

Anatolian Rover Challenge Junior
2024 Manual v3



Version Information

This file is the ARC Jr. Manual v.3 released on 08.03.2024.

Written by the ARC Committee. Digitally distributed.

Information Channels and Contacts

The Anatolian Rover Challenge website is the main source of information about the event.

ARC Website: www.anatolianrover.space

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1. Calendar

An up-to-date calendar of the challenge and important dates are shown in the table below.

Date	Event
08.01.2024	ARCJr'24 Manual V1
08.02.2024	ARCJr'24 Manual V2
08.03.2024	ARCJr'24 Manual V3
08.03.2024	Applications Start
30.06.2024	Applications End
07.07.2024	Announcement of Finalists
07.07.2024	Online Check-in Start
12.07.2024	Online Check-in Deadline
16.07.2024	Timetable Announcement
17.07.2024	Challenge Registrations and Orientation
18.07.2024	Lunar Day 1 - Exploration Challenge
19.07.2024	Lunar Day 2 - Delivery Challenge
20.07.2024	Lunar Day 3 - Excavation Challenge
21.07.2024	Awards Ceremony



2. Introduction

The Space Exploration Society (UKET) is an association established by young space professionals who come together with the goals of making contributions to space studies, carrying out practical training activities in this field, and being the planner and stakeholder of extraterrestrial exploration activities. The main goal of the association is to create opportunities that will unite the scientists, technocrats, students, and enthusiasts working in the space industry. Anatolian Rover Challenge (ARC) and Anatolian Rover Challenge Junior (ARC Jr.) are organized by the Space Exploration Society (UKET).



The Anatolian Rover Challenge Junior is a competition for junior rovers open to participants of any nationality and age. Participants will send their application for their junior rover on the website to qualify. Finalist junior rovers will be chosen based on readiness and announced before the event. During the finals, held on a challenge field that is created to simulate space exploration and investigation scenarios, junior rovers will complete various tasks. Scoring will be done by judges according to the ARC Jr. Manual, and prizes will be given. The ARC Jr. event provides an opportunity for individuals to showcase their ability to solve complex engineering and scientific problems through the design, manufacturing, and equipping of their vehicles.





3. General Information and Rules

3.1 Application and Participation Conditions

1. Applications **must be submitted electronically** through the online application system on anatolianrover.space. Any changes to application information **must be** reported to the Organizing Committee. Questions can be answered through the contact address provided and website online chat.
2. **FAQ** and **Q&A** sections override the ARC Jr. Manual.
3. **No** age, nationality, or profession limitation exists on ARC Jr. competitions.
4. All underage participants **must deliver** a signed consent by their legal guardian on the registration and orientation day. Otherwise, they **will not be permitted** to be in the competition field. Underage participants must have an advisor of legal age in the challenge field.
5. Registration of multiple junior rovers for the competitions is encouraged. Note that there **must be** an application for **each junior rover**.
6. **An application** consists of the following:
 - a. A single video of the junior rover, consists of:
 - i. Introduction of the junior rover, robotic arm design and its capabilities, sub-walk system design, wheel design, etc.
 - ii. Illustration of the competition readiness, problem-solving approach to the tasks given on different challenges, the strategies planned for different challenges, etc.
 - iii. Status of the manufacturing, problems faced, foreseen solutions to those problems, etc.
 - iv. The video will be uploaded **online**. The link to the video will be submitted to the application form. Make sure the video content is **publicly accessible**.
 - v. Maximum video length is **3 minutes**.
 - b. **Photos** taken from **5 different** perspectives of the junior rover. (1 isometric, 1 front-side, 1 right-side, 2 free-angle photographs.)
 - c. A photo of the participants alongside the junior rover.
7. Finalist junior rovers **will be chosen** based on the **competition readiness** presented on the application content.
8. Participants **can choose** which challenges their junior rover will compete. Participation in all challenges **is not required**.

