



The 2021 World CanSat/Rocketry Championship for the African Continent and Middle East | WCRC2021 Africa and Middle East |

1. INTRODUCTION

The **World CanSat/Rocketry Championship** (hereinafter: **WCRC**) is generally an international competition open to elite competitors from around the World, representing their nations (as university student Teams or as independent student Teams), and winning this **Championship** will be considered the highest or near highest achievement in this field.

More information about the **WCRC** can be found at:

1. https://wcr.world/Files/WCRC_Founding_Act.pdf
2. <https://wcr.world/>

What is a CanSat?

A CanSat is a simulation of a real satellite, integrated within the volume and shape of a soft drinks 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 by a

rocket, or dropped from a platform, drone or captive balloon. Then its mission begins. This involves carrying out a scientific experiment, achieving a safe landing, and analysing the data collected.

Educational value of the CanSat project

Through the CanSat project, the participating student teams experience all the phases of a real space project, from selecting the mission objectives, designing their CanSat, integrating the components, testing the system, preparing for launch, and analysing the scientific data obtained. Throughout this process the students:

- learn by doing,
- 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 the importance of coordination and teamwork,
- enhance their communication skills.

Miscellaneous

Tunisia is the northernmost country in Africa. It is a part of the Maghreb region of North Africa, and is bordered by Algeria to the west and southwest, Libya to the southeast, and the Mediterranean Sea to the north and east; covering 163,610 km², with a population of 11 million.

Tunisia's climate is Mediterranean in the north, with mild rainy winters and hot, dry summers. The south of the country is desert. The terrain in the north is mountainous, which, moving south, gives way to a hot, dry central plain. The south is semiarid, and merges into the Sahara.

Among Tunisia's tourist attractions are its cosmopolitan capital city of Tunis, the ancient ruins of Carthage, the Muslim and Jewish quarters of Jerba, and coastal resorts outside of Sousse. According to The New York Times, Tunisia is "known for its golden beaches, sunny weather and affordable luxuries".

2. COMPETITION PHASES

The **WCRC2021 Africa and Middle East** consists of 3 phases:

1. Phase 1 – Preparation of the **WCRC2021 Africa and Middle East** launch campaign
2. Phase 2 – **WCRC2021 Africa and Middle East** launch campaign
3. Phase 3 – Post-launch campaign activities

Student team eligibility conditions

In order for a student team to be accepted in the competition the following conditions have to be fulfilled:

- 1) Each team must have 3 members, respecting one of the following conditions:
 - All 3 team members are students enrolled full-time in a University or Similar Higher Educational Institution.
 - 2 team members are students enrolled full-time in a University or Similar Higher Educational Institution and 1 team member is their Professor/Mentor. (**RECOMMENDED**)
- 2) Elementary and secondary education students cannot participate in this competition.

Phase 1 - Preparation of the WCRC2021 Africa and Middle East Launch Campaign

All teams participating in the **WCRC2021 Africa and Middle East** launch campaign will have to carry out technical work on their CanSats, applying the procedures used in the typical lifecycle of a real space project, which are:

- Selection of Mission Objectives;
- Definition of technical requirements necessary to achieve these objectives;
- Design of hardware and software;
- Design of ground station/ground telecommunication system;
- Integration and testing of the CanSat before the launch campaign starts;
- Recording (making video materials) during **Phase 1** and **Phase 2**.

Phase 2 - WCRC2021 Africa and Middle East Launch Campaign

The highlight of the **WCRC2021 Africa and Middle East** is the launch campaign, taking place from 4 to 6 October 2021. The launch campaign will be realized at the CRMN. The CanSat of each team will be launched by a rocket/Drone. The CanSats will then separate from the rocket/Drone, conduct their missions, and land on the ground to be recovered by the teams. The teams' CanSats must be flight-ready in time for the launch campaign.

A Jury of experts will be nominated by CRMN to evaluate the teams and their work. The Jury will select the winning teams based on the criteria listed in Section 4.

