Your Own Mission to Mars

Suggested Grade Level: 3–5

Summary

- Students will work in a team to act out a mission to Mars.
- Each student within the team plays the part of one of the mission components.

Standards

- NM State Science Content Standards: Strand III, Science and Society
- NM State Career Readiness Standards: Standard 5
- National Science Education Standards: Standard G, History and Nature of Science

Background Information

Planetary missions are extremely complex and require many different components and jobs. This activity models a Mars mission consisting of components including an orbiter, lander, and sample collector. Each physical component of the mission will be acted out by one or more students. Although this classroom mission will be completed in less than an hour, students will be surprised at the time required, the difficulty of planning and communicating, and the many different components of hardware and humans that are required.

Materials

- One classroom or large room
- One large table in one corner of the room that will represent Mission Control on Earth
- One round table that will represent Mars located in a corner of the room that is opposite to Mission Control
- Orbiter image of Mars, with dashed lines on it, included in the activity
- Surface image of Mars, included in the activity
- A small film canister or other small plastic container partially filled with dirt and a piece of paper on which you have typed a very simple description of the dirt (color, sandy, filled with small pebbles, etc.)
- Name tags for all students and table signs, included in this activity
- Three ropes, cords, or belts
- A certificate for each mission member, included in this activity

Preparation

1. Print images of Mars included in this activity, or find other images that you would like to use. Cut the orbiter image of Mars into strips, along the dashed lines on the image. Number the pieces on the back. For younger students you can make a full-size map or diagram showing how the pieces go together so that the students can place each piece in the correct location.

2. Print one Mission Science Team and one Mission Engineering Team sign.

3. Print and photocopy the name tags so that there are enough for all students. On a typical mission, there would be one each Spacecraft, Antenna, Lander/ Rover and Soil Collector. If you have a large number of students, you can run two missions simultaneously and have two of each of the above. Print and photocopy additional Computer, Mission Engineer, and Mission Scientist name tags as needed so that each student has a role.

4. Print and photocopy the certificate and fill out for each student.

5. Fill a small plastic container with local dirt. Type a short description of the color and appearance of the dirt on a piece of paper and place the paper within the container.

6. Set up the room and tables. Place the Mission Science Team and Mission Engineering signs and the location map of the orbiter image in three separate areas around the Mission Control table. Place the orbiter image pieces, Mars surface image, and Mars sample (the plastic container containing the dirt and the paper with the description of the dirt) on the Mars table.

Introduction for Students

You are going to experience a mission to Mars by acting out the mission as if it were a play. This is a robotic planetary mission, such as the recent rover mission to Mars, not a human mission. What roles do we need in order to act out a planetary mission? First, we need a spacecraft. To land on Mars, we will need a lander. To move around on the surface, we need a rover. To find out about Mars we will need a scientific instrument. To communicate with Earth and send back information about our findings, we will need an antenna. These are the parts of the mission that actually go to Mars, but what do we need here on Earth? We need people to make decisions about the mission such as engineers and scientists. We need communication with the spacecraft, and we need computers to help us talk to the spacecraft and analyze the scientific data that is sent back to Earth.

Procedure

1. Assign each student to a job; there should be one spacecraft, one antenna, one lander/rover, one soil collector, two to four computers, and as many scientists and engineers as needed so that each student has a role.

2. Gather the computers, scientists, and engineers in three locations around the Mission Control table. Have the students who are playing the roles of the spacecraft, lander/rover, antenna, and soil collector gather together near Mission Control.

3. The students playing the role of the spacecraft, antenna, lander/rover, and soil collector should be attached to each other by holding opposite ends of ropes or belts. The spacecraft should be attached to both the antenna and lander/rover. The lander/rover should be attached to the soil collector.

4. All of the students in the room should count down for launch (10–9–8–...1– launch), and the four students playing the roles of the spacecraft, lander/rover, antenna, and soil collector should walk together (still attached to each other by holding ropes or belts) and travel from Earth to Mars and go into orbit around Mars. This means that they will walk slowly together to the table representing Mars and begin a slow steady walk around the table.

5. As soon as they have completed one orbit of Mars (one rotation around the table), the spacecraft should release the antenna to walk back to Earth. When the antenna arrives at Mission Control, he/she should say, “We have arrived at Mars and are in orbit around the planet.”

