Curiosity sets down safely on Mars

Six-wheeled robot now set to begin its multi-year mission at Gale Crater.

Eric Hand

06 August 2012

PASADENA, CALIFORNIA

NASA/JPL-Caltech

Ready to roll: Curiosity's first glimpse from Gale Crater.

“It’s the wheel! It’s the wheel!”

The jubilant shout was heard over cheers and exclamations as team members with NASA’s Mars Science Laboratory — also known as Curiosity — watched the first image from their spacecraft flash up on a control room screen here at NASA’s Jet Propulsion Laboratory (JPL) in Pasadena, California, just minutes after it landed. The picture capped off a dramatic descent sequence that deposited the rover on the surface of Mars at 10:32 p.m. Pacific daylight time on 5 August.

Although not a beautiful image — it was shot through a lens cover by the rover’s rear hazard camera — the picture was enough to show one of Curiosity’s wheels resting firmly on the Martian soil. Off in the distance, the curving horizon beckons.

After an 8-month journey, Curiosity survived its violent, 7-minute fall through the thin atmosphere of Mars before touching down with a speed of less than 1 metre per second, the softest landing in Mars exploration history. The feat proved that the mission's wickedly complicated landing system was as robust as advertised.

The 900-kilogram rover touched down at the bottom of Gale Crater, a 154-kilometre-wide pit the size of Kuwait, where it will begin its search for past habitable environments.

Indication of a safe landing came almost immediately via Mars Odyssey, an 11-year-old orbiter that relayed telemetry data from the spacecraft to large radio antennas in Canberra, Australia, part of NASA’s Deep Space Network.

But Adam Steltzner had to be sure. The entry, descent and landing phase lead, easily spotted in the control room with this pomaded hair, was also looking for confirmation that the inertial sensors on board the rover had ceased registering movement. When it came he counted to ten – to make sure that the descent module hadn’t fallen back down on the rover. Only then did he point at Allen Chen, the voice of mission control.

“Once I had all three things, I gave Al Chen the A-OK to say ‘touchdown confirmed’.”

At the press conference, the mission leaders sat on a dais, with the rover’s second picture projected behind them: a picture from the front hazard cameras, which showed the shadow of the rover against the late afternoon sun. “There is a new picture of a new place on Mars,” Steltzner says. “And for me, at least, that’s payoff.”

The event marks the seventh successful Mars landing for NASA, out of eight tries.

Although the precise location of the rover is not yet known, its target was a wide, smooth plain between the steep crater walls and Aeolis Mons, a 5.5-kilometre-tall mound in the centre of the crater that mission scientists have dubbed ‘Mount Sharp’.

The landing proves the viability of a radically different landing system — one that gives NASA the ability to deliver a lander more precisely on the surface and therefore closer to interesting targets for scientific study. One innovation was the use of guided entry, borrowed from the Apollo programme, which allowed the spacecraft to steer its way through the thin Mars atmosphere to a landing ellipse just 20 kilometres long. A second change involved swapping the airbags used on previous rovers for a ‘sky crane’, which unspooled the rover on three nylon cords, and lowered its six wheels gently to the surface at less than 1 metre per second.

It will be about a week before the rover takes its first drive. With a top speed of 4 centimetres per second, it will be many months, if not a year, before it arrives at Aeolis Mons. Meanwhile, there is plenty of science to be done at the landing site; the rover is expected to have landed near the foot of an alluvial fan, a triangle-shaped feature that reflects a period in the geological past when water spilled over the crater rim and deposited sediments.

But the mystery of Aeolis Mons remains paramount (see ‘Crater mound a prize and puzzle for Mars rover’). The science team wants to understand first how the mountain, which rises above the rim of the crater, formed at all. But the team also wants to understand the hundreds of millions of years of history embedded within the mountain. At the bottom of the mountain are layers, about 3.8 billion years old, that contain water-altered minerals such as clays and sulphates. Farther up the mountain, however, are layers that reflect no evidence of water at all. Somewhere in that stack lie clues to Mars’ “great dessication event”, says project scientist John Grotzinger, a geologist at the California Institute of Technology in Pasadena. “How did Mars go from being a wet planet to a dry planet?” he asks. Among the rover’s 100-kilogram science payload are instruments that will help address whether those watery environments in the deep past could have allowed for life.

But those questions were far from the minds of relieved engineers at JPL. As hundreds of science team members geared up for years of work, engineers at JPL could relax for the first time in months.

Ed Weiler, NASA’s recently retired science chief was among the cast of senior officials on hand. “I was there for the conception of this 12 years ago,” he told *Nature*. “It was a long, long pregnancy. But the baby sure is beautiful.”

Nature | doi:10.1038/nature.2012.11125