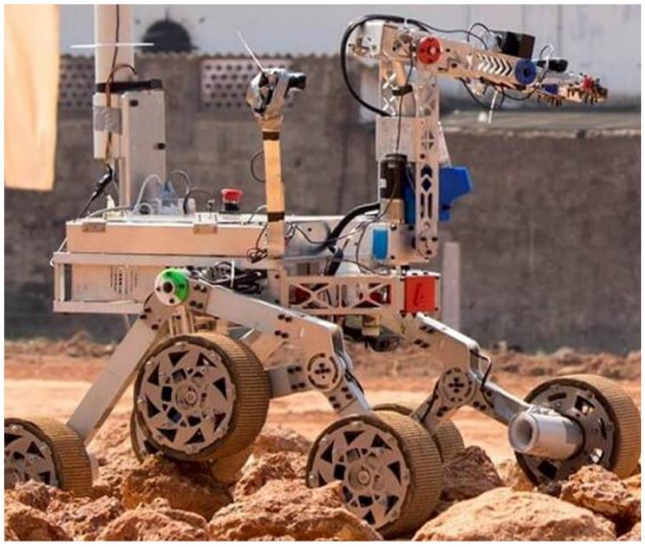
PRESIDENCY UNIVERSITY

International Rover Challenge

Space Robotics Society

RULE BOOK

INTERNATIONAL ROVER CHALLENGE 2023



28-31th JAN 2023

BENGALURU INDIA

WWW.ROVERCHALLENGE.ORG

CHANGING THE WAY YOU INNOVATE

LIST OF ABBREVIATIONS

ABEx	Astrobiology Expedition
AI	Artificial Intelligence
AutEx	Autonomous Expedition
BPP	Business Plan Presentation
FAQ	Frequently Asked Questions
GHz	Giga Hertz
GPS	Global Positioning System
IEEE	Institution of Electrical and Electronic Engineering
IDMO	Instrument Deployment and Maintenance Operation
INR	Indian Rupees
IRC	International Rover Challenge
IRDC	International Rover Design Challenge
PERT	Program Evaluation Review Technique
pH	Potential of Hydrogen
RDO	Reconnaissance and Delivery Operation
RF	Radio Frequency
SDDR	System Design and Development Review
USD	United States Dollars
WGS	World Geodetic System

FOREWORD

Welcome to International Rover Challenge - 2023

The Space Robotics Society (SPROS) has come up with an updated rulebook for International Rover Challenge (IRC) – 2023, which will take place at Presidency University, Bengaluru, India. These changes have been made through insights gained from previous editions of IRC, while also keeping the challenges faced by the rover teams in the post-pandemic world in mind. It would be fair to call it a new avatar of IRC.

From this year onwards, there will be an increased emphasis on creating awareness about the best practices and methods of systems engineering. The main focus is to highlight the benefits of an approach covering the whole project life cycle of developing a Mars Rover. In order to achieve that, changes have been made to the IRC Review Stages (Qualifiers) and the result from the qualifications will not carry into the Finals. The Finals have been restructured and will have three types of mission – Expeditions, Operations and Assessments.

To qualify for the Finals, teams will have to successfully clear two stages – International Rover Design Challenge (IRDC) and System Design and Development Review (SDDR). The SDDR has two components: SDDR report and SDDR video.

In addition to that, up to 5 teams will be granted "wildcards", which will allow them to directly enter the IRC-2023 Finals. Only the teams which have participated in any of the following on-site competitions – University Rover Challenge, Anatolian Rover Challenge, European Rover Challenge, Canadian International Rover Challenge and Australian Rover Challenge, from January 1 to October 1, 2022, are eligible to apply for the ''wildcards''. Teams applying for the ''wildcards'' will have to prove their readiness by showcasing their rover in a live working presentation to the judges before November 10, 2022.

These changes aim at making the competition a more comprehensive and better learning experience for everyone involved.

Wishing all the teams good luck and hoping for an exhilarating IRC experience for everyone.

Sagar Dhaka
Event Director (IRC)

1.0 COMPETITION OVERVIEW

1.1 COMPETITION OBJECTIVE

IRC is a space robotics engineering competition. It challenges university students to conceptualise, design, develop and operate an astronaut-assistive next-generation planetary Rover and perform specific missions in Mars simulated conditions.

The objective of the competition is to provide students with a real-world interdisciplinary engineering experience, combining practical engineering skills with soft skills, including business planning and project management.

