

'Curiosity' at Gale crater

The spectacular landing of NASA's *Curiosity* probe on August 6 was a daring feat of precision engineering which many people (the writer included) thought could never have succeeded. The one-ton lander was the heaviest yet to reach Mars, and following the usual aerobraking procedure it deployed a 16 metre wide parachute (cover and Figure 1) prior to being gently lowered to the surface by a cable suspended from a rocket. All systems are functioning well at the time of writing (August 27) and the not-so-little rover has begun its first explorations around the landing site.¹ The rim of Gale crater can be seen on the horizon in the probe's images; in the foreground lies a gravel field (Figure 2).

According to the *Mars Exploration Rover* website,² during the prime mission phase of one Mars year, '...the rover will investigate whether the region has ever offered conditions favourable for microbial life, including the chemical ingredients for life'.

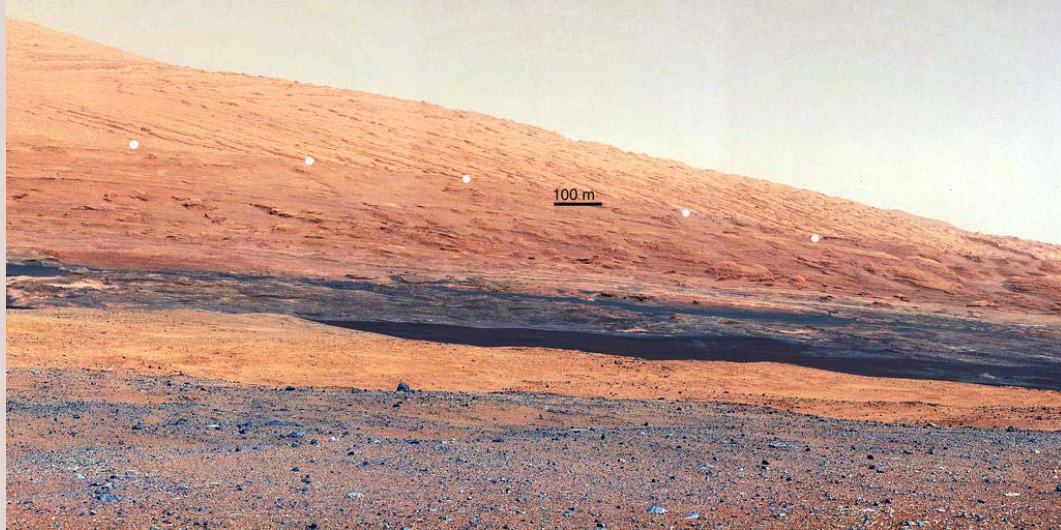


Figure 3a. The sculpted terrain of Mount Sharp, *Curiosity*'s eventual target, as seen in a telephoto image on August 27. Above the added white dots, the strata are highly inclined, dipping from left to right, relative to the lower strata which are rather flat. This adds to data from martian orbit which show bands of hydrated minerals exist only in the lower slopes. The process of sedimentation does not seem to have occurred above the line of the white dots.

After lengthy status tests and early imagery, on 2012 August 19 the rover was ready to attack its first nearby rock with its ChemCam instrument. Producing an ionised plasma by laser bombardment, the technique is called laser-induced breakdown spectroscopy. The craft's weather station and robotic arm have also been employed. Neutrons are being fired into the ground by the Russian-built DAN instrument; their scattering will assess the amount of water present (likely to be mostly chemically bound in hydrated minerals at this low latitude).

Only one of the two wind sensors is in working condition, however. Measurements during the first

two weeks showed air temperatures to vary from -2° down to -75° Celsius, while ground temperatures typically ranged from a chilly pre-dawn morning at -91° , to $+3^{\circ}$ in the afternoon.³

The rover's long-awaited first drive began on August 22, travelling up to 6m away from the landing site, now named 'Bradbury Landing' after the recently-deceased science fiction author Ray Bradbury (1920–2012).⁴ A more adventurous drive taking it 400m away is planned. Meanwhile, telephoto lens pictures of Mount Sharp (Figure 3) reveal geological layers, knobs and gulches on the lower flanks.