3.2 Junior Rover Design Requirements

1. A **Junior rover** is a small unmanned ground vehicle that is remotely controlled or autonomous. Wireless communication, including sound or radio waves, is allowed to control the rover, with the participant standing within a few meters of the rover and **maintaining visual contact** or using the **onboard camera**.
2. Junior rovers **must be designed** to withstand local weather and terrain conditions,





including gravel, loose or hardened soil, and fine particle sand. The Organizing Committee is **not responsible** for any damage to hardware or software during the challenge.

3. The missions of the challenges are designed for rovers with maximum dimensions of **40cm x 40cm x 40cm**. For instance, the airlock of the lunar dome is a restriction for designs with a 40cm x 40cm rectangular cross-section. **No weight limitations** apply.
4. Each rover will be given a **restart option**, when decided, the rover will be carried to the starting point and the timer will be **reset**. In case of use, the scores gained from the prior run will be **ignored**, and only the second run points will be **taken into account**. The restart option can be used on **each challenge once**.
5. The challenge will take place on a simulated lunar surface with loose soil and potentially cratered or sloped sections, approximately 7.2 meters **major** and 5 meters **minor** ellipse, including a Lunar dome with 3.6~ meters in diameter.
6. The Organizing Committee reserves the right to change soil particle size and type.

3.3 Organization Rules

1. The Timetable showing the fielding time of the junior rover will be announced by the ARC Jr. Organizing Committee on the website after **online check-in**. The timetable may be subject to change at the discretion of the Organizing Committee.
2. Participants must **adhere** to the changes regarding the rules, calendar, or timetable published on the website.
3. Participants must **obey** the set timetable. The junior rover must take the field with a **maximum delay of** 5 minutes from the appointed time, otherwise, the rover is disqualified from that day's competition. Time limitations and timetable are **not** a matter of debate.
4. Watching the mission fields while other junior rovers are competing **will not be allowed**.
5. It is **forbidden** to touch or manipulate the junior rover by any participant during the challenge. In case of violation of this rule, **%30 deductions will** be applied to the gained challenge score.

3.4 Ethics

1. Any kind of **inappropriate behavior** will be noted by The Organizing Committee and related authorities will also be informed immediately if necessary. These behaviors can be summarized as follows;
 - a. Insulting, swearing, threatening, etc. actions against other participants, people, or organizations through social media or in the challenge area during the challenge period.
 - b. Provocation, disturbing other participants, being involved in fights, etc.
2. Language, religion, belief, political opinion, race, age, and gender discrimination will not be tolerated in the **challenge area**, as well as behaviors and practices that **may jeopardize equal opportunity**.



4. Challenges

Competition challenges are designed to simulate an unexpected disaster occurring on the lunar surface. Three different days corresponding each with a unique challenge scenario are explained in this section. Each challenge will be evaluated independently, and the results will be announced at the Award Ceremony. Junior rovers can execute the tasks in a mixed order.

