Edible Rover

Suggested Grade Level: 3–8

Summary

The students will design and build a model of the rover vehicle from the Mars Exploration Rover (MER) mission using a supply of different food items.

Standards

- NM Science Content Standards: Strand III, Science and Society
- National Science Education Standard: Standard E, Abilities of Technological Design

Introduction

Using a rover during a planetary mission can provide several advantages: the mission can land at a safe site and move to a more interesting site; more area on the planet can be explored and studied; and the same instruments can be used again and again to look at different rocks or soil in different geological terrain. In 1997, NASA sent its first robotic rover to Mars, the Pathfinder mission rover called Sojourner. Sojourner was small (microwave-oven sized) and only traveled about 30 meters total, but it was a beginning. In 2004, the two Mars Exploration Rover mission (MER) rovers, Spirit and Opportunity, each the size of a golf-cart, landed at two very different sites on Mars and continued to roam and explore for more than a full Mars year. Each MER rover carried nine cameras and seven scientific instruments and was designed to do the work of a field geologist.

The design of a rover is always a compromise. Engineers and scientists attempt to design the most capable rover they can, while keeping under certain size and weight limits. The instruments carried by the MER rovers were specifically selected for their tasks in analyzing the rocks. Instruments were designed to examine rocks beneath their weathered rind (Rock Abrasion Tool), obtain a chemical analysis of the elements or minerals in the rock (the several types of spectrometers), and see the rock close-up (PanCam and Microscopic Imager). This activity will help to familiarize students with planetary rovers and the components they need in order to function.

Materials For Each Team

- MER drawing and Edible Rover Parts Sheet, included in this activity
- Parts of the Rover included in this activity
- One plastic or small paper bag for each team containing the following food items:
- Four wafer cookies
- One licorice rope
- Two Twizzlers™
- Six mini marshmallows
- Four to six LifeSavers™
- One SpreeTM, SweetTart™, Skittle™, or Smarty™
- Two Tootsie Rolls™
- Pretzel sticks, six thin and two thick
- Five gum drops
- Four Starbursts™
- One five-ounce cup of cake frosting (any flavor)
- Four toothpicks
- One popsicle stick
- One small paper plate
- One napkin, paper towel, or piece of waxed paper

Preparation

1. Purchase bulk packages of the food and paper products listed above. Note: to reduce cost of supplies assign each student to bring a different packaged product or ask your PTO, PTA, or Home School Association to provide the items.

2. Divide and bag the food and materials needed for each student team. The frosting is used to “glue” pieces together and can be included in the bag or distributed to each student team as a small amount in a paper cup or on a piece of wax paper or paper towel.

3. Print and photocopy the MER rover drawing so that each student team has one copy.

4. Prior to the lesson, the teacher should review the component parts of the Mars Exploration Rover; see the activity in this Guide entitled Rover Components and the information about the MER rovers in Chapter III, section E, entitled The MER Rovers.

Introduction for Students

You are going to build a model of a Mars rover. What is a rover? What parts would you need on a rover in order to make it function on another planet? Take a look at the rover from the Mars Exploration Rover mission and note all of the different parts that make that rover work. The rover has to move, but it also has to make observations and collect scientific data. What parts does the rover need in order to do this? Your project will be to make an accurate model of the MER rover using the materials provided to your team.

Procedure

1. Introduce your class to the concept of rover missions on another planet.

2. As a class, ask students to make a list of what rovers need in order to function. What do they need to move around? What do they need to explore and acquire scientific information? Some examples include wheels, power, camera, scientific instruments, on-board computer, antenna.

3. As a class, review the components of the Mars Exploration Rovers and describe their function on the rover.

4. Students should work in teams. Pass out the food materials and a copy of the rover drawing and the parts sheet to each team.

5. Direct the student teams to construct their own model of the MER rover using the food items.

6. Ask each team to choose a spokesperson to display and discuss their model.

Process/Closure

Ask students to discuss the strategies they used to design and build their rover model. Ask students why certain components or instruments were included in the original MER rover design. If their teams had to leave certain components off of their model, which ones did they include and which ones did they not include, and why.

