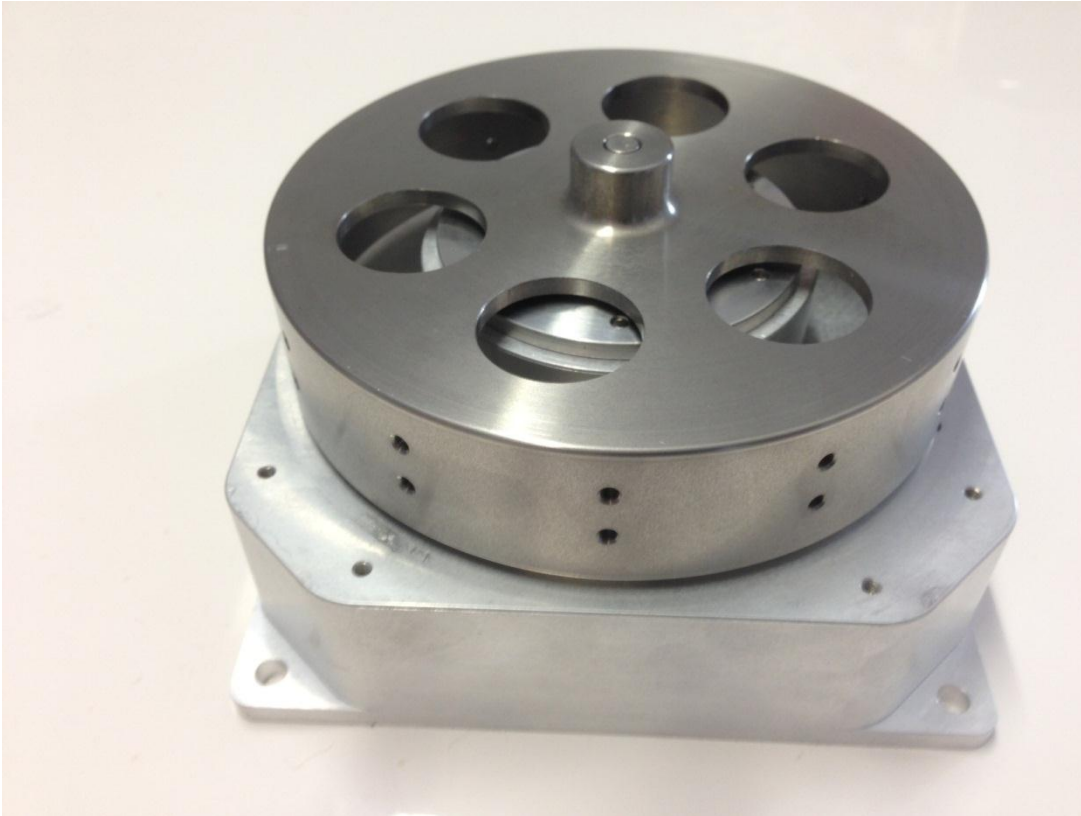
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*Figure 5: Disc Dynamic Balancing – material removal using laser*



*Figure 6: The completed assembly of the torque reaction drive*



*Figure 7: The completed assembly of a larger torque reaction drive*