Midlands Innovation CubeSat Newsletter

Mar 2022 WUSAT-3

Warwick – Aston – Birmingham – Cranfield – Keele – Leicester – Loughborough – Nottingham

ESA 'Design Booster' Option to get WUSAT-3 Launch Programme Ready!

Despite the enormous effort, and (we felt) the strength of our submission, WUSAT-3 was not shortlisted for ESA's FYS4 Selection Workshop. Having attended a previous selection workshop, it appears that we have received our ESA feedback on WUSAT-3 and we will now only be shortlisted when we really are 'ready to go'.

Following two academic years that have been heavily affected by Covid and left us unable to do practical manufacturing/prototyping/testing, etc, this is most disappointing. The current team have worked very hard to make up ground in this area, and we hoped that such Covid affects would be considered with our submission.

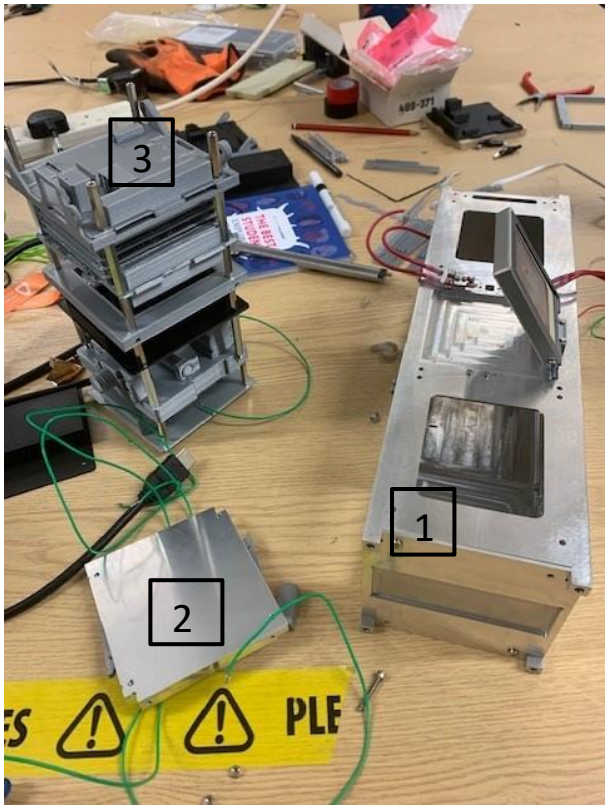
Dr Bill Crofts, Alex Bolland, Mattias Langer, Eduardo Hopkins, Myles Ing,

Jai Bassi, Chiara Biquet, Tahrim Uddin, Prof Julia Hunter-Anderson

However, ESA likes to give the selection workshop opportunity to as many different teams as possible, so others will have the chance of attending and we will look to progress onto ESA's **'Design Booster Programme'** and associated **'Test Opportunities Programme'.**

However! – we are pleased to announce that **Nottingham's CubeSat** project has been selected for the ESA workshop. WUSAT Director, Dr Bill Crofts, has spoken with their academic staff, **Dr Chantal Cappelletti** and **Professor Nathaniel Szewczyk**. We hope to add WUSAT's experience of the process to assist the Nottingham team's preparation for the selection workshop! Good luck with their entry!

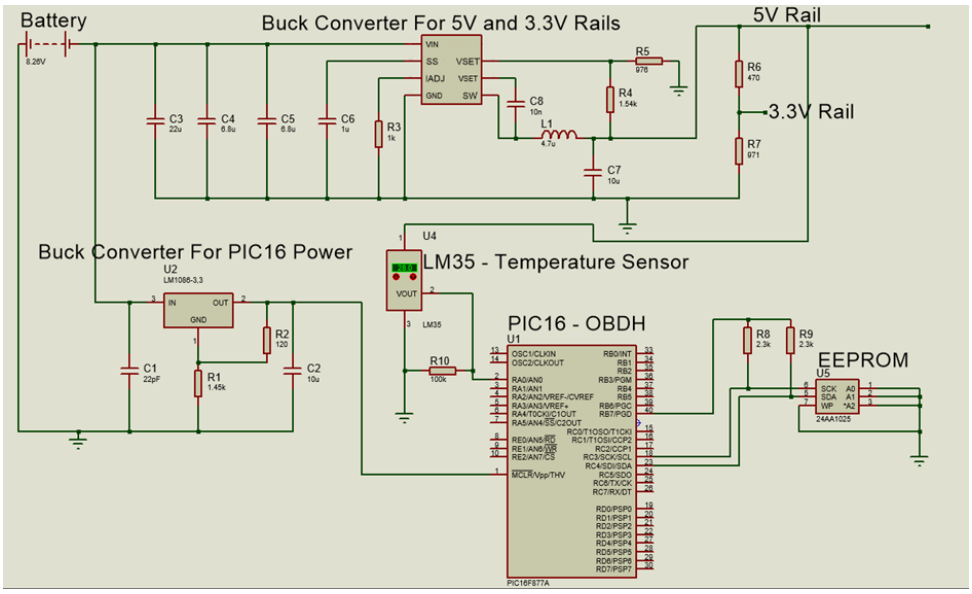
This image shows some of the work undertaken by the current WUSAT-3 mechanical team attempting to make up for time lost over the Covid period.



