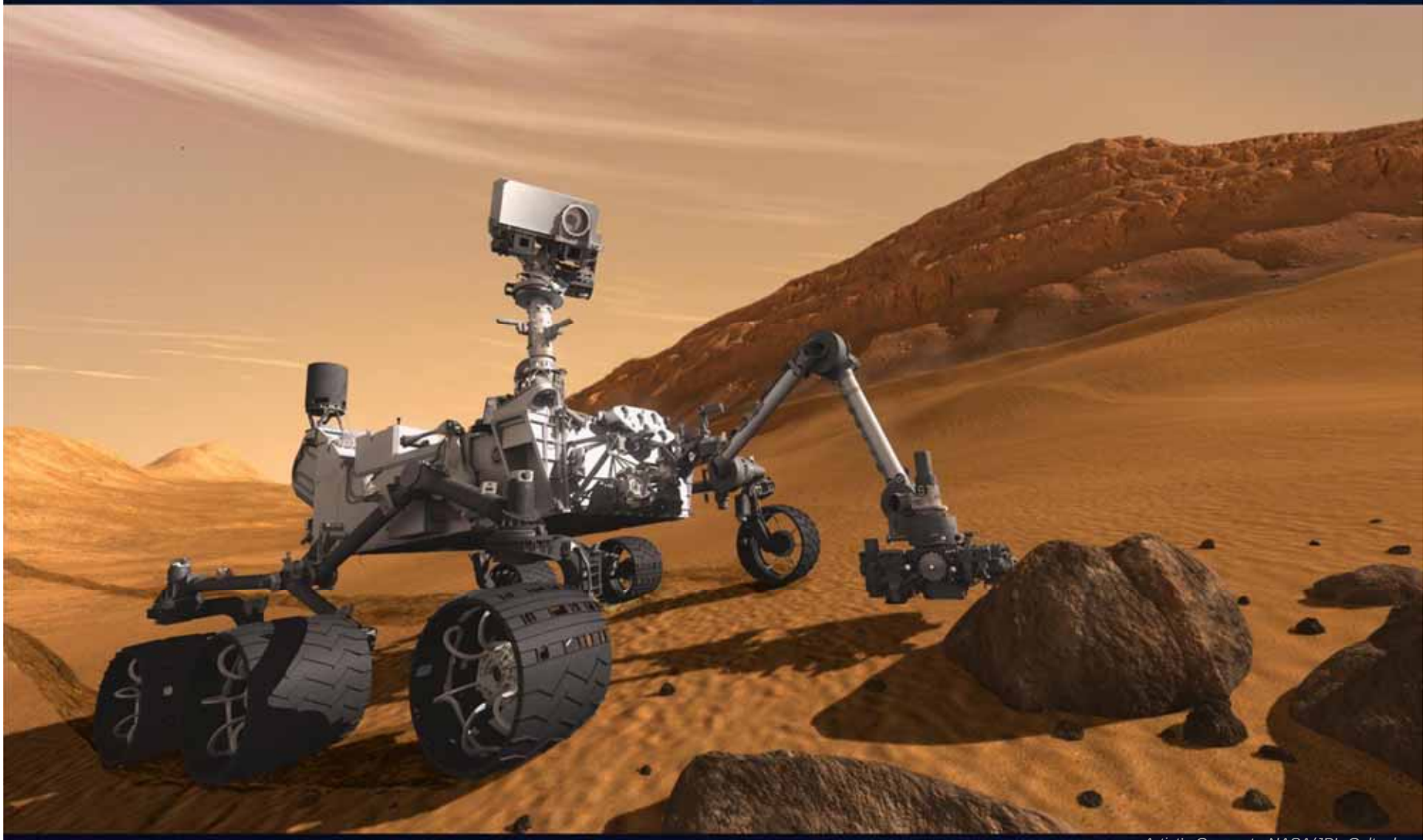
CURIOSITY:
Big Mars Rover for Big Mars Science!



Artist's Concept. NASA/JPL-Caltech

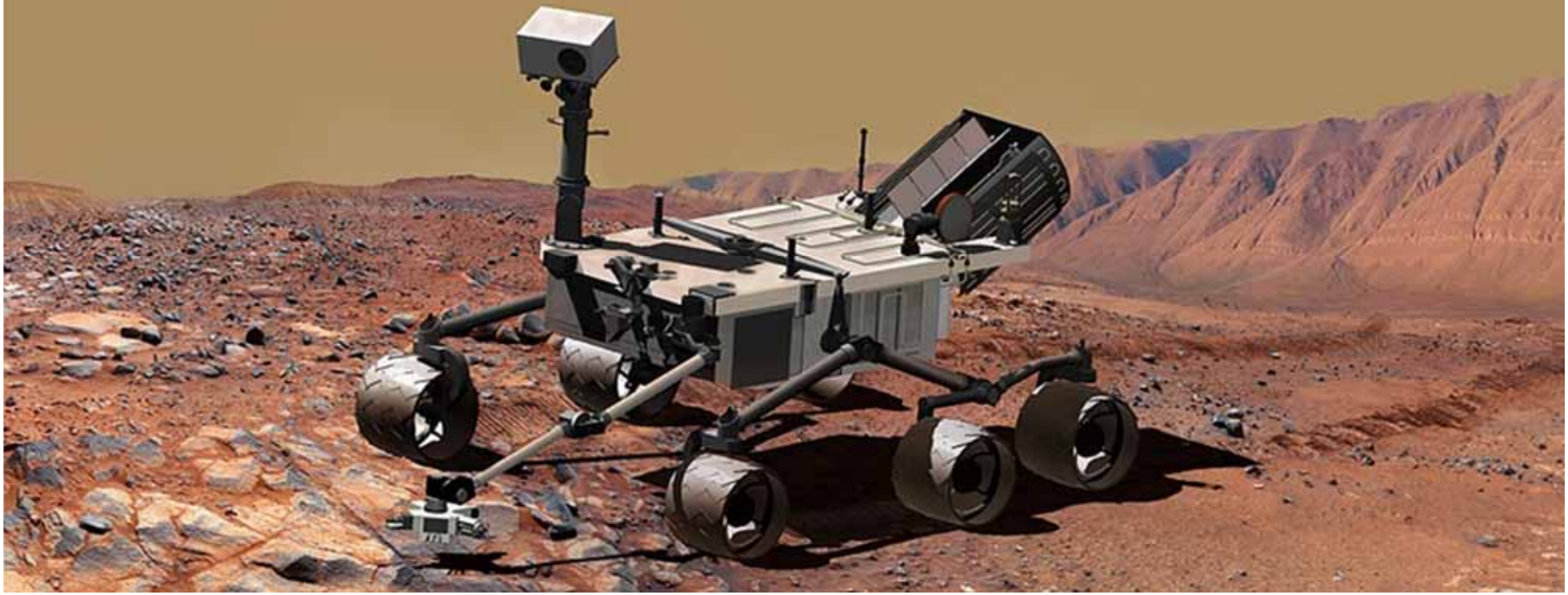
Enabling Capabilities

A Robotic Field Geologist

- Access to a site mapped from orbit
- Long life, mobility, capability to explore a local region
- Remote sensing and contact science

A Mobile Geochemical Laboratory

- A broad and flexible payload including analytical laboratory instruments
- Ability to acquire and process dozens of rock and soil samples
- An integrated science team and operations strategy



Scientific Objectives for MSL

Explore and quantitatively assess a local region on Mars' surface as a potential habitat for life, past or present.

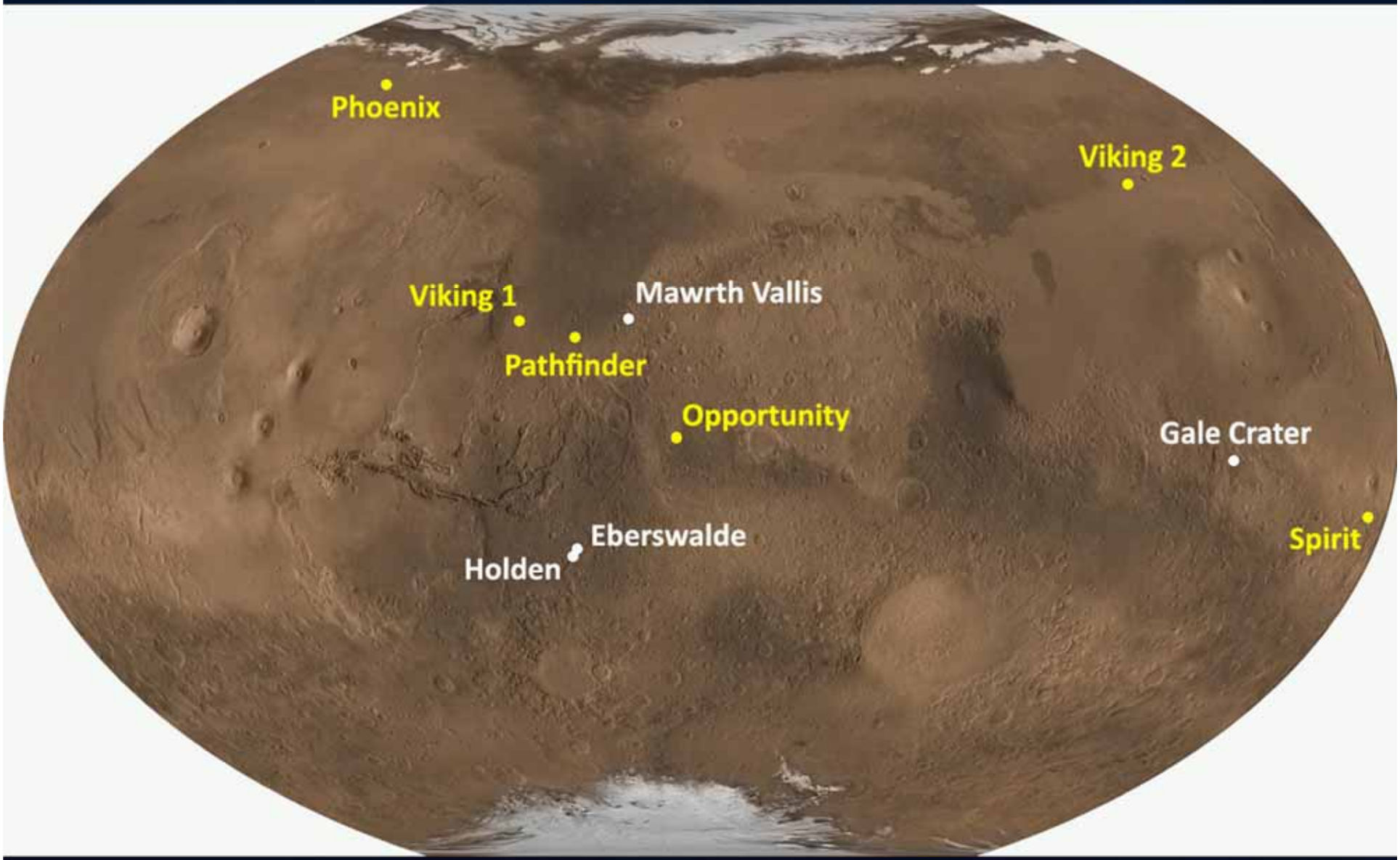
A. Assess the biological potential of at least one target environment.
   1. Determine the nature and inventory of organic carbon compounds.
   2. Inventory the chemical building blocks of life (C, H, N, O, P, S).
   3. Identify features that may represent the effects of biological processes.

B. Characterize the geology and geochemistry of the landing region at all appropriate spatial scales (i.e., ranging from micrometers to meters).
   1. Investigate the chemical, isotopic, and mineralogical composition of martian surface and near-surface geological materials.
   2. Interpret the processes that have formed and modified rocks and regolith.

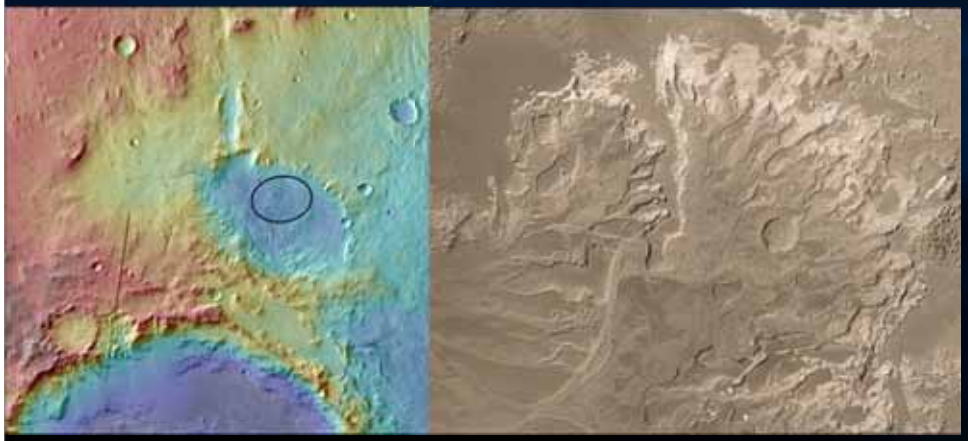
C. Investigate planetary processes of relevance to past habitability, including the role of water.
   1. Assess long-timescale (i.e., 4-billion-year) atmospheric evolution processes.
   2. Determine present state, distribution, and cycling of water and CO_2.

D. Characterize the broad spectrum of surface radiation, including galactic cosmic radiation, solar proton events, and secondary neutrons.

