

The Exploration of Mars.

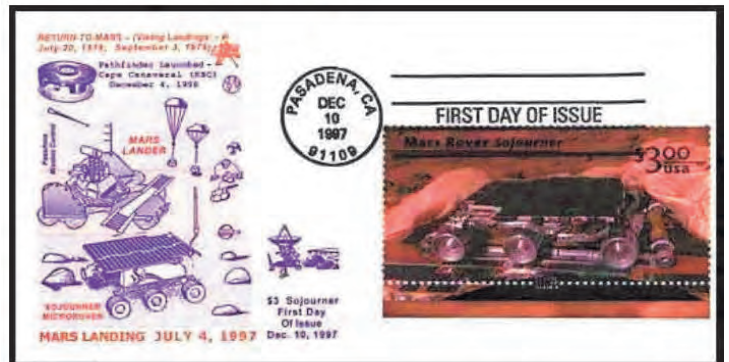
Part 2 : First Steps Moving About

After 21 years of quietude on Mars with no surface exploration a lander with a roving vehicle had been planned. This would be the start of a new era of Mars exploration and this time it would involve moving about. NASA launched a small lander—the Mars Pathfinder on July 1997. Onboard was a rover called Sojourner weighing just 23 lbs. Pathfinder landed in an ancient flood plain at the Ares Valles in the Chryse Planitia in the northern hemisphere. Pathfinder continued to operate on the surface for 83 sols or 85 days and was later renamed as The Carl Sagan Memorial Station. A low cost mission under the motto “cheaper, faster and better”, its main mission was to land a rover but also to conduct a range of experiments whereby it analysed the Martian atmosphere, climate, geology and the composition of the rocks and soil around the lander.



Pathfinder landing (Mali 1997)

Pathfinder USA 1997



The mobile explorer vehicle was named after Sojourner Truth (1797 – 1883) who was an African-American abolitionist and women's rights activist. (USA 1986)

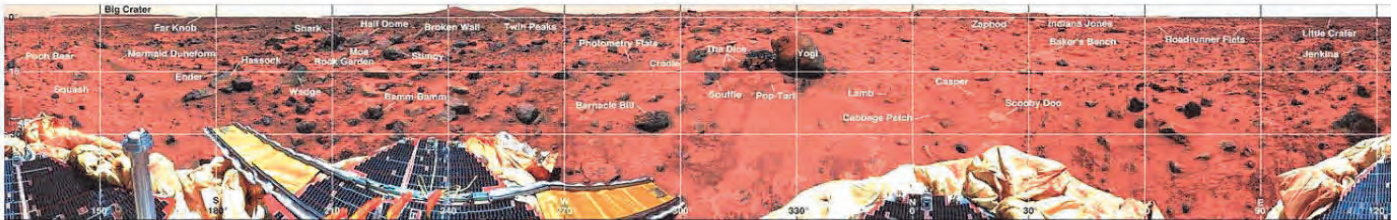


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First panoramic image taken by the lander

That first image taken with named features superimposed



The mission was truly a Pathfinder for follow on attempts using proof of concept for various new technologies that could be used in later missions. It landed using an innovative airbag system to deliver the lander and rover to the surface. The entry capsule was protected by an atmospheric entry aeroshell after which a supersonic parachute was used to slow its descent down further. At a suitable altitude the airbags were inflated and three retro rockets were fired from the back shell which was still attached to slow it down further. The Pathfinder protected by the airbags was released. The airbags cushioned the impact when it bounced 15.7 metres high and a further 15 times before coming to rest. The airbags deflated and Pathfinder was on the surface, ready to start work. (Gambia 2000)



Sojourner meets Yogi

Photo and stamp from St Thomas and Prince (2004)

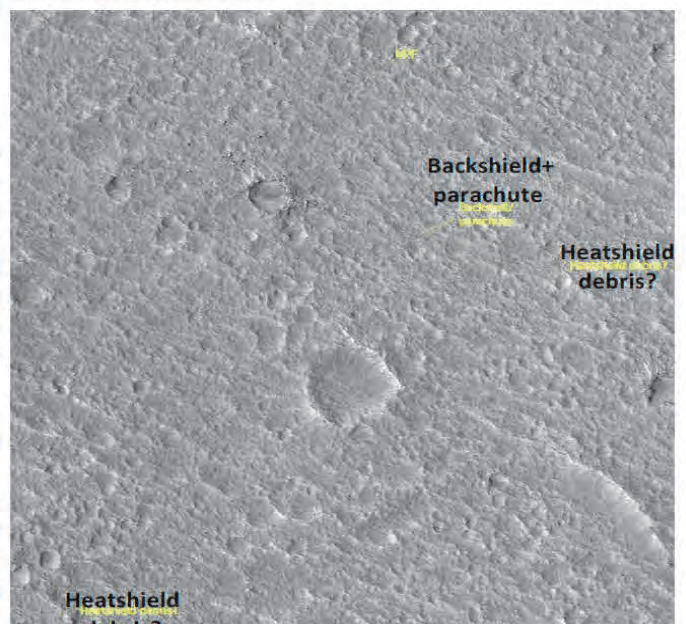


The Mars Reconnaissance Orbiter imaged Pathfinder on the surface.



