CANSAT IN GREECE

Application form

S.M.A.L.L. Sat

Contact info

Team Leader

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Data of group

Team name	Smart Magnetometer Active Location Landing Satellite Team (S.M.A.L.L. Sat Team)
Name of School	ACS Athens

Group Core Group Member Details

N/A	Full name	Age	Grade	School
1	Minogiannis Sotirios	13 (13/11/2009)	9th	ACS Athens
2	Zoe Tsaligopoulou	14 (18/11/2008)	10th	ACS Athens
3	Denis Romain	15 (29/12/2007)	11th	ACS Athens
4	Yubo Chen	14 (12/12/2008)	9th	ACS Athens
5	Yonghan Du	17 (22/9/2006)	11th	ACS Athens
6	Adel Tooma	15 (19/08/2008)	10th	ACS Athens

Deputy Team Leader

Full name	Antonis Karampelas
E-mail	karampelasa@acs.gr
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Details of Substitute Team Members

The team may have alternate members, who will participate as guests in the Final Event.

N/A	Full name	Age	Grade	School
1	Ioannis Apostolopoulos	15(19/05/2008)	10th	ACS Athens
2	Aristeidis Sargkisian	16 (27/7/2007)	11th	ACS Athens
3	Tanya Haroun	15 (16/10/2008)	10th	ACS Athens
4	Weijun Ye	17(26/03/2006)		
5	Di An	??(12/12/????)		
6				

Organization

How will you divide tasks among team members?

Consider all aspects of your experiment (construction, software, data analysis, etc.)

The Team consists of 10 students of ACS Athens currently enrolled in 9th, 10th and 11th grade.
The student's names are: Tanya Haroun, Ioannis Apostolopoulos, Adel Tooma, Yubo Chen, Denis Romain, Minogiannis Sotirios, Aristeidis Sargkisian, Zoi Tsaligopoulou, Yonghan (Johnson) Du.

Bellow you can find all the roles assigned throughout the team:

- **Marketing & Social Media**: Zoi Tsaligopoulou, Aristeidis Sargkisian
  This team is responsible for promoting the CanSat project through various marketing channels and managing the project's presence on social media platforms. They create engaging content, interact with the online community and potentially seek sponsorships.

- **Mechanical Design:** Minogiannis Sotirios, Johnson, Denis
  The Mechanical Design team is in charge of designing and building the physical structure and mechanisms of the CanSat. They ensure that the CanSat is robust, aerodynamic and capable of withstanding the demands of the mission.

- **Electrical Design:** Tanya Haroun, Ioannis Apostolopoulos
  The Electrical Design role involves creating and implementing the electronic systems within the CanSat. This includes sensors, power supply and data recording systems.

- **Telecommunication**: Ioannis Apostolopoulos
  The Telecommunication specialist manages the communication system of the CanSat. This includes establishing connections for data transmission and ensuring reliable communication with ground stations.

- **Primary Mission:** Yonghan Du, Denis Romain
  The Primary Mission team focuses on defining and executing the main objectives of the CanSat mission. They are responsible for collecting and analyzing mission-critical data and ensuring the success of the primary mission.

- **Secondary Mission:** Yonghan Du, Denis Romain, Aristeidis Sargkisian
  The Secondary Mission team works on the Secondary mission of the group which is suggested to be the targeted landing along with an active navigation system as well as the collection of data for the magnitude of the magnetic field.

- **Aerodynamics Simulations:** Ioannis Apostolopoulos, Adel Tooma
  This team specializes in simulating the aerodynamic behavior of the CanSat. They use software tools and mathematical models to optimize the CanSat's performance during descent.

- **Data Analysis:** Aristeidis Sargkisian
  This role involves processing and analyzing the data collected during the mission. The

Data Analysis team members examine the results of the primary and secondary mission collected from the various sensors and instruments to draw meaningful conclusions.

- **Construction:** Yubo Chen, Tanya Haroun, Zoi Tsaligopoulou
  The Constructions ream is responsible for physically assembling and interrogating all components of the CanSat, ensuring that it is built accurately and securely for the mission.

Each team plays a critical role in the success of the CanSat project , contributing their expertise and skills to various aspects of the mission, from design and construction to communication and data analysis.

Do you have a workspace available ?

Do you have access to a lab? How will you meet this need?

ACS Athens has a dedicated space for the CanSat project. This is the Innovation Lab in ACS Athens' Learning Common area sponsored by LEROY MERLIN.

