

**2017**

**ROMANIAN CANSAT COMPETITION  
GUIDELINES**



## Table of contents

2017 .....	1
ROMANIAN CANSAT COMPETITION .....	1
GUIDELINES .....	1
<b>1 INTRODUCTION .....</b>	<b>3</b>
<b>2 COMPETITION OVERVIEW .....</b>	<b>4</b>
2.1 CALL FOR PROPOSALS AND TEAM SELECTION .....	4
2.2 TEACHERS' INTRODUCTORY WORKSHOP .....	5
2.3 CANSAT CONSTRUCTION AND TEST ACTIVITIES .....	5
2.4 COMPETITION LAUNCH CAMPAIGN, 1-5 JUNE 2017 .....	6
2.5 KEY DATES .....	7
<b>3 MISSION OVERVIEW .....</b>	<b>8</b>
3.1 THE ROCKET LAUNCH .....	8
3.2 PRIMARY AND SECONDARY CANSAT MISSIONS .....	9
3.2.1 Primary mission .....	9
3.2.2 Secondary mission .....	9
3.3 CANSAT REQUIREMENTS .....	11
<b>4 EVALUATION AND SCORING .....</b>	<b>12</b>
4.1 EDUCATIONAL VALUE .....	12
4.2 TECHNICAL ACHIEVEMENT .....	12
4.3 TEAMWORK .....	12
4.4 OUTREACH .....	12
4.5 MARKING SCHEME .....	12
<b>5 FUNDING .....</b>	<b>13</b>
<b>6 CONTACT .....</b>	<b>13</b>

## 1 INTRODUCTION

The European Space Agency (ESA) supports a broad range of CanSat activities across its Member States, in order to give European high school students their first experience of a real space-related project.

A CanSat is a simulation of a real satellite, integrated within the volume and shape of a soft drink can. The challenge for the students is to fit all the major subsystems found in a satellite, such as power, sensors and a communication system, into this minimal volume. The CanSat is then launched to an altitude of a few hundred meters by a rocket or dropped from a platform or captive balloon and its mission begins: to carry out a scientific experiment and achieve a safe landing.

CanSats offer a unique opportunity for students to have a first practical experience of a real space project. They are responsible for all aspects: selecting the mission objectives, designing the CanSat, integrating the components, testing, preparing for launch and then analyzing the data.



The Flying Dutch Can- CanSat from the 2012 European CanSat competition

## 2 COMPETITION OVERVIEW

The 2017 Romanian CanSat Competition will consist of four phases:

1. Call for proposals and team selection
2. Teachers' introductory workshop
3. CanSat construction and test activities
4. Competition launch campaign

### 2.1 Call for proposals and team selection

The call for proposals is published on the ESERO Romania's website ([www.esero.ro](http://www.esero.ro)) and on the Romanian Space Agency's website at [www.rosa.ro](http://www.rosa.ro). The deadline for proposals is Sunday 8 2017 at 24:00 local hour. A complete proposal form must be submitted to [cansat@rosa.ro](mailto:cansat@rosa.ro) before the deadline.

#### **Eligibility**

The following conditions should be fulfilled, in order for a proposal to be considered as eligible:

- The team should be mixed (boys and girls) and comprise between 4 and 6 high school students (aged 16+), assisted by a teacher.
- The team members must be enrolled as full-time students at a school in an ESA Member State.
- The majority of team members must hold the nationality of an ESA Member State.
- The number of former participants that can enroll in a team is limited to half of the total number of team members. Ex: If a team has 5 members (excluding the teacher), the number of former eligible members is 2.
- A complete application must be submitted to [cansat@rosa.ro](mailto:cansat@rosa.ro) before 24:00 local hour on Sunday 22 January 2017.

#### **Responsibility for leading the team**

Each team must have a teacher responsible for monitoring the team's technical progress, available to offer help and advice, and acting as the point-of-contact between the ESERO Education Office and the student team. The teacher must be available to attend the teachers' introductory workshop and to accompany the team to the competition launch campaign.

