

University of Warwick Satellite Engineering Team 2020-21

WUSAT!

*Sorry for the delay,
but we're still going strong!*



Dr Bill Crofts



Prof. Julia
Hunter-Anderson

Mainly due to Covid-19 effects and Bill's health problems (see end article), this is the first newsletter since April 2020. However, things have been far from static as you'll see from this newsletter. A great deal is being achieved in such difficult conditions. I hope you'll agree if you read on!

WUSAT Teams 2020-21



For the first time in 15 years, we are running two integrated WUSAT teams.

We have a 6-member Platform Team (mainly WUSAT-3 Chassis & related sub-systems) comprising;
Srinivas Calindi, Pierre Savare, Anirudh Fatania, David Jewsbury, & Michael Shanta.

They are working with the 7-member Payload Team (mainly working on the signal direction-finding payload and associated sub-systems) comprising;
Joseph Murphy, George Booth, Hiran Patel, Megan D'Souza, Maksim Makerov, Ilic Mateja, & Paul Stinson.

I managed to capture most of them (above) with Julia and I on the first day of term, but pandemic restrictions were already taking effect, and a couple of them are missing from this picture. We have tried to maintain face-to-face meetings when we could, but most meetings have been online, and working sessions in the WUSAT lab have had to be restricted to a rota of small sub-groups.

Nevertheless, the combined team is working very well and making good progress in the circumstances. Their

task is to advance last year's WUSAT-3 **configuration model** (a final determination of what the layout of WUSAT-3 will be – where will everything fit, etc).



WUSAT-3 Configuration Model

This now needs to be developed into a fully-defined **engineering model** that can be put through rigorous testing procedures.

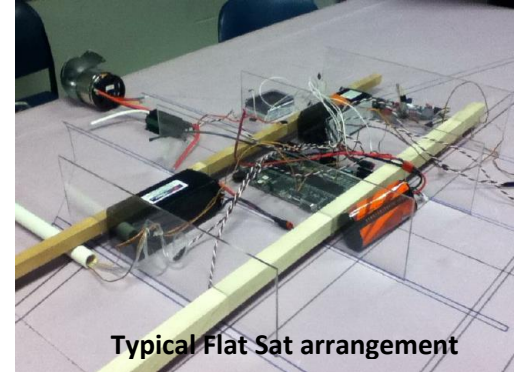
We have determined that the first stage of this is to produce two working systems.

1. **Flat Sat**

This is effectively a set of inter-connected prototype WUSAT-3 subsystems laid out on a bench surface, but capable of showing the operating principles of WUSAT-3.

2. **Engineering Prototype Chassis**

Produce a fully-defined operational chassis with materials suitable for final flight model.



Typical Flat Sat arrangement

If the two teams can work together to achieve most of this, they will not only have significantly progressed the development of WUSAT-3, they will also have defined a 3-unit Cubesat chassis that could be the platform for other WUSAT missions. They are making excellent progress to date!

WUSAT Partner Companies

We are already indebted this year to **RS Components** who have provided components and **Eurocircuits** who have provided custom-designed PCB boards for prototyping work. **Open Cosmos** have provided access to their software platforms **beeApp** and **OpenApp** to run space mission simulations and analysis for the WUSAT-3 mission. **CubeSpace** are very kindly carrying out an initial assessment of WUSAT-3's critical orientation/pointing control requirement. As things, hopefully, return more to normal next year, we will expect to be in touch with many more of our partner companies who are crucial to the success of WUSAT.

WUSAT / UK Launch Services Ltd – Ground Station Project



Electronics Engineering student, Safura Colette, is working on the design and production of a ground station (radio transmit/receive station) for the new CanSat design/build/launch programme devised and operated by **UK Launch Services Ltd (UKLSL)**. Supervised by Bill, as part of an extended WUSAT activity, Safura already has a preliminary design in place and is hoping to begin prototyping various elements over the Christmas break.

