Strange New Planet

A Lesson From CAP's AEX Middle School Earth & Science Book

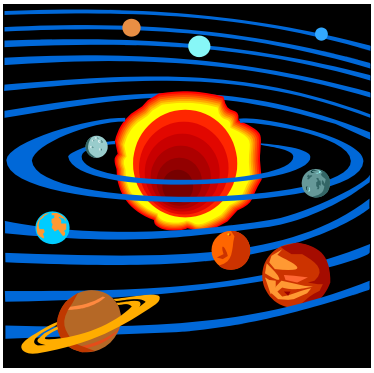
Lesson Reference:
This lesson is adapted from the Strange New Planet lesson located in *Mars Activity Book: K-12 Classroom Activities Booklet* available at http://mars.jpl.nasa.gov/classroom/pdfs /MSIP-MarsActivities.pdf.

Objectives:

- Students will perform various observations.
- Students will simulate pre-launch reconnaissance, a flyby, an orbit, and and landing.
- Students will determine the challenge of performing celestial observations from Earth.
- Students will determine the importance of planning and asking questions.
- Students will practice effective communication and teamwork.

National Science Standards:

- Science as Inquiry
- Physical Science
  - Properties in matter
- History and Nature of Science
  - Science as a human endeavor
  - Nature of science
  - History of science



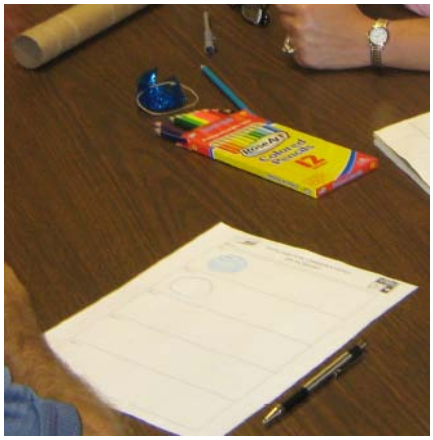
Background Information:
(from http://starchild.gsfc.nasa.gov/docs/StarChild/questions/question37.html)

The earliest record of an existing telescope is from a patent application in Holland on October 2, 1608. The application was made by Dutch spectacle maker Hans Lippershey (sometimes found as Lipperhey).

Lippershey applied to be granted exclusive rights to make and distribute an instrument that would allow you to see distant objects as if they were nearby. The instrument consisted of a positive lens at one end of a narrow tube and a negative lens at the other end. His claim for the invention was soon challenged by a couple of other men and the Dutch authorities eventually ruled that the situation was confused, and refused to grant a patent to anyone.

The telescope went on, regardless of who invented it, to be one of the most important scientific instruments of the 1600s. For example, it allowed for observations of phenomena in the universe which eventually led to the acceptance of the sun-centered solar system. Galileo was the first one who used the telescope for astronomy, making wonderful discoveries about our Moon, the moons of Jupiter, and other things.

Materials:



- Paper towel or toilet paper tubes (one per group)
- Rubber band (one per group)
- Pieces of blue cellophane (one per group - available at most art/craft stores)
- Observations data sheet (one per group)
- Colored pencils (one set per group)
- At least one spherical object made to look like a strange new planet
  For example, decorate a medium-sized Styrofoam ball with various colors, including blue. You may place small "alien" or bug stickers randomly on the planet. You may use a toothpick to insert into the ball and place a grape on the other end to represent a moon. You might spray something on the planet or moon to make it smell. The possibilities are endless.
- Cloth, box, or other material to hide the spherical object(s)

Advance Lesson Preparation:

- Create "telescopes" by using a rubber band to attach a blue piece of cellophane over one end of each paper towel/toilet roll. Overlap the piece of blue cellophane in order to have two layers of cellophane covering one end of the paper towel/toilet paper tube.
- Decorate the spherical object(s) as desired to make them interesting to observe and that require careful observation up close from all angles.
- Place the spherical object(s) relatively close to one another at the front of the room. Cover these objects with a cloth or box.
- Make copies of the Observations data sheet (one per group).

Lesson Presentation:

1. Divide students into groups of at least three, but no more than five, members per group.
2. Distribute one "telescope" and one data sheet to each group.
3. Ask the students if they have ever been interested in exploring and what methods they use to explore something. Tell them that they will be space explorers today.
4. Ask one member from each group to take the "telescope" and line up across the back of the room. While group members are making their way to the back of the room, ask students if anyone knows who invented the telescope. (While Galileo is credited for being the first person for using the telescope for astronomy purposes, Hans Lippershey is the first person to have applied for a patent for his telescope invention.)
5. Instruct the other group members who are seated to turn and face the back of the room until instructed to do otherwise.

Pre-launch Reconnaissance 

6. Instruct the "explorers" with the telescope to look toward the front of the room where the objects are covered. Tell them that you are going to uncover the object(s) in just a moment and that they will observe the object(s) using their telescope. Ask the students with the telescopes to close one eye and look through the telescope with their other eye. (The blue cellophane should be at the end of the tube towards the object(s) as opposed to being against one's eye.)
7. Reveal the object(s) at the front of the room just long enough for students to observe. After about thirty seconds, cover the object(s) and instruct the students with the telescopes to go back to their group and describe what they saw.
8. Groups should sketch the description in **Box 1** on their data sheet.
9. Instruct groups to select another member to take the telescope and go to the back of the room. (If a group has less than 5 members, ask the same "telescope" students to return to the back of the room again.)
10. Repeat steps 6 - 8, except for step 7, ask the students with the telescope to **remove** the blue cellophane at the end of their telescope.
11. After the students describe their observations with their groups, have groups sketch the description in **Box 2** on their group's data sheet.

