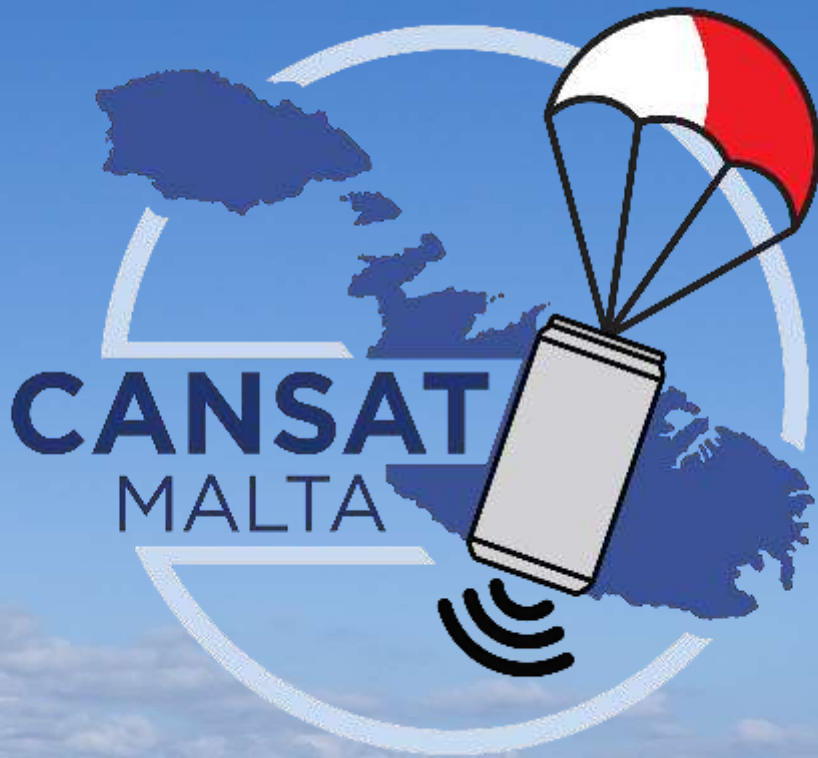




The Malta Council for
Science & Technology



2019-2020 Participation Guide



The Malta Council for
Science & Technology



PARLIAMENTARY SECRETARIAT FOR FINANCIAL SERVICES,
DIGITAL ECONOMY AND INNOVATION
OFFICE OF THE PRIME MINISTER

This Competition is coordinated by the *Malta Council for Science and Technology* with the support of the *European Space Agency* and the *Ministry for Education and Employment*. The initiative is financed by the National Space Fund 2018-2022.

Coordinated by:



The Malta Council for
Science & Technology



PARLIAMENTARY SECRETARIAT FOR FINANCIAL SERVICES,
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1. Introduction

In a continued effort to raise awareness on space applications and related sectors, the Malta Council for Science and Technology (MCST) is being supported by the European Space Agency to embark on a Space Education Programme (SEP) for Maltese schools. This education programme intends to bridge the gap between space applications and society. It aims to drive into Maltese classrooms the relevance of space-related data in better approaching challenges here on Earth. This programme is in line with Malta's first National Space Policy, published in 2017, which identifies a continued need for awareness raising and related capacity building.

The competition introduced in this document, entitled **CanSat Malta**, is one of the Space Education Programme's activities that targets secondary and post-secondary school students between 14 and 18 years of age. This activity is an opportunity for students to come together and work as a team in designing and building a small-scale space related project. It enables students to strengthen STEM-associated skills in a practical and exciting way as they explore the significance of space applications.

This document serves as a guide to students and teachers that are interested in participating in the CanSat Malta 2019-2020 Competition.



Figure 1

2. The Educational Value of the CanSat Malta Competition

The participating teams will have the opportunity to experience the phases associated with a real space project such as: mission objectives and requirements selection, CanSat design, components, system testing, launch campaign and scientific data analyses. Apart from exposing the potential of satellite-related applications in better approaching Earthly challenges, throughout this competition the students will:

- learn by doing – through a practical design and development project,
- get acquainted with the enquiry-based methodology that is typical of real-life scientific and technical professions,
- acquire and/or reinforce fundamental Technology, Physics and programming curricular concepts,
- understand of the importance of project coordination and team work,
- enhance their communications skills.



Figure 2: Learning through experimentation and troubleshooting is of significant value.

3. What is CanSat Competition?

A CanSat is a simulation of a real satellite, integrated within the volume and shape of soft drink can (Figure 3). During the CanSat competition teams consisting of four to six secondary school students led by their teacher are tasked to design and build a CanSat. The challenge for the student teams is to fit the major subsystems typically found in a satellite such as power, sensors and communication systems into this limited volume. The CanSat, which the teams would have designed to carry out particular 'missions' is then launched to an altitude using a rocket and transmits data as it descends under a parachute. The competition is subdivided into four phases as follows:

- **Phase 1: Call for Proposals and Team Selection.** On opening of the call for proposals, interested teams are to submit an *Application Form*, providing an overview on the scientific mission (secondary mission) the team intends on doing if provided with a CanSat kit. Interested teams are to keep in mind the CanSat requirements provided in Section 7 when submitting a proposal. The teams behind the best 10 Research Proposals will be provided with a free CanSat Kit and admitted to the competition.
- **Phase 2: Teachers' Introductory Workshop.** Teachers leading the selected teams will be invited to a teachers' introductory workshop organised in Malta and delivered by experts from the European Space Agency (ESA). In this workshop, the teachers are guided to how to assemble the basic components of the CanSat.
- **Phase 3: CanSat Construction and Test Activities.** The teams, under the guidance of the leader, will design and construct a CanSat that carries out a compulsory primary mission and the secondary mission they had defined in the *Application Form*. All teams are to abide by the CanSat requirements provided in Section 7. At the end of this phase teams will have the opportunity to trial CanSat functionality in a test day organised before the actual launch campaign.
- **Phase 4: Competition Launch Campaign and Post-Flight Activities.** The completed CanSats will be launched using a rocket. When at altitude, the CanSats separate from the rocket and descend under individual parachutes, transmitting data associated with the planned scientific missions. The teams will have the opportunity to collect, process and analyse the data obtained from the CanSat.

