eece

The Electrical, Electronics and Computing Engineering Newsletter

Issue 3
March 2023

In this issue:

Welcome

Matt Dunnigan - Head of EECE

Dear EECE Student,

I hope you find the overall tone of this piece upbeat. I am writing this during consolidation week – a time I hope you find useful to relax somewhat and reflect on your courses so far. Of course, I expect you will be using much of this time to study the teaching material and catch up on tutorials. You are about to start the last quarter of teaching for this academic year and the time has flown past.

There is no doubt that you have chosen a difficult degree programme to study which requires sustained effort throughout the academic year. The Semester 1 exams have shown that high grades cannot be achieved easily. I realise that many of you question the need for exams. It is a fact that we would not receive our IET accreditation, which is vital, without exams for degree qualifying courses.

Of course, it is worth striving for the goal of achieving your BEng or MEng degree. A recent salary survey showed that the average salary for an engineer with significant experience is £58,000. This rises to £63,000 for those who have achieved Chartered status. This is good news but more importantly the survey shows that most engineers are very happy with their employment and career prospects.

Our MEng degrees offer the possibility of a 6 month placement with industry and I am happy to report that the membership numbers of our Industrial Advisory Board have grown significantly this academic year. This means that more companies will offer placements. It is a fact that industry values the qualities that our students possess and the research capabilities of EECE staff. This is excellent news for you all.

All the best for the remainder of this academic year.
Best regards,
Matt Dunnigan

EECE SOCIETY

In the end of November, we had our first annual Winter Ceilidh at the Student Union, in Zeros. Undergraduate and postgraduate students across all years and disciplines in EPS came together. We had a great time and are looking forward to more events like this on in the future, and to continue growing our community.

We are looking forward to planning future events for the remainder of the academic year, as well as looking forward to the next year! If you would like to get involved, please get in touch!
Thank you to the Heriot-Watt Annual Fund for helping fund this event and others like this.

TEAM AERO-WATT

We are Team Aero-Watt, a multidisciplinary team competing in the Institute of Mechanical Engineer's Unmanned Aircraft System challenge! This challenge involves designing, manufacturing, and assembling a fully autonomous plane with a wingspan of around 3 meters. Once assembled, we test (then ideally not, but likely crash and rebuild), then fly off at the competition against other teams from all over the world, taking place yearly at BMFA Buckminster over 4 days. However its not just about the flying, we also have to complete several missions, including way point navigation, endurance flying, aid-box delivery, and more – all fully autonomously!

Our team of ~25 members consists of three sub-teams: Flight Dynamics (FD), Airframe Design (AD), and Software and Electrical Systems (SES), each with their own dedicated area of the plane to design, and coming together with as much cross team collaboration as possible to produce the final model! Working through year-round deliverables, ensuring the plane fits technical specifications, and physical rapid-prototyping alongside iterative assembly, we really do try to provide an industry-similar experience but with all the perks of being student led, such as regular socials!

Now in our third year of the competition, our ambitions are only increasing! For example this year is the first year we are attempting composites work, and we are shying away from the easy autopilot implementation to provide us with further customizability and cost efficiency.

Keep a look out for us soon on the Bridge Link, where we will be hosting a competition to choose the name of the plane! Last year our plane AW404 really lived up to its name, by disappearing into a nearby field for a section of the competition, so this year we hope not to curse it too much! (AW-WINS?)

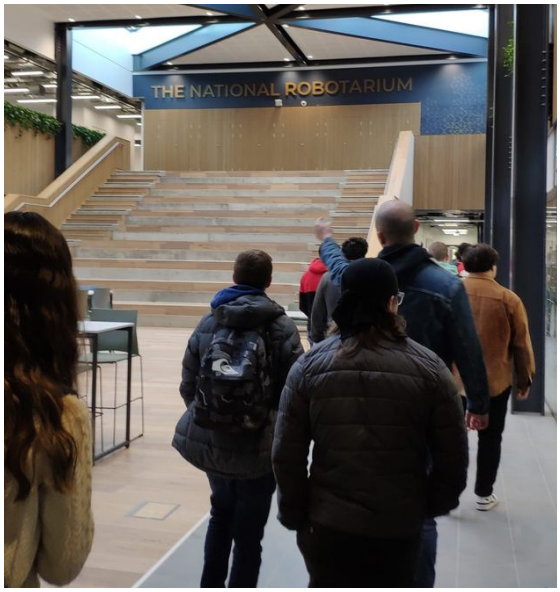
For further information including when we will be recruiting again, keep an eye on our Instagram @aerowatt, or our website: https://www.aero-watt.com! We'd also just like to quickly thank our sponsors, 3DXR, EasyComposites, ANSYS, and of course Heriot-Watt Mechanical Engineering Department for their generous contributions to the team! Without them we really wouldn't be able to compete!

