Initial Results from the Mars Science Laboratory

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Curiosity’s primary scientific goal is to explore and quantitatively assess a local region on Mars’ surface as a potential habitat for life, past or present

- Biological potential
- Geology and geochemistry
- Role of water
- Surface radiation
REMOTE SENSING
Mastcam (M. Malin, MSSS) - Color and telephoto imaging, video, atmospheric opacity
ChemCam (R. Wiens, LANL/CNES) – Chemical composition; remote micro-imaging

CONTACT INSTRUMENTS (ARM)
MAHLI (K. Edgett, MSSS) – Hand-lens color imaging
APXS (R. Gellert, U. Guelph, Canada) - Chemical composition

ANALYTICAL LABORATORY (ROVER BODY)
SAM (P. Mahaffy, GSFC/CNES/JPL-Caltech) - Chemical and isotopic composition, including organics
CheMin (D. Blake, ARC) - Mineralogy

ENVIRONMENTAL CHARACTERIZATION
MARDI (M. Malin, MSSS) - Descent imaging
REMS (J. Gómez-Elvira, CAB, Spain) - Meteorology / UV
RAD (D. Hassler, SwRI) - High-energy radiation
DAN (I. Mitrofanov, IKI, Russia) - Subsurface hydrogen

Curiosity's Science Payload
Target: Gale Crater and Mount Sharp
150-km Gale Crater contains a 5-km high mound of stratified rock. Strata in the lower section of the mound vary in mineralogy and texture, suggesting that they may have recorded environmental changes over time. Curiosity will investigate this record for clues about habitability, and the ability of Mars to preserve evidence about habitability or life.
Landing precision for Curiosity and previous Mars surface missions
Curiosity on parachute, imaged by HiRISE on the Mars Reconnaissance Orbiter
Heat shield separation captured by Curiosity’s Mars Descent Imager

NASA/JPL-Caltech/MSSS
Kicking up dust just prior to landing
“Touchdown confirmed.”
“Let’s see where Curiosity will take us.”
Curiosity self-portrait with navigation cameras
Navigation camera image showing the surface scour marks and rocks on the rover’s deck

NASA/JPL-Caltech
Bedrock exposed by the landing engines in the scour mark named Goulburn

Each image is 10-12 cm (4-5”) across.

NASA/JPL-Caltech/LANL/CNES/IRAP/MSSS
Curiosity and its tracks captured by HiRISE on the Mars Reconnaissance Orbiter

NASA/JPL-Caltech/Univ. of Arizona
Looking North to Crater Rim
Mastcam-34 mosaic of Mount Sharp, descent rocket scours, and rover shadow
Mastcam-100 image of Mount Sharp’s layers, canyons and buttes

This boulder is the size of Curiosity

NASA/JPL-Caltech/MSSS
Curiosity self-portrait using the arm-mounted Mars Hand-Lens Imager, through dust cover
Curiosity images its undercarriage with its Mars Hand-Lens Imager
“Coronation” ChemCam Target
ChemCam spectra of Coronation

Target: Coronation (N165)
Sol 13
Shots: 30
ChemCam’s laser induced breakdown spectrometer acquires a 5-spot raster

Target: Beechey (Sol 19)
Power: 1 Gigawatt
Shots per spot: 50

Before

After

8 cm (3”)

NASA/JPL-Caltech/LANL/CNES/IRAP/LPGN/CNRS
Navigation camera mosaic of Curiosity’s robotic arm
Images of Curiosity’s turret centered on MAHLI (left) and APXS (right)
Nested, hand-lens imaging of the 25-cm (10”) high rock Jake Matijevic
Curiosity’s Radiation Assessment Detector operated throughout the cruise to Mars.

RAD observed galactic cosmic rays and five solar energetic particle events.

RAD was shielded by the spacecraft structure, reducing the observed particle flux relative to NASA’s ACE satellite.

RAD is now collecting the first measurements of the radiation environment on the surface of another planet.

NASA/JPL-Caltech/SwRI
Curiosity’s Rover Environmental Monitoring Station is taking weather readings 24 × 7

REMS’ ground and air temperature sensors are located on small booms on the rover’s mast.

The ground temperature changes by 90°C (170 degrees Fahrenheit) between day and night.

The air is warmer than the ground at night, and cooler during the morning, before it is heated by the ground.
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REMS’ pressure sensor is located inside the rover’s body

Each day the pressure varies by over 10%, similar to the change in pressure between Los Angeles and Denver

Solar heating of the ground drives an atmospheric “tidal wave” that sweeps across the planet each day

Earth’s atmosphere = 101,325 Pascals, or about 140 times the pressure at Gale Crater

NASA/JPL-Caltech/CAB(CSIC-INTA)
Curiosity's Dynamic Albedo of Neutrons experiment sounds the ground for hydrogen.

DAN sends ten million neutrons into the ground, ten times a second.

The “echo” back is recorded. If hydrogen is present in the ground, perhaps in aqueous minerals, some neutrons will collide and lose energy.

DAN is used to survey the upper one meter of the ground below the rover as it drives along.
Curiosity is progressing toward Glenelg, where three distinct terrain types meet.
Map view of conglomerate outcrops (next slides)
The Goulburn scour revealed the first look at underlying bedrock

NASA/JPL-Caltech/MSSS
“Hottah” reveals additional conglomerate, evidence of an ancient streambed
The conglomerate “Link” with associated loose, rounded pebbles
Curiosity’s ultimate goal is to explore the lower reaches of the 5-km high Mount Sharp
Sol 55 (yesterday evening); Navcam mosaic from JPL Public Release JPEGs...
MSL is off to a great start!
Landing August 6, 2012
End of Primary Mission: Dec. 31, 2014