3.1. Anatomy of a CanSat

At the core of a CanSat is the Arduino platform, as shown in Figure 3. An Arduino is an electronics platform which may be powered by a 9V battery and can be programmed through a standard PC. Such platforms are typically programmed using a dialect of features from the C and C++ programming languages. Numerous versions of Arduino exist, and being an open-source electronics platform used in a variety of applications ensures the availability of ample education materials online. The Arduino Uno is pictured in Figure 4.

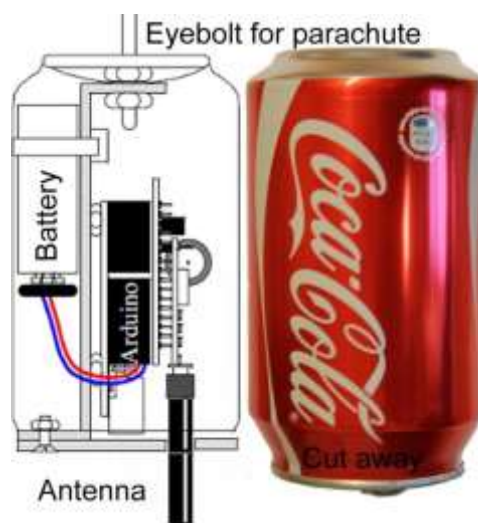


Figure 3: CanSat simple diagram [1]

A variety of input and output devices can be connected to an Arduino board. As an example, the former may be a sensor that converts physical parameters to electrical signals readable by the board. Output devices, such as physical actuators amongst other, convert electric signals into movement enabling interaction with the surrounding environment.

The CanSat starter kit that will be provided for free to the teams admitted to the CanSat Malta Competition includes the Arduino R3 platform together with other electrical components. The [CanSat book](#), prepared by the European Space Education Resource Office (ESERO) in the Netherlands, details the kit that will be provided to the participating teams. This technical handbook enables interested teachers and students to understand the potential of the CanSat kit and master it without having previous experience.



Figure 4: Arduino Uno Rev 3 [2]

3.2. Eligibility for Participation

The Student Team

The competition is open to all secondary and post-secondary school students based in Malta. Eligible teams shall be composed as follows:

- A team shall involve a minimum of 4 up to a maximum of 6 full-time secondary or post-secondary school students aged between 14 and 18 years. A minimum of 4 students per team is required in order to guarantee proper team interaction and collaboration.
- The team shall be led by a teacher ideally teaching subjects in technology, physics and programming curricular subjects as will be mentioned in the forthcoming section.
- University (Level 6) or higher-education level (Level 5) students are not eligible to participate in this competition.
- A school, a coding club or any other after-school groups can apply under this competition. Each school or any other after-school groups can have more than one team however each Team Leader must lead a maximum of 1 team.
- The same team shall not be eligible to submit more than one proposal.

The Team Leader (teacher or mentor)

Each team must have a *Team Leader* (teacher) responsible for submitting the *Application Form* by the deadline specified in *Section 4* and for monitoring the team's technical and general progress that must be available to offer help and advice.

Considering the nature of the competition, the *Team Leader* is to preferably be to proficient in technical subjects such as Computing, Physics, Design and Technology, Engineering Technology and

Information Technology, amongst others. Although this is not a requirement, a teacher that has the right background helps ensure the student team receives appropriate guidance throughout the competition.

The *Team Leader* shall act as the point of contact between the Council and the participating teams. The teacher or mentor assuming the role of the leader must be available to attend the following activities, which are detailed in the forthcoming sections:

- Attend a teachers' workshop in Malta delivered by ESA;
- Accompany the team during the following activities:
 - CanSat test day;
 - Rocket Launch event;
 - European Competition Launch campaign if the team wins the National competition.

Note that the same teacher or mentor shall not represent more than one team under the CanSat Malta Competition 2019-2020.

3.3. Primary and Secondary Mission

Primary Mission

All CanSat teams admitted to the CanSat Malta Competition shall accomplish the following compulsory primary mission. Following rocket separation and during descent, the CanSat must measure the following parameters and transmit them as telemetry to the ground station at least once every second:

- Air temperature,
- Air pressure,

This data must be collected in a way that enables the team to analyse it, make an altitude calculation and display it on graphs (for example, altitude against time and temperature against altitude). This exercise shall be done in a post-flight analysis.

Secondary Mission

In contrast with the Primary Mission, the secondary CanSat mission must be selected by the team and is the mission proposed in the Application Form. The secondary mission can be inspired by real satellite missions, a perceived need for scientific data for a specific project, a technology demonstration for a student-designed component, or any other mission that would fit the CanSat's capabilities.

