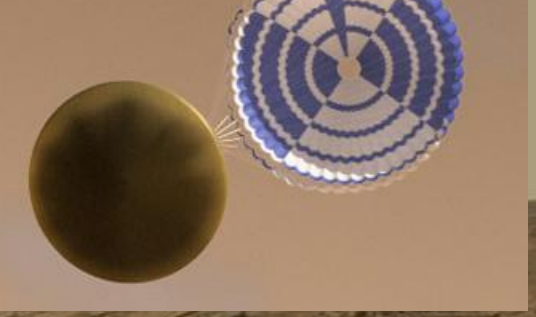


Exploring the Red Planet

Dr. Anita Sengupta

University of Southern California

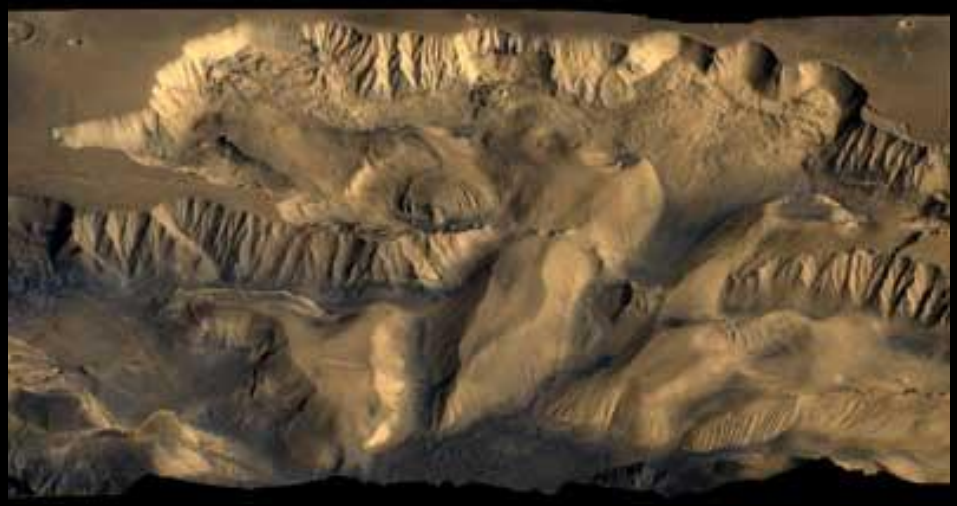
How do we land on Mars?

Why Are We so Interested In Mars?

Earth and Mars Look very Different From Each Other, but what about at the beginning of time?

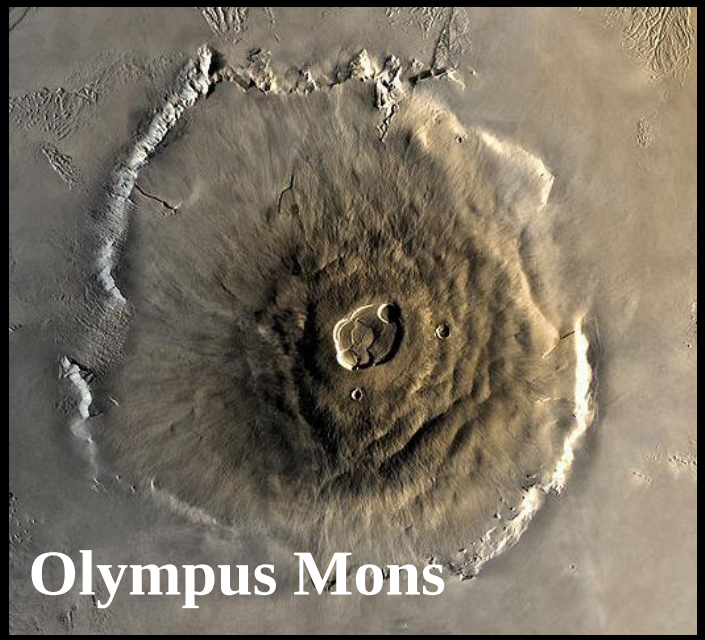
Could We One Day Live on Mars

- How long is the day? 24.6 hrs
- What is the gravity 1/3 Earth
- What is the Temperature Range? -90C to 5C
- Surface pressure compared to Earth 1/100
- What is the Atmosphere made of? CO_2

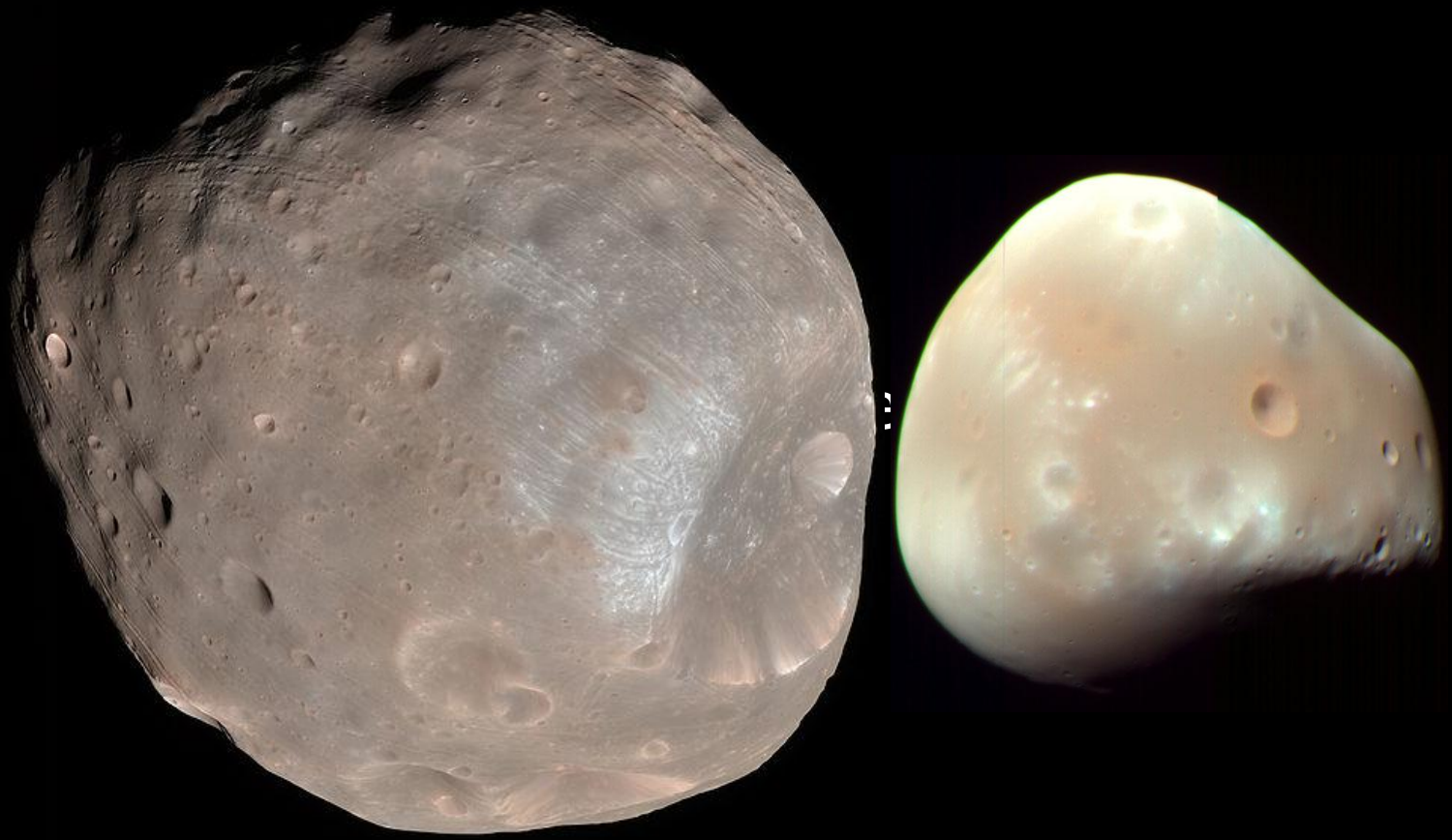


Active Geological History

- Olympus Mons
  - Largest Mountain in the Solar System: 21,000 m high
  - 3 times as high at Mount Everest
- Valles Marineres
  - Largest Valley in the Solar System
  - 4,000 km long, 200 km wide and up to 7 km deep
  - 6 times as deep as Grand Canyon



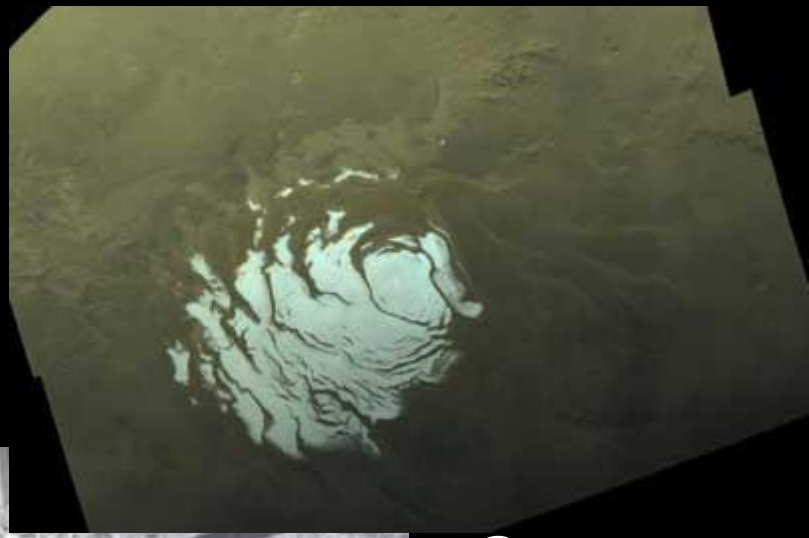
Moons of Mars



Phobos and Deimos

Waters of Mars

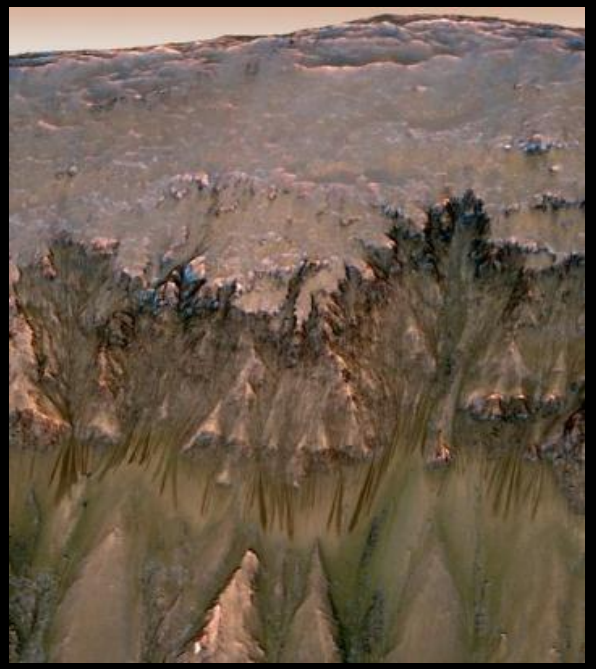
- Large bodies of water once flowed on the surface
- Polar Caps have water ice
- Phoenix Lander Found Brine Water