6. The spacecraft, lander-rover, and soil collector must continue to slowly orbit Mars until they receive commands from Mission Control. The antenna must walk back and forth between Earth and Mars in order to carry commands from Mission Control to Mars or data from Mars to Mission Control.

7. The next step is for the engineers to send a command (tell the antenna to tell the spacecraft) to begin taking images of the surface of Mars. The antenna should walk to Mars and relay the message to the spacecraft and wait for data from the spacecraft.

8. At Mars: After receiving the antenna’s message, the spacecraft will take an image strip of the surface of the planet and hold it in its on-board computer (the student picks up one of the pieces of the map or mosaic from the table and holds it in his or her hand).

9. Continuing to orbit, when the spacecraft is in direct line of sight with Earth, the spacecraft will give the image to the antenna and the antenna will transmit it to Earth (walk back to Earth carrying it and hand it to the computers).

10. Repeat the steps above, with the antenna walking back and forth between Mars and Mission Control and carrying each piece of the orbiter image, until all pieces of the

orbiter image have been sent to Earth. There may be a transmission failure so that one piece does not arrive. (The teacher or an assistant can step in front of the student who is the antenna and intercept the image piece, so that piece will be lost and not arrive at Mission Control.)

11. At Mission Control, the antenna will hand each image piece to the computers who will place the image pieces onto the map to produce a complete image of a portion of the surface of Mars. The scientists should being to study this completed image.

12. After the orbiter image is completely transmitted, the engineers should tell the antenna to command the spacecraft to release the lander/rover and soil collector, the lander will go to the planet's surface (sit on the table) and send a surface image to Earth (pick up the surface image from the table, give it to the spacecraft which in turn gives it to the antenna which then carries it to Earth and gives it to the computers).

13. A further command from the engineers will tell the antenna to tell the lander/ rover to release the soil collector from the lander. The soil collector will then pick up the container of Mars soil and hand it to the lander for analysis. The analysis data (a piece of paper) is removed from the container by the lander/ rover, handed from the lander/rover to the spacecraft, then from the spacecraft to the antenna, and then from the antenna to Mission Control computers.

14. The Mission Scientists should study the images as they are placed on the map by the computers and they should look at the soil sample data when it is returned. They should prepare a written or oral report about what they have learned about Mars.

15. The engineers send a command to the antenna to end the mission. All components become students again and return to mission control to hear the report by the Mission Scientists.

Process/Closure

This is a fairly good approximation of one type of planetary mission. The problems? The antenna doesn't actually physically walk back and forth between the planets, of course; instead it sends radio signals. And everything in a real mission takes much longer. What other problems are there in this re-creation? Ask the students what was difficult about running this mission. What would they do differently if they were organizing a Mars mission? The scientists on the mission team can use the images to make conclusions about the geology of Mars (the orbiter image shows an impact crater and a channel leading into it and the surface image shows sand dunes and rocks). The analysis of the sample may also be used to make conclusions about the sand or rocks on the surface. Note the sand dunes and the size and number of rocks in the foreground. The scientists may also correctly identify the dust devil (column of dust carried by the wind) that is visible in the background of the surface image and use this information to conclude that Mars has wind at the surface.

Extension/Enrichment

Ask students to write the mission as a play, with specific incidents, scenes, and dialog that allows them to act out the entire story of a mission.

The students can define the type of mission to be run (choosing an orbiter, lander, rover, probe, or sample return), choose a scientific problem to be solved, select a site on Mars for the lander/rover, and create a mission name and mission patch (see the activity entitled Design Your Own Mission Patch, included in this Guide.)

This mission could be a sample return mission if the lander is commanded to launch back to Earth and return holding the sample.