Item 1 shows a finalised chassis design and the initial prototype of a hold/released mechanism for the deployable payload antenna. An electrical burn wire is the hold/release method.

Item 2 shows an integrated TM/TC antenna release mechanism that will be installed on one end of the main chassis. TM/TC allows telemetry status signals to be transmitted by WUSAT-3 to the ground, and telecommand signals from a ground station to be received by the satellite. This device also uses electrical burn wires for hold/release.

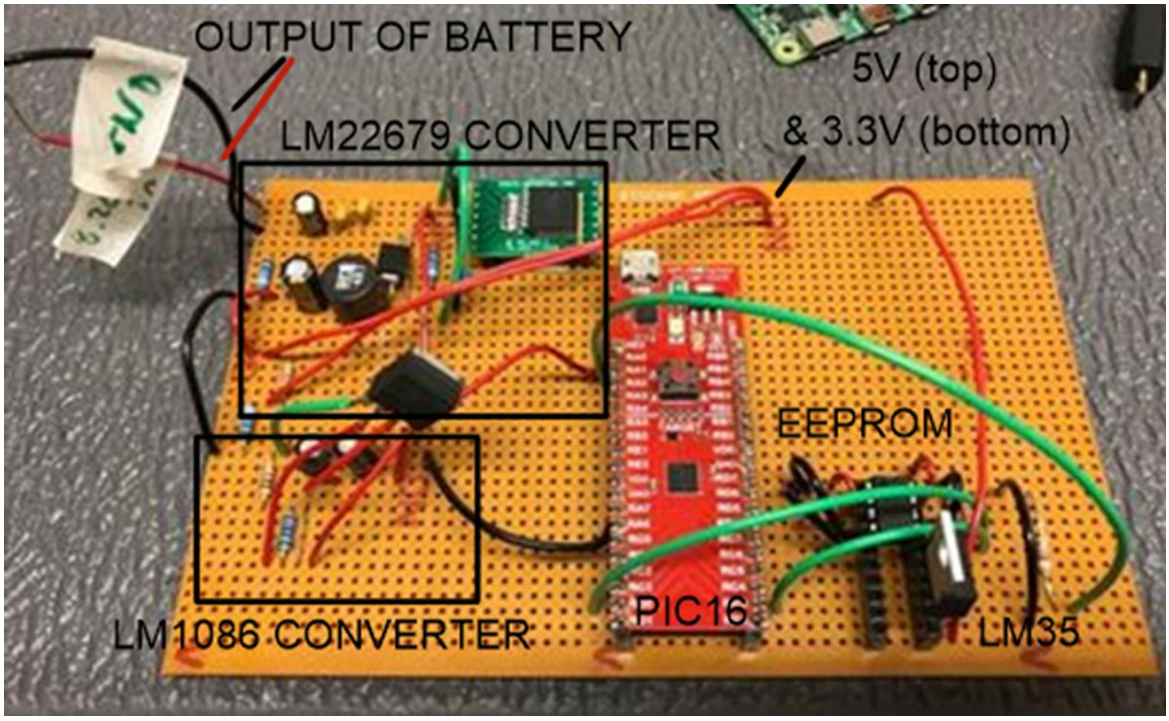
Item 3 is a prototype internal shelving system to position and retain WUSAT-3 sub-systems and main components. Not only must it do this accurately and effectively, but it must also pass vibration and thermal cycling tests to ensure that all systems remain secure and aligned through launch and operation.



The current WUSAT-3 electrical team have also been working on the electrical power supply (EPS) circuitry which uses a buck convertor to generate the required voltage supply levels from a CubeSpace Optimus 40 battery. Also shown is the power supply to a PIC microcontroller that will form the heart of WUSAT-3's control system. The PIC is also interfaced to an EEPROM memory device that will form the basis of the satellite's On-Board Data Handling system (OBDH).

The opportunities presented by ESA's 'Boost Your Design' and 'Test Opportunities' programmes will help to move all of this forward to a level where we can get a level of design approval, complete some subsystem testing and effectively be at an assembly/integration phase for entry onto the FYS launch programme.

