# Innovation Day – micro:sat

## Setting the Scene

You and your team have been drafted into the [UK Space Agency](https://www.gov.uk/government/organisations/uk-space-agency) to work on a micro:sat project. Recently there has been a Coronal Mass Ejection (<https://en.wikipedia.org/wiki/Coronal_mass_ejection> ) which has affected many satellites in orbit. Your mission is to design and develop a prototype micro-satellite to meet several objectives including re-establishing communication with a damaged satellite.

This project supports the [Global Goals](https://www.globalgoals.org/goals/), [goal 9](https://www.globalgoals.org/goals/9-industry-innovation-and-infrastructure/) specifically:

**BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION.**

A functioning and resilient infrastructure is the foundation of every successful community. To meet future challenges, our industries and infrastructure must be upgraded. For this, we need to promote innovative sustainable technologies and ensure equal and universal access to information and financial markets. This will bring prosperity, create jobs and make sure that we build stable and prosperous societies across the globe.

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| A picture containing icon  Description automatically generated | **SUPPORT DOMESTIC TECHNOLOGY DEVELOPMENT AND INDUSTRIAL DIVERSIFICATION** |

There are **4 missions** to complete during the day. Each mission has success criteria that must be met to be successful. These missions each add some functionality to the satellite and must be carefully designed and a prototype made. As a team, you must collaborate and communicate effectively to meet the success criteria of all 4 missions to the best of your abilities.

You are only working on the functionality described in the missions, you can assume that the micro:sat can be controlled and navigated in space by the UKSA team.

This is a competition. Each mission is scored separately and is judged on the following criteria:

* Design innovation
* Build quality
* Effective communication and collaboration
* The elevator pitch

There are also bonus challenges to complete that will reward you with extra points.

Hardware needed per team:

* 4 x micro:bit V2 GO package
* Laptop with internet (Chromebook and laptops from TA)
* Making supplies for satellite build
* Control:bit and motors (including wires)

## Mission 1

The first mission is to collect satellite telemetry upon re-entry and be able to visualise the data. This will be modelled by your satellite being dropped from a height, once with a parachute and once without. Your satellite should be ruggedised to avoid damage to the system. The satellite should be able to capture appropriate data locally for both falls. This data should then be taken off the micro:bit and turned into a visualisation to compare the drop vs the parachute drop.

## Success criteria

* Design and build a rugged micro:sat body no bigger than 30cm x 30cm that can hold 4 x micro:bits, batteries and control:bit, motors and wires
* Create a team brand and ensure this brand is shown on your micro:sat. The branding should include:
  + A name and logo
  + A colour palette (no more than 3 colours)
* Design and build a suitable parachute for the micro:sat, the micro:sat needs to be able to survive a drop from a height (TBC ~10m from balcony onto a bean bag)
* Program a micro:bit to collect appropriate data during the 2 drops
* Collect the data from the micro:bit and create a visualisation to compare the 2 drops
  + Use a suitable chart/graph to represent the data visually
  + Write a short report comparing the data you gathered that describes how the parachute changed the way the micro:sat fell (this needs to be presented later!)

## Mission 2

The UKSA has a damaged satellite that it needs your micro:sat to investigate. This mission is TOP SECRET and cannot be discussed with other teams. The satellite is known to be transmitting some sort of encrypted data. Your mission is to find out what is being transmitted and what it means. This satellite will be modelled by a micro:bit in a model UKSA satellite that you can access to test your solution. Part of the cipher has already been worked out, these are the special characters (:,/,!,?) all other characters are still encrypted.

## Success criteria

* Design and program a micro:sat to receive the input signals from the damaged satellite
* Decipher the encrypted signal
* Report your findings as part of your team’s presentation to the UKSA
* Do not discuss this mission with other teams

## Mission 3

A common risk for space travellers is space debris. This can be whole satellites that are now defunct all the way to tiny shards of plastic, rock and metal travelling at high speeds orbiting Earth. These debris that can cause damage to satellites and space travellers alike. Your mission is to design and build a working prototype of a system that can capture space debris.

The system will need to be deployed once the satellite is in space and so needs to be stored on the micro:sat in as small a space as possible during launch.

## Success criteria

* The system must ‘deployable’ (you will need to demonstrate the ‘stored’ and ‘deployed’ states to the judges)
* The deployment must be trigged remotely and not involve any help from the team
* The solution must involve the control:bit and at least one motor

## Mission 4

Your team’s micro:sat will be one amongst many other micro:sats being developed by the other teams. You need to develop a **collision detection system** that all the teams can use. To do this you will need to work collaboratively with the other teams to design and use a system that meets the success criteria.

A representative from each team will need to meet to agree a common method for the micro:sats to communicate with each other and know whether they are too close together (<1m). If the micro:sats sense they are too near to another micro:sat they need to play a warning sound from the speaker.

Radio channel **10** has been reserved for this system.

## Success criteria

* Collaborate with the other teams to agree a common way to send/receive collision warnings
* The micro:sat must sense whether other micro:sats are within 1m
* The micro:sat must play a warning sound when another satellite is within 1m
* The micro:sat should have some way to know which other satellite is too close
* The system must use as little power as possible and not interfere with other systems
* The code for this solution must be hosted on [GitHub](https://github.com/) under an [open-source](https://opensource.org/licenses) licence

## Bonus missions:

1. You will be required to present your solution to a panel of experts. The presentation should be <2 minutes and there will be time for questions from the panel.
2. You are required to ‘open source’ your code (sharing is caring), create a GitHub repository for your missions. Ensure your code is commented appropriately for easy re-use.
3. You have been asked to promote STEM as part of the UKSA education programme. Recent research suggests that TikTok and YouTube are the most effective social platform to share content. Create some content about your project. Ensure you use your teams branding appropriately.
4. Create a website for your teams project (use a Google Site). Add links or embed your social media content as well as links to your GitHub code base. Add profiles for each of your team. Ensure it is branded using your team’s brand.