#### **Team selection**

The competition will have 8 CanSat launch slots available, divided into two categories: Beginners and Advanced.

- The Beginners' category (4 slots) is intended for teams with no prior experience in designing and building a CanSat or a similar project.
- The Advanced category (4 slots) is intended for teams that already have some practical experience or come from a technical background and are therefore able to undertake a more complex project. Furthermore, a team is considered Advanced if the teacher/member of the team has participated before in a CanSat or robotics event coordinated by ESA or the Romanian ESERO Office.

A Selection Panel of experts will consider all proposals on the basis of their scientific merit, team organization and outreach plans. The final selection will be communicated to the teams and published on the ESERO and ROSA website on Friday 26 January 2017.

## **Selection Panel**

Organizers of the Romanian CanSat Competition will appoint a number of experts that shall evaluate the merit of the proposals submitted.

## **Additional terms and conditions**

Team member substitutions are not allowed for the duration of the competition. The complete list of team members must be submitted to the organizers before the **Introductory Teacher Workshop** at the beginning of February.

Students that are enrolled in other school competitions should make a firm commitment for their participation in the Romanian CanSat competition. Teams that retire from the competition because of other scheduling conflicts will be sanctioned with a ban from participating in all ESERO events for two years (teacher and students).

The calendar of the competition is at the discretion of the Organizers.

The official language of the competition is English.

## **2.2 Teachers' introductory workshop**

A teachers' introductory workshop will take place between 4-7 February 2017, during the short inter-semester vacation. The aim is to ensure that all teams have the necessary equipment and expertise to proceed with their CanSat project. Teachers that have participated in the past to a similar course will not be invited to participate but a kit will be sent for their team.

At this workshop additional teachers may be present that shall not compete in the Competition Launch Campaign.

During the workshop, each teacher will receive a CanSat kit and there will be lectures and training sessions on several topics, including: sensors and signal analysis; data handling and data transmission; software installation and programming.

## **2.3 CanSat construction and test activities**

Between February and early April 2017, the selected teams will carry out technical work on their CanSats and engage in outreach activities. This work will include the following tasks:

- Detailed definition of the secondary mission
- Finalization of the CanSat design
- Building the CanSat
- Integrating the components and sensors
- Programming the software
- Testing all the systems
- Preparing for the launch campaign
- Updating the team's Facebook page, and additional website/blog
- Other outreach activities, e.g. presentations, video clips, media coverage, etc.

In order to ensure that all projects are on track, a total of two brief progress reports are due at regular intervals.

Guidelines for the activities, as well as templates for the required reports, will be provided to each team that is selected to participate in the competition. Expert advice will be available throughout this phase. The CanSat must be flight-ready upon arrival at the Competition Launch Campaign.

## **2.4 Competition launch campaign, tentative 19-23 Aprilie2017**

The highlight of the competition will be the competition launch campaign, where each CanSat will be launched to an altitude of 1 km. The CanSats will conduct their missions, and land safely on the ground to be recovered by the teams.

A report on the results from the launch will be required from each team. The competition winners will then be chosen based on the team's performance throughout the project, as well as the final flight operations and results.

An outline of the programme is as follows:

<b>Day 1</b>	Teams arrive
<b>Day 2</b>	Welcome and introduction Presentations of projects by CanSat teams Final technical inspection of the CanSats
<b>Day 3</b>	CanSat launch day
<b>Day 4</b>	Presentation of results by CanSat teams Jury evaluation & Competition prize ceremony
<b>Day 5</b>	Evaluation & Closing Optional cultural activities Teams depart



## 2.5 Key Dates

Phase 1: Call for proposals and team selection	
Activity	Deadline
Call for proposals opens	21.12.2016
Deadline for proposals	22.01.2017
Announcement of selected teams	26.01.2017
Phase 2: Teachers' introductory workshop	
Activity	Deadline
Teachers' introductory workshop	04-07.02.2017
Phase 3: CanSat construction and test activities	
Activity	Deadline
Progress report 1(Preliminary design review)	19.03.2017
Progress report 2 (Critical design review)	09.04.2017
Phase 4: Competition launch campaign and post-flight activities	
Activity	Deadline
Competition launch campaign	19-23.04.2017



A selection of CanSats from the 2012 European CanSat Competition



## 3 MISSION OVERVIEW

The CanSat competition is designed to simulate aspects of a real satellite mission, including design, development, testing, launch, operations and data analysis.

