



# The MSL Science Story

Michael Meyer

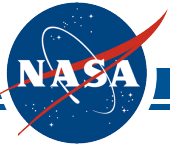


# Mars Exploration Program

## Science Value in Planetary Exploration

PSS—Mars Science Laboratory

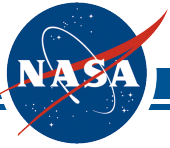
- Exploration of the “first billion years” of solar system formation
  - Mars is a terrestrial planet with a superb record, far exceeding that of Earth, of the planet’s earliest environmental history
  - At least Mars was once habitable, and a key to understanding how life began in our solar system
- 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

PSS—Mars Science Laboratory

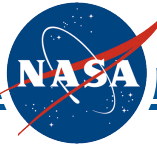
- Critical step towards answering—is there life outside Earth?
  - We now believe that Mars preserves a record of habitable environments, some of which may be active today
  - Mars' environmental record is both diverse and dynamic – it has changed in time and space and is preserved in the stratigraphic 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



# MSL's Value to Planetary Exploration

PSS—Mars Science Laboratory

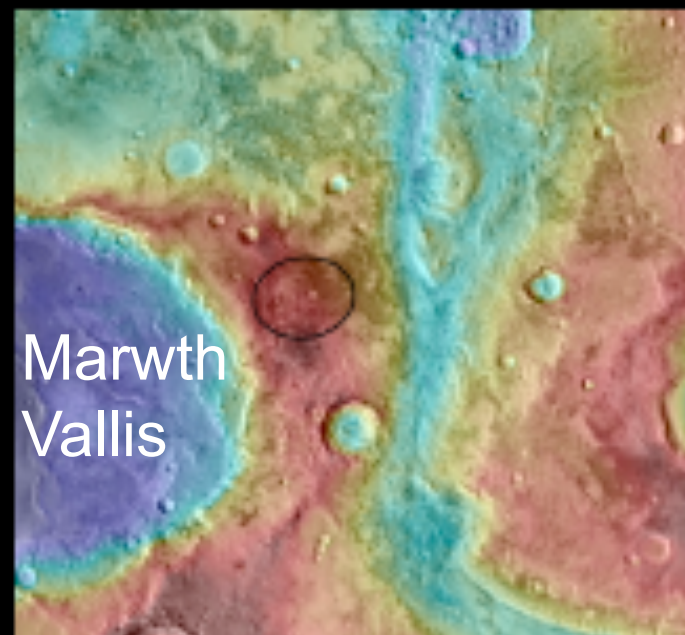
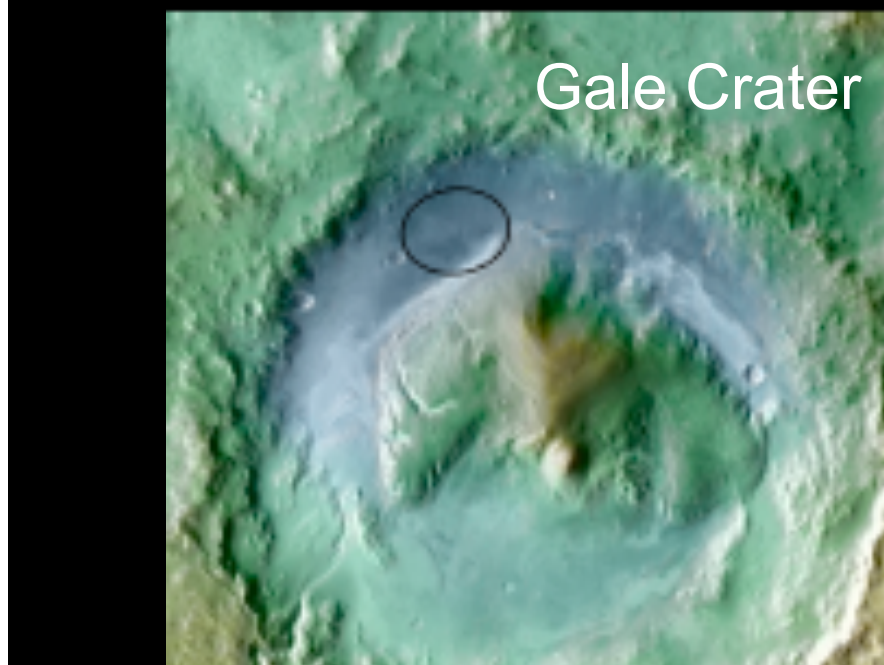
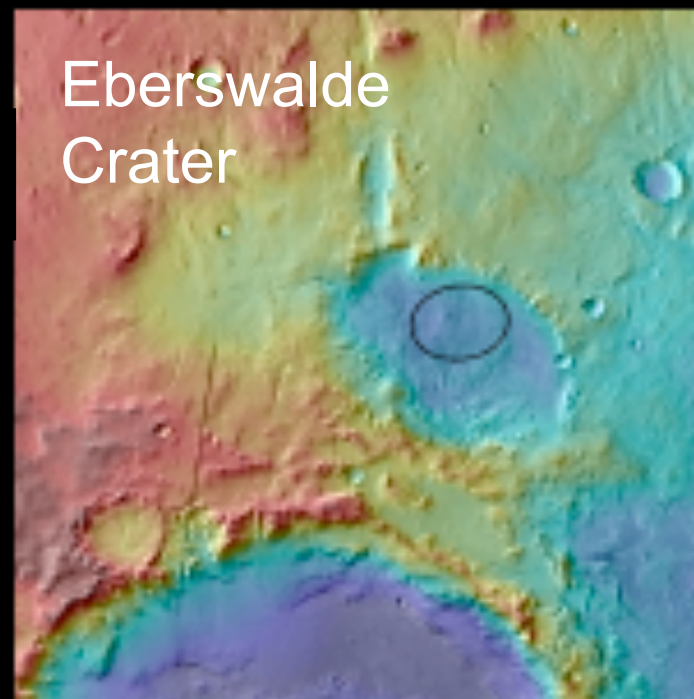
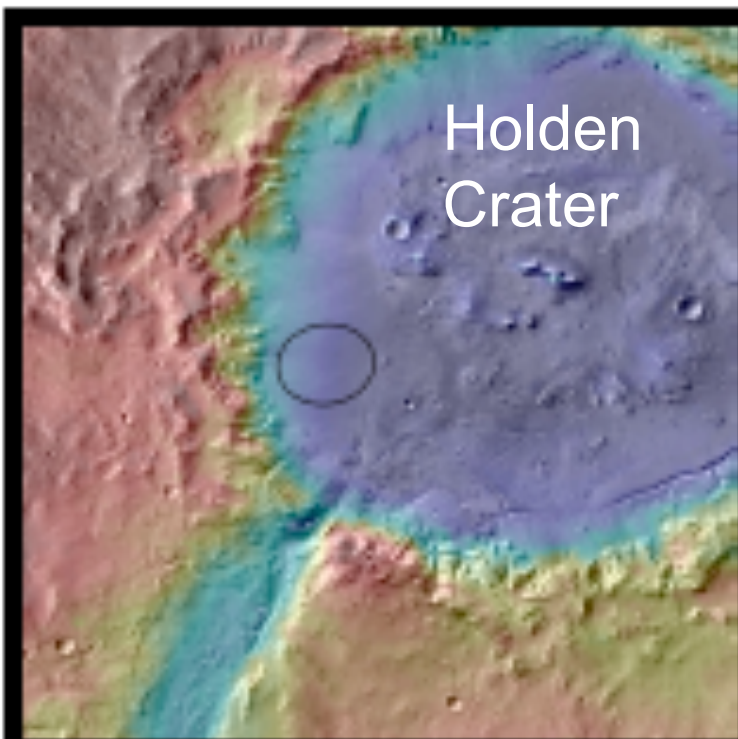
- MSL carries the most sophisticated suite of instruments ever be flown to the surface of another planet. Analytic and in-situ measurements will provide essential ground truth to anchor regional and global remote sensing mineralogy data
  - These in-situ data will:
    - Test hypotheses of early Martian 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