4.1. Lunar Day 1 - Exploration Challenge

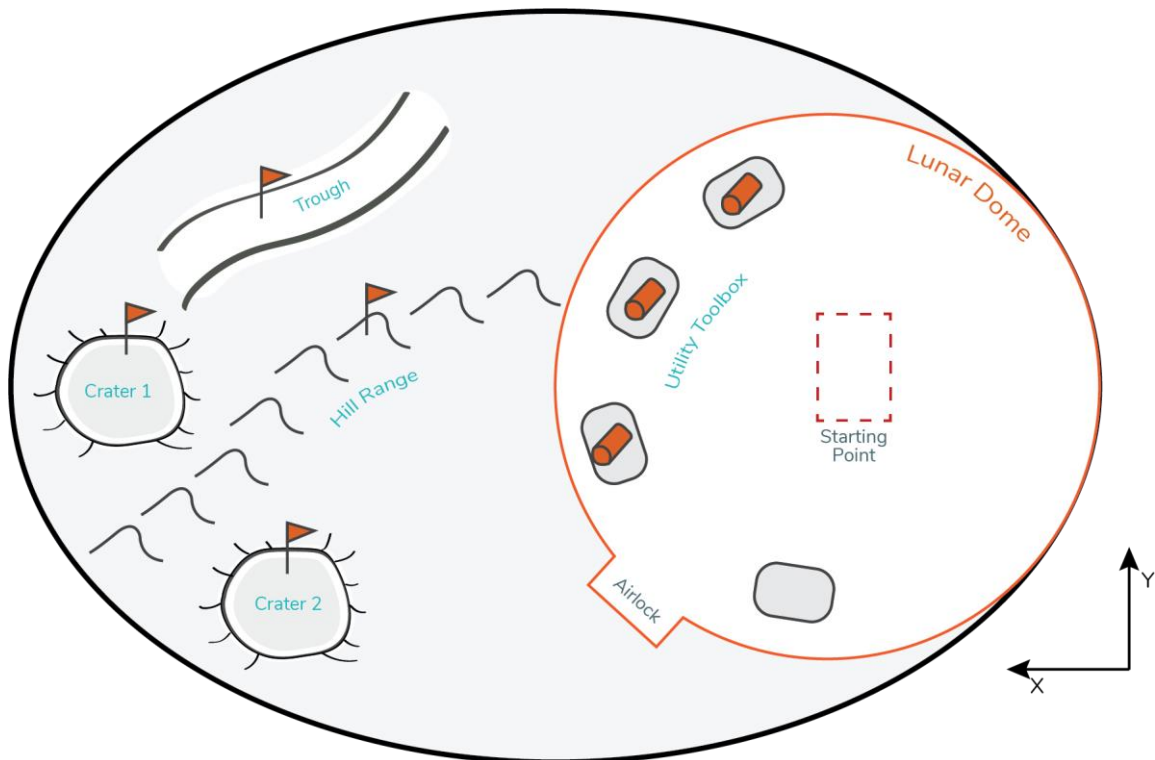
Time Limit: 15 minutes

Purpose: Investigate the lunar crash site and document the residuals

The purpose of the task: Waiting for future missions, the Junior rover is in a sleep state in the lunar base. Suddenly powered with a warning signal, the rover is tasked with investigating the crash site of a rocket, which faced a malfunction during its soft-landing phase, leading to a scattered array of rocket part debris and critical payloads across the rough lunar surface. Following a rapid terrain scan from the dome's sensors, potential locations for the scattered debris were identified. Tasked with a detailed inspection and retrieval, the rover, equipped with specialized scanning and navigation systems, thoroughly traversed through the lunar landscape. Utilizing its high-resolution cameras and manipulator arm, the rover carefully documented the crash site and collected the debris, aiming to explain the cause of the rocket malfunction.

4.1.1. Challenge Map

The Exploration Challenge map is shown below.





4.1.2. Tasks

1. The rover starts at the designated starting point.
2. The rover traverses through the given possible debris location indicators (flags).
3. The rover takes images of the discovered crash residue parts. By saving images to its memory card, the rover reports the crash site to the mission command.
 - a. The images should be named by the X and Y locations where the image is taken relative to the starting point. The naming should be in the format of “x, y” where the x and y are 2 digits rounded and in meters (example: “1.11, 2.22.jpg”). Check the challenge map for the reference frame.
 - b. Image formats can be any of “.png” or “.jpeg”.
 - c. The images must have the rocket part in the scene. Multiple images taken of a single site will be evaluated together.
4. The rover finds and documents the valuable resource location during its investigation of the crash site.
5. The rover returns to the base and delivers the microSD card containing the evidence images.

Note: The microSD (16 GB of memory) card will be provided by the jury before the mission starts. Evaluations will be done based on the contents of the delivered microSD card.

4.1.3. Score Table

Exploration Challenge will be scored according to the table below.

No	Score Parameter	Explanation	Score (per site)
1.a	Reach designated point	Reach to the crash site designated by flags (touching or knocking down the flag is considered as reaching)	10
1.b	Report the crash site	Locate and document the crash site by onboard camera and sensors. (taking images and saving to the microSD card is considered as documenting)	15
2	Return to base	Return to the lunar dome before mission time runs out. (Touch by any rover part within the starting point limits is considered as the returning)	25
3	Discovery Bonus	Locate and document valuable resource locations.	25
4	Design and Creativity Bonus	Extra points will be given to rovers designed according to the task and have performed innovative solutions to the problems faced during the mission.	25



