MISSION BRIEFING

Experience Activity

Experience: Getting a Grip on the Moon

Phase I

Prep Time: 20 minutes

Activity Length: 60 minutes

Summary: Preparing to explore the surface of the Moon goes well beyond designing and building safe spacecraft and spacesuits. In order to do science on the surface of the Moon, NASA has to ensure that the surface vehicles and suits enable the mobility required and that there are tools to collect rock and soil samples. Several important factors must be considered when developing tools for use in environments other than Earth. One of those factors is environmental conditions. For example, tool designs must account for temperature extremes ranging from –414 °F to 250 °F. Another thing to consider when designing a tool to be used by an astronaut is that wearing a spacesuit is essentially like wearing a balloon, and the astronaut will have to squeeze against that balloon every time they grab something. Human factor concerns include ensuring that tools are easy to use without causing the astronaut pain or difficulty.

Watch the Creating Artemis Tools video

www.youtube.com/watch?v=qv0oTVCkrUA

Learning Objective: Participants will use the problem-based learning framework and work cooperatively in small teams to create a geological tool to collect rock samples on the lunar surface.
Outcome: Participants will build a geological tool that contains a rake and a specimen collection cup.
Student roles: The Tools Engineer will build the lunar rake attachment. The Project Manager assists team members with tool build responsibilities and builds the lunar tongs. The Human Factors Engineer builds the lunar tool handle. The Mission Specialist (**Geologist**) builds the lunar collection cup attachment.

Activating Prior Knowledge

Ask students:

- What do you think astronauts will do while they are on the Moon?
- What work will they be performing?
- What are they looking for?
- How do you think astronauts will collect and store any samples they find?

Challenge Questions:

- What were some difficulties your team faced during the initial design and build process, and how did you overcome them?
- What challenges does your team anticipate in the next phase of the activity, when you begin to test the tool?
- Do you think wearing the gloves will cause any difficulty, or has your team already considered the use of gloves with your new tools?

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Phase II

Prep Time: 20 minutes

Activity Length: 60 minutes

Summary: Since tool design for the Artemis missions involves consideration of the different environment factors on the lunar South Pole, testing and improving the design is essential. Prototyping early and often to get feedback from the crew will be a necessary step. Testing while wearing gloves in an analog environment like the Johnson Space Center rock yard creates a baseline for the Artemis tools' performance, and this helps scientists and engineers understand how the tool will eventually function on the lunar surface.

Learning Objective: Participants will use the problem-based learning framework to test and redesign their modified tool.
Outcome: Participants test and redesign their tool to collect rock samples.
Student roles: The Tools Engineer, Project Manager, Human Factors Engineer, and Mission Specialist (Geologist) will complete testing of the tool and provide feedback to the team.

Challenge Questions:

- What were some difficulties your team faced during the initial design and build process, and how did you overcome them?
- Were you surprised by the performance of your tool? Explain.
- How were you able to improve your tool during the redesign phase? What design changes did you make, and how did they improve your tool's performance?

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Phase III ???

Prep Time: 20 minutes

Activity Length: 60 minutes

Summary: NASA established the foundation for the Axiom Extravehicular Mobility Unit (AxEMU) with the agency's Exploration Mobility Unit (xEMU) **prototype** development efforts that advanced spacesuit designs for multiple destinations. Axiom Space used the experience, expertise, and data behind the xEMU as a basis for AxEMU design and development, including advancements in technology, training, astronaut feedback on comfort and maneuverability, and compatibility with other NASA systems.

Learning Objective: Participants will test the redesign of their tool and present the pros and cons of their design.
Outcome: Participants will test their improved design from Phase II and present their designs along with their reflections to the group.
Student roles: The Tools Engineer will test the redesigned lunar rake attachment. The Project Manager will test the redesigned lunar tongs. The Human Factors Engineer will test the redesigned lunar tool handle. The Mission Specialist (Geologist) will test the redesigned lunar collection cup attachment. All testers will summarize and present their findings to the group.

Challenge Questions:

- What were some difficulties your team faced during the initial design and build process, and how did you overcome them?
- Were you surprised by the performance of your tool? Explain.
- How were you able to improve your tool during the redesign phase?
- What design changes did you make, and how did they improve your tool's performance?