Our workspace is in the Innovation Lab where original student projects are discussed, created and presented. The importance of an innovation lab in a school is of paramount importance for several reasons:

- ➢ New areas of interest as they relate to technology can be explored;
- ➢ Students embrace hand-on-activities;
- ➢ New, innovative solutions can be designed, tested, improved;
- ➢ Promotes critical thinking & an openness to adapt;
- ➢ Enhances confidence and creativity.

Various projects can be conceived and implemented in this specially designed space, such as the creation of robots, drones and energy saving equipment. We choose this workspace to be the starting point of our team and if there is a specific need that exceeds the potential of this Lab we will outsource the need to one of our sponsors / partners.

More information on the workspace: https://www.acs.gr/students_student_experience_innovation_lab/

How much time will you have available to work on your CanSat
How will you manage it?

Describe your work schedule (eg per week).

We will be meeting on a weekly basis, each Thursday for one and a half hours. The meetings are from 16:00 to 17:30 in the Innovation Lab of our School starting from September. As the team works further with both the primary and secondary mission there might be extra sessions to be scheduled. This could be adjusted later on.

Our monthly draft timeline is the following:

- **September:** Set up a team that will participate in CanSat in Greece Competition. Make the students familiar with the competition, the mission and the regulations. Start brainstorming ideas for our satellite mission.

- **October:** Set up a marketing team, write the application and get the team ready and organized for the CanSat project and the creation of the CanSat. This is a very important part of the mission as it could dictate how well the team organizes our time and supplies.

- **November:** Start working on the primary mission; gather all supplies for the primary mission; and test the whole primary mission to make sure it is fully functional to decide whether we can move on to the secondary mission without needing to backtrack or continue on adjusting the primary mission.

- **December:** The month of December is when the development of the secondary mission will begin. We will gather all supplies once again, and work on the guided landing system, as well as adding the magnetometer to the CanSat. This will be tested multiple times to ensure that our systems work as intended.

- **January:** Since December consists of a winter break, we will not be able to complete the secondary mission. Thus, during January, the secondary mission will be worked on further, and ideally a first version on it will be ready for testing and problem solving. This month will also be when testing will begin.

- **February:** If we are behind schedule with completing the secondary mission, this will be worked on during this month as well. Testing will also be a main part of this month, especially when it comes to the guided landed testing, which will be dropped off of a height for testing. Any damages done during testing will also have to be taken care of, as well as problem solving the electronics, hardware, and coding behind the secondary mission and parachute.

- **March:** March will include intensive problem solving and testing. As we reach closer and closer to the deadline, it is crucial that every component in the CanSat is fully functional.

- **April:** The S.M.A.L.L. Sat will be tested in full. This includes both the primary and secondary mission, and how they will work together, as well as the magnetometer, which is a smaller component of the secondary mission.

- **May:** May is the month of the competition. By this point, we should be on schedule, doing final tests and fixes for the final launch date. Godspeed to S.M.A.L.L. Sat!

How do you plan to cover your expenses?

Describe the plan for finding and using the necessary financial resources.

Our marketing team aims to look for sponsors and partners through social media accounts and engagement. We plan to raise funds through school events. The expected school events vary from bake sales to seasonal bazzars such as Halloween Bazaar and Christmas Bazaar that our CanSat team will organize in partnership with ACS Athens. We are also working with the Innovation Lab of ACS Athens which is supporting us by providing multiple tools to work with, a workspace for our meetings and support from various mentors in the field of Marketing, Soft Skills and many more.

Find more information about ACS Athens Open and The Institute here: https://theinstitute.gr/acsopen/

Do you have all the necessary equipment and materials required for the mission? If not, how do you plan to get them?

Our Innovation Lab which is sponsored by LEROY MERLIN provides our CanSat team with most necessary equipment and different materials to complete all the different parts of our project. These include:

- Multiple Tools (Drills, welder, razors, hot glue gun, protection glasses, etc)
- Sewing machines (x2)
- Ender 5 plus 3D printer (x1)
- PLA Filament
- Arduino UNO (x10)
- Arduino MEGA (x2)
- Arduino NANO (x2)
- Jumper cables
- Breadboards
- Multiple actuators like Piezos, Servo motors, LED, etc.
- Multiple Sensors like TMP sensors, Light sensors, etc.

