



Life on Mars? The thought has fascinated us since the turn of the century.

Photos courtesy NASA.

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Mars Pathfinder: A new era of Mars exploration

NASA hatches a new series of trips to the Red Planet. Was there ever life on Mars?

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Life on Mars would be hostile, if not impossible. The average temperature is -53 degrees Celsius, plunging to -120 at the polar ice caps. Dry dust storms rip through the deep canyons where water must have once flowed. Volcanic rocks litter the red soil, coloured by the oxidized iron in the Martian rock. Despite these less-than-hospitable surroundings, NASA's Mars Pathfinder will land on Mars on July 4th and herald a new era of Mars exploration.

"It's a new and much less expensive way," says Michael Carr of the U.S. Geological Survey in Menlo Park, California. Priced at \$171 million, the Mars Pathfinder is one fifteenth the cost of the Viking - the last spacecraft to land on Mars just over twenty years ago. Along with an orbiter called Mars Global Surveyor, Pathfinder is the first of a series of ten smaller, less ambitious spacecraft headed in pairs for the Red Planet over the next decade. A pair of spacecraft will bring back clues from Mars every 26 months in order to solve an ongoing mystery - is there or was there ever life on Mars?

Since the turn of the century, we've been fascinated with the possibility of life on Mars. Fuzzy telescopic pictures of Mars showed deep river channels, which some interpreted to be canals built by a Martian civilization. Later, many believed that the planet's colour variation was caused by flourishing vegetation in the summer that lay dormant in the winter. Flybys of the planet in the sixties, however, quashed any hope of life at the time. They indicated a heavily cratered surface like our own moon, which of course harbours no life. Since then, it's been a never-ending rollercoaster of enthusiasm and waning interest for life on the Red Planet. But why this planet in particular?

"Mars is the only planet outside of the Earth that has all the ingredients you need to support life," says Dr. Matthew Golombek, project scientist for Pathfinder at the Jet Propulsion Lab in Pasadena, California. "It's also the only one where you could even imagine terraforming it - making it more earthlike."



Viking pictures showed channels, volcanoes, and canyons.

In 1976, the Viking missions seemed to confirm this. 55,000 pictures taken by two Viking orbiters which

systematically mapped Mars, showed that Mars had an abundance of the one key ingredient for life — water. Dry river valleys, deep canyons, flood features and signs of water erosion suggested that early Mars was warm and wet. Mars was also dotted with volcanoes.

The Viking landers however, which carried complex life-detecting tests, produced negative results.

Still, interest soon picked up again when earth studies of a molecule found in all living organisms called ribonucleic acid (RNA) revealed an unexpected discovery. "The most primitive organisms on Earth — the ones that have evolved the least from however life started — all lived in places where water comes into contact with volcanoes," explains Carr, who led the Viking imaging team. These hydro-thermal conditions were also abundant on Mars.

Hence, yet another spaceship was sent to Mars in 1992. But, days before the costly Mars Observer entered into orbit, NASA lost contact with it. What arose from the whopping \$1 billion loss, was a whole new plan to explore Mars. Rather than placing all its eggs into one basket, NASA now plans to send a series of smaller, inexpensive missions "so that over a period of time, we would accumulate the kind of knowledge acquired from these large, expensive ones," explains Carr, who was also on the review panel for the conception of Pathfinder.

As its name implies, Pathfinder will help blaze a new trail in the search for life — with American fanfare. To ensure it lands on Mars on the American Independence Day, NASA increased Pathfinder's speed to make up for a two-day launch delay last December.

If all goes according to plan, Pathfinder will parachute into the mouth of a large river channel called Ares Vallis on July 4th. Scientists hope to get a look at a wide variety of rocks there, which they suspect would have been pushed down by a large flow of water. The channel drains into ancient, 3.6 billion-year-old terrain called the highlands. It's also the home of the well-known Mars meteorite ALH84001 that made headlines last August when NASA scientists announced the rock showed evidence of past life on Mars.

Slowing down from its travelling speed of 37,000 kilometres per hour, Pathfinder's landing will be cushioned by three enormous balloons. With gravity a third of what it is on Earth, Pathfinder will bounce up as high as a ten-storey building until it finally settles onto the surface.

Once it lands, the petals of the spacecraft will unfold and let the first-ever rover on any planet to roam the landing site. Think of the rover — dubbed Sojourner — as a little geologist, says Golombek. With an Alpha Proton X-Ray Spectrometer on its back, it can analyze the composition of the Martian rocks and beam the information back to Earth. It will be given directions from Earth by remote control.

The analysis however, won't settle the controversy over the much-talked-about microbial life on ALH84001. "The pictures from the meteorite have resolutions of nanometres — that's a billionth of a centimetre," explains Carr. "The resolution on the Pathfinder cameras is one millimetre. When you're looking for microorganisms, it's hopeless."

In fact, the Mars Pathfinder won't definitively answer the question of life on Mars — at least not now.

"That's clearly the overriding question, but you need a whole variety of missions (about a dozen) to do that," says Golombek. "We need to look at Pathfinder as the first small step in that. We need to build up our database and our understanding about Mars to the point where you can then ask that all-important question — at the right place." Golombek means that literally. The Viking missions showed that life isn't ubiquitous on Mars, so now it's a matter of zeroing in on the right place before testing for life. A Mars rock sample, which would help squelch the controversy over microbial life, won't even be brought back to Earth until 2005.

"The Pathfinder was originally going to be mainly an engineering test to test the new ways of landing on Mars," says Carr, "because the Viking was so expensive." The Mars Pathfinder, then, will really just uncover the route that subsequent spacecraft will take.



Sojourner, the rover.
"Think of it as a little geologist."



Microfossils? A close look
at Mars meteorite
ALH84001.

Still, the mission is a difficult one, particularly the landing. "It takes four minutes from when we hit the atmosphere to bouncing for the first time on the surface," explains Golombek. "In between that time, a hundred events have to occur with split-second timing."

While nothing precludes either the lander or rover from lasting up to a year, it will be successful if they last a week. "Effectively, if we land safely and if we drive the rover off and operate for a week or so, I think we've been remarkably successful," says Golombek. But, chances are that if it lasts a week, it will last for months, adds Carr.

With a long and difficult history and years of study, does it matter if there's life on Mars?

"Isn't that almost a theological question?" asks Golombek. "Are we alone in the universe? That's really the question we're after here. You can stare up at the sky and the stars for millions of years and you may never hear anything because the time delay between us and the next star is so huge.

But here, we can go right next door in our solar system — our neighbouring planet — and see whether the development of life would happen anywhere where the conditions are right, or whether you need divine intervention. And to me, that's well worth it."

He pauses.

"Wouldn't *you* like to know?"