The intention is to provide a ground station facility that UKLSL can use to receive signals from CanSats that are launched during UKLSL's CanSat event planned for July 2021 (see more below). We hope that this is part of a welcome ongoing collaboration between WUSAT and UKLSL. We also expect that Safura will bring her experience and knowledge into the main WUSAT team during the next academic year.

WUSAT & Warwick Aerospace Society CanSat Projects

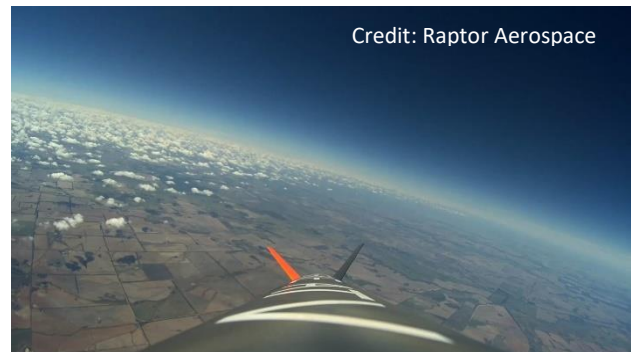


Warwick Aerospace Society will this year run **two CanSat projects** where WUSAT will act as Faculty Advisors. This is a particularly exciting development that will provide a wonderful opportunity for two **cross-department** teams to apply their design/development skills in two demanding projects that will produce **two launches each year**.

Details of the two projects are given below.

UKLSL Mach-21 CanSat Programme

UKLSL have devised a combined **CanSat Competition and Space Careers Conference** for university teams. This will give university students an opportunity to develop practical, hands-on mechanical and electronics skills, with industrial technical support provided to the teams remotely. The **cross-department Warwick team** of six students will commence work after Christmas and will plan to launch their CanSat from **Machrihanish Airbase** (one of the UK's planned new Space ports) in July 2021. Launch will be via a **sounding rocket** provided by **Raptor Aerospace** (see images below).



The launch event at Machrihanish will be combined with a **Space Careers** Conference providing talks and workshops with future employers and fellow space enthusiasts for students looking to graduate into the fast growing and stimulating UK Space sector. WUSAT are delighted to support this event.

Manchester UK CanSat Competition



The UK University CanSat Competition (UKCC) is a design-build-fly challenge that provides teams with an opportunity to experience the design life-cycle of an aerospace system.

The cross-department Warwick team will expect to process their CanSat design to meet the specification of the UKCC competition and to meet the requirements of a Manchester administered **Design Review**, and if successful, will proceed to a **Flight Readiness Review**. The launch and final performance review is expected to take place in April 2021 with the collaboration of the **Midand Rocketry Club** at their base near Twycross.

This is the **third year** we have supported this competition in collaboration with **Warwick Aerospace** and it provides another great opportunity for students across Warwick departments to apply their skills in designing, building and launching a miniature satellite-type device to meet a rigorous specification.

Warwick Space Research Group (WSRG)



Since 'Space' became an added theme to Warwick's Global Research Priority of 'Innovative Manufacturing & Future Materials' and a call was made to Warwick staff whose research could contribute to this theme, we have had **39 responses** from across the university. This includes individuals with known Space heritage from the Depts of Physics, Engineering, Chemistry, etc, but also many others who have expertise that is readily adaptable to Space applications. **WMG** in particular have considerable resource in areas related to **Advanced Manufacturing for Space Technology**, and from an engineering point of view, that is likely to be the main thrust of our development to enable Warwick to become a leading player in a regional **Space Technology Hub**.

However, we were also delighted to see the **range of Warwick respondents**, including individuals from **Film & TV, Politics & International Affairs, Computer Science, Mathematics, & the Warwick Writing Programme**. Given the plethora of activities that are required in both the **upstream** (satellite/system/mission production), **downstream** (end user deliverables, commercialisation of proven technologies), the **politics of Space use** (retaining peaceful objectives for global benefit, mitigating environmental effects, etc), and of course **outreach** (promoting STEM, Warwick University, and Space Careers generally), there is clearly enormous scope for everyone to make important contributions and direct their research towards **Warwick's future coordinated role** in Space science and technology! (See Warwick's Space GRP theme at: <https://warwick.ac.uk/research/priorities/materials-innovative-manufacturing/research/space>).