For the materials we do not have already, we plan on obtaining them through sponsorships through social media and the marketing team or even purchasing them with funds from the team, earned from the fundraising plan of the marketing team as well .

Scientific Mission

What is your chosen secondary mission for your CanSat?

Describe the scientific and technological purpose of your secondary mission. At this point, the connection of the scientific purpose to the experiment you will perform should be apparent. Explain in detail how this will be achieved and highlight possible innovative elements.

The chosen secondary mission will consist of two components: the guided landing of the S.M.A.L.L. Sat and the incorporation of a magnetometer.

The guided landing will act as the technical aspect of the secondary mission, and will be conducted through the use of a RAM chute steered by pivot arms situated within the S.M.A.L.L. Sat . Using a software, the S.M.A.L.L. Sat will be able to interpret its momentary position in relation to the landing spot, as derived from an altimeter and GPS coordinates, and will steer itself accordingly. The guided landing will stimulate situations including sensitive aerial parcel delivery, collecting data for the magnetic field in places where ground stations are not present. We plan to compare our results with the data of SuperMAG magnetometers and as we can see in the picture below (Image 1) the SuperMAG ground stations are limited around the globe with no coverage above sea. Our CanSat will try to provide data for magnetic fields above areas with no data access.

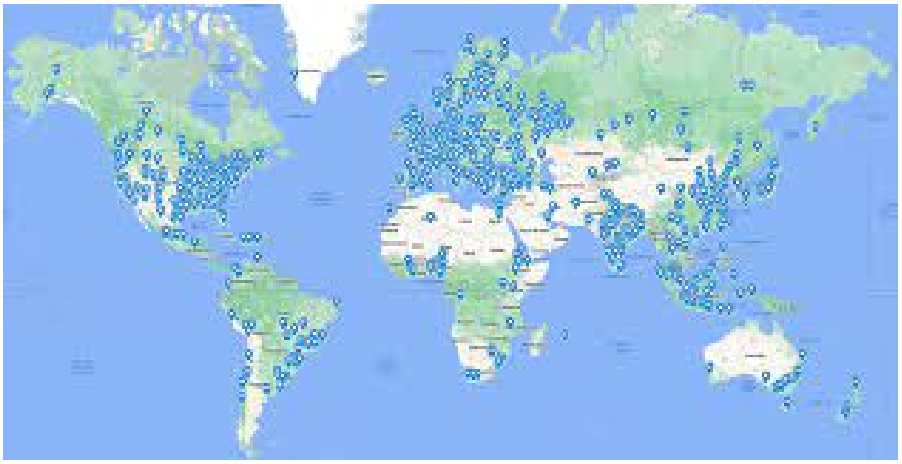

Image 1: SuperMAG Magnetometers location

Alternatively, the magnetometer will be the scientific component of the secondary mission, collecting data regarding the magnetic field, which will then be analyzed to predict and forecast magnetic storms. The significance of these forecasts include the evasion of cosmic radiation exposure in high altitude polar flights under conditions of geomagnetic storms, as well as the projection of disruptions in accurate Satellite communication and navigation.

Where did you get your idea from?

E.g. from a real satellite mission, a scientific article, a book, etc.

We drew our inspiration for our CanSat from the innovative combination of two key elements: a real satellite mission equipped with a magnetometer and a reusable satellite with a guided landing system. The mission that particularly piqued our interest and served as a model for our concept was NASA's Mars Science Laboratory (Curiosity Rover) mission and the pioneering developments in space exploration, specifically the concepts of reusable rockets pioneered by SpaceX and Virgin Galactic.

NASA's Mars Science Laboratory mission, featuring the Curiosity Rover is renowned for its impressie exploration of Martian Surface. The mission sparked our creativity for several reasons:

> Magnetometer on the Satellite: The Mars Reconnaissance Orbiter (MRO), one of the spacecraft in the Mars Science Laboratory mission, is equipped with a powerful magnetometer. This instrument is essential for studying the Martian magnetic field and gathering valuable data about the planet's geology and history. We found the ability to measure magnetic fields from orbit to be an intriguing and valuable aspect of space exploration.
> Magnetometer on the Rover: The Curiosity Rover itself is fitted with a magnetometer, which it uses to measure local magnetic fields on the Martian surface. This dual approach of studying magnetic fields from both orbit and the planetary surface significantly enhances the scientific understanding of the Martian environment. It also highlighted the importance of having a ground-based magnetometer for more detailed and localized measurements.

