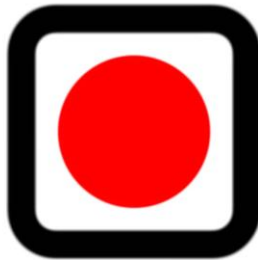




RESPONSIBLE ORGANIZER in front of the *WCRC Consortium*:

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The
World CanSat/Rocketry Championship
World Finals
| 2021/22 |

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 an independent student Teams), and winning this event will be considered the highest achievement in this field. The **WCRC** is managed by a *WCRC Consortium* (<https://wrc.world/>).

The **WCRC** consists of 3 phases:

Phase 1 – *National CanSat/Rocketry Competition* as qualification for *Continental CanSat/Rocketry Competition*. In this Competition student Teams participate across their own State. If the State does not have a *National Competition*, then all student Teams can directly participate in the *Continental CanSat/Rocketry Competition* (i.e. Phase 2);

Phase 2 – *Continental CanSat/Rocketry Competition* as qualification for the *World Finals*;

Phase 3 – *World Finals CanSat/Rocketry Competition*;

Due to the pandemic situation for the 2021/22 competition period, all *National* and *Continental competitions* have been canceled and all teams can participate directly in the *World Finals*. For the period 2022/23, the **Championship** will be realized through all phases (if the pandemic situation allows it).

1.1 Background

What is a CanSat?

A CanSat is a simulation of a real satellite. All components are housed inside a can up to 350 ml. CanSat provides an affordable way to gain basic knowledge and skills in Space engineering for teachers and students, as well as experience engineering challenges when designing Satellites. Students are able to design and build a small electronic payload that can fit into the cans to 350 ml. CanSat is launched by Rocket, Balloon, Plane or Drone and delivered in apogee. With the Parachute, the CanSat slowly descends to the ground and carries out its mission during descent (for example: measures air pressure and temperature and sends telemetry). By analyzing the data collected by CanSat, students will explore the reasons for the success or failure of its mission.

Space engineering learning, based on the CanSat/Rocketry concept, enables students to gain hands-on experience through a specific interdisciplinary project. Since this is a Space engineering project, teachers and students will gain experience from mission defining, conceptual design, through integration and testing, to launching and actual system operation, ie experience from the whole Space project cycle and then participate in the CanSat/Rocketry competition with its peers at home country and abroad. One of the main advantages of the CanSat/Rocketry concept is its interdisciplinary: combination of mathematics, physics, informatics/programming, mechatronics, telecommunications, aviation and rocketry, mechanics, etc.. CanSat is a simulation of a real, large, Satellite and contains all the components as a real Satellite, but with limited complexity.

Benefits of CanSat/Rocketry Based Education:
CanSat/Rocketry is an effective educational tool for:

- Learning by doing;
- Involving students in technology and engineering as a practical complement to other, fundamental, subjects they study, such as mathematics and physics;
- Emphasizing teamwork where each student has a specific task/role that creates a sense of responsibility for him/her;
- Students gain experience of the complete process: defining the mission, design, development/constructing, programming, testing, launching and analysis;
- Simple conducting experiments with balloon/rocket/plane/drone;
- Learning methods can be adapted to the age level of students, or to their needs and abilities;
- Students are able to analyze the reasons for success or failure after descending CanSat and Rocket to the ground;
- Acquired knowledge and experience can be applied to other projects as this concept enables obtaining of ideas and stimulates student's thinking;
- Useful for a further education/career guidance process;
- Provide Opportunities and Network for Launching their Own Small Satellites to Low Earth Orbit in a frugal way!
- Provide Opportunities and Network for Sharing and Learning from each other teams from various countries.

1.2 Miscellaneous

WCRCWF2021/22 will be held at the same time with the European Championship in Rocket Modeling (under FAI). Serbia has traditionally hosted International Rocket Modeling Competitions, European and World Championships. It can be stated, as an interesting historical fact, that Serbia has organized the first World Championship in Rocket Modeling nearly 50 years ago.

The city of Novi Sad officially became European Capital of Culture on January 13 after a yearlong delay caused by the coronavirus pandemic. The European Capital of Culture designation was created by the European Commission to highlight the richness and diversity of cultures in Europe. Novi Sad's program during 2022 will follow the concept originally sketched out for 2021, which consists of four areas under the theme "For New Bridges". The program is designed to help the city develop its strategy for the sustainable development of its cultural sector with a focus on strengthening cultural institutions and participation, and renewing cultural heritage. Novi Sad citizens and visitors will be offered various cultural programs throughout the year, both from the popular and the alternative cultural scene. According to the organizers, Novi Sad will host more than 4,000 artists during the year (<https://novisad2022.rs/en/home-3/>).