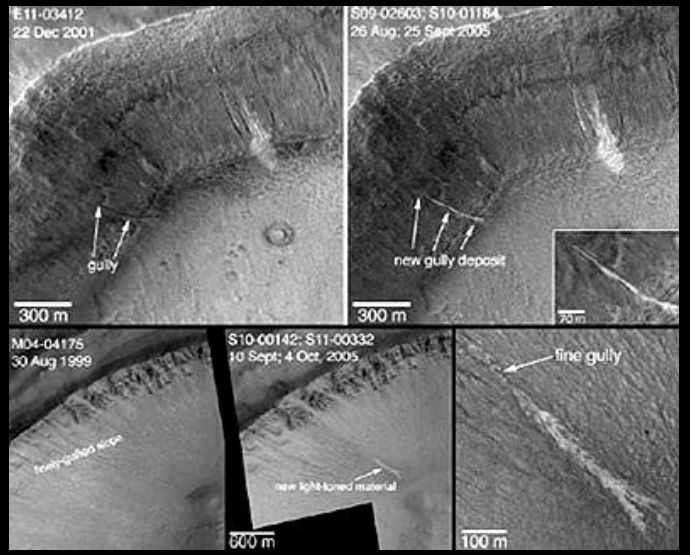


Have We Found Water on Mars?

Is there Water Flowing on Mars Today?

- NASA confirmed just last week that Mars has water flowing on the surface
- Mars is tilted on its axis resulting in seasonal freezing and thawing of subsurface water



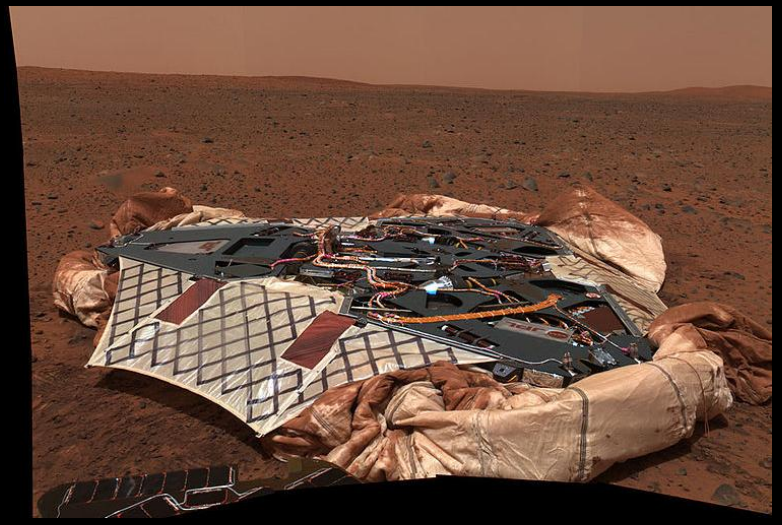


Landing on Mars

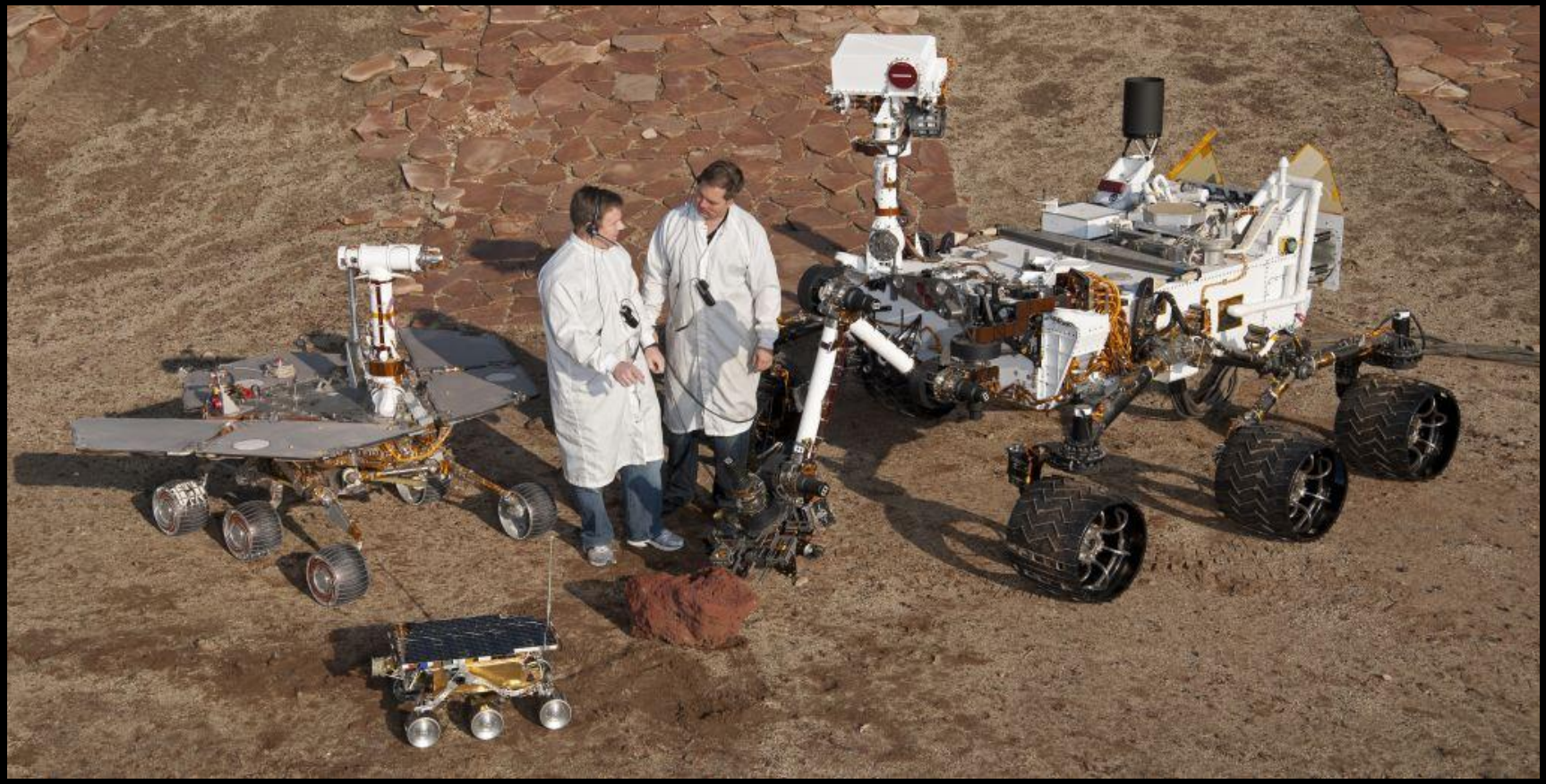
- How many times have we landed on mars?

  <u>7 times!</u>

  - Viking Landers (2)
  - Pathfinder Sojourner
  - Spirit and Opportunity (2)
  - Phoenix Lander
  - Curiosity: Aug 2012
  - Next: Insight (2016)

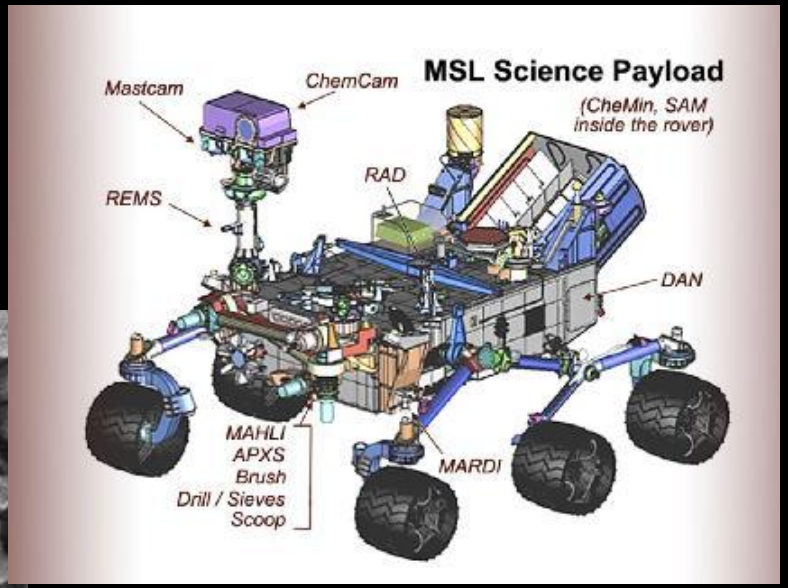


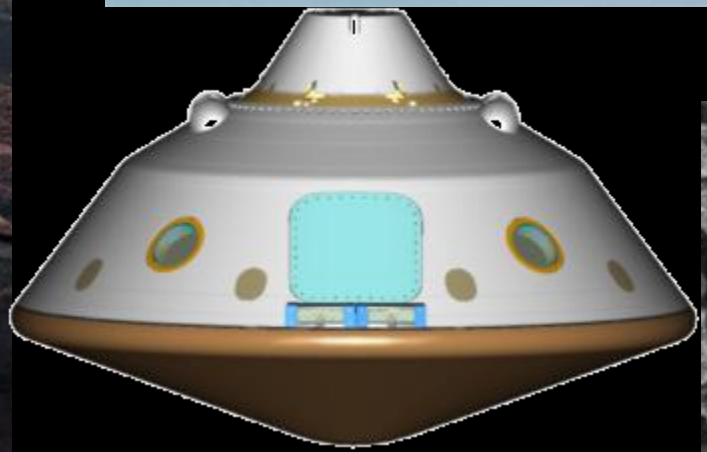
Learning from Past and Building the Future

