Out of This World! - Week 7

Grades K-2

Day 5: Lunar Touchdown: Improve

Teacher/Parent Background:

NASA has announced its plans to return astronauts to the Moon by 2024 through a collaboration with commercial and international partners. In going to the Moon, NASA is laying the foundation that will eventually enable human exploration of Mars. The Moon will provide a proving ground to test technologies and resources that will take humans to Mars and beyond, including building sustainable, reusable architecture.

Overview:

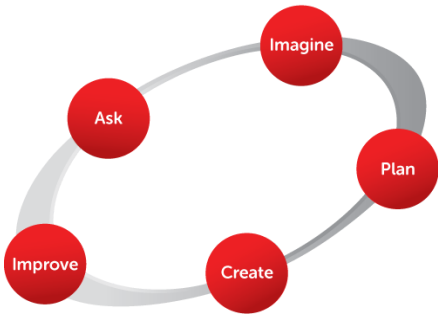
In this activity, learners will apply their knowledge of the features of the Moon (particularly craters) and lessons learned from the results of the initial test of the spacecraft to redesign and rebuild a spacecraft that can land in one of the Moon's craters without injuring astronauts or damaging the spacecraft.

Related Standards:

- **Plan and carry out investigations** which demonstrate how equal forces can balance objects and how unequal forces can push, pull or twist objects, making them change their speed, direction or shape.

Key Terms:

- moon - a natural satellite of a planet
- satellite - an object that stays in an orbit around a planet
- crater - dish-shaped pits formed when objects from space struck the moon's surface
- engineering design process - a set of steps engineers use to propose solutions to problems



Engineering Design Process

- blueprint - a design plan

Materials List:

- *Exploring the Moon* handout
- Additional building supplies (as needed)
- scissors
- tape
- pencil

Activity Description:

1. Revisit the results of the spacecraft testing recorded on the *Exploring the Moon* handout from Day 4.
    - Engineers' early ideas rarely work out perfectly. How does testing help them improve a design?
    - Based on your specific test results, what would you like to improve/change about your design?
    - What additional materials do you need to make your improvements?
2. Prompt the student to record his/her revised plan and materials list on the *Exploring the Moon* handout.
3. Provide the student with time, space, materials and adult support (as needed) to create his/her spacecraft based on his/her blueprint.
    - Reminder - you can build only what you drew using only the materials labeled in the revised plan.

Closure:

Once the student has finished recreating or the allotted time has elapsed, provide the student with time to retest the spacecraft.

- Place the astronauts (the two regular marshmallows) in/on the spacecraft.
- Drop the spacecraft from a height of 30 cm (1 foot).
- Record the results on the *Exploring the Moon* handout.

- Then discuss successes and struggles that he/she experienced during the Improve stage of the engineering design process and record on the *Exploring the Moon* handout.
    - What happened during the retesting of your spacecraft?
    - Was your spacecraft successful? Why or why not?
    - What advice would you give to another engineer trying to solve this problem?
    - What forces affected your lander as it fell?
    - The Moon is covered in a thick layer of fine dust. How might this be an advantage? A disadvantage?

Extension:

Hold a" How High Can You Go?" Contest

- Have the student drop the lander from two feet, three feet, etc. How high can the spacecraft drop before it is ineffective? Can he/she find a new way to make the spacecraft safely land from a greater distance?

Test Springs of Different Sizes

- Have the student see if the number of folds in an index card makes a difference in the amount of force the spring can absorb. Have him/her fold index cards with two, four, and six folds. Have him/her test to see how much of a difference these different springs make in how softly a lander touches down.

ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.

Exploring the Moon

Goal: Design and build a spacecraft that can safely land in a crater on the Moon in order to look for water and other usable resources.	
IMPROVE	
Proposed Improvements	What Problem It Solves
Diagram (with labels)	Materials (type & quantity)
Test Results: What happened during the retesting of your spacecraft? Be specific.	

ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.

REFLECTIONS	
Was your spacecraft successful? Why or why not?	What advice would you give to another engineer trying to solve this problem?
What forces affected your lander as it fell?	The Moon is covered in a thick layer of fine dust. How might this be an advantage? A disadvantage?