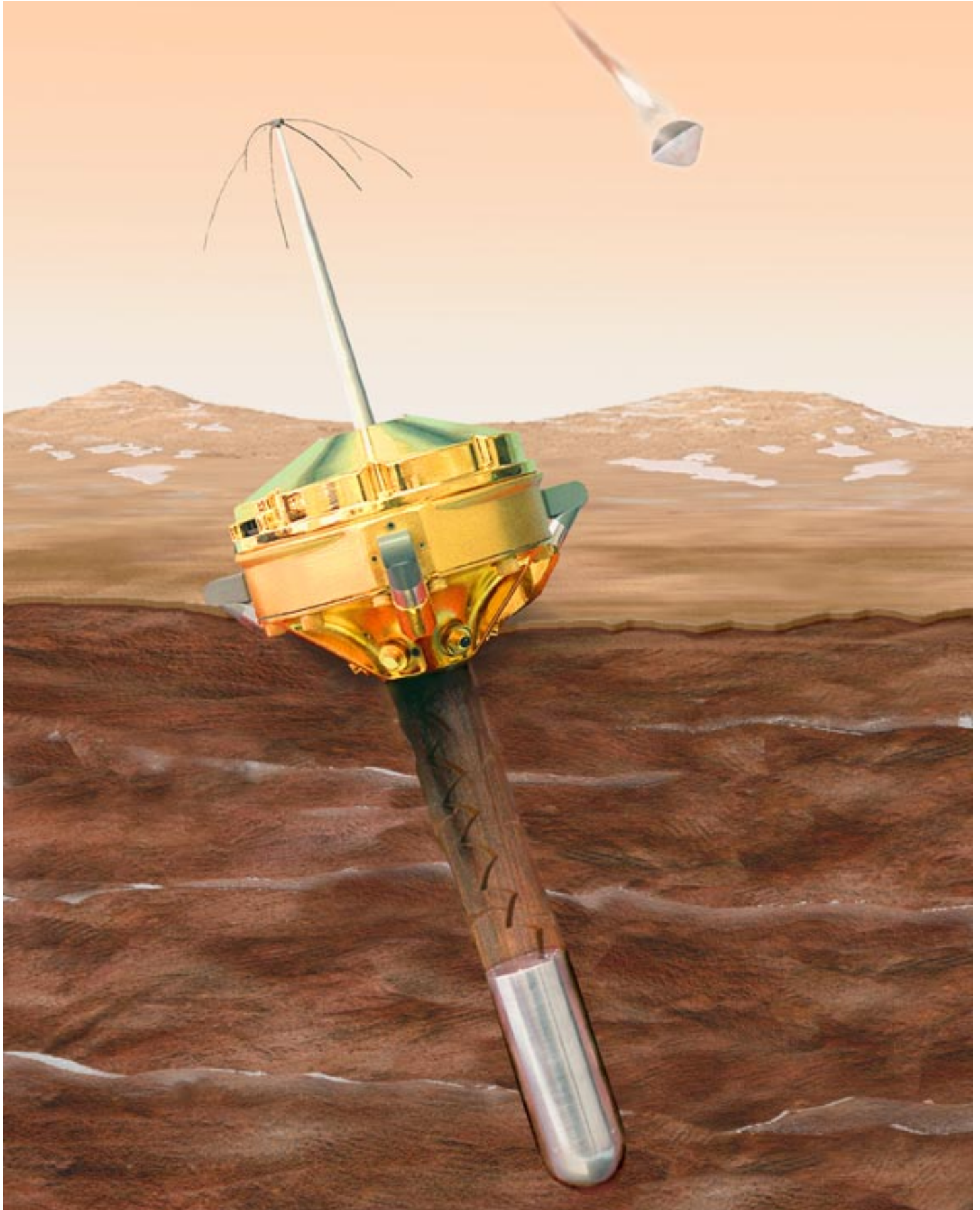




National Aeronautics and
Space Administration
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Pasadena, California

