The Mars Exploration Rovers at NASA
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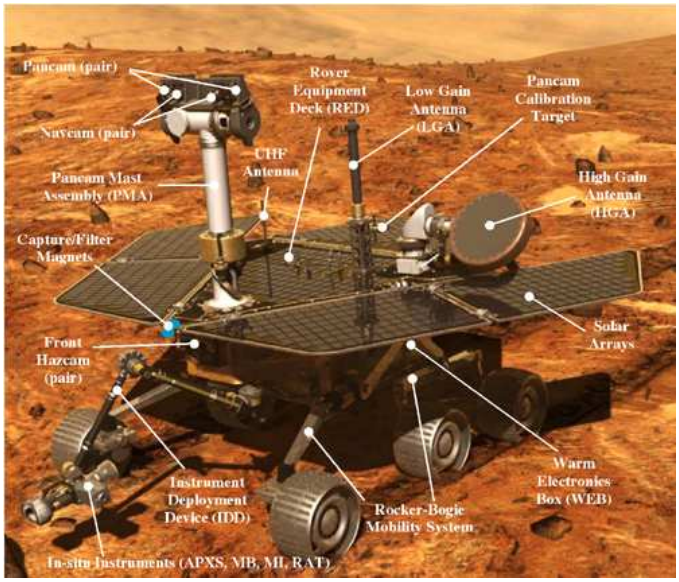
The Mars Exploration Rovers will act as robot geologists while they are on the surface of Mars. This robot has:



body: structure that protects the rovers´ "vital organs".
brains: computers to process information.
temperature controls: internal heaters, a layer of insulation, and more.
"neck and head": a mast for the cameras to give the rovers a human-scale view.
eyes and other "senses": cameras and instruments that give the rovers information about their environment.
arm: a way to extend its reach.
wheels and "legs": parts for mobility.
energy: batteries and solar panels.
communications: antennas for "speaking" and "listening".

THE BRAIN

The rover carries an Inertial Measurement Unit (IMU) that provides 3-axis information on its position, which enables the rover to make precise vertical, horizontal, and side-to-side (yaw) movements. The device is used in rover navigation to estimate the degree of tilt the rover is experiencing on the surface of Mars and calculating the safe traverses as those with a lowes slope.
Once the rover emerges from the lander, the software checks for the presence of commands to execute, performs communication functions, and checks the overall status of the rover.
The main control loop essentially keeps the rover "alive" by constantly checking:

(A) a correct communication throughout the surface mission and
(B) a thermical stability (not too hot or too cold) at all times. It does so by periodically checking temperatures and responding to potential overheating conditions, recording power generation and power storage data throughout the Mars sol (a Martian day), and scheduling and preparing for communication sessions.

Activities such as taking pictures, driving, and operating the instruments are performed under commands transmitted in a command sequence to the rover from the flight team.
Optionally, the rover generates constant engineering, housekeeping and analysis telemetry and periodic event reports that are stored for eventual transmission once the flight team requests the information from the rover.

THE TEMPERATURE CONTROLS

The rover must not exceed extreme temperatures of -40° Celsius to +40° Celsius by cooling with radiators, and heating with an electrical heater.
The electrical heater can be turned on or off automatically through "thermal switches".
If the rover starts to cool below -20° Celsius, the heaters will turn on.
If the temperature of the rover approaches 20° Celsius or above:

(A) during the day, the switch would increase the heat transfer path to the radiators so that the excess heater could be convected and radiated away to the martian environment.

(B) when daytime turns to nighttime, (i.e. the excess heat becomes necessary to maintain battery temperatures) the switch decreases the heat transfer path to the radiators in order to retain heat.

Temperature in Mars: An atmospheric daytime high might be -3° Celsius, while a nighttime low might be -96° Celsius.

THE NECK & THE HEAD

The rover's neck is 1.4 meters tall. In the head it has the following elements:

(A) 1 Mini-TES: is an infrared spectrometer that can determine the mineralogy of rocks and soils from a distance by detecting their patterns of thermal radiation.

(B) 2 Pancam (Panoramic Cameras): is a high-resolution color stereo pair of CCD cameras that will be used to image the surface and sky of Mars. It can rotate a full 360° to obtain a panoramic view of the Martian landscape. The camera bar itself can swing up or down through 180° of elevation. Pictures are 4,000 pixels high and 24,000 pixels arround.

(C) 2 Navcam (Navigation Cameras): is a B&W camera 45-degree field of view to support ground navigation planning by scientists and engineers (Earth analysis of the situation).

(D) One motor for the entire Pancam Mast Assembly head turns the cameras and Mini-TES 360° in the horizontal plane.

(E) A separate elevation motor can point the cameras 90° above the horizon and 90° below the horizon.

(F) A third motor for the Mini-TES elevation, enables the Mini-TES to point up to 30° over the horizon and 50° below the horizon.

Out of the head, but very related to the above elements, the rover has 4 Hazcams (Hazard Avoidance Cameras), 2 in front and 2 in rear. A hazcam is a B&W to avoid the rover getting lost or inadvertently crashing into unexpected obstacles (automatic movement). The cameras each have a wide field of view of about 120 degrees. The rover uses pairs of Hazcam images to map out the shape of the terrain as far as 3 meters in front of it, in a "wedge" shape that is over 4 meters wide at the farthest distance.

After the lander opens on the surface of Mars, the Pancam Mast Assembly rises from the rover equipment deck by driving a motor that moves the Pancam upward. Once the Pancam Mast Assembly is in its full-upright position, it will not stow again, but will stay upright for the entire duration of the mission.

THE ARM

Elements in the arm:

(A) The Microscopic Imager: provides close-up images of rocks and soil.

(B) The Mössbauer Spectrometer: analyzes the iron in rocks and soil.

(C) The Alpha Particle X-Ray Spectrometer: analyzes the elemental composition of rocks and soil.

(D) The Rock Abrasion Tool (RAT): grinds away the outer surface of rock to expose fresh material.

Once the arm and instruments have succeeded in one location but before the rover begins another traverse, the arm stows itself underneath the "front porch" of the rover body.

THE WHEELS AND THE LEGS

Rover has six wheels, each with its own individual motor. The two front and two rear wheels also have individual steering motors (1 each). The rover is programmed through its "fault protection limits" in its hazard avoidance software to avoid exceeding tilts of 30 degrees during its traverses.
The rover has a top speed on flat hard ground of 5 centimeters per second.

The rover is programmed to drive for roughly 10 seconds, then stop to observe and understand the terrain it has driven into for 20 seconds, before moving safely onward for another 10 seconds.

THE ENERGY

When fully illuminated, the rover solar arrays generate about 140 watts of power for up to four hours per sol (a Martian day). The rover needs about 100 watts to drive.

The power system for the Mars Exploration Rover includes two rechargeable batteries that provide energy for the rover when the sun is not shining, especially at night. Over time, the batteries will degrade and will not be able to recharge to full power capacity. Also, by the end of the 90-sol mission, the capability of the solar arrays to generate power will likely be reduced to about 50 watts of power due to anticipated dust coverage on the solar arrays.