1.2 COMPETITION PROCEDURE AND SCHEDULE

The competition is divided into two stages:
- Qualifiers (Online)
- Finals (On-site)

Missions / Sub-missions	Points
Qualifiers (Online)	
IRDC-2022 Score	200
SDDR Video	300
SDDR Report	500
Total (Qualifiers)	**1000**
Finals (On-site)	
Astrobiology Expedition (AbEx)	225
Reconnaissance & Delivery Operation (RDO)	200
Instrument Deployment & Maintenance Operation (IDMO)	200
Autonomous Expedition (AutEx)	225
Assessment (On-site)	
Project Implementation & Management Assessment (PIMA)	100
Business Plan Presentation (BPP)	50
Total (Finals)	**1000**

Figure 1.2 Points Distribution

1.2.1 Team Selection Criteria

All teams will undergo a review and down-selection process during the qualifiers, i.e. only the top 25 teams that pass each milestone will be invited to compete in the on-site Finals. Specific

details for each deadline (including deliverable format, submission requirements, and judges' expectations) will be posted to the SPROS website (www.spaceroboticssociety.org) and the IRC website (www.roverchallenge.org). Additionally, officials may respond to teams with follow-up questions or requests for clarification at any of these milestones.

1.2.2 Registration

All teams have to declare an intent to compete. The registration form will be available online on the IRC website from August 30 to September 30, 2022. No significant deliverables are required for this deadline, aside from team details requested via the IRC website.
Teams will have to apply separately for the International Rover Design Challenge (IRDC) - 2022. The IRDC registration form will be available online on the website from August 30 to September 30, 2022. For more details about IRDC, visit www.roverchallenge.org/irdc. IRDC is not only a review stage for IRC but is a competition in itself. Teams participating in IRDC will be awarded separate prizes and certificates, which will be independent of their participation in the IRC.

1.2.3 System Design and Development Review (SDDR)

Teams are required to submit a System Design and Development Review (SDDR) package before November 15, 2022. The SDDR package will focus on both technical and project management aspects of the rover development and has written report and video components. In the Project Management aspects, teams shall include the organisational structure of the team, resources management, project planning, a PERT chart showing the project timeline, initial budget, fundraising plans, sponsorships, team's recruitment process, educational and public outreach. In the Technical aspects, teams shall include the current state of the rover development and prototypes, overall system design, science strategy, and team's prototype testing strategy. The video component will be a 5 minutes video showcasing salient features of rover design and its readiness. This video has to be shot after August 2022. Teams are not allowed to reuse edited videos from earlier competitions or previous design cycles. SDDR is a competitive milestone, and packages will be judged against other teams' submissions by the judges. The top 25 teams will advance to the on-site finals based on their normalised score from IRDC and SDDR. All the teams qualified for the IRC Finals will have to confirm their participation by December 1, 2022. If a qualified team is unable to participate in the Finals due to a particular reason, then its spot will be transferred to the highest-ranked reserve team.

Competition Dates - IRC Finals will be held during January 28-31, 2023, at Presidency University, Bengaluru, Karnataka, India.

Note: Any changes in the dates or mode of the Finals due to any reason shall be communicated to the teams. The decision solely rests on the discretion of the IRC organising team.