Source: http://marsed.asu.edu/sites/default/files/styles/book_image/public/images_book/strange%20new%20planet_lessons.JPG

12. Ask students what they think the blue covering represented. (Earth's atmosphere) Discuss how Earth's atmosphere can distort images and color when trying to study celestial objects.

The Flyby  (NASA picture of *Mariner* 2 which flew by Venus in 1962)

13. Instruct groups to face the back of the room again and to send another group "explorer" to the back of the room. This time, have these students in the back of the room form a single file line. Tell these group representatives that they will actually get to walk past the object(s). Emphasize that they should look closely, but continue walking. They cannot stop in front of the object(s)! Once they understand, reveal the objects and allow the group representatives to walk by in front of the objects and then go back to their seats. Remember to cover the objects once the students have walked past the front of the objects.
14. Ask students what they demonstrated when walking past the object. (a flyby)
15. Have the group's flyby explorers describe what they observed while other group members sketch the verbal description in **Box 3** on their data sheet.

16. Inform students that they will send another group member to observe the objects. If anyone in the group has anything specific they want their next "explorer" to look for regarding the object(s), they should inform the group member at this time.

The Orbit 

17. Instruct everyone to face the back of the room. Have the next group of explorers form a circle around the object(s). Tell the explorers that they will walk in a circle, keeping their hands to themselves, about 4 times around the objects. Reveal the object(s) and instruct the students to begin walking around the object(s).
18. After about 4 times around, cover the objects and instruct the representatives to return to their group and describe what they saw. Have students complete **Box 4** on their data sheet.
19. Ask students what walking around the objects represented. (orbiting)

The Landing  (NASA picture of *Sojourner*, the rover that landed on Mars in 1997)

20. Tell the groups that they will have one last opportunity for someone to view the object(s). Once groups have selected their last person to view the object(s), allow the group to give any final instructions to the member. (If someone from a group has not made an observation yet, that person must make the last observation for his/her group. Everyone in the group must contribute to the observations.)
21. Direct all of the last explorers to form a circle around the object(s) while everyone else faces the back of the room. Allow these observers to touch and smell the object(s), but they cannot pick up the object(s).

22. Cover the object(s) and send the last explorers back to their groups to describe their observations and complete **Box 5** on their data sheet.
23. Ask students what being allowed to touch the objects represented. (landing)
24. Conduct a class discussion about what team members asked their exploration representatives to look for during observations. (e.g. Did anyone ask a member to look for a particular color, texture, or feature related to the object?)
25. Allow each group to share their **Box 5** drawing prior to revealing the object(s).
26. Reveal the object(s) and discuss why the groups did or did not come close in their drawings or overall description of the object(s).

27. Ask students to try to identify any specific features on the strange, new planet(s). Ask students to explain why they think this may or may not be a safe place to visit or colonize. Are there any indications that a human could benefit from any aspect of the planet(s)? If further space missions to the planet(s) were possible, what would be the purpose of those missions?

Summarization:
Ask students why we might prefer to have a progression of observation methods rather than choosing to land first. Confirm correct responses and/or lead students to consider some of the following factors: money, technology, weather, terrain, and/or other dangerous situations.

Ask students what the group members remaining at their desks during the flybys, orbits, etc., may simulate. (a mission control center) Ask students if questions played an important role in the groups' collection of data. Explain that questions are important in determining the course of action in missions. Effective communication is vital to creating an accurate picture or an accurate assessment of a situation. Information from different sources can be gathered and evaluated at a central location. Teamwork and effective communication among scientists, engineers, pilots, and others involved in the mission is crucial to the mission's success. Everyone brings something of value to the table, even if it is just the person who always asks questions.

Career Connection: (from http://science.jpl.nasa.gov/PlanetaryScience/index.cfm)

Planetary scientist - The duties include studying the atmospheres, surfaces, and interiors of planets; understanding the origins of planets and the physical processes at work; and using radar to determine the physical characteristics of asteroids and to search for asteroids that may pose a hazard to Earth. This work performed by planetary scientists allows them to improve our understanding of the planets, moons, and smaller bodies in the solar system. Research is carried out in the laboratory, from astronomical facilities throughout the world, and from spacecraft and landers, including the Mars rovers.

Evaluation:

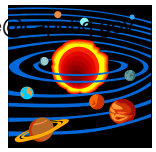
- Teacher observation
- Space Exploration Observations data sheet

Lesson Enrichment/Extension:

- Have students research space probes that have conducted planet flybys.
- Have students create their own planet along with a description of its location, topography, neighboring planets or moons, and any life forms.

Associated Websites:

- News regarding the search for other planets http://planetquest.jpl.nasa.gov/news
- *Kepler*, a NASA space telescope responsible for finding planets http://www.nbcnews.com/id/49840320/ns/technology_and_science-space/t/more-years-keplers-planet-hunting-mission-extended/



Observations

Box 1
Box 2
Box 3
Box 4
Box 5

Source: http://photojournal.jpl.nasa.gov/ipbrowse/PIA15416_ip.jpg