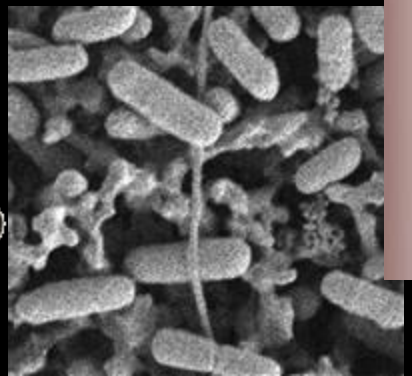


Mars Science Laboratory

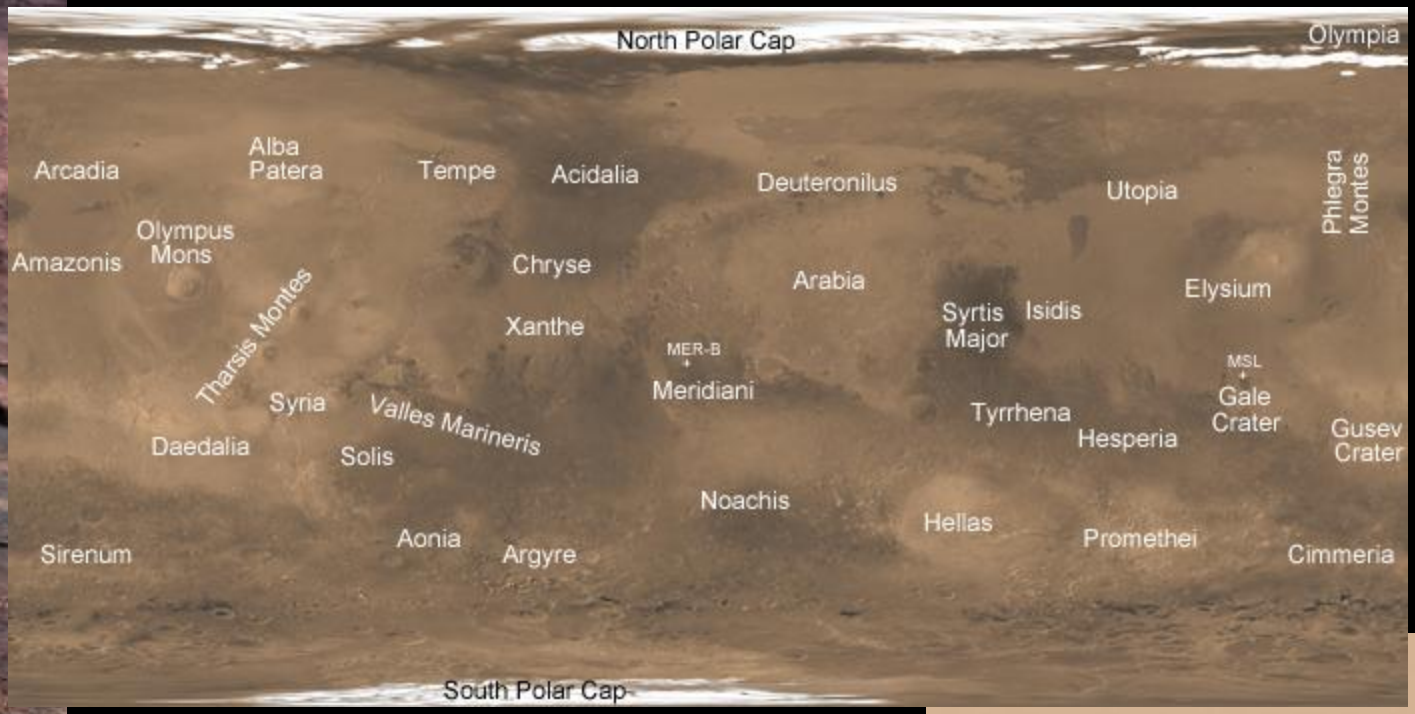
- Was Mars a habitat for life?
- Largest Rover Mission to date
- Advanced suite of instruments for organic molecule detection
- Advanced EDL

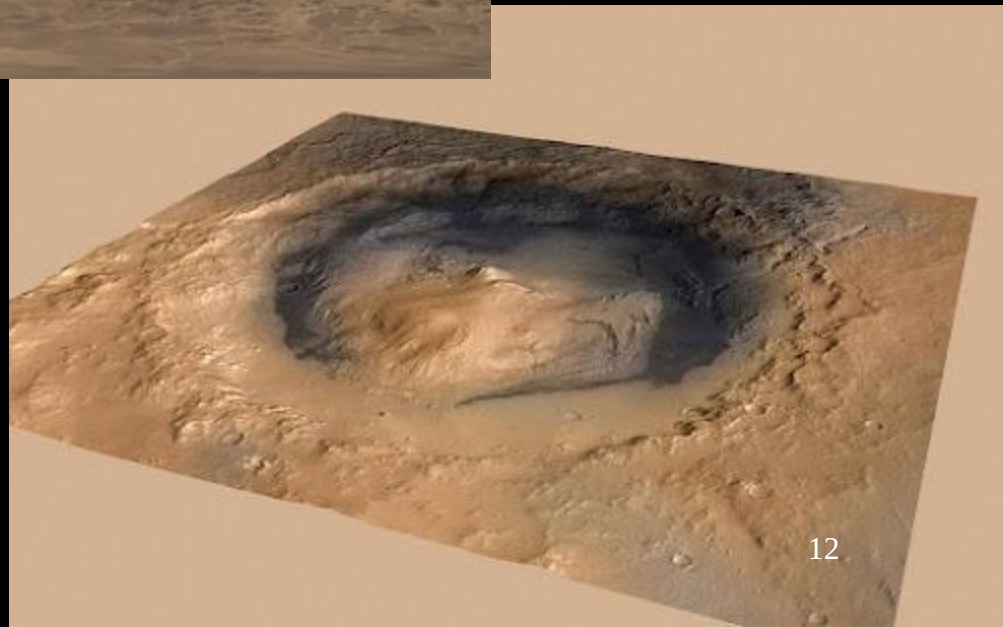






Picking a Landing Site: Gale Crater



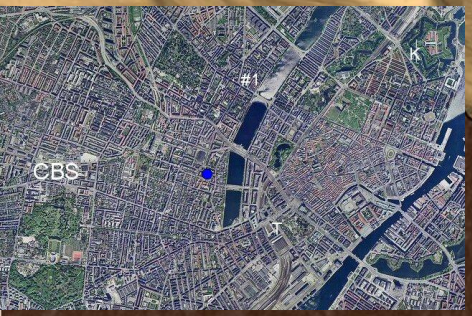


Did Mars Once Support Life?

The Mars Science Laboratory

- Biological Potential
- Geology and Geochemistry
- Role of Water
- Surface Radiation

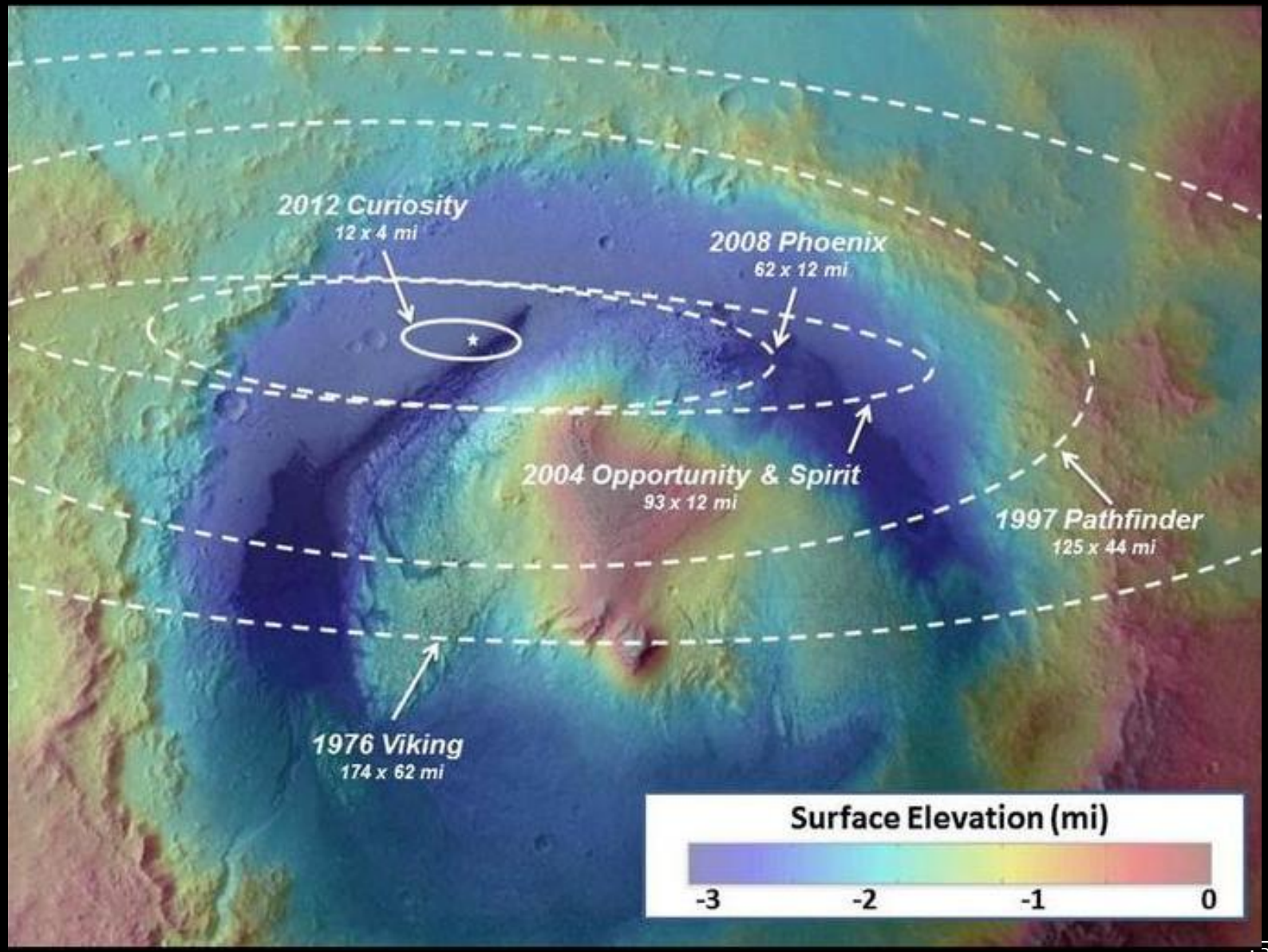
Gale Crater Targets a 20 km Landing Ellipse



Mt. Sharp in the middle of Gale Crater is as tall base-to-peak as Mt. McKinley in Alaska, which is the tallest mountain in North America

150-km Gale Crater contains a 6-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.

