ERC EUROPEAN ROVER CHALLENGE

PRO Rules

2018

www.roverchallenge.eu

Table of contents

Change record

Date	Section	Description
01.02.2018	All	Preliminary public document version

1. General information

1.1. What is ERC

The European Rover Challenge (ERC) is an integrated programme towards technological development specifically in a area of space exploration and utilization. The ultimate goal of ERC is to become standardised test trials and benchmark for planetary robotic activities with strong professional career development platform.

ERC is split between two program tracks. ERC-Student delivers career development platform with major focus on space engineering. It includes workshops, and all year activities and mentoring around designing and building student planetary rover. All the effort is finalised by yearly event where student teams compete on specially landscaped area.

Second track, called ERC-Pro is designed to provide opportunity to demonstrate abilities in solving field tasks inspired by space robotics roadmaps. It is suited for startups, any companies, research groups and others working in space robotics domain. On the other hand, those not yet connected with space industry and having solutions solving given tasks can benefit from participation by presenting their strengths and getting introduced to the domain challenges and community of 'doers' in this specific field.

In a long term ERC-Pro want to provide platform for monitoring and benchmarking on realisation of robotics exploration roadmaps to strategic institutions and other interested actors. As a implication of aforementioned activities, ERC-Pro is aspiring to disrupt pattern of single-mission systems and following best practices form terrestrial robotics, bring iterative development and improvement in field of space robotics projects by annual trials and demonstrations.

Both tracks are the part of one community network managed under ERC flag. Such solution provides unique opportunity to collect people on different level of career focused on (robotic) space exploration. Community works as a motor of continuous improvement effort one way, providing transfer of expertise and feedback from professional teams to students and other, creating transfer of talents to engaged companies. It also connects universities, companies and other institutions promoting their strengths and identifying opportunities for collaboration.

The European Rover Challenge is owned and coordinated by European Space Foundation, organised in cooperation with group of independent experts creating steering and jury board. Mars Society Polska is a partner of the programme.

1.2. Benefits of ERC-Pro

What you can get by joining ERC-Pro:

- **environment of 'doers'** with passion for planetary robotics and special guests influencing and guiding this domain all collected at one venue
- **'powerspeach' presentations** - workshop style sessions of short presentations closed by summarizing panels
- opportunity to **demonstrate and benchmark** projects in roadmaps inspired scenarios at comfortable and affordable venue with organised logistics
- occasion for **non-space robotic groups and companies to join** space robotics community with technical and business support and guidance from professionals.
- direct contact with **cohort of** highly ambitious **future professionals**
- **inspiration** by tens of different students designs collected in one place with their creators and focused on solving particular challenge tasks
- access to **community** of proactive people working on shaping movement towards **incremental improvement** in space robotics
- extension of the field of **expertise and experience** in the tasks inspired by long term customers roadmaps (agencies, governments etc.).
- development of task oriented **use cases** and interfaces that can be later used in space and earth applications
- leveraging **system** level **awareness and lightweight** project **management** approach experience across team members on different levels of engagement and different specialisations
- boosting **creativity and innovation** by solving different-than-everyday-work problems in failure-tolerant environment
- lot of **fun and team building** opportunities around ambitious goals by challenging teams to build/prepare existing hardware and software to specific challenge tasks

In exchange ERC community aims to motivate you to:

- show full **engagement** during the event and preparation time
- actively **participate in demonstration trials** - bringing your system (hardware or software) which is capable of solving presented tasks or subset of their elements
- show proactive attitude and long lasting engagement towards **community values and goals**
- help ERC reach **wider audience of students and professionals**

1.3. Schedule and Venue

For information about ERC 2018 event venue please follow updates on challenge website or subscribe (see *Information channels and contacts*). Official schedule can be found as appendix to this document.

1.4. Information channels and contacts

The Challenge website address: www.roverchallenge.eu

Teams' Contact Point email address: pro@roverchallenge.eu

Please, send expression of interest to Teams Contact Point to do not miss important updates about the Event.

2. Teams

2.1. General

The 2018 edition of the challenge is planned for limited number of teams. The ERC Board will select which of the registered teams will be invited to participate in the event. The choice will be made based on Registration Proposals teams are requested to send to the Contact Point by deadline given in program schedule. Additionally individual agreements will be discussed as preparation to the event. The organizer will announce accepted teams by deadline given in program schedule.

