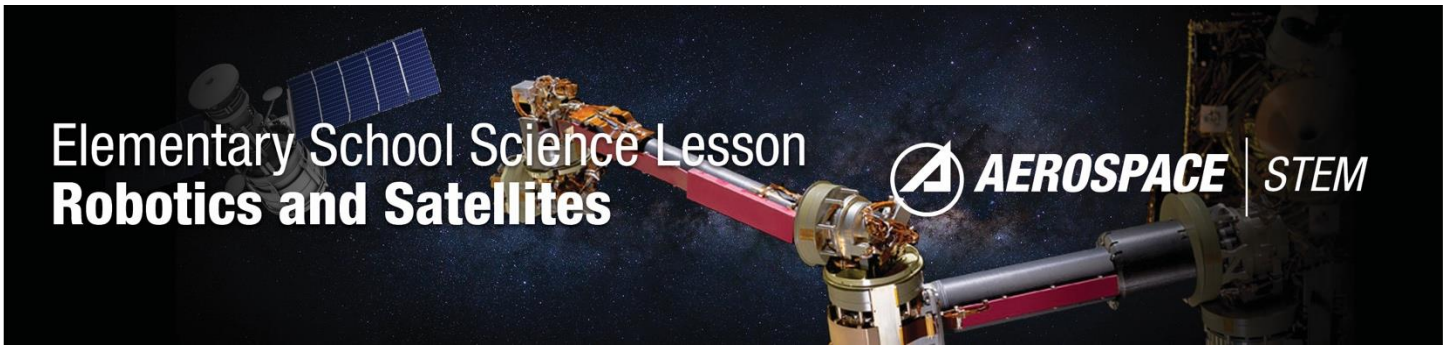


| Lesson Overview | Career Highlight |
|---|---|
| Students will learn how CubeSats are programmed to orient themselves in space through a hands-on activity. Students will learn the basics of coding through a team simulation. | **Propulsion Engineer**: Designs the way satellites, rockets, or other things are able to be launched from Earth or propelled through space.<br><br>**RF Antenna Engineer**: Designs and builds the communication equipment (antennas) and the types of signals that satellites and spacecraft use to send and receive signals.<br><br>**Computer Scientist/ Software Engineer**: Creates the code for a satellite's onboard computer, which it uses to complete its mission.<br><br>**Space Scientist:** Collects data about the harsh environments that the satellite or spacecraft may travel to, and determines what features need to be added to the design to make sure it can complete its task. |

| STEM Course Connections | 21st Century Skills |
|---|---|
| Elementary STEM | Collaboration<br>Communication |

| Engineering Activity | |
|---|---|
| **Science and Engineering Practice #2** | Students will program a CubeSat to navigate a maze and capture an image of a celestial object. |

| Materials |
|---|
| ● Bean Bags<br>● Blindfolds<br>● Painter's Tape |

- Classroom Diagram

## Essential Questions

1. What are CubeSats, or other small satellites, and what do they do?
2. How do CubeSats, and other spacecraft, position themselves in space for a mission?

## Prerequisite Knowledge

Students should be aware of some general definitions (launch, satellite, Mission Control, launch pad), that satellites carry a payload to space, and should have a general grasp of gravity and how objects maneuver.
*Teacher Note: This is not an introduction to satellites lesson.*

## Mission

**Programming the Orientation of a Satellite (45 mins)**
*Mission Objective*

- The objective for this mission is for one student to direct another blindfolded student to a target point and drop a beanbag "payload" on a target area. There are two outcomes:
    a. Mission Success: The Satellite successfully drops the Payload inside of the designated Target Area.
    b. Mission Failure: the Satellite fails to drop the Payload inside of the designated Target Area.

*Set Up*
*Teacher Note: Use the Drawing of the classroom as a model.*

- Approximately five feet from any walls or obstacles, make a "Launch Pad" with a piece of painter's tape. Use painter's tape to mark off a path for students to follow, with one or two 90 degree turns.
- At the end of the path, mark a three-foot by three-foot box with painter's tape, then make a large "X" connecting the two corners. This denotes the target area for the "payload."
- Group students into pairs. They will take turns operating as both Mission Control and the Satellite.
- Hand one beanbag (or similar object) to each pair of students to act as their Mission Payload.

*Activity*

- Have the Satellite student stand on the Launch Pad and put on a blindfold. Ensure they are holding the Mission Payload.
- The Mission Control student will provide verbal guidance to the Satellite along their path to the target area.
    - *Teacher Note: In addition to aiding the Mission Control student in guiding the Satellite to the target, the line of painter's tape should be considered a safety buffer–if the Satellite strays too far from the line, they should be reset back to the Launch Pad.*
- Once at the target area, they will command the Satellite to release the payload. If it falls within the target area, the mission is successful.
    - *Teacher Note: Students can measure the distance their payload lands from the target and can incorporate mathematics at the older grade levels.*
- Once each student has gone through the activity, have the pairs switch responsibilities (time permitting).

*Discussion*

- As a whole class, discuss the following questions:
    - What did you notice about the codes that were stated to you by your partner? *Answers will vary.*
    - What happened if your instructions were not clear enough? *If the Satellite didn't make it close enough to the target, the Payload would miss its mark.*

- How did you and your partner work together to achieve the mission? *Answers will vary.*
- What comparisons do you see between your team and what occurs in space? *Mission Control has to do a lot of work to make sure that the Satellite gets to the right place.*
- What differences do you think there are between your teams and the space CubeSat? *The CubeSat doesn't get to have someone telling it what to do the entire time.*

## Extension

- If the mission is not successful, students can repeat the process until the mission is successful.

## CA NGSS Standards

**K-2-ETS1-2**. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

**1-ESS1-1**. Use observations of the sun, moon, and stars to describe patterns that can be predicted.

## Resources


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