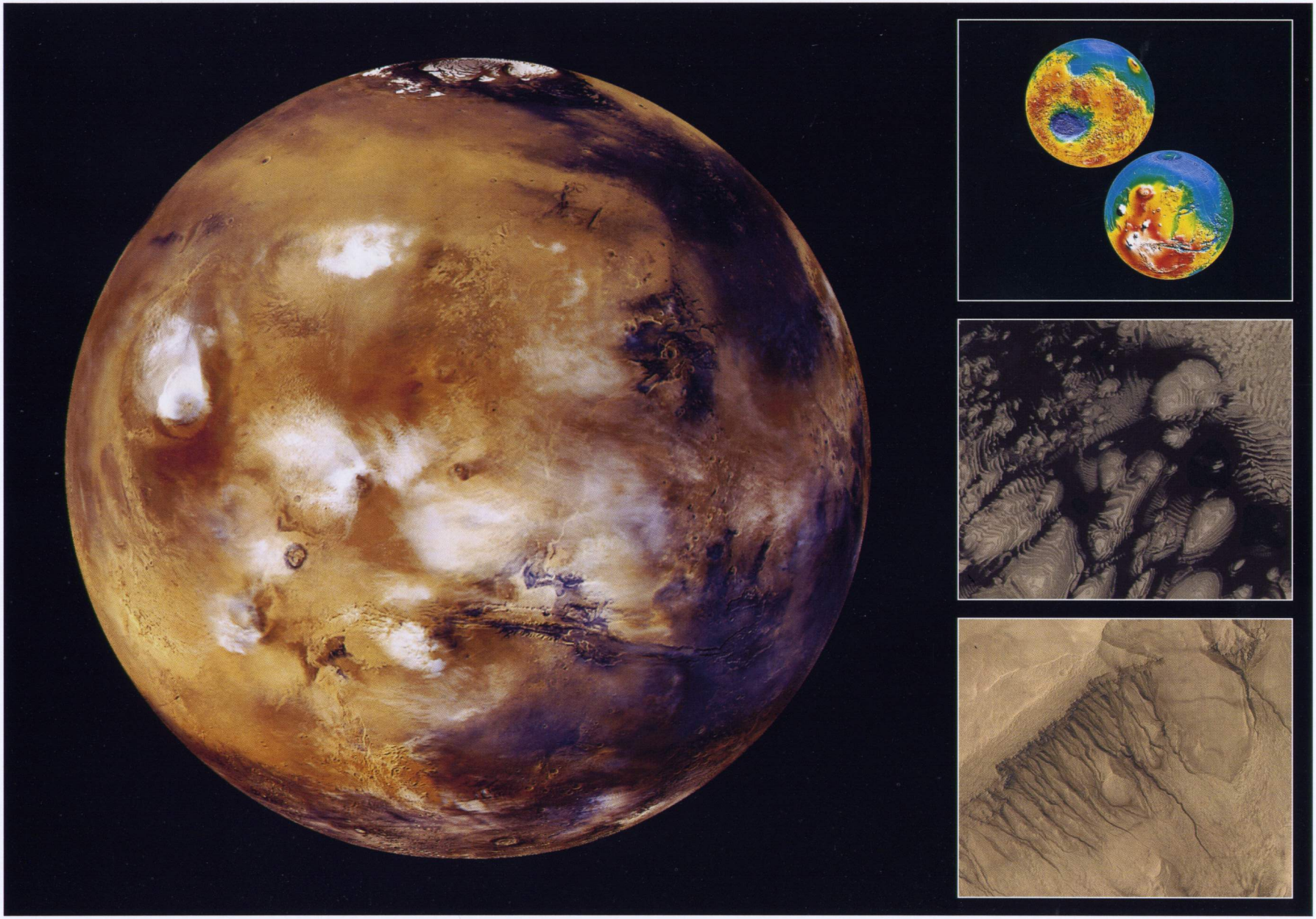
National Aeronautics and
Space Administration

Mars ♂



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The red planet **MARS** has inspired wild flights of imagination over the centuries, as well as intense scientific interest. Whether fancied to be the source of hostile invaders of Earth, the home of a dying civilization, or a rough-and-tumble mining colony of the future, Mars provides fertile ground for science fiction writers, based on seeds planted by centuries of scientific observations.

We know that Mars is a small rocky body once thought to be very Earth-like. Like the other "terrestrial" planets—Mercury, Venus, and Earth—its surface has been changed by volcanism, impacts from other bodies, movements of its crust, and atmospheric effects such as dust storms. It has polar ice caps that grow and recede with the change of seasons; areas of layered soils near the Martian poles suggest that the planet's climate has changed more than once, perhaps caused by a regular change in the planet's orbit. Martian tectonism—the formation and change of a planet's crust—differs from Earth's. Where Earth tectonics involve sliding plates that grind against each other or spread apart in the seafloors, Martian tectonics seem to be vertical, with hot lava pushing upwards through the crust to the surface. Periodically, great dust storms engulf the entire planet. The effects of these storms are dramatic, including giant dunes, wind streaks, and wind-carved features.