Deep Space 2: Miniature Probes to Mars





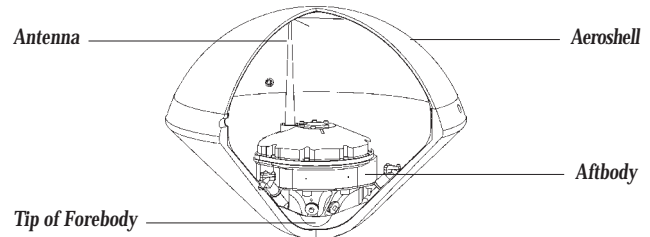
The New Millennium Program's Deep Space 2 mission, which launched in January 1999, is sending two highly advanced miniature probes to Mars. They will be the first spacecraft ever to penetrate the surface of another planet. Each probe weighs just 2.4 kilograms (5.3 pounds) and is encased in a protective shell (called an aeroshell). They are riding to Mars aboard another spacecraft, the Mars Polar Lander. Upon arrival just above the south polar region of Mars on December 3, 1999, the basketball-sized shells will be released from the main spacecraft and plummet through the atmosphere, hitting the planet's surface at over 600 kilometers per hour (400 miles per hour). On impact, each shell will shatter, and its grapefruit-sized probe will punch through the soil and separate into two parts. The lower part, called the forebody, will penetrate as far as 0.6 meter (about 2 feet) into the soil; the upper part of the probe, or the aftbody, will stay on the surface to radio data to the Mars Global Surveyor spacecraft, currently in orbit around Mars, which will then send the data to Earth.

Why Miniature Probes? Several spacecraft around a planet could give scientists valuable information about different locations on a planet, as well as provide data that a single spacecraft could not. Networks of seismic stations (like those used on Earth for many purposes, including detecting earthquakes), for instance, can tell scientists about the structure of a planet deep below its surface. A network of meteorological stations on a planet could help scientists understand its atmosphere. So, why haven't networks of spacecraft ever been sent to another planet? Standard spacecraft are too large, and therefore too costly, to launch in large numbers. In contrast, dozens of miniaturized spacecraft could be launched at an affordable cost. Thus, the Deep Space 2 probes could pave the way to make networks of scientific stations on other planets a reality.

The microprobes are also revolutionary in the way they will plunge into Mars. Typical spacecraft use a parachute and rockets, as well as an aeroshell, to slow their descent through an atmosphere and land safely. The Deep Space 2 probes are the first spacecraft to use only an aeroshell. By eliminating parachutes and rockets, the probes are lighter and less expensive, but also very hardy. Similar in weight to a lap-top computer, they are designed to survive a high-speed impact, and to operate successfully in extremely low temperatures, which is something conventional miniaturized electronics and standard spacecraft could never do.

Mars Science: A Wonderful Bonus. The primary purpose of Deep Space 2 is to test new technologies for use in future science missions, but the probes are also miniature data-gathering laboratories. They will penetrate the south polar layered deposits of Mars near the landing site of the Mars Polar Lander. These deposits may contain a record of changes in the climate of Mars, in the form of dust and water ice. Each probe will use microinstruments in the forebody to (1) collect a sample of soil and analyze it for the presence of water; (2) measure how quickly the probe cools after penetration to give scientists information on the physical properties of the soil; and (3) measure how fast each probe slows down in the atmosphere —

to determine the pressure and temperature of the atmosphere — and in the ground, to estimate the hardness of the soil and to look for layers. Data from the forebody will be collected and relayed to Mars Global Surveyor, which is currently orbiting Mars on a mission to map the planet. Deep Space 2's scientific objectives complement those of the Mars Polar Lander.



Points to Ponder. What other planets would be interesting places to send probes to? What questions about planets could networks of spacecraft help scientists answer? How could Deep Space 2's miniaturized technology be used by scientists here on Earth?

The New Millennium Program. The National Aeronautics and Space Administration (NASA) envisions a new way of conducting space exploration in the 21st century. Low-cost and frequently launched missions will use revolutionary technologies to enhance the capabilities of spacecraft, onboard instruments, and mission operations systems. Spacecraft are expected to be smaller and lighter, with highly efficient power systems. New measurement techniques may be possible with microsensors and miniaturized devices. Navigation and mission operations will be carried out by "intelligent" flight systems aboard the spacecraft.

NASA's New Millennium Program will develop and test in spaceflight the critical, revolutionary technologies needed to enable future missions. Each flight acts as a "test track" for its suite of technologies, its mission type, its operations concepts, and its scientific goals. The first flights, with launches that began in 1998, include Earth-observing and deep-space missions.

The New Millennium Program is sponsored by NASA's Offices of Space Science and Earth Science, and is managed for NASA by the Jet Propulsion Laboratory of the California Institute of Technology.

For more information:

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