While some examples of possible missions are listed below, teams are free to design a mission of their choice provided they can demonstrate it has some scientific, technological or innovative value. It is also important that the proposed mission satisfies the CanSat requirements provided in Section 7. Teams should also keep in mind the limitations of the CanSat mission profile, and focus on the feasibility (both technical and administrative) of their chosen mission. Some secondary mission examples are listed hereunder:

- **Advanced Telemetry:** Following release and during descent, the CanSat measures and transmits additional telemetry to that required for the primary mission, for example: acceleration, GPS Location or radiation levels.
- **Telecommand:** During descent, commands are sent from the ground to the CanSat to perform an action, such as switching a sensor on and off, changing the frequency of measurements, etc.
- **Targeted Landing:** The CanSat navigates autonomously with a control mechanism such as a parafoil. The objective is for the CanSat to land as close as possible to a fixed target point on the ground after it has been released from the rocket. This mission is an advanced telemetry/telecommand mission - navigation data is exchanged between the CanSat and a ground station throughout the descent.
- **Landing System:** For this mission, an alternative safe landing system for the CanSat would be deployed, such as a bespoke parachute or airbag.
- **Planetary Probe:** A CanSat can simulate an exploration flight to a new planet, taking measurements on the ground after landing. Teams should define their exploration mission and identify the parameters necessary to accomplish it (e.g. pressure, temperature, samples of the terrain, humidity, etc...

4. Timeline

The CanSat Malta Competition 2019-2020 consists of four phases as mentioned previously. The associated timeline is shown below. While the dates associated with Phase 1 are confirmed, the timeline associated with the other phases is only indicative.

Confirmed dates associated with the rest of the timeline will be published on the Space Education Programme webpage (<http://mcst.gov.mt/space-directorate/sep/#cansat>) and will be communicated with all competition participants by the *Teachers' Introductory Workshop*. Nevertheless, the applying teachers or mentors with their team shall make themselves available to the indicative dates mentioned below.

Phase 1: Call for Proposals and Team Selection

Activity	Dates
Call for proposals opens	July 2019
Deadline for Application Form	Wednesday 13 th November 2019
Announcement of selected teams	Mid - End November 2019

Phase 2: Teachers' Introductory Workshop*

Activity	Dates
Teachers' Introductory Workshop	End November 2019

Phase 3: CanSat Construction and Test Activities**

Activity	Dates
CanSat Construction and Related Reporting	End November 2019– March 2020
CanSat Test Activities	

Phase 4: Competition Launch Campaign and Post-Flight Activities**

Activity	Dates
Pre-Launch Activities	March 2020 – May 2020
Rocket Launch Event	
Post Flight and Final paper reporting	
Award Ceremony	

*Exact dates will be communicated in due course.

** Dates are expected to be published during the Teachers' Workshop.

5. Competition Overview

5.1. Phase 1: Call for Proposals and Team Selection

Application Form Submission

To participate in the CanSat Malta Competition 2019-2020, the team is to complete the *Application Form* that is now uploaded on the Space Education Programme [webpage](#). This form, which is to be submitted on the template provided by the Council, provides details on the student team, the teacher assuming the role of the team leader and the secondary mission the team intends on doing if provided with a CanSat kit. Interested teams are to keep in mind the CanSat requirements listed in Section 7 when submitting a proposal. The *Application Form* should be concise and must include aspects analogous to the typical lifecycle of a real space project. A sample application form is shown in Annex 1.

The completed *Application Form* shall be submitted as detailed below. Submission deadline is **Wednesday 13th November 2019**.

Email To	space.edu.mcst@gov.mt
Email Subject	2018– 2019 CanSat Malta Competition Proposal <i>Team_Name</i>
Proposal Format	The proposal should be submitted as an attachment in .pdf format. Application Form shall be named identical to the Email Subject .
Deadline	Wednesday 31 st October 2018

Teams Selection

On call closure, submitted *Application Forms* will be assessed by evaluators appointed by MCST and ranked according to the quality and technical feasibility of the proposed missions. The teams behind the best proposals, which will be announced in mid – November 2019, shall be admitted to *CanSat Malta Competition* and provided with a free CanSat kit (refer to Annex 2).

5.2. Phase 2: Teachers' Introductory Workshop

The teachers or mentors leading the selected teams will be invited to a teachers' introductory workshop with duration of 1.5 days organised in Malta and delivered by experts from the European Space Agency Education Office. During this 1.5-day workshop, teachers will be provided with technical handbooks and introduced to the CanSat kits through practical exercises associated with the Arduino microcontroller, ground station communications and, amongst others.

The workshop is tentatively planned at the end of November 2019. Additional details, including dates and course content shall be communicated there and then.



Figure 5: Teachers' Workshop 2018-2019 at Esplora

5.3. Phase 3: CanSat Construction and Test Activities

As team leaders, the teachers shall guide their respective teams in designing and developing a CanSat that carries out the compulsory Primary mission and the Secondary mission outlined in the *Application Form*. The technical design and development work includes aspects that are analogous to the typical design lifecycle of a real space project, which are:

- Selection of mission objectives;
- Definition of technical requirements necessary to achieve mission objectives;
- Design of CanSat hardware and software;
- Design of ground station/ ground telecommunication system;
- Submission of a **Pre-Launch Report** of a maximum 15 pages to the Council by the deadline to be specified in due course;
- Integration and testing of the CanSat with the necessary test data analysis;
- Launch campaign preparations and related operations

Pre – Launch Report (PLR)

All selected teams are to submit the Pre-launch report before the actual rocket launch. The Pre-Launch report, or PLR, is a **15 page document** (excluding appendices) that summarises all the work done (progress), providing a full description of the CanSat mission, system and functionalities, and indicating the steps, rationale and trouble-shooting which was needed to achieve the CanSat refined design, as well as a detailed budget costing table. This document should accurately record all the details of the completed CanSat prototype. This will be the main document provided to the Jury members before the launch campaign, who will then be tasked with evaluating the work and performance of each team as detailed in Section 6.