ROBOTICS SOCIETY

Welcome back to the second semester from the Robotics Society! We aim to introduce the fun side of robotics to students from all schools, disciplines, and backgrounds, creating a community of those who love robotics!

Throughout this academic year we have been hard at work with our partners and sponsors, organising events and activities for our members! Specifically, with the National Robotarium, we have organised a tour of the building (with another one coming up soon hopefully including companies working in there), alongside volunteering opportunities, lab visits, and more! We have also been working with one of our extremely generous sponsors, CENSIS (Scotland's Innovation Centre for sensing, imaging, and IoT) to secure a donation which will go towards providing parts for our part borrowing service, and supporting individuals and teams who want to take part in robotics competitions (more information on this soon!). Along with that, we have been working towards a ROSbot workshop, teaching the basics of the Robotics Operating System, used commonly in industry

In terms of competitions, we are extremely excited to have now two RoboWars teams working with us! Their progress has been exceptional, and we are looking forward to continuing to see their progress!



Other members have also begun work on a UniBots competition entry! For more information about any of these competitions, please come along to one of our Come&Builds, or message on our discord!

We have also been organising regular socials, including our pub quiz, nights out, and Halloween event, which have been great so far!

Aside from just our Heriot-Watt Robotics society, we are very proud to present the Robotics in Edinburgh Network (REN). This new group forms together ourselves and the Edinburgh University Humanoid Robotics Society, creating a community for likeminded students to come together across universities. In January we organised our first joint social event for members to meet one another, an awesome event with beer pong and a night out included! Keep an eye on our social medias and discord to hear more!

If any of this sounds interesting to you, please come along on Wednesday's between 2 pm and 4pm to the GRID Flex Lab 1, or follow our social media @hwurobotics to stay updated! Our discord also has constant updates of information, available at discord.gg/8vHUcGj!

CANSAT TEAM

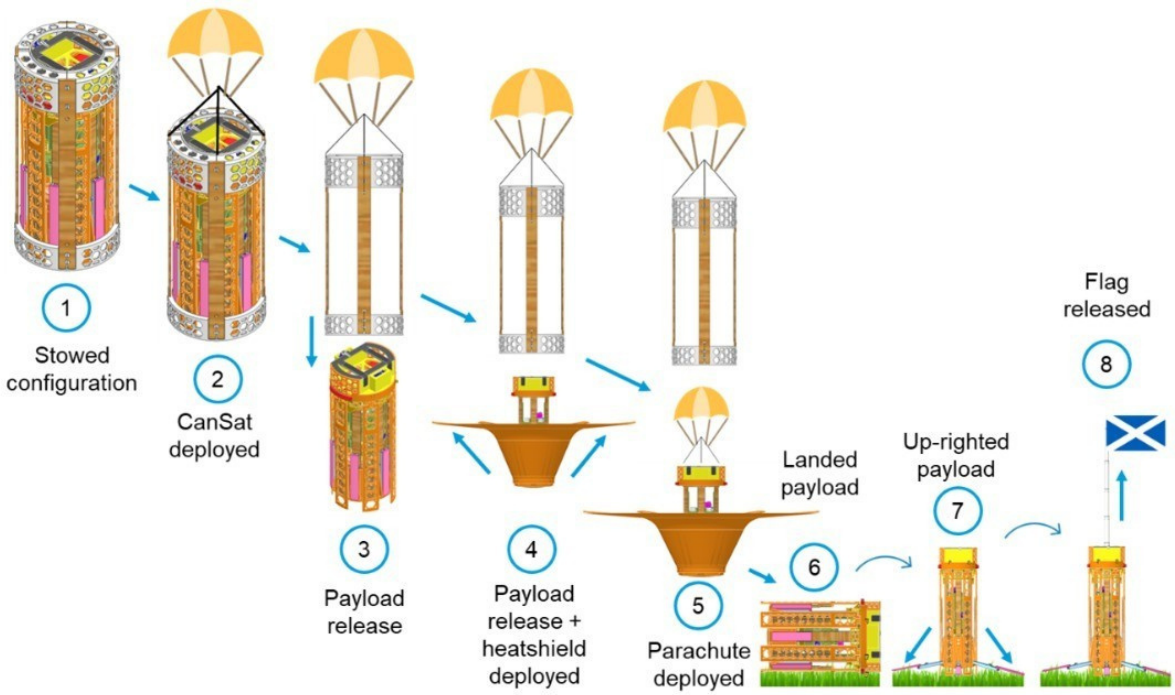
If this is the first time you've heard about us, you may be thinking: what on earth is CanSat? The CanSat competition is an international challenge organised by the American Astronautical Society and is sponsored by some of the biggest names in aerospace, such as NASA and Siemens. The goal of the competition is to design and build a payload (a CanSat) for a suborbital rocket that carries research instruments.

