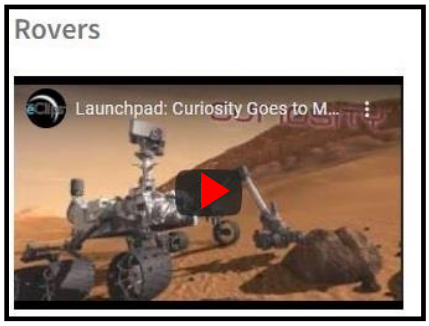
Challenger Center® and NASA eClips™

Make the Most of Destination Mars

PRE-MISSION ASTRONAUT TRAINING (~30 MIN)

Prepare your class of Astronauts for a richer virtual mission experience by helping them learn more about rovers, solar weather, and radiation ***before*** the mission.



Rover Experts



Radiation Experts



Solar Energy Experts

Divide the group into teams of three (3). Each person in the group will watch a different NASA eClips™ video to become an expert on one of the three topics.

NASA eClips™	***Rover Experts*** Launchpad: Curiosity Goes to Mars	***Radiation Experts*** Real World: Space Weather	***Solar Energy Experts*** Real World: STS-119 Brings More Power to the Space Station
Essential questions guide experts as they watch their video.	• What is a rover and why has NASA used rover missions? • What kinds of data would be helpful to gather to answer questions about the habitability of Mars?	• What is space weather? • Why is space weather important to predict?	• How is electricity supplied in space? • What astronaut functions would require electricity?
AFTER **viewing the video, experts report findings to their team.**	• What instruments does Curiosity have to collect data and what information can they provide? • What other instruments might you want to consider for exploration with future rovers?	• In what ways might space weather impact exploration and settlement?	• How is electricity produced on the ISS and how will it likely be produced for habitats on the Moon and other planetary bodies? • What might be some variables that could affect the operation of solar panels?

THE MISSION: DESTINATION MARS (~60 MIN)

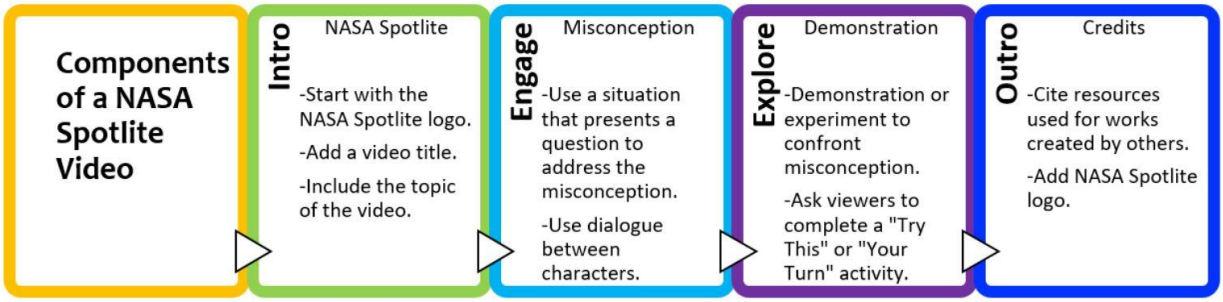
Researchers are ready to explore Mars, but there's one glaring problem – more than 40 million miles separate Earth from the Red Planet. The team needs to build a base on one of the Red Planet's moons, Deimos or Phobos, that will allow them to send a spacecraft to the surface of Mars and back in the fastest and safest way possible. ***Student teams will select which moon is best to build a base by analyzing three sets of data collected by rovers on Deimos and Phobos.***

POST-MISSION CHALLENGE (~3-4 CLASS PERIODS)

Students complete activities and demonstrate their knowledge by producing a NASA Spotlite animated video that will help others change what they think about one of two Mars misconceptions.

Working in teams, students:

- Identify criteria for the animated video.



- Select one of the two misconceptions.

Misconception 1: Mars is red because it is hot.