The Pre-Launch Report must be submitted to the Council (**written in Verdana font, size 11**) at space.edu.mcst@gov.mt with the name of the team written in the email subject line (e.g. “Team_Name_PLR”). The document attached should be in a .pdf format, with the following file name format: Team_Name_ PLR.pdf

Additional details, such as submission deadlines and the respective template will be published on the Space Education Programme [webpage](#) and communicated to all participants in due course. The

template, which shall serve as a guide to completing the respective sections, will be published on the Space Education Programme [webpage](#) and communicated to all participants.

Submission details are as follows:

Email To	space.edu.mcst@gov.mt
Email Subject	<i>Team_Name_PLR</i>
Report Format	The reports should be submitted as an attachment in .pdf format. Name of attached shall be identical to the email subject.

Test Day

At the end of Phase 3, all teams will have the opportunity to test their CanSat during a trial day organised before the actual launch. During this trial, which is considered as an important milestone in the design process, the CanSat will be dropped from several metres above ground. This test is not meant to simulate the acceleration and flight profile in the actual rocket launch; however it enables the teams to take preliminary readings and test the functionality of their design. Following the test, the teams are allowed to make some final design and construction changes as long as the purpose of the mission remains unchanged. The teams will not be assessed on test results.



Figure 6: Preparing for the CanSat drop test



Figure 7: Checking the CanSat according to regulations

5.4. Phase 4: Rocket Launch Campaign Programme

The final phase, often considered as the highlight of the competition, is the launch campaign. As depicted in Figure 8, the fully functional CanSats will be launched to an altitude of a few hundreds of meters in a rocket. When at altitude, the CanSats separate from the rocket and descend under individual parachutes. Each mission begins here: the CanSats collect and transmit data associated with the primary and secondary missions. The transmitted data is received by the student teams via an antenna interfaced to a laptop as shown in Figure 9. Following the launch event, all teams will have the opportunity to analyse the data received during the launch event.

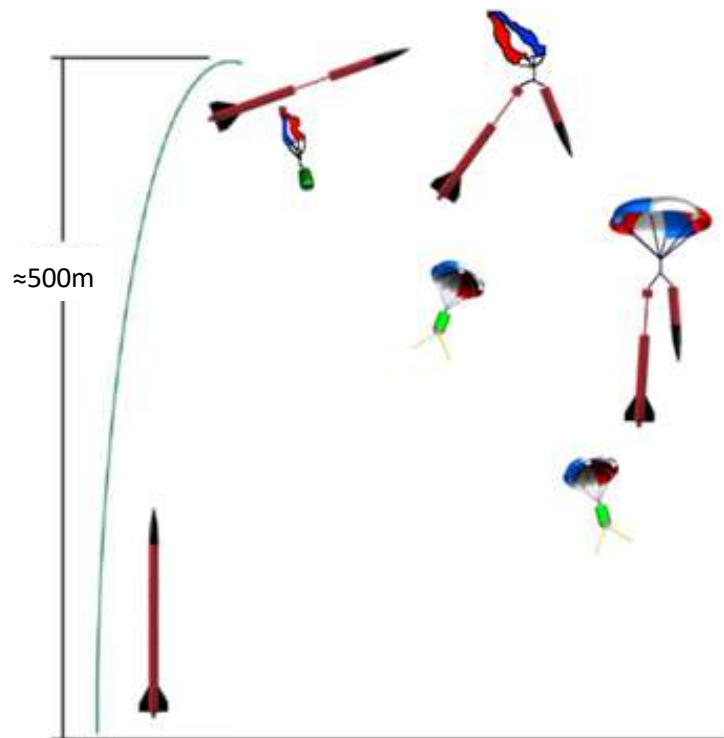


Figure 8: Rocket Launch Schematic [3]

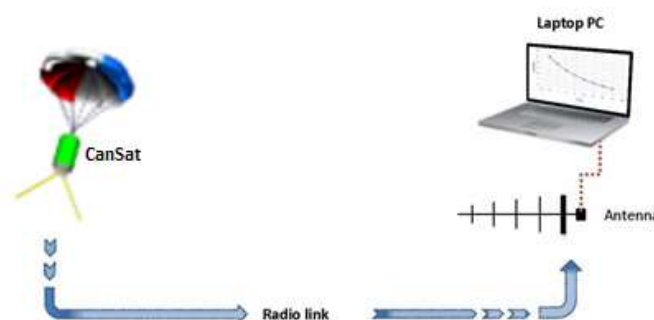


Figure 9: Capturing data from the CanSat via an antenna [4]

A typical programme for a launch event is as follows:

Day 1 – Prelaunch Activities

- Opening ceremony;
- Team's presentation of their overall CanSat design and satellite mission in front of the jury.
The presentation shall be a summarized version of the PLR report however any additional information found after submission of the PLR report are allowed to be presented;
- Final integration and technical inspection of the CanSats;
- Mission overview session to all teams before the Rocket Launch Event;

Day 2 – Rocket Launch Event

- Launch and recovery operations:
 - All CanSats will be launched by a rocket to an altitude of several hundreds of meters above sea level;
 - Once the altitude is reached, the CanSats separate from the rocket and descend under individual parachutes as shown in Figure 8;
 - Each team collects data by pointing an antenna to the descending CanSat;

Day 3 – Post-Flight Activities

- Analysis of the acquired data and mission results;
- Final student presentation of data analysis and results to the jury;
- Jury evaluation, award ceremony, prizes and announcing the winner.



