

Part 4 : Currently Working on the Surface

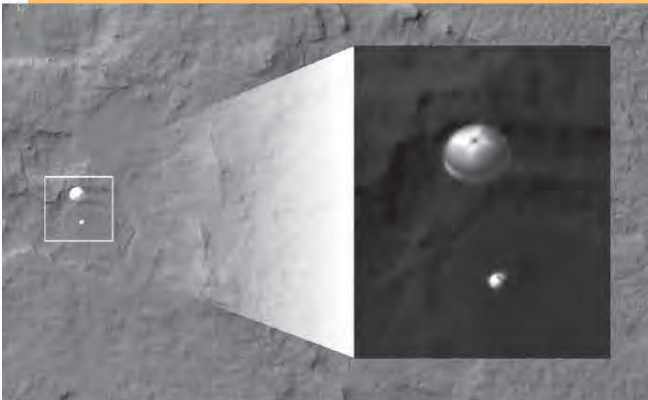


Then came the Mars Science Laboratory (MSL), a leap in Mars exploration more complicated than anything that had been sent before. It was in effect a full laboratory of investigation instruments, though it's been delayed by two years waiting for the next available launch window. "Curiosity" was so chosen following an essay

competition. "Curiosity is the passion that drives us through our every day lives. We have become explorers and scientists with our need to ask questions and to wonder"



ORBIT



MRO observes Curiosity under the parachute during landing



Curiosity's travels have taken their toll on its wheels and in particular the tyres. Curiosity has taken images of them over the years to monitor how they have been bearing up to the surface and for engineering purposes. This will allow for the construction of better wheels and tyres for future rovers. Even so the aluminium wheels still have plenty of wear left in them to continue to explore the surface.



The landing took place on August 6, 2012 fewer than 1.5 miles (2.4 km) from the centre of its landing target. Curiosity landed on Aeolis Palus between Peace Vallis and Aeolis Mons (Mount Sharp) in the Gale crater. (See "selfie" left) The landing site originally nicknamed Yellowknife near the base of Aeolis Mons was renamed the 'Bradbury Landing' site.

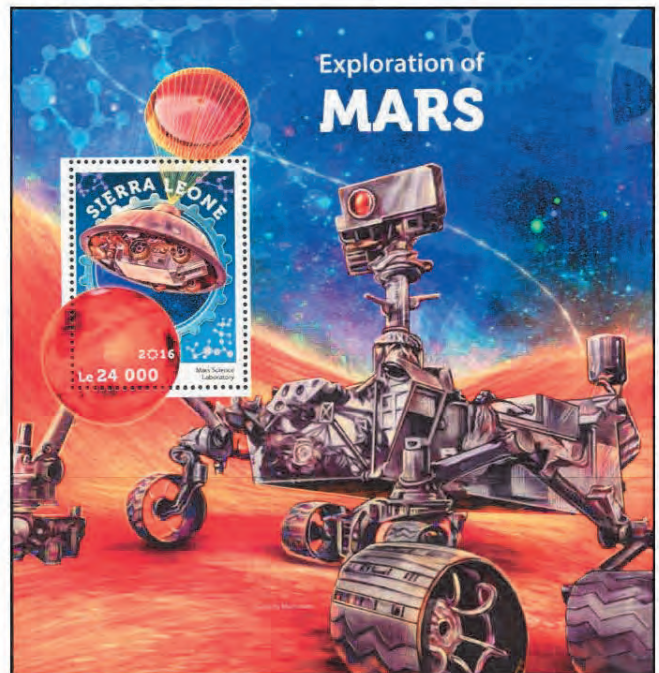
Curiosity's view of Mount Sharp.