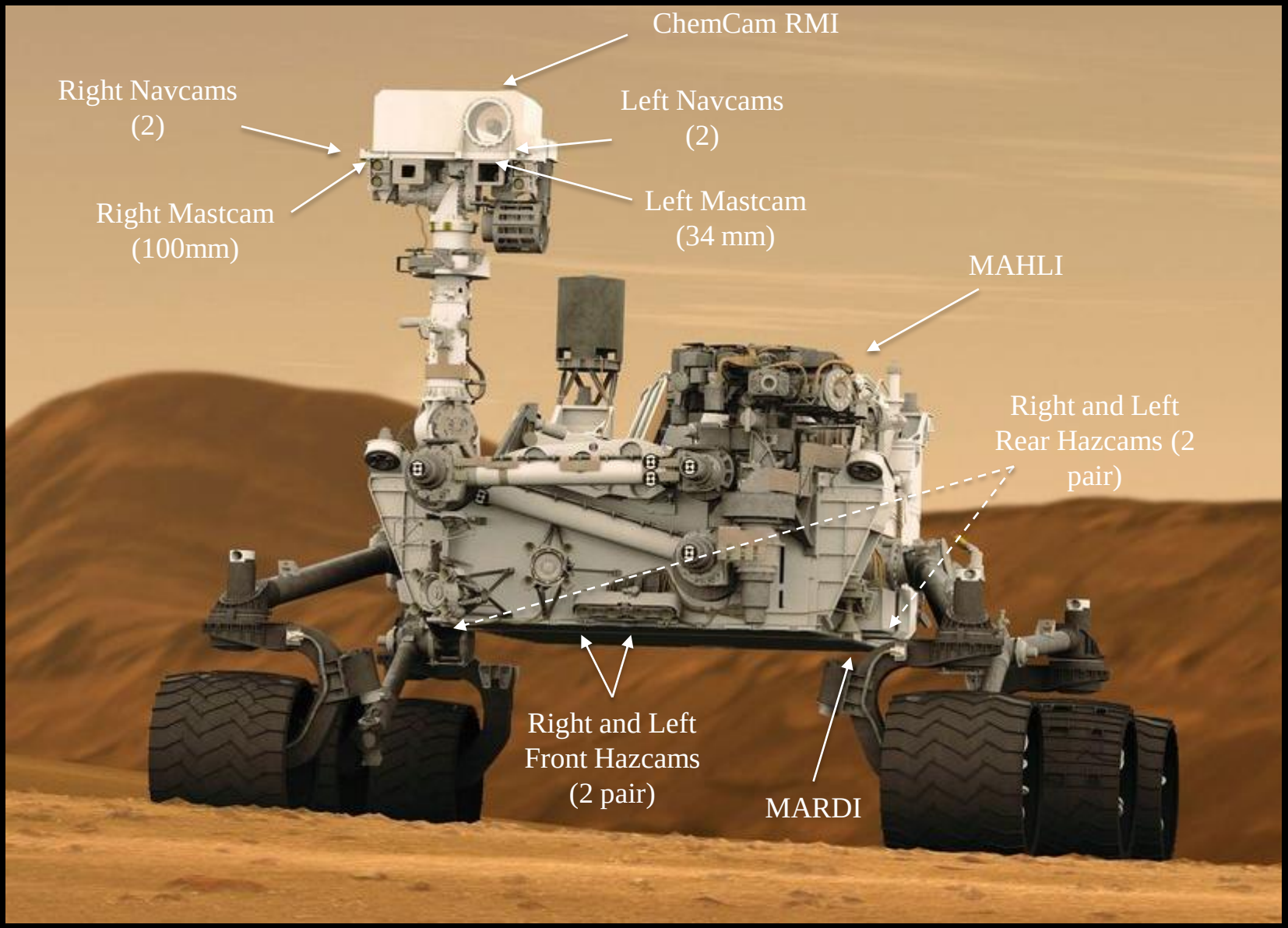
Bulls Eye on Mas



Faster than a bullet
50 times as fast as an airplane

Curiosity is the Size of a Small Car

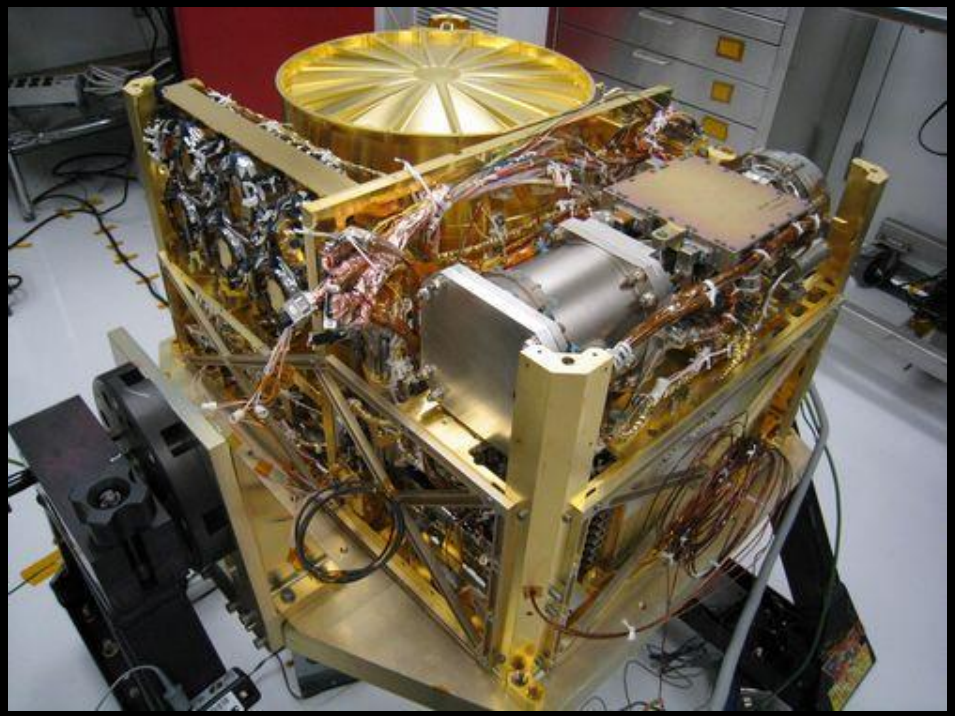
The Rover Needs Eyes Too



Science on Mars!

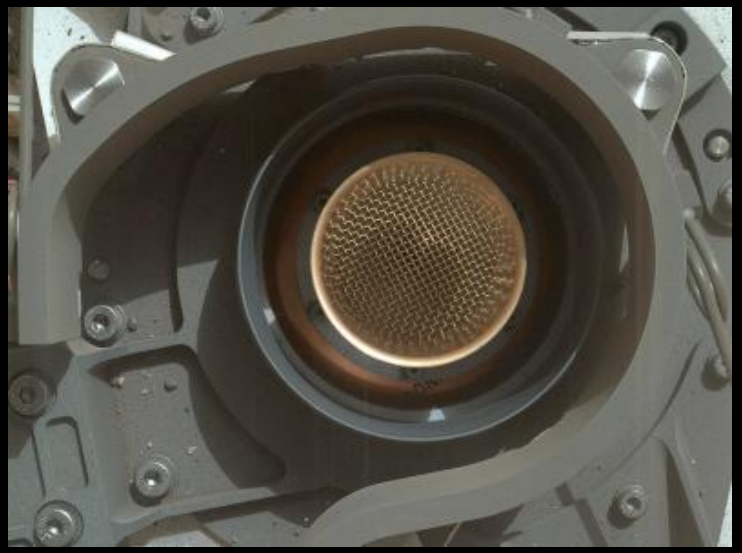
SAM & CheMin

SAM instrument which takes up more than half the science payload on the rover

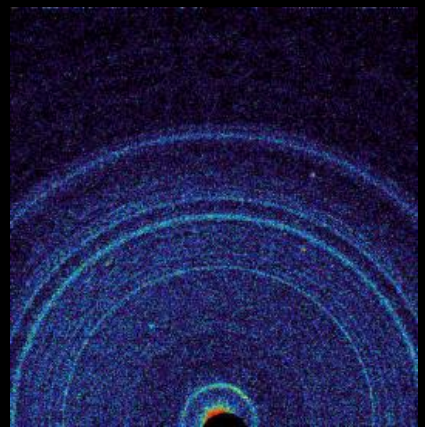


Sample Analysis at Mars (SAM) is the rover's Easy Bake Oven.