Figure 10: Team preparing for the rocket launch



Figure 11: CanSat Rocket Launch Event 2018-2019

Following the analysis of acquired data, the teams will present the results of their CanSat project in front of a jury appointed by the Council. The evaluation jury shall then rank the teams against the criteria detailed in Section 6 employed throughout the whole competition. The presentation of results can happen one day after the rocket launch event. All teams are required to be prepared and present their work on a PowerPoint presentation or on similar presentation software.



Figure 12: CanSat team's presenting their results from the rocket launch event

The team placing first in the CanSat Malta Competition shall be admitted to the European CanSat Competition 2019 as guest participant, with the Malta Council for Science and Technology funding related costs. This European level competition is organised and coordinated by ESA and additional information will be published at www.cansat.eu in due course.



Figure 13: CanSat 2018-2019 winning team – MoniCanSat from St Monica School Birkirkara

6. Evaluation and Scoring

6.1. The Jury

The Jury, **appointed by MCST**, will be comprised of CanSat experts, education experts, or engineers and scientists who will evaluate the teams' performances during 'Phase 4: Launch Campaign Programme', taking into account the CanSat Pre-launch Report (PLR). The jury members will score the teams during the launch campaign and announce the results from their scoring in the Closing Ceremony.

The jury will typically have 4-6 members, and their fields of expertise can vary from science to engineering or education. The jury board is usually comprised of:

- Space science/engineering expert(s)
- IT/Electronics expert(s)
- Education expert(s)
- Radio communication expert(s)

6.2. Scoring

Performance in the following areas will be evaluated:

6.2.1. Technical Achievement

The Jury will take into account how the teams obtained the results, how reliable and robust the CanSat was, and how the CanSat performed. Innovative aspects of the project will be judged (e.g. the tools selected and the hardware/software used).

The aspects evaluated will be:

- **Mission's technical complexity:** The CanSat's technical level, understanding of the technical concepts and the originality of the engineering aspects of the mission.
- **Performance of the Primary mission:** The CanSat's technical performance in terms of deployment and data collection for the Primary Mission.
- **Performance of the Secondary mission:** The CanSat's technical performance in terms of deployment and data collection for the Secondary Mission.

6.2.2. Scientific Value

The scientific value of the teams' missions and the teams' scientific skills will be evaluated. This includes the scientific relevance of the mission, the quality of the technical reporting (both written and oral) and the team's scientific understanding that will be assessed from the team's ability to analyse and interpret results appropriately.

The aspects evaluated will be:

- **Scientific relevance:** Assessment of whether measurements are done with a clear and well-founded scientific purpose, the extent to which the CanSat is used in an original way and if the data collection is appropriate for reaching the objective.
- **Scientific understanding:** Level of understanding of the scientific principles that underlie the project.
- **Technical reporting:** Ability to summarise with clarity and provide a readable and complete Pre-Launch report, the proper labelling of the graphs and use of the correct units and the ability to present scientifically sound data and interpretations during the launch campaign.

6.2.3. Professional Competencies

The Jury will assess the team's collaboration and coordination, adaptability and communication skills.

The aspects evaluated will be:

- **Teamwork:** Collaborative effort of the team in order to complete the tasks in the most effective and efficient way.
- **Adaptability:** Attitude towards continual improvement and ability to adapt to new conditions, both from the national competition towards the European Competition (if applicable) and/or as far as ideas for improvement after the European Competition are concerned.
- **Communication:** Oral presentation skills, the ability to provide a captivating presentation involving confident speaking skills and a visually appealing presentation.

6.2.4. Outreach

The team will also be scored on how well the project was communicated to the school and the local community, taken into consideration any web or social-media pages, blogs, presentations, promotional materials, media coverage, etc.

6.3. Marking Scheme

The teams participating in the CanSat Malta Competition will be evaluated throughout the whole competition, with the due consideration to the following criteria:

Category	Weight %
Technical Achievement	35
Scientific Value	35
Professional Competencies	20
Outreach	10
Total	100

Penalties

Teams' final scores will be penalised with 1% per day of late submission of the CanSat Pre-Launch Report. Similarly, 1% of the final score will be subtracted per 10 euros extra spent over the maximum CanSat budget of 500 euros.

7. CanSat Requirements

7.1. Requirements and Constraints

The CanSat hardware and missions must be designed to the following requirements and constraints:

