

robotex

International

MOON ROVER
COMPETITION

COORDINATOR FOR THIS COMPETITION

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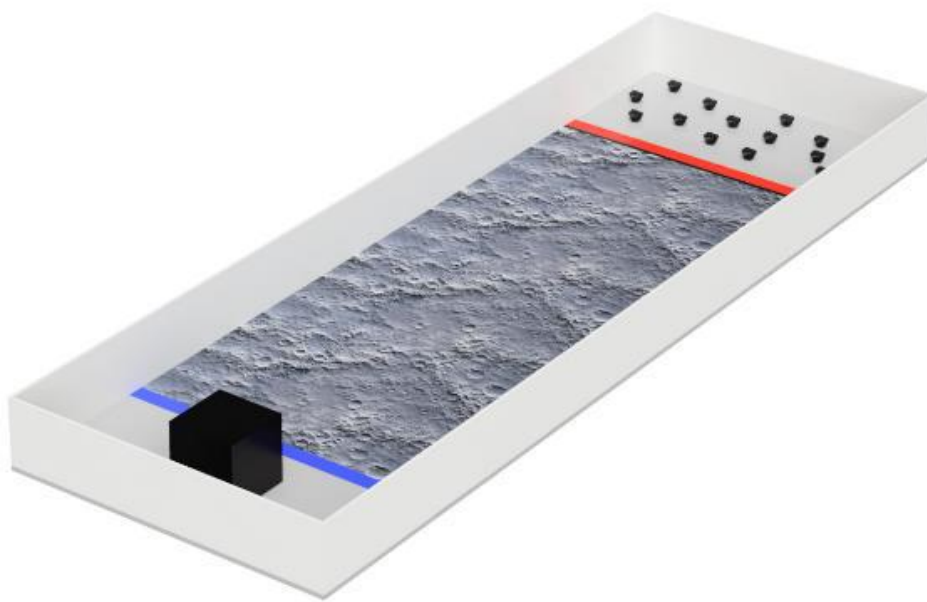
1 Introduction

The aim of the competition is to imitate the obstacles faced by Moon exploration. The teams need to design and build a moon rover that can traverse the difficult terrain of the moon, gather samples and then return to home base. The limitations set for building the rover are dimensions, weight and budget.

