



## **AMSAT-UK**

**Spectrum Forum Meeting – Saturday 7<sup>th</sup> November 2015**

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

#### **About AMSAT-UK**

AMSAT-UK represents the interests of amateur satellite operators in the UK and is at the forefront of amateur satellite construction.

The thrill of communicating via satellites orbiting in space has led amateurs to develop stations for the VHF, UHF and Microwave bands when they may not have otherwise done so. Having established a satellite capable station many have gone on to discover the fascination of terrestrial DX working, so helping generate more activity in these allocations which are sometimes overlooked by amateurs who start out on the HF bands.

#### **AMSAT-UK payloads**

The past year has seen AMSAT-UK members working on transponders for two new spacecraft:

- A 1260/145 MHz FM transponder has been developed for the ESA's European Student Earth Orbiter (ESEO) satellite.
- AMSAT-UK has worked in conjunction with AMSAT-NL to develop a 435/145 SSB/CW transponder and 1200 bps educational beacon payload for the Nayif-1 CubeSat built by students at the American University of Sharjah, UAE, in partnership with the Mohammed bin Rashid Space Centre. Nayif-1 is expected to launch in the 1st quarter of 2016.

FUNcube-1 is completing its second year providing both an Educational resource for school use and a 435/145 MHz transponder for amateur SSB/CW communications. UKube-1 and QB50p1 carry the FUNcube-3 and 4 transponders, it is hoped these transponders will be activated at a later date when the satellites have completed their primary mission.

Educational establishments and radio amateurs around the world have collected over 2.8 million telemetry packets from the FUNcube-1 Educational Beacon currently amounting to some 734.5 MB of data. This has been stored in the FUNcube Data Warehouse where it is freely available for research and analysis.

#### **UK University Satellites**

The constraints imposed by the UK Outer Space Act 1986 have continued to inhibit the development of University satellites in the UK. However, young people at several universities are working towards developing CubeSats. AMSAT-UK members are in contact with several of the teams.

- **UoS<sup>3</sup>:** The University of Southampton Small Satellite group have been working towards getting a CubeSat launched on a VEGA launcher via the ESA education initiative. Aleksander Lidtke attended the AMSAT-UK International Space Colloquium in 2014 and gave a well-received presentation about the project.
- **WUSAT:** Students at Warwick University have developed CubeSat technology that has been tested in near-space using High Altitude Balloons and on a sub-orbital rocket flight from northern Sweden. The students hope that a subsequent satellite will achieve Earth orbit.
- **University of Surrey Space Centre:** The STRaND-1 and DeorbitSail satellites developed by students and researchers at the University of Surrey Space Centre carried amateur radio payloads. A presentation on STRaND-1 was given to the RSGB Convention in 2013 by Chris Bridges M6OBC (later 2E0OBC) one of the team who designed and built the CubeSat. There are a number of radio amateurs holding both Foundation and Intermediate licences working on satellite projects at the Space Centre. The Surrey Electronics and Amateur Radio Society (SurreyEARS) is based at the University and they have organised training courses resulting in many students getting their Foundation and Intermediate licences. A sign of the success of the society is that in October, at the start of the 2015 academic year, they managed to sign up over 100 members.

## **The UK Outer Space Act 1986**

Since 2010 AMSAT-UK has been supporting the proposed legislative changes to enable amateurs and educational establishments to develop and launch low cost Earth-orbiting satellites. Changing UK Primary Legislation is a slow process; however, in July 2015 the UK Space Agency announced a review to evaluate how the regulatory approach might be tailored for CubeSat systems. AMSAT-UK provided input into this review and it is hoped we will see a positive outcome in the coming years.

## **International Space Station**

AMSAT-UK members are leading on the Amateur Radio on the ISS (ARISS) Schools contacts programme for the upcoming Tim Peake Principia mission to the ISS. A number of high profile school contacts are planned to be carried out and this activity is being coordinated with the UK Space Agency as part of the overall Principia Educational Outreach programme.

Two specially augmented Raspberry Pi's called Astro Pi's are planned to fly on an Orbital Sciences' Cygnus cargo freighter to the ISS in early December. They will be used by UK astronaut Tim Peake KG5BVI during his Principia mission on the Space Station which is expected to commence in mid-December.

The Astro Pi's are planned to run experimental Python programs written by young people in schools across the country; the results will be returned back to Earth at the end of the mission. ARISS/AMSAT-UK members are actively involved in discussions with the UK Space Agency, ESA, the Raspberry Pi Foundation and others to establish the feasibility of re-purposing one of the Astro-Pi units, either within or post Tim Peake's mission, to provide an alternative video source for the amateur radio HamTV transmitter in the ISS Columbus module. Additional discussions are ongoing with all parties for joint educational activities into the future with the Astro-Pi units being networked and potentially enhancing the capability of the amateur radio station on board Columbus.