Outline of the Launch Campaign:

CRMN/ Date / Time	Teams Arrive
CRMN/ 04-10-2021/ 9h	I Static Display of CanSat, Parachutes, GS/Antenna, Posters and Design/Development/Testing/Test Flight Process etc by Teams and First Technical Inspection of CanSats by the Jury Members II CanSats Launch (Rocket) and Evaluation by the Jury Members
CRMN/ 05-10-2021 / 9h	III Presentation by Teams (How the Team was preparing for the competition, Making of CanSat, What happened during launch, Flight Analysis, Data Analysis etc. / Please look at <i>Point 4.2</i> below) to the Jury Members Presentation of Results / Distribution of Prizes/Awards Ceremony Valedictory Function/Group Photo Session/Closing
CRMN/ 06-10-2021 / Time TBD	Other Activities: Excursions/Sightseeings Sideline Meetings/Interactions Teams Depart

Phase 3 – Post-Launch Campaign Activities

After the launch campaign ALL teams will be requested to prepare and submit their CanSat Report (CR) and Video Clip made from recorded video material. The report should be limited to a maximum of 10 pages and must summarize the work done before, during, and after the launch campaign, with a special focus on the results obtained (data analysis etc.). All reports and Video Clips then will be published by WCRC to the International Community.

The CanSat Report (CR) and Video Clip has to be submitted to CRMN at **lazreg.nissen@yahoo.fr** by 1st November 2019, 22:00 CET, stating the name of the team and of the document submitted in the subject line (e.g. “**Team Name CanSat Report**”). The document should be sent in a pdf format, using the following file name format: **Team Name CanSat Report.pdf** . The Video Clip format is mp4.

The form of the Report is defined by the each team independently (free form).

3. MISSION OVERVIEW

The **WCRC2021 Africa and Middle East** is designed to simulate all aspects of a real satellite mission, including design, development, testing, launch, operations, and data analysis, by means of teamwork.

3.1 The Rocket/Drone Launch

The rockets/Drone for the launch campaign will be provided by the CRMN.

The rocket/Drone would deploy its parachute at apogee, together with the CanSat. Just after the apogee (0-2 seconds later), the CanSat would separate from the rocket/Drone and make separate parachute descent. Recovery of the CanSat cannot be guaranteed. However, it is advised to integrate with the GPS for its easy location and/or with additional beacons.

3.2 CanSat Mission

The team must Build a CanSat and Program it to accomplish the following Compulsory Mission:

To measure Air pollution, after release and during descent, and transmit these data as telemetry to the ground station at least once every 2 seconds.

During the post-flight analysis, it must be possible for the team to analyze the data obtained and display it in graphs. However, teams can have their own additional features as they wish or capable to demonstrate during the mission.

3.3 CanSat Technical Requirements

The CanSat hardware and mission must be designed following these requirements and constraints:

1a. All the components of the CanSat must fit inside a standard soft drink can / or similar structure (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.

- 2a. The antennas, transducers and other elements of the CanSat cannot extend beyond the can's diameter until it has left the launch vehicle.
- 3a. The mass of the CanSat must be a maximum 300 grams.
- 4a. 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 CRMN, Material Safety Data Sheets (MSDS) may be requested from the teams.
- 5a. The CanSat must be powered by a battery. It must be possible for the systems to remain switched on for four continuous hours.
- 6a. The battery must be easily accessible in case it has to be replaced/recharged.
- 7a. The CanSat must have main power switch.
- 8a. Inclusion of a positioning system for retrieval (beeper, radio beacon, GPS, etc.) is recommended.
- 9a. The CanSat must have a recovery system (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.
- 10a. CanSat must have minimum 1 parachute attached. The strength of the parachute must be tested to ensure that the system will operate nominally.
- 11a. The CanSat must be able to withstand an acceleration of up to 20 g.
- 12a. It is recommended that teams pay attention to the design of the CanSat in terms of hardware integration and interconnection, so that the radio frequency can be easily modified if necessary.
- 13a. The CanSat must be flight-ready upon arrival at the launch campaign.