Ask students to decide what instruments and what capabilities they would want to add or change if they were to design an improved version of the MER rover.

Extension/Enrichment

This activity can be presented as an accompanying activity to two other activities in this Guide: the Mars Exploration Rover Coloring Sheet for younger students and the Rover Components activity for older students.

An entire unit on the MER rovers could begin with this activity and then continue with the following activities: Rover Traverse; How the RAT Works; Getting a Closer Look; and MER Image Analysis. Each of these activities focuses on specifics of the MER rovers: movement, instruments, and images.

Instead of modeling the MER rover, students can choose to (or be assigned to) create their own new and unique rover design with the food supplied. Another food option can include vegetables (celery, cherry tomatoes, etc.) with hummis or cream cheese as the "glue," cheese cubes as instruments, and crackers as solar panels.

This activity can be done individually if enough materials are available.

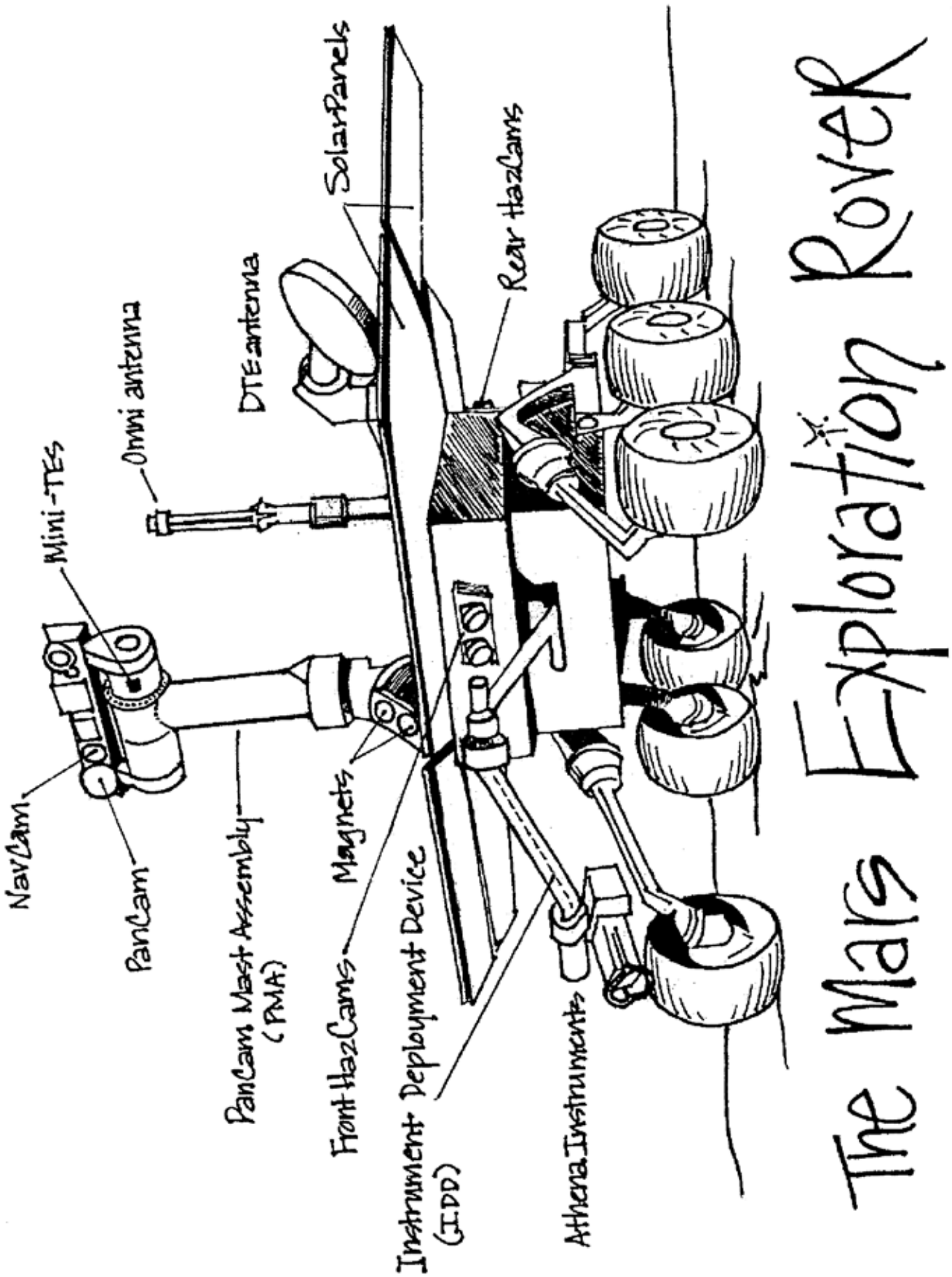
Credits

This activity was adapted by Amy Grochowski and Jayne Aubele, New Mexico Museum of Natural History & Science, from an activity based on the Mars Pathfinder Mission in NASA's Mars Activities: Teacher Resources and Classroom Activities, which in turn had been adapted from Jean Settle's Edible Rockets. Rover drawing by Tiffany Yazzie, LodeStar Astronomy Center.

MARS FACTS

Compared to previous missions, the MER mission was unique for the following reasons:

- Two big (golf-cart-sized) rovers landed on opposite sides of the planet and traveled long distances.
- Instruments were specifically designed to analyze the rocks of Mars.
