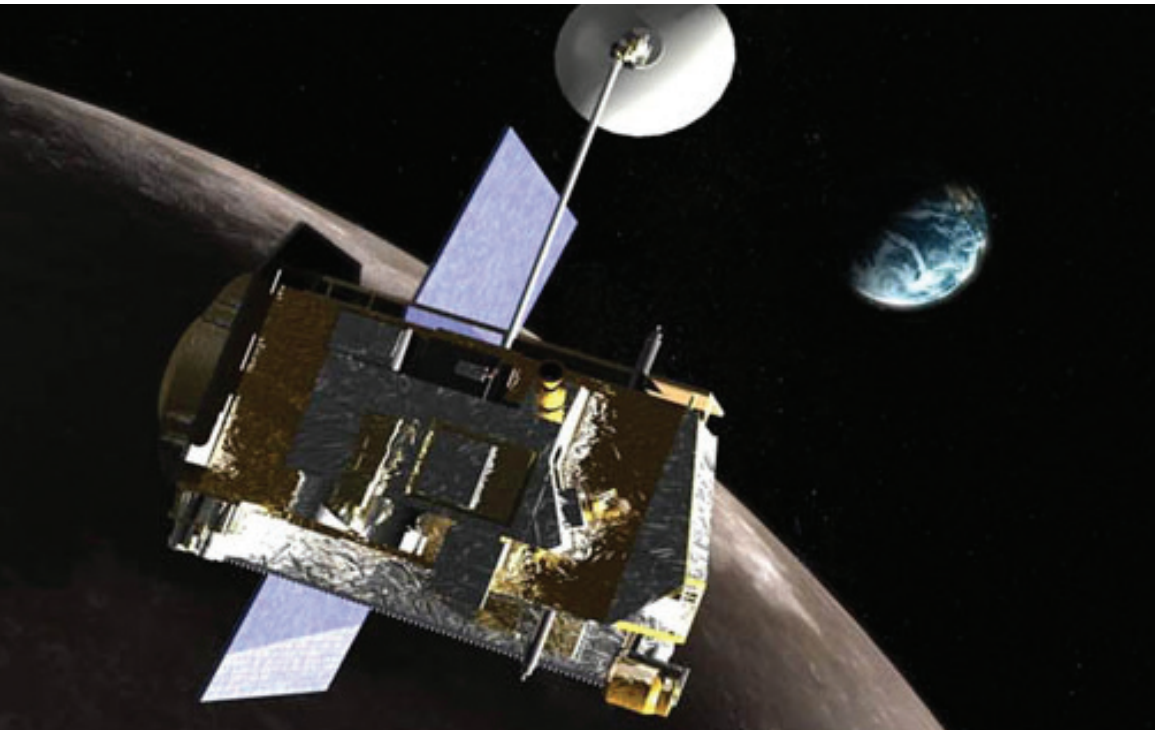


Build a Satellite to Orbit the Moon

DESIGN challenge

To design and build a satellite that will orbit the moon. It must carry a combination of cameras, gravity probes, and heat sensors to investigate the Moon's surface. The satellite will need to pass a 1-meter Drop Test without any parts falling off of it.



