Mars rover 2012: the search for life on Mars

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1. LIFE ON MARS

Life on Mars has been long speculated. Liquid water is widely thought to have existed on Mars in the past, and there may still be liquid water beneath the surface. The origin of the potential biosignature of methane in Mars atmosphere is unexplained, although abiotic hypotheses have also been proposed. By July 2008, laboratory tests aboard NASA's Phoenix Mars Lander had identified water in a soil sample. The lander's robotic arm delivered the sample to an instrument which identifies vapours produced by the heating of samples. Photographs from the Mars Global Surveyor from 2006 showed evidence of recent (i.e. within 10 years) flows of a liquid on Mars's frigid surface. There is evidence that Mars had a warmer and wetter past: dried-up river beds, polar ice caps, volcanoes and minerals that form in the presence of water have all been found. Nonetheless, present conditions on Mars may support life since lichens were found to successfully survive Martian conditions in the Mars Simulation Laboratory (MSL) maintained by the German Aerospace Center (DLR). In June, 2012, scientists reported that measuring the ratio of hydrogen and methane levels on Mars may help determine the likelihood of life on Mars. According to the scientists, "...low H2/CH4 ratios (less than approximately 40) indicate that life is likely present and active".

2. MARS SCIENCE LABORATORY (MSL)

The Mars Science Laboratory mission is part of NASA's Mars Exploration Program, a long-term effort for the robotic exploration of Mars that is managed by the Jet Propulsion Laboratory of California Institute of Technology. The total cost of the MSL project is about US$2.5 billion. Germany contributed 2.5 million euros ($3.1 million USD). It is a robotic space probe mission to Mars launched by NASA on November 26, 2011, which successfully landed Curiosity, a Mars rover, in Gale Crater on August 6, 2012. The overall objectives include investigating Mars' habitability, studying its climate and geology, and collecting data for a manned mission to Mars. The rover carries a variety of scientific instruments designed by an international team.

3. MARS ROVER

A Mars rover is an automated motor vehicle which propels itself across the surface of the planet Mars after landing. Mars rover Curiosity will look for environments where life could have taken hold -- and been preserved. It has several advantages over stationary landers: they examine more territory, they can be directed to interesting features, they can place themselves in sunny positions to weather winter months and they can advance the knowledge of how to perform very remote robotic vehicle control. The successful landing of the Mars rover Curiosity is an incredible achievement that has spawned more than its fair share of news.

3.1. Curiosity's Mastcam system

Curiosity can cover about 330 feet (100 meters) per day — about the length of a football field — so it will take the rover a while to reach its destination. NASA is showing off a high-resolution color picture sent back by the Mars rover Curiosity, detailing the mountain where scientists plan to focus their search for the chemical ingredients of life. The image reveals distinct tiers near the base of the three-mile-high mountain that rises from the floor of Gale Crater, where Curiosity landed on 6 August. Scientists estimate it will be a year before the rover reaches the layers of interest at the foot of the mountain, 6.2 miles from the landing site.

This image from NASA's Curiosity rover looks south of the rover's landing site on Mars toward Mount Sharp. From orbital imagery, NASA has said, the layers appear to contain clays and other hydrated minerals that form in the presence of water. Curiosity was dispatched to hunt for organic materials and other chemistry considered necessary for life to evolve. In this picture, the layers above where scientists expect to find hydrated minerals show sharp tilts, offering a strong hint of dramatic changes in Gale Crater, which is located in the planet's southern hemisphere near its equator. Mount Sharp, the name given to the towering formation at the centre of the crater, is believed to be the remains of sediment that once completely filled the 96-mile-wide basin. The higher layers are steeply slanted relative to the layers of underlying rock, the reverse of similar features found in the Grand Canyon. "The layers are tilted in the Grand Canyon due to plate tectonics, so it's typical to see older
layers be more deformed and more rotated than the ones above them," Grotzinger said. "In this case you have flat-line layers on Mars overlaid by tilted layers.

3.2. 12 Crazy Facts about the Mars Rover

1) It's on Mars - In the words of one mission control engineer: "We are wheels down on Mars.
2) It was named by a 6th Grader - The winning name, selected by NASA, was dreamed up by a sixth-grader in Lenexa, Kansas.
3) What's cooler than 1.5 billion dollars? $2.5 billion - the Curiosity mission cost - a full billion over NASA's original budget for the project.
4) It (literally) weighs a ton - Curiosity weighs 1,982 pounds on Earth. That's about as much as a MINI Cooper.
5) The landing happened fast - Curiosity entered Mars's atmosphere at 13,200 mph. Its approach velocity was more like 8,000 mph, with the planet's gravity making up the difference.
6) Now it's on the ground, it's slow - The rover is only expected to travel 3 to 12 miles in its two operational years on Mars, with a maximum average speed of 0.00073 mph.
7) Nuclear Power – It is specifically the Multi-Mission Radioisotope Thermoelectric Generator. The generator has enough plutonium-238 dioxide to power Curiosity for as long as 14 years, though its mission will only last 23 months.
8) Its computers are less powerful than the iPhone 4S - The iPhone 4S has four times the processing power of Curiosity, which packs a mere 200MHz CPU, and a measly 2GB of SSD storage. Curiosity has several of these fallout-resistant computers (in case one breaks).
9) Curiosity isn't equipped to find life on Mars; just signs that it's possible- Curiosity's explicit mission is to search for the basic ingredients essential for life - concentrations of elements like carbon, nitrogen, phosphorous, sulfur and oxygen. It doesn't have the equipment to excavate fossils or examine microorganisms.
10) Power Tools - Curiosity is packed with all kinds of boring science-y stuff - 17 cameras, a weather station, an onboard chemistry lab and radiation detector. It's also got a robotic arm with a power drill and a laser that can zap rocks into oblivion from as far off as 23 feet.
11) Bull's Eye - Curiosity came down at the foot of a mountain inside the Gale Crater, right on target.
12) What happened to the lander - NASA doesn't know where the jetpack lander that helped bring the rover down to the surface crashed after it detached.

It's fair to say that the science team and our rover drivers, and really everybody are working together to evaluate a few different routes that will take us eventually to Mount Sharp.