

- [www.exploratorium.edu/spectra\\_from\\_space/](http://www.exploratorium.edu/spectra_from_space/)  
This Exploratorium site describes space probes that are now in orbit, including the Hubble Telescope, listing their purposes and some of their interesting discoveries.

### Suggested Print Resources

- Bizony, Piers. *The Rivers of Mars: Searching for the Cosmic Origins of Life*. Aurum Press, London, England; 1997.
- Morton, Oliver. *Mapping Mars: Science, Imagination, and the Birth of a World*. Picador USA, New York, NY; 2002.
- Raeburn, Paul. *Mars: Uncovering the Secrets of the Red Planet*. National Geographic Society, Washington, DC; 1998.
- Zubrin, Robert, and Richard Wagner. *The Case for Mars: The Plan to Settle the Red Planet and Why*. The Free Press, New York, NY; 1996.



## The Case for Mars

### Grades 9–12

This series tells the stories behind the science of astronomy in an informative and entertaining way. Fast-paced and visually rich, viewers journey to exotic destinations within our solar system from moons and planets to comets and asteroids. Featuring advances in scientific investigation, this series investigates cosmic mysteries including the birth and death of stars, the structure of the universe, and the search for extraterrestrial life.

This guide provides a brief synopsis of the program, background on the science concepts presented in the show, discussion topics, activities, vocabulary and additional resources.

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#### TEACHER'S GUIDE

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#### COMPLETE LIST OF TITLES

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| • 21ST CENTURY COSMOS | • THE SEARCH FOR NEW PLANETS |
| • THE CASE FOR MARS   | • STELLAR EVOLUTION          |
| • THE ENIGMA OF VENUS | • THE STORY OF COMETS        |
| • EXTREME ASTRONOMY   | • TRAVELING TO OUTER PLANETS |
| • HUBBLE'S HERITAGE   |                              |

Teacher's Guides Included  
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## Program Summary

Mars, our planetary neighbor, has always captured our imagination. A mere 60 million kilometers from Earth at its closest point in orbit, Mars forms an eye-catching beacon in the night sky. It is the only planet that has surface features we can study from Earth. In 1877, Italian astronomers noticed dark, linear features criss-crossing the red planet and called them canali, meaning channels. A few years later, a wealthy businessman from Boston named Percival Lowell became interested in Mars.

Using personal funds and grants from other sources, he built what became the Lowell Observatory near Flagstaff, Arizona, to study the planet. This research led him to argue that Mars had once been a watery planet and that the topographical features known as canals had been built by intelligent beings. Over the course of the next 40 years, others used Lowell's observations of Mars as a foundation for their arguments. The idea of intelligent life on Mars remained in the popular imagination until NASA gathered the technology needed to travel to our distant neighbor.

The two planets are very similar—Mars and Earth both have water, dunes, glaciers, dust storms, snow and polar caps. They both have had hot springs, volcanoes, and other geological activity, yet there is no proof of any life on Mars. This is probably due to the fact that there is no protective ozone layer or magnetic field on Mars, and there is a chronic shortage of oxygen. Life can exist over only a certain range of temperatures, and although we're not quite sure what the lower limit is, Mars must be close to it. With such a thin atmospheric blanket, the temperature at the surface plunges every night to below minus 100 degrees Celsius. Liquid water simply isn't stable on the surface of Mars — any water that seeped or gushed to the surface today would boil away into steam or (much more likely) freeze solid.

Scientists have discovered signs that large amounts of water have flowed across Mars in the recent past. This comes as quite a surprise. For water to have flowed in enough quantity to carve channels and leave other traces suggests that enormous floods must have poured out from volcanically heated springs. These, in turn, must have been fed by vast reservoirs of underground moisture.

While many unmanned missions to Mars have failed in recent years, the mission that has provided scientists with the greatest amount of information about the red planet has been very successful. The Mars Global Surveyor (or MGS) mission that produced these results has received relatively little publicity, but its findings are transforming our view of our planetary neighbor. Besides the evidence for flowing water, a laser device on MGS has given us, for the first time, an accurate relief map of the whole planet.

Engineering models of future Mars rovers have been sent crawling around the scorched and barren landscapes of the Mojave Desert in California. Prototype rovers have also been tested in the Kamchatka Peninsula in eastern Russia. These desolate places offer scientists and engineers an opportunity to test their designs on terrain that is very similar to the craggy surface of Mars. Another Mars-like place called Haughton Crater is on a large island in northernmost Canada and offers astronauts a chance to practice maneuvering instruments and vehicles in hopes of sending a manned spacecraft to Mars in the future.

## Vocabulary

**ESA** — European Space Agency

**MGS** — Mars Global Surveyor. An orbiter that has circled Mars since 1997. The MGS sends back images of the red planet and can act as a communication satellite to relay data from future rover missions to computers on Earth.

**NASA** — Acronym for the National Aeronautics and Space Administration, a U.S. government agency formed in 1958 with the goal of making space exploration possible.

**Pathfinder** — Spacecraft that successfully landed on Mars on July 4, 1997.

**Sojourner** — The small rover dispatched on the Pathfinder Mission in 1997 to explore the terrain of Mars.

**THEMIS** — Thermal Emission Imaging System. Science payload sent to examine the geology of Mars.

## Activities & Discussion

- Why do you think scientists think it is important to design robotic spacecraft to collect samples of Martian rocks and soil and return them to Earth for study before astronauts are sent on a mission to Mars?
- Access information about Mars' atmosphere and surface features. Is there air on Mars? Is there gravity? Is water present? What is the climate and temperature on Mars? Based on scientific exploration, is there evidence of changes in atmosphere or surface over time?
- Discuss the many failed missions to Mars. Ask students to decide whether NASA's policy of developing spacecraft and missions "smaller, faster and cheaper" really amounted to "cheaper, flimsier and less prepared."
- Research the various unmanned missions to Mars. Develop a time line to show what we have learned about our closest planetary neighbor.

## Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at [www.LibraryVideo.com](http://www.LibraryVideo.com)

• [mars.jpl.nasa.gov/](http://mars.jpl.nasa.gov/)

"Mars Exploration" from NASA contains lessons, resources and programs about Mars along with links to standards in mathematics, science and technology.

• [athena.cornell.edu/mars\\_facts/past\\_missions.html](http://athena.cornell.edu/mars_facts/past_missions.html)

This site chronicles the many attempts to send spacecraft to Mars and showcases the controversy about the direction future missions to Mars should take.

• [nova.stanford.edu/projects/mod/](http://nova.stanford.edu/projects/mod/)

"The Daily Martian Weather Report" allows students to see how the climate of the red planet evolves from day to day and season to season.

*(Continued)*