2.2. Registration

Registration document, with content described below, should be send to the Contact Point via email (see *Information channels and contacts*) before deadline specified in Schedule (see appendix).

Content of the registration document:

1) Affiliation of the team (if the team is affiliated with more than one institution, please list all the names, in descending order of involvement);
2) Team name and description (experience and expertise);
3) Project name (may be the same as team name);
4) Approximate number of team members who plan to participate in the Challenge event (i.e. appearing on site of the event);
5) Team contact point: person name and surname, telephone number and e-mail address;

6) Group and project website address or/and social media fan-page (preferably Facebook as a main social media platform used by ERC team);
7) Short description of the demonstrator system (incl: photo of platform and control equipment, general dimensions and weight)
8) Scope of planned participation (which tasks will be approached, general limitation/non-compliance of the system comparing to rules herein)
9) Other general feedbacks, requests, suggestions.
10) The following declaration in English:

"By sending this application and registering the team to the European Rover Challenge each team member fully accepts all terms and provisions of the European Rover Challenge rules and all final decisions of the European Rover Challenge organizer."

Document requirements:

1) Format: A4, searchable PDF;
2) Length: max 5 pages (+ 1 for front page);
3) Language: English;

2.3. Team members

A team may consist of members of more than one institution. An institution may also affiliate more than one team. Team membership is exclusive – each person can be a member of only one team.

3. Powerspeach presentation

Purpose of those fast presentations is to understand common interest, motivations, activities and way forward in topic of cooperation and systems development towards roadmapped goals. It is opportunity to introduce demonstrator and demonstration scenario, present technology readiness, highlight strengths and look for future cooperation. Additionally some panels will be organised to discuss state of advancements, gaps, blocking points and ways forward common goals.

Presentation organisational guidelines

a) Time for presentation is limited to 5-10 minutes and after that time presentation will be interrupted immediately;

b) after presentation 5-10 minutes is allocated for Q&A session;

c) The team can use a projector provided by the organizer (VGA connector as a standard, other connectors might be available);

d) The organizer does not provide any computer;

e) Presentation must be conducted in English;

f) Presentation can be done in any format and creativity is welcome.

4. Demonstration Trials

For description of proposed tasks and demonstration scenarios and expected conditions, please see *ERC-Student 2018 rules* document (esp. Field Trials chapter). Please, follow it as a guidelines and recommendations rather than strict rules. Most important differences are listed below. Feel free to leave any comments and concerns about presented descriptions and requirements.

4.1. Platform system requirements

Each platform should be compliant with requirements listed below to take part in the challenge. The cases of non-compliance should be discussed with organiser as soon as possible. The organiser has right to exclude team from field trials especially when non-compliances are reported too late (e.g. during challenge event). It is highly recommended that teams present status of compliance with specified requirements within Registration Proposal in highly transparent way.

4.1.1. General requirements

Both custom made and COTS (Commercial Off The Shelf) components and platforms can be used.

Robotic platform should be mobilized and operational in all-terrain environment, however static platforms (e.g. demonstration of manipulator, drill, sampling tool functionalities without mobile base) is also allowed but should be equipped with stand to secure and anchor it in outdoor environment.

4.1.2. Dimensions and weight

There is no particular weight limit for participating system, however it is worth to remember that trials and demonstrations will be held on the same trial tracks as student competition so the

arenas are designed for 50-80 kg rovers with about 0.75m radius envelope. Nevertheless, no infrastructure elements strictly prevent from participating with bigger or smaller platforms.

4.1.3. Control and operations

It is recommended that the rover maximum speed should not be greater than 0.5 m/s.

It is suggested that team should be able to control platform via radio link in real time. Each Task will require robot to travel a certain distance, but never further than 100m from the starting point. In case of static platforms can be delivered to operation area manually, but such operations (and specification of workspaces) should be discussed with ERC board during negotiations period (see schedule). The starting point will be no farther than 50 meters from the antenna mast. All communication equipment, including antennas, should be deployed in vicinity of control station. Teams should be prepared to place antenna mast maximum 20m from control station location.

The mobile platform should be built to handle challenging terrain, appropriate dust and general weather conditions resistance described in *FIeld Trials* section.

4.1.4. Autonomy

Robot autonomy or capabilities of automation of particular tasks are highly recommended to be presented during competition trials.