- 1) All the components of the CanSat must fit inside a standard soft drinks can (115 mm height and 66 mm diameter), with the exception of the parachute. Radio antennas and GPS antennas can be mounted externally on the top or bottom of the can, depending on the design, but not on the sides.
- 2) The antennas, transducers and other elements of the CanSat cannot extend beyond the can's diameter until it has left the launch vehicle.
- 3) The mass of the CanSat must be between a minimum of 300 grams and a maximum of 350 grams. CanSats that are lighter must take additional ballast with them to reach the 300 grams minimum mass limit required.
- 4) Explosives, detonators, pyrotechnics, and inflammable or dangerous materials are strictly forbidden. All materials used must be safe for the personnel, the equipment, and the environment. In case of doubt by ESA, Material Safety Data Sheets (MSDS) may be requested from the teams.
- 5) The CanSat must be powered by a battery and/or solar panels. It must be possible for the systems to remain switched on for four continuous hours.
- 6) The battery must be easily accessible in case it has to be replaced/recharged.
- 7) The CanSat must have an easily accessible master power switch.
- 8) Inclusion of a positioning system for retrieval (beeper, radio beacon, GPS, etc.) is recommended.
- 9) The CanSat should have a recovery system, such as a parachute, capable of being reused after launch. It is recommended to use bright coloured fabric, which will facilitate recovery of the CanSat after landing.
- 10) The parachute connection must be able to withstand up to 500 N of force. The strength of the parachute must be tested to ensure that the system will operate nominally.
- 11) For recovery reasons, a maximum flight time of 120 seconds is recommended. If attempting a directed landing, then a maximum of 170 seconds flight time is recommended.
- 12) A descent rate between 8 and 11 m/s is recommended for recovery reasons. However, the CanSat's descent speed must not be lower than 6 m/s or higher than 12 m/s for safety reasons.
- 13) The CanSat must be able to withstand an acceleration of up to 20 g.

- 14) The total budget of the final CanSat model should not exceed 500€. Ground Stations (GS) and any related non-flying item will not be considered in the budget. More information regarding the penalties in case the teams exceed the stated budget can be found in the previous section.
- 15) In the case of sponsorship, all sponsored items should be specified in the budget with the actual corresponding costs on the market.
- 16) The assigned frequency must be respected by all teams in the Launch Campaign. The range of allowed frequencies changes depending on the country where the event is hosted and will be communicated in due time. It is recommended that teams pay attention to the design of the CanSat in terms of hardware integration and interconnection, so the radio frequency can be easily modified if necessary.
- 17) The CanSat must be flight-ready upon arrival at the launch campaign.

7.2. Meeting the Requirements for the Launch Campaign

To verify that the CanSats are suitable for launch, a technical inspection and a drop test will take place at the beginning of Launch Campaign. The way the requirements are evaluated is as follows:

- **Requirements 1, 2, 3, 7, 12 and 16 will be evaluated** on site by a specially appointed CanSat technical team. Teams that don't pass any of the tests at the first attempt will only be permitted one second chance to amend the issues, in order to meet all the requirements. In case of failing at the second attempt, the team will be considered not to have achieved flight status and their CanSat won't be approved for launch.
- **Requirements 10 and 13** refer to tests that should be carried out prior to the 2019 European CanSat launch campaign and the proof of these tests being successful should be stated in the PLR.
- A statement of confirmation that the rest of the requirements are met should be included in the Pre-Launch Report, paying special attention to **requirement 14**, which must be stated in the document.

8. Competition Financing

The *Malta Council for Science and Technology* shall cover the costs associated with the CanSat Malta Competition, which is financed by the National Space Fund 2018-2022.

While certain terms and conditions apply, the covered costs include:

- One basic CanSat kit per team which costs around €130. In addition to the provided kit, the Council shall reimburse the school for all documented components used with the CanSat (including parachute materials) and relates ground station equipment up to a maximum of €370.
- Teachers' Introductory Workshop delivered in Malta to the teachers leading the teams admitted to the CanSat Malta Competition.
- Costs associated with the test day and the launch day.
- Accommodation and transport expenses associated with the participation of the CanSat Malta winning team in the European CanSat Competition.

9. Notice to Team Leaders – Post Selection Process

After admittance to the competition, the team leader applying for and behalf of the school, the coding club or any other after-school groups will be handed a Memorandum of Understanding (MOU) articulated by MCST. The MOU is to be signed between the head of school and the Executive Chairman of MCST establishing the terms and conditions associated with this competition. The team leader is then obliged to obtain consent in writing from the respective parent/ guardian of all participating students once they are admitted into the competition. The outreaching part of this competition may include the taking of photographic, audio and/or video recording of students. This also applies during the activities of the CanSat Malta Competition such as the CanSat Test Day, Rocket Launch Event and the Post-Launch Award Ceremony. The consent shall also cover the taking of such media in the presence of the Executive Chairman of MCST, the Parliamentary Secretary for Financial Services, Digital Economy and Innovation and any other Member of the Parliament who may attend such events. Furthermore, such consent should also explicitly include that the students may walk along a rough terrain to recover the CanSat during the *Test Day* and the *Rocket Launch Event*. Any surface health risks in the location where these events will be held shall be identified by MCST and communicated to the team leaders before the event itself to maximise safety awareness of the participants. Finally, it is also the responsibility of the school to provide to MCST the attendance record of the students in each and for every event.



10. Contact

All questions and expression of interest should be directed to:

Email: space.edu.mcst@gov.mt

Tel: 2360 2209

More information on:

<http://mcst.gov.mt/space-directorate/sep/#cansat>

Annex 1 – Guidance for teachers to fill the Application Form

CanSat Malta Competition Proposal Form

Before submitting your proposal, please ensure that you have carefully read the Participation Guide available at <http://mcst.gov.mt/space-directorate/sep/#cansat>

The teacher or mentor is to send the completed application form to space.edu.mcst@gov.mt by

Wednesday 13th November 2019 at 23:59 CET.

CanSat Team Name

Choose a unique team name. Ideally the team name is generated together with your students/ team member. A catchy and cool team name is preferred!

Teacher's Contact Details

Name and Surname:	Click or tap here to enter text.
E-mail (Work):	Click or tap here to enter text.
Phone Number (Work):	Click or tap here to enter text.
Mob No (optional but effective for communication):	Click or tap here to enter text.
Teaching Subject:	Click or tap here to enter text.
ID Card Number:	Click or tap here to enter text.
School's Name (or any other club):	Click or tap here to enter text.
School Level: (select one)	<input type="checkbox"/> Secondary <input type="checkbox"/> Post-Secondary
School Postal Address:	Click or tap here to enter text.