By emulating this concept in our CanSat mission, we aim to recreate a scaled-down version of the Mars Science Laboratory mission's dual magnetometer approach. Our CanSat will be designed to collect magnetic field data from a high-altitude perspective and data from already existing ground stations will contribute to re-create a configuration that is similar with the Mars Reconnaissance Orbiter and the Curiosity Rover. We believe this methodology will enable us to obtain comprehensive magnetic field measurements, which can have various applications in space science and research.

The second part of our mission focuses on targeted landing, drawing inspiration from groundbreaking developments in the space industry, particularly the pioneering work of companies like SpaceX and Virgin Galactic. SpaceX's achievements in reusable rockets have transformed space travel, and their emphasis on controlled descent and precision landing has significantly reduced the cost of space access. Here you may find a video of the first successful recovery of both fairings of one of Space X's rockets by using a Ram parachute.

Similarly, Virgin Galactic's approach to suborbital space tourism, with the SpaceShipTwo rocket plane, places great importance on precise landings, safety, and controlled descent for commercial spaceflight.

We have embraced these concepts in our CanSat project, aiming to replicate the principles of controlled descent and precision landing demonstrated by these industry leaders. Through the implementation of a glider mechanism and a parachute system, our CanSat seeks to achieve a precise landing, contributing valuable experience in controlled descent technology, a fundamental aspect of modern space exploration. By merging these two mission components, we aim to provide a holistic and enriching learning experience that mirrors the precision and scientific depth of real-world space missions.

What data will you capture and how?
What do you plan to do with the results of your measurements after launch?

Analyze processes / methodologies you will follow to draw conclusions required by your secondary mission.

The primary mission will include data collections of atmospheric pressure, temperature, and geographic coordinates. This data will be gathered with a barometer sensor (eg. BMP280) and a GPS (eg. adafruit ultimate breakout). The data will be both stored locally on the CanSat with a microSDcard, as well as transmitted to the ground station by using telemetry. All data will then be analyzed and presented by the team in order to extract useful information from the mission.

As for the secondary mission, we will be putting the data gathered from the magnetometer on the CanSat through analysis and calculations to forecast magnetic storms and/or substorms, and the GPS data will be going through an algorithm for the Smart autonomous guided landing system. The raw data from the magnetometer will eventually be plotted into a graph and compared with existing ones from SuperMAG to capture the abnormalities and/or characteristics in order to forecast magnetic weather. The GPS data will both be stored on board of the CanSat and transmitted back to our station through Telecommunication. The on board GPS data will be used for live adjustment of the CanSat flying path in order to achieve guided landing. With the support of guided landing and data from the magnetometer our CanSat has a purposeful real-life application of forecasting magnetic weather and providing data for the magnetic field at locations without access to a stationary magnetic-substorm forecast station such as pacific ocean areas.

Promotion Plan

Describe your business promotion plan before, during and after the CanSat in Greece competition.

E.g. articles in newspapers, local radio, website, presentation at the institution , etc.

Our promotion plan for the CanSat in Greece competition is designed to ensure maximum visibility and engagement before, during and after the event. Here are the key components of our promotion plan:

Before the Competition:

- **Website Creation**: We will develop a professional and user-friendly website dedicated to our CanSat project. This website will serve as a central hub for information about our mission, team members, technical details and updates. It will be an informative resource for anyone interested in our project.
- **Social Media Presence**: We will establish a strong presence on popular social media platforms such as Facebook, Twitter and Instagram. These platforms will be used to share regular updates, behind the scenes glimpses of our projects and engage with our audience. We aim to foster a supportive online community of supporters, sponsors and fellow enthusiasts.

During the competition:

- **Live Updates**: Throughout the competition, we will provide real time updates on our website and social media platforms. This includes sharing our experiences, challenges and successes as they happen.
- **Interactive Content**: We plan to engage with the audience through interactive content such as polls, quizzes and Q&A sessions. This will not only inform our audience about the competition but also create a sense of involvement and excitement.
- **Networking**: During the competition we will actively network with other participating teams, judges and attendees.

After the Competition:

- **Detailed Documentation**: After the competition we will provide detailed documentation of our CanSat mission, including a post-competition report, technical documents and analysis of results. This will be shared on our website and through social media.
- **Sponsors Acknowledgment**: We will express our gratitude to our sponsors through personalized thank-you messages on our website and social media. This will highlight their support and encourage future sponsors.