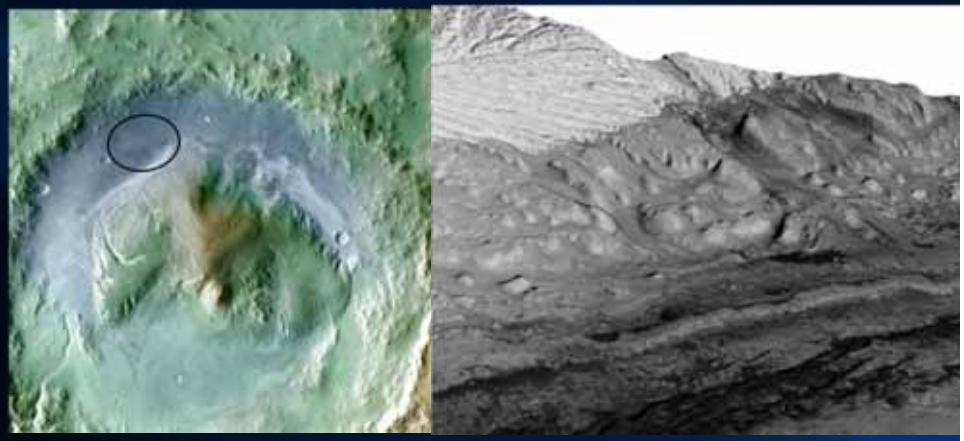
Previous and MSL Landing Sites
(USA! USA! USA!)



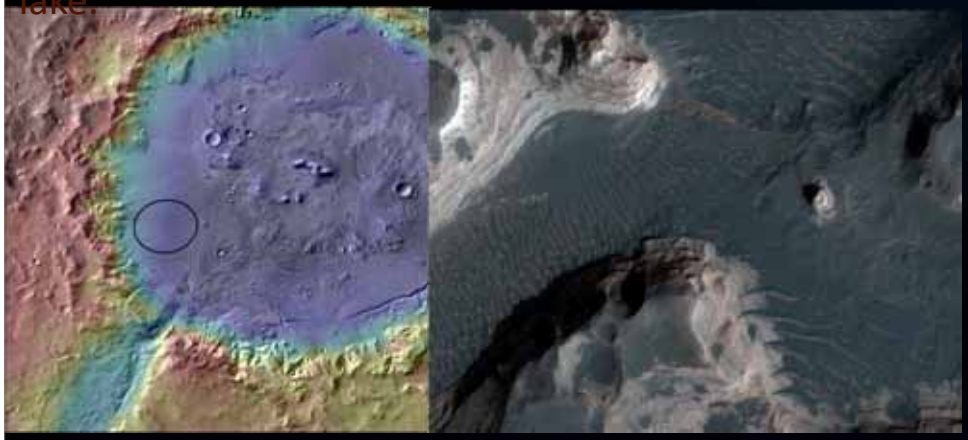
MSL Final Candidate Landing Sites



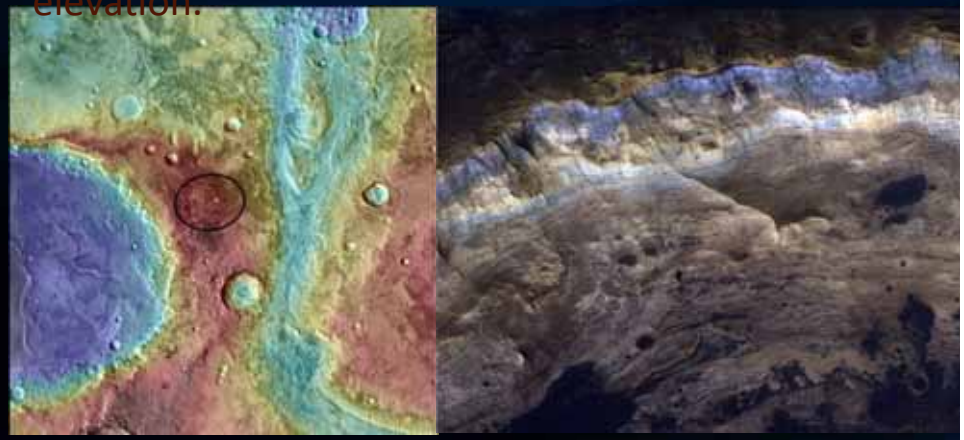
Eberswalde Crater (24 ° S, 327 ° E, -1.5 km) contains a clay-bearing delta formed when an ancient river deposited sediment, possibly into a lake.



Gale Crater (4.5 ° S, 137 ° E, -4.5 km) contains a 5-km sequence of layers that vary from clay-rich materials near the bottom to sulfates at higher elevation.



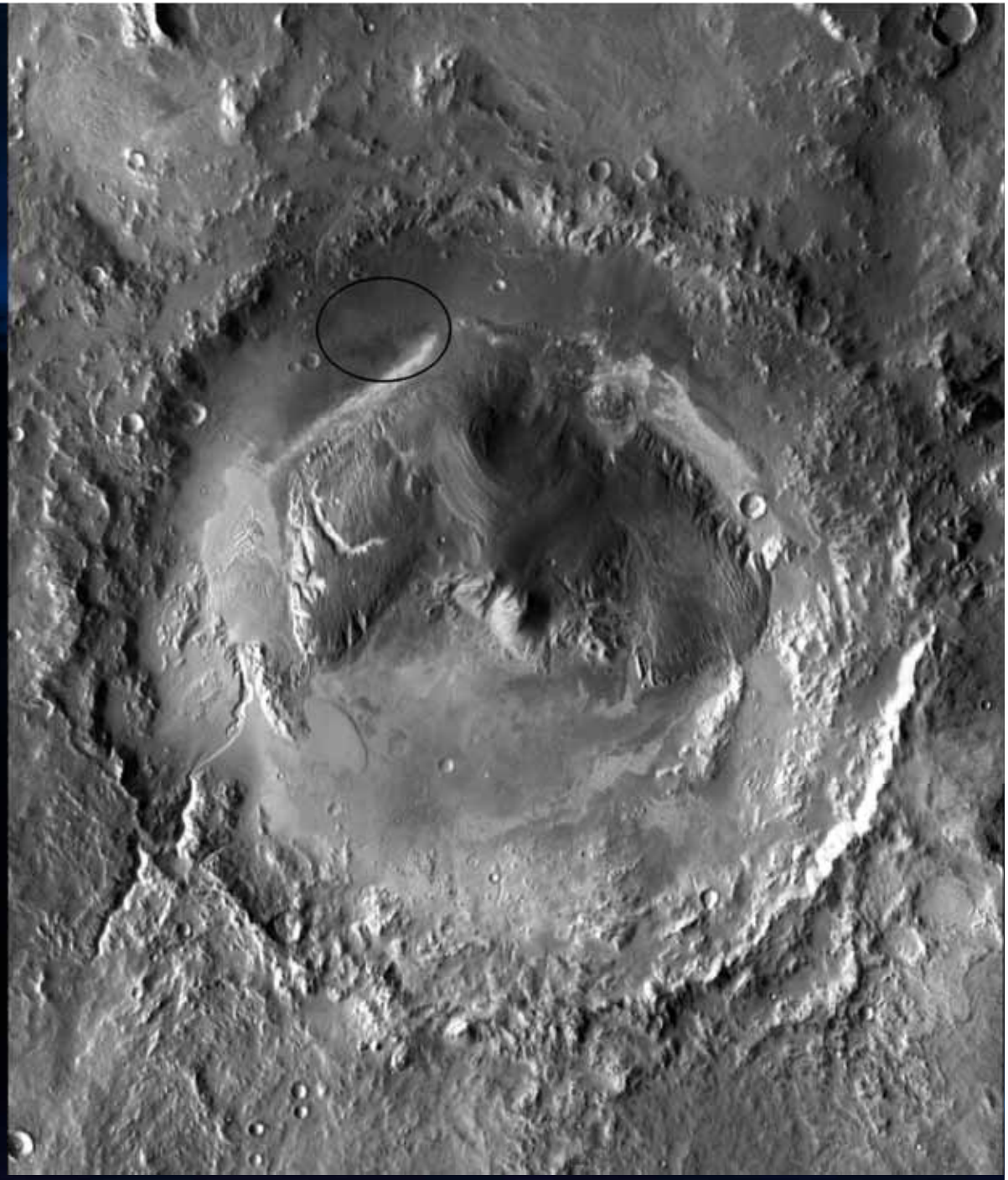
Holden Crater (26 ° S, 325 ° E, -1.9 km) has alluvial fans, flood deposits, possible lake beds, and clay-rich sediment.



Mawrth Vallis (24 ° N, 341 ° E, -2.2 km) exposes layers within Mars' surface with differing mineralogy, including at least two kinds of clays.

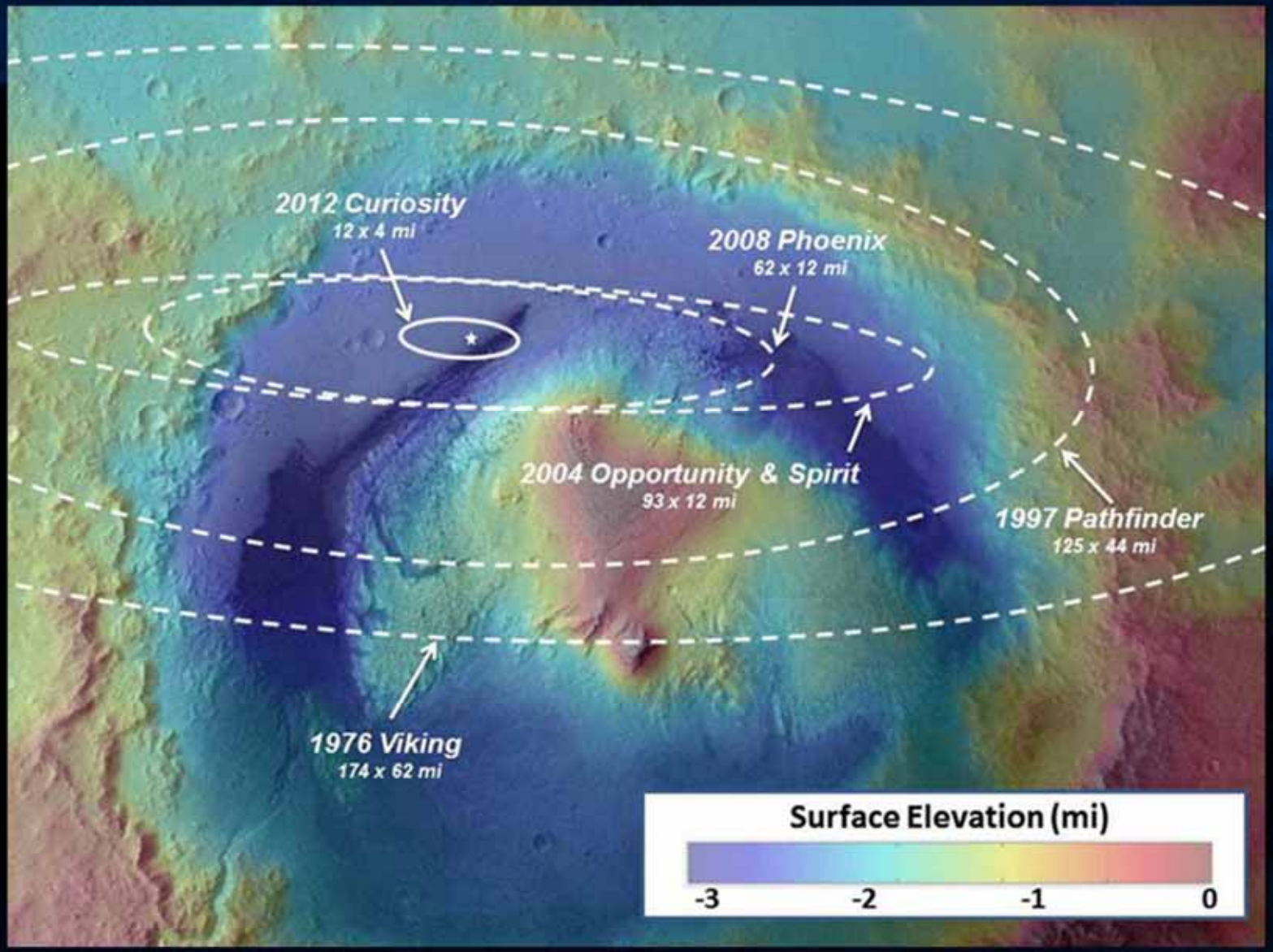
Gale Crater is about
96 miles wide.

It has many
rock layers for
Curiosity to explore,
from canyons
to channels,
all in one place!

