

MISSION TO MARS

PROJECT BASED LEARNING



Mission to Mars: Project Based Learning

Previous, Current, and Future Missions to Mars

Dr. Anthony Petrosino, Department of Curriculum and Instruction, College of Education, University of
Texas at Austin

Benchmarks content author: Elisabeth Ambrose,
Department of Astronomy, University of Texas at Austin

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<http://www.edb.utexas.edu/missiontomars/bench/bench.html>

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Previous, Current, and Future Missions to Mars

By: Elisabeth Ambrose

Mariner 4

Mariner 4 was a small robotic spacecraft that was sent to Mars on November 28, 1964 to complete one flyby. It flew over Mars in July, 1965 and took pictures of the surface with its digital tape recorder. The images showed lunar-type impact craters. After its flyby, it continued in orbit around the Sun for three years.

Mariner 6-7

Mariner 6 and Mariner 7 were identical small robotic spacecraft that were launched on July 31, 1969 and August 5, 1969, respectively. They arrived at Mars at about the same time and completed one flyby. Mariner 6 flew over the Martian equator, and Mariner 7 flew over the southern polar region. Both had imaging equipment, and they sent back hundreds of pictures. They also

analyzed the Martian atmosphere with remote sensing equipment. The data that Mariner 6 and Mariner 7 collected confirmed that the dark lanes seen on Mars from Earth were not canals, as was previously thought.

Mariner 9

Mariner 9 was also a small robotic spacecraft, and it was launched on May 30, 1971. Unlike Mariner 4, 6, and 7, which simply flew by Mars, Mariner 9 was designed to establish an orbit around the planet. It did so successfully, and continued to orbit for almost a year. Mariner 9 used its imaging instruments to make a map of the entire surface of Mars. As a result, many previously unknown features of Mars were discovered, including Olympus Mons and Valles Marineris, and dry river beds.

Close up images were also taken of the two Martian moons, Phobos and Deimos.



Mariner 9. NASA/JPL.

Viking 1-2

Viking 1 and 2 were identical robotic spacecraft launched on August 20, 1975 and September 9, 1975 respectively. They were the first man-made spacecraft to land on another planet. Each Viking spacecraft consisted of an orbiter and a lander. Each orbiter and lander flew to Mars together, and then decoupled in the Martian atmosphere. The lander descended to the ground and the orbiter continued to orbit the planet. The entire mission was

designed to continue for 6 weeks after landing, but all 4 components continued to be active long after this deadline had passed. The Viking 1 orbiter continued to fly over the Martian surface for a full three years, and the lander lasted 7 years on the surface of Mars. The Viking 2 orbiter and lander both lasted for four years.

The Viking 1 and 2 landers descended to two different parts of Mars, but they carried out the same types of experiments. While on the ground, they performed tests of the Martian soil to look for signs of life. However, no such signs were detected. Both the landers and the orbiters sent many hundreds of images of the surface of Mars back to Earth.

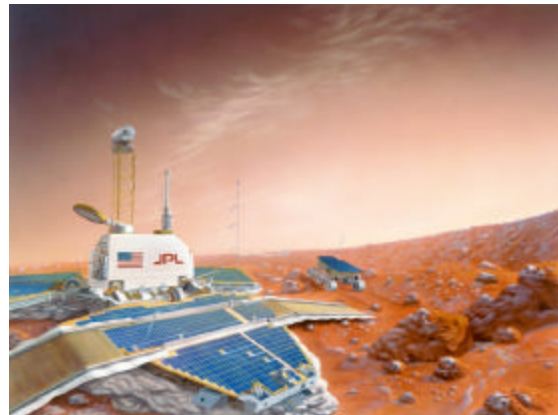


Viking Lander. NASA/JPL.

Mars Pathfinder landed in an outflow channel littered with many different kinds of rocks. Cameras on the lander sent back over 16,500 images of the Martian surface, and cameras on the Sojourner Rover sent back another 500 more. In addition, Pathfinder completed more than 15 chemical analyses of the rocks and soil, and it studied the wind and weather of the planet.

Mars Pathfinder/Sojourner Rover

Mars Pathfinder was a robotic spacecraft that was launched on December 4, 1996. It landed on Mars on July 4, 1997, using a parachute and airbags to cushion the fall. Upon landing, Pathfinder unfolded its instruments and deployed a small mobile robot called Sojourner Rover. The lander was renamed the Carl Sagan Memorial Station after successful setup on the Martian surface.



Mars Pathfinder. NASA/JPL.



Airbags landing system for Mars Pathfinder. NASA/JPL.

Mars Global Surveyor

Mars Global Surveyor is a robotic spacecraft designed to study Mars while in a polar orbit around the planet. It was launched from Earth on November 7, 1996. Mars Global Surveyor completed its mission in January 2001, and as it is still orbiting Mars today, it is currently in an extended mission phase. The satellite has returned more data about Mars than all of the previous missions to Mars combined. It has sent back thousands of images including 3-D images of the northern polar ice cap, studied the magnetic field of Mars, found possible locations for water, and studied the Martian moons.



Mars Global Surveyor. NASA/JPL.

2001 Mars Odyssey

2001 Mars Odyssey is a robotic spacecraft that was launched on April 7, 2001. It is currently in orbit around Mars, collecting images and data to help scientists determine the soil and rock composition, the amount of water on Mars, the history of the climate of Mars, and the extent of radiation on the planet.



Mars Odyssey. NASA/JPL.

2003 Mars Exploration Rovers

Two identical rovers will be launched between May and July 2003, bound for Mars. The rovers will be much like the Sojourner Rover, but they will be much more powerful. Like Mars Pathfinder, the Rovers will enter the Martian atmosphere directly, slowed by parachutes. Then airbags will shelter the robots as they bounce approximately 12 times and roll to a stop. Upon landing, the spacecraft will unfold and the Rover will deploy. Unlike Pathfinder, the Rovers will have all the scientific instruments on board, and they will be able to travel up to 100 yards each

Martian day. With no need to return to the landing site, the Rovers will be able to explore a comparatively large area of the Martian surface. The Rovers, which will land in different areas on Mars, will send back images from their cameras and data about the Martian soils, which they will be able to analyze at very small scales.



Mars Exploration Rover. NASA/JPL.

2005 Mars Reconnaissance Orbiter

This robotic spacecraft, planned for launch in 2005, will be designed to image the surface of Mars to even smaller scales. It will map the surface of the planet with sufficient resolution to be able to see rocks the size of beach balls.

Hopefully the data it collects will allow scientists to understand better the location and amount of water on Mars.



Mars Reconnaissance Orbiter.
NASA/JPL.

Smart Lander and Long-Range Rover

The Smart Lander and Long-Range Rover are planned for launch by 2007. They will be designed to use a new precise landing method that should allow landings in otherwise inaccessible areas. The spacecraft will also be a laboratory for even better surface measurements.

Scout Missions

Scout Missions, which could be small airborne craft or small landers, are also planned for 2007 launch. They would help increase the scale of airborne observations or increase the number of sites on Mars that have been visited by human spacecraft.

Sample Return and Other Missions

NASA plans many other missions to Mars after 2010. One type of mission includes a spacecraft that would land on Mars, collect samples of Martian soil, and return those samples to Earth. This type of mission might be underway as soon as 2011, but for now the first Sample Return mission is slated for 2014, and the second for 2016.

The Benchmark Lessons were developed with the help of the following sources:

JPL's Mars Missions website, <http://mars.jpl.nasa.gov/missions/>

JPL's Planetary Photojournal, <http://photojournal.jpl.nasa.gov/>

The NASA Image Exchange, <http://nix.nasa.gov/>