Space Center Houston | Mission Innovation Challenge

Competition Guide

Middle School-High School

2026-2027 Mission: Lunar Dust Defense

CHALLENGE OVERVIEW

NASA's Artemis missions are preparing astronauts to return to the Moon and build the skills, systems, and technologies needed for future exploration. As crews live and work near the lunar South Pole, they will rely on spacesuits, rovers, habitats, science tools, power systems, and other equipment to complete their mission safely.

One major challenge is lunar dust. Lunar dust is very fine, abrasive, and clingy. It can cling to spacesuits, scratch surfaces, block seals, cover solar panels, interfere with tools, and follow astronauts back toward living spaces. A small dust problem can quickly become a mission problem.

How might we prevent, remove, capture, or manage lunar dust so astronauts can safely live and work on the Moon?

In this Mission Innovation Challenge, students will research the lunar environment, identify a specific dust-related problem, and develop an innovative solution that supports future Artemis missions. Teams may focus on spacesuits, habitats, rovers, tools, science instruments, solar panels, crew health, or another mission system affected by lunar dust.

ELIGIBILITY

Who Can Enter:

Students in **K–12** (public, charter, private, homeschool, and community-based programs are all welcome).

Entry Type

Individual or **team** entry.

Team size: **2–5 students**.

Grade Divisions

K–5, 6–8, 9–12.

Entry Limits

One submission per student (either solo or on one team). **One slide deck per team.**

Original Work

Entries must be the team's **own original work**. Properly **credit all sources** and images used.

PRIZES

Top Innovators will receive two general admission tickets to Space Center Houston and a virtual chat with an astronaut. Top Innovators will be chosen from Individual and Group Submissions.

CHALLENGE TIMELINE

Mission Innovation Challenge runs as a semesterly challenge.

Milestone	Fall Semester Cycle	Spring Semester Cycle
Challenge Launch	September 3rd, 2026	January 14th, 2027
Submissions Due	November 5th, 2026	March 18th, 2027
Virtual Awards Ceremony	November 19th, 2026	April 1st, 2027

OBJECTIVE

Design and pitch a space-ready concept that prevents, removes, captures, or manages lunar dust for Artemis astronauts, habitats, spacesuits, rovers, tools, science instruments, or power systems. Project pitch decks will include the following:

1. Explain the mission problem, affected system, and user for your idea.
2. Show a workable dust mitigation concept that respects key limits (mass, volume, power, safety, crew time, maintainability, and the lunar environment).
3. Include a system view and concept of operations so judges can see how it fits into an Artemis surface mission day.

Describe the impact and trade-offs: why this design helps the crew, protects mission hardware, and supports sustainable lunar exploration

DELIVERABLES (ONE SLIDE DECK PER TEAM)

Acceptable presentation formats include:

- Microsoft PowerPoint
- Google Slides
- PDF (Word or Google Document)

Acceptable video formats include (video can be included in your presentation):

- MP4
- MOV
- AVI

<u>Maximum Slide Deck Count: 8 slides</u>

Required Sections (use these as slide titles)

1. TITLE & TEAM
    - What is the name of your innovation?
    - Who is on our team and what are our roles?
    - What grade and school are you representing?
2. MISSION CONTEXT & USERS
    - What problem are you solving?
    - Where will this be used (spacesuit, habitat, rover, solar array, tool, science instrument, or other Moon system) and by whom?
    - Why does solving this problem matter for Artemis astronauts or mission operations?
3. CRITERIA & CONSTRAINTS
    - What must your solution do to be considered successful?
    - How would you test your innovation to see if it works? What would you measure, observe, or compare?
        - If your first test did not work as expected, how would you improve and re-test your design?
    - How will your team define success for your specific innovation?
        - For example, success might be measured by how much dust is prevented, removed, captured, or contained; how much astronaut time is saved; how safely the system works; how easily it can be maintained; or how well it protects a specific mission system.
    - What constraints (limits) do you have (mass, volume, power, crew time, safety, maintainability, dust storage, Moon environment)?
    - Which constraint is the toughest, and how are you addressing it?
4. CONCEPT OVERVIEW & VISUAL– HOW IT WORKS
    - How does the concept work from start to finish (plain-language steps)?
    - What makes this idea different or better than a basic alternative?
    - What are the key features of your system?
    - What materials are needed to run this system successfully?
    - How does your concept connect to Artemis surface systems (habitat, power, data, rover operations, EVA tasks, or crew procedures)?
    - Which part is most critical, and what depends on it?
    - Include a design drawing or digital diagram.

