Introduction

The Australian Virtual Astronaut (AVA) Space Challenge is a 9-step STEM design sprint. It is based on challenges facing NASA's Artemis Mission and the Australian space industry. Scenario 2 is the AROSE Lunar Rover Challenge which is based on the Australian Government's Moon to Mars Trailblazer Program. The Moon to Mars initiative is a $150 million investment over five years to drive the growth of the Australian space industry.

Scenario 2: AROSE Lunar Rover Challenge

Challenge partners:

AROSE (Australian Remote Operations for Space and Earth)
AROSE is a national consortium which plays a crucial role in positioning Australia as a leader in remote operations for both terrestrial and extra-terrestrial applications. The consortium plays a pivotal role in Australia's space sector, particularly with its role in designing and building a lunar rover for the Trailblazer mission under NASA's Artemis program.

Australian Space Agency
The Australian Space Agency is an Australian Government agency responsible for the development of Australia's commercial space industry, coordinating domestic activities, identifying opportunities and facilitating international space engagement that include Australian stakeholders. Its headquarters, opened in February 2020, are located in Lot Fourteen in Adelaide.
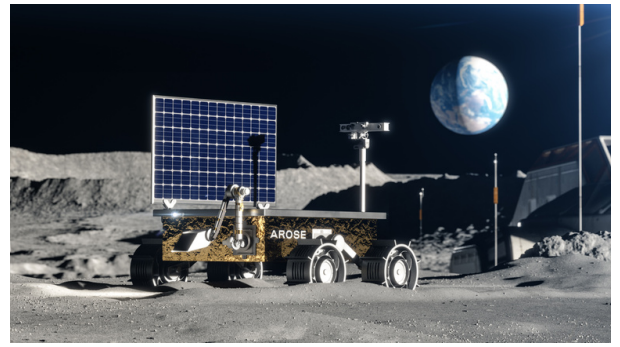
NASA
NASA, the National Aeronautics and Space Administration NASA, established in 1958, oversees the American civilian space program and aerospace research. It has led significant missions including the Apollo moon-landings, Skylab, and the Space Shuttle. Currently, NASA focuses on space and Earth research, notably through the Artemis program aimed at returning humans to the Moon and planning for Mars exploration, to establish a sustainable lunar presence as a foundation for future interplanetary missions.
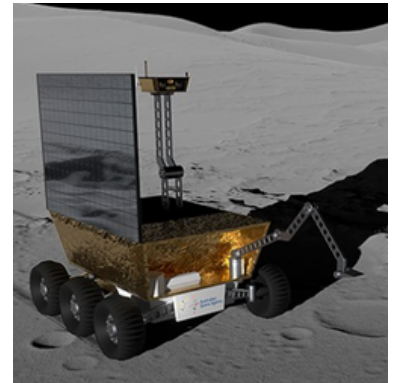
Trailblazer Program

Through the Trailblazer Program, the AROSE consortium will develop and build a lunar rover #AROSELunarRover. Controlled from Earth, the rover will collect lunar soil (regolith), which contains oxygen (in the form of oxides). NASA will then aim to extract oxygen from the regolith, using separate equipment that will be sent to the Moon with the rover.

This is a key step towards establishing a sustainable human presence on the Moon, as well supporting future missions to Mars. Australia's ability to develop and operate a rover like this is supported by our skills and experience in remote operations and autonomous systems here on Earth.

Connecting space and resources with a focal point for learning.
- The Trailblazer program will develop and build a lunar rover (Roo-Ver) in 2026 that will be controlled from Earth.
- The 20 kg rover will scoop lunar regolith and return it to NASA using the in-situ resource utilisation (ISRU) unit.
- The ISRU will extract oxygen (in the form of oxides) from the lunar regolith.
- The rover is part of an Australian Space Agency program, Trailblazer, which will leverage technologies that Australia has expertise with, such as mining and robotic operations, for lunar exploration.
- This is a key step towards establishing a sustainable human presence on the Moon, as well as supporting future missions to Mars.