After an essay competition the name of Sojourner was chosen in honour of the abolitionist and women's rights activist Sojourner Truth. Sojourner was the first rover to operate outside the Earth-Moon system. Although the Sojourner driver would wear 3D glasses which supplied images from the cameras via the lander or base station and used a joystick to manoeuvre the rover it tested out an automated obstacle avoidance system, essential to later missions including the Mars Exploration Rovers.

Sojourner used the lander to relay data, imagery and communications between Mars and the Earth so the rover could not travel too far away. Yet, it travelled a total distance of 330ft during its exploration including visiting a number of rocks such as Barnacle Bill, Scooby-Do and Yogi. Analysis of Yogi showed that it was a basaltic rock which because of its shape and texture showed that it was probably deposited there by a flood.





As part of the Mars Surveyor '98 Mission, NASA launched the Mars Polar Lander (MPL) on January 3, 1999. It was planned to go to the Planum Australe region near the south pole to study the soil and climate. MPL would have worked in conjunction with the Mars Climate Observer to gather climate data.



With a large volume of frozen water believed to be under the thin layer of dust at the south pole, it was hoped to study the seasonal change of the polar caps at the poles. Of particular interest would be the exchange of water vapour between the atmosphere and the ground. To study the soil the MPL had a scoop which would have collected samples.

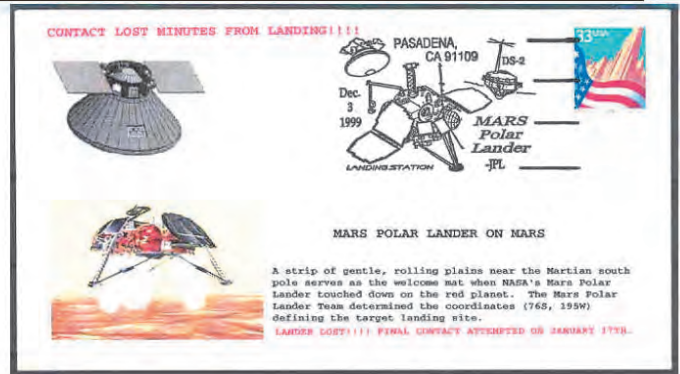
Carried onboard the MPL were two small identical impactor probes which were known as Deep Space 2A and 2B. These probes were intended to strike the surface at a high velocity. The result was hoped to be that they would penetrate the soil to a depth of at least 1 metre to study the subsurface composition. They were released from the MPL before atmosphere entry but after they completed their descent contact was lost and no data returned. They were regarded as being a failure. These probes were given the names 'Scott' and 'Amundsen' after Robert Scott and Roald Amundsen, the first explorers to reach the Earth's south pole.



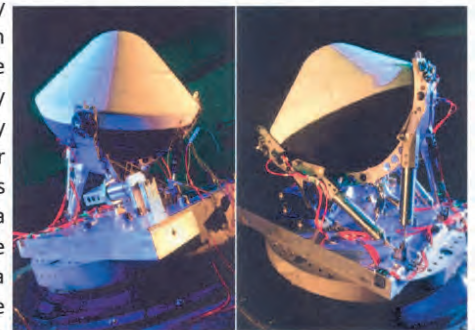
Comoros 2008
And right mission patch



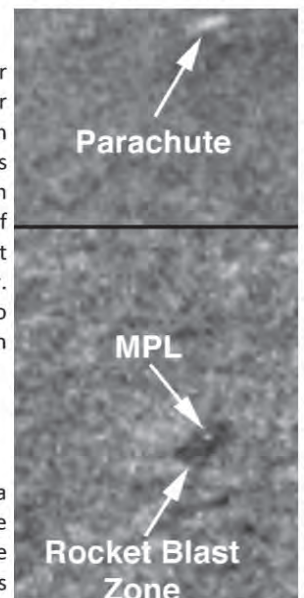
When the lander reached Mars and initiated its descent through the atmosphere for an automatic landing communications were not restored and all contact with the lander lost. Later analysis found that the most likely cause of the failure was a premature termination of the engine firing before the lander touched down resulting in the lander striking the ground at high velocity.



