



Strange New Planet

Middle grades

Lesson Summary

Strange New Planet brings insight into the processes involved in learning about planetary exploration. This activity demonstrates how planetary features are discovered by the use of remote sensing techniques.

Prior Knowledge & Skills

- Exploration of the solar system

AAAS Science Benchmarks

The Physical Setting

The Earth

The Nature of Science

The Scientific Enterprise

The Scientific Worldview

Scientific Inquiry

NSES Science Standards

- **Earth and space science:** Structure of the earth system
- **Science and technology:** Understandings about science and technology
- **Science as inquiry:** Abilities necessary to do scientific inquiry, Understandings about scientific inquiry
- **History and nature of science:** Science as human endeavor, Nature of science

Science context

What can astronomers learn about other planets using telescopes on Earth? Why do they sometimes choose orbiters or landers instead? In this activity, students explore the pros and cons of each research technique and practice generating observing plans.

Suggested background reading

Cassini Spacecraft and Huygens Probe

Cassini Mission to Saturn

Cassini-Huygens Mission to Saturn

New Horizons Mission Design

Teaching Time: 90 minutes

Materials

To share with the whole class:

- Plastic bails
- modeling clay
- Playdoh®, styrofoam® balls, or rounded fruit (cantaloupe, pumpkin, oranges, etc.)
- Vinegar, perfume, or other scents
- Small stickers, sequins, candy, marbles, anything small and interesting!
- Cotton balls
- Toothpicks
- Objects that can be pierced with a toothpick to make a moon
- Glue (if needed)
- Towel (to drape over planets)
- Push-pins
- Viewer material (sheet of paper, paper towel roll, or toilet paper roll)
- 5" x 5" blue cellophane squares (one for each viewer) and other selected
- Colors to provide other filters for additional information
- Rubber bands (one for each viewer)
- Masking tape to mark the observation distances
- Student data sheet

Advanced Planning

Preparation Time: 30 minutes

1. Gather materials
2. Create "Strange New Planet" (optional if you have decided to let students create their own planets)
3. Set up viewing station(s)
4. Review lesson plan

Source: ASU Mars K-12 Education Program



Strange New Planet

ASU Mars K-12 Education Program 6/99

Adapted from NASA Education Brief “EB-112: How to Explore a Planet” 5/93

Introduction: *Strange New Planet* brings insight into the processes involved in learning about planetary exploration. This activity demonstrates how planetary features are discovered by the use of remote sensing techniques.

Suggested Grade Level: 5 - 8 (Can be used K - 12 with adaptations - simple observations vs. more data collection related to current remote sensing data and techniques)

Objectives: Students will be engaged in making multi-sensory observations, gathering data, and simulating spacecraft missions.

National Science Standards Addressed:

Standard A: Abilities necessary to do scientific inquiry

Materials: (Planets can be made from a combination of materials)

- Plastic bails, modeling clay, Playdoh©, styrofoam© balls, or rounded fruit (cantaloupe, pumpkin, oranges, etc.)
- Vinegar, perfume, or other scents
- Small stickers, sequins, candy, marbles, anything small and interesting!
- Cotton balls
- Toothpicks
- Objects that can be pierced with a toothpick to make a moon
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Procedure:**1) Selecting a Planet**

Choose an object such as a plastic ball or fruit (cantaloupe, etc) that allows for multi-sensory observations. Decorate the object with stickers, scents, etc. to make the object interesting to observe. Some of these materials should be placed discreetly so that they are not obvious upon brief or distant inspection. Some suggestions for features are:

- Create clouds by using cotton and glue
- Carve channels
- Attach a grape using a toothpick (to make moons or orbiting satellites)
- Affix small stickers or embed other objects into the planet
- Apply scent sparingly to a small area

For older students, teams can create their own planets for other teams to view. This allows the students to create their own set of planetary features and write up a key to these features for the team that explores that planet to compare to their own findings.

2) Set-up

Place the object (planet) on a desk in the back of the room. Cover the object with a towel before students arrive. Brief students on their task: To explore a strange new planet. Students can construct viewers out of loose-leaf paper by rolling the shorter side into a tube (can also use toilet paper roll or paper towel roll.) These viewers should be used whenever observing the planet. Form mission teams of 4-5 students. Make sure students have a place to record their data (student data sheets.) Encourage use of all senses (except taste unless specifically called for).