CheMin

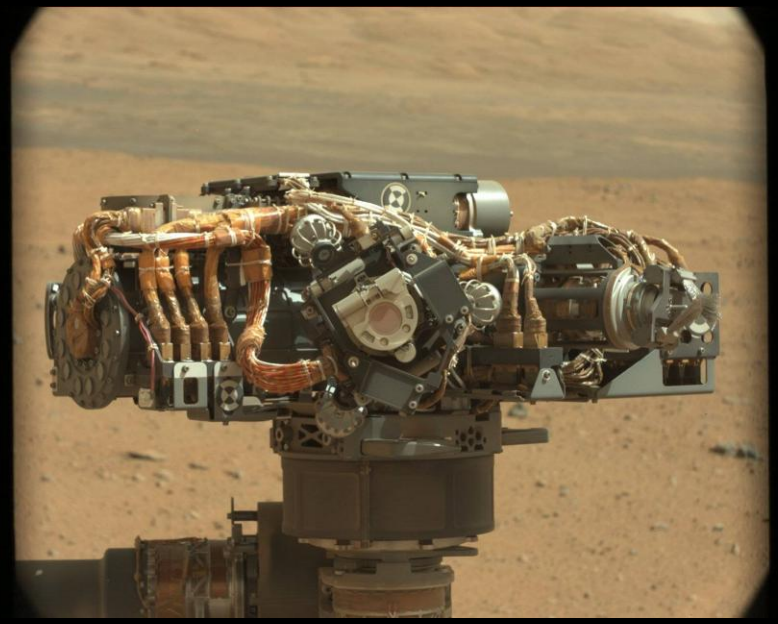


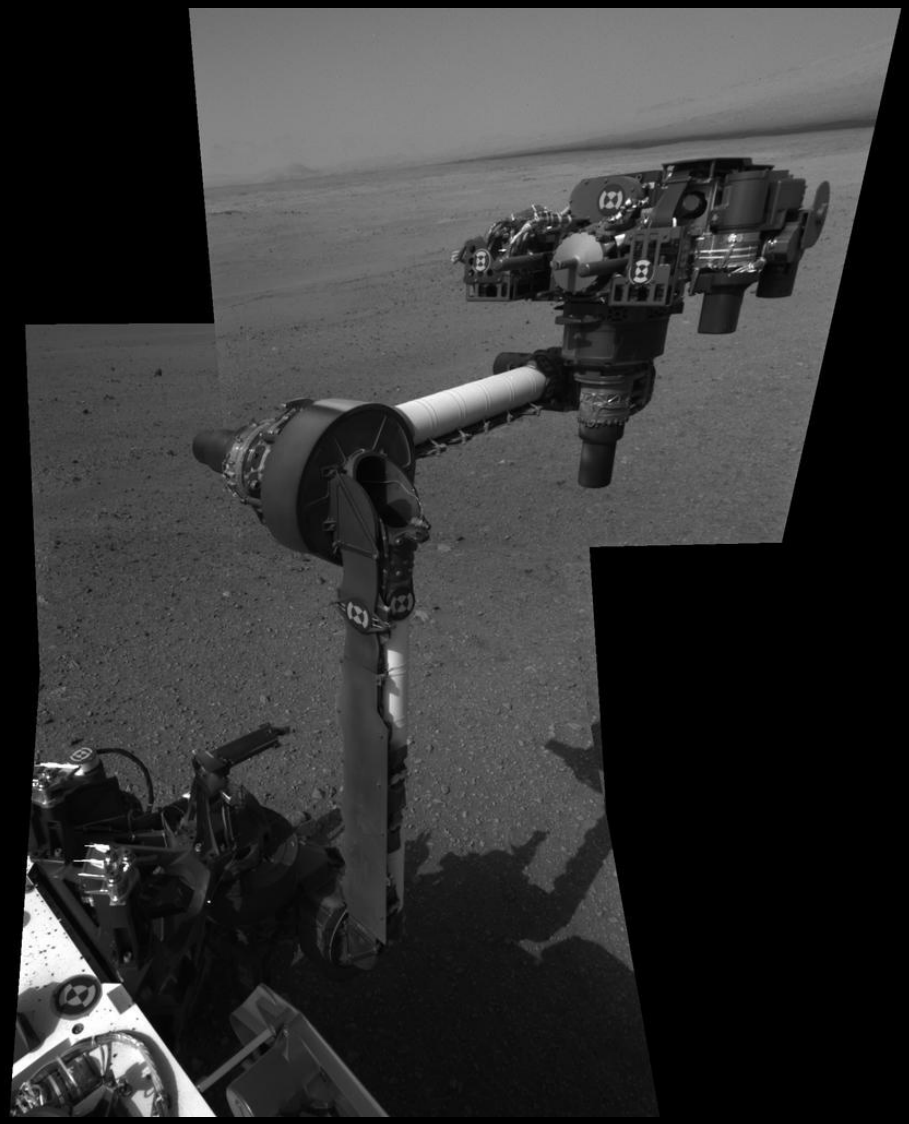
CheMin uses X-rays to determine mineral content and crystal structure of surface samples



Reach out and touch someone

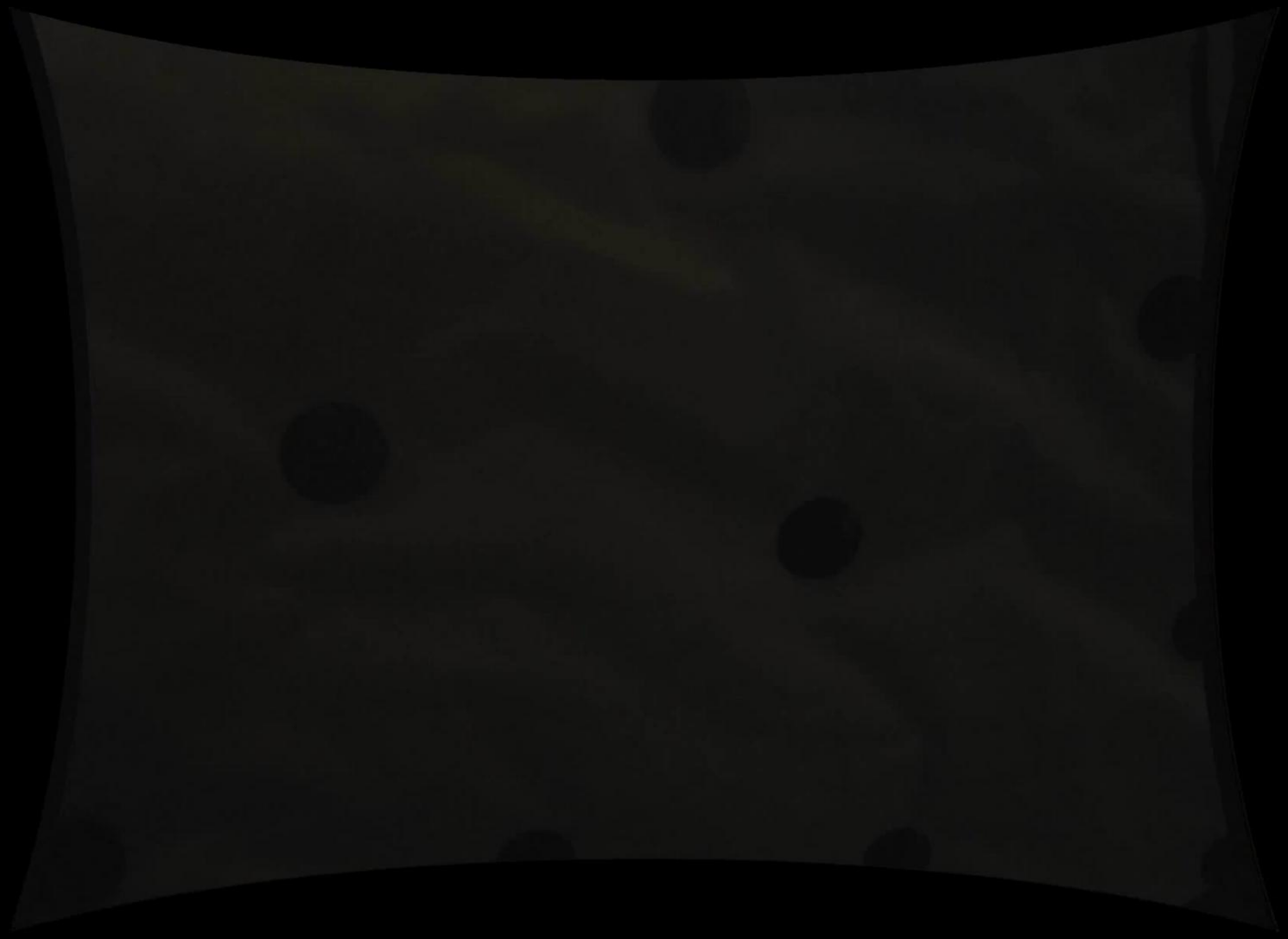
- Drill
- Scoop
- Microscope
- Brush
- APXS Instrument





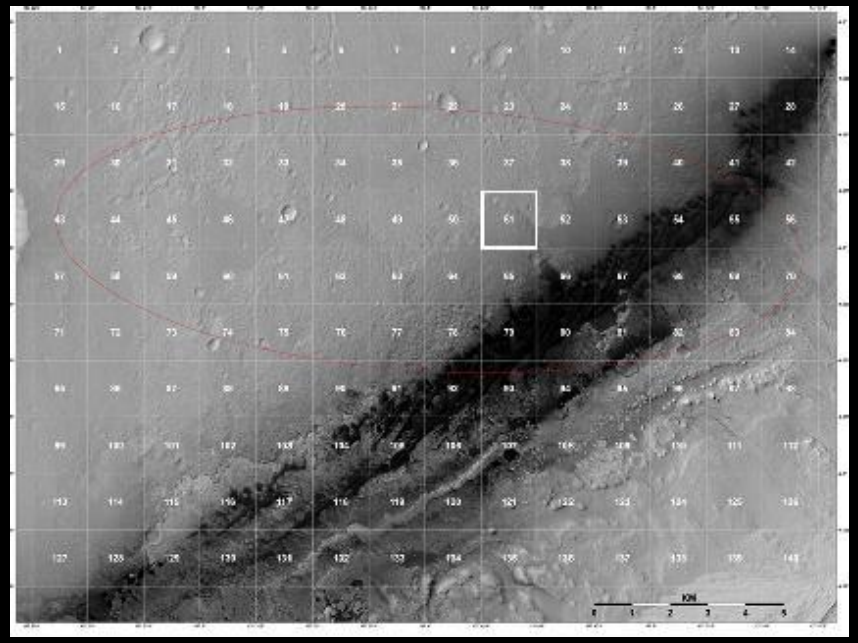
How long does it take to get to Mars?

