COMMUNICATION IN SPACE

Topic	Communication in space
Objectives	Students will compare and contrast digital and analog signals and investigate the effects of communication in space.
Standards and benchmarks addressed	MS-PS4-3 Waves and their Applications in Technologies for Information Transfer. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Action

Phase 1: Engage

Select several images from this website that are taken from the Mars Rover. Print out the images you select and display these around the classroom. You may want to download some of the 360° images and have students explore them. Do not tell students where the images are from; just have them note what they think the images represent in a science notebook. Then, ask them what viewing the images makes them wonder about. Chart student responses.

After charting what students notice and wonder, help students make the connection that these are images from the surface of Mars.

You can say something like, "The Mars Rover *Opportunity* has been transmitting images like these from the surface of Mars since January of 2004. It was originally designed to be operational for just 90 days! Communication to and through space has its own complications, which we will investigate today."

Phase 2: Explore

In pairs, students can open and play with the online oscilloscope, found at: https://academo.org/demos/virtual-oscilloscope/

Define the following terms for students:

- oscilloscope
- volts
- amplitude

Ask student to freeze-frame the oscilloscope to model three different audio experiences. Using these, ask students to compare and contrast how the wave looks different based on the audio input.

Phase 3: Explain

Have students read this article: https://learn.sparkfun.com/tutorials/analog-vs-digital

Or watch one of the following videos:

https://www.youtube.com/watch?v=WxJKXGugfh8&feature=youtu.be

https://www.youtube.com/watch?v=4BVR3IjDRhc

https://learn.sparkfun.com/tutorials/analog-vs-digital

https://www.youtube.com/watch?v=thX5Cdlt8QE

https://youtu.be/WxJKXGugfh8

Assign students to partners. Then assign each set of partners to either the "analog" or "digital" group. Students will have 30 minutes to collect three pieces of evidence to support their argument that their assigned signal—digital or analog—is a more effective way to communicate through space.

Teacher note: NGSS, Argue from Evidence (Science and Engineering Practice)

Phase 4: Elaborate

Using the above information, students will need to design the best way to communicate with a space station. They will need to create a new communication system with the space station and/or Mars, addressing the following Driving Question: "Would you use an analog or digital signal?" Encourage students to consider reasons why astronauts and scientists might want to use one over the other.

Additional resources for this phase include the following:

https://mars.nasa.gov/msl/mission/communicationwithearth/

https://www.mars-one.com/faq/technology/how-does-the-mars-base-communicate-with-earth

https://ehomerecordingstudio.com/digital-audio/

Phase 5: Evaluate

Students will create one Claim, Evidence, and Reasoning statement as an exit ticket from class. They will need to suggest how a space station, a station on Earth, or a station on Mars should communicate across space.