CanSat Team Members	
Teams should be composed between 4 to 6 students . The team shall be led by the teacher or mentor.	
Student 1	
Name and Surname	Click or tap here to enter text.
Age	Click or tap here to enter text.
Student 2	
Name and Surname	Click or tap here to enter text.
Age	Click or tap here to enter text.
Student 3	
Name and Surname	Click or tap here to enter text.
Age	Click or tap here to enter text.
Student 4	
Name and Surname	Click or tap here to enter text.
Age	Click or tap here to enter text.
Student 5	
Name and Surname	Click or tap here to enter text.
Age	Click or tap here to enter text.
Student 6	
Name and Surname	Click or tap here to enter text.
Age	Click or tap here to enter text.

If your school, coding club or any other after school coding group requires that more than one teacher/mentor accompanies the students, the participating team needs to submit evidence of this. However, the total amount of participants must not exceed seven people (e.g. maximum of 6 students + 1 teacher or 5 students + 2 teachers) due to capacity limitations in the European CanSat Competition.

Scientific Mission	
<p>What is the secondary mission that you have chosen for your CanSat? (In a few words)</p>	<p>This section must be brainstormed with your students. Ask your students to search the internet and explore real satellite missions, other CanSat projects and Arduino projects. Refer to the following tips to formulate your secondary mission:</p> <ol style="list-style-type: none"> 1. Head to http://mcst.gov.mt/space-directorate/sep/#cansat and click on CanSat Malta Participation Guide; some secondary mission examples are listed on page 7. You are encouraged to go beyond from what is listed in the participation guide. 2. Other ideas from previous European CanSat Competition are: <ol style="list-style-type: none"> a. Determine the possibility of life existence b. Automated Tracking Antenna 3. The secondary mission shall have a different scope from the primary mission! 4. The important thing is not to set an unachievable mission.
<p>Where did you get the idea from? (e.g. from a real satellite mission, another CanSat project, a scientific publication, a book, etc.)</p>	<p>Your team is encouraged to list what inspired you to choose the secondary mission mentioned above and must specify from where you got the idea.</p>
<p>Outline the scientific or technical objective of your secondary mission.</p> <p>Highlight any innovative aspects.</p>	<p>To accomplish what is stated in the secondary mission, you need to outline the objective. For example, if we were to say our secondary mission is: ‘to determine the possible of life existence on the planet’, you need to specify how this can be achieved.</p> <p>Careful that this question only state ‘Outline’ therefore only a summary is expected. Any innovative aspects can be highlighted – how original is your idea?</p>
<p>Describe your secondary mission in detail. This part should link the scientific objective to the experiment itself. Explain how in practice you are going to fulfill the scientific goal.</p>	<p>This section continues with the above and must be in detail. Here you are expected to lay down a plan, with your team, and specify how your CanSat will be built. Here you are expected to mention what type of sensors/ actuators are you going to use and how are you going to use them. You are also expected that what is written here is both technical and practically achievable.</p>

<p>Which data will you measure, and how?</p>	<p>This ties up directly with the above. For example, for the primary mission:</p> <p>With BMP280 sensor, we are going to capture air pressure and temperature readings every second to the ground station.</p> <ol style="list-style-type: none"> 1. Which data: Temperature in degree and Pressure in pascals; 2. How: BMP 280 sensors gathers data from the environment and logs it in every second. <p>Something similar should be done for the chosen secondary mission.</p>
<p>What do you plan to do with your results after the flight?</p> <p>How will you analyze the obtained data?</p>	<p>Regarding the primary mission, with temperature and pressure recorded every second whilst the CanSat is descending, one can calculate 'Altitude vs time' as altitude is a function of both pressure and temperature.</p> <p>With the data gathered for the secondary mission, similarly one can present their findings by creating graphical plots and/ or calculate equations as with the primary. Analysing the graphical plots, one can assess whether the mission is a success and/ or able to draw conclusions on the results.</p> <p>There is no limit what you can do with your data, the important thing is that it must make sense and must be practicable.</p>
<p>NOTE</p>	<p>Most of the examples written here are based on the primary mission.</p> <p>Although the primary mission is important, it is a common output for all CanSat teams.</p> <p>You and your team will be assessed on your secondary mission. Hence, this part of the application should be primarily focused on the chosen secondary mission</p>

Organization	
<p>How will you distribute the work between the team members? Consider all aspects of your experiment (structure, software, data analysis, etc.)</p>	<p>E.g.</p> <p>Student 1: Hardware Design Student 2: Programming Student 3: Primary Mission and Parachute Design Student 4: Ground support, telemetry and data analysis Student 5: Secondary mission design Student 6: Marketing, media outreach and disseminating</p> <p>This is only an example and will vary from one team to another.</p>
<p>Do you have access to a workshop or a laboratory?</p>	<p>YES/ NO</p>
<p>How much time will your team have available to work on your CanSat, (total number of hours/hours per week), and how will you spend it?</p>	<p>E.g.</p> <p>Each team member will spend approx. a certain amount of hours You can utilize a portion amount of time to meet up, and the rest to be spent either on individual work or in small groups. Contribution to the project should be equal throughout.</p>
<p>How does your team plan to finance its expenses? Are you supported by your school or other sponsors?</p>	<p><i>If selected, the team shall be financed by the Malta Council for Science and Technology through the National Space Fund. Include here any other sponsors, if applicable:</i></p> <p>Click or tap here to enter text.</p>
<p>Do you have all the material and equipment needed for your mission?</p> <p>If not, how do you plan to obtain it?</p>	<p><i>All equipment associated with the primary mission will be provided by the Malta Council for Science and Technology. Secondary Mission components shall be purchased by the team and reimbursed by the Council up to the limits stipulated in the Participation Guide available at http://mcst.gov.mt/space-directorate/sep/#cansat</i></p> <p><i>Provide details on how you plan to obtain the secondary mission components:</i></p> <p>Click or tap here to enter text.</p>

Outreach Programme

Describe your outreach programme for before, during, and after the CanSat competition.