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

Bag of various sized buttons

STUDENT PAGES

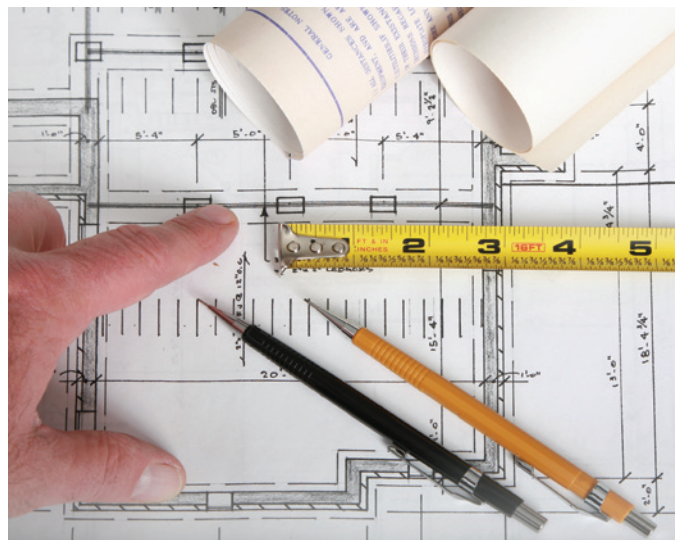
Design Challenge

Ask, Imagine and Plan

Experiment and Record

MOTIVATE

- Spend a few minutes asking students if they know what engineers do, then show the NASA's BEST Students video titled, "Engineering":
<http://svs.gsfc.nasa.gov/goto?10515>
- Using the *Engineering Design Process (EDP)* graphic on the previous page, discuss the EDP with your students
 - **Ask** a question first about the goal.
 - **Imagine** a possible solution.
 - **Plan out** a design and draw your ideas.
 - **Create** and construct a working model.
 - **Experiment** and test that model.
 - **Improve** and try to revise that model.



SET THE STAGE:

ASKIMAGINE &PLAN

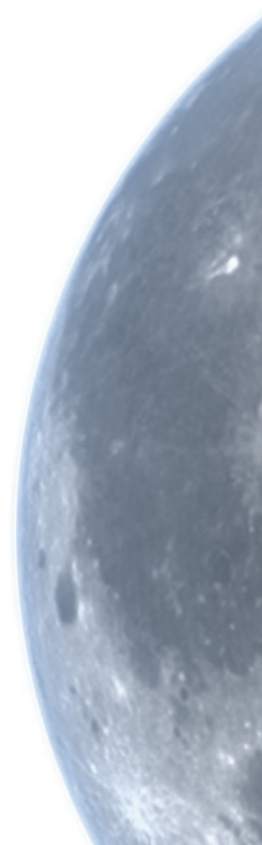
- Share the *Design Challenge* orally with the students (see next page).
- As a group, have students ask questions about the Challenge and brainstorm ideas. Then have students break into teams to create a drawing of a satellite. All drawings should be approved before building begins.

CREATE

- Distribute materials for students to build their satellites based on their designs and specifications.

EXPERIMENT

- Teams should make observations of the satellite drop and record them in the data tables of their worksheet or report orally to a group leader.





IMPROVE

- Have students inspect their satellite and rework their design if needed.

CHALLENGE CLOSURE

Engage the students in a discussion with the following questions:

- List two things you learned about what engineers do through building your satellite today.
- What was the greatest difficulty you encountered while trying to complete this challenge? How did you solve this problem?

PREVIEWING NEXT SESSION

Ask teams to bring back their satellite model for use at the next session. You may want to store them in the classroom or have one of the club facilitators be responsible for their safe return.

DESIGN challenge

To design and build a satellite that will orbit the moon. It must carry a combination of cameras, gravity probes, and heat sensors to investigate the Moon's surface. The satellite will need to pass a 1-meter Drop Test without any parts falling off of it.

Build a Satellite
Teacher page





NASA's Lunar Exploration Missions

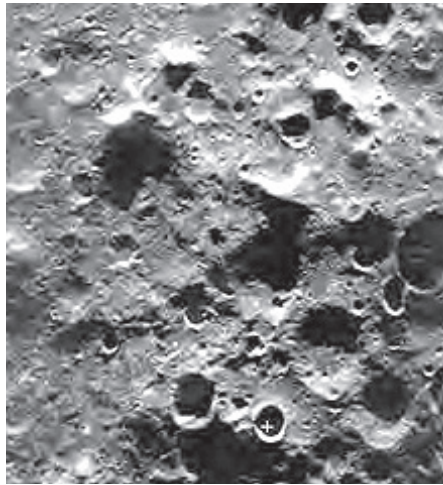
NASA's lunar exploration missions will collect scientific data to help scientists and engineers better understand the Moon's features and environment. These missions will ultimately help NASA determine the best locations for future human exploration and lunar bases.





SATELLITE INSTRUMENTS

The information gathered by lunar exploration missions will add to information collected during earlier missions. Some of these missions gathered data that caused scientists to have more questions — questions they hope to solve with new instruments on new satellites. For example, NASA has recently sent a satellite to look for water ice on the Moon. Thus, that satellite carried instruments (sometimes called “detectors” or “sensors”) to look for the ice. Other instruments will help collect data to make exact maps of the Moon’s surface and make careful measurements of the radiation falling on the lunar surface for the safety of future lunar explorers.