3) Pre-Launch Reconnaissance

This step simulates earth-bound observations. Arrange students against the sides of the room by teams. These areas will be referred to as Mission Control. To simulate Earth's atmosphere, a blue cellophane sheet could be placed on the end of the viewers, taped or held in place by a rubber band. This helps to simulate the variation that occurs when viewing objects through the Earth's atmosphere. Remove the towel. Teams observe the planet(s) using their viewers for 1 minute. Replace the towel. Teams can discuss and record their observations of the planet. At this point, most of the observations will be visual and will include color, shape, texture, and position. Teams should write questions to be explored in the future missions to the planet.

4) Mission 1: The Fly-by (Mariner 4,6,7 - 1965,1969,1969)

Each team will have a turn at walking quickly past one side of the planet (the other side remains draped under towel). A distance of five feet from the planet needs to be maintained. Teams then reconvene at the sides of the room (Mission Control) with their backs to the planet while the other teams conduct their fly-by. Replace towel over planet once all the fly-bys have taken place. Teams record their observations and discuss what they will be looking for on their orbit mission.

5) Mission 2: The Orbiter (Mariner 9,1971-72; Viking 1 and 2 Orbiters, 1976-80; Mars Global Surveyor, 1996-present)

Each team takes two minutes to orbit (circle) the planet at a distance of two feet. They observe distinguishing features and record their data back at Mission Control. Teams develop a plan for their landing expedition onto the planet's surface. Plans should include the landing spot and features to be examined.

6) Mission 3: The Lander (Viking 1 and 2,1976-1982; Mars Pathfinder, 1997)

Each team approaches their landing site and marks it with a push pin (or masking tape if planet will pop using a pin.) Team members take turns observing the landing site with the viewers. Field of view is kept constant by team members aligning their viewers with the push pin located inside and at the top of their viewers. Within the field of view, students enact the mission plan. After five minutes, the team returns to "Mission Control" to discuss and record their findings.

Assessment:

Each individual student should complete a Student Data Sheet. Each team shares their data with the class in a team presentation. As a class, compile a list of all information gathered by the teams to answer the question "What is the planet like?" (or each planet if multiple planets are used). Have the class vote on a name of the newly discovered planet or the geologic features discovered using the rules for naming a planet (planetary nomenclature) which is located at the USGS website: (<http://www.flag.wr.usgs.gov/USGSFlag/Space/nomen>). Teams critique their depth of observations and ability to work together.

Variations:

Create a solar system of planets, hang them from the ceiling and have students make observations of all the planets.

Name: _____

Strange New Planet Student Data Sheet

A. Pre-Launch Reconnaissance - Earth-bound observations

- 1) Estimate your distance from the planet: _____ (feet or meters).
- 2) Using your viewer (with blue cellophane attached to simulate Earth's atmosphere) observe the planet. What types of things do you observe? Record any observations (shape of planet, color, size, etc.)
- 3) Discuss all of the observations with your team members while at Mission Control. Record any team observations that differ from yours.
- 4) As a team, write questions to be explored in the future missions to the planet. What else do you wish to know and how will you find that information out (special features of the planet, life of any kind, etc.)
 - a.
 - b.
 - c.
 - d.

C. Mission 2: The Orbiter (Mariner 9, 1971-72; Viking I and 2 Orbiters, 1976-80; Mars Global Surveyor, 1996-present)

Using a viewer, each team takes a total of two minutes to orbit (circle) the planet at a distance of two feet. Divide the two minutes by the number of team members to get the time each person gets to orbit the planet. After your observation, return to Mission Control.

1) Record your observations of the planet. What did you see that was the same as your Earth or fly-by observations? What did you see that was different? Can you hypothesize (make a science guess) as to why there were any differences?

2) Record any similarities or differences that your team observed.

3) As a team, develop a plan for your landing expedition onto the planet's surface.

a. Where will you go and why? How did your team decide where to land?

b. What are the risks or benefits of landing there?

- c. What specifically do you want to explore at this site?

- d. What type of special equipment or instruments would you need to accomplish your exploration goals? (Remember, anything you bring has to be small and light enough to bring on a spacecraft!)

D. Mission 3: The Lander (Viking 1 and 2, 1976-1982; Mars Pathfinder 1 1997)

Each team will approach their landing site and mark it with a push pin or masking tape. Each team member will take a turn observing the landing site through their viewer. Field of view (the area that you can see through your viewer) is kept constant by aligning the viewer with the push pin located inside and at the top of their viewers. Each team has a total of five minutes to view the landing site. After each member views the landing site, return to Mission Control.

1) Now that you have landed, what do you think you can accomplish at this landing site?

2) How long (in days) will it take you to get the job accomplished?

3) Was your mission successful? Why or why not?

4) What were the greatest challenges of this mission (Personally and as a team)? What would you change for the next mission?

5) List the members of your team.

a.

b.

c.

d.

e.

f.