In automated/autonomous control, states and commands defined below or their equivalences should be differentiated:

- “start” command - command to be send at the beginning of the attempt;
- “working” state - nominal work during attempt;
- “wait” command - enter “wait” state. Team can use it at any time for sensor readings stabilization;
- ”waiting” state - robot should wait still for “resume” command. This state should be automatically entered if robot reaches task check-point. System should be prepared that during this state sensors can be obstructed by people presence in platform vicinity (e.g. checking distance to the check-point). Operator cannot influence a system during this state. Reaching this state do not stop task time;
- “resume” command - transition from “waiting” to “working” state;
- “stop” - robot immediate stop - control can be switched to manual.

Above list is not exhaustive and teams can define additional states and commands.

In order to present autonomy or single task automation capabilities, teams cannot touch the controls once the attempt begins. The only exception is to send commands listed above. However, at any point teams may switch to manual control to complete the task in tele-operation. System

telemetry should be monitored during autonomous/automatic operations and its recording and open access sharing after the event is highly recommended but not mandatory.

In autonomy mode extra safety precautions should be taken. Minimum requirements are specified in *Platform Safety* section of this document.

4.1.5. Safety System

Elements listed in this section are mandatory for all teams and compliance with them should be clearly presented in technical documentation and during checks before field trials. This compliance will be strictly checked and failure to present it can result in disqualification of the team from entire trials.

4.1.5.1. Emergency stop

The platform shall be equipped with an easily accessible red emergency stop button. It must be part of highly reliable circuit which action is to isolate the batteries from the system by single button hit until reset procedure is executed. Only laptops with own batteries can stay powered on-board. Therefore, an unmodified, industrial, commercial-off-the-shelf, emergency stop button and other parts of safety circuit are required. If an unsafe event occurs, assistants must be able to access button and deactivate robot without any additional actions necessary. Operation must be possible by open hand hit. Button mounting should withstand hard hit and should be attached to stiff element of the platform. In cases when aforementioned requirements about battery isolation cannot be met (e.g. use of well tested, reliable, ready or COTS platform with EM stop just immobilising robot) access to main switch (one isolating batteries) should be clearly marked and described in documentation.

Even if RF certified EM button is in use at least one physical emergency button must be placed on the platform construction.

4.1.5.2. Activity Indicator

The platform should be equipped with indicator lamp informing about readiness to receive commands. Indicator should be clearly visible from at least 10m attracting attention of people in vicinity by blinking or flashing. It should be active in any case when robot is ready to move (drive or e.g. operate manipulator). Recommended colours are: yellow, orange or red. It is highly recommended to use industrial grade device.

Activity indicator lamp should be active for 5 seconds before any robot operation is executed. During this time robot should be completely still and safe.

4.1.5.3. Automatic/Autonomous functionality

Any autonomous or automatic operation should start with delay of at least 5 seconds after activation.

ERC assistant should be informed about all planned autonomous/automatic attempts before they are executed.

It is also recommended that platform is equipped with additional indicator showing that robot is performing task (or its part) autonomously.

4.1.6. Communication requirements

Please read carefully communication requirements in *ERC-Student 2018 rules* document. Please be aware that all students platforms are strictly following those rules to avoid interference. In case team cannot comply with those rules, organiser should be informed and special slot will be allocated outside 'rush hours' of the student competitions.

4.2. Documentation

4.2.1. General

Requested documentation in this track is minimal to allow proper planning of the event and check of most important requirements.

4.2.1.1. Technical report

Content of the document

1) Any updates/specification of information comparing to registration document especially:
    a) any additional details of the system that can affect event preparation and need additional agreements

    b) update of scope of planned participation (e.g. estimation of the time for preparation on the field and attempts itself)

    c) update of non-compliances and limitations according to the rules herein.
2) Hardware safety description (important points about system safety compliance with rules herein, safety features and necessary operations in case of unsafe event - ideally with simple visual presentation, documentation about elements that could need special safety measures regarding spectators and people working closer e.g. judges (e.g. laser safety, high voltage equipment etc.));

3) Radio Frequency form - system information (this part should be filled for each RF system used):
    - RF system name/function;
    - Frequency;
    - Bandwidth;
    - RF power (output power + EIRP);
    - Antennas description;
    - Modulation;
    - Short description

Document requirements:

1) Format: A4, searchable PDF;
2) Length: max 10 pages (including a front page);
3) Language: English.