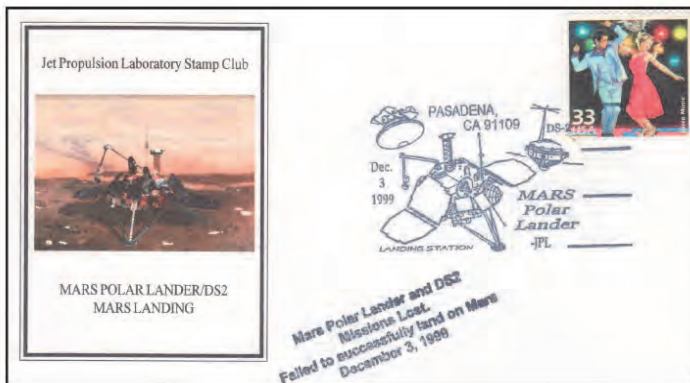
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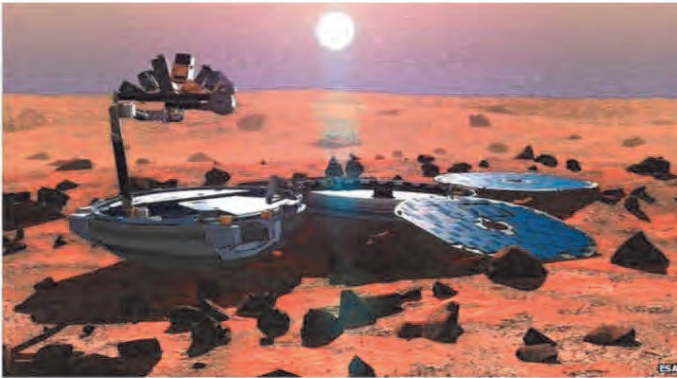
What became of the Mars Polar Lander? The Mars Global Surveyor orbiter returned images which scientists believe show the lander's parachute. About 1410 ft away from the parachute is a dark patch of disturbed soil around a shiny bright point which may be the lander. Evidence of the remains of the two Deep Space 2 probes has not been found.



Britain's attempt at landing a spacecraft on Mars came with Beagle 2 in 2003. It was taken to Mars by the European Space Agency Mars Express orbiter mission. Beagle 2 was an astrobiology mission that would have looked for past and present life in the shallow surface of Mars. It was designed and developed by a group of British academics that were headed by Professor Colin Pillinger of the Open University.



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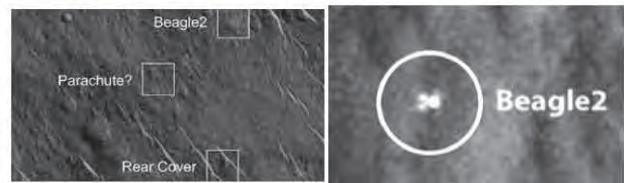


Beagle 2 was named after *HMS Beagle*, Professor Pillingier said, "*HMS Beagle* was the ship that took Darwin on his voyage around the world in the 1830's and led to our knowledge about life on Earth making a real quantum leap. We hope Beagle 2 will do the same thing for life on Mars".

Beagle 2 was aimed to land at Isidi Planitia which is a large flat sedimentary basin between the ancient highlands and the northern plains. Beagle 2 was released from the Mars Express spacecraft on December 19 and coasted for 6 days before it entered the atmosphere with the landing planned for Christmas Day. Protected from the fierce heat as it passes through the atmosphere by a heat shield until large parachutes could slow it down further. At an altitude of about 656 ft large airbags were inflated around Beagle 2 to protect it from the impact of landing. Once on the ground Beagle 2's solar panels should then open automatically and a signal set to Mars Express for relay back to Earth but no signal was received. Subsequently no image of the surface was received and no data from the mole, an instrument that should have crawled across the surface up to 10 ft, the limit of its umbilical, away from Beagle 2 to collect soil from under rocks. Beagle 2 was declared a failure and the lander lost, so the top photo is an artist's impression only.



In early 2015 the Mars Reconnaissance Orbiter found Beagle 2. It was found that Beagle 2 had landed only 3 miles (5 km) away from its target landing site. The images showed that Beagle 2 had worked as planned with the exception of one solar panel not opening. This last solar panel remained closed so covering the antenna which would have allowed communications with Beagle 2 and the success of the mission.



Left: Beagle 2 found on the surface by MRO image
Right: MRO image showing Beagle 2 panels *did* open