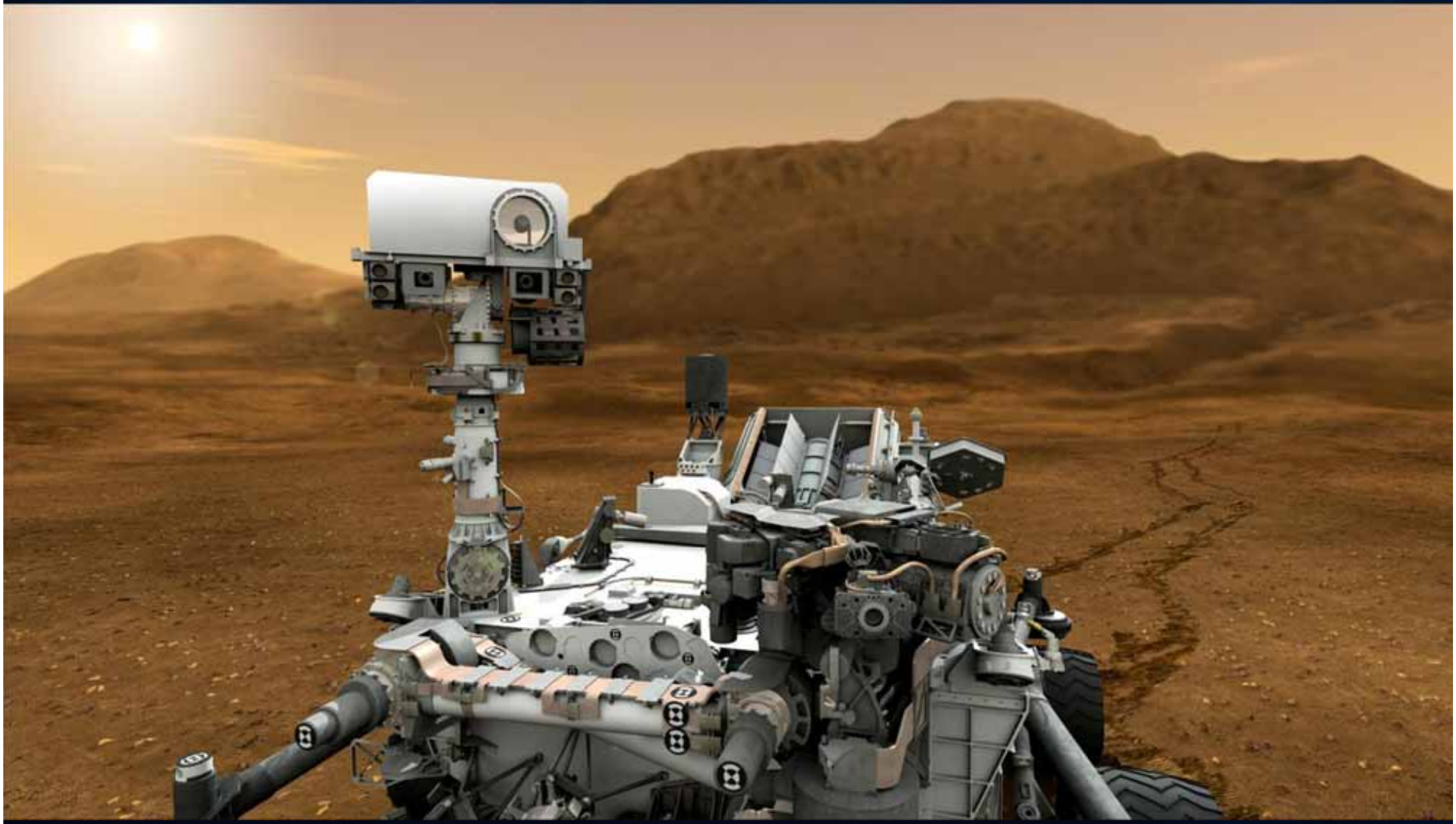


NASA/JPL-Caltech

Improvement in Mars Landing Uncertainty vs. Time

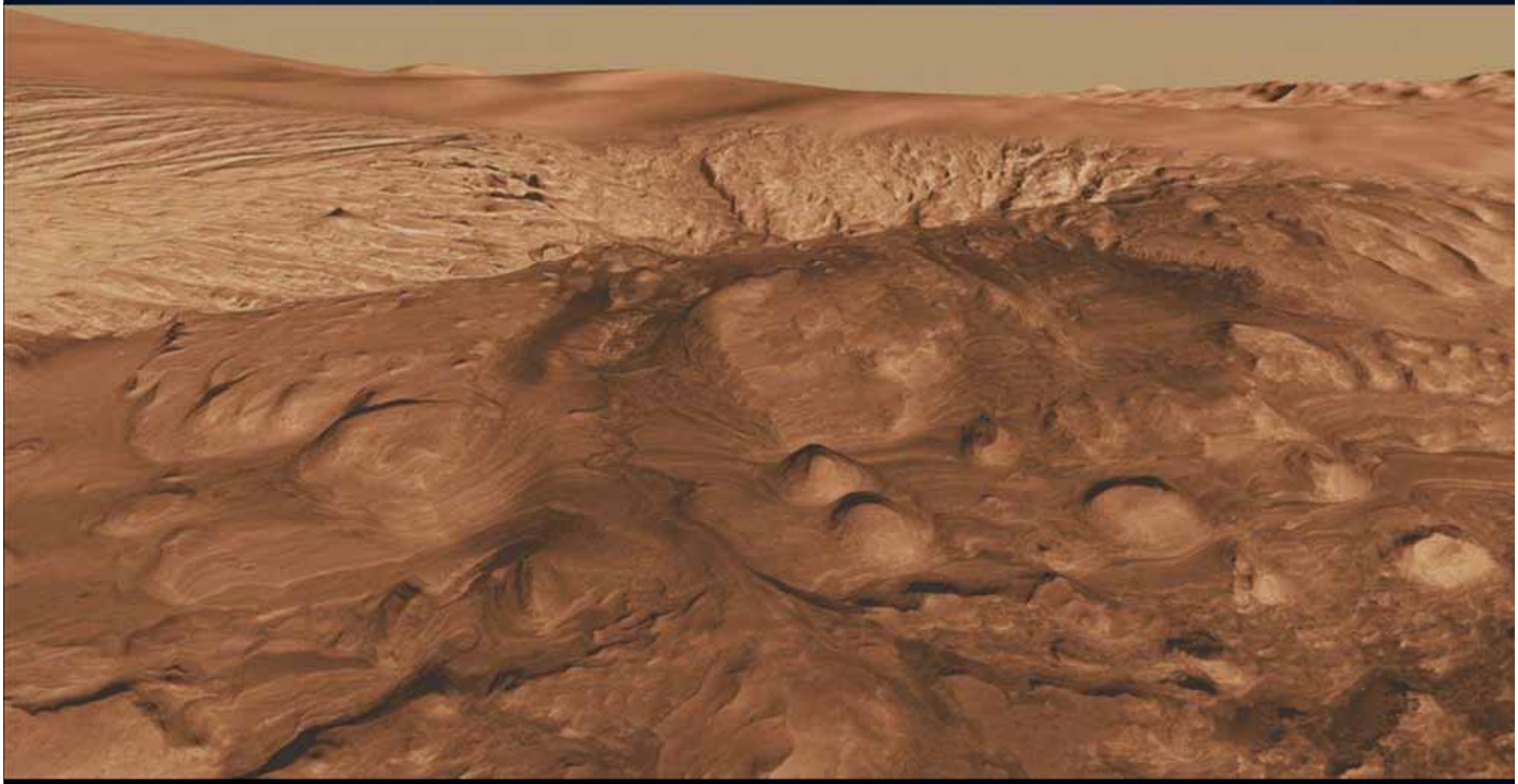


Curiosity will pick up where other Mars rovers left off. Beyond signs of water, the rover will look for signs of organics, the chemical building blocks of life.



Artist's Concept. NASA/JPL-Caltech

The 3-mile-high mound has multiple rock layers.
Each rock layer reveals a different time in Mars' history.
Some have clays and sulfates, which both form in water.



Beyond signs of water, the rover will look for
signs of organics, the chemical building blocks of life.

NASAJPL-Caltech/ESA/UA

Curiosity: By the Numbers

Length: 10 feet (3 m)

Width: 9 feet (2.8 m)

Height: 7 feet (2.1 m)

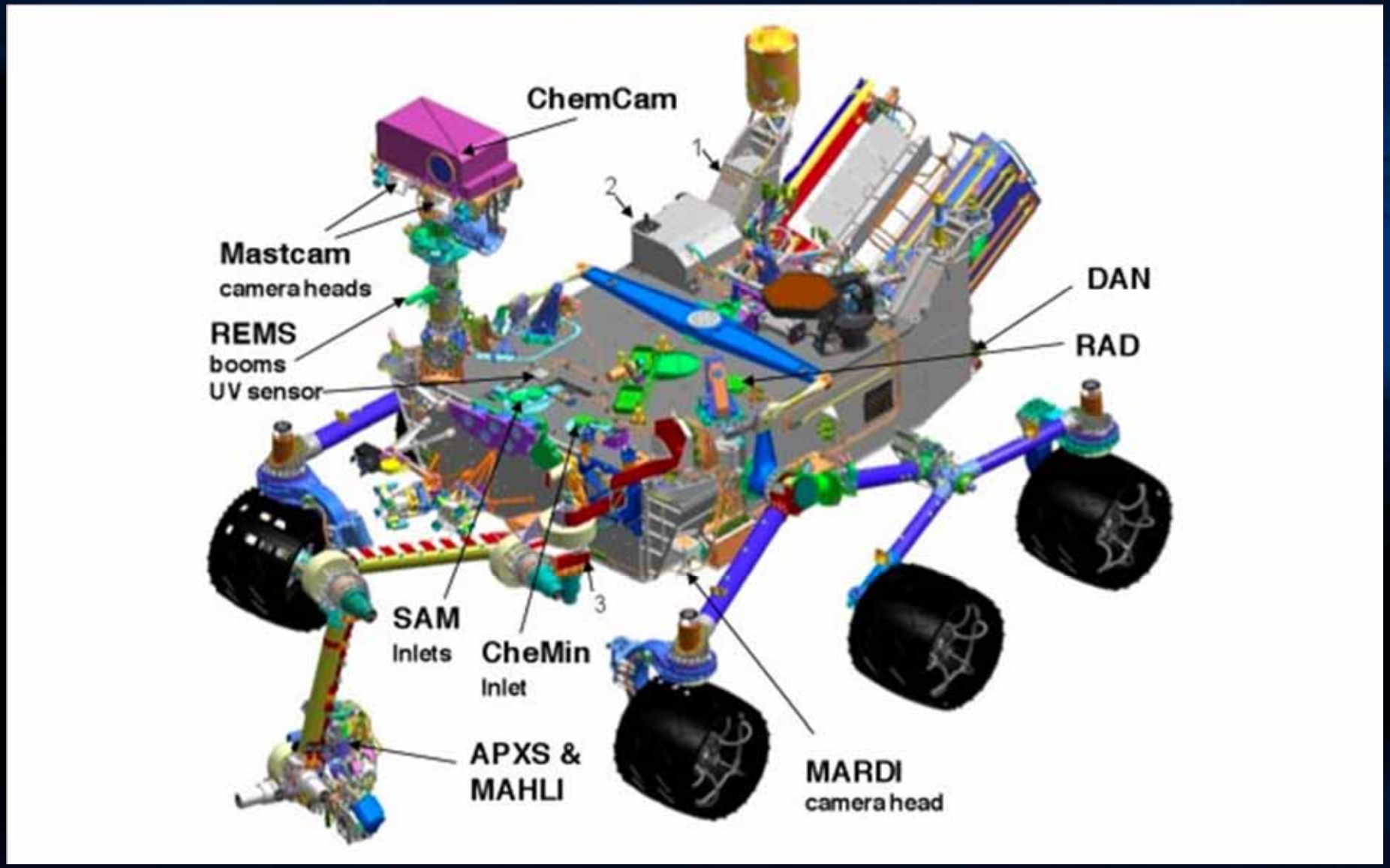
Mass: 1,982 pounds (899 kg)

Arm Length: 7 feet (2.1 m)

Wheel Diameter: 20 inches (0.5 m)

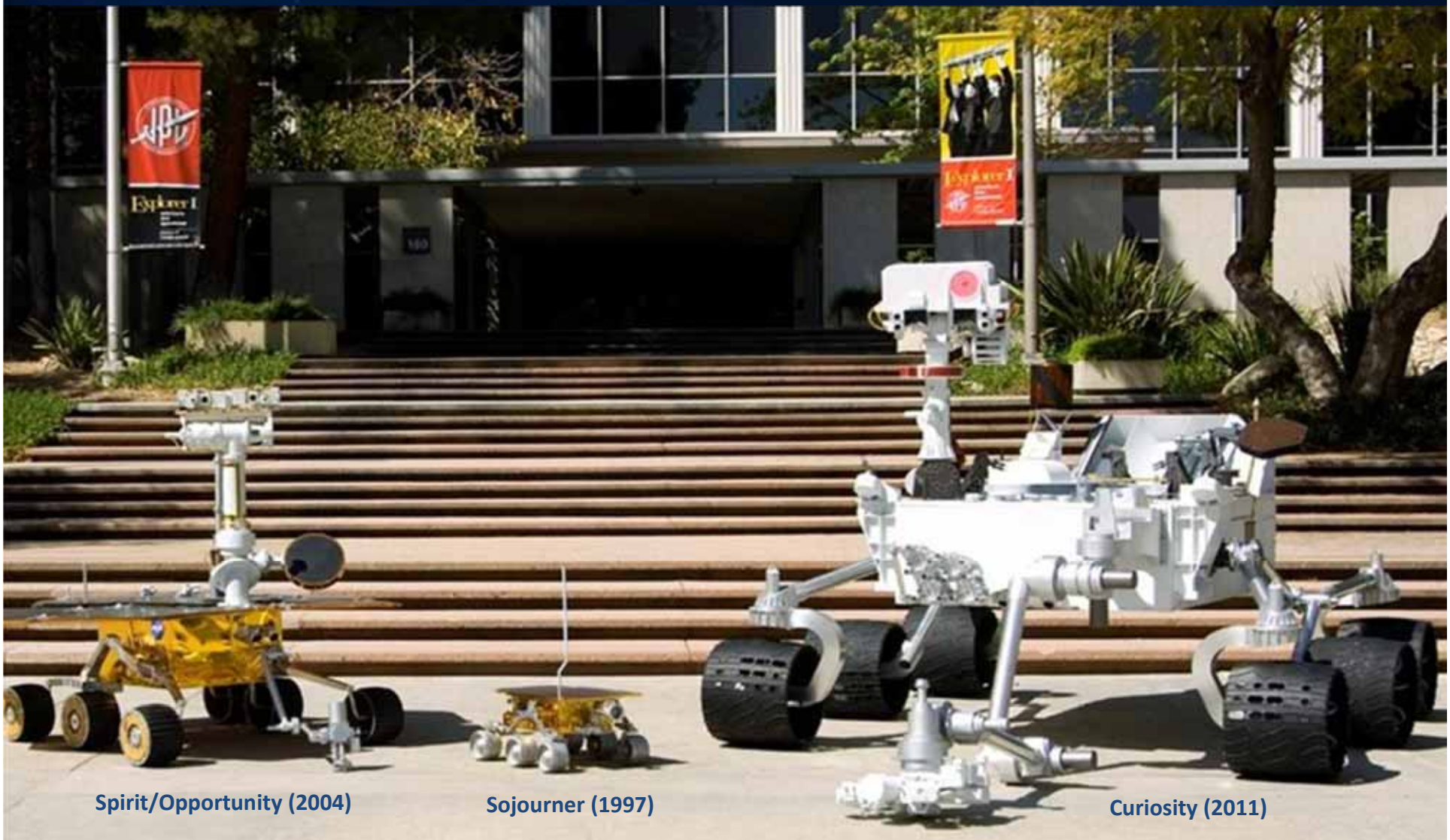
Science Instruments: 10

Here are some of Curiosity's main tools for studying Mars. You can see that the rover is packed with tools!



