DESIGN challenge

To design and build a model of a Lunar Buggy that will carry equipment and astronauts on the surface of the Moon and to determine the best slope of ramp for the rover to travel the farthest distance.

OBJECTIVE

To demonstrate an understanding of the Engineering Design Process while utilizing each stage to successfully complete a team challenge.

PROCESS SKILLS

Measuring, designing, evaluating

MATERIALS

General building supplies

Meter stick

Digital scale

Small plastic people (i.e. Lego)

Plastic eggs

Pennies or washers ("cargo")

Wheels

Something to use as a ramp (preferably a flat surface that would enable the buggy to roll for 25 cm or more)

STUDENT PAGES

Design Challenge

Ask, Imagine and Plan

Experiment and Record

PRE ACTIVITY SET-UP

Set up a small ramp for the students to use with their Lunar Buggies. It can be made with something as simple as a large book set up on a table or a piece of wood propped up on chair.

MOTIVATE

- Show the video about the Apollo 15 Lunar Rover on the Moon:

http://starchild.gsfc.nasa.gov/Videos/StarChild/space/rover2.avi

- Ask students to pay attention to the comments made about the difficulties in driving on the lunar soil.

SET THE STAGE:
ASK IMAGINE & PLAN

- Share the *Design Challenge* with the students.
- Remind students to ask questions and brainstorm ideas, then break into teams to create a drawing of a Lunar Buggy. All drawings should be approved before building.

CREATE

- Challenge the teams to build their Lunar Buggy based on their designs. Remind them to keep within specifications.

EXPERIMENT

- Students will let their rover roll down the ramp and record their observations.
- Students will test how much cargo weight their rovers can support by adding pennies (or washers, rocks, etc) to the plastic egg.

IMPROVE

- Students should improve their Lunar Buggy models based on results of the experiment phase.

CHALLENGE CLOSURE

Engage the students in the following questions:

- *Did the cargo mass make a difference on your Buggy's performance?*
- *How did the slope of the ramp affect your Buggy's performance?*

PREVIEWING NEXT SESSION

Ask teams to bring back their Lunar Buggy models for use in next session's challenge. You may want to store them in the classroom or have the facilitator be responsible for their safe return next session.

Ask teams to think about potential landing pods for use during the next session. Tell students they will be building the landing pod out of the materials that have been available to them. The pod will be dropped from as high as possible (out a second story window, off a tall ladder, or from the top of a staircase).