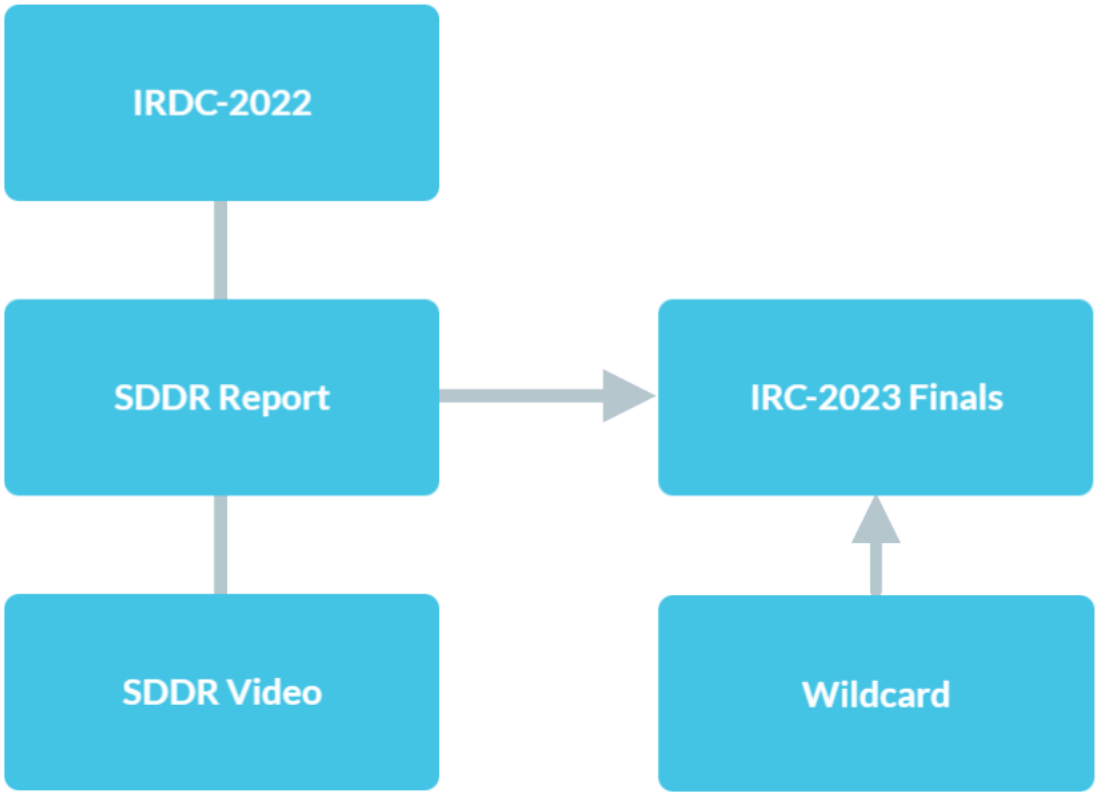


Figure 1.2.3 Competition Stages

1.3 ADMINISTRATIVE REGULATIONS

1.3.1 Competition Information

The competition-specific rules and relevant information are defined in this Rulebook, and the specific guidelines issued separately for various submissions/missions will be available on the competition website. All the questions in the FAQ section on the IRC website will also be considered part of the rules and guidelines. In addition, any official announcement shall also be considered part of these rules. Any issues not covered by these published rule sets will be addressed on a case-by-case basis by the IRC officials. If there is a discrepancy, the Rulebook (this document) will take precedence over FAQs.

1.3.2 Queries regarding the Rules

Queries regarding any rules or guidelines may be asked to the officials only through email (irc@roverchallenge.org). The frequently asked questions (FAQ) section on the competition website must be checked before submitting a question. The officials will only answer questions that are not already answered in the rules or FAQs or that require new or novel interpretation. The official language of the competition is English. Refer to the competition website for specific directions on how to submit a query.

1.3.3 General Officials Authority

The officials reserve the right to revise the schedule of the competition and/or interpret or modify the competition rules at any time and in any manner that is, in their sole judgment, required for safe, fair and efficient operation. Therefore, all team members are required to cooperate with and follow all instructions from the officials.

1.3.4 Official Instructions

Failure of a team member to follow an instruction or command explicitly directed to that team and/or member will result in a 20 points penalty, which will be deducted from their overall score.

1.3.5 Conduct with Officials

Argument with or disobedience to any official will result in the team being eliminated from the competition.

1.3.6 Unethical Conduct

In case of unethical conduct by a team member, a 20 points penalty will be deducted from the team's overall score. A second violation will result in the expulsion of that member and his/her team from the competition.

1.3.7 Protests

If a team has a question about scoring, judging, policies or any official action, in that case, it must be brought to the officials' attention for an informal initial review before an official protest can be filed. A team may protest any rule interpretation, score, or officials' action which they feel has caused some actual, non-trivial harm to their team or has had a substantive effect on their score. If a resolution cannot be found through the initial review, a protest must be filed in writing and presented to the officials by the Team Leader. The decision of the officials regarding any protest will be in a written form and will be final, and no further protests will be considered on that same topic.

1.4 GENERAL REQUIREMENTS FOR TEAMS & PARTICIPANTS

1.4.1 Teams per University

There is no limit to the number of teams a university can send to the competition. Teams that are formed with members from two or more universities are treated as a single team. It is up to the members to decide if they want to represent one university or compete independently. Representing more than one university is not allowed.

1.4.2 Team Members

A person can be a part of only one team. Each team must have one team member identified as their team leader/captain. The team leader/captain is the main point of contact for the officials during the registration process and competition.

1.4.3 Student Status

Team members must be enrolled as degree-seeking undergraduate or graduate students in any university. Team members who have graduated before the competition are ineligible to participate.
Students seeking a PhD degree/PhD students or equivalent are not allowed to participate.

1.4.4 Age

Team members must be at least 18 years of age. Written permission from the official guardian should be provided for members below the age of 18 years on the date of January 1 of the year of the Finals.

1.5 FINANCES

The maximum allowable cash budget which a team can spend on the project is 2,000,000 INR (25,000 USD). It shall include components for the rover, rover module, rover power source, rover communication equipment, and rover base station equipment. Teams are encouraged to get financial and in-kind sponsorships and donations for their project. Teams should mention the sponsorship amount and donations in their SDDR.

1.6 DOCUMENTATION & SUBMISSION DEADLINES

1.6.1 Submission

Submitted documents may only be viewed by members of the submitting team, authorized judges and officials. The official website of the competition will be used for all online submissions. By submitting documents via the competition website, the team agrees that these documents may be reproduced and distributed by the officials, in both complete and edited versions, for educational and marketing purposes. Teams should check the competition website regularly to keep track of the submission deadlines.