I began writing this note a few days after the sad news of the death of Neil Armstrong (1930–2012), the first man to have walked on the Moon, 43 years ago. In the optimism of the late 1960s, I am sure that Armstrong and his fellow *Apollo* crew members would ▶

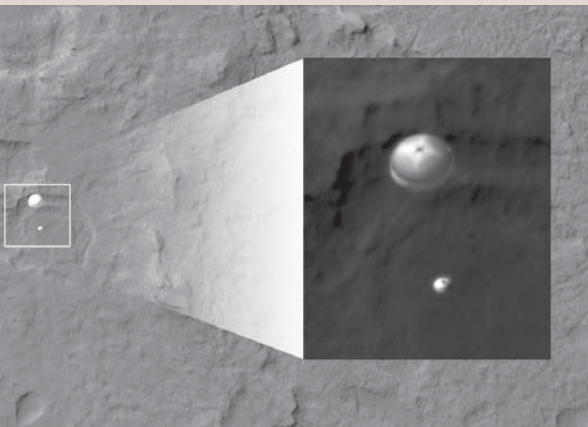


Figure 1. *Curiosity* after aerobraking, shown with its large parachute, imaged from orbit by NASA's *Mars Reconnaissance Orbiter*. (All pictures credit NASA/JPL-Caltech).



Figure 2. A 360° panorama of Gale crater made with 130 images from the Mast Camera late in the afternoon of August 8. The foreground grey areas were caused by the descent engines blowing away a surface deposit. Preliminary ChemCam data suggest the presence there of pieces of basalt within a sedimentary layer. The distant crater rim can be clearly seen, together with the very large central peak (provisionally named) 'Mount Sharp'. Spacecraft observations indicate layers of clay and sulphate minerals in the lower layers of the mountain, indicative of a wet history. A detailed route to drive there is currently being planned, and the journey is likely to take up to a year to accomplish.



have imagined Mars to have been colonised by now. In spoken words radioed to the rover on Mars and relayed back again to the Deep Space Network on Earth, NASA Administrator Charles Bolden noted the difficulty of landing the rover on Mars, congratulated those

concerned, and said curiosity is what drives humans to explore.

Dave Lavery, NASA *Curiosity* programme executive was upbeat: 'With this voice, another small step is taken in extending human presence beyond Earth, and the experience of ex-

ploring remote worlds is brought a little closer to us all... As *Curiosity* continues its mission, we hope these words will be an inspiration to someone alive today who will become the first to stand upon the surface of Mars. And like the great Neil Armstrong, they will speak aloud of that next giant leap in human exploration.'

Richard McKim, *Director*

References & notes

- 1 R. J. McKim, *J. Brit. Astron. Assoc.*, **122**(4), 202–203 (2012)
- 2 News bulletins from the *Rover* team are to be found at the official site, <http://mars.jpl.nasa.gov/msl/news/whatsnew/index.cfm>. There is also a video of the landing available.
- 3 At the time of writing, daily Mars weather reports are soon to be made available at <http://cab.inta-csic.es/remms/marsweather.html> and at <http://bit.ly/RzQe6p>
- 4 Ray Bradbury's engaging novel of the human exploration of Mars, *The Silver Locusts*, was first published by Rupert Hart-Davis in the UK in 1951. Just one of nearly 50 books he wrote, it was later released under the much better-known title *The Martian Chronicles*, and also made into a TV series. The novel spans the years 1999–2026, which then were in the distant future: 'They had a house of crystal pillars on the planet Mars by the edge of an empty sea, and every morning you could see Mrs K. eating the golden fruits that grew from the crystal walls, or cleaning the house with handfuls of magnetic dust, which taking all dirt with it, blew away on the hot wind...'



Figure 3b. A close-up view of the lower slopes of Mount Sharp. Colour has been enhanced to help with analysing different areas of terrain. For scale, the highlighted dark rock is about the same size as the *Curiosity* rover, and the pointed mound behind it about 300 metres across and 100m high.

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