The image below shows a working prototype of the above EPS/OBDH schematic.



Prototype EPS/OBDH Subsystem

Systems Engineering remains a key control methodology for all design/engineering work undertaken on WUSAT-3. The diagram below shows which WUSAT-3 subsystems are active during the various operational modes of the satellite. This diagram is only one of many budget spreadsheets (power, mass, volume, thermal, data, pointing) that WUSAT-3 Systems Engineers use to ensure the integrity of the spacecraft in its development towards launch and operation.

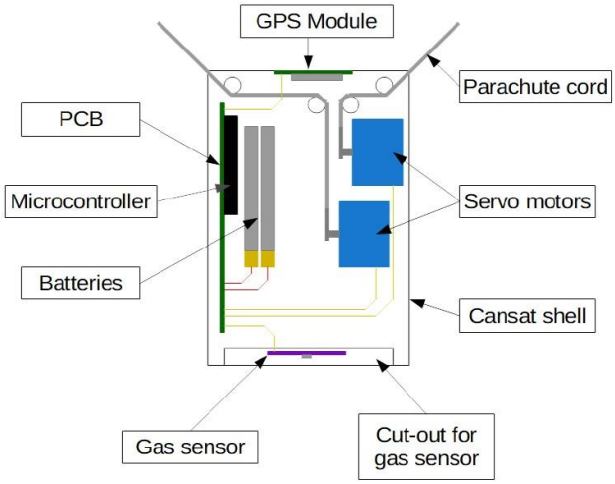
Operational Mode	Subsystem							
	EPS	OBDH	TMTC	Thermal	ADCS	Deployment Mechanisms	Payload Imaging	Payload Comms
1a	ON (partial)	ON (partial)	OFF	OFF	OFF	OFF	OFF	OFF
1f	ON	ON	ON	ON	ON	ON	OFF	OFF
3a Reduced	ON	ON	ON	ON	ON	OFF	OFF	OFF
3b Eclipse	ON	ON	ON	ON	ON	OFF	OFF	OFF
3c Full	ON	ON	ON	ON	ON	OFF	ON	ON
3d Imaging	ON	ON	ON	ON	ON	OFF	ON	OFF
3e Data Dump	ON	ON	ON	ON	ON	OFF	OFF	ON
3f Safe Mode	ON	ON	ON	ON	OFF	OFF	OFF	OFF
4 De-orbit	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Outreach

CanSat Project - King Edward VI School, Stratford-upon-Avon, Warwickshire

As part of its broader programme WUSAT supports a number of CanSat projects. A CanSat is a small drinks-can sized device that allows teams to achieve a form of satellite capability within a modest size and budget. They are normally launched from e.g. a model rocket, and then descend by parachute to perform a number of specified tasks within a limited time before landing.

Within recent months we agreed to support such a project being undertaken by King Edward VI school in Stratford who had entered a CanSat design to the ESERO-UK CubeSat competition. Dr Bill Crofts agreed to review their initial Design Review document before submission and was extremely impressed by the standard of their work and their level of ambition.

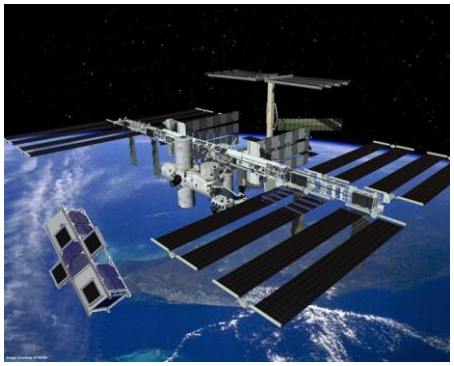


This diagram shows their concept design which includes, not only a GPS module and a Gas Sensor, but also a sophisticated method of using Servomotors to steer the CanSat during its parachute descent.

In the event, their schoolwork and exam preparations had to be given priority and they felt unable to submit their design to ESERO-UK. However, in the immediate post exam period, they are determined to complete and launch it themselves – even if in a simplified form.

Many congratulations to them for their efforts in completing the design to that stage and, having met one of their team at a Warwick Open Day, I have a strong suspicion that we will be seeing her on a future WUSAT mission before long!

Summary of WUSAT-3 Mission!



WUSAT-3 is a 3-Unit CubeSat designed for launch into Low Earth Orbit (approx. 400km altitude) either via deployment from the International Space Station (ISS) or direct launch into orbital position.

It will test a novel signal direction-finding instrument, devised by **Roke Manor Research Ltd**, as a potential method of tracking wildlife with radio frequency tags that would be much smaller and lighter than current tags. This could increase the range of species (especially smaller birds) that can be monitored from Space.

Our **partner companies/organisations**

Best wishes,

Bill & Julia