Touchdown

Engineering Design Notebook

The Engineering Design Process

Ask - Identify the Problem

Landing on the moon is tricky. First, since the spacecraft can go as fast as 18,000 miles an hour on its way to the moon, it needs to slow way down. Then it needs to land gently. That lander has astronauts inside, not crash test dummies!

In the space to the right, Let's identify some problems for each element. You can use words or pictures to show the problem.

The moon lander:

The astronauts:

Imagine - Brainstorm

The challenge: design and build a shock-absorbing system that will protect two “astronauts” when they land.

Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing
- How will you make sure the lander doesn’t tip over as it falls through the air?

Materials:

- 1 piece of of cardboard (4x5in)
- 1 small paper or plastic cup
- 3 index cards
- 2 regular marshmallows (these are your astronauts)
- 10 mini-marshmallows
- 3 rubber bands
- 8 plastic straws
- Scissors
- tape

Imagine - Brainstorm

Use words and/or pictures the space below to brainstorm some ideas about how to use the materials to build your launcher - think of the “little pieces” of the project

Plan - Design

In the space below, use words and pictures to put your whole design together! (See the building guidelines on the next page)

Create -Build

1. First design a shock-absorbing system

   Think springs and cushions

2. Then, put your spacecraft together

   Attach the shock absorbers to the cardboard platform

3. Finally, add a cabin for the astronauts

   Tape the cup to the platform. Put two astronauts (the large marshmallows) in it. (Note: the cup has to stay open - no lids!

Use words and/or pictures in this space to make a prediction about whether or not your mission will be successful. Be ready to explain!

Test and Evaluate

Ready to test? Drop your lander from a height of one foot. You may want to have a friend watch to help identify any issues.

Possible Problems:

- Did the launcher tip over as it fell?
- Did the astronauts bounce out of the cup?

Use words and/or pictures in this space to show any problems you saw when you tested your launcher.

Improve - Redesign

Now that you have tested your launcher, it is time to redesign to make improvements to solve any problems you observed!

Possible Solutions:

- **Did the launcher tip over as it fell?** *Make sure that it is level during release, center the cup on the cardboard, and check that the weight is evenly distributed*
- **Did the astronauts bounce out of the cup?** *Add soft pads or change the number or position of the shock absorbers. Also, make the springs less springy so they don't bounce the astronauts out*

Use words and/or pictures in this space to show how you plan to redesign your launcher to ***fix*** some of the problems!

Share the Solution

Now that you have made some changes to your design, take turns to share your design with your classmates.

As you listen to your classmates share, use the space to the right to record something you liked about others' designs, or something interesting you noticed about their launchers.

1. **Classmate #1**

2. **Classmate #2**

3. **Classmate #3**

Sources and Citations

Engineering Design Process

https://www.txstate-epdc.net/models-of-the-engineering-design-process/

On the Moon Educator Guide

https://www.nasa.gov/pdf/308966main_On_the_Moon.pdf