🌍 *Mission M.A.R.S Habitat*

Humanity is preparing for its next giant leap — establishing a sustained presence on Mars.
But survival on Mars is not science fiction — it is a systems engineering challenge.

Thin atmosphere.
Extreme temperatures.
High radiation exposure.
Dust storms.
Communication delay with Earth.

Now imagine this:

Four astronauts.
60+ days.
One hostile planet.
And your design decides their survival.

Welcome to **Mission M.A.R.S Habitat** — a design and deployment challenge where engineering meets imagination.

 Problem Statement

*Participants are challenged to **scout a viable location on Mars and design a fully deployable shelter capable of sustaining four astronauts for more than 60 days** under Martian environmental conditions.*

The challenge simulates a near-future Mars mission scenario where:

- The crew arrives with limited prefabricated modules.
- On-site deployment must be efficient and reliable.
- Environmental hazards must be mitigated through smart engineering.
- Every kilogram, every material choice, and every design decision matters.

Teams must approach this as a **real mission architecture problem**, integrating:

- Site selection strategy
- Habitat layout and structural design
- Life support systems
- Radiation protection
- Thermal management
- Pressure containment
- Communication systems
- Material optimization
- Deployment methodology

The goal is not just to design a shelter —
It is to design a survivable Martian habitat.

🛰️ Competition Structure

🔴 Round 1: Mars Site Scouting & Pre-Planning

Objective: Identify and justify the optimal 10km × 10km area for habitat deployment.

Deliverables:

1. **5-Slide Presentation (PPT)**
    - Slide 1: Selected Location Overview (with map reference)
    - Slide 2: Terrain & Topography Analysis
    - Slide 3: Environmental Considerations
      (radiation exposure, temperature variations, dust risk, slope stability)
    - Slide 4: Accessibility & Deployment Feasibility
    - Slide 5: Justification backed with relevant data
    - 2 slides for self-introduction/title and references.

2. **STL File Submission**
    - 3D terrain model of the selected 10km × 10km area
    - Must clearly indicate:
        - Habitat placement location
        - Orientation
        - Key terrain features
3. **Location Identification**
    - Exact marking on the Mars map (provided by organizers, see reference 4)