4.2. Lunar Day 2 - Delivery Challenge

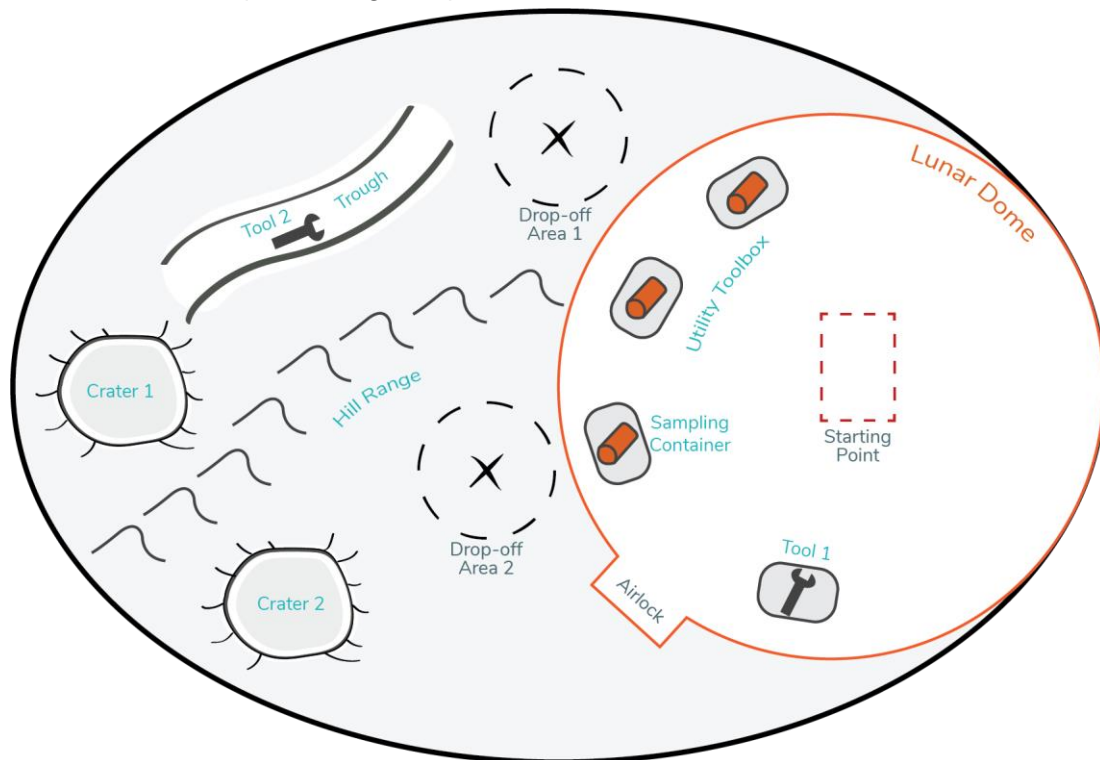
Time Limit: 15 minutes

Purpose: Delivery of payloads to designated areas for upcoming lunar mission

Scenario: Following a recent lunar mission crash, the soil in the surrounding area requires analysis to identify potential chemical and radioactive contaminants, posing a threat to future lunar operations. However, the limited visibility of the sun prevents the rover from safely operating on the lunar surface to retrieve samples. As a result, the mission is divided into two phases. The junior rover is initially assigned the crucial task of delivering essential payloads, including the lunar sample container—a critical component for the upcoming sampling mission—to the designated field. This strategic approach ensures the safe transportation of necessary materials before the subsequent phase focuses on regolith sample retrieval.

4.2.1. Challenge Map

The Delivery Challenge map is shown below.



4.2.2. Tasks

1. The rover delivers the sample containers to the designated areas:
 - a. Crater 1.
 - b. Crater 2.
2. The rover delivers/retrieves the useful tools:
 - a. Deliver Tool 1 to the dropoff area 1.
 - b. Deliver Tool 2 to the dropoff area 2.
3. The rover returns to the lunar base.



4.2.3. Score Table

Delivery Challenge will be scored according to the table below.