AROSE Lunar Rover Challenge

The Mission Overview

On 13 October 2021, the Australian Space Agency reached an agreement with NASA for an Australian-made, semi-autonomous rover to be part of a future mission to the Moon. The mission will demonstrate Australia's world-leading skills and experience in remote operations and autonomous systems and draws on our expertise from the resources and mining sectors.

Challenges facing the AROSE Lunar Rover Design Team include:

▢ Designing and building a lightweight rover.
▢ Navigating unknown terrain.
▢ Collecting and transferring regolith (lunar soil).
▢ Mission design.
▢ Communication with Earth.
▢ Design with the future in mind.

The first challenge facing your team is: Roving Around
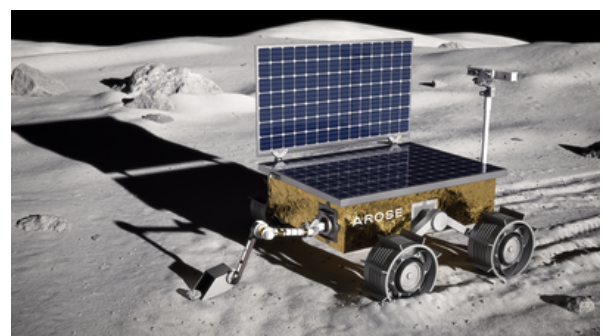
'Roving Around'

This challenge emphasises the design of a rover's mobility on the lunar surface. Your team may wish to consider:

- The lunar surface and adhering dust.
- Wheel design and traction.
- Gravity.
- Navigation.
- The lunar environment, temperature, and darkness.
- Technology considerations related to the harsh lunar environment.

Teams will research and design a solution to one of these challenges and present it in the form of either a 90-second video pitch or poster.

Scan me

Ask the Experts
Teams will have the opportunity to ask AROSE questions regarding their research, their ideas, or their design. Don't forget to 'Ask the Experts' before the end of each month by using the QR Code.

Team Deliverables

Teams will develop a 90-second video or poster to address one or more of the challenges outlined above in Roving Around.

Teams should include:

- A summary of your research.
- An outline of the challenge your team has worked to solve.
- A presentation of the solution your team has designed.

Winning teams will then be selected to pitch their ideas to a panel of judges from industry and education. The goal of the AROSE AVA Challenge is to engage young people in a real space challenge and to inspire them to address the emerging challenges in space and on Earth.

Age Divisions

The Australian Virtual Astronaut (AVA) Challenge is open to all students from Year 5 to Year 10.
There are three age divisions for judging:

- Stage 3 – Years 5 and 6
- Stage 4 – Years 7 and 8
- Stage 5 – Years 9 and 10 (Eligible for Phase 2)

Mission Schedule

The Australian Virtual Astronaut (AVA) Challenge missions will be delivered by subject matter experts and will provide relevant information to enable the team to complete the challenge in a systematic way using the iSTEM Engineering Design Process as a guide.

Step-by-Step Schedule
Run these missions at your own pace, using as little or as much of the AVA resources as needed.

Mission 1: Introduction and Webinar
Mission 2: Define
Mission 3: Identify
Mission 4: Brainstorm
Mission 5: Design
Mission 6: Prototype
Mission 7: Evaluate
Mission 8: Iterate
Mission 9: Communicate

The culmination is submitting your pitch to be judged. Finalists will be invited to pitch to a group of experts. For this mission there are two rounds!

Round 1: Submissions due Friday 28 June 2024
Round 2: Submission date to be confirmed by AVA.

Phase 2: - Pitch Session

Winning Teams will be selected for Phase 2. In this phase, teams will be given 3 minutes to pitch their idea to an expert panel from industry and education. Pitch sessions will take place following Semester 1 submissions, and again following Semester 2 submissions.
Closing date for submissions: Semester 1- Friday 28 June 2024; Semester 2 - To be confirmed

Team Deliverables

- An introduction to your team and your roles.
- A summary of your research.
- An outline of the challenge your team has worked to solve and why your solution should be considered by the AROSE panel of experts for the challenge: *Roving Around.*