1.7 GENERAL RULES

1.7.1 Forfeit for Non-Appearance

It is the responsibility of each team to be present at the competition site with their rover at their scheduled timeslot, which will be communicated to them beforehand by the organisers. If a team is not present and ready to compete at the scheduled time, it forfeits its attempt at that mission/task.

1.7.2 Team Briefing

All team leaders/captains and members are supposed to attend the team briefing for that day. If any member is not present at the briefing, it's the team's duty to get those members up to speed. If any specific doubts are there regarding the mission, they can be cleared during the briefing. No doubts or clarifications will be entertained once the mission time has begun.

1.8 ROVER OPERATIONS

- Teams will operate their rovers from designated base stations. These base stations will be isolated such that the visibility of the course is blocked to the operators. Basic Indian-style power outlets (220V, 50Hz), tables, and chairs will be provided.
- All of the competition events will be held in full daylight or under adequate artificial light.
- The GPS coordinates provided shall adhere to the WGS 84 datum standard. The format for the same will be latitude/longitude in decimal degrees.
- There will be a radio communication line of sight from the command station to the rover for all the on-site tasks. Rovers are expected to travel 500m at most from the command station.
- Testing will not be allowed at the site during or before IRC-2023.

2.0 ROVER GUIDELINES

2.1 FACULTY ADVISOR ROLE

- The rover entered into the competition must be entirely designed and built by the student team members without direct involvement from faculty advisors and industry professionals.

- The role of faculty advisor/coordinator/supervisor will be limited to mentorship and guidance. He / She may not make design decisions.

- Students should perform manufacturing and fabrication tasks themselves as much as possible. For cases where in-house manufacturing and fabrication are not possible, teams can approach contractors, but the amount charged will be considered in the team budget.

2.2 SIZE, WEIGHT AND DESIGN

- The rover shall be a stand-alone, off-the-grid, mobile platform. Tethered power and communications are not allowed. A single connected platform must leave the designated start line.

- The maximum allowable mass of the rover when deployed for any competition mission is 60 kg. The total mass of all fielded rover parts for all events is 75 kg. For example, a modular rover may have a robotic arm and a sensor that are never on the rover at the same time. The rover plus arm and rover plus sensor combinations must each be under 60 kg, but the total rover plus arm plus sensor must be less than 75 kg. The limitations on the rover's weight do not include any spares or tools that may be required to build or maintain the rover If the rover is overweight during a mission, the team will be charged a penalty of 5% of the points scored for every kilogram over 60.

- The maximum allowable length and breadth of the rover are 1.5m and 1.2m, respectively. There is no vertical height limit for IRC 2023. If the rover is oversized during a mission, the team will be charged a penalty of 20% of the points scored during that mission.

- The rovers must use power systems that may be applicable on Mars. Battery-powered systems can only be used for the rovers. Any potential hazardous material will require proper documentation to be submitted to the organisers before the competition.

- All rovers must be equipped with a "kill switch" placed on the rover's exterior, accessible and visible at all times. This switch must cease any movement by the rover and withdraw all power draw from batteries in case of an emergency.