DESIGN challenge

To design and build a satellite that will orbit the moon. It must carry a combination of cameras, gravity probes, and heat sensors to investigate the Moon’s surface. The satellite will need to pass a 1-meter Drop Test without any parts falling off of it.

TEAMWORK IS IMPORTANT

The different instruments are designed, tested, and assembled by different teams of engineers and scientists. The separate teams must work together to ensure instruments are the right mass, fit correctly, and make proper measurements. Working together is an important skill for everyone to practice.

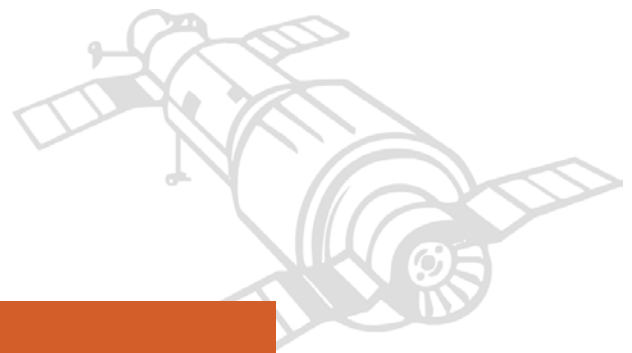


Build a Satellite
Student page

THE CHALLENGE:

Your mission is to build a model of a lunar exploration satellite with the general building supplies available.

Use different shape and sizes of buttons or beads to represent the various instruments. Your team must:



DESIGN challenge

To design and build a satellite that will orbit the moon. It must carry a combination of cameras, gravity probes, and heat sensors to investigate the Moon's surface. The satellite will need to pass a 1-meter Drop Test without any parts falling off of it.

1. Use a combination of instruments that cannot go above four (4) solar cells to power your satellite.
2. The satellite must withstand a drop from above your head without any pieces falling off.

Design a Satellite
Student page

ASK IMAGINE & PLAN

For this activity, you must design your own satellite. These are the instruments you may choose to put on your satellite:



Camera
Takes Pictures



Gravity Probe
Measures Gravity



Heat Sensor
Measures Temperature

Each of these instruments requires a certain number of solar cells to operate on your satellite. A solar cell  collects energy from the sun to power the instruments.

needs



needs



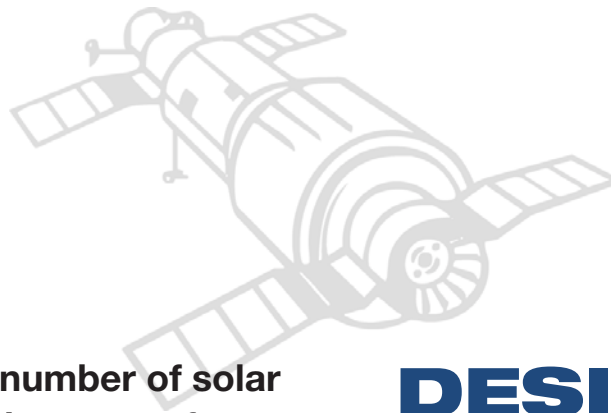
needs



If you were to build a satellite with one (1) camera and one (1) heat sensor, how many solar cells would you need? Complete the number sentence below:

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

(camera) (heat sensor) (total solar cells)



Draw your satellite. Include the correct number of solar cells it will need. Make sure to label all the parts of your satellite.

DESIGN challenge

To design and build a satellite that will orbit the moon. It must carry a combination of cameras, gravity probes, and heat sensors to investigate the Moon's surface. The satellite will need to pass a 1-meter Drop Test without any parts falling off of it.

Build a Satellite
Student page

Approved by: _____



Experiment & Record

Drop your satellite from above your head. Describe to your teacher what happened during your satellite's drop or make a drawing.

Build a Satellite
Student page

Did any instruments fall off the satellite? Yes No

Was the satellite damaged during the fall? Yes No

If you answered yes to either question above, discuss with your team how you should design your satellite differently. If there is time, make changes in your drawing and add those changes to your satellite.

