Activity Title: Design a Landing Pod!

Activity Objective(s): The teams' challenge is to design and build a Landing Pod for the model Lunar Transporter Rover that they built last week.

Grade Levels: K - 2

Lesson Duration: One 60-90 min session

Process Skills: measuring, calculating, designing, evaluating

Apollo 11 Lunar Module Descent Nozzle

http://history.nasa.gov/ap11ann/kippsphotos/apollo.html

Materials and Tools (per group of three students):

- General building supplies and tools
- Bubble wrap

Club Worksheets: (Make copies for each student to put in binder)

1. Landing Pod Design Challenge
2. Landing Pod Imagine and Plan Sheets
3. Experiment Notes and Data Table
4. Fun With Engineering at Home

Club Facilitator or Teacher Notes by Stage:

(Based on those running 60-minute Clubs)

Stage 1: Set the Stage, Ask, Imagine, Plan (Approx 20 minutes)

- Share the **Design Story** (in the Unit 2 Overview) and **Challenge** (in teacher pages) orally with the students. The story provides the context and motivation for trying to accomplish the challenge. This is the **ASK** phase of the Engineering Design Process.
- Discuss the Mars Rover Entry, Landing and Descent video called "Six Minutes of Terror." (Available on Blackboard Site) Explain to them why a parachute won't work on the Moon (no atmosphere on the Moon).
- Discuss ways to land the rover safely and make a list of ideas on chart paper or a blackboard.

- The NASA website with more video on the Mars rovers is: http://marsrover.nasa.gov/gallery/video/challenges.html
  The "Six Minutes of Terror" video is near the bottom of the page in the **Entry, Descent and Landing (EDL)** section.

- Put the students in teams of 3 around the room – try to separate the teams so they are not working "on top" of one another.
- Hand out the ***Landing Pod Design Sheet*** (1 set of worksheets per team).
- Let the challenge begin - Encourage them to **IMAGINE and PLAN** before building. Ask them to use their worksheets to capture their design ideas.

Stage 2: Create (Approx 20 minutes)

- Challenge the teams to **CREATE** or build their Landing Pod based on their designs. Remind them to keep within specifications.
- Ask members of each team to check mathematical calculations and check designs and models to make sure they are within specified design constraints. Members should also be sure that the egg inside the rover is empty and is not carrying remaining cargo from the previous lesson.

Stage 3: Experiment – (Approx 15 minutes)

- The students should test to make sure that the rover, carrying the empty plastic egg, fits inside the Landing Pod. They should also be sure that they are able to open the Landing Pod after it comes to rest. Each group will complete two trial drops and within this phase they will have the opportunity to make one improvement to their Landing Pod before experimenting with a second trial drop.

Stage 5: Challenge Closure – After week 3

The Summary of this activity will come after the simulated lunar landing.

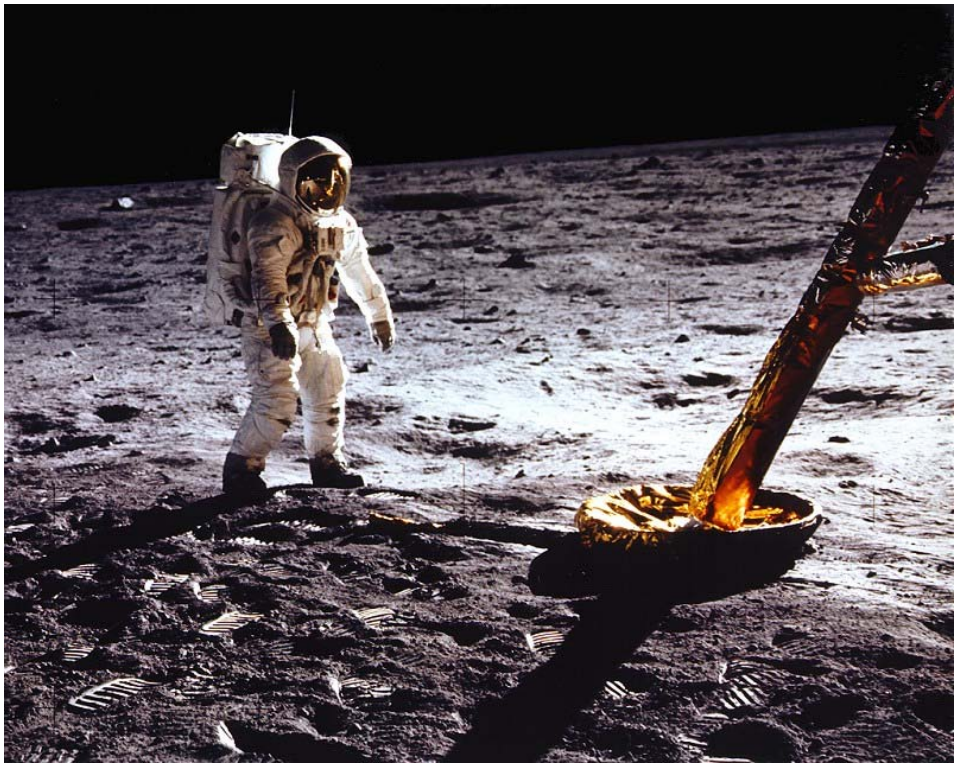
Stage 6: Previewing Next Week (Approx 5 minutes)