Demonstration and Experimenting Ideas

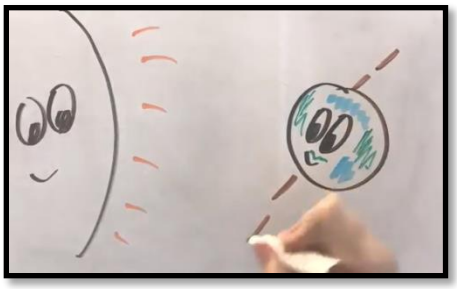
- WETA - Reading Rockets Activity 1: Why Is Mars Red? (Lab Instructions).
  Visit Resource
- American Chemical Society - Rust - the Crust That Makes Stuff Bust (Lab Instructions)
  Visit Resource

Misconception 2: All planets have one moon.

Demonstration and Experimenting Ideas

- NASA Solar System Simulator
  https://space.jpl.nasa.gov/
- NASA Eyes on the Solar System
  https://eyes.nasa.gov/

- Increase their knowledge by completing activities.
- Develop an interesting storyline.
- Write a script for the animated video.
- Film. Edit. Produce.
- Submit completed video to NASA eClips™ for review.



Misconception – The distance between Earth and the Moon causes seasons.

Exemplary animated videos will be added to the NASA eClips website under Student Productions.

ANSWER KEY FOR PRE-MISSION ASTRONAUT TRAINING

	Rover Experts *Launchpad: Curiosity Goes to Mars*	***Radiation Experts*** *Real World: Space Weather*	***Solar Energy Experts*** *Real World: STS-119 Brings More Power to the Space Station*
Essential questions guide experts <u>as they watch their</u> video.	**What is a rover and why has NASA used rover missions?** NASA has used rovers, vehicles that can move through a wide variety of terrains, to explore the surface of planets and the Moon. **What kinds of data would be helpful to gather to answer questions about the habitability of Mars?** Photographs, videos, data on mineral composition of rocks/soil, oxygen, atmospheric composition, temperature, presence of water, pH. radiation.	**What is space weather?** The gases with charged particles that are produced as a result of our Sun's activity and sent into space. **Why is space weather important to predict?** Space weather can damage orbiting spacecraft (such as satellites), expose astronauts to harmful radiation, and disrupt communication systems and electrical grids.	**How is electricity supplied in space?** Energy from the Sun is captured by solar arrays. The photovoltaic cells on the arrays convert solar energy into electrical current. Energy produced that is not used can be stored in rechargeable batteries. **What astronaut functions would require electricity?** Electricity is needed for the life support systems such as producing oxygen through electrolysis; removing excess carbon dioxide, additional gases, and particulates from the air; and to power the water recovery system (water is recovered from wastes).
***<u>AFTER</u>* viewing the video, experts report findings to their team.**	**What instruments does Curiosity have to collect data and what information can they provide?** 10 different instruments. Cameras, drill for taking rock/soil samples, laser for determining chemical composition of rock/soil, radiation detector, etc. **What other instruments might you want to consider for exploration with future rovers?** Answers will vary. High definition cameras, ways to store and bring back rock/soil samples, etc.	**In what ways might space weather impact exploration and settlement?** Space weather contains charged particles that could be extremely harmful to living things. It can cause electrical blackouts which could affect many different life-sustaining systems and disrupt communication (such as radio and GPS signals) needed to effectively explore and develop a permanent settlement.	**How is electricity produced on the ISS and how will it likely be produced for habitats on the Moon and other planetary bodies?** Electric current on the ISS is produced by photovoltaic cells located on the solar arrays which capture energy from the Sun. The conversion of solar energy to electricity is likely to power habitats on the Moon and other planets. **What might be some variables that could affect the operation of solar panels?** Damage to solar panels caused by solar radiation, blockage of Sun reaching solar panels by dust or atmosphere, angle at which sunlight strikes the solar arrays, the distance from the Sun to the solar arrays, equipment failure.