(Continues on next page)

5. IMPACT & WHY THIS DESIGN
    - What mission benefits does this bring (crew health, time saved, reliability, equipment protection, sustainability)?
    - What trade-offs did you consider, and why did we choose this path?
    - If given more time, what's the next most valuable improvement?
6. REFERENCES & CREDITS
    1. Which sources support your solution?
    2. Who created each image/diagram?
    3. Who helped you (mentors, teachers, classmates) and how?

Judging Criteria

Criteria	Description	Percentage
Mission Context & Users	• Clearly identifies the lunar dust problem the team is solving. • Explains where the solution will be used, such as a spacesuit, habitat, rover, solar array, tool, science instrument, or other Moon system. • Identifies who will use or benefit from the solution. • Explains why solving this problem matters for Artemis astronauts or mission operations.	20%
Criteria & Constraints	• Defines what the solution must do to be considered successful. • Explains how the team will measure, observe, or compare success. • Describes how the team would test, improve, and re-test the innovation. • Identifies important constraints such as mass, volume, power, crew time, safety, maintainability, dust storage, and the Moon environment. • Explains the toughest constraint and how the team is addressing it.	20%
Concept Overview & Visual	• Clearly explains how the concept works from start to finish. • Identifies the key features, materials, and most important parts of the system. • Explains what makes the idea different from or better than a basic alternative. • Connects the concept to Artemis surface systems, such as habitat, power, data, rover operations, EVA tasks, or crew procedures. • Includes a clear design drawing, digital diagram, or system visual.	30%
Impact & Design	• Explains the mission benefits of the design, such as crew health, time saved, reliability, equipment protection, or sustainability. • Identifies trade-offs, risks, or limitations considered during the design process. • Explains why the team chose this design approach. • Identifies the next most valuable improvement if given more time.	20%
References & Credits	• Uses credible sources to support the problem, solution, and design decisions. • Clearly credits sources, images, diagrams, and outside support. • Explains who helped the team and how.	10%

KEY VOCABULARY

- **Lunar Dust:** Fine, abrasive particles on the Moon that can cling to surfaces, scratch materials, interfere with seals, and affect equipment performance.
- **Regolith:** The loose dust, soil, and broken rock covering the lunar surface.
- **Dust Mitigation:** Preventing, removing, capturing, or managing dust to reduce risk to astronauts and mission systems.
- **Artemis:** NASA missions focused on returning humans to the Moon, building lunar exploration capabilities, and preparing for future Mars missions.
- **Lunar South Pole:** A target region for Artemis exploration where lighting, terrain, temperature, and resources create unique mission opportunities and challenges.
- **Habitat:** A place where astronauts live/work on the Moon or in space.
- **EVA (Extravehicular Activity):** Work astronauts do outside a spacecraft or habitat, such as moonwalks and surface operations.
- **Spacesuit:** A wearable life support and protection system used by astronauts during EVA.
- **Rover:** A vehicle used to transport astronauts, tools, science equipment, or cargo on the lunar surface.
- **Criteria (Must-Haves):** What your solution must do to count as a success.
- **Constraints (Limits):** Rules or limits you cannot ignore (size, weight, power, time, safety, environment).
- **Mass:** How heavy something is.
- **Volume:** How much space something takes up.
- **Power:** Energy needed to run a device or system.
- **Crew Time:** How much astronaut time it takes to use, clean, monitor, or fix a device.
- **Maintainability:** How easy it is to keep a device working through cleaning, repair, replacement, or troubleshooting.
- **Concept of Operations:** The step-by-step story of how people use your idea in real life: normal use, storage, maintenance, and what to do if something goes wrong.
- **Block Diagram (System View):** A simple picture showing inputs -> process -> outputs and how parts connect.

- **Trade-Off:** Choosing one benefit while accepting a cost, such as lighter but slower or safer but more complex.
- **Feasibility:** Whether an idea seems doable with the limits you have.
- **Risk:** Something that might go wrong.
- **Mitigation:** What you do to reduce a risk or handle it safely.

Resources

The Moon and Lunar Dust

- https://science.nasa.gov/moon/moon-dust/
- https://science.nasa.gov/biological-physical/earth-soil-vs-lunar-regolith-whats-the-difference/
- https://science.nasa.gov/moon/composition/

Artemis Missions and NASA Technology

- https://www.nasa.gov/humans-in-space/artemis/
- https://www.nasa.gov/centers-and-facilities/kennedy/nasa-technology-helps-guard-against-lunar-dust/
- https://science.nasa.gov/solar-system/moon/phenomena-nasa-astronauts-will-encounter-at-moons-south-pole/