Midlands Innovation Space Group (MISG)



WUSAT continues to lead on Warwick's representation in this very important group of Midlands Universities who are, or have a desire to be, **space active**.

Project managed by Sue Clayton (Midlands Innovation), we are working closely with the University of Leicester to support the development of **Space Park Leicester**. The £100 million Park that will create a world leading hub for space and space-enabled industries to flourish.

WUSAT's proposal for an '**Innovative Manufacturing Hub in Advanced Materials, Technologies and Manufacturing for Space and Extreme Environments**' has been further developed through collaboration with our partners at the University of Leicester and other Midlands partners. It has been adopted by the **Space Academic Network (SPAN)** as one of the proposals for Space Technology Hubs that will be presented to the UK Space Agency.

In connection with this Space Hub proposal, there are also a set of **key research themes** being developed by the MISG partners. These are;

- 1: Systems Design for Modular Robotically Serviceable Spacecraft**
- 2: Materials and Manufacturing Processes for Extreme Environments**
- 3: Design and Hybrid Additive Manufacturing for Spacecraft Structures and RF Antennas**

We believe that the emerging Warwick Space Research Group (above) will be able to lend its weight considerably to these key research themes.

West Midlands Space Cluster

In a recent development, **City-REDI** (a Research Institute at the University of Birmingham, Business School) has acquired UK Space Agency funding to carry out a research project with the aim of supporting the development of an early stage **local space cluster in the West Midlands**.

City-REDI will work in partnership with the West Midlands Combined Authority, GBSLEP, the Black Country LEP and Coventry and Warwickshire LEP. (LEP – Local Enterprise Partnerships).

WUSAT have been approached by Dr Chloe Billing who is leading this project, and we have provided a **comprehensive breakdown of Warwick's actual and potential Space capabilities** as defined by feedback from our previous Warwick Space Research Group GRP call (see above). As a result, and in order to represent Warwick in this initiative, Bill is now a member of their **Local Space Leadership Group**, but importantly we are joined by Sue Clayton and Martin Barstow from our Midlands Innovation Space Group as it will be vital for any development of this West Midlands group to link effectively to our MISG group.

Personal Stuff to finish!

From Bill – Given the level of activity described above, and what has been achieved under the most difficult of conditions in relation to both Covid-related lockdowns and my own health problems following my operation for bowel cancer in Sept 2019, I have to take this opportunity to thank a lot of very special people who have enabled me to remain amazingly active over the whole of this period.

Clearly **NHS-SWFT staff have emerged as the main partners** in enabling all of this to continue throughout the most trying of times. So I propose to include their logo as one of our support partners in the WUSAT-3 programme.



I finished my chemotherapy treatment in mid-June this year, and in mid-November I was fortunate to be able to have an operation to reverse my temporary ileostomy. This has taken some time to recover from, but I'm now well on the way to 'normality'. At every stage of my treatment, staff have been incredible in, not only providing the best care, but often changing their schedules to accommodate events I was due to attend. Amazing!

I must specifically give enormous thanks to Consultant General & Colorectal Surgeon **Henry Ferguson**, Consultant Clinical Oncologist **Peter Correa**, all of the staff on **Willoughby Ward** (Warwick) and the **Aylesford Unit** (particularly Snr Satellite Nurse **Roxy!**), and the wonderful Stoma nurses **Denise & Elizabeth**. You all do such a phenomenal job!!



Finally, and most importantly, my wife **Sue** who has done an incredible job keeping us in supplies and keeping everything in good shape throughout the lockdown year. **Julia** who has covered for me when necessary and has somehow managed to retain her detailed role with WUSAT despite working away on a very busy job and having major family commitments. **Neil, Georgina, & granddaughter Isabelle** for providing lots of things to look forward to!



Anyway, **everyone is on the WUSAT team** and next year is going to be a big year, so no slacking!!☺