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. ARISS has been working with Goonhilly and hope to provide a video download facility via one of their large dishes for the schools contacts as well as attempting to receive the video at each school as part of the contact.

## **Microwave Transponder Satellites**

There is optimism that there may be three satellites carrying amateur radio microwave transponders launched into high (> 25,000 km) orbits in the next couple of years.

Two amateur radio microwave transponders will be flown on a Qatar geostationary satellite Es'hail-2 which is expected to launch in 2016, this will be the first time that amateur transponders have been put into geostationary orbit. The satellite will be positioned at 25.5 degrees East and will provide coverage of one third of the globe from Brazil to Vietnam.

A 250 kHz wide linear transponder will cater for SSB and CW communications  
2400.050-2400.300 MHz Uplink  
10489.550-10489.800 MHz Downlink

An 8 MHz wideband digital transponder will cater for Digital ATV and similar modulations schemes  
2401.5-2409.5 MHz Uplink  
10491.0-10499.0 MHz Downlink

In April 2015 AMSAT-NA announced an opportunity for an amateur radio payload in a geosynchronous orbit. The potential footprint could extend over the US from the Mid-Pacific to Africa with coverage at times of the British Isles and parts of Western Europe.

The proposed frequency plan for the spacecraft is:  
Uplinks: 5655-5665 MHz  
Downlinks: 10455-10465 MHz

In July, at the AMSAT-UK International Space Colloquium, it was announced that a potential High Earth Orbit launch opportunity for the Phase-3E satellite had been identified. AMSAT-DL had been trying to obtain a launch since 2005 so this was welcome news. The P3E space frame that is currently stored in Germany has been transferred to Virginia Tech in the USA for further construction; testing and preparation for eventual launch to HEO should the US Government formally agree to fund such a mission.

It is expected it will carry a 5 to 10 GHz transponder similar to that to be flown on the geosynchronous satellite.

## **Spectrum**

During the year in review it was identified that an old amateur spacecraft was capable of transmitting bursts of APRS packet in the narrow band section of the 144 MHz band. After some uncertainties users have now been briefed not to attempt access to this object.

September 19, 2015 saw the successful launch from China of seven satellites carrying amateur radio transponders. These transponder payloads were built by young people at several educational establishments under the coordination of CAMSAT, a number of the students developing the payloads were licenced radio amateurs. The Harbin Institute of Technology in Heilongjiang province, Manchuria, has a particularly active amateur radio club BY2HIT. The Harbin students developed LilacSat-2 which carries an FM voice transponder and APRS digipeater. The students have worked hard to make both LilacSat-2 software and supporting documentation available to other radio amateurs across the English speaking world.

Unfortunately, due to misunderstandings of IARU band planning processes in the Region five of the seven satellites ended up on frequencies which, while fully complying with ITU allocations, were outside the internationally accepted amateur satellite segments. This has resulted in some of the transponders not being activated, clearly a disappointment for the young people involved in these projects.

At the recent IARU Administrative Council meeting and IARU Region 3 Conference held in Bali, Indonesia, recommendations were made by the Chinese Radio Amateur Club (CRAC) and others which will hopefully resolve the issue and ensure that in future amateurs in Region 3 have the correct information regarding amateur satellite operation.

Whilst the 144 MHz band plan in IARU Region 1 is fairly comprehensive, the same is not true in some other areas of the world. There appears to be a lack of global coordination with regard to the protection of weak-signal operation in 144 MHz.

It remains 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** and a new 10 MHz wide L-band segment become available to the Amateur-Satellite Service for both Earth-to-Space and Space-to-Earth communications.

### Annual Colloquium

AMSAT-UK's 2015 Colloquium was held at the Holiday Inn, Guildford. The British Amateur Television Club (BATC) provided a webcast live to a world-wide audience. Video of the presentations are available on the [AMSAT-UK YouTube Channel](#).

### Other Activities

On October 25, 2015 the AMSAT-UK [FUNcube Yahoo Group](#) had 3832 members, the [Twitter Account](#) 4450 followers and the [AMSAT-UK Facebook Page](#) having 2032 likes.

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 2015  
<http://www.amsat-uk.org/>

The banner includes a circular logo on the left with the text 'AMSAT-UK' at the top, 'FUNcube' at the top right, and 'Fun in space with Amateur Radio' at the bottom. The center features a satellite in space with the text 'YAHOO! GROUPS' and 'FUNcube UK Amateur Radio Educational Satellite'. On the right is another satellite image with 'YAHOO! GROUPS' text. Above the banner are two buttons: 'FOLLOW US ON twitter' and 'Become a Fan'.