This year, the mission has changed a lot and consists of simulating the landing sequence of a planetary probe! As in the previous competition, the CanSat is composed of a container and a payload, but this time they are not attached together. The payload has a heat shield to slow down its fall to the ground and once it lands it has to upright itself... The difficulty has definitely raised, but our team is ready to handle the challenge!

We have recently submitted our Preliminary Design Review - outlining what is the two current prototype designs of our CanSat. Results for this will be coming out in March, hence, whilst we wait on results, we have been keeping busy with the Critical Design Review.

- Our mechanical crew is working from their awesome CADs to manufacture and assemble the CanSat's skeleton and parachutes.
- The electronics team are focusing on finalising and ordering the PCB layout for the electronic bay.
- Our software guys are setting up the radio communication network and testing the sensor subsystem.
- Meanwhile, management has been scrambling to keep the team on schedule and find funding for the next part of the project (turns out a building a CanSat and a group trip to America is expensive).

If you want to see how the competition evolves, head over to our Instagram @hwucansat, we will keep you all updated trough there!



THE RESEARCH CORNER

New Experimental Satellite Ground Station Facility

George Goussetis

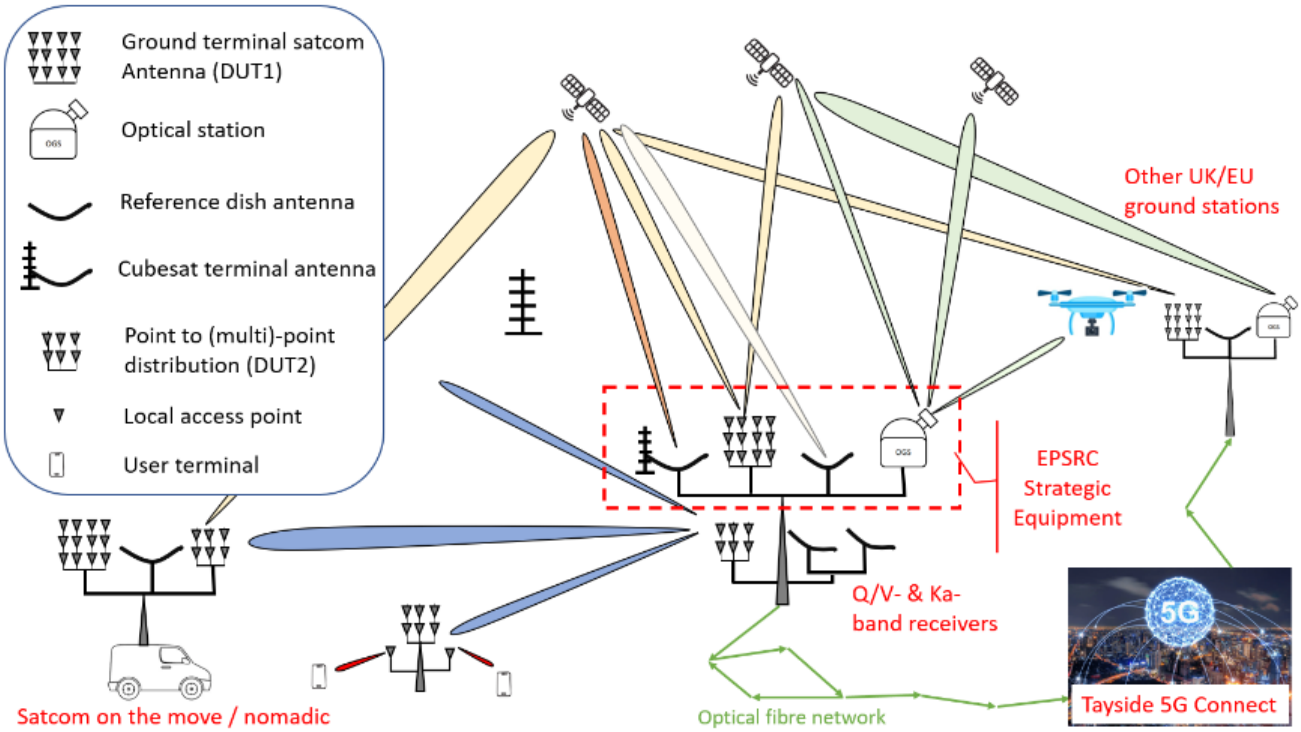
Current DSS facilities at the Errol airfield.

Under the Strategic Equipment programme, EPSRC has announced funding to support the establishment of an experimental satellite ground station facility (SGSF). SGSF will be hosted by Heriot-Watt University and be located at the Errol airfield, collocated with Dundee Satellite Station Ltd (DSS).