DESIGN
challenge

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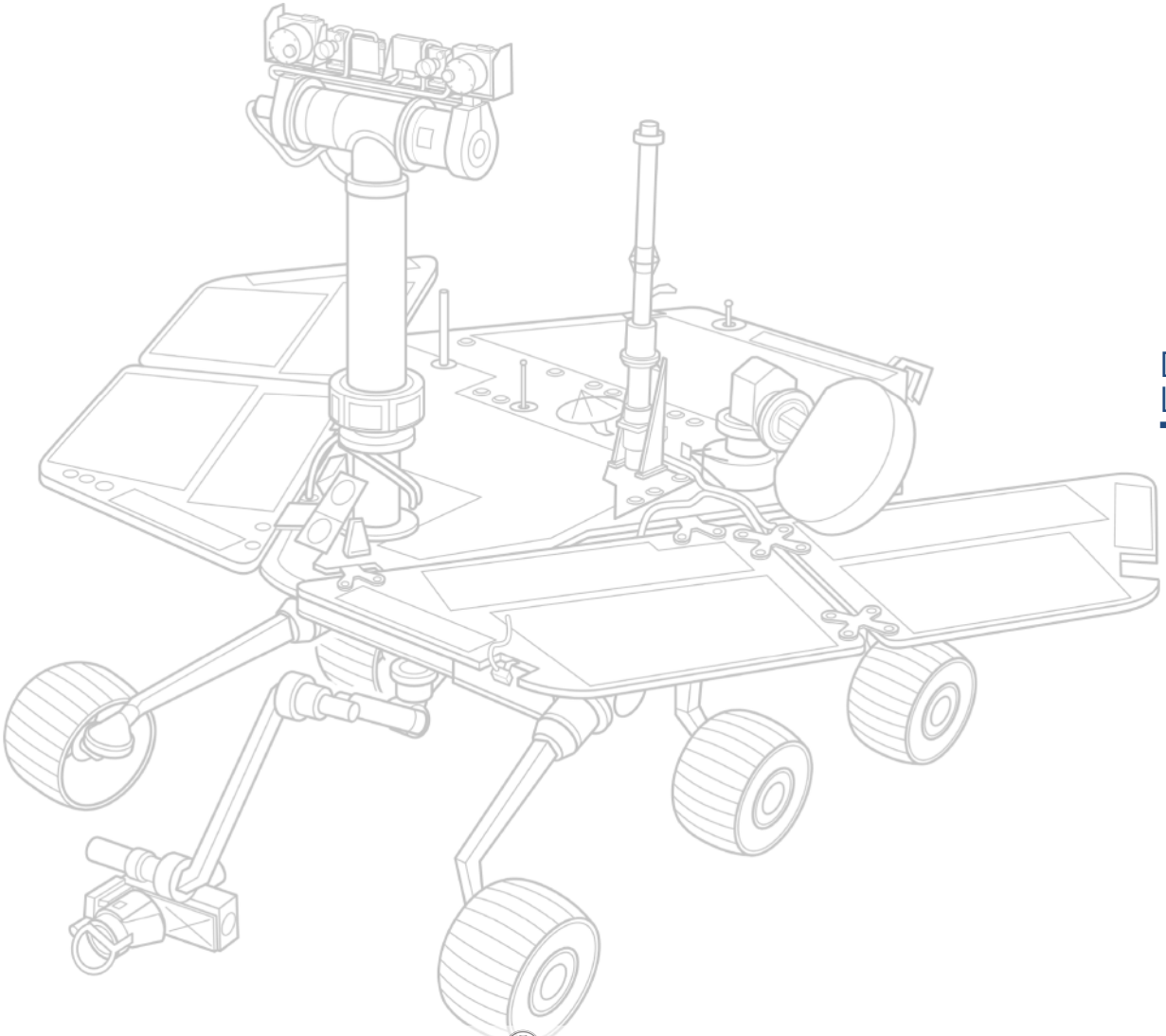
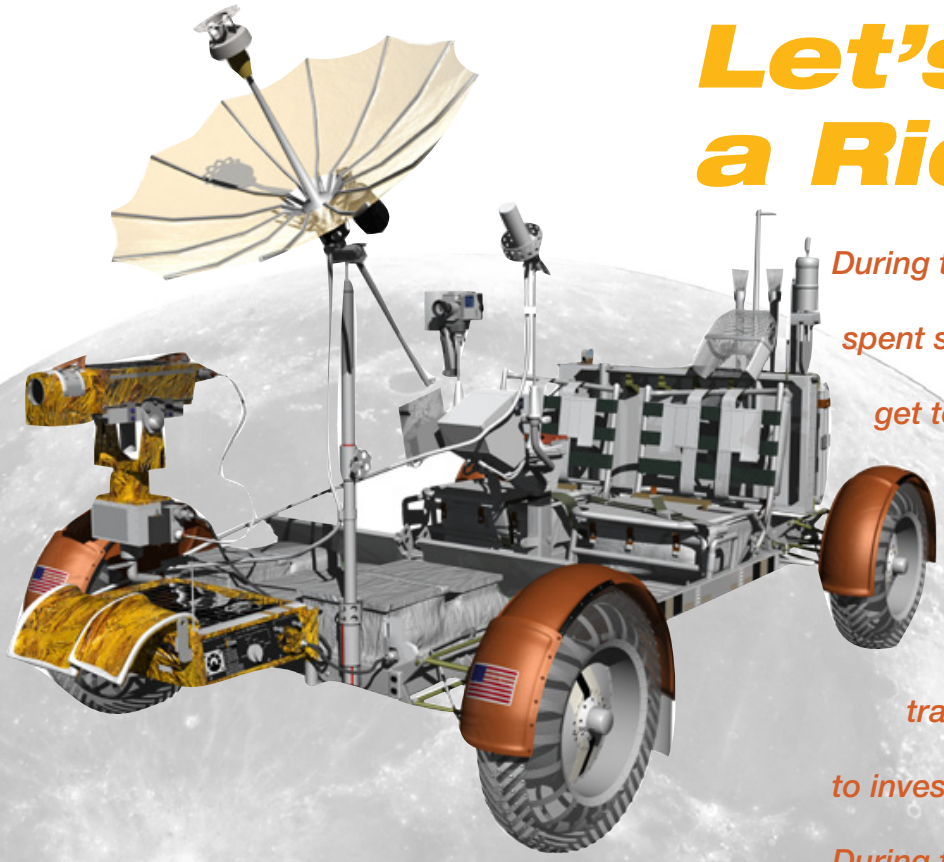