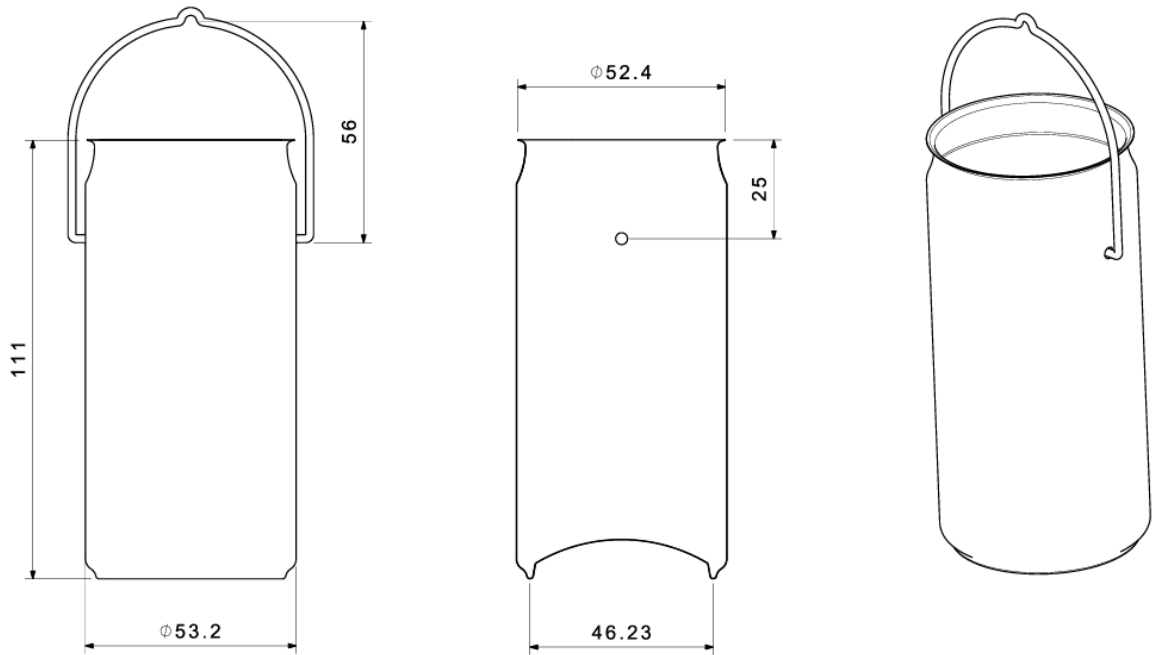
No	Score Parameter	Explanation	Score
1.a	Repository delivery	Pick up the sample container. (to make the object lose contact with the ground is considered as picking up)	10
		Deliver the sample container to Crater 1. (placing the object within a 15cm radius centered by the flags is considered as deliver)	15
1.b		Pick up the sample container.	10
		Deliver the sample container to the Crater 2.	25
2.a	Tool Delivery	Pick up Tool 1.	5
		Deliver Tool 1 to the Delivery Area 1.	10
2.b		Pick up Tool 2 from Delivery Area 2.	5
		Deliver Tool 2 to the lunar base.	20
3	Return to base	Return to the lunar dome before mission time runs out. (Touch by any rover part within the starting point limits is considered as the returning)	25
4	Design and Creativity Bonus	Extra points will be given to rovers designed according to the task and have performed innovative solutions to the problems faced during the mission.	15





4.2.4 Sample Container

Generic 200ml aluminum beverage cans with pinned handles and removed top will be used as the sample containers. Technical drawings of the sample containers are provided below. The sample container weighs around 10 grams.



Note: Dimensions given are approximate, there might be small variances.