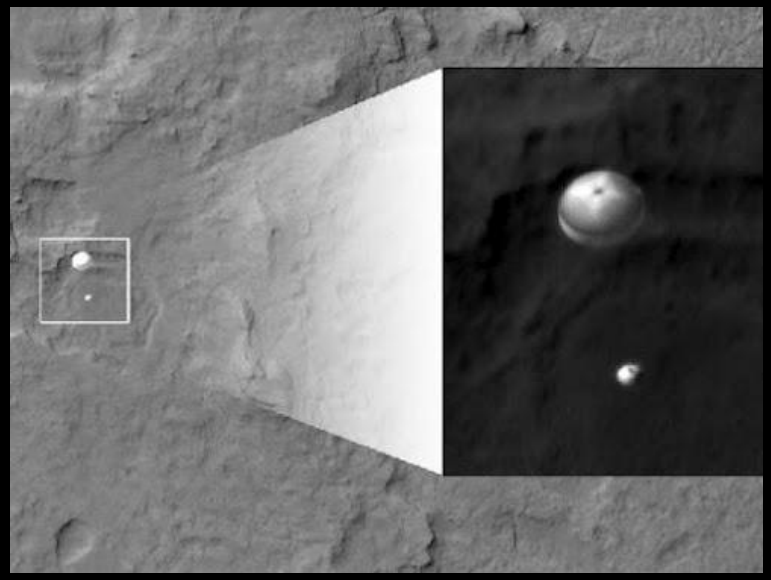
Landing Night: The Birds Eye View



Curiosity landed in an ancient lake on Mars

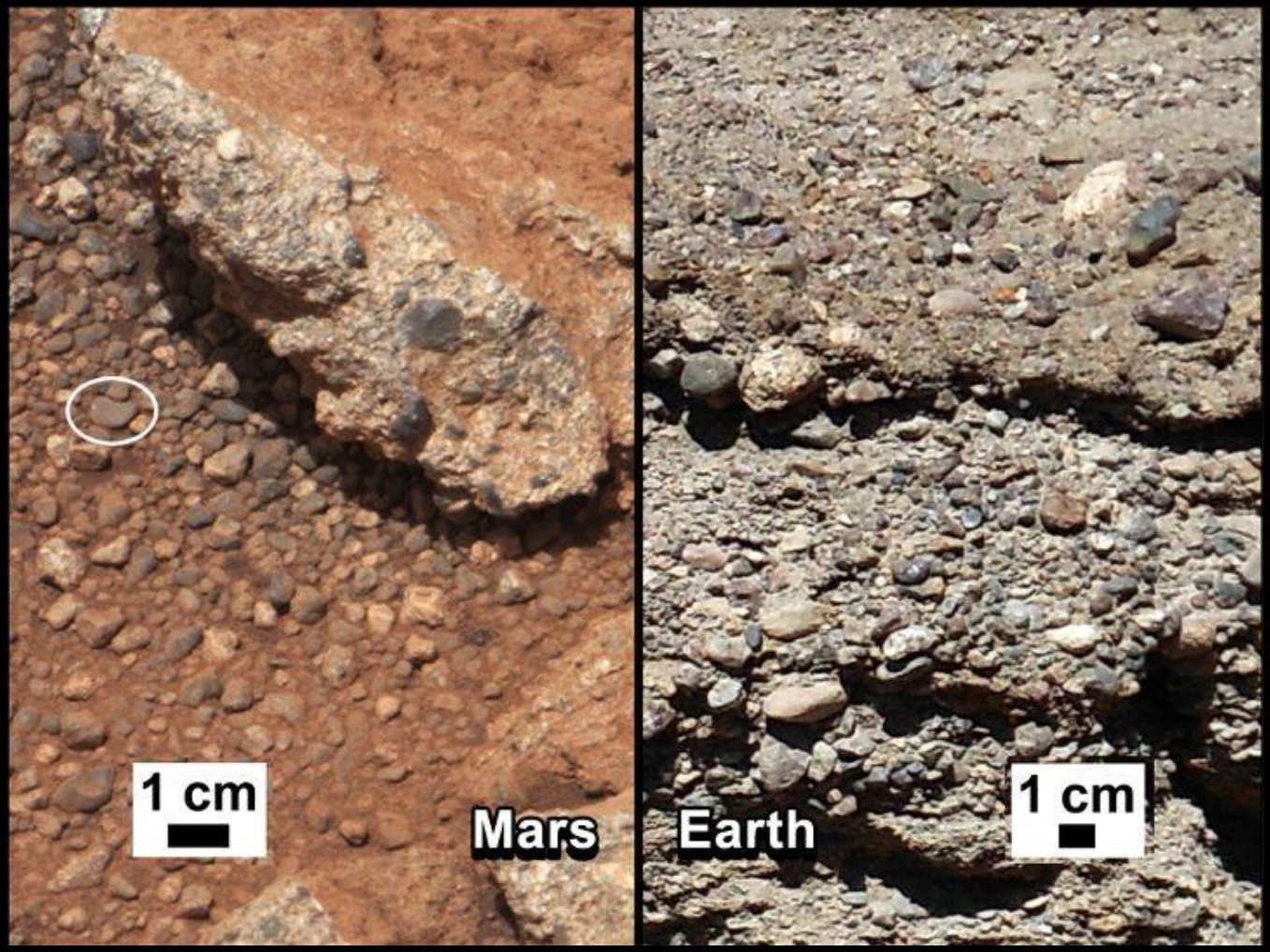
Post Landing EDL Assessment

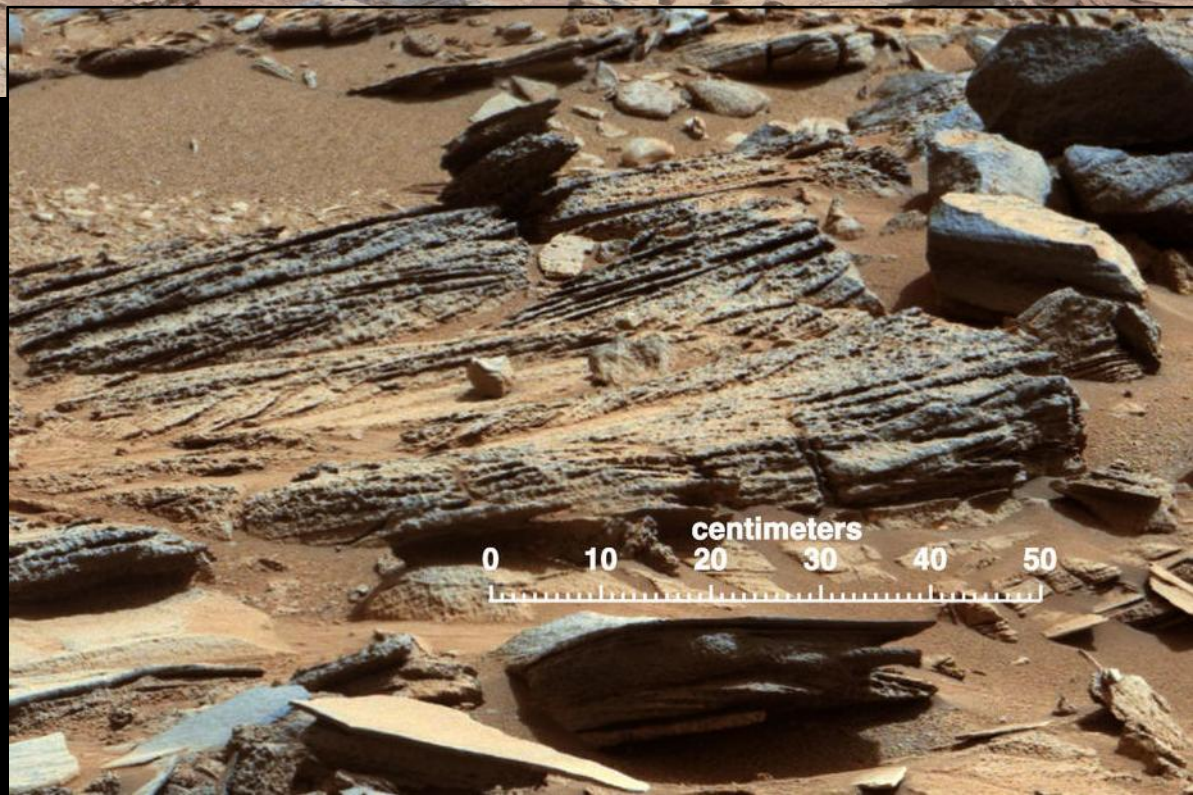




and so the Journey Began

Behold the Ancient Martian Riverbed





Fine layers that indicate sediment transport

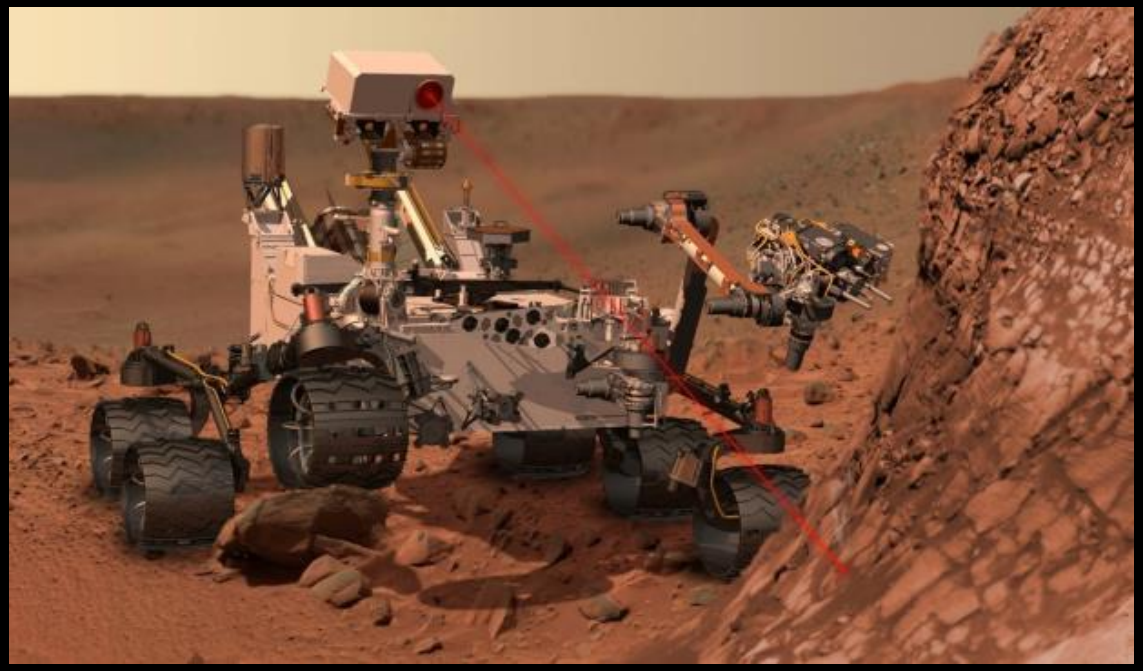
Phylosilicates formed in the presence of water