- Ask teams to bring back their Lunar Transporter Rover model and the Landing Pod for use in next week's club challenge. You may want to store them in the classroom or have one of the facilitators be responsible for their safe return next week.
- Remind the teams that their Landing Pods, loaded with their Lunar Transporter Rovers will be "landing" (after being dropped out a second story window? Or at least off a tall ladder, or the top of a staircase. Just make sure they know from how high their models will be dropped.)

Design Challenge

The **Landing Pod** must meet the following Engineering Design Constraints:

- It must safely deliver your Lunar Transporter Rover to the surface from a height given to you by your teacher.
- It must land RIGHT-SIDE up. (The rover must be able to roll out, so it must land in the correct orientation.)
- It must be reusable. You must be able to open it, retrieve the Lunar Transporter Rover, and then use the Landing Pod again.



Buzz Aldrin and the Apollo 11 lunar Module on the Moon
http://history.nasa.gov/ap11ann/kippsphotos/apollo.html

1. Landing Pod Design Challenge

Apollo 11 Lunar Module
Descent Nozzle

http://history.nasa.gov/ap11ann/kippsphotos/apollo.html

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2. Imagine and Plan Worksheet *Page 1*

What height will be used to drop your rover? _____

List or draw pictures of the materials you will use to protect the rover *inside* the Landing Pod?

How will you make sure the Landing Pod lands right-side up?

Estimate, or predict, the total amount of pieces of bubble wrap you will use to create your Landing Pod.

We predict that our group will use _____ pieces of bubble wrap to create our Landing Pod.

Imagine and Plan Worksheet Page 2

Draw a picture of the side of your Landing Pod:

Draw a picture of the "door" or "hatch" of the Landing Pod:

3. Experiment Notes and Data Table

Make two test drops with your Landing Pod. Start at a height less than the height from which it eventually be dropped. Note carefully how it lands and think about what changes you should make to improve the landing.

Trial	Drop Height (m)	Observations – What happened during trial 1?
1		

What is one change you should make to your Landing Pod to improve the landing?

Trial	Drop Height (m)	Observations – What happened during trial 2?
2		

What is the hardest part of this experiment?

What is the total number of bubble wrap pieces used for your design?

_____

Team Name:_____

Fun with Engineering at Home

Activity 6: *Design a Landing Pod for the Lunar Transporter Rover!*

Today we designed and built a Landing Pod for the Lunar Transporter Rover model we built last week. The Landing Pod must safely deliver the rover by protecting it from the impact and landing upright. Next week, the "landing" will take place.

Home Challenge: During this week, see what you can learn about landings that have taken place in the past. For example, NASA has landed spacecraft on the Moon and Mars.

Here are some questions to talk about with your parents, grandparents, brothers or sisters:

NASA has also dropped satellites into the atmospheres of Venus and Jupiter. What happened to those spacecraft?

Where in the Solar System, besides Earth, have humans visited? When was that? What kind of a lander did they use? How did it slow down before impact on the surface?

Why did Apollo 13 not land on the Moon? Who said, "Houston, we've had a problem," and what was the problem to which they were referring?

http://www.nasm.si.edu/collections/imagery/apollo/AS13/a13.htm