Satellite Instruments

The data gathered by lunar exploration missions adds 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 collect data that help make exact maps of the Moon's surface and 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. Each team 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.

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:

1. The total mass, including detectors, probes, sensors, and solar cells, can be no greater than 10 g.
2. The entire satellite must **fit within an oatmeal canister**. This item is a size constraint. The satellite is not to be stored in the container or launched from this item.
3. The satellite must withstand a 1 m drop test without any pieces falling off.

Satellite Design Challenge

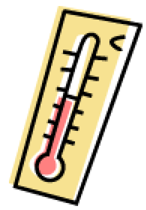
Task 1: The objective of this activity is to design your own satellite. These are the instruments you may choose to use put on your satellite:

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. 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 three solar cells to operate. A gravity probe requires two solar cells to operate. A heat sensor requires one solar cell to operate.

1. 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:

2. 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:

Task 2: Now, draw your **own** satellite on graph paper. Include the correct number of solar cells it will need and label each instrument. Also label the materials that you will use.

Remember: The possible materials that you can use for your design are: aluminum foil, balloons, beads, cardboard, cardstock, pipe cleaners, string, napkins, straws, rubber bands.

Example Rubric

Criteria	Exceeds Expectations	Meets Expectations	Needs Improvement
Total Satellite Mass	The total mass, including detectors, probes, sensors, and solar cells, is less than 10 g.	The total mass, including detectors, probes, sensors, and solar cells, is 10 g.	The total mass, including detectors, probes, sensors, and solar cells, is greater than 10 g.
1 m Drop Test	The satellite was dropped from a height greater than 1 m and remained intact.	The satellite was dropped from the height of 1 m and remained intact.	The satellite was dropped from the height of 1 m and broke.
Commercial	The commercial lasted over three minutes and included the 1 m drop.	The commercial lasted three minutes and included the 1 m drop.	The commercial did not last three minutes and/or did not include the 1 m drop.
Engineering Design Process (EDP)	When describing the satellite during the unit and in the commercial, all five steps to the EDP were mentioned.	When describing the satellite during the unit and in the commercial, the basic ideas behind the EDP were mentioned.	When describing the satellite during the unit and in the commercial, the EDP was not mentioned.