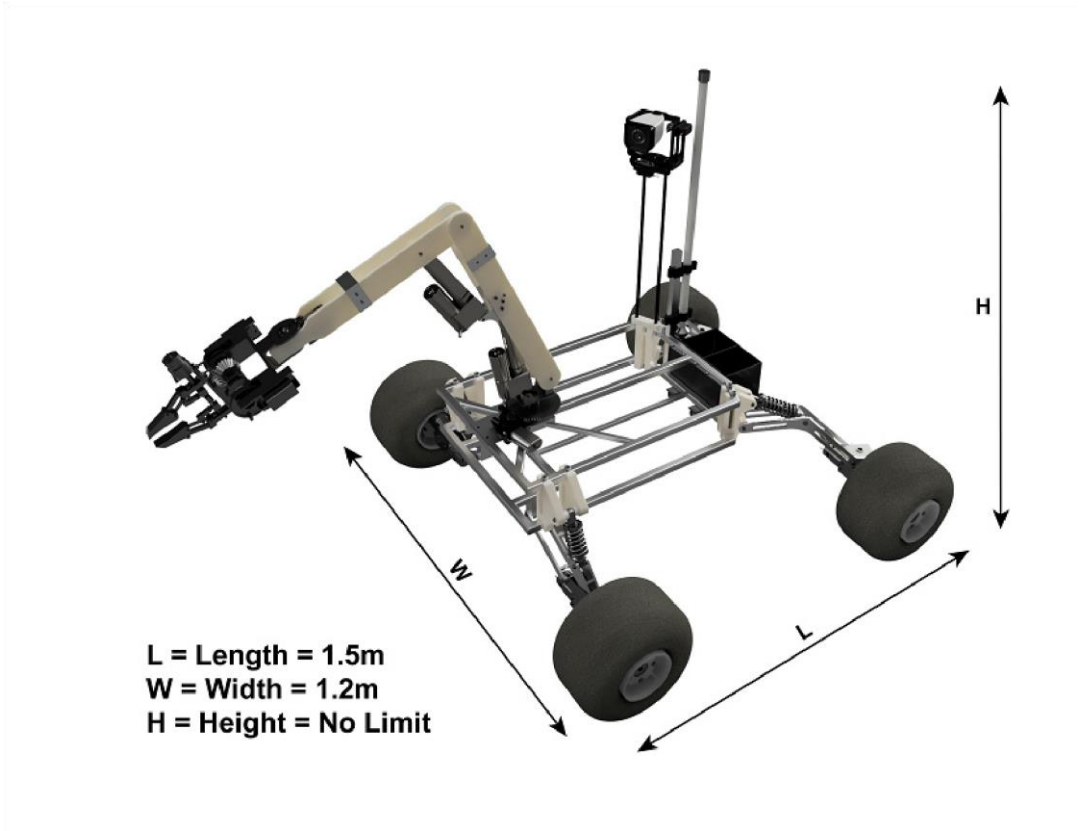


Figure 2.2: Rover Dimensions

2.3 COMMUNICATION EQUIPMENT

- The rover shall be operated remotely using wireless communications with no time delay. The operators will not be able to view the rover or the site directly, and line-of-sight communications will be available for all of the missions. Teams must power down communications equipment at the event sites while not competing to not interfere with other teams. Aerial devices are not allowed for communications at IRC 2023.

- Both omnidirectional and directional antennae are allowed, but communications equipment must not rely on the team's ability to watch and track the rover first hand. Steered directional antennae may use a mechanized antenna mounted outside that is controlled via an electronic signal from the command station. Signal strength, relayed GPS, or other strategies may be used to give feedback on antenna direction, but it is not allowed to mount a camera on top of the antenna for visual feedback.

- Base station antenna height is limited to 3 metres and shall adhere to all applicable regulations. Antenna bases must be located within 5 meters of the team's command station.

- Any ropes or wires used for stability purposes only may be anchored within 5 meters of the command station.

2.4 RESTRICTIONS ON THE 2.4GHZ COMMUNICATION BANDS

Teams must inform the organisers of IRC about the communications standards they will be using, including frequency bands and channels, by December 1, 2022.

- 2.4 GHz frequency band (2.400-2.4835 GHz): Teams shall use centre frequencies corresponding to channels 111 of the IEEE (Institute of Electrical and Electronics Engineers) 802.11 standard for 2.4 GHz. A team shall be allotted three channels in each mission, details of which will be posted along with the competition schedule. The teams must strictly stay within the assigned channels, which will be monitored by the judges during the tasks.

- These restrictions apply to both the command station to rover communications and any local wireless network such as (but not limited to) on-board the rover between subsystems.

- Communication on the 5.8Ghz band is recommended for less interference.

2.0 COMPETITION MISSIONS (FINALS)

- The IRC Finals are divided into three categories – Expeditions, Operations and Assessments.

- Expeditions are the missions which are investigatory in nature and for which teams have to present the findings and results to the judges after the completion of the mission. Expeditions contain both dynamic and static components.

- Operations are the missions which contain only dynamic components and in which the rover has to perform specific tasks in the field.

- Assessments are the missions which are static in nature like Project Implementation and Management Assessment (PIMA) and Business Plan Presentation.

- Teams will get the maximum time of 30 minutes to complete a mission. If a team completes a mission in less than 20 minutes, the team will get 20% bonus points for that mission.

- Only the teams which score more than 20% points during the first 20 minutes of a particular mission are allowed to utilise the entire mission time of 30 minutes. The teams which score less than 40 points will have to stop their mission after 20 minutes.

- All the penalties are additive: e.g. penalties of 10% and 20% would result in a score of 70% of the points earned during that particular mission. All the missions are scored independently, and it is not possible to score less than zero in a mission.

- Before the start of the mission, teams will get 10 minutes as the setup time to set up all necessary systems and equipment at the base station. After completing the mission, teams will have to switch off their radio communication equipment immediately, and they will have 10 minutes to disassemble all the equipment and vacate the base station.

- The rover is not required to be in the same configuration during the entire competition. Teams can change the configuration of the rover according to their needs and mission requirements. The rover will be accessible to the teams throughout the competition, and teams can make modifications and repair between the missions.

3.1 INTERVENTIONS

An intervention can be called when a critical error hinders regular rover operation during a mission. However, the following set of guidelines is to be followed to service an intervention call.

Teams are allowed to call for a maximum of two interventions during a mission. An additive 10% penalty of the total points scored in that particular mission will be imposed per intervention. So, a team may call for multiple interventions, with each call resulting in a penalty. If a team calls for a second intervention during a mission, it will have to start the mission from the starting point of that mission/stage. The mission clock continues to run during an intervention.