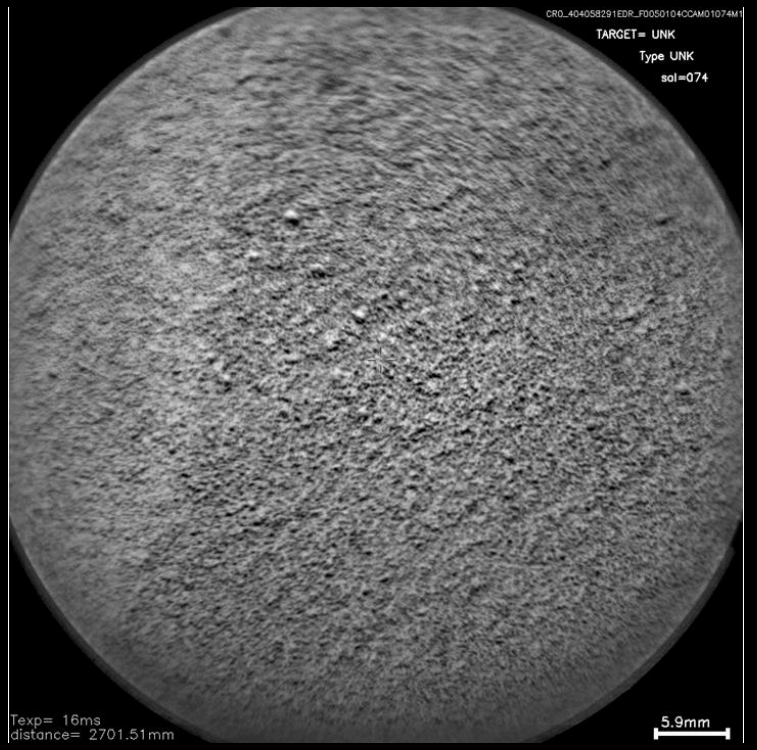
Neutral soil alkalinity

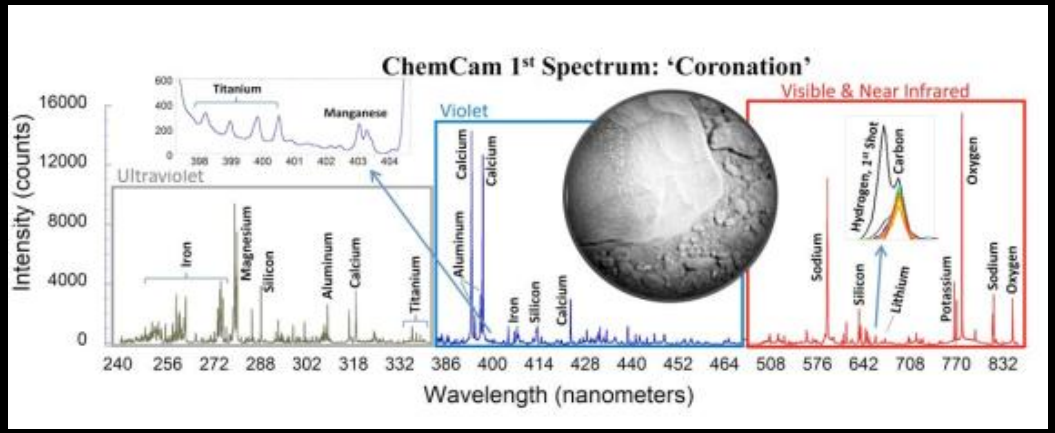
Scooping the Soil

Lasers on Mars

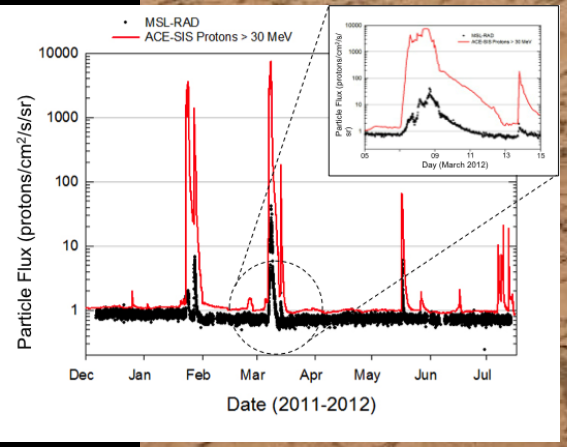
A Laser (ChemCam)

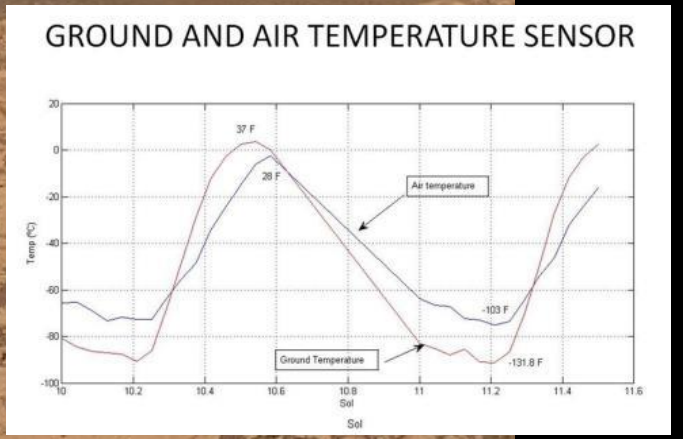






Mars Weather



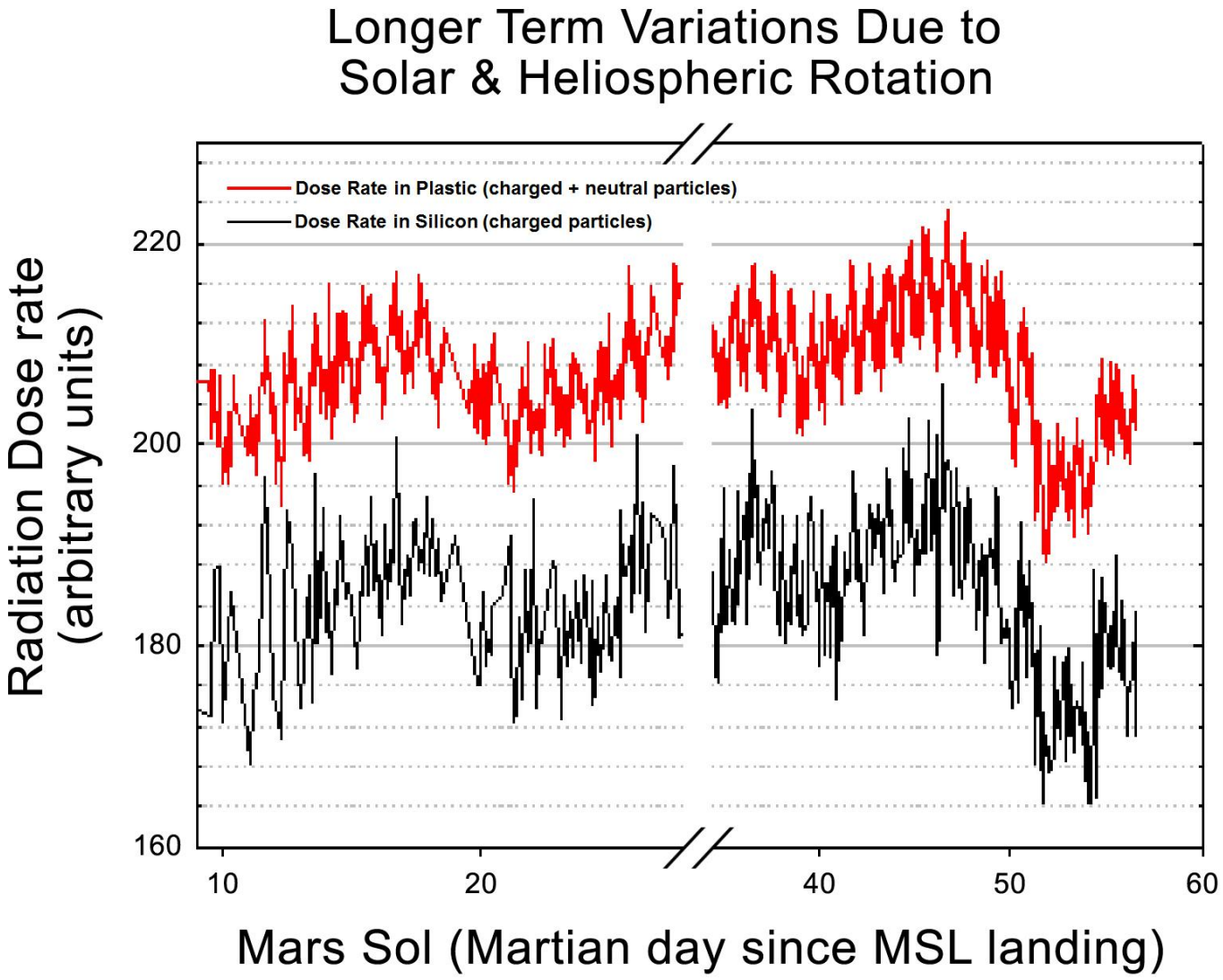


Mars Weather @MarsWxReport 5h

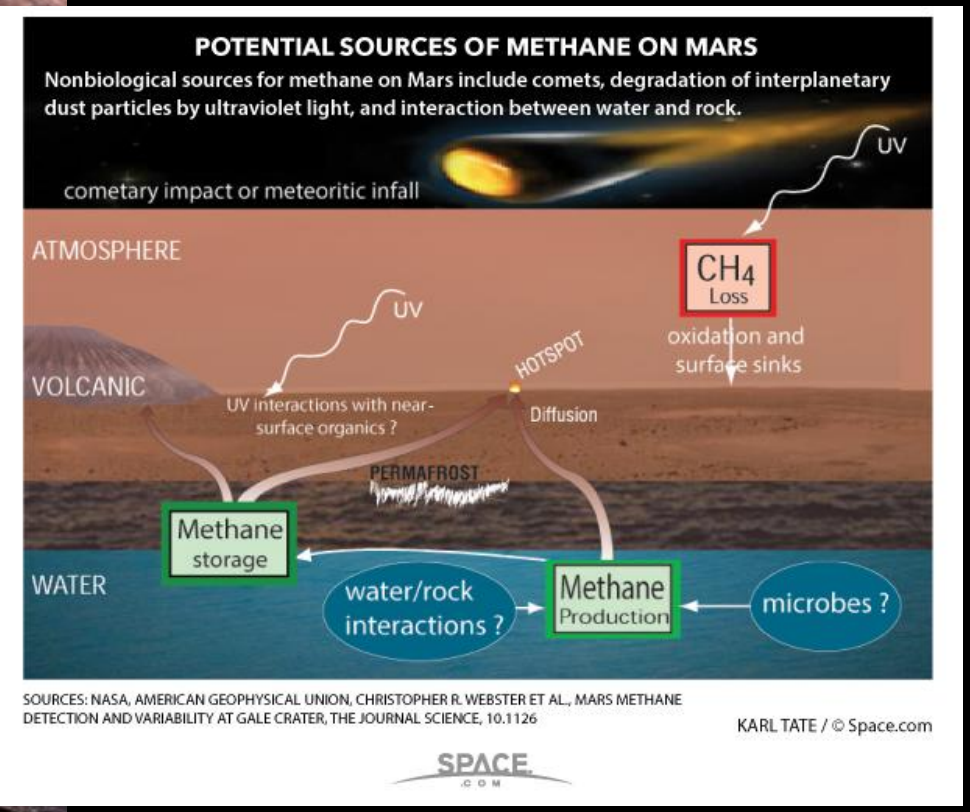
Sol 76 (Oct 23, 2012): Sunny, high -1C/30F, low -72C/-97F, pressure higher at 7.91 hPa, wind E at 7.2kmh/4.5mph, daylight 6am-5pm