3.4 Meeting the Requirements for the Launch Campaign

To verify that the CanSats are suitable for launch, a technical inspection will take place at the beginning of **WCRC2021 Africa and Middle East** Launch Campaign. The way the requirements are evaluated is as follows:

- Requirements 1a, 2a, 3a, 7a, 10a and 13a will be evaluated on site during First Technical Inspection by a specially appointed CanSat Technical Team. Teams that don't pass some requirements during evaluation 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 chance, the team will be considered not to have achieved flight status and their CanSat won't be approved for launch.

4. EVALUATION AND SCORING

4.1 The Jury

The Jury, appointed by CRMN, will be comprised of CanSat Experts, Education Experts, or Engineers and Scientists who will evaluate the teams' performances during '**Phase 2 – WCRC2021 Africa and Middle East Launch Campaign**'. The Jury members will score the teams during the launch campaign and announce the results from their scoring at the end.

The Jury will typically have 3-5 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)
- Rocketry Expert(s)

4.2 Scoring

Performance in the following areas will be evaluated:

A. Technical Achievement

The Jury will take into account how the teams obtained the results, how reliable and robust the CanSat was, visual appearance 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 Mission*: The CanSat's technical performance in terms of deployment and data collection for the mission.

B. 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 analyze 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*: Display Posters for Static Display Describing the CanSat Design and

Development/Integration and Working along with Special Features! etc.

C. 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.
- *Communication*: Oral presentation skills, the ability to provide a captivating presentation.

D. Outreach

The team will be rewarded with additional points based on explanation: How the project is communicated to the university and the local community, taking into account of the following:

- *Web Pages, Blogs, Presentations, Promotional Material, Media Coverage etc.*

4.3 Marking Scheme

The overall balance between the items to be evaluated is as follows:

Technical Achievement	30%
Scientific Value	30%
Professional Competencies	20%
Outreach	20%

TOTAL	100%

4.4 Prizes

- 1st Prize - Qualified to participate in the World Finals
- 2nd Prize - Qualified to participate in the World Finals
- 3rd Prize - Qualified to participate in the World Finals
- 4th Qualified to participate in the World Finals
- 5th Qualified to participate in the World Finals
- 6th Qualified to participate in the World Finals
- 7th Qualified to participate in the World Finals

The following rule will apply:

- *A team can't receive more than one prize!*
- *Special Jury Awards may be presented to Unique Approaches of Team(s) for their Novelty!*
- *If one or more of the qualified teams cannot participate in the World Finals, the team/s from the extended list enters the list of qualified!*

5. LOCATION OF COMPETITION

CRMN Novation City Sousse 35.8177° N, 10.5957° E

<https://www.google.rs/maps/place/CRMN/@35.8192571,10.5934384,17z/data=!4m5!3m4!1s0x12fd8aeb27aba6f7:0x46c3599f3841541d!8m2!3d35.817739!4d10.59567>

6. PARTICIPATION FEES

Basic fees:

75€/participant = 225€/team
(Payment to CRMN)

Additional fees:

- Transportation costs to Tunisia must be covered by participants/teams by themselves.
- If participants/teams come by plane, the transportation from Airport to accommodation place and vice versa will be covered by themselves.
- Accommodation and meals costs must be covered by participants/teams. With the exception of the lunch meals at the event site that will be covered by CRMN.
- As far as accommodation is concerned, since the situation is unclear because of COVID-19, CRMN will send a list of the cheapest hotels so applicants can manage according to their choices.

7. ORGANIZER

CRMN (Tunisia) under WCRC is organizer of the competition.

8. APPLICATION AND DEADLINE FOR APPLICATION

Please apply via email: lazreg.nissen@yahoo.fr

Deadline: **31/08/2021**

9. CONTACT

<p><i>Center for Research in Microelectronics and Nanotechnology (CRMN)</i> <i>Sousse Technopole, Novation City, Sousse,</i> <i>Tunisia</i> <i>Contact Person : Nissen Lazreg</i> <i>Email : lazreg.nissen@yahoo.fr</i> <i>Telephone: 00216 53 231 633</i></p>	<p><i>The WCRC website:</i> <i>https://wcr.world/</i></p>
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