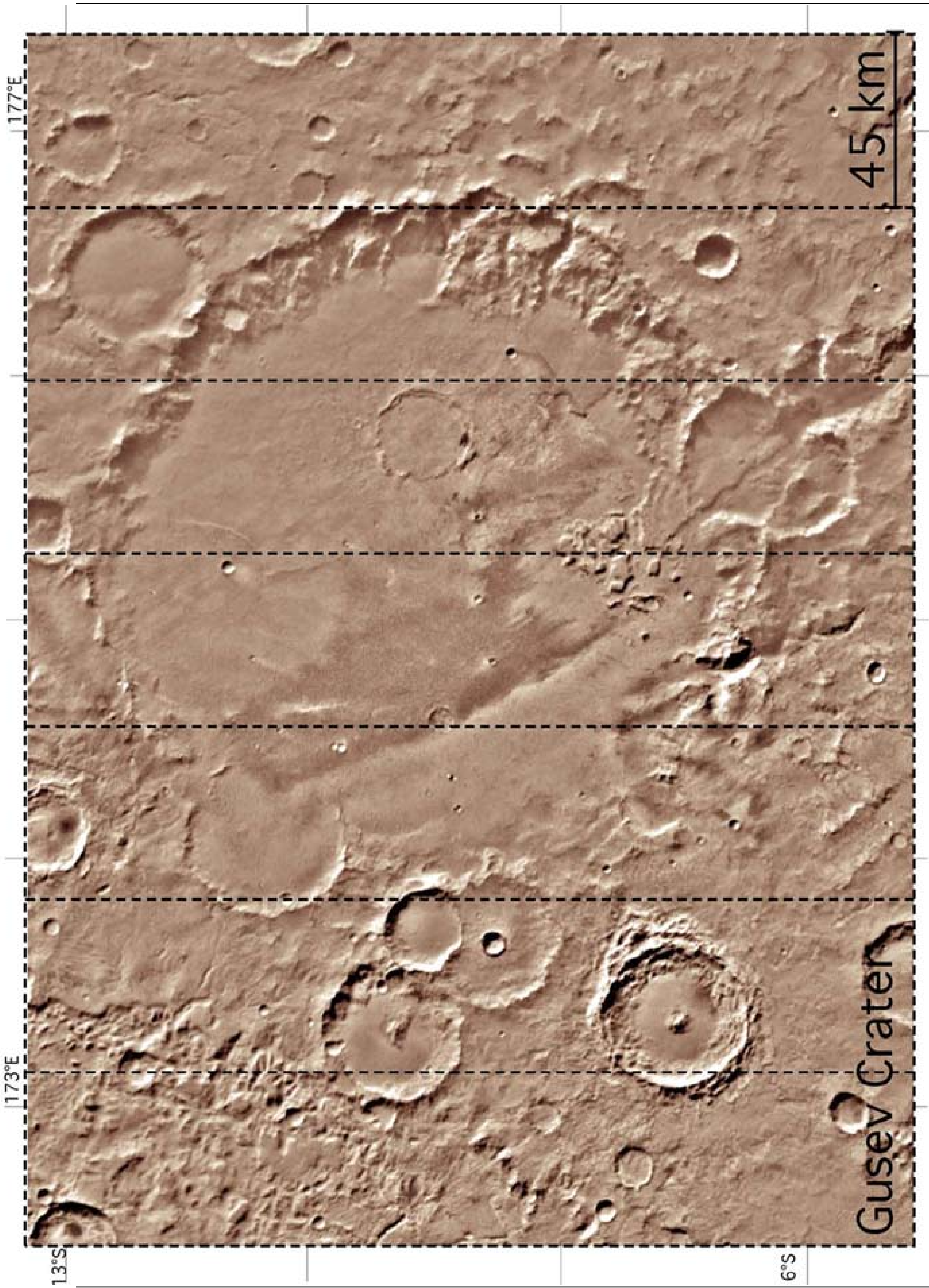
If two adjacent classrooms are available, this activity can be run with Earth and Mars in different rooms so that Mission Control cannot actually see what is going on at Mars.

Instead of pieces of an image of Mars, the antenna can return a stream of numbers, each number representing a black or white square called a pixel (see the activity entitled Pixel Picture, included in this Guide). This activity can be part of a thematic unit linked with the Design Your Own Mission Patch or Select a Landing Site on Mars activity.