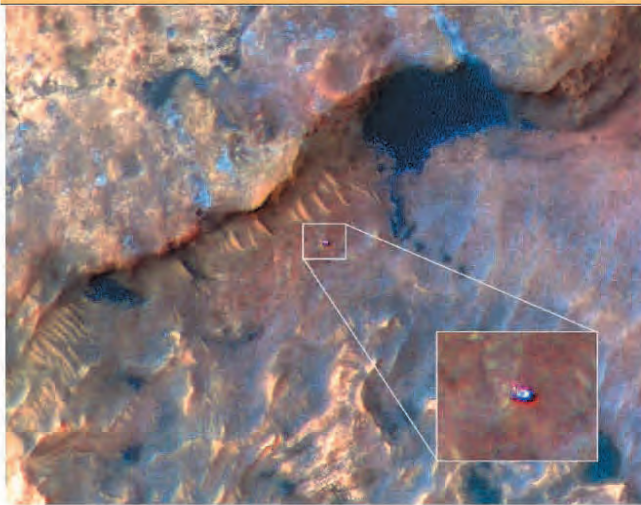
Curiosity's tyres



Curiosity had a wide range of science instruments to be used on its journey including robotic arms cameras and a drill to look into the rocks encountered. Curiosity has visited many sites during its journey and including climbing Mount Sharp, taking the image below. The rover has travelled over 13 miles (21 km) making many stops for science.



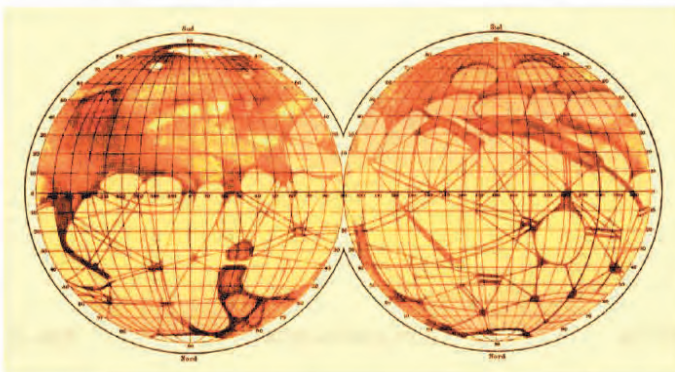
Big brother is watching. Almost wherever you are a camera is watching even if no one else is around. Travelling across the Martian surface the Curiosity rover was scaling the mountain Mount Sharp at a point called Woodland Bay. Overhead the Mars Reconnaissance Orbiter (MRO) was busy gathering images of the surface. One of these it took was different from the others, a glint of light was seen—the remote sensing mast of the rover. Taken on May 31, 2019 further colour enhancement of the image showed Curiosity clearly against the terrain it was in. It was investigating the clay bearing deposits laid



down by the action of water in Mars's past (above).

Schiaparelli

Next to attempt to get to Mars was the Schiaparelli EDM. Launched from Russia in 2016 this Italian built European Space Agency spacecraft was from the ExoMars programme. Schiaparelli was a failed Entry, Descent and Landing demonstrator module (EDM). Named after Giovanni Schiaparelli a 19th century astronomer who made observations of Mars. He recorded features on the surface which he called "canali" and made hand drawn maps of Mars during the 1877 oppositions with earth using an optical refracting telescope.



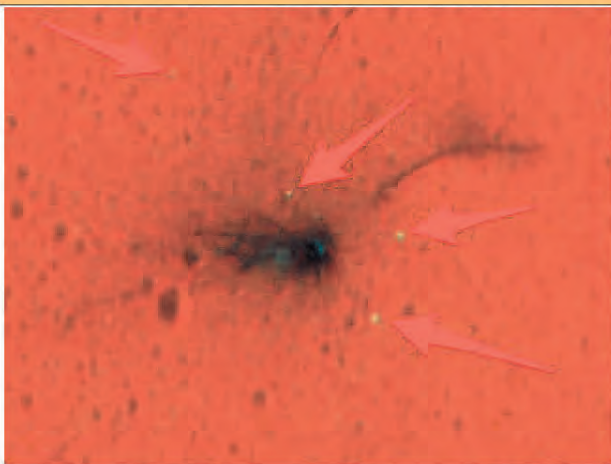
It was intended to test technology that would be used for future soft landing on the surface of Mars. Launched with the ExoMars Trace Gas Orbiter (TGO) it would remain attached until 3 days before landing. The EDM was then spun up for stability during entry when it reached the Martian atmosphere, protected by a heat shield. At the correct height it would deploy a parachute and would complete its landing by using retro-rockets. At a height of 6 ft (2m) above the ground the retro-rockets would turn off the platform would land on a crushable structure designed to absorb the final touchdown impact.



