



Setting up a CanSat Competition *(draft)*

1. Introduction

The European Space Agency (ESA) fosters and supports the development of CanSat activities in its 19 Member States. The objective is to give European high school students aged 16-19 their first experience of a real space-related project, as a practical supplement to their scientific curriculum.

CanSats are inexpensive, accessible and adaptable to many different mission goals. Through designing, building and operating a CanSat, students can increase their scientific and technical knowledge and develop valuable project skills. Such a project is proven to raise young people's interest in scientific subjects and motivate them to follow a related career path.

This document offers advice to anyone who is interested in setting up a CanSat Competition.

2. CanSat Basics

A CanSat is a mock satellite contained 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 metres 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.

The students are responsible for all aspects of the project: selecting a mission, designing the CanSat, integrating the components, testing, preparing for launch and then analysing the data.



Fig. 1: A CanSat descending on a parachute

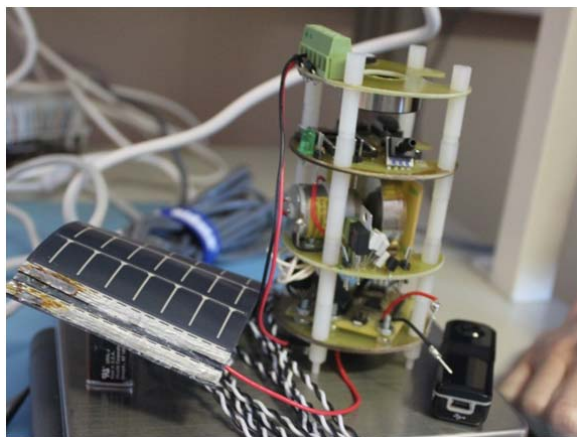


Fig. 2: Internal components of a CanSat designed by Sintpieterscollege Jette, Belgium



3. CanSat Equipment

Designing and building a CanSat from scratch is a daunting prospect for students with no prior experience of such an activity. For this reason, many teams start with a CanSat kit, which already contains the basic elements, and adapt it to their own requirements.

The most common kit is commercially available from the company Pratt Hobbies for USD \$259: <http://www.pratthobbies.com/proddetail.asp?prod=CANSAT-1>

It includes:

- A mechanical structure and mounting components
- A main circuit board, a computer board with processor, a sensor board with pressure and temperature sensors and a communications board, plus all necessary connectors and interfaces
- A CD containing manuals, data sheets and software

Alternative kits have been developed by the University of Aalborg and the organisers of the Italian CanSat competition.

In addition to the CanSat itself, an antenna and ground station is required to receive and interpret the data transmitted by the CanSat.

4. Competition Activities

A competition normally involves the following activities:

4.1 Call for proposals and team selection

An announcement of opportunity is published, with information about the competition and guidelines for applications. It is recommended to follow the European CanSat Competition Guidelines, which describe standards with respect to team composition, mission objectives and CanSat technical requirements. [Ref: 2012 European CanSat Competition Guidelines]

Proposals are reviewed against certain selection criteria and a number of teams are selected. For a first competition, it is recommended to select between 4 and 10 teams.

4.2 Teachers' introductory workshop

Before the students start work on their projects, a workshop is held for the teachers of each team to introduce the CanSat concept, demonstrate how the hardware and software works and give teachers the opportunity to build their own CanSat. It is recommended to allow 2 days for this workshop.

At this point, it is also recommended to involve technical experts, for example from a nearby university or laboratory, who will be able to support the teams during the next phase.



4.3 CanSat construction and test activities

Students are encouraged to follow a normal space project lifecycle as follows:

- Selection of mission objectives
- Definition of requirements
- Design of hardware and software
- One or more reviews of the design (leading to design refinement)
- Integration and testing
- Launch and operations
- Data analysis and reporting of results

A template is available for both design documents and progress reports.

Technical experts will be required on a regular basis in this phase to review documentation, reply to students' questions and troubleshoot when problems inevitably occur.