A request for intervention can only be called by the team members present at the base station. It must be relayed through the judges at the base station. Teams may designate any number of team members who may repair or retrieve the rover (hereafter referred to as "runners"). Spectating team members may be asked to act as runners, and also rover operators may leave the base station and become runners, but members from the base station will not be allowed to re-enter the base station.

A spectating team member may only interfere with the rover's operation to press the kill switch to prevent fatal harm to the rover. Once the kill switch is used, the mission will be forfeited, and only the points scored until that moment will be considered.

3.2 ASTROBIOLOGY EXPEDITION (ABEx)

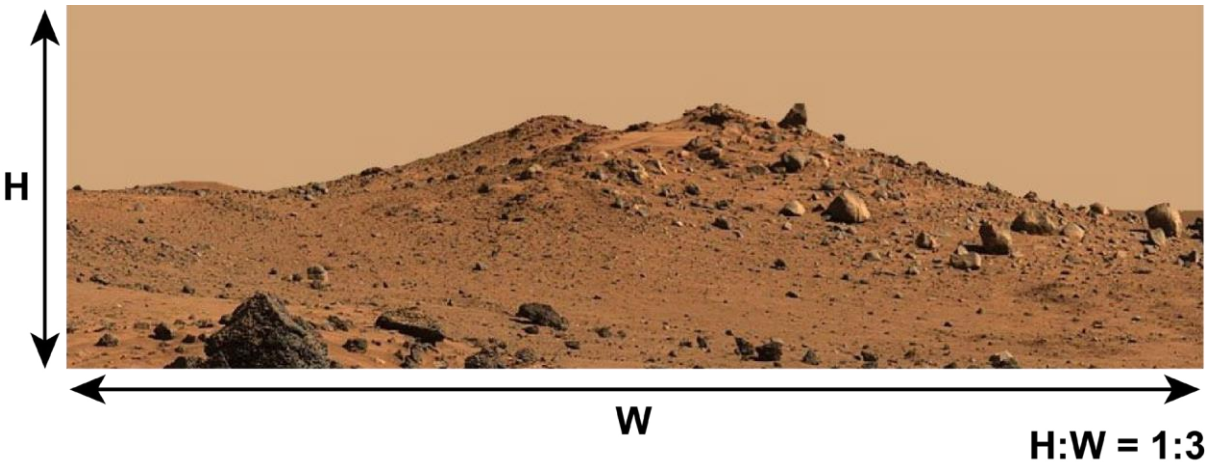
In this mission, the rover will function as a Mobile Science Laboratory to collect samples from designated sites and perform basic science evaluation of these samples using a suite of carefully designed tests and experiments. The objective is to identify and characterise the sites for their capabilities to support microbial life and seek signs of extinct or extant life in those sites. The rover may use cameras or other passive instruments to investigate the designated area and collect samples using mechanical methods. The rover must have at least one life-detection capability instrument or assay of the team's choice. Samples must be investigated by the rover on-site, and at least one sample must be brought back to the base station uncontaminated. There will be no laboratory analysis at the base station. All instruments/tests must be on-board the rover.

- Teams will be collecting data (of scientific relevance in context to the Martian biosphere), and during this mission, teams must select, collect and analyse (investigate) samples from at least two sites.

- Teams shall document each selected site by investigating it using a wide-angle panorama of a minimum 1:3 height to width ratio showing the full context of the site. The panorama must indicate cardinal directions and scale, GPS coordinates of each site, elevation and accuracy range. Based upon the investigation of the selected sites, teams shall then collect and store soil samples from a depth of 5 cm or deeper. Sample(s) must be at least 10g and may consist of a single rock, loose soil, or anything in between.

- The teams should conduct these analyses on both soil and atmosphere: sub-surface temperature, humidity, pH and atmospheric pressure. The teams can do other analysis

depending on their choice. Teams should conduct only those tests and analysis which provide conclusive results in the allotted mission time of 30 minutes.



- Any chemicals used on-board, including water and other chemical products, must follow a no-spill policy and should not spill on the ground during the mission. In addition, the use of hazardous chemicals must be pre-approved before the competition by submitting a usage plan, transportation, safety precautions, and accident plan.

- After completing roving time, teams will have to prepare for a 10-minute presentation for the judges, based on the on-board analysis. The presentation is mandatory for the teams, even if they are unable to collect data during the mission.

- The presentation to the judges should include:
- The team's conclusions (results and explanation of results) based on the analysis performed.
- Results of on-board rover tests performed, including data and images.
- Scientific knowledge of astrobiology and Mars based on responses to judges' questions.

- The score for this task will be based on the following components:
- Correct identification of extant or extinct life in the designated sample(s).
- Quality and applicability of the on-board analysis and how well this supports the team's conclusions.
- The completeness, correctness, and clarity of the science plan.
- Scientific knowledge of astrobiology, particularly as it relates to Mars.

