



## AMSAT-UK

**Spectrum Forum Meeting – Saturday 2<sup>nd</sup> November 2013**

### **Spectrum Report – Amateur-Satellite Service**

#### **Spacecraft**

In the past year AMSAT-UK has completed the development of two satellite projects FUNcube-1 and FUNcube-2 on UKube-1 and is involved with several new projects.

#### **FUNcube-1 Satellite**

The [AMSAT-UK FUNcube-1 satellite](#) has the primary goal of enthusing and educating young people about radio, space, physics and electronics. It is designed to support the educational Science, Technology, Engineering and Maths (STEM) initiatives. FUNcube-1 will carry a 1200 bps BPSK telemetry beacon and a 435/145 MHz linear transponder for SSB/CW communications.

The project was started in 2009 and the satellite is expected to be launched at the end of November 2013 on a Dnepr rocket from Dombrovsky near Yasny in Russia. It will be owned and operated by AMSAT-NL (see below regarding the UK Outer Space Act).

AMSAT-UK plans to operate a monitoring station at the National Radio Centre immediately following the launch.

#### **FUNcube-2 on the UKube-1 Satellite**

AMSAT-UK was approached by the UK Space Agency to provide a set of FUNcube boards for use in their first satellite [UKube-1](#). A set of boards that will provide a 1200 bps BPSK telemetry beacon and a 435/145 MHz linear transponder for SSB/CW communications has been supplied. The satellite is expected to be launched in February 2014.

#### **FUNcube Software for the Educational Beacons**

The FUNcube Dashboard and FUNcube Data Warehouse have been developed to support the FUNcube-1/2 educational telemetry beacons.

The FUNcube Dashboard software will be available free of charge to schools and individuals. It will run on a Windows computer and provide the user with a meaningful display of the telemetry data. The software takes data from the FUNcube Dongle SDR while it is receiving live signals from the satellite and, if so configured, relay any received telemetry to the Data Warehouse via the Internet. In this way we can build up a store of telemetry from all over the world

The FUNcube Data Warehouse software will collect, collate, de-duplicate, store and display data from the Dashboards. It will enable everyone to see what telemetry is being received, by whom and where

they are, all in real time. Historical telemetry data can also be retrieved for analysis by the command team and by students for their own research purposes. The warehouse is at <https://warehouse.funcube.org.uk/>

## **QB50**

In July 2013 AMSAT-UK along with AMSAT-NL and AMSAT-Francophone signed a Memorandum of Understanding with The Von Karman Institute (VKI), a non-profit research organization based in Belgium to enable two amateur radio payloads to fly on two 2-Unit CubeSats in the first half of 2014.

The CubeSats will be deployed into a 600 km orbit. One will carry an SDR based 435/145 MHz linear transponder for SSB/CW and will also provide a telemetry downlink at 1200 bps using FUNcube compatible BPSK modulation, the other a 435/145 MHz FM voice transponder and 9600 bps FX25 telemetry beacon.

## **European Student Space Orbiter (ESEO)**

AMSAT-UK is supplying a 1260/145 MHz FM transponder with FUNcube compatible telemetry for this European Space Agency (ESA) project. The beacon downlink will have a higher power than FUNcube-1/2 and should give even easier reception for schools. The estimated launch date is the summer of 2015.

## **Delta-Dsat**

This is a 2U CubeSat being developed by Cranfield University in Bedfordshire. AMSAT-UK has offered assistance to Cranfield to finish their Ground Station Equipment (GSE) installation.

## **European Space Agency (ESA)**

AMSAT-UK member Graham Shirville G3VZV has been asked to give a presentation on AMSAT-UK's experiences with developing Cubesats to the ESA CubeSat Club at the European Space Research and Technology Centre (ESTEC) in Noordwijk, The Netherlands in December 2013.

Anu Ohja from the National Space Centre (NSC) in Leicester is producing some educational material for the ESA Education department that relates to FUNcube-1.