(e.g. newspaper articles, local radio, website, presentation at school, etc...)

The team will also be scored on how well the project was communicated to the school and the local community, taken into consideration any web or social-media pages, blogs, presentations, promotional materials, media coverage, etc.

The teacher or mentor is to send the completed application form to space.edu.mcst@gov.mt by **Wednesday 13th November 2019 at 23:59 CET.**

Annex 2 – The Basic CanSat Kit

The CanSat kit which will be given to the best applications which consists of an Arduino Uno R3 board, universal prototyping shield along with other electronic components to effectively carry out the primary mission. The kit is shown in the following figure.

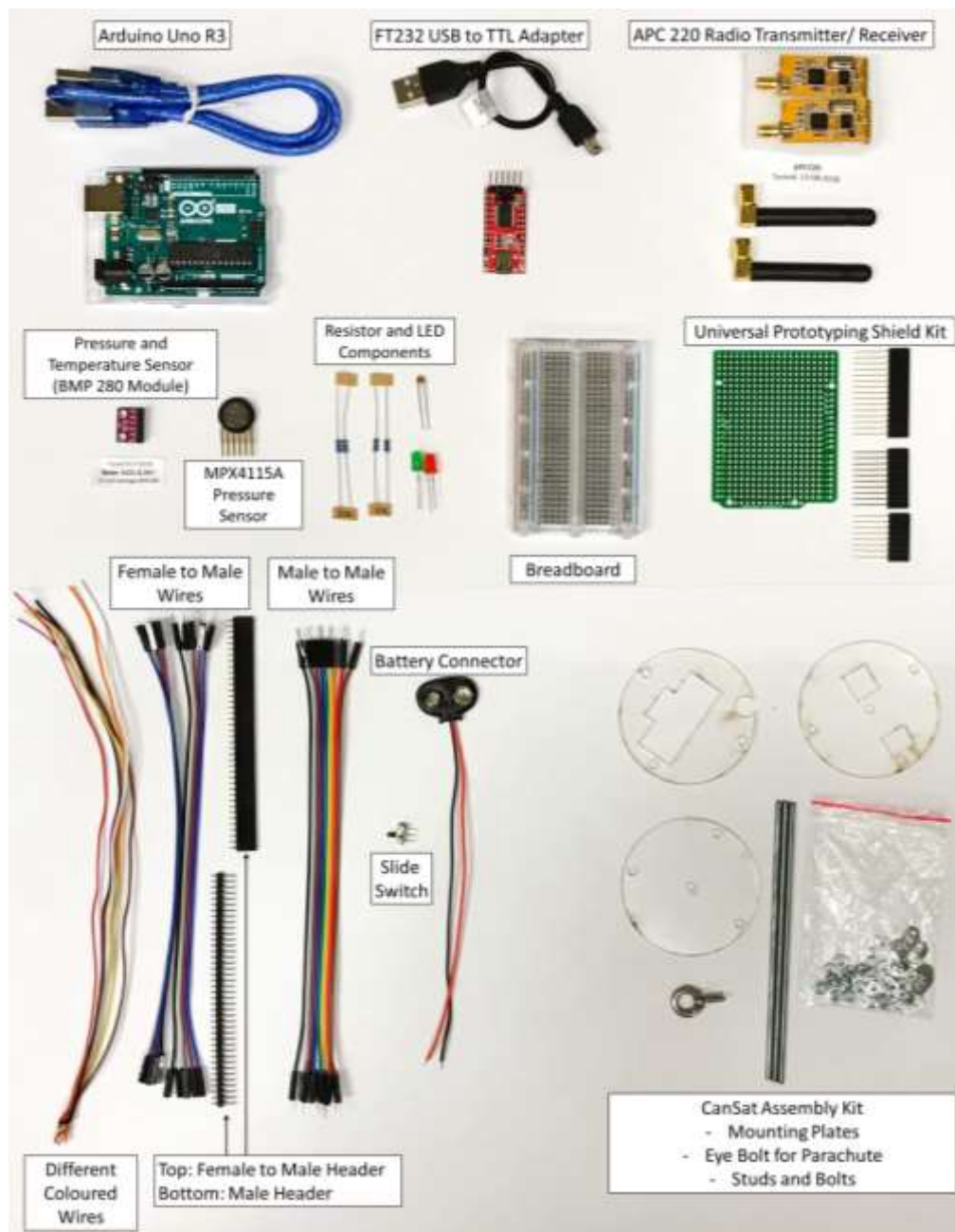


Figure 14: The basic CanSat kit

A step by step guide how to build the above CanSat kit can be found by referring to the [CanSat book](#), prepared by the European Space Education Resource Office (ESERO) in the Netherlands. The team are expected to substantiate this kit with components acquired to carry out the secondary mission.