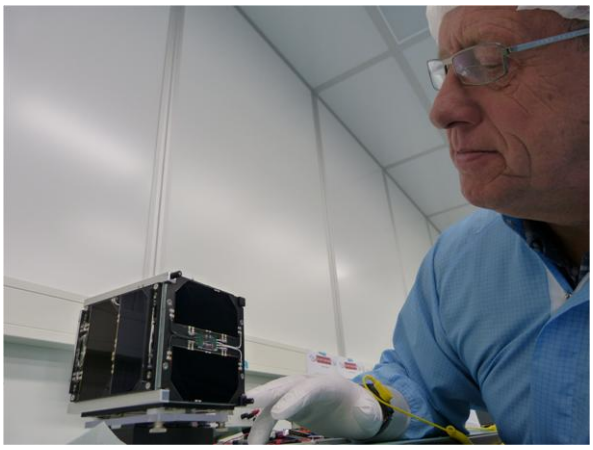
AMSAT-UK, a group of radio amateurs especially interested in space, has launched a new satellite project called FUNcube. The project has received major initial funding from the Radio Communications Foundation (RCF) charity.

The FUNcube project has created the first ever educational CubeSat for schools. This is intended to enthuse, excite and educate young people about radio, space, physics and electronics. It will also support other educational Science, Technology, Engineering, Maths (STEM) initiatives.

FUNcube-1 will be launched as a stand-alone 1U CubeSat on November 21st and FUNcube-2 will be part of the UKube 3U CubeSat platform which is scheduled to launch in February 2014. A "1U" CubeSat is just a 10cm cube and only weighs about 1 kilogram. They are very small but effective spacecraft.

The primary mission of both platforms is to provide downlink telemetry that can be easily received by schools and colleges for educational outreach purposes.

The target audience is primarily students at both primary and secondary levels and the project includes the development of a simple and cheap "ground station" operating on VHF frequencies in the Amateur Satellite Service.



FUNcube-1 – small but effective!

This station will simply be a USB dongle which will receive the signals direct from the satellite and transfer the data to specially developed graphical software running on any Windows laptop. The required antenna will be no more than a simple VHF dipole or turnstile.

The telemetry will provide information about:

- On board temperatures – internal and external
- Voltages and currents flowing from the solar arrays and to/from the battery.
- Temperatures from external metal strips which have different finishes to provide an enhanced demonstration of the "Leslie's Cube" experiment. (One of the traditional demonstrations of how objects emit heat)

Additional educational objectives and opportunities offered by the project include:

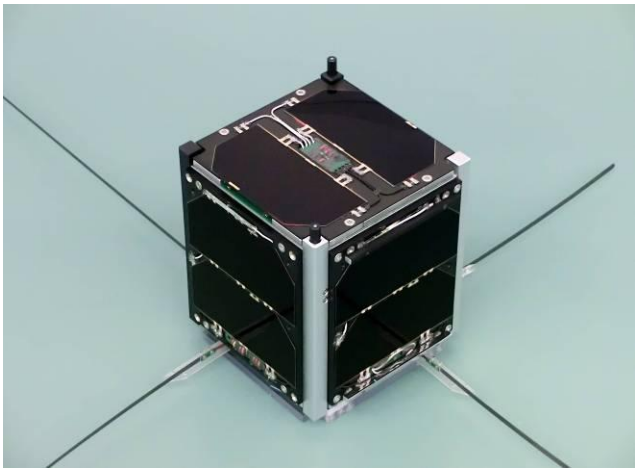
- "Whole Orbit Data" for orbit illumination/eclipse demonstrations.
- More advanced demonstrations relating to antenna radiation patterns and levels of solar radiation. Long term effects of radiation on microcircuits and other subjects would also be possible.
- Integration into the maths and physics curricula at primary and secondary levels
- Demonstrations of radio communications at schools
- Display of an actual FUNcube "demosat" in the school
- Involvement of university undergraduates for more advanced studies – "ranging" etc

The FUNcube project also includes the development of suitable software to enable the display of the telemetry data and orbital tracking/prediction information and actual satellite attitude in an interesting and lively way. The display software will be developed in collaboration with teachers and will be available in different "flavours" to accommodate a variety of age groups.

In addition to displaying the telemetry, the software will also have a live "tracking map" display with predictions for the particular school location and be capable of visually showing the spacecraft attitude and spin rates etc.