- Only two museums were directly involved, and the New Mexico Museum of Natural History & Science was one of them.
- There is a New Mexico connection through a science team member from this museum and a teacher/student intern team from our state.


The Mars Exploration Rover
Solar Panels
DTE antenna
Omni antenna
Mini-TES
Rear hazCams
NavCam
PanCam
PanCam Mast Assembly (PMA)
Front HazCams
Magnets
Instrument Deployment Device (IDD)
Athena Instruments

The Parts of the Mars Exploration Rover

- Athena Instruments are a set of scientific instruments on the Instrument Deployment Device (IDD) that can observe and study the geology of the surface of Mars. These instruments are also called "the geologist's toolkit."

- The DTE Antenna sends and receives messages directly from the rover to Earth.

- HazCams (front and rear) are small cameras that help the rover navigate the terrain of Mars.

- The Instrument Deployment Device (IDD) is the robotic arm that can move scientific instruments to the rocks and soils of Mars for a close look.

- Magnets separate magnetic soil particles from non-magnetic ones in the dust of Mars.

- The Mini-TES shows the composition of the rocks and soils of Mars.

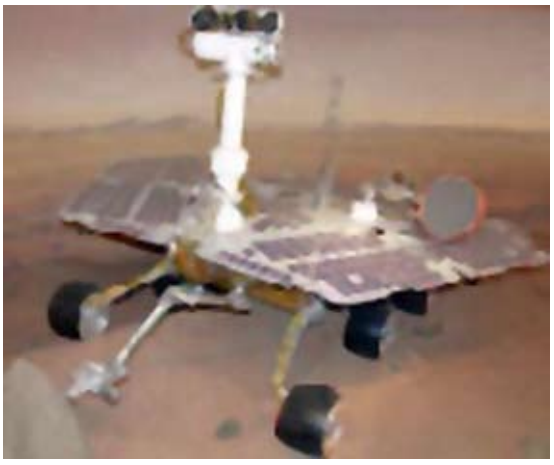
- The NavCam is a stereo black and white camera that is used by mission scientists to decide where the rover should go.

- The OMNI Antenna sends and receives messages from spacecraft orbiting Mars.

- The PanCam is a stereo color camera that takes 360-degree pictures of the rover's surroundings.

- The PMA is a mast assembly that holds the PanCam, the NavCam, and the mini-TES.

- Solar Panels generate energy from the sun.



Rover model at the New Mexico Museum of Natural History & Science in Albuquerque, NM.