Serbia is small and extremely rich country by nature. Since that the country is located at an excellent intersection of roads in Europe, Serbia has excellent connections with other parts of the world, especially with Asia and Africa. Serbia is not an EU country and therefore has a flexible VISA regime with most countries in the world. Also, the cost of living is much lower than the costs in the EU countries and belongs to the lowest in Europe. Transportation/travel to Serbia is very affordable and the country does not have certain aggravating circumstances for entering the country due to migrant's crisis. **Come to Serbia and feel like at home.**

2. WCRC WORLD FINALS COMPETITION PHASES

The **WCRC World Finals 2021/22 (WCRCWF2021/22)** consists of 3 phases:

1. Phase 1 – Preparation of the **WCRCWF2021/22** launch campaign
2. Phase 2 – **WCRCWF2021/22** launch campaign
3. Phase 3 – Post-launch campaign activities

Student team eligibility conditions

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

1.)

Each team must have 3-5 members, respecting one of the following conditions:

- All 3-5 team members are students enrolled full-time in a University or similar Higher educational institution and come to the competition **without** a Professor/Mentor.
- All 3-5 team members are students enrolled full-time in a University or similar Higher educational institution and come to the competition **with** a Professor/Mentor.

Which means: 3-5 team members + 1 Professor/Mentor. (**RECOMMENDED**)

2.)

Each team is expected to do the following:

- Define a TEAM NAME,
- Bring 2 state flags to the competition,
- Bring National anthem on USB Flash stick,
- Wear the same colorful shirts,
- Appoint a team leader,
- Appoint a person from team who will video record the team activities during the competition.

3.)

Elementary and secondary education students cannot participate in this competition.

Phase 1 - Preparation of the WCRCWF2021/22 launch campaign

All the teams participating in the **WCRCWF2021/22** 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.

Phase 2 - WCRCWF2021/22 launch campaign

The highlight of the **WCRCWF2021/22** is the launch campaign, taking place from 25th to 29th September 2022. The launch campaign will be realized at 2 places in Serbia. The first place is launch spot Aradac located in the Zrenjanin municipality. The second place is in the city of Novi Sad. All teams will be accommodated in Novi Sad and all activities except CanSat launches will take place in Novi Sad (see table below). During activities in Aradac all CanSats will be launched by Rockets. The team's CanSats must be flight-ready in time for the launch campaign. The teams will by themselves assemble motors and parachutes to their Rockets at the launch spot Aradac. Video instructions on how to do this will be sent to each team in a timely manner. The Rocket and motor will be given to each team by the organizer, and the parachute for the Rocket team will make it independently and bring to Serbia. On the launch spot Aradac will be people from the host side to assist in case the teams have never handled Rockets to oversee any kind of mishap.

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

Outline of the launch campaign:

Day 1 / 24 th September	<ul style="list-style-type: none"> • Teams arrive to city of Novi Sad
Day 2 / 25 th September	<ul style="list-style-type: none"> • Team briefing, only for team leaders, at 6PM
Day 3 / 26 th September	<p>At 8:00 AM teams departure with buses to the field (launch spot Aradac located in the Zrenjanin municipality)</p> <p>-----</p> <p>From 9:00 AM to 9:00 PM activities on the field (launch spot Aradac located in the Zrenjanin municipality):</p> <ul style="list-style-type: none"> • Opening, • Review of the rules, • Technical inspection of CanSats by Jury, • Teams interviewing and promoting their products (if any) through LIVE BROADCASTING, • Assembling motors and parachutes to the Rockets by teams <i>(Video instructions on how to do this will be sent to each team in a timely manner!)</i>, • Launch of CanSats and recovery, • Return to Novi Sad.
Day 4 / 27 th September	<p>Free day (Novi Sad):</p> <ul style="list-style-type: none"> • for fun/sightseeing, • for Presentation/Technical Report preparation, • for CanSat Report (CR) preparation.
Day 5 / 28 th September 8:00 AM	<p>Presentations/Technical Reports by one representative of each team in the place provided for that in Novi Sad</p> <p>-----</p> <p>Preparation of CanSat Report (CR) by the rest of the team and submission by 8:00 PM</p>
Day 6 / 29 th September Time: TBD	<p>At the Banquet:</p> <ul style="list-style-type: none"> • Proclamation of the winner(s) / Prizes ceremony • Closing
Day 7 / 30 th September	<ul style="list-style-type: none"> • Teams depart

After the launch of CanSats ALL teams must prepare and submit their CanSat Report (CR). The CR should be limited to a maximum of 10 pages and must summarize the work done before and during the launch of CanSats, with a special focus on the results obtained (data analysis etc.). All CRs then will be published by the *WCRC Consortium* to the international community.

The CanSat Report (CR) has to be submitted to the *WCRC Consortium* representative by 18th August, 8:00 PM via USB flash drive or email (the email will be published later), stating the name of the team and country (e.g. “**TeamName_Country_CR**”). The document should be in a pdf format, using the following file name format: **TeamName_Country_CR.pdf**

The form of the CR is defined by the each team independently (free form). **The content of the CR is not scored but its submission is mandatory! A team that does not submit a CR will be disqualified!**

Phase 3 – Post-launch campaign activities

After the launch campaign ALL teams must send to the *WCRC Consortium* the video materials they made during the preparations and participation in the World Finals. The *WCRC Consortium* will publish all videos in its media and make them available to the international community.