The payload will also enable the uploading (indirectly via a moderated host) of short greetings messages for schools to use and the deposition of the data received by a school on a central database. This central data will also be available to be retrieved by schools for display and analysis.

We envisage that inter-school competitions for, say, the most data collected in a period, the most inventive use of the data, or reports of "lessons learnt" from different age groups could be easily established with prizes and presentations.

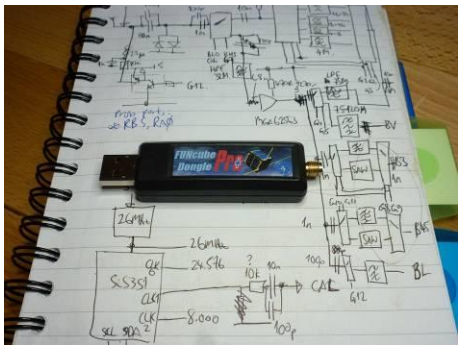


The actual FUNcube-1 spacecraft after an antenna deployment test

Finally the linear UHF to VHF transponder will provide for a ranging functionality to enhance the determination of the satellites orbital parameters. The ranging information would have sub 50 metre accuracy and the development of suitable ground segment hardware and software could form a useful and interesting project for a University team.

Measuring just 10x10x10 cm, and with a mass of less than 1kg it is the smallest satellite ever to carry such a sophisticated communications payload. FUNcube-1 is the first CubeSat which has been designed to benefit these younger age groups.

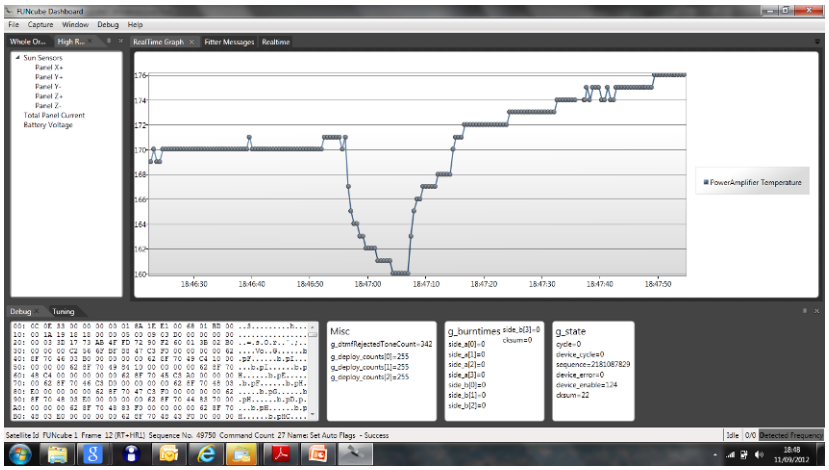
Both spacecraft will be launched into low earth orbits that pass over the poles. In such an orbit, the satellite passes over Europe every day usually three times in the morning, and three times in the evening. Out of school times and at weekends, FUNcube will be made available to radio amateurs to use for their communication experiments. For reliability and maximum power efficiency, the design has been kept as straight-forward as possible with control of the satellite being achieved using simple commands.



The FUNcube Dongle receiver

The FUNcube-1 spacecraft has now been completed and is already in Russia awaiting launch on a DNEPR launch vehicle – actually a converted SS18 Intercontinental Ballistic Missile from the Cold War era. The USB receiver dongle for the ground segment already in series production and the initial ground display software, the "Dashboard", has also been completed.

The AMSAT-UK FUNcube project is being undertaken by an experienced team of volunteers in collaboration with AMSAT-NL and ISIS-Innovative Solutions in Space BV who are based in Delft in the Netherlands. AMSAT-UK has more than 350 individual radio amateur members and is one of 20 such groups worldwide. AMSAT-UK teams have provided hardware for more than 10 satellites over the past 35+ years including SSETI Express in 2005.They are presently involved with the development of hardware and software for a number of satellite projects including the European Student Earth Orbiter (ESEO), P3E, ARISSat, the Columbus module on the ISS and also the GENSO Ground station network.



The FUNcube Dashboard - Engineering version

Further information about FUNcube and details of sponsorship and support opportunities are available from:
www.funcube.org.uk and
Mr Jim Heck – AMSAT-UK – g3wgm at amsat.org or
Mr Graham Shirville – AMSAT-UK – g3vzv at amsat.org

Nov 2013

AMSAT-NL Radio Amateur Satellites

AMSAT-UK