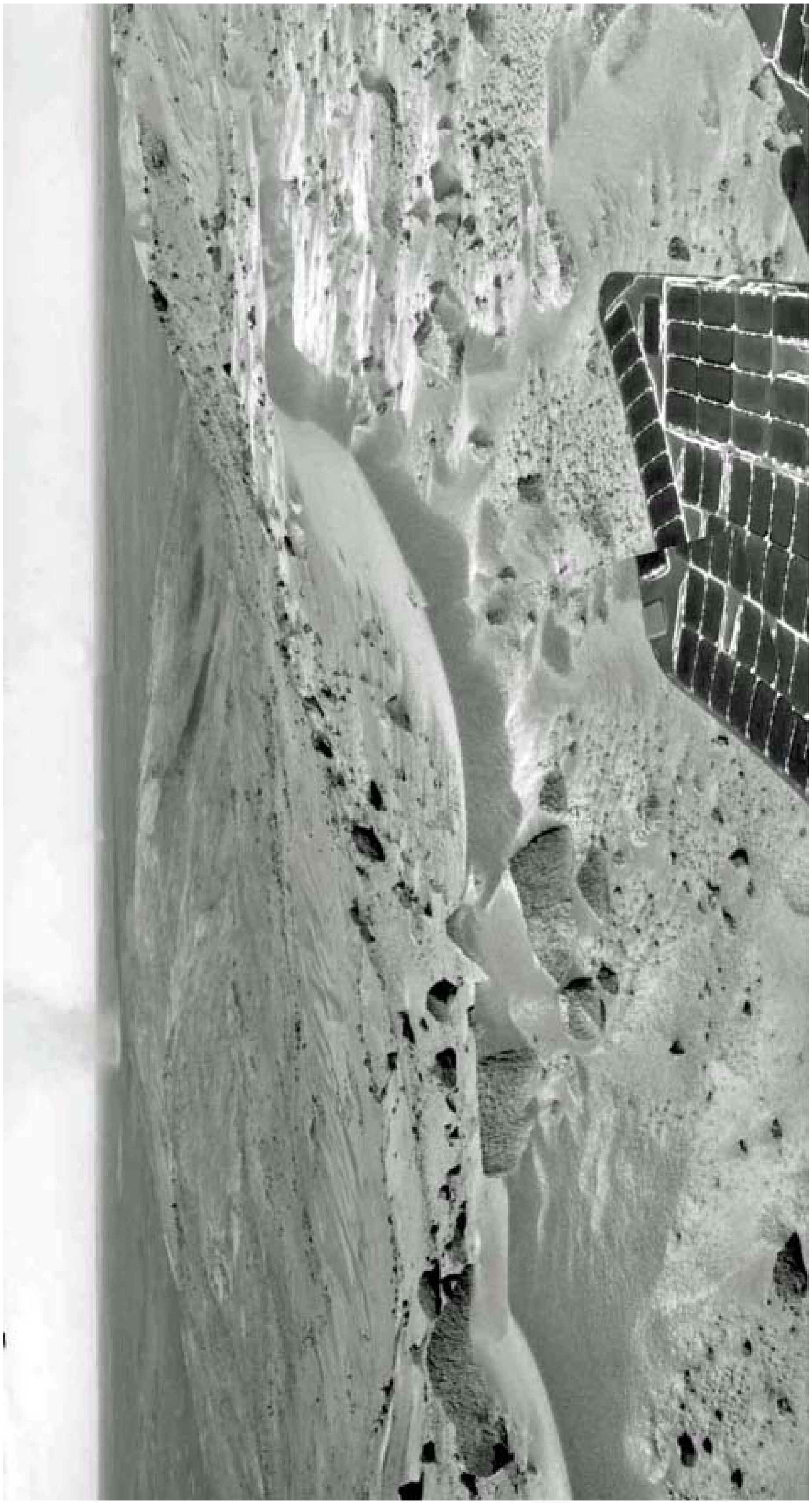
Credits

This activity was created by Jayne Aubele for the NASA Rhode Island Space Grant Program and adapted by her for this Guide.

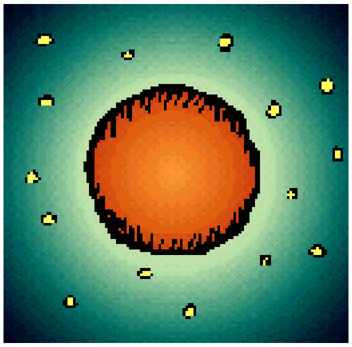
Martian clouds viewed by the rover named Opportunity from Endurance Crater on Sol 291



