



Revised 6/04

Lesson #23 Red Rover, Red Rover

Grade Level: 5-6

Teachers, this is a basic lesson plan that you may modify at your discretion.

Modifications to video: There have been several changes to the lesson plan since the video was made. This lesson plan reflects the latest changes made as a result of suggestions from teachers who have presented the lesson during the daytime program. Please continue to send us your ideas!

Overall educational objective: Students navigate Red Rover explorers across Mars landscapes in a simulation of NASA's Pathfinder Mission.

Associated Standard and CORE objective:

3060-04 Students will describe and compare the components of the solar system.

Materials list:

- 6 - Red Rover Simulator Stations consisting of:
 - Lego rover vehicle with "QuickCam" video camera
 - Computer with color monitor, mouse, keyboard
- 1 - Mars landscape backdrop and props
- 1 - Red Rover classroom video (to stay in blue box at end of day)

Teacher Provides: Solar system poster

Classroom setup: An area of 20 feet by 30 feet is needed for computers and Lego Rovers. Contradictory to the video, tables are NOT needed for this module.

Lesson activities:

1. Junior Engineering State personnel will set up the computers and help with the landscape. The instructor should take some time to become familiar with the software, general rover operation, and methods of class management.
2. Set up a poster of the solar system; ask the students if they can find Mars and have them point it out. Where is it in relation to the earth and sun?

3. Fill the students in that this event happened in real life. The rocket was launched on December 7, 1996, and landed on July 4, 1997.
4. Have the students view the the classroom video on the Mars Pathfinder Mission. Remind them to listen carefully to the video clip for discussion afterward.
5. Divide the students up into teams of four, with each team going to the computer and taking turns operating a Lego model of the Mars rover. Each student will have a task: the driver sits at the console and operates the mouse; the back-seat driver helps the driver stay on task; the direction giver stands in the rover lane box behind the backdrop and gives direction signs to the observer; and the observer stands next to the console and conveys directions to the driver.
6. Jr. Engineering personnel will repack the computer stations when the program ends.

Computer operation: Windows 95 (IBM compatible)

1. Turn on the computer; once Windows 95 is running, it will automatically start the Red Rover program.
2. The rover is controlled by clicks on the direction pad in the Navigation section.
3. The rover moves in timed increments and awaits the next command. It is best to leave settings where they are: FOR/BACK - 4
RT/LFT - 4
POWER - 7
4. If you have problems with a rover or computer, get help from the JES staff.
5. Double click on the "Exit" icon in upper right hand corner to shut down.

Figure 1

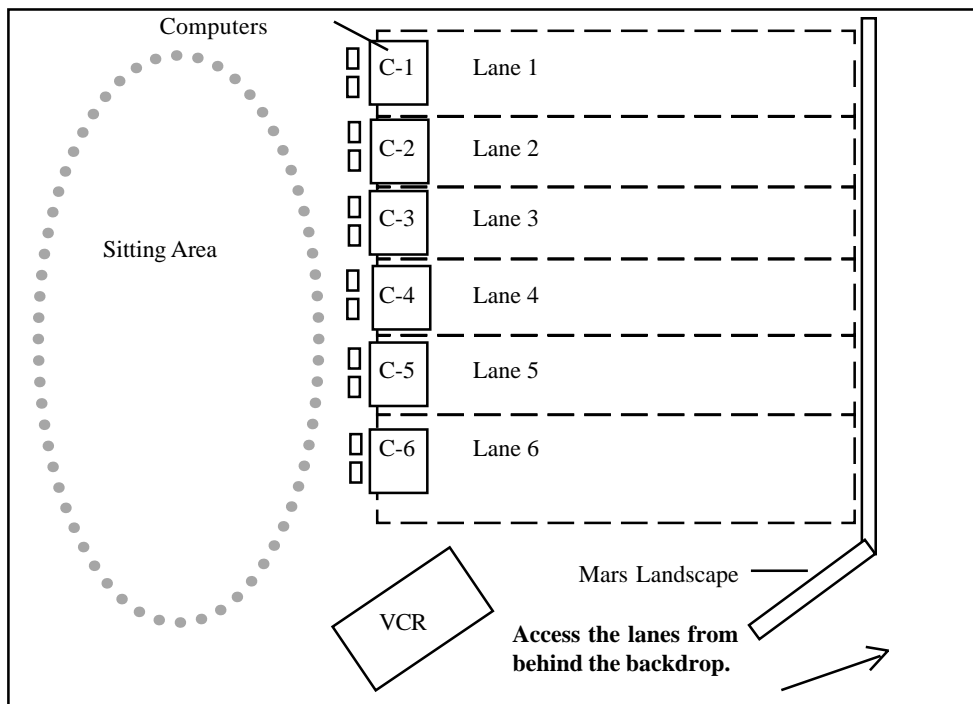
Red Rover team members' roles and places

Driver - seated at the computer console and operates mouse.

Back-seat Driver - seated by driver and helps the driver stay on task.

Observer - stands next to console and conveys directions to driver.

Direction Giver - stands in the team's rover lane box behind the backdrop and gives directions to the Observer. Care needs to be taken not to step over into another team's lane.



The Junior Engineering State staff will set up and take down the equipment. The VCR equipment (furnished by the school) is set up at one end of the classroom. The computers are set up at the side with lanes to maneuver the rover vehicles in front of the Mars landscape backdrop.

Guidelines: The students will need to know these instructions and tips to run the computers and the rovers; knowing the guidelines will also help to reduce teacher stress.