NASA/JPL-Caltech

That's why Curiosity is so large.
It takes a car-sized rover to carry so many tools.



NASA/JPL-Caltech

MSL Mission Overview


*

CRUISE/APPROACH

- 9-10 month cruise
- Spinning cruise stage
- Arrive N. hemisphere summer

LAUNCH

- Nov. 2011
- Atlas V (541)

ENTRY, DESCENT, LANDING

- Guided entry and controlled, powered “sky crane” descent
- 20×25-km landing ellipse
- Discovery responsive for landing sites ±30º latitude, <0 km elevation
- ~1000-kg landed mass

SURFACE MISSION

- Prime mission is one Mars year
- Latitude-independent and long-lived power source
- 20-km range
- 85 kg of science payload
- Acquire and analyze samples of rock, soil, and atmosphere
- Large rover, high clearance; greater mobility than MPF, MER


*

* Artist's Renderings

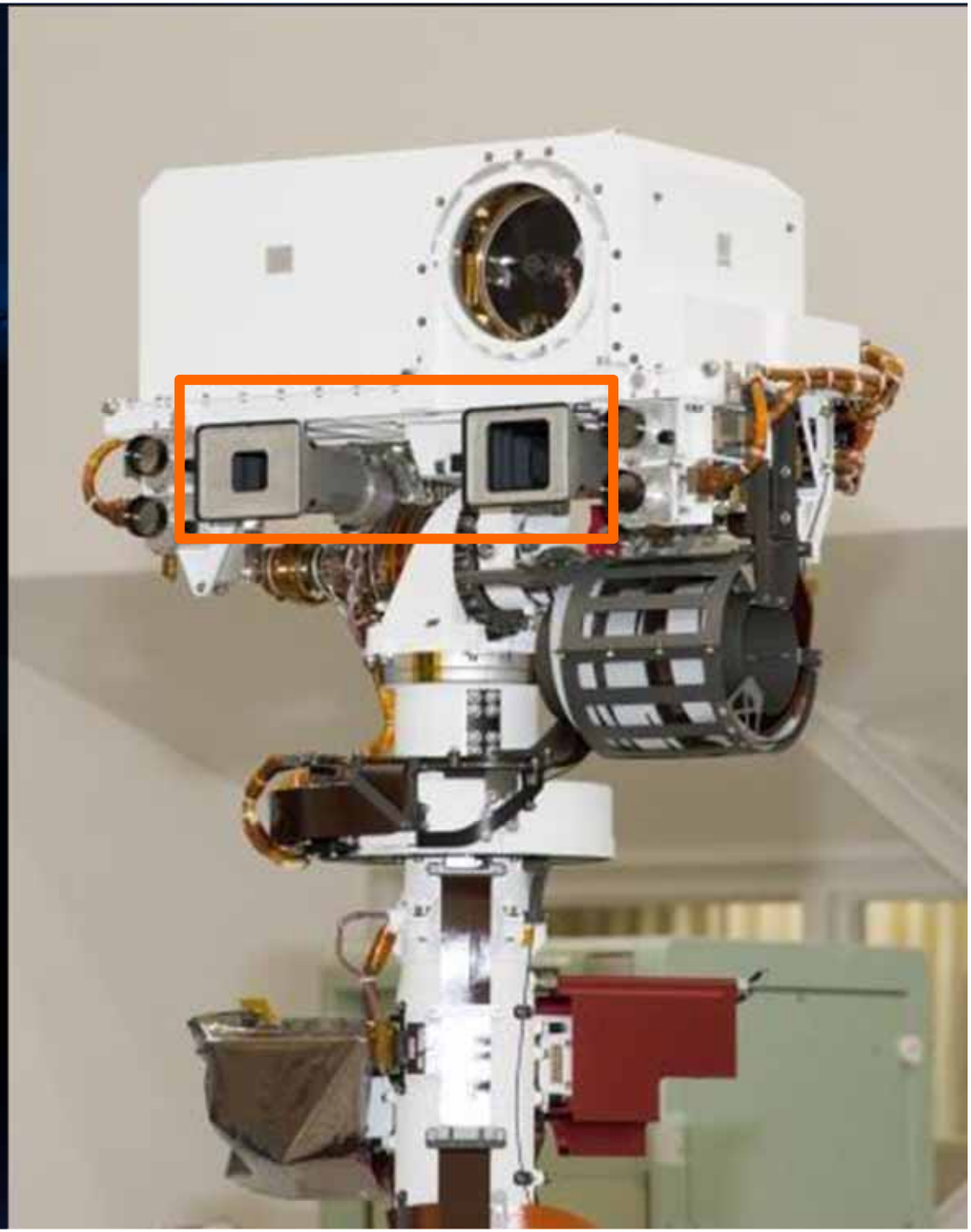
Among Curiosity's tools are seventeen cameras, a laser to zap rocks, and a drill to collect rock samples.

NASA/JPL-Caltech

Curiosity will use her camera “eyes” to take images of the Martian landscape and to study rock layers.

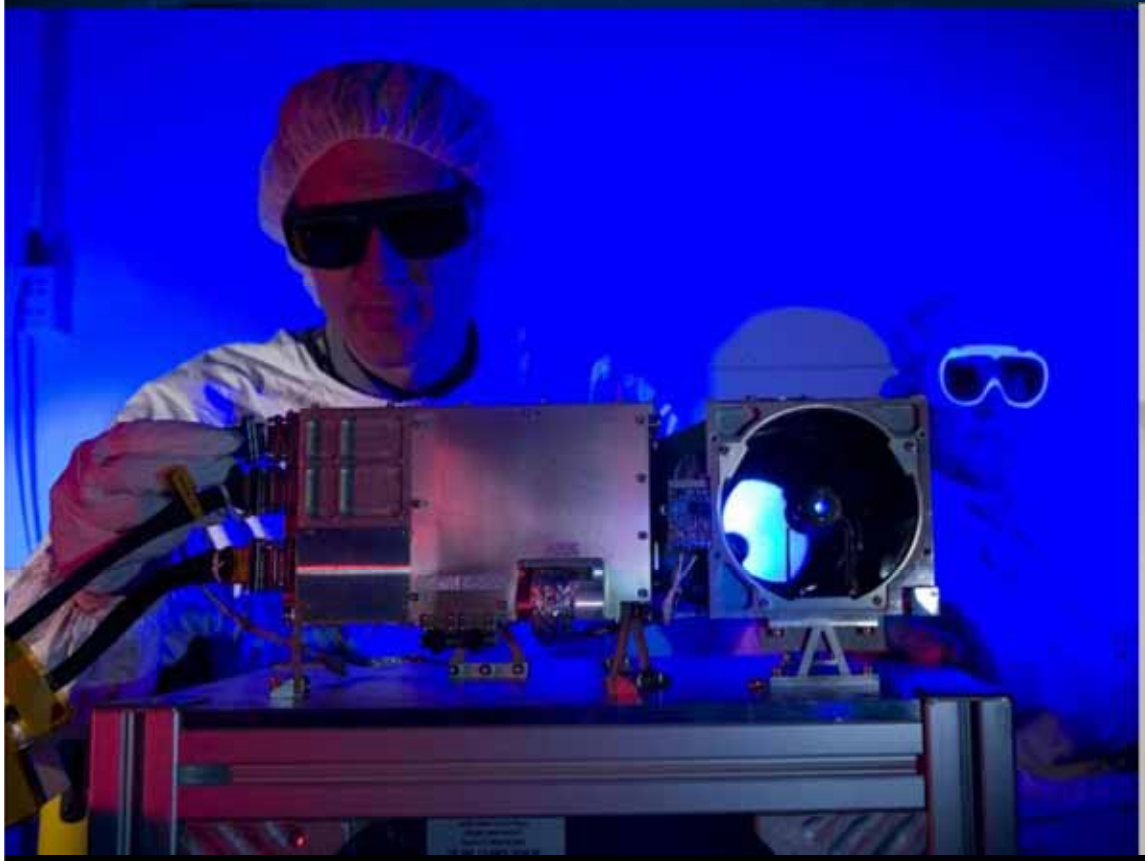
Some of these rock layers hold clues to whether Mars could have ever been a habitat for life.

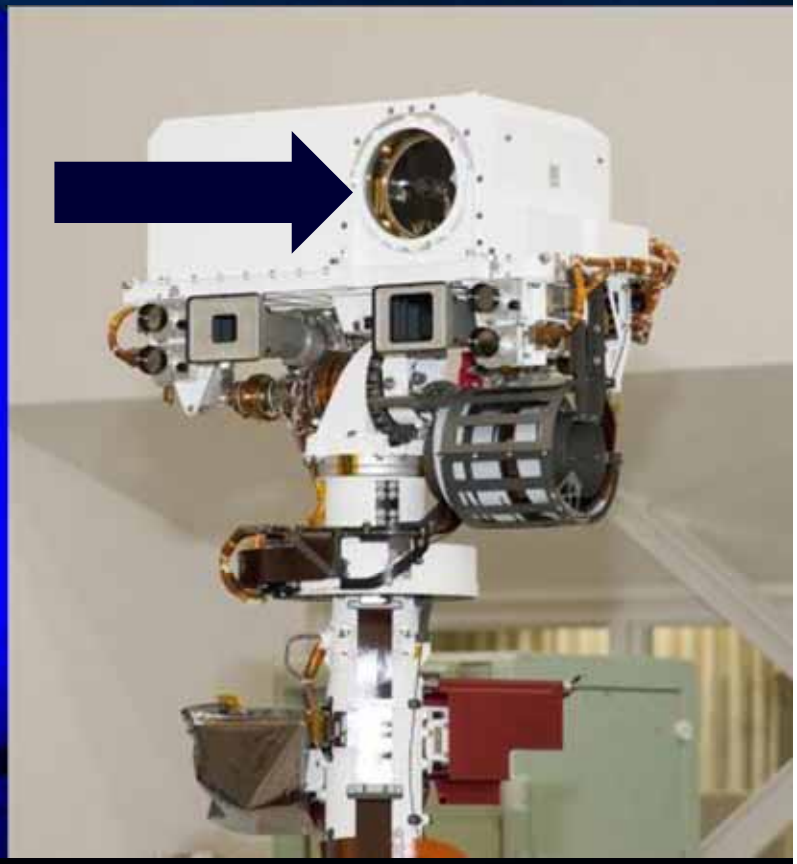
These two cameras are called Mastcam.



NASAJPL-Caltech

Engineers built a laser with a tool called a spectrometer, which detects chemical elements in rocks. It is called ChemCam.