## **The UK Outer Space Act**

The UK Outer Space Act 1986 was introduced with large commercial and government satellites in mind. This legislation imposes unrealistic requirements on small satellite projects, additional costs can be £50-60,000 for each year of a satellite's life. If a UK group or individual were to procure a satellite launch anywhere in the world without fully complying with the act they would be subject to prosecution.

AMSAT-UK has, together with other organisations, been in contact with the UK Government for over 3 years now in an effort to resolve this issue.

In May 2012 the UK Space Agency [issued a consultation](#) seeking views of stakeholders on proposed changes to the Outer Space Act 1986. The key aspects of the consultation were the proposals to waive the capped liability and insurance requirement for in-orbit operation of any satellite that meets the criteria of a CubeSat and to remove the requirement for unlimited indemnity from their operators. The proposed changes have been welcomed by AMSAT-UK and if adopted should enable UK registered CubeSat projects to start. *There has been no noticeable action since the consultation took place.*

## International Space Station

The equipment for the [HamTV project](#) has now been installed in the Columbus module of the International Space Station. It is the culmination of over ten years work to establish an amateur radio TV transmitter on the ISS and will use patch antennas fixed on the Meteorite Debris Panels (MDP) protecting the hull of the ISS Columbus module. These antennas were installed while Columbus was being constructed. A fund-raising campaign took place during 2005-7 to raise over 65,000 Euros for the antennas. Individual radio amateurs from around the world donated generously as did several organisations such as **AMSAT-UK** and the **RSGB**.

The system will transmit DVB-S signals on 2422.0 MHz or 2437.0 MHz at either 1.3 Msps or 2.3 Msps with 10 watts of RF output.

The main mission of HamTV is to perform contacts between the astronauts on the ISS and school students, not only by voice as now, but also by unidirectional video from the ISS to the ground.

AMSAT-UK has been supporting this development over the past 10 years and has been directly involved with the development of the ground segment.

This project highlights the long-term nature of Amateur-Satellite Service projects. HamTV has taken over 10 years to come to fruition and the equipment may remain operational for the remainder of the lifetime of the ISS, possibly until 2025.

## Spectrum

At the interim meeting in Vienna IARU Region 1 agreed to a revision of the 28 MHz band plan to show uplinks as well as downlinks in the satellite segment.

IARU Regions 2 and 3 have agreed to a [new Amateur-Satellite segment](#) at the bottom of the 144 MHz band. Although there was a vote in favour of this allocation at the IARU Region 1 interim conference it was not unanimous and will need to be confirmed at the next full Region 1 meeting.

Satellite projects are long term ventures, it typically takes between 4 and 10 years to develop and launch a new satellite, and so it may be sometime after a positive IARU Region 1 decision is achieved before the new segment can be utilised.

It is an aspiration that the Amateur-Satellite Service allocations at UHF and Microwaves should align with the weak-signal sections of the bands. In particular it is desirable that the European Common Frequency Allocation Table Footnote EU17 sub-bands **3400-3410 MHz**, **5660-5670 MHz** and **10360-10370 MHz** along with **50-51 MHz** become available to the Amateur-Satellite Service for both Earth-to-Space and Space-to-Earth communications.

## Annual Colloquium

AMSAT-UK's 2013 Colloquium was held at the Holiday Inn, Guildford and attracted a high proportion of overseas visitors.

During the two day event, presentations were made on a variety of amateur satellite related projects and technical discussions between amateur satellite builders and users continued late into the evening.

Thanks to the British Amateur Television Club (BATC) the event was webcast live to a world-wide audience and using the BATC chat facility viewers were able to submit questions to the presenters.

Video of the presentations are available via the [AMSAT-UK website](#).

## Other Activities

The AMSAT-UK [FUNcube Yahoo Group](#) now has over 4000 members.

AMSAT-UK hosts the [Amateur Satellite Frequency Coordination Status](#) pages for the IARU. These pages give details of the many Amateur Radio satellite projects under development.

**AMSAT-UK** October 2013  
<http://www.amsat-uk.org/>

