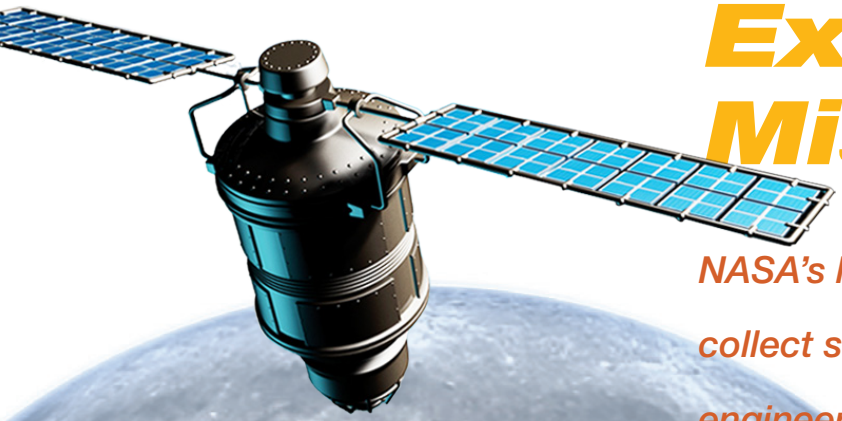
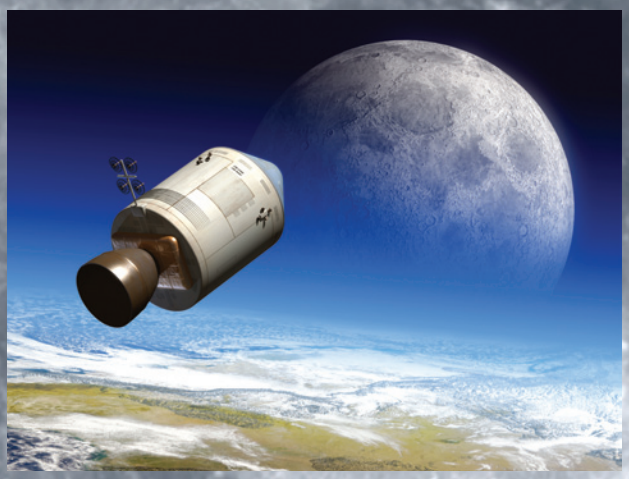
# NASA's Lunar Exploration Missions

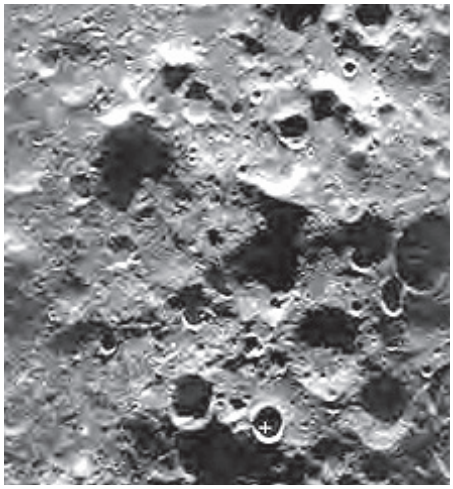


*NASA's lunar exploration missions will collect scientific data to help scientists and engineers better understand the Moon's features and environment. These missions will ultimately help NASA determine the best locations for future human exploration and lunar bases.*