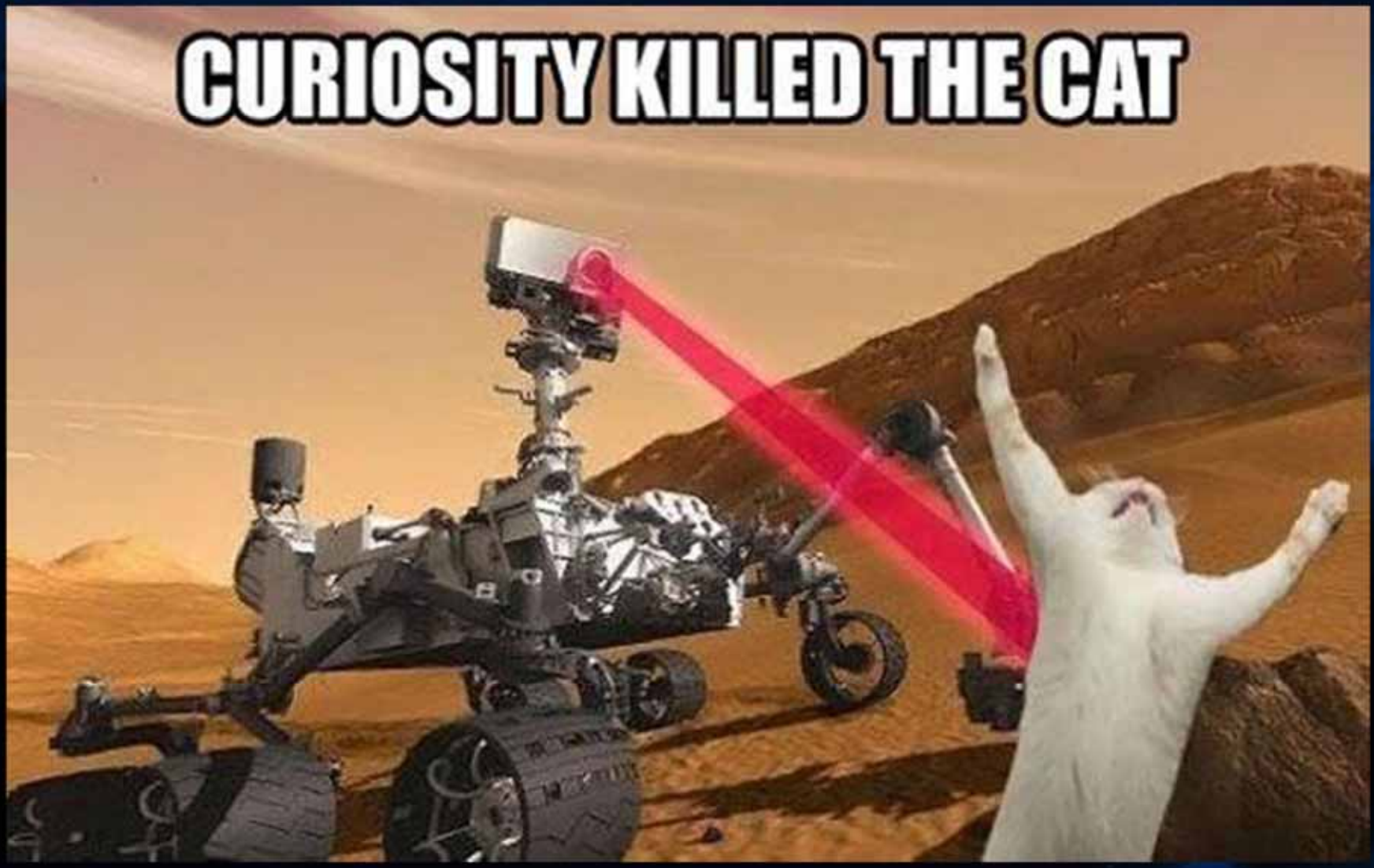




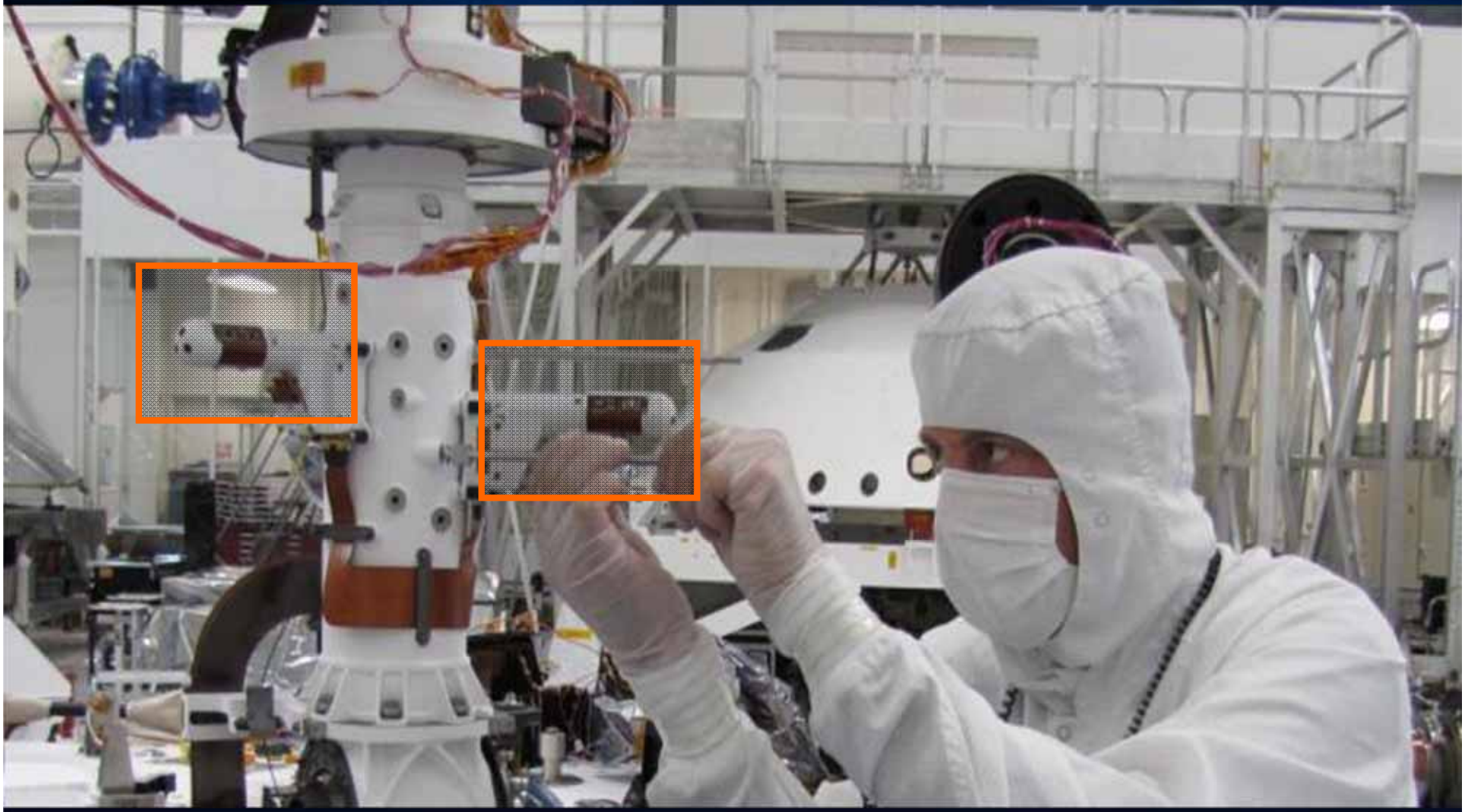
On Curiosity's "head" is ChemCam's laser system.

In its body is the part of the spectrometer that will detect different chemical elements in rocks.

NASAJPL-Caltech/LANL

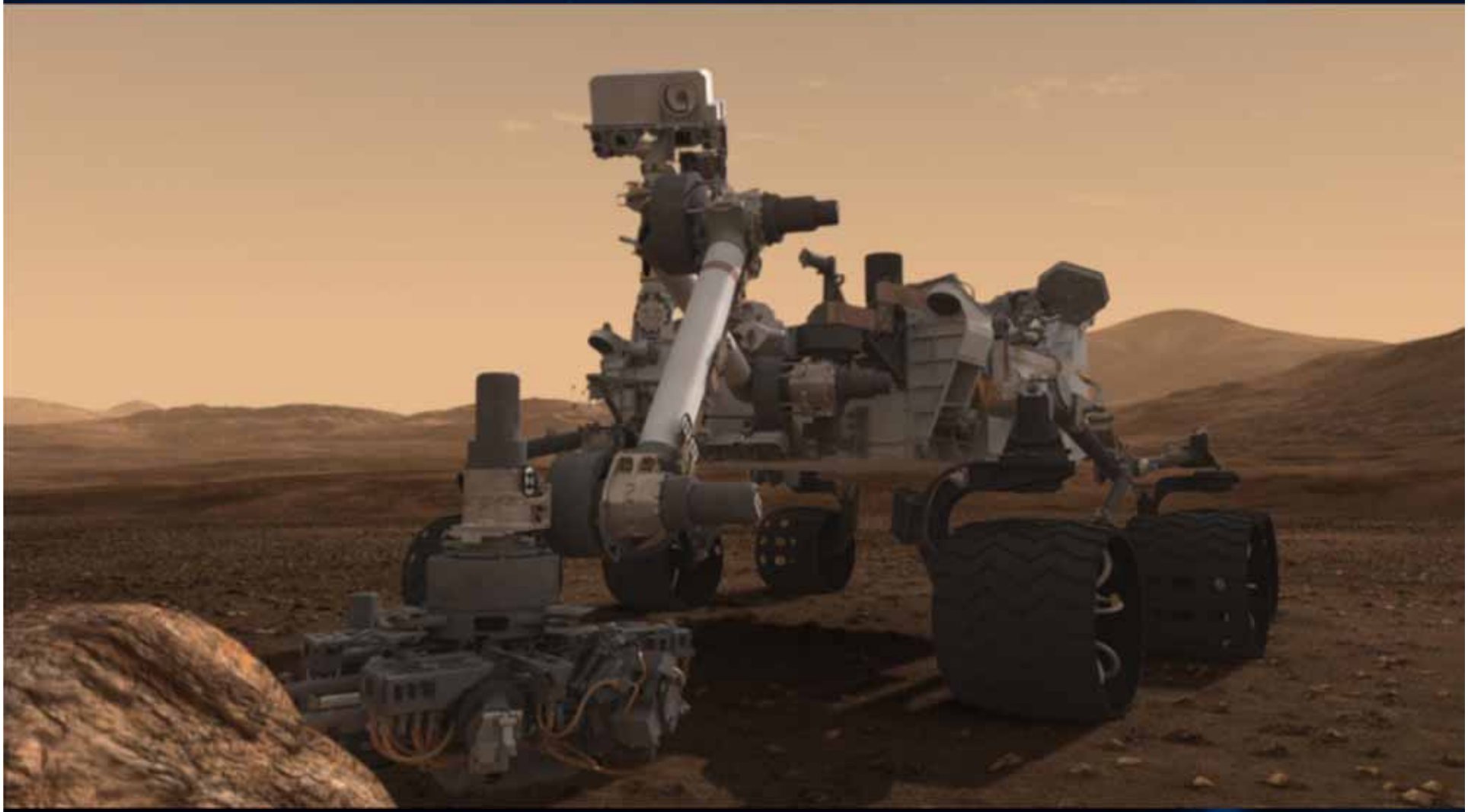

CURIOSITY KILLED THE CAT

Curiosity will be able to send weather reports from Mars too! Two little booms on the rover's mast ("neck") called REMS will monitor temperature, wind speed and direction. REMS also measures pressure and ultraviolet light.



NASAJPL-Caltech

Curiosity's seven-foot-long arm has tools built into its "hand."

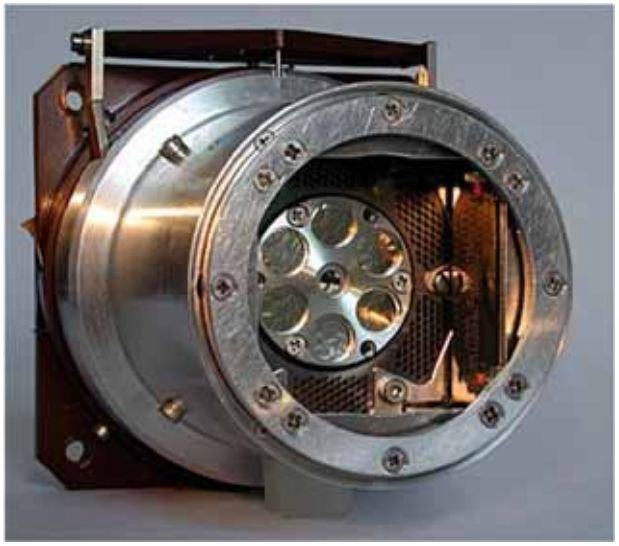


The "hand" will reach out and touch Mars, finding out about what the past environment was like.

Artist's Concept. NASA/JPL-Caltech

Curiosity has three more rock analyzers. Each has a special job.

APXS:
Identifies Chemical Elements in Rocks



On Hand

CHEMIN:
Identifies Minerals, including those formed in water

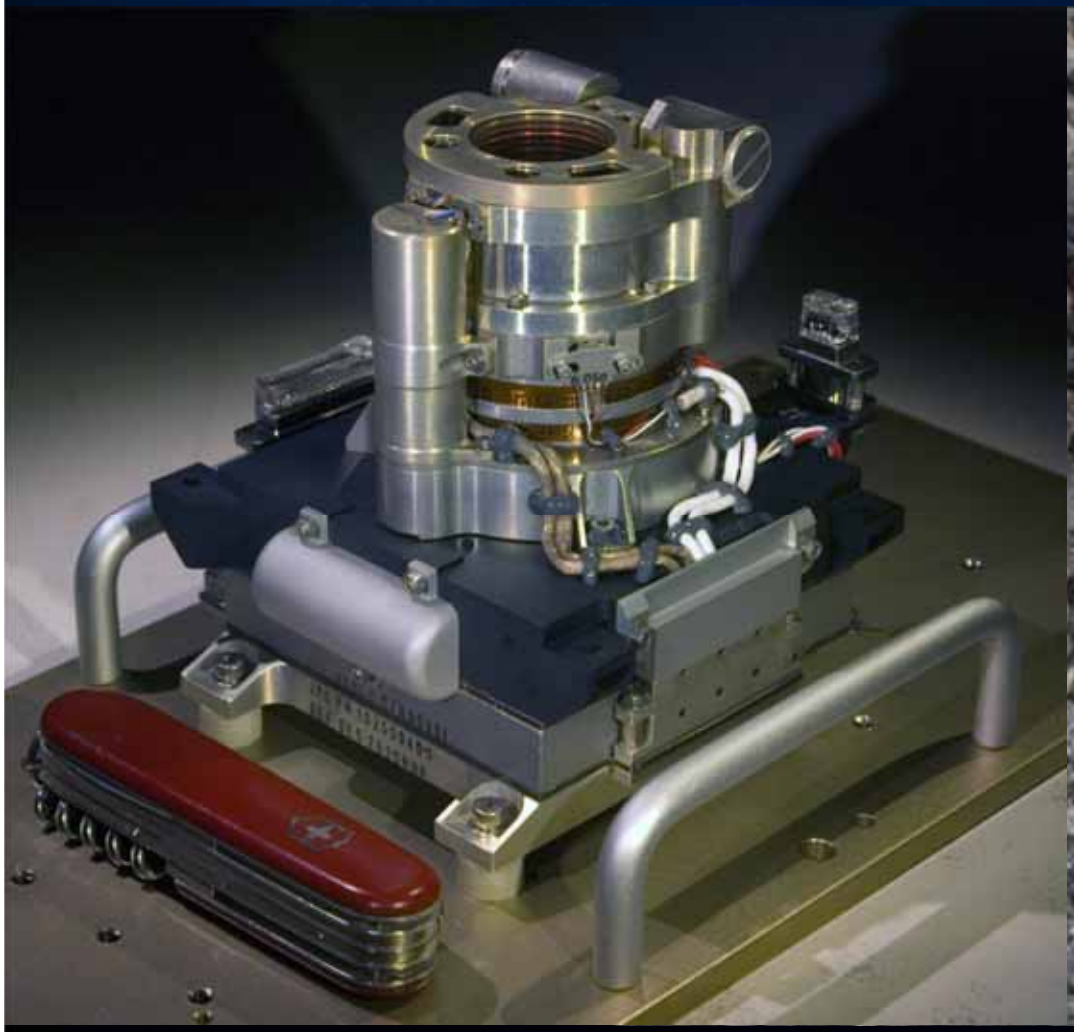
In Body

SAM:
Identifies Organics, the Chemical Building Blocks of Life

In Body

All will determine what the rocks and soils are made of. That data will tell scientists about whether Mars had the right chemistry for possibly supporting microbial life.

