

2003 – The Year of Mars

Two orbiting spacecraft are already gathering information about Mars, and another orbiter and three surface landers are ready for launch – all this in a year when the red planet will be closer to Earth than it has been since prehistoric times.

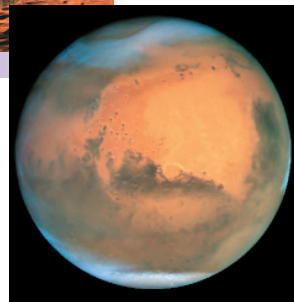


Above: This artist's rendering shows a side view of NASA's Mars 2003 Rover as it sets off on its exploration of the red planet. The rover is scheduled for launch in June 2003 and will arrive at Mars in January 2004 with an airbag-shielded landing shell.

JPL/NASA

Right: Frosty white water ice clouds and swirling orange dust storms above a vivid rusty landscape reveal Mars as a dynamic planet in this sharpest view ever obtained by the Hubble space telescope. On August 27, Mars will be closer to Earth than it has been in more than 50,000 years.

NASA AND THE HUBBLE HERITAGE TEAM (STSCI/AURA)



ing a total of four spacecraft to Mars.

The ESA launches its *Mars Express* orbiter mission in June. The *Mars Express* will also carry the United Kingdom's *Beagle 2* lander, designed to look for signs of extant or extinct life on Mars (2).

Also launching in June will be NASA's twin Mars Exploration Rovers (MERs). Similar in design but larger than the historic Mars Pathfinder Rover *Sojourner* that surveyed the surface of Mars in 1997, each MER weighs 380 lb but will cover a much greater distance — as much as 100 yards per day — than did *Sojourner*. The MERs will be sent to different locations on Mars and will use the successful system of parachutes and airbags similar to that used by *Mars Pathfinder*, and will literally bounce to a stop. Unlike the *Mars Pathfinder* mission, though, the MERs will not have a lander. The MERs will uplink their data to the *Mars Odyssey* orbiter already circling Mars. The primary goals of each MER will be to study the geology of Mars in greater detail than *Mars Pathfinder* did and to look for clues pertaining to whether or not Mars had or still has liquid water weathering its environment. Though the MERs are not designed or equipped to look for evidence of life and will not carry out any meteorological experiments, each will have a cache of five scientific instruments representing a collaboration between the United States and Germany.

A panoramic camera will provide the "eyes" for each rover and help determine the most suitable rocks and soils in the landing area to investigate. The camera boasts three times the resolution of the *Mars Pathfinder* lander camera and was de-

signed by engineers at NASA's Jet Propulsion Laboratory (JPL, Pasadena, CA).

A miniaturized version of the thermal emission spectrometer (TES) now on board NASA's *Mars Global Surveyor* (still orbiting Mars and gathering data) will be carried on each rover to analyze rocks and soils in the infrared. It will try and determine mineral types and abundances. The Mini TES is designed by the same researchers from Arizona State University (Tempe) who built the larger version now on *Mars Global Surveyor*.

A Mössbauer spectrometer built by planetary scientists from Johannes Gutenberg University (Mainz, Germany) will seek minerals that contain iron to determine what processes on Mars may have weathered the rocks — water, wind, or ice?

The Max Planck Institute (Mainz) will supply an alpha proton x-ray spectrometer. This is an improved version of the one that was used on the *Mars Pathfinder* rover in 1997. It will try to decipher the major elements that make up Martian rocks and soils.

A low-power microscope is also included on each rover. The Microscopic Imager supplied by NASA's Jet Propulsion Lab will examine rock and soil grains at a resolution as high as 30 mm/pixel — meaning it can resolve tiny objects roughly about the size of a 0.1-mm sand grain.

One of the most important tools being carried on the MER mission is a rock abrasion tool designed and built by Honeybee Robotics (New York, NY). When the *Mars Pathfinder* rover placed its alpha proton x-ray spectrometer up against rocks to determine elemental abundance in 1997, geologists were confused with the reported findings because all the rocks surrounding the landing site seemed to be the same. Later it was discovered that nearly all the rocks had weathered coatings and dust covering them. Thus, the only way to be certain of the elements in the rocks themselves is to scrape these coatings off and expose the rock matrix itself.

The NASA MERs are expected to land on Mars in January and February 2004, the two landings separated by a month. The researchers taking part in this mission expect the rovers to operate for 90 days, but are hopeful they could last much longer.

REFERENCES

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2. B. DiGregorio, *Spectroscopy* **15**(12) 28–29, 2000. ■

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According to Italian mathematician Aldo Vitagliano of Naples University (Italy), the planet Mars, named after the mythological Roman god of war, will come closer to the Earth this summer than it has in more than 50,000 years. How this amazing figure was arrived at is an interesting story. Belgian author and mathematician Jean Meeus described how the distance between the orbits of Mars and Earth varied in the distant past (1). Meeus calculated that Mars has not been closer to Earth since the year 73,000 B.C. His findings were published in news media all over the world. However, Meeus now says his initial calculations, which were based on the work of French astronomer Pierre Bretagnon, are off by more than 20,000 years. After his book was published, Meeus contacted Vitagliano and asked him to investigate the motion of Mars by numerical integration. In April 2002, Vitagliano told Meeus the last time Mars was closer to Earth than this year's spectacular opposition was on September 12 of the year 57,617 B.C.

A planetary opposition occurs whenever a planet is lined up with Earth on the same

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