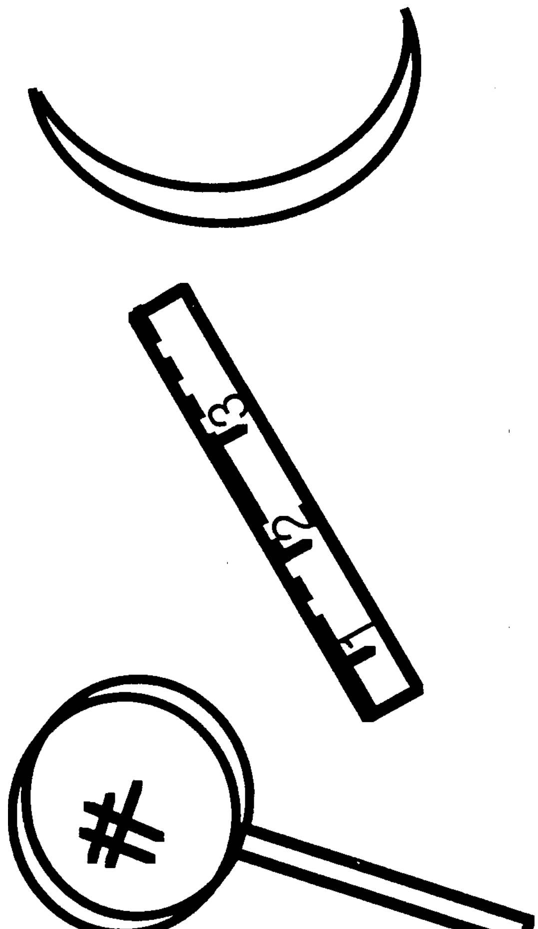
Orbiter image of Mars: Gusev Crater from Orbit