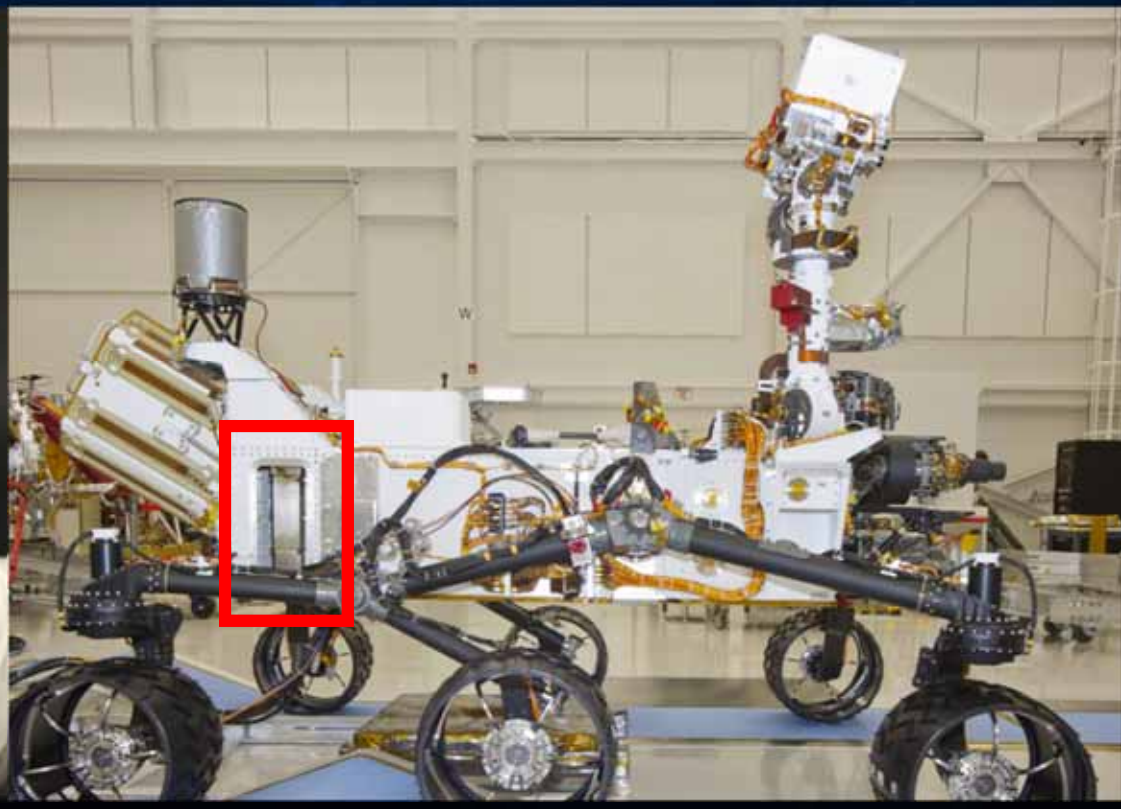
On its hand, Curiosity has a hand lens called MAHLI (a “magnifying glass”) for studying soil grains.



It can take photos of rocks far away too, and carries its own lighting to take photos at night.

NASAJPL-Caltech/MSSS

Curiosity also carries two radiation detectors.

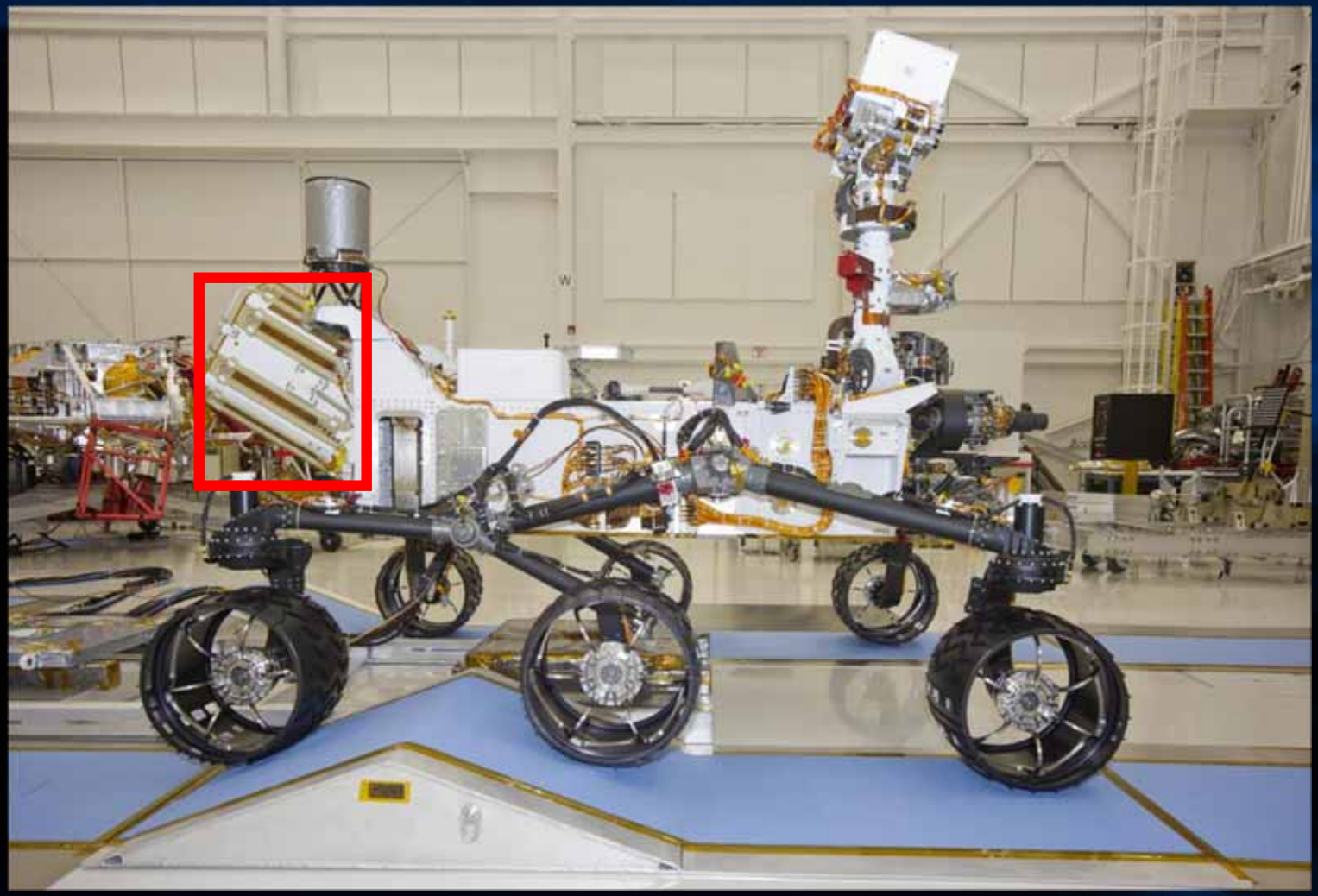


RAD will help scientists understand the Martian radiation environment to prepare for human exploration someday.

DAN will help scientists detect any water below the surface, whether in the soil or bound inside minerals.

NASA/JPL-Caltech

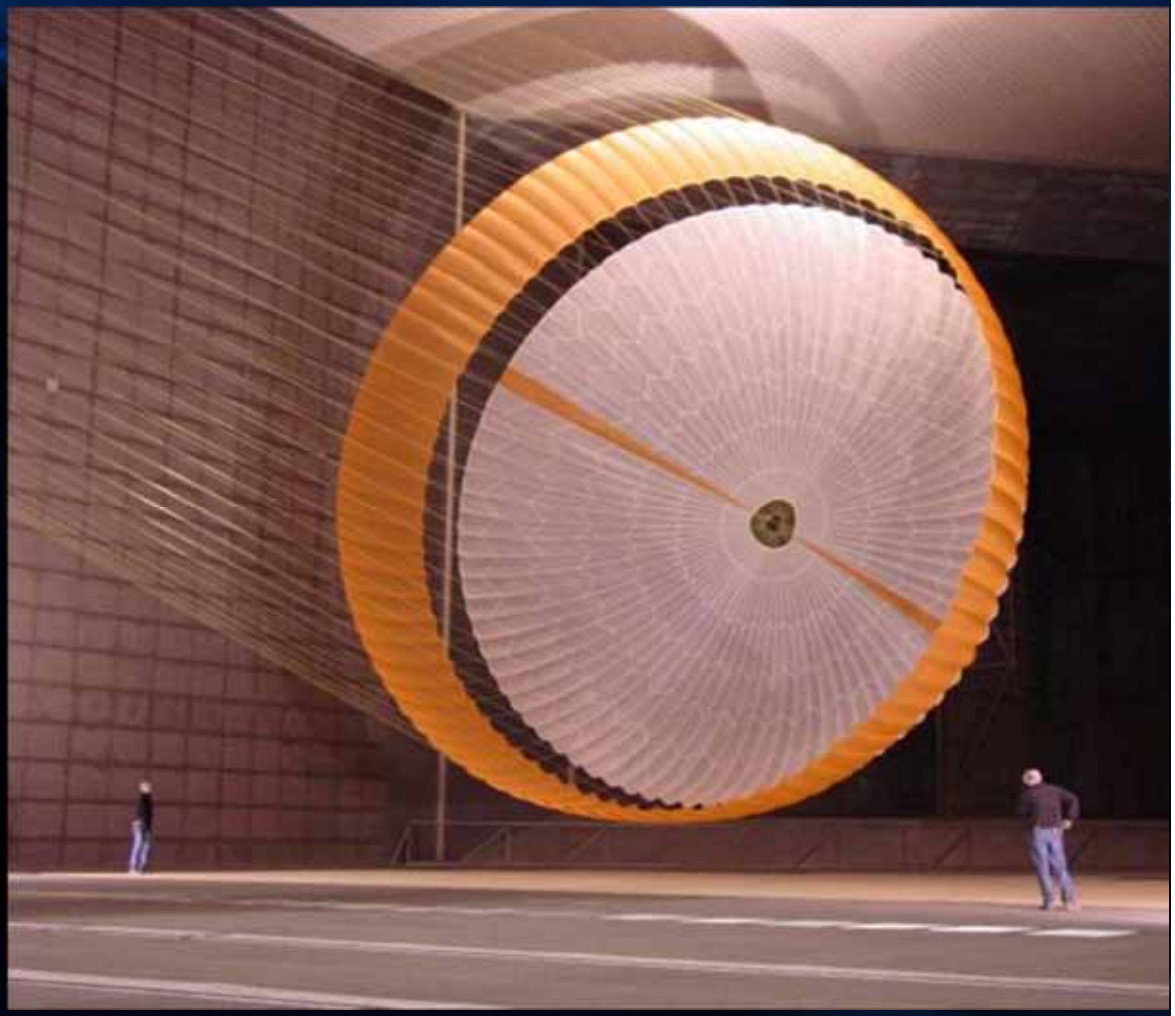
**To power these instruments,
Curiosity uses electricity provided by a battery
that is continuously recharged by heat from the natural
radioactive decay of plutonium-238.**



It will take about 110 watts of electricity to run the rover and its instruments.

NASA/JPL-Caltech

**To fit all these tools on the rover,
the team had to supersize everything,
from the capsule that holds the rover,
to the parachute that slows it down before landing.**

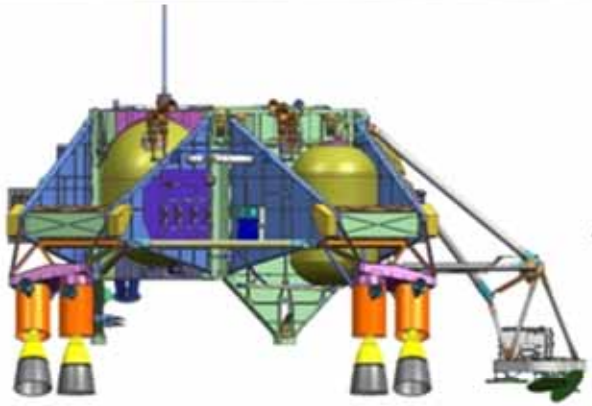


NASA/JPL-Caltech

To get to Mars, Curiosity will travel tucked safely inside a protective shell.