## 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.



## TEAMWORK IS IMPORTANT

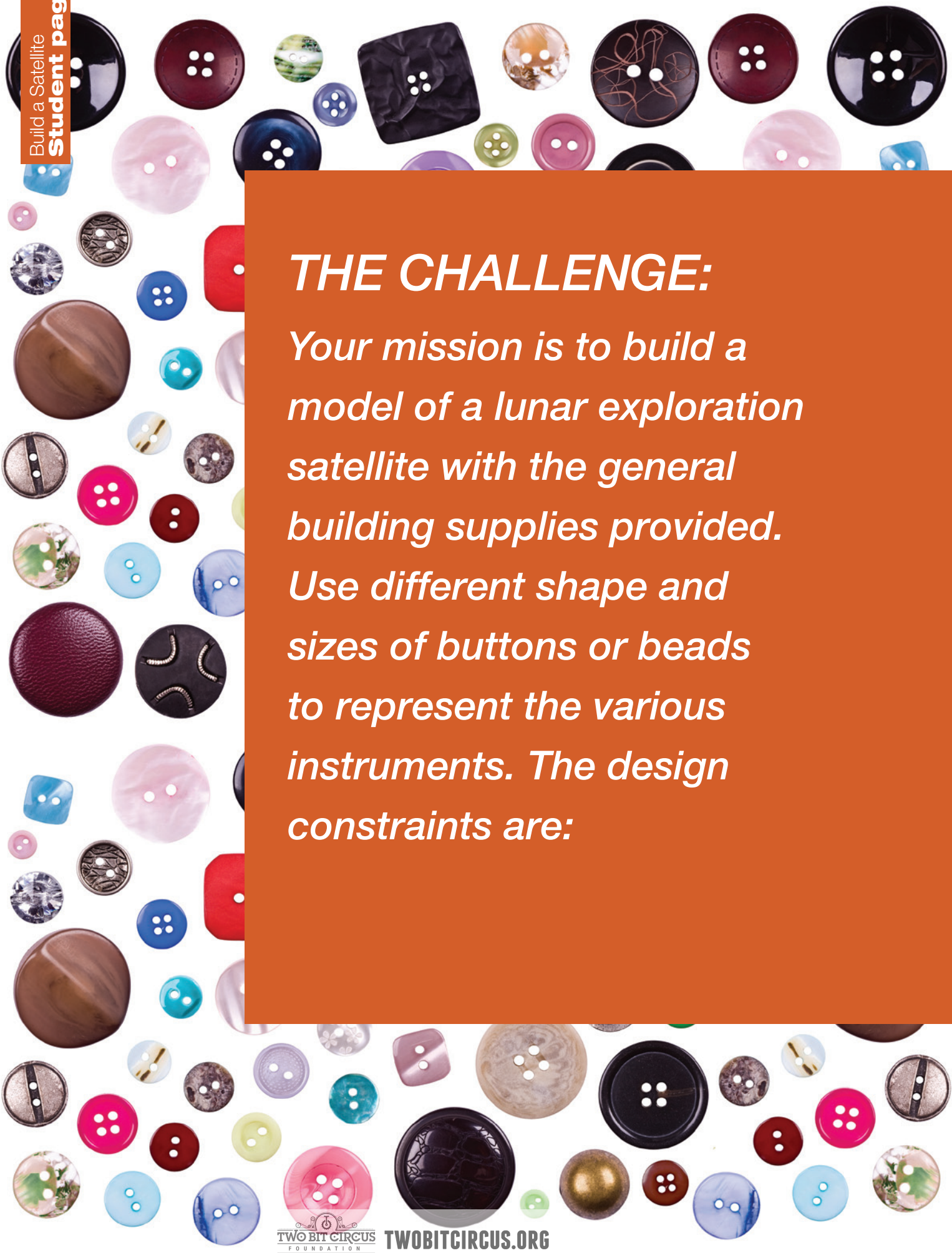
The different instruments are designed, tested, and assembled by different teams of engineers and scientists. The separate teams must work together to ensure instruments are the right mass, fit correctly, and make proper measurements. Working together is an important skill for *everyone* to practice.

## DESIGN challenge

***To design and build a satellite that meets specific size and mass constraints. 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 Satelliite
**Student page**

satellite



# *THE CHALLENGE:*

*Your mission is to build a model of a lunar exploration satellite with the general building supplies provided. Use different shape and sizes of buttons or beads to represent the various instruments. The design constraints are:*

# DESIGN challenge

*To design and build a satellite that meets specific size and mass constraints. 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. *Using the data on the Ask, Imagine, and Plan worksheets, calculate the total mass of the instruments. The total mass, including detectors, probes, sensors and solar cells, can be no greater than 10 grams.*
2. *The entire satellite must **fit within the _____ (i.e. mailing tube, oatmeal canister).** This item is a size constraint. The satellite is not to be stored in this or launched from this item.*
3. *The satellite must withstand a 1-meter Drop Test without any pieces falling off.*

Design a Satellite
**Student page**

satellite

# ASK IMAGINE &PLAN

**What questions do you have about today's challenge?**

**The objective of this activity is to design your own satellite. These are the instruments you may choose to use put on your satellite:**

**Camera**
Total Mass = 2.5 g

**Gravity Probe**
Total Mass = 2 g

**Heat Sensor**
Total Mass = 1 g

**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. Each solar cell has a mass of 0.5 g.**
**A camera requires 3 solar cells to operate. A gravity probe requires 2 solar cells to operate. A heat sensor requires 1 solar cell to operate.**

## DESIGN challenge

*To design and build a satellite that meets specific size and mass constraints. 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.*

**If you were to build a satellite with two (2) cameras and one (1) heat sensor, how many solar cells would you need? Write the number sentence below for this problem:**

_____

_____

**If you were to build a satellite with two (2) cameras and one (1) heat sensor, would the total mass be greater or less than the mass limit for the challenge? Write the number sentence below for this problem:**

_____

_____

**Now draw your own satellite. Include the correct number of solar cells it will need and label each instrument.**

Approved by: _____

Build a Satelliite
**Student page**

satellite

# Experiment & Record

**1. Write a hypothesis.** Complete the following statement:
When our team's satellite is dropped from a height of one (1) meter, it will:

_____

_____

_____

**2. Record your observations.**
Describe what happened during your satellite's drop from a height one (1) meter.

_____

_____

_____

| | | |
|---|---|---|
| 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, explain how your team could improve the design to make sure these errors would not happen again.

_____

_____

_____

_____