Expand

Mars Radiation

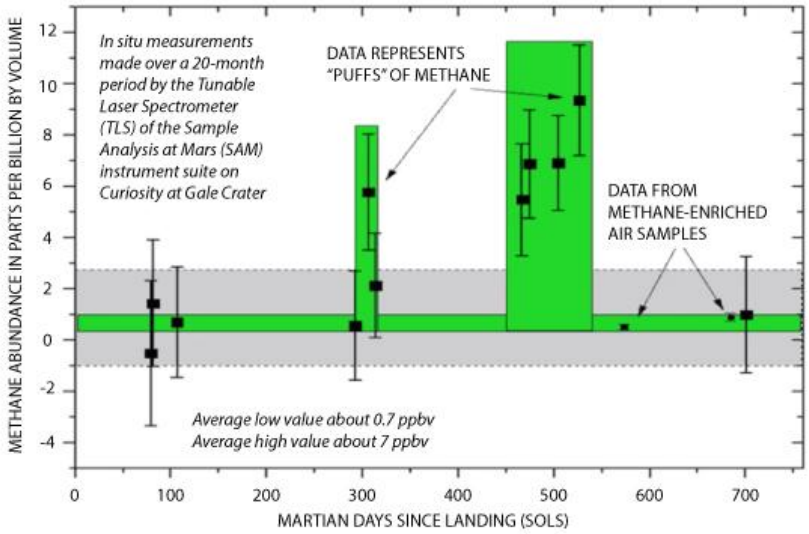


Methane on Mars



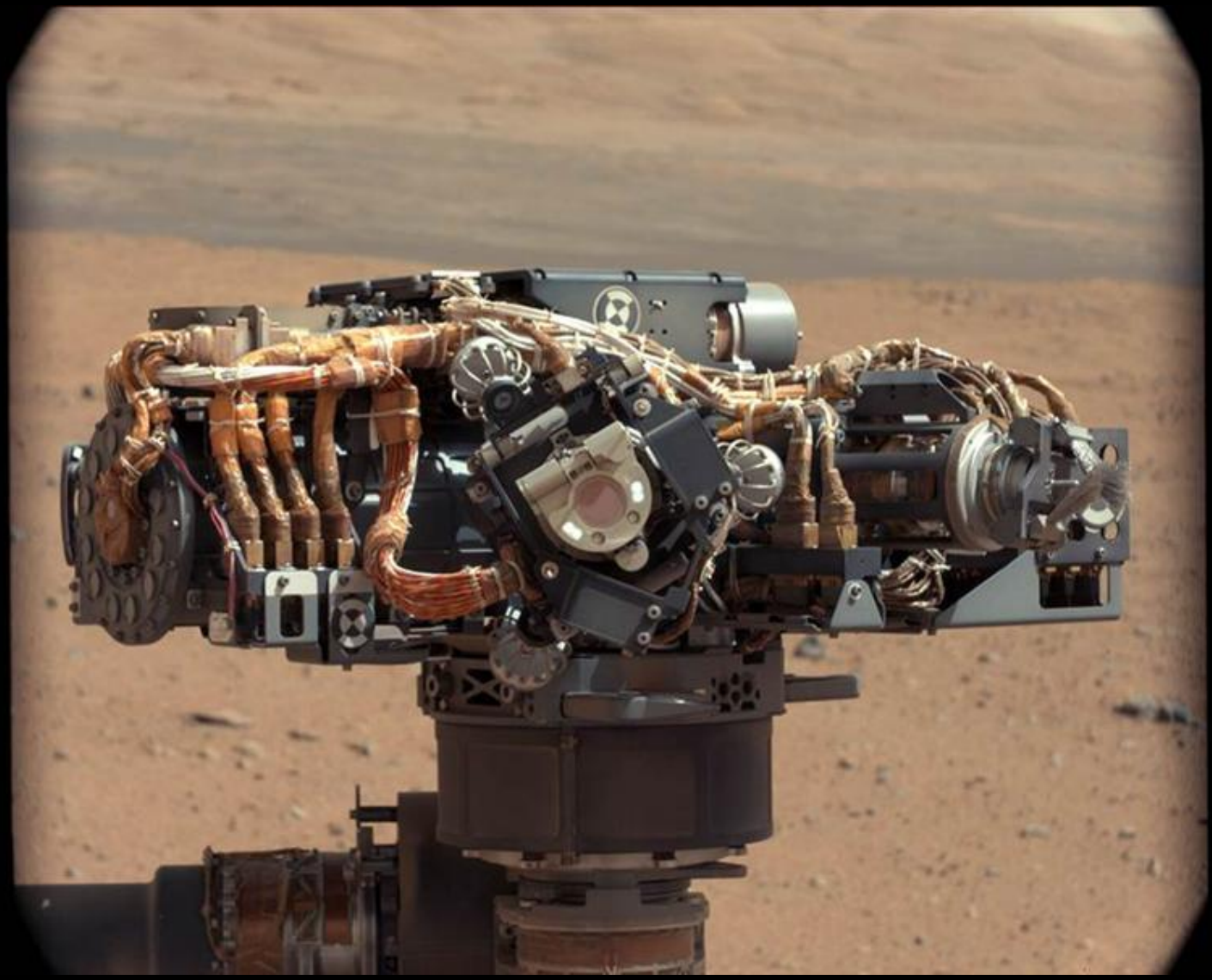
The Curiosity rover on Mars has detected methane in the atmosphere, which indicates the presence of organic chemistry, either today or in the distant past. The source of the methane is unknown, but it could have been created by either geological processes or life forms.

METHANE DETECTED IN MARS ATMOSPHERE BY CURIOSITY

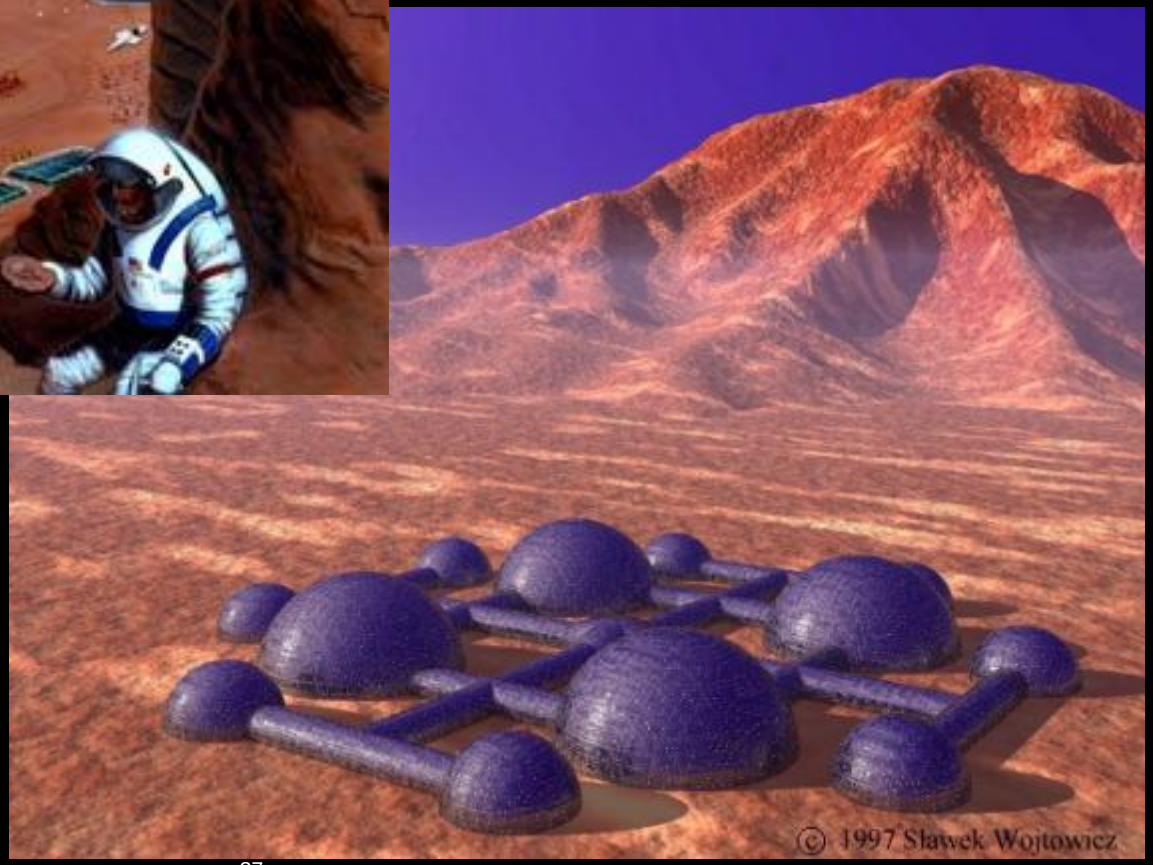


http://www.youtube.com/watch?v=CP3cud3QIaM&sns=tw

Intelligence on Mars



Would You Want to Live on Mars?
#journeytomars



Who Knows What Is Over The Next Horizon

@Doctor_Astro

- Over a 1000 of engineers and scientists made this a reality
- 12 countries contributed scientific instruments or have participating scientists on the project
- All the images returned to Earth are publically available minutes after they arrive **because this is our rover**

http://mars.jpl.nasa.gov/msl/