Cruise Stage

Back Shell



Descent Stage

Rover

Heat Shield

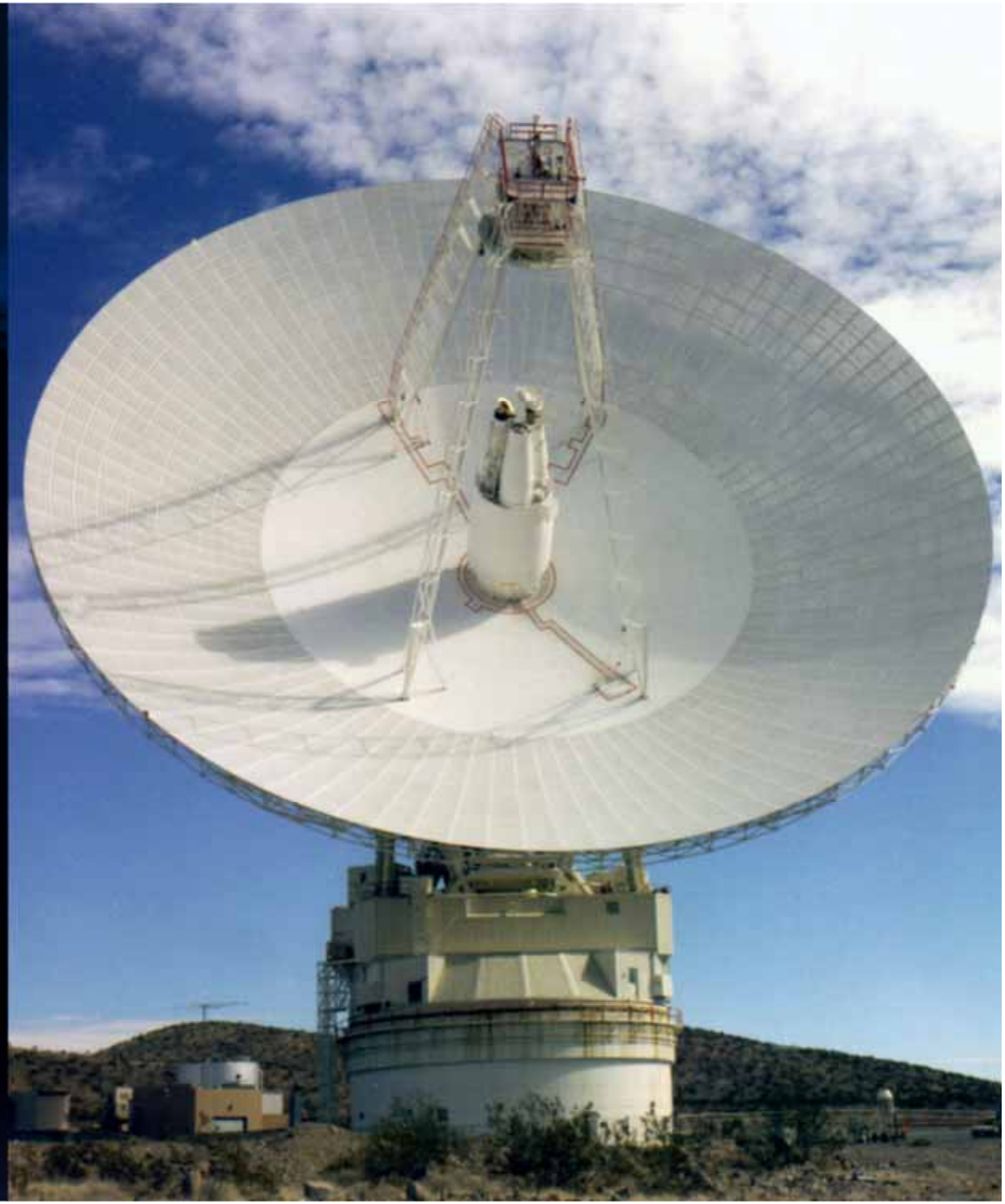
Curiosity will tell us about what it finds through the Deep Space Network.

Three centers with large communications antennas receive the signals:

in California,

Spain,

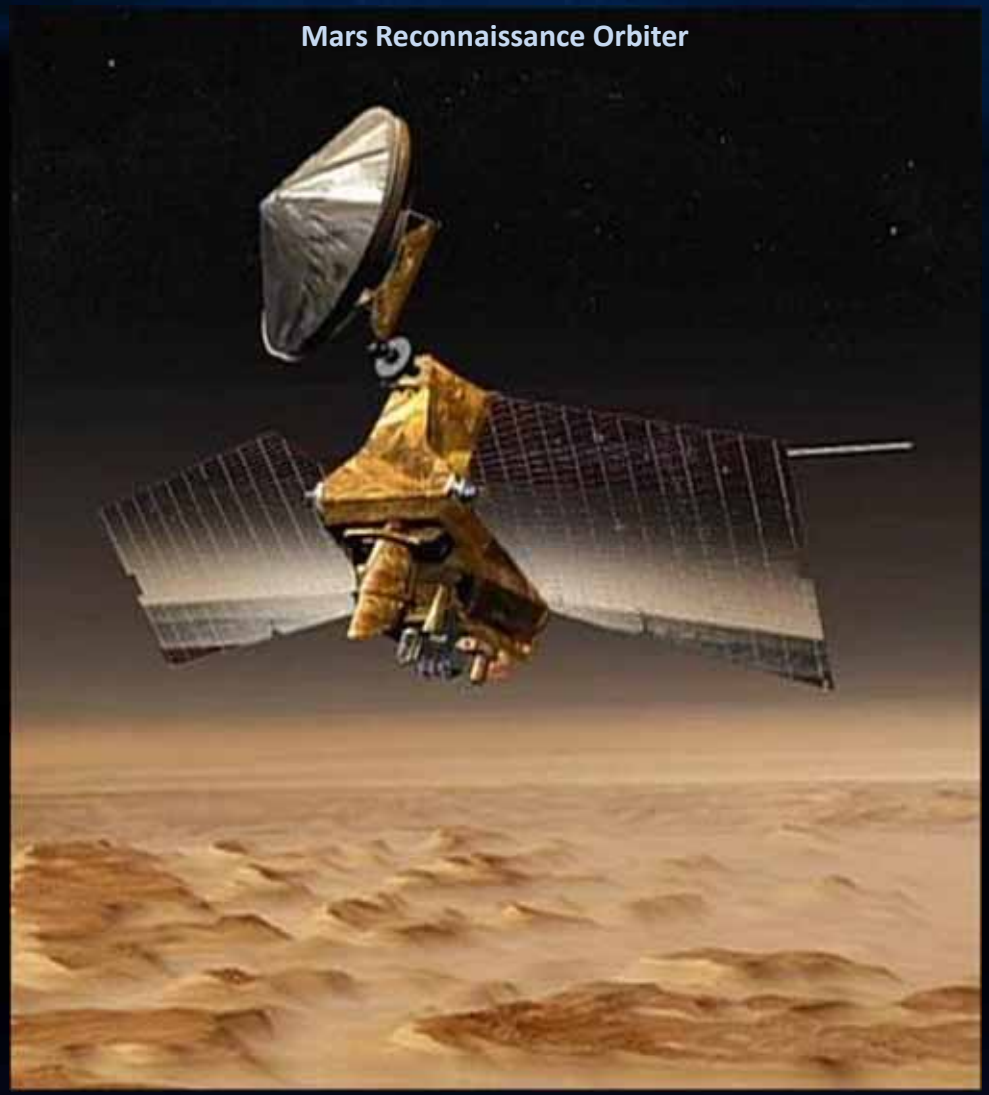
and Australia.



NASA/JPL-Caltech

Curiosity will send data back to Earth's Deep Space Network through Mars orbiters.

Mars Reconnaissance Orbiter



Mars Odyssey Orbiter

Artist's Concept. NASAJPL-Caltech

NASA's Mars Rover Curiosity launched from Cape Canaveral in Florida.

NASA/JPL-Caltech

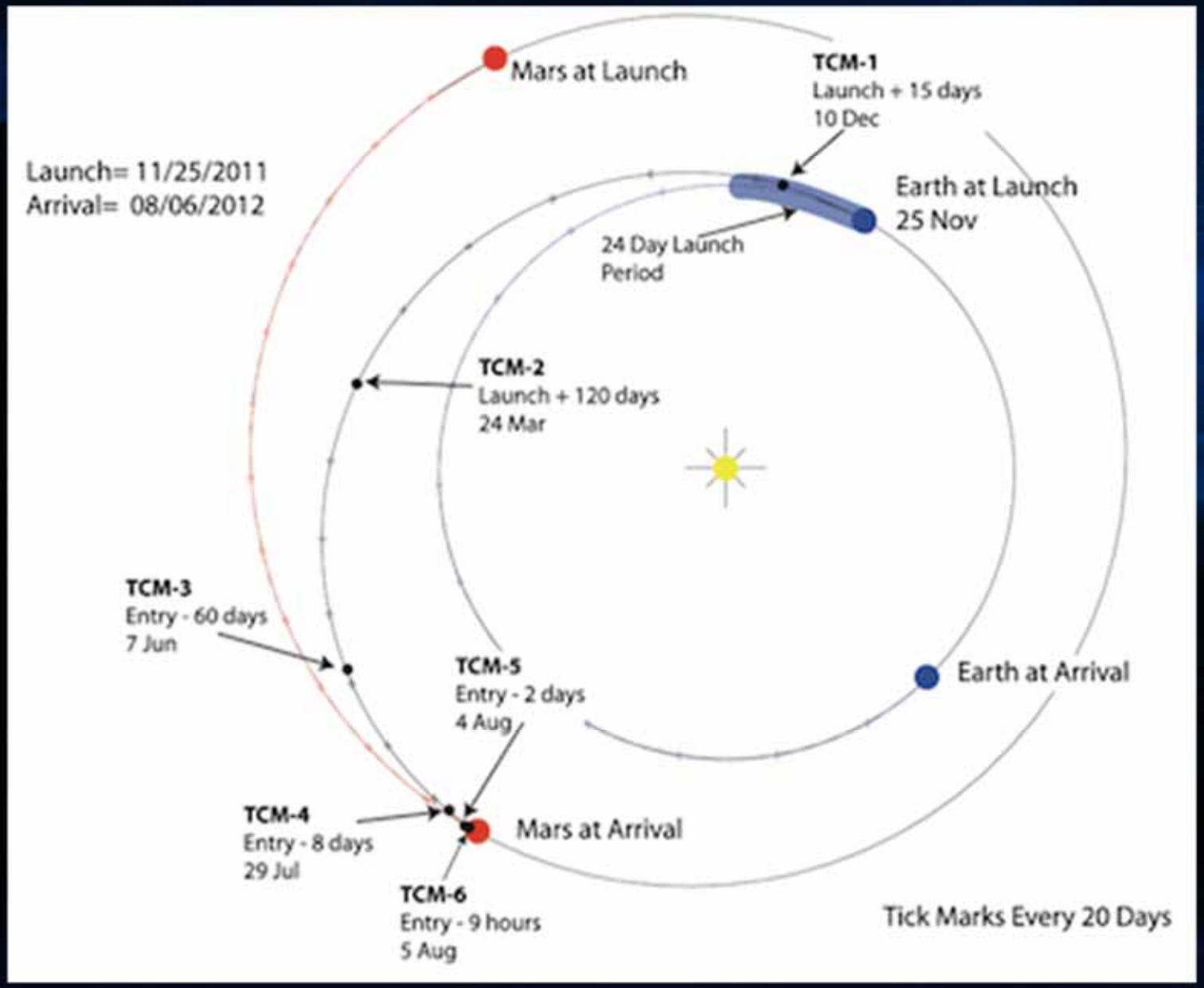
MSL Launch Video, Cape Canaveral 11/26/11

http://www.youtube.com/watch?v=1_eob8e7ae8

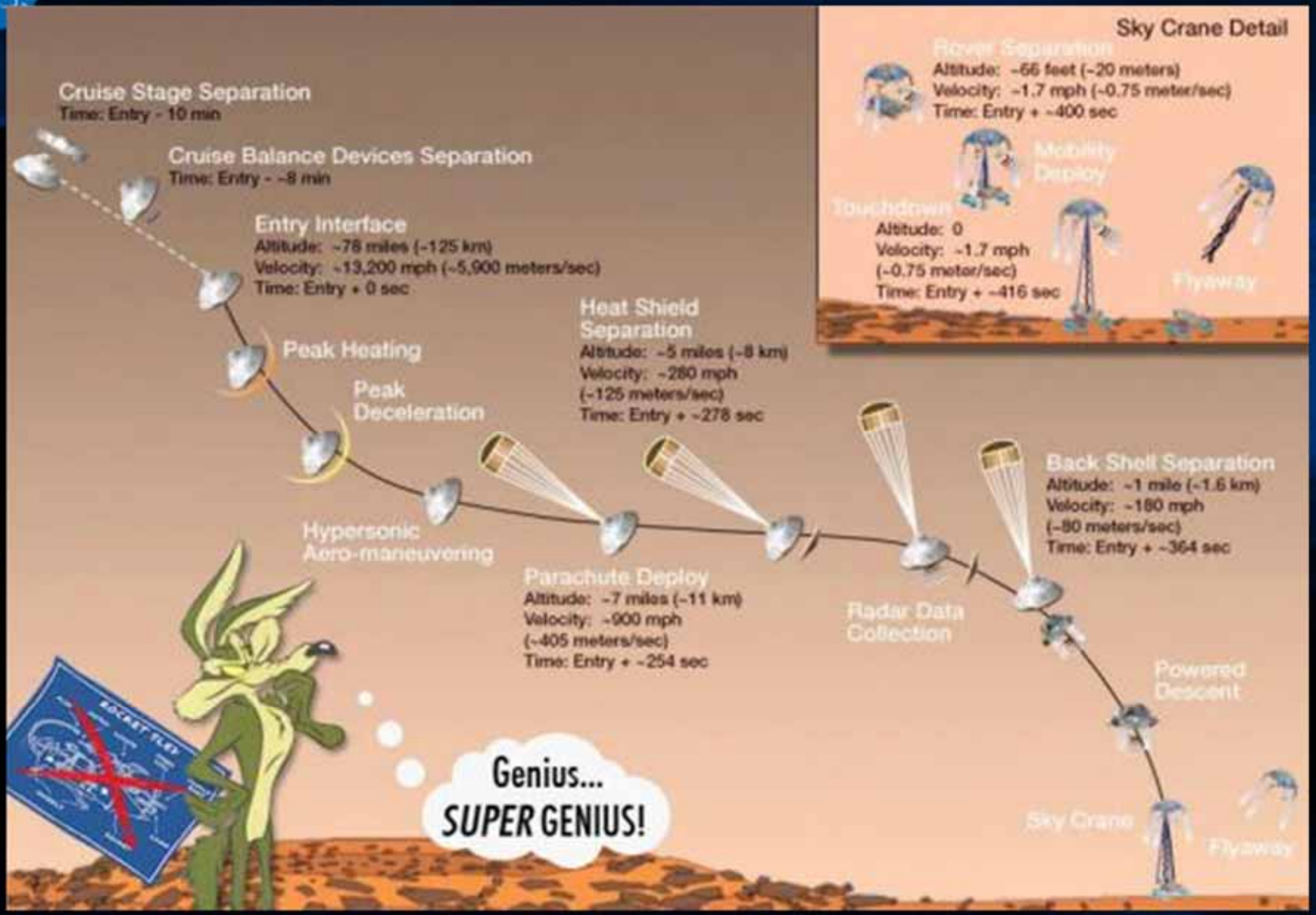
MSL Spacecraft Separation from Atlas V Launch Vehicle (Actual Movie!)