3.3 RECONNAISSANCE AND DELIVERY OPERATION (RDO)

In this mission, rovers shall be required to conduct reconnaissance operation over terrain not more than 500m away from the base station. The rover will search, locate, pick up, and deliver objects to specific locations (GPSS coordinates) and/or pick up and store objects until the mission's end to deliver to the base station. The objects will be scattered over the field. Hence, this task will require the rover to have a storage facility and an arm for assistance.

3.3.1 Reconnaissance

In this stage, the rover will have a maximum of 15 minutes to reconnaissance through an area to search and locate various objects around the competition site. Teams shall document each located object by taking its photograph and the GPS coordinates of its location. The team may choose to pick up and store any one object of its choice during this stage (Not to be delivered in this stage). The rover may carry at most one object in its storage cache (carrying an object by gripping will not be allowed) during this stage. The remaining time at the end of this stage will not be added to the following stage, which will begin immediately after this stage.

3.3.2 Delivery

In this stage, the rover will have 15 minutes to pick up and deliver the objects to designated locations. During this stage, the rover can use a gripper or other mechanisms to deliver the objects.

- Objects will include small, lightweight hand tools (e.g., screwdriver, hammer, wrench), supply containers (e.g., toolbox), or rocks up to 5 kg in mass. All items will be graspable, with diameters no greater than 7 cm. The maximum dimensions will be 40 cm x 40 cm x 40 cm, but teams should expect a variety of sizes and weights. The terrain will vary from soft sandy surface to rough stony terrain and may contain rocks and boulders, vertical drops, sand dunes and slopes. The difficulty of the task will increase with further levels.

- Approximate GPS coordinates or colours of the markers will be provided for all the delivery locations, although accuracy may vary. The rover can take any sequence/path it wants. However, certain sequence or parts of the terrain may be compulsory to complete the mission, and the same information will be provided beforehand. In addition, the instructions regarding the markers' colour and the objects (if necessary) will be provided in advance.

- Teams will be scored based on their ability to search, locate, pick up and deliver/store the correct objects from/to the correct locations and based on the proximity of the object placed to the objective within the specified time.

3.4 AUTONOMOUS EXPEDITION (AutEx)

During this mission, rovers shall be required to traverse between markers across moderately rugged terrain autonomously. Teams may be required to begin on this mission, possibly as soon as 10 minutes after the completion of the Instrument Deployment and Maintenance Mission, from the same base station.

Before beginning the mission, teams must formally announce to judges that they are entering into the autonomous mode. In autonomous mode, team members may monitor video and telemetry information sent from the rover but may not transmit any commands. No scouting will be allowed before the start of this mission.

The mission will consist of multiple arrow signs (all black in colour) of size 30 cm x 20 cm elevated at 10 - 50 cm off the ground. The arrows will be printed on white background. The arrowheads point to the direction the rover is expected to navigate, leading the rover to the endpoint, which will be marked by an orange colour traffic cone. Each arrow sign will be located inside a circle of a 2 m radius on the ground. The rover will have to stop (pause) inside the circle for a minimum of 10 seconds (once it detects the particular arrow sign) before navigating to the next arrow sign. At least half of the rover should be inside the circle for 10 seconds before moving to the next arrow. If the rover hits the arrow signs, there will be no points for that particular arrow detection. Teams can take the picture given below as reference (the picture is not drawn to scale):