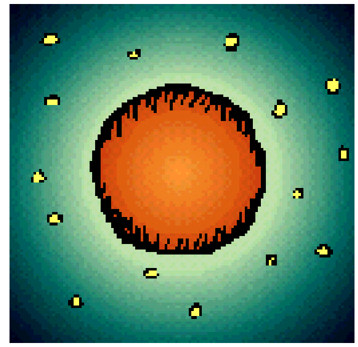


Surface image of Mars: Ground-level Viewof the Interior of Gusev Crater

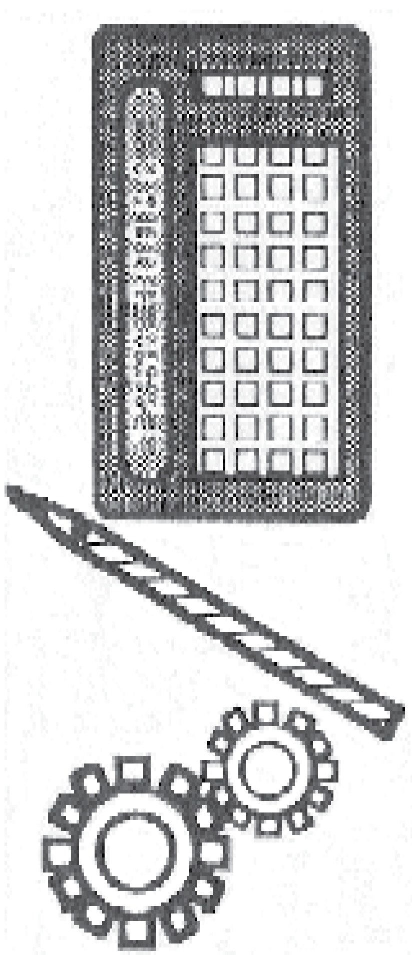


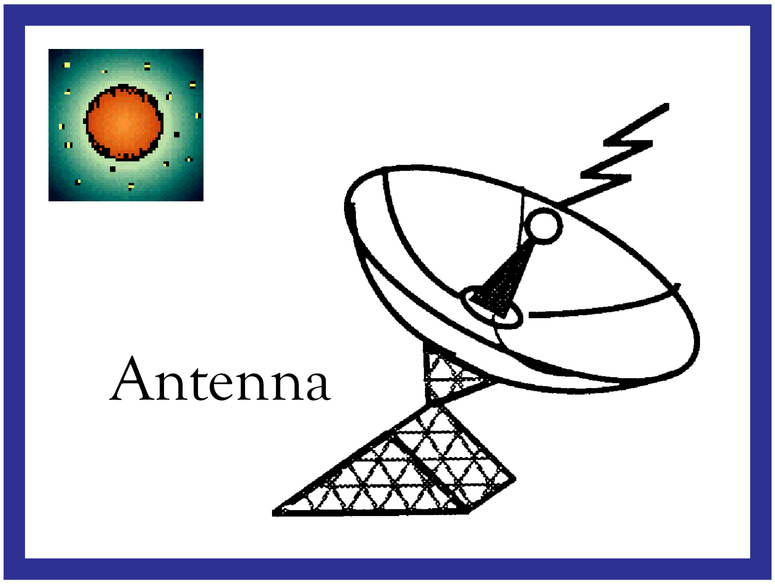
Mission Science Team





Mission
Engineering
Team

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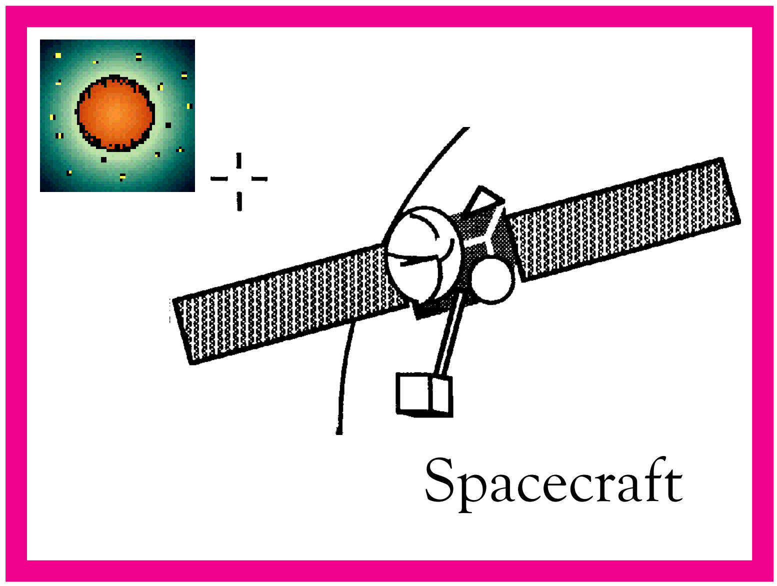
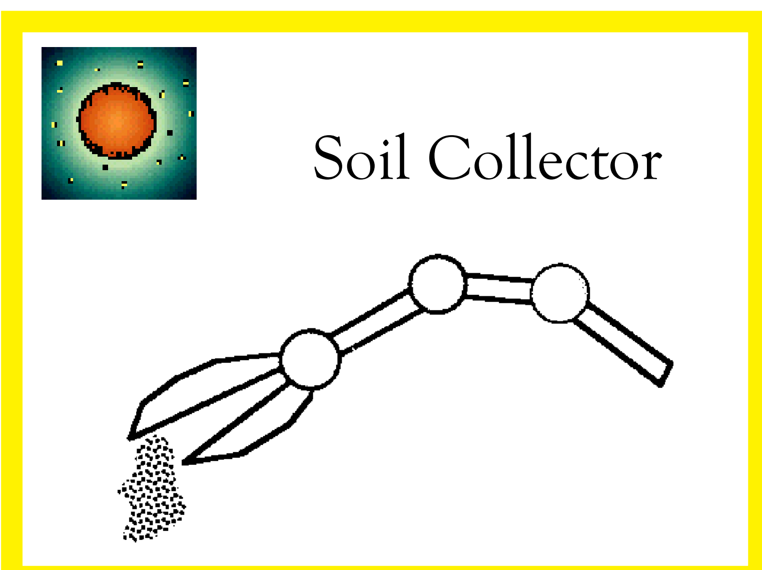

Spacecraft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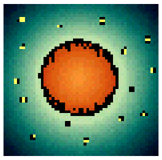
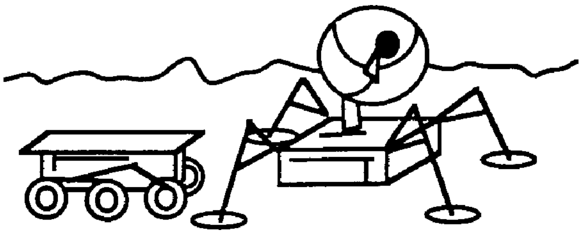
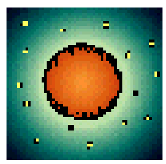


Lander and Rover





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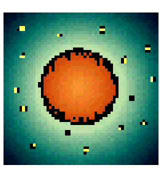

