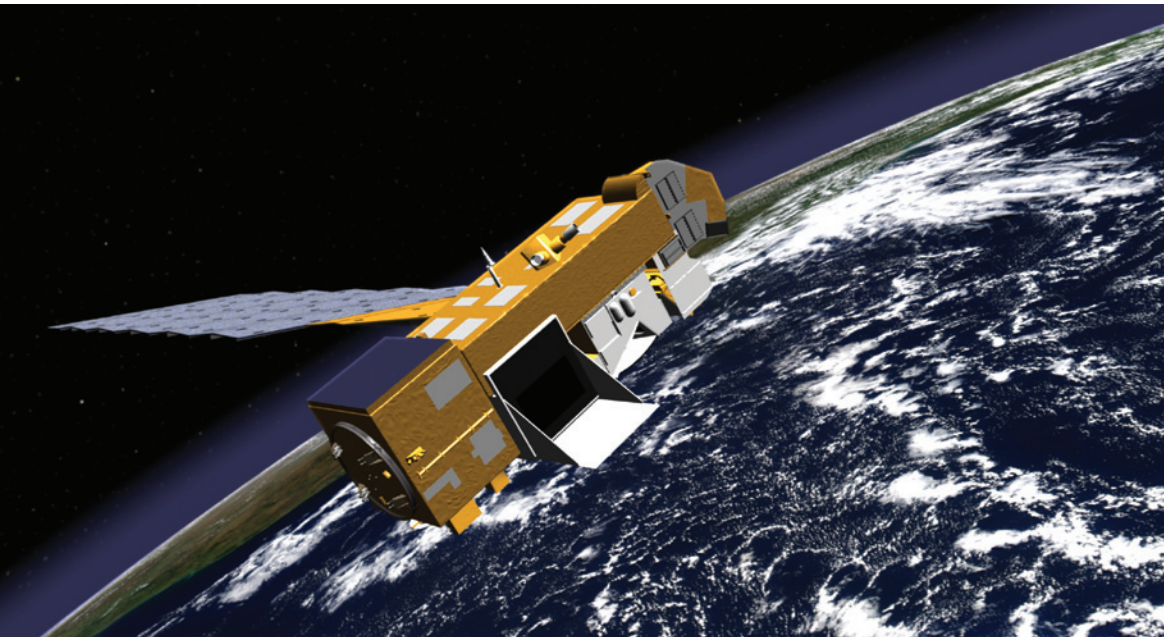


DESIGN challenge

To design a balloon rocket to launch the satellite that was built in the last activity. The goal is to get the satellite to go as far as possible.

OBJECTIVE

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

PROCESS SKILLS

Observing, communicating, measuring, collecting data, inferring, predicting, making models

MATERIALS

Satellite model from previous activity

General building supplies

Rulers or meter sticks

Binder clips or clothes pins

Balloons (several per group)

Straws

5-meter fishing line set-up strung between two tables

STUDENT PAGES

Design Challenge

Ask, Imagine and Plan

Experiment and Record

PRE-ACTIVITY SET-UP

The fishing line apparatus should be at least 5 meters in length. Clamp or tie one end at table or chair height and stretch the line across the space to another table/chair at the same level. Holding the free end of the line taut for each trial enables easy restringing of the successive balloon rockets. The line must be very taut for best results. Shoot the rockets toward the tied end. Two fishing line set-ups should be sufficient for a group of 20 students. Note: Use clips or clothes pins to hold filled balloon shut before launch. If the opening in the balloons tends to stick, try putting a little hand lotion inside the opening.

MOTIVATE

- Show the video of a recent rocket launch, titled, "Liftoff…To the Moon!"

  http://lunar.gsfc.nasa.gov/launch.html

SET THE STAGE:

ASKIMAGINE
&PLAN

- Share the *Design Challenge* with the students and ask students to retrieve their satellites from last session.
- Demonstrate how a balloon rocket works by sending a balloon connected to a straw up the fishing line. Do not model how best to attach the satellite or how best to power the rocket, other than releasing the air by using your fingers.
- Ask the students, "How can we use this set up to launch your satellite?" Remind students that one end of the line is the launch pad and the other end is the Moon.
- Have students take the time to imagine a solution for a balloon rocket design and then draw their ideas. All drawings should be approved before building begins.

CREATE

- Challenge the teams to build their rockets based on their plans. In addition, teams will need to design a system to attach their satellites to the launch set up. Remind students to keep within specifications.

EXPERIMENT

- Send teams to their assigned launch sites to test their rockets, completing the data tables as they conduct each trial launch.

IMPROVE

- After the first set of trials, allow teams to make adjustments to their rockets.
- Teams re-launch satellites and record launch distance.
- Teams should then discuss how far their rocket traveled and which combination of variables gave the best results.