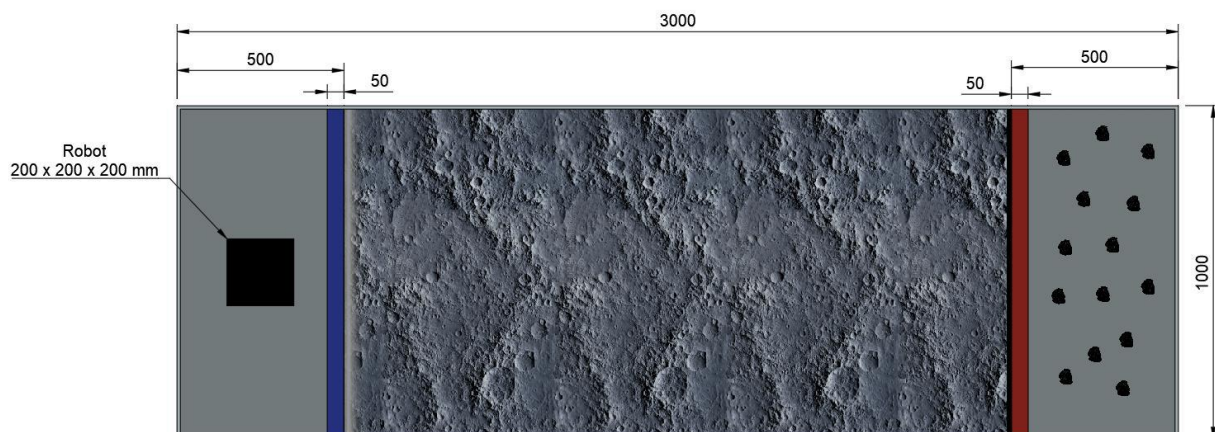
2 The competition field

1. The competition area is approximately 1000 x 3000 mm in size.
2. There is a white wall surrounding the competition area that is 20 ± 1 cm in height.
3. At the start of the competition area there is a home base approximately 1000 x 500 mm in size. Home base area is flat.
4. The end of the home base is marked by a 50 mm wide blue line (RAL 5005 blue).
5. At the end of the competition area there is a sample gathering area, the start of which is marked by a red line.
6. The size of the sample gathering area is approximately 1000 x 500 mm. Sample gathering area is flat.
7. The start of the sample gathering area is marked by a 50 mm wide red line (RAL 3020 red).
8. The terrain contains different obstacles that imitate the surface of the moon such as open ground (granite sand), rocks and craters. The color of the terrain is neutral (gray, but can contain black elements on the rocks or in the craters).
 - Max. depth of craters will be 30 mm (compared to surrounding ground), min. diameter 50 mm.
 - Open ground is imitated by granite sand (fraction 2-6 mm):
<https://uninaks.ee/en/toode/graniitliiva-amber/>
 - Rocks are put on the field as obstacles for the robot. Their minimum size is around 100 x 100 x 100 mm. Rocks are put so that it is difficult to follow the walls of the field.

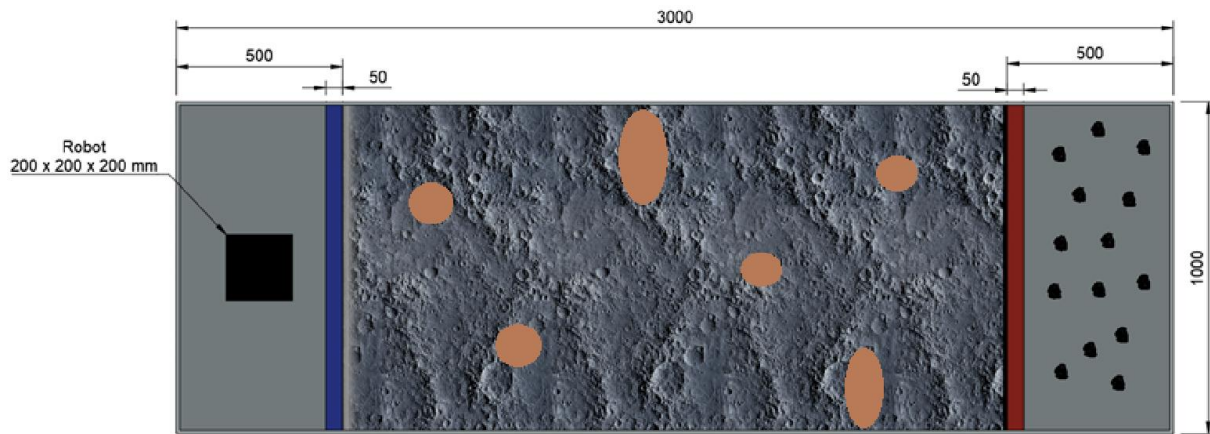
9. There are a total of 10 samples in the sample gathering area. The samples will be put into preassigned places which will be unknown to the competing teams.
10. The samples themselves are 3D-printed rock-like elements (approximately 45 x 37 x 39 mm), which are colored green (RAL 6029 green). The file for 3D-printing the samples for testig can be found on this link:
https://drive.google.com/drive/folders/1osSsucf3RKD2XCjmY5Ei-tMa_mCdAl-H
(Author of the file is Will Mckay: <https://www.thingiverse.com/brexit/designs>)
11. The sample gathering area will also contain fake obstacles, e.g. regular grey rocks that are approximately the same size as the samples. Color of the rocks RAL 7040.



Drawing 1 - Example drawing of the competition field



Drawing 2 - Example drawing of the competition field with dimensions (in millimetres)



Drawing 3 - Example of obstacle rocks positioning (Just an example - will be different on competition day)



Drawing 4 - Terrain example (up close)



Drawing 5 - Terrain example (pictured further away)