SGSF will provide currently unavailable capabilities and accelerate research in space technologies and will flexibly support the needs of broad research communities developing for example mm-wave and optical communications technologies; quantum communications; non-terrestrial and terrestrial network integration, as well as; astronomical instrumentation and data collection. SGSF will also catalyse industry academia interactions, synergising with urgent needs to validate emerging technologies on tracking antennas, optical/quantum comms, spaceborne lidar calibration and pilot satellite missions.

Capabilities:

- Flat panel antenna OTA teting
- Optical satcom link testing
- Satellite mm-wave propagation
- Satcom integration in 5G/6G
- New Space missions
- Quantom key distribution
- Hardware imperfections management
- Astronomy and astrophotonics



Nature Inspired Engineering: A New Field of Engineering for the 21st Century

Marc Desmulliez

Biomimetics is defined as the trans-disciplinary creative process between biology and technology aiming to solve anthropospheric problems through abstraction, transfer and application of knowledge from biological models.

The most symbolic example of a biomimetic device is the VelcroTM, a hook and loop fastener whose name is derived from the French **Vel**ours+**Cro**chet. The device was invented by the Swiss electrical engineer George de Mestral during a walk in the Swiss Alps in 1941. He noticed that burrs of burdock were tightly stuck on the fur of his dog and were difficult to take away. It took de Mestral ten years to translate a serendipitous discovery to a stable and scalable manufacturing process. Velcro became only universally adopted when shown on television during the Apollo landing on the moon in 1969.

This iconic story belies two persistent issues regarding biomimetics: the predominance of curiosity-driven biomimetic devices (also called solutions waiting for a problem) and the arduous translation of a discovery into a manufacturing process that can be taken up by industry. Velcro took 15 years of hard engineering work to be produced at scale.

Instead of relying on happenstance, companies need a way to be provided with natural solutions that can be matched to their industrial requirements. Dr. Ruben Kruiper, a former PhD student of mine, found a solution on how to start building this two-way bridge between biology and engineering. Using natural language processing techniques, he looked at the concept of trade-offs which is universally used by botanist, zoologists and engineers. Mining through research articles, he was able to extract explicit trade-offs described by botanists which could offer tantalising engineering solutions if translated properly. The building of a meta-methodology and its automation will take however 20 years of research effort before being of use by industry. More funding is needed to shorten this timescale. More engineers need to be taught about the wonders of nature. We are all life-long learning students when studying nature.

Nature offers solutions that do not need scarce and purified materials. Nature processes materials using ambient temperature and pressure. Seven levels of hierarchies can be found in simple structures such as bamboo and bones with information passing from one level to another with decentralised embedded intelligence affecting the structure, process and materials that build these layers. Astonishing feat of engineering if these structures were to be man-made. Yet we, engineers, are just starting to learn how nature does it.

I leave you with a simple picture of a dandelion seed. My new PhD student, Mr Bappa Mitra, is looking at the recently discovered flying properties of these seeds and try to learn from them to build battery-less nanodrones for environmental engineering and precision agriculture. More about that in a couple of years…

VOLUNTEERING AND INTERNSHIP OPPORTUNITIES

School Officer

School Officers are current students who represent the student voice for their department. They are 'team leaders' for all the Class Reps in their department. It is a great opportunity to put in your CV.

There is currently an opening for School Officer of EECE for the remainder of this year and the next academic year. If you are interested contact Matt Dunnigan at m.w.dunnigan@hw.ac.uk

Class Rep

If you would like to be a part of student representation with a less demanding roll, consider signing up to be a class rep in the next academic year!

Societies

If you would like to get involved with any societies (including our own, the EECE Society) feel free to get in touch via email or social media.

EPSRC Funded Vacation Internships

The University, in conjunction with EPSRC, has a number of summer vacation internship awards available for undergraduate students. The vacation internship scheme gives undergraduate students a taster of what it is like to do research. The students are given practical, first-hand experience of working on and carrying out research in a UK university. The awards are aimed at Home/EU undergraduate students in the middle years of their degree programme (i.e. have completed their 2nd year of study on a 3 year degree course, or have completed their 2nd or 3rd year of study on a 4 year degree course) who are undertaking their degree in a subject that falls within the remit of EPSRC.

Project details will be offered soon, so be on the look out in your emails. For any questions contact George Goussetis at: g.goussetis@hw.ac.uk

Further Help

For further help on finding and applying for internship opportunities, don't hesitate to contact Heriot-Watt's Careers Service at: https://www.hw.ac.uk/uk/students/careers.htm

Thank you to everyone who contributed to this issue!

Do you have something interesting to share?

Your group project result must be seen?

You want to be in the newsletter or just help us out?

Contact us: **eece-newsletter@hw.ac.uk**

Instagram: **@hwu.eece**

HERIOT WATT UNIVERSITY

eece