

NASA EXPLORATION EXPERIENCE

GETTING A GRIP ON THE MOON

STUDENT GUIDE

Welcome, Exploration Experience team members!



Scientist-astronaut Harrison H. Schmitt, Apollo 17 lunar pilot and **geologist**, collects lunar rake samples at Station 1 during the mission's first spacewalk at the Taurus-Littrow landing site. This picture was taken by astronaut Eugene A. Cernan, commander. The lunar rake, an Apollo lunar geology hand tool, is used to collect discrete samples of rocks and rock chips ranging in size from one-half inch (1.3 centimeters) to 1 inch (2.5 centimeters). Credits: NASA

ACTIVITY BRIEFING

Humans are returning to the Moon. To make this effort successful, Artemis astronauts will need to conduct in-depth scientific investigations on the lunar surface. This will require more advanced lunar sample collection equipment than was used during the Apollo missions. To assist in that effort, your team's task will be to use Problem-Based-Learning (PBL) to increase lunar rock sample collection rates. Your team will be constructing Apollo era inspired tools, testing them, then making modifications to increase their effectiveness. You've got this!

GOOD LUCK!

Developed in collaboration with AIAA and Students To Launch. Activity photos provided by Students To Launch.

PROBLEM-BASED LEARNING PROCESS



NASA astronauts Zena Cardman and Drew Feustel wearing mockup spacesuits after performing an engineering test run before a week of simulated moonwalks. Credits: NASA

In this experience, you will be working in a team to solve a problem using the sequence of steps shown in the flow chart to the right. A more detailed explanation of Problem-Based Learning is given below.

- Meet the Problem: Identify the problem, introduce new vocabulary, and discuss previous experiences with the problem
- Explore Knowns and Unknowns: Use resources to explore the knowns and unknowns.
- Generate Possible Solutions: Brainstorm possible solutions based on resources and prior experience with the problem.
- Consider Consequences: Examine the pros and cons of each solution to determine a viable solution
- Present Findings: Communicate and discuss the process and solutions as a team



PHASE I

Part 1: Meet the Problem

Problem Overview

Artemis astronauts need efficient lunar rock collection tools! Tasks carried out on Earth become much more difficult under the hostile conditions of the Moon. In the Apollo era, NASA design engineers developed tools based on each mission. Even with Artemis advanced spacesuits, astronauts will need better tools that can achieve the advanced scientific objectives of the Artemis mission. The tool is a system that uses multiple attachments that can be placed on a single handle, enabling use for a variety of purposes. This saves mass and uses less storage space, which is very important for space-based activities. The tool is intended to be used by astronauts on the Moon to efficiently collect lunar rock samples. Time is of the essence when working on the surface of the Moon! Your observations and innovations are vital to advancing NASA's efforts.

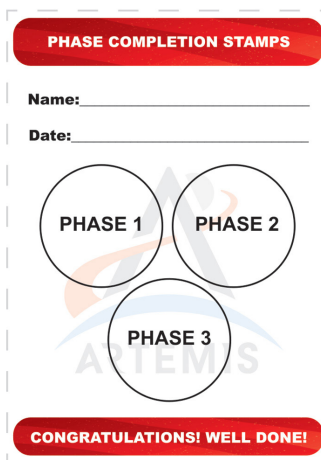
NASA officials have presented you with the following problem scenario:

Design, build, and test an Apollo era inspired tool to collect rock samples more efficiently. This tool needs to be modified based on the data and observations recorded during a test scenario.

Getting a Grip on the Moon Role Selection and Preparation

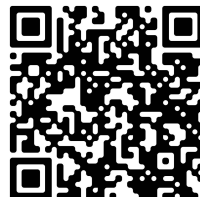
In this activity, you will be working in teams of four to solve a problem. Each member of your team will be taking on a real NASA career role. Below are the instructions for role selection and preparation.

1. Have each team member select a badge from the supply bin.
2. DO NOT trade or change your badge with your team members.
3. Have each person cut out and tape a single Stamp Card to the back of your badge. (Your team will receive your stamp cards from your Mission Directors, see example on the right.)
4. Put on your badges and the included safety glasses.
5. Each team member will now perform the specific tasks of the job listed on their badge during this activity.



Now, closely watch the **Creating Artemis Tools** video and then review the **Job Classification Task Sheet** on page 13 to answer the question on the next page.

www.youtube.com/watch?v=qv0oTVckrUA



JOB CLASSIFICATION TASK SHEET

Based on what you heard in the video and information from the Job Classification Task Sheet, what are the individual tasks you are responsible for throughout the phases of this activity?

Have each team member write a response, in pencil, to this question in the space below.

Tools Engineer

Your Name: _____

Mission Specialist - Geologist

Your Name: _____

Human Factors Engineer

Your Name: _____

Project Manager

Your Name: _____

JOB CLASSIFICATION TASK SHEET

This Task Sheet can be referenced throughout the activity to remind you of your responsibilities.

Tools Engineer

- Build the lunar rake attachment
- Test the tool and collect tool performance data
- Redesign and build a modified lunar rake attachment
- Test the redesigned tool
- Collect redesign performance data
- Provide final recommendations to NASA for the lunar rake

Mission Specialist - Geologist

- Build the lunar collection cup attachment
- Test the tool and collect tool performance data
- Redesign and build a modified collection cup attachment
- Test the redesigned tool
- Collect redesign performance data
- Provide final recommendations to NASA for the collection cup

Human Factors Engineer

- Build the lunar tool handle
- Test the tool and collect tool performance data
- Redesign and build a modified tool handle
- Test the redesigned tool
- Collect redesign performance data
- Provide final recommendations to NASA for the tool handle

Project Manager

- Build the lunar tongs
- Test the tool and collect tool performance data
- Redesign and build modified lunar tongs.
- Test the redesigned tool
- Collect redesign performance data
- Provide final recommendations to NASA for the lunar tongs
- Assist team members with tool build responsibilities
- Contact Mission Director when each phase is complete to get a red completion sticker