3 The criteria for robots

1. The robot must be autonomous.
2. The maximum dimensions of the robot during starting position are 20 x 20 x 20 cm and mass 2 kg.
3. The robot may increase in size after starting up to +10 cm to all dimensions (meaning the robot can increase its size to be 30 x 30 x 30 cm after the start).
4. The maximum budget for building the robot is 150€ (VAT included). The price of components must be shown and submitted as a separate table. The components that the team possessed before the challenge must be assigned a value that is equal or near to the market value of those components. **NB! If the jury sees that the cost of building the robot clearly exceeds the budget, the jury reserves the right to disqualify the team from competing.**
 - These criteria also prohibit the usage of study robots such as LEGO NXT, EV3, Spike as well as Makeblock mBot etc.
 - The cost of simpler structural elements is not counted towards the budget, such as 3D printed elements and plywood / plex glass details.
5. The robot cannot damage the competition field nor be dangerous to spectators.
6. The robot cannot use a voltage higher than 24 V.
7. The robot must have a start / stop button or a remote controller to start and stop the robot.

4 The competition

1. The competition takes place in 3 rounds. Each team has 1 attempt per round.
2. The team who gathers the most points wins. The points are distributed in the following manner:
 - 2.1. Driving through the whole course successfully (from base to the sample area and back to base) gives **+20 points**. To be counted towards successful navigation means crossing the line of the sample area (from top-down view) and crossing the line of the home base (from top-down view).

- 2.2. The robot may go to the sample area and back multiple times during one try however the points for successful navigation are only given once per attempt (meaning going back and forth does not stack +20 points per cycle).
- 2.3. Each sample that is collected and successfully brought back to the home base gives **+5 points**. The samples do not have to be brought back in one go and thus the robot may move back and forth gathering samples multiple times.
- 2.4. Each incorrect sample (regular rock) that is brought to home base gives **-10 points**.
- 2.5. The robot will be inspected by a jury pane which awards a maximum of **+20 points** for the following criteria:
 - 2.5.1. General solution and budgeting: **5 points**
 - 2.5.2. Software design and solution logic: **5 points**
 - 2.5.3. Teamwork and work distribution: **5 points**
 - 2.5.4. Design (visual aesthetic and cleverness in design): **5 points**.

[BONUS] The team gets **+20 points** if the robot can operate on energy received from solar panels. The robot may recharge its batteries before each attempt without having to use solar panels, however during the attempt it must be proven to the jury that the robot can operate using only solar energy from solar panels.

3. Points for successfully completing the course and gathering the samples are summed up from all three rounds and the jury points are added on top of this score.
4. Each attempt can yield a maximum of 70 points (20 points for navigation + 5 x 10 points for sample gathering). For all three attempts then it is possible to gather a maximum of $3 \times 70 = 210$ points. Adding the jury score (of up to 20 points) and the bonus points (up to 20 points) to the 3 attempts score yields a maximum of **250 points** for the whole competition.
5. The robots must start their attempt on the command of the competition judge.
6. The robot must start moving a maximum of 3 seconds after the start command. If the robot does not start moving within 3 seconds of the start command, the attempt is counted unsuccessful.
7. The maximum time for completing all assignments is 3 minutes. Surpassing this

limit all other actions are discounted towards the attempt.

8. If no robot can complete the course in 3 minutes, the robot that reaches the furthest wins.
9. One team can have up to 3 team members.

5 Organization

1. The organizers do their best to ensure smooth lighting conditions during the competition, however they cannot guarantee an arena without shadows with perfectly distributed lighting conditions. **The arena has at parts uneven lighting and infrared noise, which may disrupt the work of sensors during the competition. For this reason, the organizers recommend using covers or blinds for sensors, testing the sensors under intense lighting conditions or even under direct sunlight to imitate the lighting conditions of the competition arena.**
2. The robot must be registered before the competition. The registration process includes technical inspection of the robot, marking the robot with a number sticker, and the order number will be drawn.
3. Technical inspection must be completed by the time that is specified by the organizers.
4. All questions and problems arising during the competition are solved by the referee.
5. The final decision regarding any appeals is made by the referee and/or the organizers. All complaints must be reported to the referee during the match or right after the ending of the match. Complaints filed later will not be accepted. The final decision regarding any disputes or inconsistencies is always made by the referee.

6 Amendments to rules

Changes and amendments to the rules are made by the competition coordinator according to the competition organization committee regulations.



7 Change history

- 19.10.2024, Paragraph 2.8 – specified obstacles.
- 19.10.2024, Paragraph 2.11 – added sample pictures, specified color of the rocks.