



The MSL Science Story

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Mars Exploration Program

Science Value in Planetary Exploration

PSS—Mars Science Laboratory

- Exploration of the “first billion years” of solar system formation
 - Mars is a terrestrial planet with a superb record, far exceeding that of Earth, of the planet’s earliest environmental history
 - At least Mars was once habitable, and a key to understanding how life began in our solar system
- Mars has accessible keys for understanding the drivers of global climate change
- An opportunity for planetary science to form and test hypotheses within years of each other



MSL's Value to Planetary Exploration

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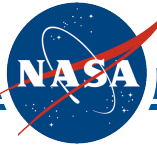
- Critical step towards answering—is there life outside Earth?
 - We now believe that Mars preserves a record of habitable environments, some of which may be active today
 - Mars' environmental record is both diverse and dynamic – it has changed in time and space and is preserved in the stratigraphic record
 - Our next step is to determine whether or not life ever started on Mars
- MSL will quantitatively assess the habitability, through time, of a region based on well-chosen site demonstrating clear evidence of hydrated minerals and morphologic attributes evincing former interaction with water



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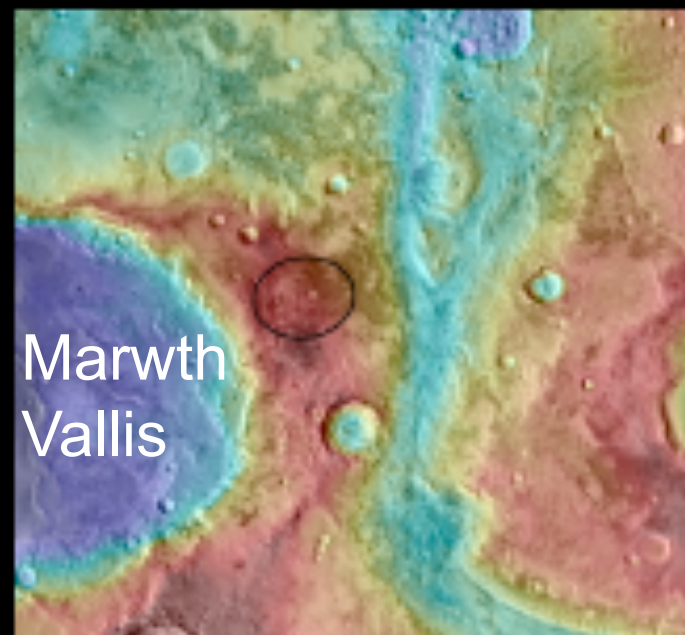
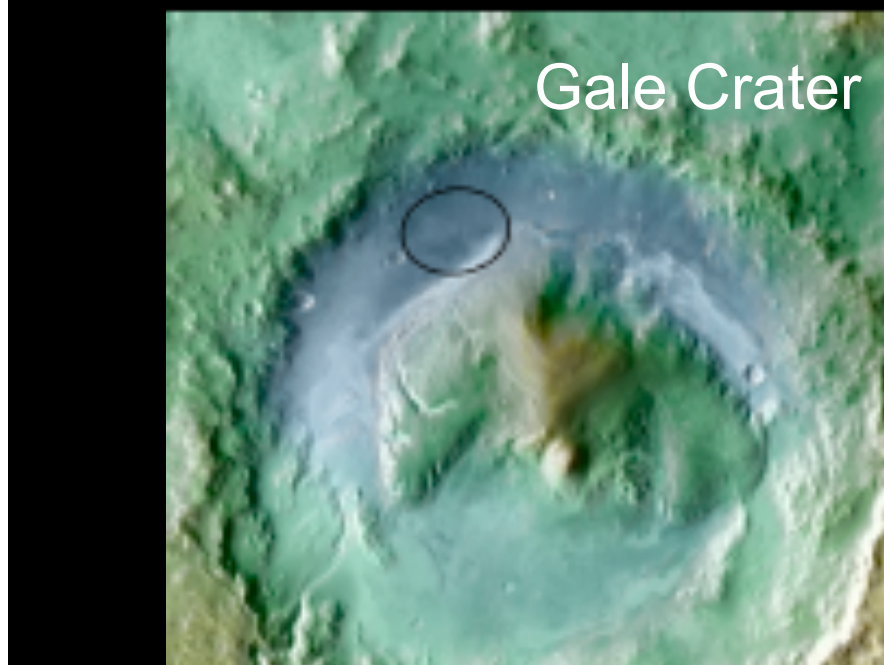
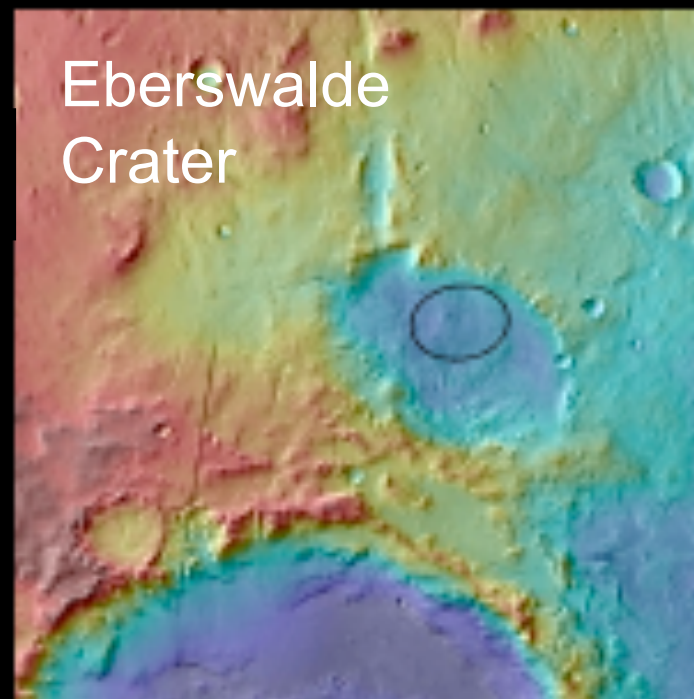
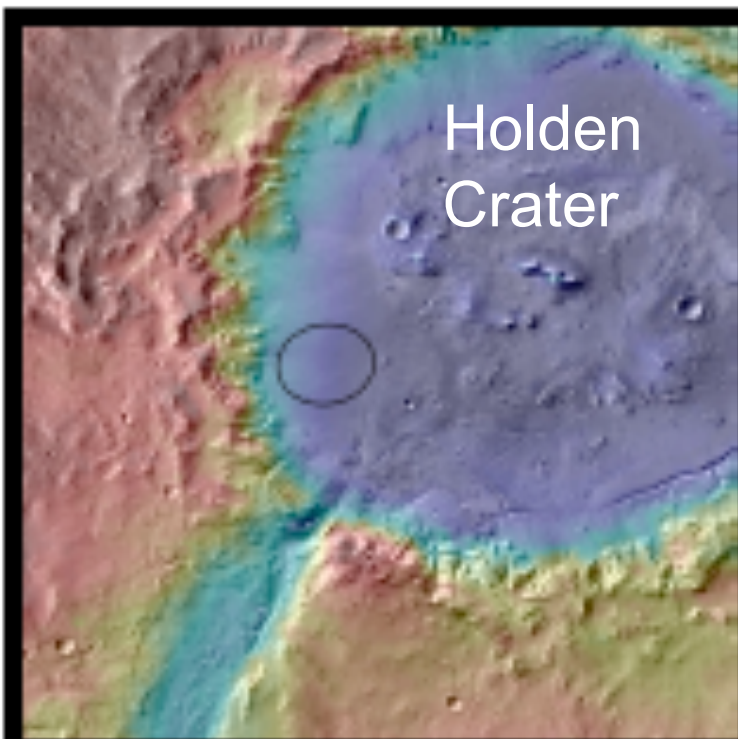
- MSL carries the most sophisticated suite of instruments ever be flown to the surface of another planet. Analytic and in-situ measurements will provide essential ground truth to anchor regional and global remote sensing mineralogy data
 - These in-situ data will:
 - Test hypotheses of early Martian environmental evolution, including climate history
 - Determine which environments might have best preserved environmental signals, and possibly biosignatures
 - Test interpretations of global mineralogy inferred from orbit
- Engineering to enable science:
 - New EDL system will enable future high-mass landings
 - Develop experience with sample collection, manipulation, and sample preparation
 - Targeted landing—critical capability for accessing high-priority science targets
 - Next generation of complex lab instruments to another planetary surface