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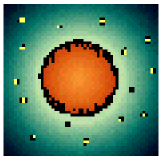
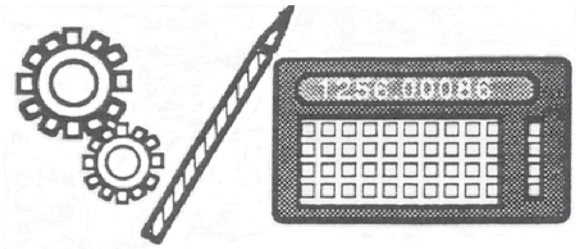
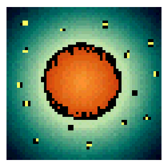
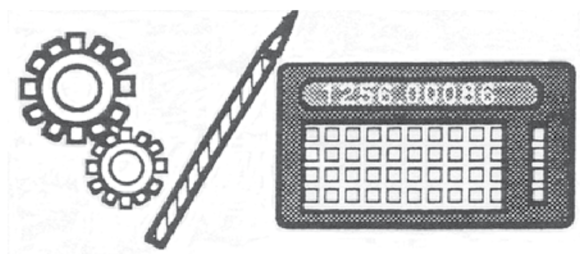


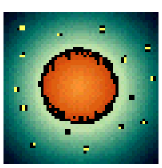
Mission
Engineer



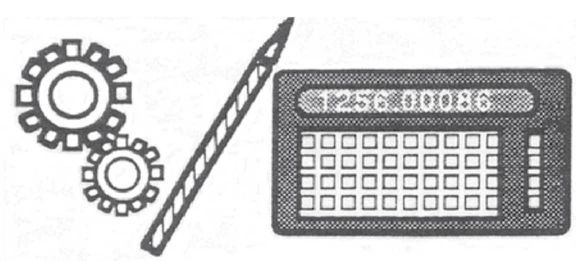


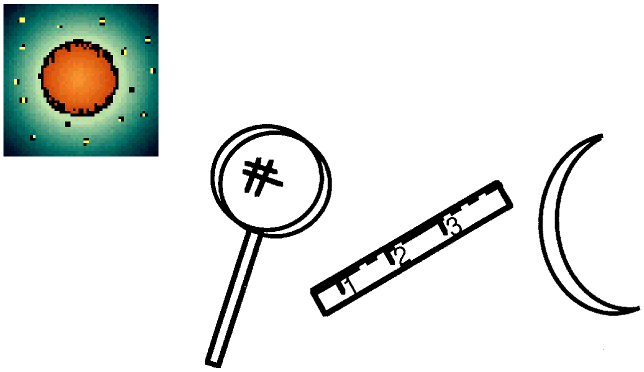
Mission
Engineer



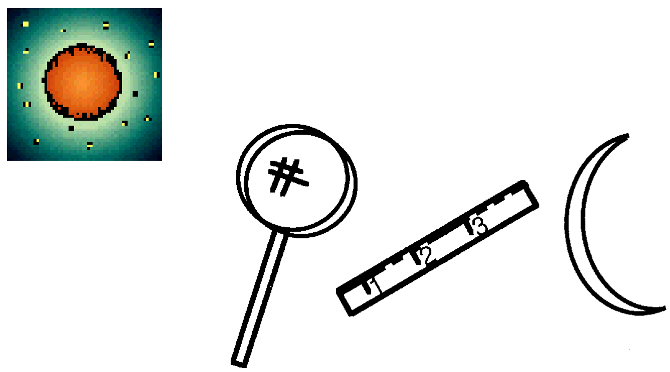


Mission
Engineer

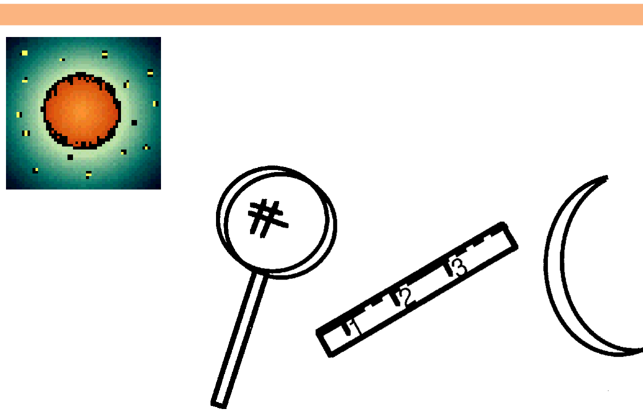




Mission Scientist



Mission Scientist



Mission Scientist

CONGRATULATIONS!

You have been selected to be a member of the Mars Mission team.

The name of your mission is: ______________________________

Your role in this mission is: ______________________________