Europe has successfully landed on Mars

The landing site was the Meridiani Planum where the Opportunity rover was working. The plan was to see if Opportunity could see Schiaparelli landing and record it from the ground. With the landing planned for the dust storm season it was a chance to study a dust loaded atmosphere during entry and descent. It would also have measured the electricity in the atmosphere and weather conditions on the ground. All best laid plans can go awry and the automated landing started on October 19 but its signal was lost shortly before landing. The parachute had opened as planned at 7.5 miles (12 km) but its inertial measurement unit became overwhelmed and released the parachute with the back shell prematurely. The retro-rockets then only fired for 3 seconds instead of the 30 seconds that it was supposed to and Schiaparelli thought that it had already landed. The result was it crash landed at a speed of 340 mph (540 km/h) creating a new crater on the Martian surface. It landed on 33 miles (54 km) from Opportunity and the MRO imaged its final resting place.

ORBIT

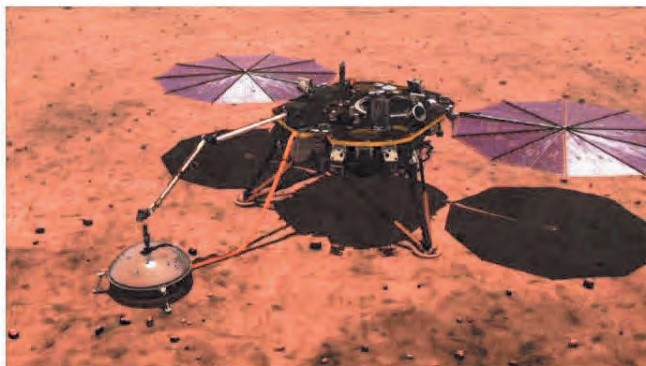


In this image the front heatshield, module impact site, rear heatshield and parachute can be seen. Where Schiaparelli impacted is a large blast area created as the fuel tank exploded.

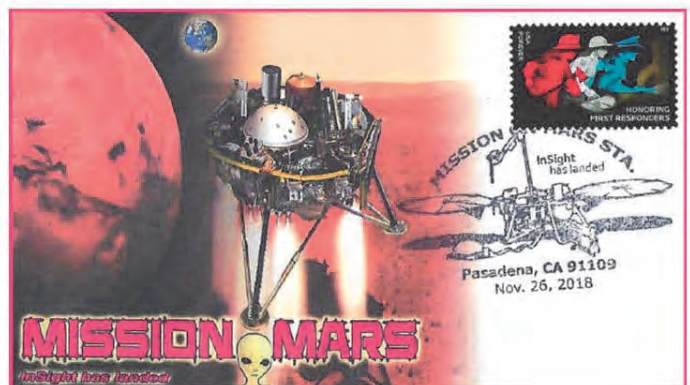
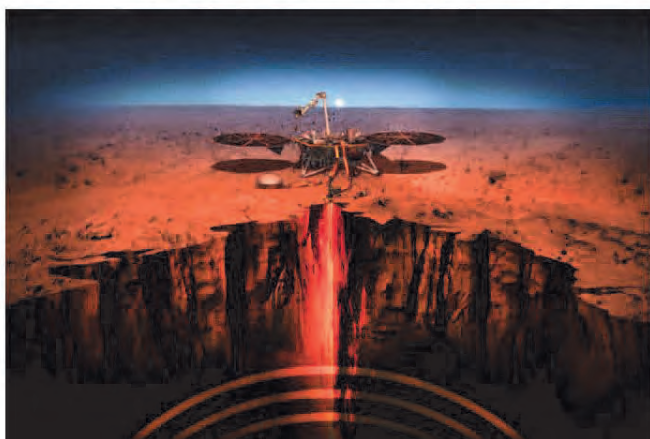
Two years later NASA's InSight lander made a successful landing on November 26, 2018. InSight is a stationary lander aimed at investigating the interior of Mars. It is equipped with a seismometer to study Mars-quakes and a drill to send down a heat probe below the surface to study the internal structure of Mars. A series of radio experiments were also carried out and the first sound from the planet's surface was made as we listened to the Martian wind for the first time.



The name InSight stands for INTERior exploration using Seismic Investigations, Geodesy and Heat Transport. Its landing site was in the Elysium Planitia. So far InSight has picked up mysterious magnetic pulses as well as a peculiar electrically conductive layer about 2.5 miles thick deep beneath Mars's surface. It is thought that this may be a sign that this layer could represent a global reservoir of liquid water. It may be a hidden sea of groundwater that has been locked up in sand, soil and rocks



InSight placing the seismometer on the surface.
InSight heatflow experiment (Artist's impression)



To be continued.....