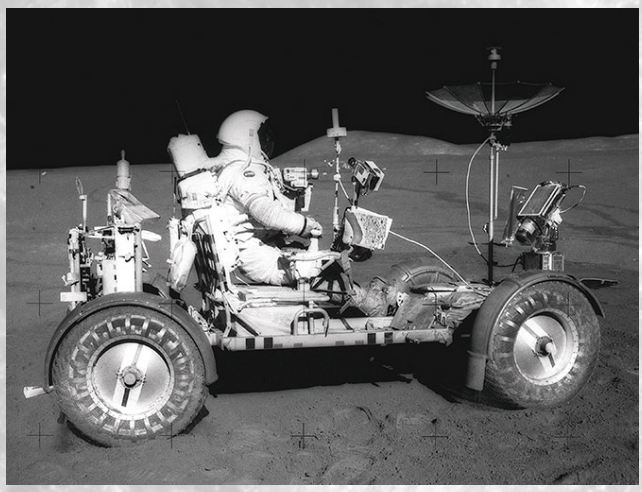
Design a
Lunar Buggy
Teacher page

lunarbuggy



Let's Go for a Ride!

During the first set of activities, we have spent some time thinking about how to get to the Moon. Now you need to think about landing on the Moon, and how to deliver cargo to the Moon. Astronauts will need a mode of transportation in order to get around to investigate different areas of the Moon. During the Apollo missions, astronauts drove a Lunar Buggy several kilometers away from their spacecraft. Today you get to be the engineers designing a new Lunar Buggy that can perform functions the Apollo Lunar Buggy could not. Your challenge is to build a model of a Lunar Buggy that astronauts will eventually use to carry **astronauts and cargo** *on the Moon.*



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THE CHALLENGE:

Each team must design and build a Lunar Buggy with the following constraints:

1. ***The Lunar Buggy must carry one plastic egg snugly. The egg may not be taped or glued into place. (The egg represents the cargo hold.)***

2. ***The Lunar Buggy must be able to roll with cargo in the cargo hold (pennies, buttons, washers, rocks, etc).***

3. ***The Lunar Buggy must have room for two "astronauts". You may use plastic people provided to you or make your own. Your astronauts may not be taped or glued into place.***

4. ***The Lunar Buggy must roll on its own down a ramp for a distance of approximately 50 cm in a straight line beyond the ramp.***

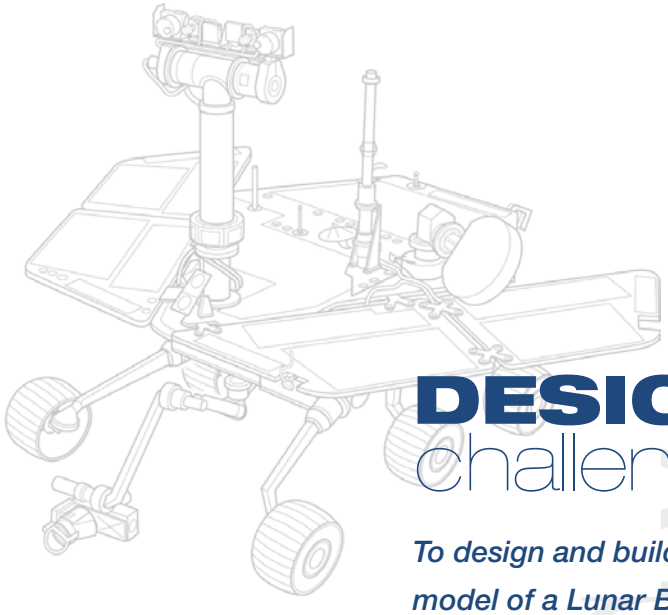
5. ***The Lunar Buggy must be able to hold cargo and astronauts in place and in tact as the Buggy rolls down the ramp.***

Design a Lunar Buggy **Student page**

lunarbuggy

ASK IMAGINE &PLAN

Draw and label your Lunar Buggy:



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Design a Lunar Buggy **Student page**

lunarbuggy

Approved by: _____

Experiment & Record

Measure the mass of your cargo on a digital scale or balance. Record the data in the table under Trial 1. Test your buggy on the ramp. Measure the distance it travels down the ramp. Record the distance in the table under Trial 1.

Lunar Buggy Data Table

	Trial 1	Trial 2
Cargo Mass (grams)		
Distance travelled down ramp (cm):		

Did your design work well? If not, redesign your Buggy and try a different amount of cargo, then experiment again. Record your data in the table for Trial 2.

Describe or draw any changes you made to your Buggy:

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Design a Lunar Buggy **Student page**

lunarbuggy