CHALLENGE CLOSURE

Engage the students in the following questions:

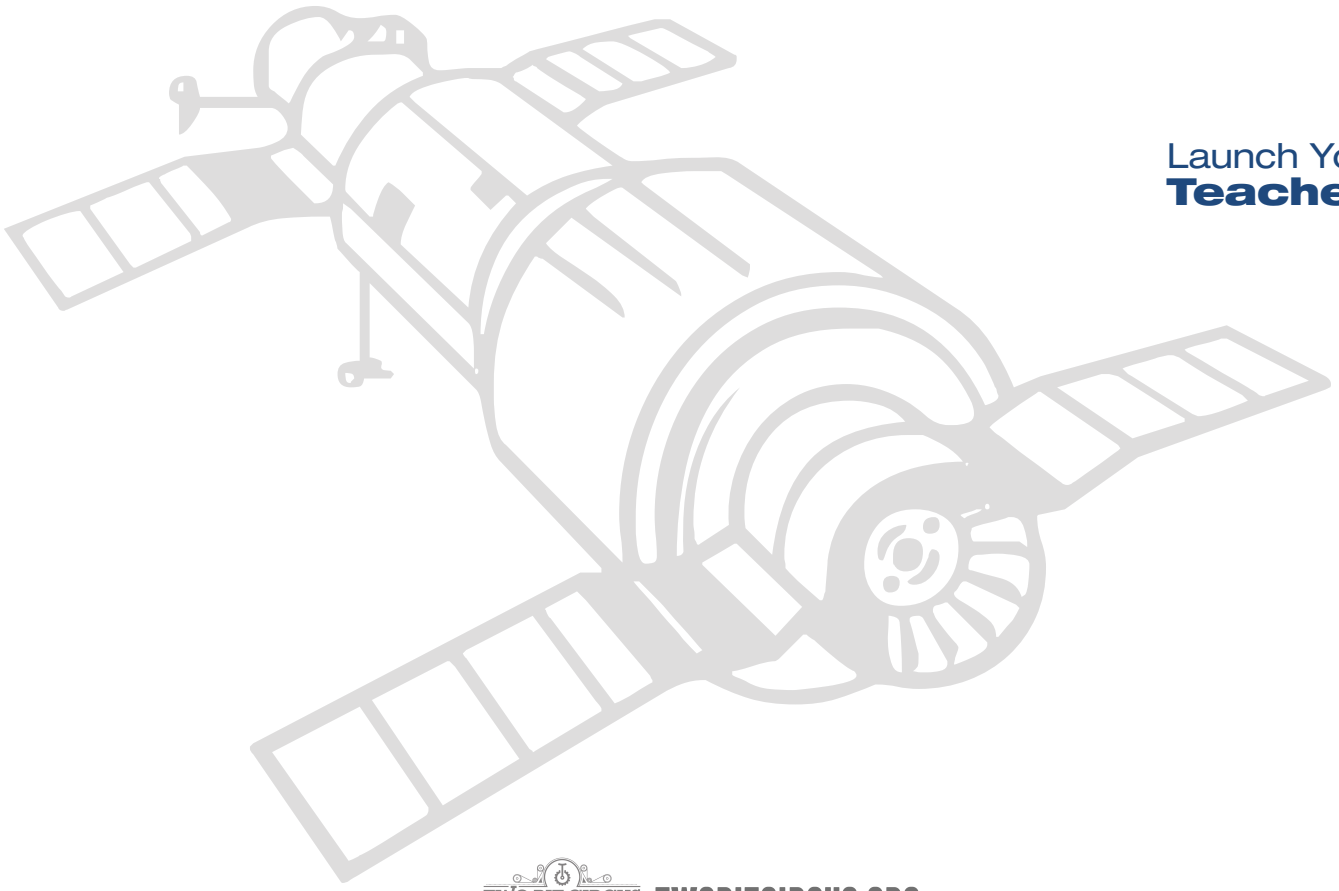
- *What was the greatest challenge for your team today?*
- *Which straw length did you choose and why did you choose it?*
- *If you had more time, what other rocket element would you change (ex: balloon shape or size)?*

PREVIEWING NEXT SESSION

Ask teams to think about how humans navigate robotic rovers on a distant planet or moon. How are they programmed? How do the rovers receive messages from a team on Earth?