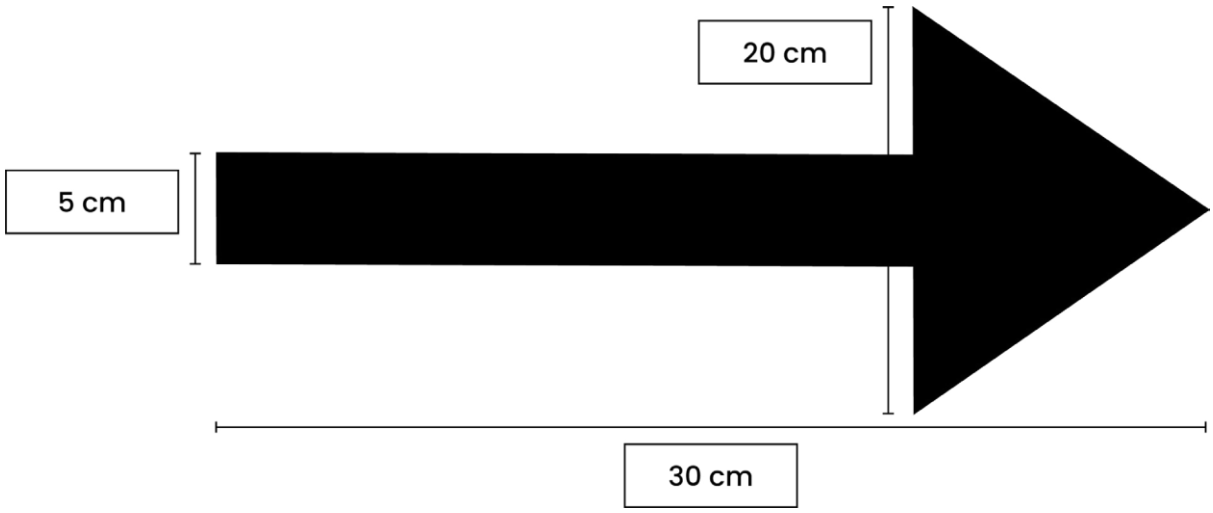


Figure 3.4: Autonomous Mission Arrow Sign

The teams should document each arrow sign by collecting its GPS coordinates and the cardinal directions. The teams can collect other data during their autonomous expedition depending on their choice. Using the collected data teams have to prepare a map of the competition site. After completing roving time, teams will have to prepare for a 10-minute presentation for the

judges, based on the on-board data collection. The presentation to the judges should include the map and the details about the autonomous systems and abilities of the rover. The presentation is mandatory for the teams, even if they are unable to collect data during the mission.

3.5 INSTRUMENT DEPLOYMENT AND MAINTENANCE OPERATION (IDMO)

This mission will be divided into two stages, Instrument Deployment and Instrument Maintenance. The rover is expected to traverse a short distance to operate on a mock-up instrument panel to perform a set of precise maintenance and deployment operations. The rover will have to use robotic manipulators to carry out this mission.

The mission may include multiple operations. The provided list is not exhaustive, and the mission may include operations similar to those mentioned below. Teams must be ready for certain flexibilities.

3.5.1 Instrument Maintenance

- Picking up a cache and traversing to the panel. The cache will have a handle of at least 10 cm in length and not more than 5 cm in diameter. The cache will weigh less than 5 kg.
- Open a drawer to place the cache inside it and close the drawer.
- Push buttons, flip switches, turn knobs.
    - Operate a joystick.
    - Undo latches.
    - Open panels.
    - Connect an electric three-pin plug to a standard three-pin socket.

3.5.2 Deployment

The deployment leg of this mission will require teams to retrieve and carry sample cache components for deployment in particular designated locations near the collection panel. The cache(s) may have to be deployed in a particular pattern/orientation, details of which will be provided at the competition site itself. The cache components will consist of standard graspable features such as handles, ropes etc.

After the deployment of the components, the rover has to read certain codes/patterns/text displayed on or near the panel or on any of the components that are being deployed. This code needs to be noted by the base station team using the transmitted video feed.

The deployment leg will be considered completed only after correctly placing the cache(s) in designated spots and the correct submission of the code to the judges by the base station team.

- The maximum height of the instrument panel will be 1.5m from the ground.

- Teams can do the sub-missions in any desired order. Points will be awarded for completing each sub-mission successfully.

3.6 PROJECT IMPLEMENTATION AND MANAGEMENT ASSESSMENT (PIMA)

The objective of the PIMA is the assessment and review of the project and final rover design. PIMA will have one-to-one interaction between the teams and the judges. The teams will have to give a presentation to the judges about their rover development. This presentation will cover the lessons learned during the whole life cycle of developing a rover. It will include both technical and non-technical aspects, from the project plan to manufacturing and testing the rover. Teams may also include spin-offs that have emerged from their rover project. Furthermore, this presentation offers the opportunity for the judges to ask some specific questions.

3.6.1 Project Implementation and Management Assessment Procedure

- Presentations are limited to a maximum of 20 minutes (15 minutes rover + 5 minutes BPP). If the teams complete their rover presentation before 15 minutes, they are free to transition into the Business Plan Presentation (BPP) without interruption. The judges will stop any presentation exceeding the allotted time.

- Teams may employ creative and interactive tools such as their Rover, Posters, Banners, PPTs etc.

- The presentation will not be interrupted by questions. Immediately following the presentation, there will be a question and answer session where judges will question the teams regarding certain design and implementation decisions.

- All team members involved in the presentation must be in the podium area and introduced to the judges at the beginning of the presentation. The team members who have been introduced may answer the judges' questions even if they were not presenting.

3.6.2 Business Plan Presentation (BPP) Objective

- The business plan presentation is part of the Project Implementation and Management Assessment Presentation. The objective of the BPP is to evaluate the team's ability to develop and deliver a comprehensive business model which demonstrates their product, a prototype rover, could become a rewarding business opportunity that generates a monetary profit. The teams should consider themselves part of a hypothetical for-profit company that wants investors and partners for its business.

- The judges should be treated as if they are potential investors or partners for the presented business model.

- The business plan must relate to the specific rover entered in the competition.

- Specific details for the BPP will be provided before the Finals.

- The details which are not covered in this rulebook will be shared in the form of separate guidelines and the FAQs section on the website.

- For any query related to the rulebook contact us at irc@roverchallenge.org