MSL—the First Astrobiology Mission Since Viking

PSS—Mars Science Laboratory

- Ten instrument packages with the objective to explore and quantitatively assess a region of Mars as a potential habitat for life, past or present.
 - MSL will carry an analytical laboratory of unprecedented capability,
 - SAM: Gas Chromatograph/Mass Spectrometer
 - In rocks, soil, and atmosphere, will be able to measure mineralogy, organics, and isotopes
 - Chemin: X-Ray Diffractometer for state-of-the-art mineral identification
 - ChemCam: New to planetary exploration instrumentation, is a laser induced breakdown spectroscope for meters-distant remote sensing of elemental/chemical composition.
 - The other instruments
 - MastCam – stereo camera, 12 filters, 10 frames/s, 7.4 cm/pixel @ 1km
 - MAHLI – color hand lens, 15 um/pixel with white and UV light sources
 - MARDI – Mars Descent Imager
 - RAD (ESMD) – high-energy radiation (direct & secondary)
 - APXS (Canada) – alpha Particle X-ray Spectrometer, all elements above sodium
 - REMS (Spain) – pressure, humidity, UV radiation, wind speed, & temperature
 - DAN (Russia) – water distribution in the near subsurface
- With its sophisticated instruments, MSL is the first astrobiology mission since Viking, and will characterize the nature of current and ancient Martian environments.





The Landing Sites

PSS—Mars Science Laboratory

Unprecedented opportunity to explore a region with varied mineralogical and morphological features

- Layered deposits
- Alluvial fans
- Flood deposits
- Bedrock outcrops
- Multi-lobed deltaic deposits
- Diverse mineralogy: phyllosilicates & sulfates
 - Correlation with stratigraphic layers