Scientists believe that 3.5 billion years ago, Mars experienced the largest known floods in the solar system. This water may even have pooled into lakes or shallow oceans. Yet the central question about Mars remains: where is the water? Where did the ancient flood water come from, how long did it last, and where did it go? At the present, Mars is too cold and its atmosphere is too thin to allow liquid water to exist at the surface for long. We know that some water exists today frozen in the polar ice caps, and enough water exists to form ice clouds, but the quantity of water required to carve Mars' great channels and flood plains is not evident on the surface today. Recent images from NASA's *Mars Global Surveyor* spacecraft suggest that underground reserves of water may break through the surface as springs. New data from Mars *Odyssey* suggest that large quantities of water ice may be frozen just beneath the surface at high latitudes. Unraveling the story of water on Mars is important to unlocking its past climate history, which will help us understand the evolution of all planets, including our own. Water is also believed to be a central ingredient for the initiation of life; the evidence of past or present water on Mars is expected to hold clues about past or present life on Mars, as well as the potential for life elsewhere in the universe. And, before humans can safely go to Mars, we need to know much more about the planet's environment, including the availability of resources such as water.

Mars has some remarkable geological characteristics, including the largest volcanic mountain in the solar system, Olympus Mons (27 km high and 600 km across); volcanoes in the northern Tharsis region that are so huge they deform the planet's roundness; and a gigantic equatorial rift valley, the Valles Marineris. This canyon system stretches a distance equivalent to the distance from New York to Los Angeles; Arizona's Grand Canyon could easily fit into one of the side canyons of this great chasm.

Mars also has two small moons, Phobos and Deimos. Although no one knows how they formed, they may be asteroids snared by Mars' gravity.

Fast Facts

Namesake	Roman God of War
Mean Distance from Sun	227,936,640 km
Orbital Period	1.88 years
Orbital Eccentricity	0.093
Orbital Inclination to Ecliptic	1.85°
Inclination of Equator to Orbit	25.19°
Rotational Period	24 h 37 m
Diameter	6,794 km
Mass	0.11 of Earth's
Density	3.94 g/cm^3
Gravity	0.38 of Earth's
Atmosphere (primary components)	95% carbon dioxide
Temperature Range	–143 °C to +17 °C
Moons (2) in Increasing Distance from Mars	Phobos, Deimos
Number of Rings	0

Significant Dates

1965	*Mariner 4* made first close-up pictures of the surface during flyby.
1969	*Mariner 6* and *Mariner 7* flybys resulted in high-resolution images of the equatorial region and southern hemisphere.
1971	*Mariner 9* became first satellite to orbit another planet.
1973	U.S.S.R. *Mars 3* and *Mars 5* first attempt to land on Mars.
1976	U.S.A. *Vikings 1* and *2* orbited Mars. *Viking Lander 1* provided first sustained surface science. *Viking Lander 2* discovered water frost on the surface.
1996	Possible microfossil found in Martian meteorite ALH84001.
1997	*Mars Pathfinder* lands on Mars. *Sojourner Rover* explores Ares Vallis area for three months.
1997–present	*Mars Global Surveyor* maps the surface of Mars from orbit.
2001–present	Mars *Odyssey* studies the surface, subsurface, and radiation environment of Mars from orbit.
2003	Twin Mars Exploration Rovers *Spirit* and *Opportunity* launched to Mars.

About the Images

(Left) Mars is about half the diameter of Earth. Here, bluish-white water ice clouds hang above the Tharsis volcanoes. The northern polar cap is visible, as is Valles Marineris, a 4,000-km-long canyon system just below the equator and to the right of center (NASA/JPL/MSSS *Mars Global Surveyor*).
(Right, top) Color-coded topography maps show the high (red and white) and low (blue) areas on Mars. The southern hemisphere is heavily cratered and high, while the northern hemisphere is lower and smoother. The large Hellas basin is seen in the southern hemisphere of the top image; the three Tharsis volcanoes, Olympus Mons, and the Valles Marineris canyon system can be seen in the lower image (NASA/JPL/GSFC *Mars Orbiter Laser Altimeter)*.
(Right, middle) Layers of rock provide a record of changes through time. The materials that created these layers in western Arabia Terra crater were deposited from above—perhaps by wind, or perhaps by settling out of water that occupied the crater as a lake. (NASA/JPL/MSSS *Mars Global Surveyor*).
(Right, bottom) Gullies with very sharp, deep, V-shaped channels on the walls of a basin might have been caused by geologically recent seepage and runoff of liquid water on Mars (NASA/JPL/MSSS *Mars Global Surveyor*).

References
1) Mars Exploration: *http://mars.jpl.nasa.gov*
2) Planetary Photojournal: *http://photojournal.jpl.nasa.gov*
3) Views of the Solar System: *http://www.solarviews.com/eng/mars.htm*
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