4.3. Lunar Day 3 - Excavation Challenge

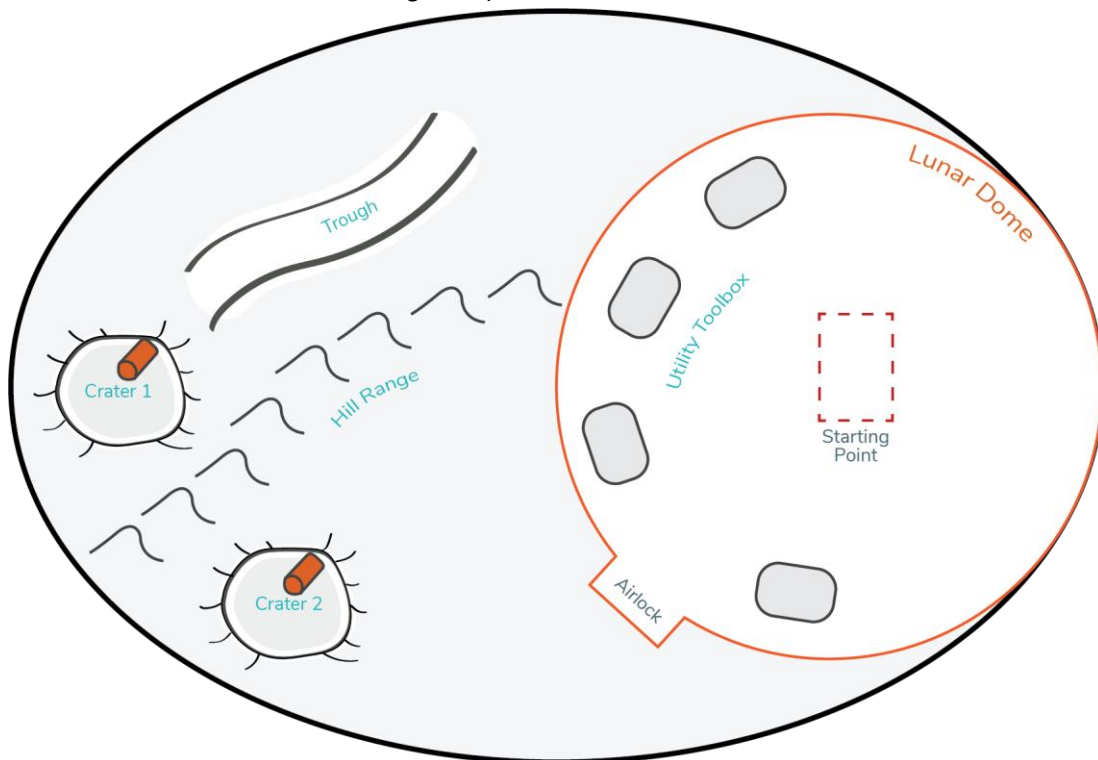
Time Limit: 15 minutes

Purpose: Sample the lunar soil

Scenario: With the sample containers set in the designated areas, the rover is now assigned to the mission of sample retrieval. Navigating through the lunar terrain, the rover collects samples from the locations. Equipped with specialized tools and mechanisms, it carefully extracts soil, rock, or any other designated materials, ensuring the secure storage of these samples for analysis upon return. The success of this mission hinges on the rover's ability to execute retrieval procedures, providing valuable data for scientific examination and contributing to our understanding of the lunar crash and its residuals.

4.3.1. Challenge Map

The Excavation Challenge map is shown below.



4.3.2. Tasks

1. The rover starts at the starting point and makes its way to the sampling craters.
2. The rover collects soil samples from the craters and deposits them into the provided sample containers.
3. The rover carries the sample containers back to the toolboxes in the base.
4. The rover returns to the lunar dome.



4.3.3. Score Table

Excavation Challenge will be scored according to the table below.

No	Score Parameter	Explanation	Score
1	Amount of soil	Collect regolith and deposit it in the sample container.	1/gr
2	Return to base	Return to the lunar dome before mission time runs out. (Touch by any rover part within the starting point limits is considered as the returning)	25
3	Sample Return Bonus	Return the sample containers to the toolboxes within the lunar dome. (placing the sample containers within the toolboxes is considered as sample container return)	50/container
4	Design and Creativity Bonus	Extra points will be given to rovers designed according to the task and have performed innovative solutions to the problems faced during the mission.	25

Note: The soil remaining at the end of the challenge time within the sample containers will be considered when evaluating No 1.

4.4. Side-Challenges

Check the “ARC’24 Manual, Section 7.2.2” for the Side-Challenges that will be available on the last day of the competition.