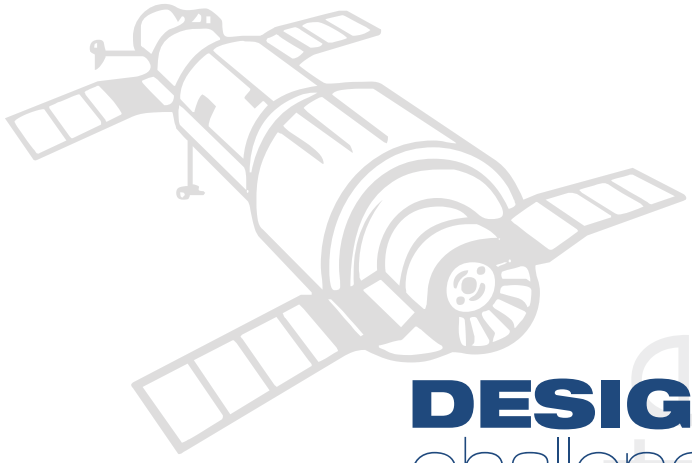
DESIGN
challenge

To design a balloon rocket to launch the satellite that was built in the last activity. The goal is to get the satellite to go as far as possible.



3, 2, 1 . . . We have lift-off!

NASA launches several rockets each year. There are actually several launch facilities around the United States. You probably know of the launch pad at Kennedy Space Center in Florida, but did you know there is a launch facility at Vandenberg Air Force Base in California, Wallops Flight Facility in Virginia, and White Sands Missile Range in New Mexico? A rocket is just the launch vehicle that carries a ***payload*** *into space. A payload is the load, or package or set of instruments, needing to be delivered to a destination. When you watched the video for this session, you saw an Atlas V rocket carry a payload, the LRO and LCROSS satellites, to a destination: an orbit around the Moon.*



DESIGN challenge

To design a balloon rocket to launch the satellite that was built in the last activity. The goal is to get the satellite to go as far as possible.

launch your satellite

THE CHALLENGE:

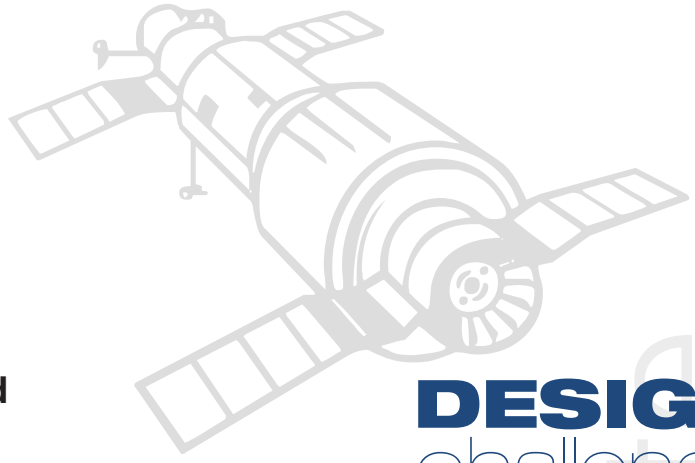
Your mission is to design and build a launch vehicle to send a payload to the Moon. Your payload is the satellite you built at the last session. The launch vehicle is a balloon rocket assembly. Your team must also determine how to attach your satellite to the balloon assembly and then launch it down a fishing wire. The design constraints are:

1. *For the first set of trials, you must change the length of the straw on your rocket.*
2. *Once you have selected an appropriate straw length, select the number of balloons to use.*

Launch Your Satellite
Student page

ASK IMAGINE &PLAN

What questions do you have about today's challenge?



DESIGN challenge

To design a balloon rocket to launch the satellite that was built in the last activity. The goal is to get the satellite to go as far as possible.

launch your satellite

Launch Your Satellite
Student page

Draw your balloon rocket assembly and include your satellite:

Approved by: _____

Experiment & Record

Your challenge is to launch your balloon rocket the farthest distance. First, you will test different straw lengths when using only ONE balloon, which will slide along a fishing line.

Find out which straw length lets a single balloon travel farthest. In this experiment, the length of the straw is the *independent variable*, the length of the balloon is controlled, and the distance the balloon travels is the *dependent variable*. Therefore, we want to investigate the question:

How does the straw length on your balloon rocket affect the distance travelled?

DESIGN challenge

To design a balloon rocket to launch the satellite that was built in the last activity. The goal is to get the satellite to go as far as possible.

Balloon Rocket Data Table 1

	Trial 1	Trial 2	Trial 3
Straw Length	**Short** _____ cm	**Medium** _____ cm	**Long** _____ cm
Length of Balloon	_____ cm	_____ cm	_____ cm
Distance Traveled	_____ cm	_____ cm	_____ cm

If you wanted to improve your rocket, what other variables could you test?

_____

_____

_____

Launch Your Satellite
Student page

launch your satellite

Now that you know the effect of straw length on the distance the balloon rocket will travel, conduct an experiment to answer this question:

How does the number of balloons on your rocket affect the distance travelled?

Balloon Rocket Data Table 2

	Trial 1	Trial 2	Trial 3
Number of Balloons			
Straw Length	_____ cm	_____ cm	_____ cm
Distance Traveled	_____ cm	_____ cm	_____ cm

Draw a picture of the final balloon rocket that your team will use based on the data collected from the trials. Label the straw length and the number of balloons used.

launch your satellite