### 3.1 Primary and secondary CanSat missions

#### 3.1.1 Primary mission

The team must build a CanSat and program it to accomplish the compulsory primary mission, as follows:

**After release and during descent, the CanSat shall measure the following parameters and transmit the data as telemetry at least once every second to the ground station:**

- **Air temperature**
- **Air pressure**

It must be possible for the team to analyse the data obtained (for example, make a calculation of altitude) and display it in graphs (for example, altitude vs. time and temperature vs. altitude).

#### 3.1.2 Secondary mission

The secondary mission for the CanSat must be selected by the team. It can be based on other 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.

Some examples of missions are listed below, but teams are free to design a mission of their choice, as long as it can be demonstrated to have some scientific, technological or innovative value. 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 example secondary missions:

1. **Advanced telemetry**  
After release and during descent, the CanSat measures and transmits additional telemetry to that required for the primary mission, for example:
  - Acceleration
  - GPS location
  - Radiation levels
2. **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.
3. **Targeted landing**





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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.

4. Landing system

For this mission, an alternative safe landing system for the CanSat would be deployed, such as a bespoke parachute or airbag.

5. Planetary probe

The CanSat simulates 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.).

## 3.2 CanSat requirements

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 soda 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, but not on the sides), depending on the design.
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 300 and 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, Material Safety Data Sheets (MSDS) will be requested.
5. The CanSat must be powered by a battery and/or solar panels. It must be possible for the systems to be 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 retrieval system (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 1000 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. In case of a directed landing, a lower descent rate of 6m/s is recommended.
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 next section.
15. In the case of sponsorship, all items obtained should be specified in the budget with the actual corresponding costs on the market.
16. The CanSat must be flight-ready upon arrival at the launch campaign. A final technical inspection of the CanSats will be done by authorised personnel before launch.



## 4 EVALUATION AND SCORING

The teams will be evaluated on an on-going basis, with the following items being taken into account:

### 4.1 Educational value

For this item, the jury will consider the quality of the progress reports and the team presentations, the level of effort made by the team and how much the team appear to have learned throughout the project.

### 4.2 Technical achievement

Innovative aspects of the project will be judged, for example: the mission selected and the hardware/software used. It will be also taken into account how the teams obtained the results, how reliable and robust the CanSat was and how the CanSat performed. If the CanSat did not succeed in accomplishing the missions but the team is able to explain the reasons why and suggest improvements, it will be also taken into account positively.

### 4.3 Teamwork

The jury will assess how well the team worked together on the assignment, the distribution of tasks, the planning and execution of the project and the team's success in obtaining the necessary funding, support and advice.

### 4.4 Outreach

The team will be scored on how well the project was communicated to the school and the local community, taking into account any webpages, blogs, presentations, promotional materials, media coverage, etc.

### 4.5 Marking scheme

1. Educational value	20%
2. Technical achievement	50%
3. Team value	15%
4. Outreach	15%
<b>TOTAL</b>	<b>100%</b>



## 5 FUNDING

All costs related to the teachers' introductory workshop in February 2017 will be sponsored by ESERO Romania. This includes accommodation, meals, training material and the provision of a CanSat kit for each team.

For the competition launch campaign, ESERO will sponsor the accommodation, meals as all costs for the launches and related flight activities for one teacher and up to six members of the team.

Teams are responsible for obtaining alternative sponsorship for any additional CanSat hardware (beyond the kit supplied), as well as the team's travel expenses to and from the competition launch campaign.

## 6 CONTACT

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Team Alpha's CanSat - winner of the 2012 European CanSat Competition