1. There are two buttons on the mouse. Use **only** the left button.
2. Show the students the camera that is mounted on the front of the rover. The kids respond enthusiastically if the rover is maneuvered so that the camera faces them and they can see themselves on the computer screen. The Rovers should be picked up and handled by the wheels only. **Never** pick up a Rover by the camera.
3. Only the direction giver for each group is allowed to access his or her rover lane by going around the end of all the computers and going behind the backdrop (see figure 1). No stepping between computer stations into rover lanes!
4. Instruct the students that this rover has not been built exactly like the one sent to Mars; if the students try to run over the rocks on the landscape, the rover will turn over. Only the Direction Giver should be permitted to move the rover by hand. This is done by gently grasping the rover by the wheels on each side, lifting, and then placing a hand under the rover and moving it to the desired location.

Facts: The Pathfinder mission landed on Mars on July 4th 1997. The Sojourner robot rover explored the Mars terrain and analyzed soil and rocks. It also sent back time-delayed video transmissions.

Safety precaution: To avoid tripping and damaging the rovers, warn the students to enter their rover lane from around the side ends of the landscape, not from between the computer stations.

Teacher tips:

- Jr. Engineering staff will help you keep things running as smoothly as possible. For the evening session, it is a good idea to limit drivers to only parents and those students who have operated the rovers during the day. Keep the door closed to avoid disruptions during the evening session.
- The NASA center at the ERTC (Educational Resource and Technology Center) at USU contains a wealth of information on space exploration, travel in space, and satellites. Information and videos are available free or at minimum cost.
- Teachers and students with Internet access can visit a good site at <http://planetary.org>. USU developed the software for the Red Rover project and supports the Planetary Society who helped develop the Red Rover project. The NASA website for the mission is <http://pfwww.jpl.nasa.gov/> and space exploration information can be found at <http://www.transatlantech.com/TPS/spacegate.html>.
- Some students have problems maneuvering their rovers because of difficulty with the mouse. Emphasize that they should not hold down the mouse button; only click the mouse once until the rover quits moving. You need to have one or two adults to help make sure that students use the equipment correctly.
- Students would enjoy following a course or path. You could add a time frame to complete the course in a certain amount of time. This would help deter students from playing with the rovers, and help them concentrate on an objective.

- Emphasize how long it takes to send messages back and forth between Earth and Mars (8 to 40 minutes). This would help the students understand why their rover took a few seconds to actually move once they gave the commands, making this more like a flight simulator experience.
- Using colored pieces of paper, which are numbered to indicate personal assignments, eliminates much confusion and facilitates quick rotation of jobs.

Please make your students aware that this lesson relates to the following:

Career Fields: SCIENCE, TECHNICAL

Occupations: Aeronautical Engineer: They design, construct, and test aircraft, missiles, and spacecraft.

They might also conduct basic and applied research to evaluate adaptability of materials and equipment to aircraft design and manufacture. They also may assist in planning the technical phases of aircraft systems, flight operations, and logistics.

Education: Bachelor's Degree

Astronaut: Working with the National Aeronautics & Space Administration (NASA), astronauts man the various space projects. NASA primarily seeks candidates with a military background, jet aircraft flight experience, and engineering training.

Several Requirements:

1. Have at least a bachelor's degree from an accredited institution in engineering, biological science, physical science, or mathematics.
2. Have three years of related professional experience following the degree.
3. An advanced degree is recommended but could be substituted with additional years of work.
4. Must be between 5'4" and 6'4".
5. Have at least 1000 hours pilot-in-command time in a jet aircraft.
6. Be able to pass a NASA Class I Space physical or an equivalent exam.

Astronomer: They use the principles of physics and mathematics to learn about the fundamental nature of the universe, including the sun, moon, planets, stars, and galaxies. They also apply their knowledge to problems in navigation and space flight.

Education: Doctor of Philosophy

Computer Engineer: They plan, design, and build computers and other related products. They also plan and design computer systems tailored for individual companies and organizations. They might also install these systems or modify already existing ones.

Education: Bachelor's Degree

Electrical Engineer: They design, develop, test, and supervise the manufacture of electrical and electronic equipment. Electronic equipment includes power generating and transmission equipment used by electric utilities, electric motors, machinery controls, and lighting and wiring in buildings, automobiles, and aircraft. Electronic equipment includes radar, computer hardware, and communications and video equipment.

Education: Bachelor's Degree

Geologist: They study the physical aspects and history of the earth. They identify and examine rocks, study information collected by remote sensing instruments in satellites, conduct geological surveys, construct maps, and use instruments to measure the earth's gravity and magnetic field. They analyze information collected through seismic studies. They also search for oil, natural gas, minerals, and ground water.

Education: Bachelor's Degree

Mechanical Engineer: They plan and design tools, engines, machines, and other mechanical equipment. They design and develop power-producing machines such as internal combustion engines, steam and gas turbines, and jet and rocket engines. They also design and develop power-using machines such as refrigeration and air-conditioning equipment, robots, machine tools, materials handling systems, and industrial production equipment.

Education: Bachelor's Degree

References:

National Geographic World v263, July '97, p.2-6 "A Robot Visits Mars. What Will It Find? This article gives an overview for the Pathfinder mission: what it will do, what it will look for, and what experiments it will conduct.

Aviation Week and Space Technology v147, Aug 04 '97, p.30-1 "Pathfinder Beginning New Operations Phase"

One of a weekly series of articles focussing on the current happenings of the Pathfinder mission.

Review Questions:

1. Where is Mars in relation to the Sun and Earth?
2. Is Mars a large planet?
3. When did Pathfinder land on Mars?
4. How long did it take to get to Mars?
5. Where is the largest volcano in our solar system? It's on Mars and it's called Olympus Mons and it's three times the height of Mt. Everest.
6. Why are communications delayed between Mars and Earth?
7. Why did the Sojourner module bounce so high when it first impacted the Martian surface?