3. MISSION OVERVIEW

The **WCRCWF2021/22** is designed to simulate all aspects of a real Satellite/Space mission, including design, development, testing, launch, operations, and data analysis, by means of teamwork.

3.1 The Rocket launch

The Rockets for the launch campaign will be provided by the organizer.

The Rocket 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 and make separate parachute descent.

3.2 Primary and secondary CanSat missions

1. *Primary mission*

The team must build a CanSat and program it to accomplish the following compulsory primary 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.

2. *Secondary mission*

Each team through its Ground Station must be able to send a telecommand (uplink) to CanSat, during the descent, which must be possible to register visually by the Jury (e.g. deploy of some parts, fake solar panels, antenna, door, National flag etc.. Literally anything that can be seen from the ground).

3.3 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 drinks can (115 mm height and 66 mm diameter), with the exception of the CanSat parachutes. 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 between a minimum of 100 grams and a maximum of 150 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 please contact *WCRC Consortium* representative (organizer).

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. The CanSat must be power OFF inside the Rocket.

8a. Inclusion of a positioning system for retrieval (beeper, radio beacon, GPS, etc.) is recommended.

9a*. The CanSat must have a recovery system (**a 3 parachutes attached to the CanSat**), capable of being reused after launch. It is recommended to use bright coloured fabric, which will facilitate recovery of the CanSat after landing.

10a. The opening of the CanSat parachutes will be scoring. The strength of the parachute must be tested to ensure that the system will operate nominally.

11a. 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.

12a*. The CanSat must be flight-ready upon arrival at the launch campaign.

13a*. Each team makes a Parachute for the Rocket for recovery and brings it to the competition.

14a. The opening of the Rocket parachute will be scoring.

(Video instructions for making a Rocket parachute will be sent to each team in a timely manner!)

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 **WCRCWF2021/22** Launch Campaign on the field (launch spot Aradac located in the Zrenjanin municipality). The way the requirements are evaluated is as follows:

* Requirements 1a, 2a, 3a, 4a, 7a, 9a, 12a, 13a will be evaluated on site by a specially appointed CanSat technical team. Teams that don't pass some requirements during evaluation **will be disqualified!** **Teams will also be disqualified if the primary and/or secondary mission is not accomplished!**

4. EVALUATION AND SCORING

4.1 The Jury

The Jury, appointed by the *WCRC Consortium*, will be comprised of CanSat experts, education experts, or engineers and scientists who will evaluate the team's performances during '**Phase 2 – WCRCWF2021/22 launch campaign**'. The Jury members will score the teams during the launch campaign and announce the results from their scoring during the last day of the competition.

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 Primary mission: The CanSat's technical performance in terms of deployment and data collection for the Primary Mission. Number of CanSat's parachutes opening etc.
- Performance of the Secondary mission: Whether the Secondary mission was realized or not.

B. Scientific value

The scientific value of the team's missions and the team's scientific skills will be evaluated. This includes the scientific relevance of the mission, the quality of the technical reporting 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.

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/state community, taking into account web pages, blogs, presentations, promotional material, media coverage, video material from CanSat development process etc.

4.3 Marking scheme

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

Technical achievement 35%
Scientific value 35%
Professional competencies 20%
Outreach 10%

TOTAL 100%

4.4 Prizes

- 1st Prize
- 2nd Prize
- 3rd Prize

The following rule will apply:

- A team can't receive more than one prize.

5. LOCATIONS OF THE COMPETITION

1.) City of Novi Sad:

<https://www.google.com/maps/place/Novi+Sad/@45.27143,19.7794015,12z/data=!3m1!4b1!4m5!3m4!1s0x475b10613de93455:0xb6f7d683724fe28!8m2!3d45.2396085!4d19.8227056>

2.) Launch spot Aradac located in the Zrenjanin municipality:

<https://www.google.com/maps/place/Aradac/@45.3723521,20.2155928,12z/data=!3m1!4b1!4m5!3m4!1s0x475adeab27896eef:0xc2659ad50e4687bd!8m2!3d45.3763341!4d20.2952485>

6. PARTICIPATION FEES

Basic fees:

120€/participant

(payment via PayPal to CSPD until 15th Jun 2022)

Additional fees for participants:

Transportation costs to Serbia must be covered by participants/teams.

If participants/teams come by plane, the transportation from Airport “Nikola Tesla” to accommodation place and vice versa will be covered by participants/teams.

Accommodation and meals costs must be covered by participants/teams.

Organizer covers:

The costs of transferring teams from accommodation to launch spot Aradac and back are covered by the organizer.

Rockets and motors are covered by the organizer.

Costs for participation on the Banquet during proclamation of the winner(s), prizes ceremony and closing are covered by the organizer.

7. SUPPORTERS AND CO-ORGANIZERS

- WCRC Consortium;
- Aero Club “Sremska Mitrovica”;
- Aeronautical Union of Serbia;

8. APPLICATION AND DEADLINE FOR APPLICATION

Please apply via email: wrcserbia@gmail.com

Deadline: **15th Jun 2022**

9. RESPONSIBLE ORGANIZER

Committee for Space Programme Development (CSPD)

/ WCRC Consortium member /

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