4.4. Competition launch event and prize-giving

The site for the launch event will depend upon the chosen launch platform. The most common options are:

- A small rocket, launching up to 1 km
- A light aircraft, dropping from ~1 km
- A captive (tethered) balloon, dropping from ~300m
- A crane, dropping from ~100m

Rocket launches are subject to strict legal and safety requirements, which should be investigated well in advance.

A typical programme for a launch event is as follows:

Day 1

- Opening ceremony
- Student teams present missions and designs to the jury
- Final integration and technical inspection of the Cansats

Day 2

- Launch and recovery operations
- Analysis of the mission data and conclusion of results

Day 3 (sometimes several days later)

- Student teams present data analysis and results to the jury
- Competition prize ceremony



Fig. 3: Students track their CanSat during its descent

Standard evaluation criteria for judging the projects are described in the European CanSat Competition Guidelines.



5. Competition Budget

The following items should be considered when developing a budget for the competition:

- Personnel costs
 - Project management and promotion
 - Technical support to teams
 - Logistical arrangements for launch event
 - Launch operations
- Travel, accommodation and subsistence costs
 - Organisation / progress meetings
 - Teachers introductory workshop
 - Visits of technical experts to schools
 - Competition launch event
- Materials costs
 - Promotional material
 - CanSat kits
 - Printed handouts for teachers' introductory workshop
 - Equipment for teachers' introductory workshop (e.g. soldering irons, tools, antennas, computers, etc.)
 - Launch platform and associated infrastructure (e.g. rockets, tethered balloon, crane)
- Facilities costs
 - Laboratory for teachers' introductory workshop
 - Presentation area during launch event
 - Pre-launch preparation area
 - Launch site



Fig 4: A student team prepares their CanSat for flight



6. ESA Support for CanSat Activities

ESA offers the following support to national or regional competitions taking place within its Member States, on the basis 'no exchange of funds':

- Promotional material for the competition can be created, using the 'cansats in europe' brand, which features the flag colours of all ESA Member States. Available material includes a logo, a set of posters, a slide template, and a letterhead (see fig. 3). Specific requests will also be considered.
- Webpages for the competition can be created at the 'cansats in europe' online portal <http://www.cansat.eu> with content provided by the competition organiser. Alternatively, just an introductory paragraph can be added with a link to an external website.
- For the first edition of a competition, ESA will sponsor experienced trainers from a well-established national competition (e.g. Norway or The Netherlands) to carry out a training session with the teachers of the selected teams and the people who will be responsible for technical support.
- Upon request, an ESA scientist or engineer can attend the launch event or prize ceremony, for example to participate in the jury or give a presentation.
- The winning team of each national or regional competition is invited to take part in the European CanSat Competition. The participation of one teacher and four students is sponsored by ESA and a rocket launch for the CanSat is guaranteed.
- *Coming in 2012:* ESA will publish an online lesson based on a CanSat, to address the educational aspects of a CanSat project.
- *Coming in 2013:* A new CanSat kit, adapted to the needs of the European secondary school audience will be developed under ESA contract and made widely available.



Fig 5: Examples of a homepage, letterhead and poster in the 'cansats in europe' brand.



7. Contact Point

All questions and expressions of interest should be directed to:

Helen Page
ESTEC (PPC-PE)
European Space Agency
Postbus 299
2200AG Noordwijk
The Netherlands
Tel: +31 71 565 5518
Fax: +31 71 565 5590
E-mail: cansat@esa.int

8. Further Reference

- 2012 European CanSat Competition Guidelines
- The CanSat Book, written by the organisers of the Dutch and Norwegian competitions
- Templates for Design Document and Progress Report
- Campaign Manual for 2012 European CanSat Competition
- CanSats in Europe Portal <http://www.cansat.eu>



Fig. 6: Participants of the 2012 European CanSat Competition, 22-26 April 2012, at Andøya Rocket Range, Norway