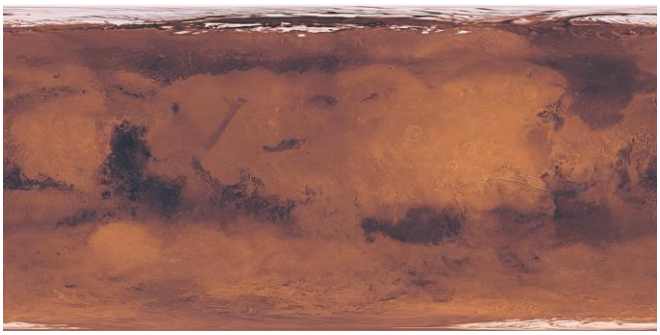

Figure 1: Map of mars

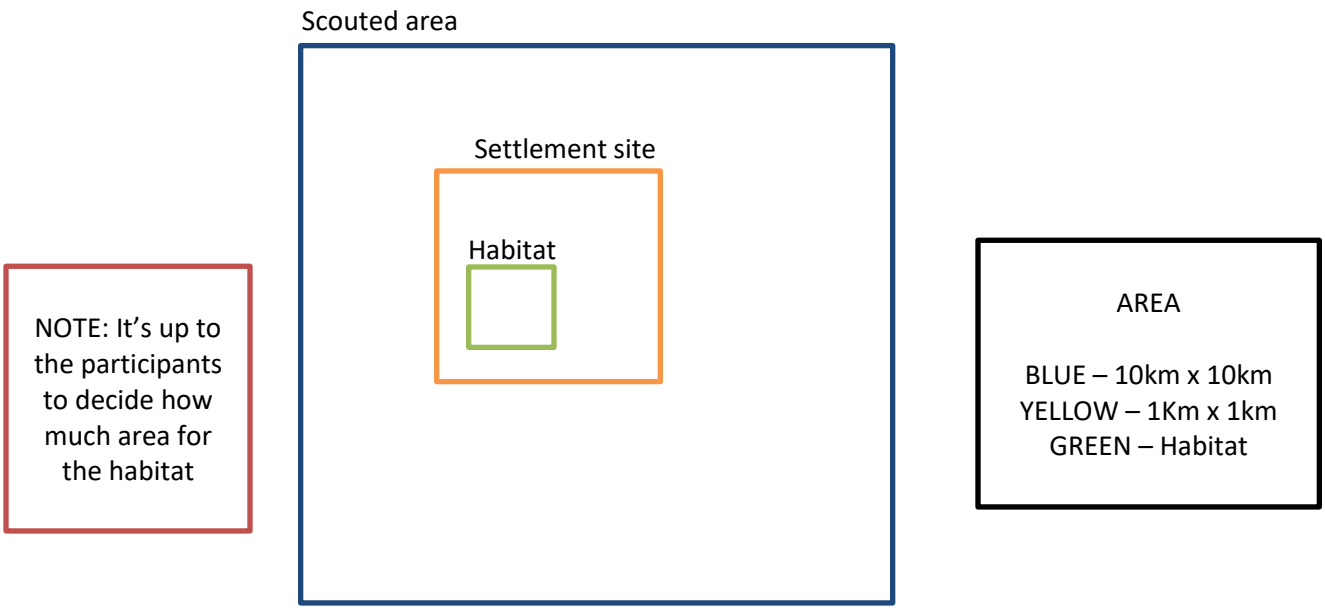

Figure 2: Scouted area representation

Evaluation Criteria:

- Scientific justification
- Data-backed decision making
- Engineering reasoning
- Clarity and precision

Deliverables:

- STL file of the selected 10km × 10km scouted area.
- Original editable work file (if available), used to generate the STL.
- Clear identification of the scouted area on the map, with proper markings of settlement site (1km x 1km) and the habitat.
- A 7-slide PowerPoint presentation that clearly presents the selected location and provides a concise justification for its selection.

🟠 Round 2 & Final Round: Habitat Design & Deployment Validation

This round takes place **on the day of the hackathon**.

Phase 1: Live CAD Deployment Validation

Each team must:

- Demonstrate habitat assembly/deployment inside a CAD environment
- Show:
    - Deployment sequence
    - Structural expansion/inflation (if applicable)
    - Anchoring or terrain integration
    - System integration overview

This live demonstration will be evaluated by the jury.

Evaluation Focus:

- Engineering feasibility
- Realistic deployment strategy
- Structural stability
- Innovation
- CAD clarity and professionalism

📘 Final Submission (Post Deployment Validation)

1. Technical Report (*Maximum 15 Pages)*

The report must include:

- Mission Requirements Definition (*need not worry about rocket and payload*)
- General Habitat Layout
- Structural Design Approach
- Life Support Systems (Air, Water, Waste)
- Radiation Shielding Strategy
- Thermal Regulation
- Pressure Containment Strategy
- Communication Systems
- Material Selection & Justification
- Weight Estimation
- Deployment Methodology
- Risk Assessment

2. Final Presentation *(submitted prior to commencing of phase 2)*

Each team will present:

- Round 1 Site Justification
- Final Habitat Layout & Design
- Systems Overview
- Engineering Decisions
- 30-second maximum deployment CAD animation video
- Final CAD work file (submitted prior to presentation)

Deliverables

- Final CAD Assembly File (editable native format)
- STL File of the complete deployed habitat
- 30-Second Deployment Animation Video
- Technical Report (Max 15 Pages, PDF Format)
- Final Presentation (PPT Format)
- Original Editable CAD Work Files (if separate from assembly)

🧠 What This Hackathon Tests

This is not just a CAD competition.

It tests:

- Systems thinking
- Space habitat engineering
- Structural mechanics
- Environmental adaptation
- Realistic mission planning
- Data-driven decision making
- Communication & technical articulation

⚙️ Assumptions

- Rocket design, launch vehicle, and payload delivery systems are out of scope.
- Food for 4 astronauts is resupplied every 60 days by an automated carrier rocket.
- The crew safely arrives at the Martian surface; interplanetary transit is not part of the design scope.
- The resupply vehicle successfully lands within operational proximity of the habitat site.
- Primary power systems are available (participants must estimate usage, not generate power architecture in detail).
- Communication with Earth is established and functional.
- Core life support technologies exist; teams must focus on integration and layout.
- The mission duration is 60+ days, assuming periodic resupply.
- Budget limitations are not the primary constraint; engineering realism is the focus.

References

1. https://www.spaceappschallenge.org/2025/find-a-team/wrc/?tab=project
2. https://www.marstiet.com/achievement
3. https://spacefdn.com/projects/mars-colony-hackathon/
4. https://planetpixelemporium.com/mars5672.html