4.2.1.2. Official statement

The organizer will keep all technical documentation confidential and will not publish or disclose it to third parties without earlier approval of a team representatives. The sole exception to this is the Challenge jury board.

The organizer may ask for an additional permission to use any promotional materials and visuals (e.g. photos and videos), as well as any additional photos, videos, portraits, documents, interviews and other materials resulting from participation in the Challenge (using the name of the Participant or not) on all media, in any language, anywhere in the world, in any manner, for advertising and promotional purposes.

4.3. Field trials

Field trials are organised as benchmarking activity allowing to compare performance of teams in resolution of several tasks. Each task present independent set of problems to be solved connected to particular technologies required by future space robotics missions.

Scoring of any part of trials will be performed only for internal use for future benchmarking activities, however processed, anonymous results can be included in official reports of the competitions for advancements monitoring purpose.

Specific time windows will be agreed individually with each team.

For further details about site conditions, tasks descriptions, prioritised technologies and many other, please, refer to relevant sections of *ERC-Student 2018 rules* document.

5. Miscellaneous

5.1. Awards

Some symbolic awards will be given for recognition of excellence and advancements in the field. Honored teams will be chosen by Jury, ERC-board and special guests.

5.2. Organiser disclaimer

Teams are taking full responsibility for any damages, accidents, unsettling events caused by their hardware software as well as members of the team. Teams are obligated to follow all safety and good conduct rules specified by organisers. Britch of any safety rules and requirements will result disqualification of team from entire competition.

5.3. Changes to Competition Rules

The organizer has the right to extend the deadline for submission of documents and provide essential but inevitable changes to the competition rules. However, introduced changes cannot concern the key issues for the rover's design. All introduced changes will be reasonably announced in advance and provided on the challenge website.

5.3.1. Deadline extension

The organizer has the right to extend the deadline for submission of documents and announce it reasonably in advance and provide on the challenge website.

5.3.2. Q&A

Answers to any challenge related questions that arise will be provided on the challenge website. If you have questions, contact the challenge contact point (see *Information channels and contacts*).

The organizer will provide 'European Rover Challenge 2018 Questions & Answers' as a part of the competition rules. All arrangements contained therein are ultimately binding – even if they change the competition rules. FAQ will be announced in advance and provided on the challenge website.

5.3.3. Organizational issues

Organizational issues, including: team eligibility, challenge organization and the execution of jury decisions, shall be resolved by the organizer.

5.3.4. General Challenge issues

Should there arise any conflict related to the challenge, the organizer's decision shall be considered final and binding

5.4. Disqualification

The organizer may disqualify a team in the event of a serious breach of rules or fair play.

5.5. Personal data storage

Team members agree to their personal data being stored and processed in the organizer's computer systems and also for the purpose of ERC's integrated programme towards technological development specifically in a area of space exploration and utilization. They also give the organizer, parties designated by the organizer and the audience, the right to disclose and publish any photos, videos or other visuals; their names and surnames, identifiable pictures of themselves and any other persons, as well as pictures of machines, devices and equipment in any and all of the available formats, by any and every known method, in any and every known medium. Personal data and information about team members other than their names and surnames will not be published without prior consent of the each team member.

5.6. Team members responsibility

Teams and team members accept sole responsibility for securing and ensuring the safety of their equipment and luggage in the challenge location. They indemnify and release the organizer of any responsibility in the event of damage, destruction or theft of any property.

5.7. Organizer responsibility

The organizer's civil liability is limited solely to the responsibility for organizing a mass event in accordance with Polish law and local regulations.

5.8. Copyrights

The organizer keeps all the copyrights to the competition rules especially description of the tasks. You may not make alterations or additions to the competition rules, or sell it. Rules can be used and/or copied only for ERC-connected activity (eg. registration process).

APPENDIX 1.

Challenge Schedule

Please find below preliminary schedule of 2018 edition of competitions.

Event	**Date**
Rules publication	Feb 01st 2018
Registration coordination start	Feb 01st 2018
Registration end	May 31th 2018
Technical documentation final update and finalisation of individual agreements	Aug 16th 2018
Competitions event	Sep 14-16th 2018
• warm up day	T-1
• on-site registration	T0
• closing ceremony	T+2