http://www.youtube.com/watch?v=Xjip3w0Q4hg

MSL Representative Interplanetary Trajectory



Slamming on the brakes: 7 Minutes of Terror

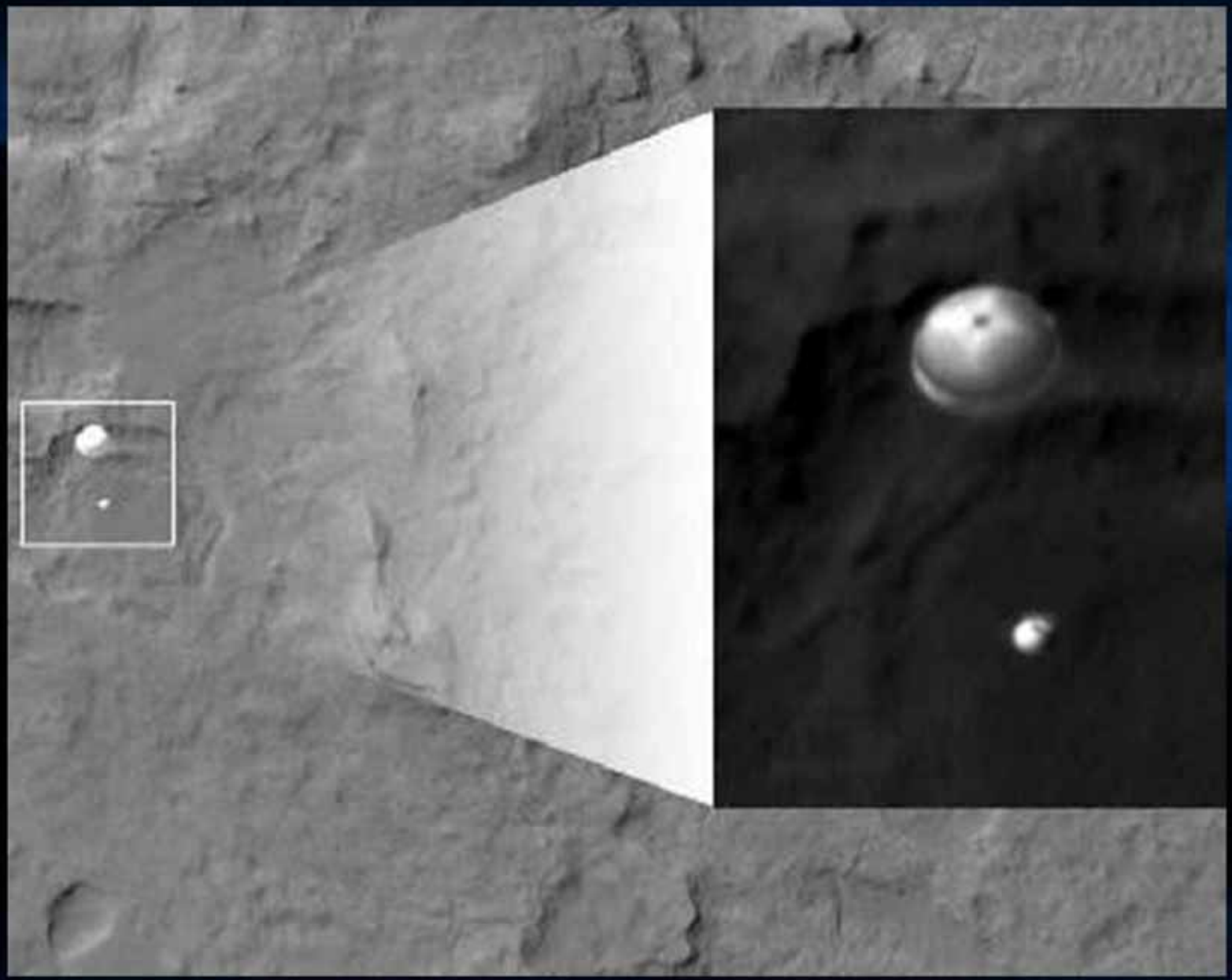


“7 Minutes of Terror” / Animation Videos

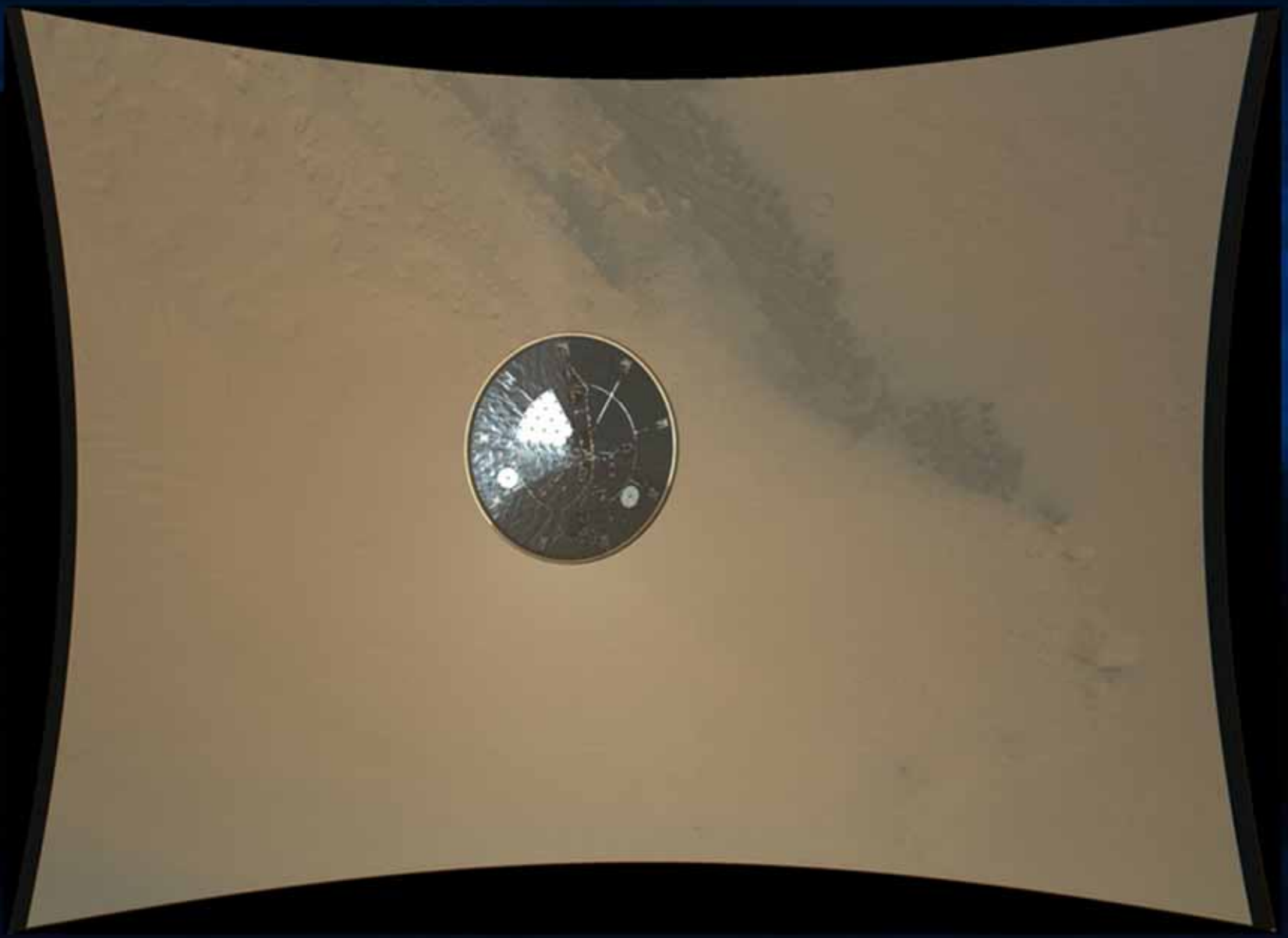
http://www.youtube.com/watch?v=Ki_Af_o9Q9s

http://www.youtube.com/watch?v=BudIaGh1A0o

Parachute Deployed! (Real Pic from MRO)



Thank you for your service, oh brave heat shield!



MARDI (Mars Descent Imager) Video, HD

http://www.jpl.nasa.gov/video/index.cfm?id=1126

Curiosity’s First Picture from the Martian surface

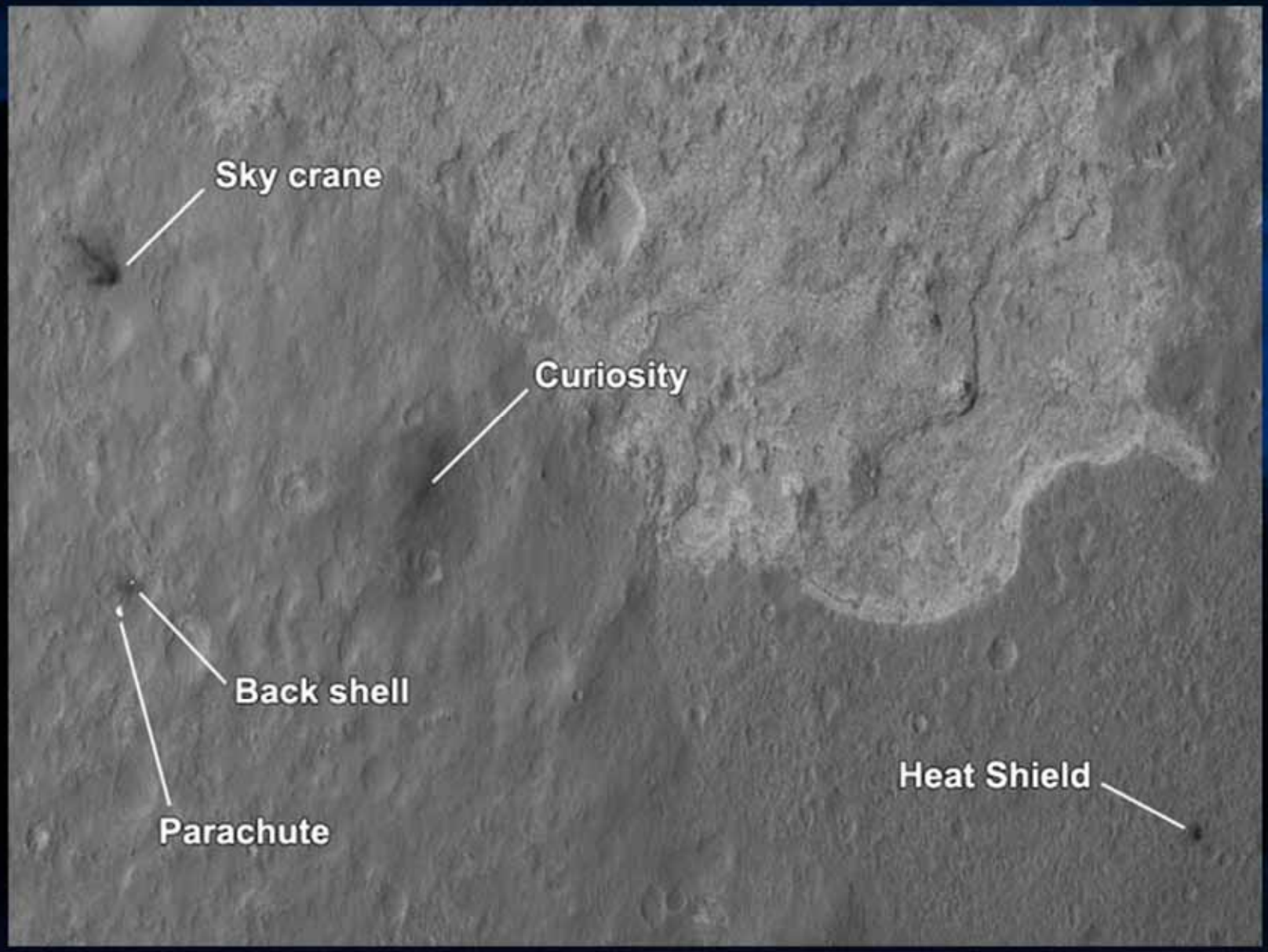
Behold Mt. Sharp! (and note rover shadow)

Descent Stage Impact Plume (Minutes after Landing)

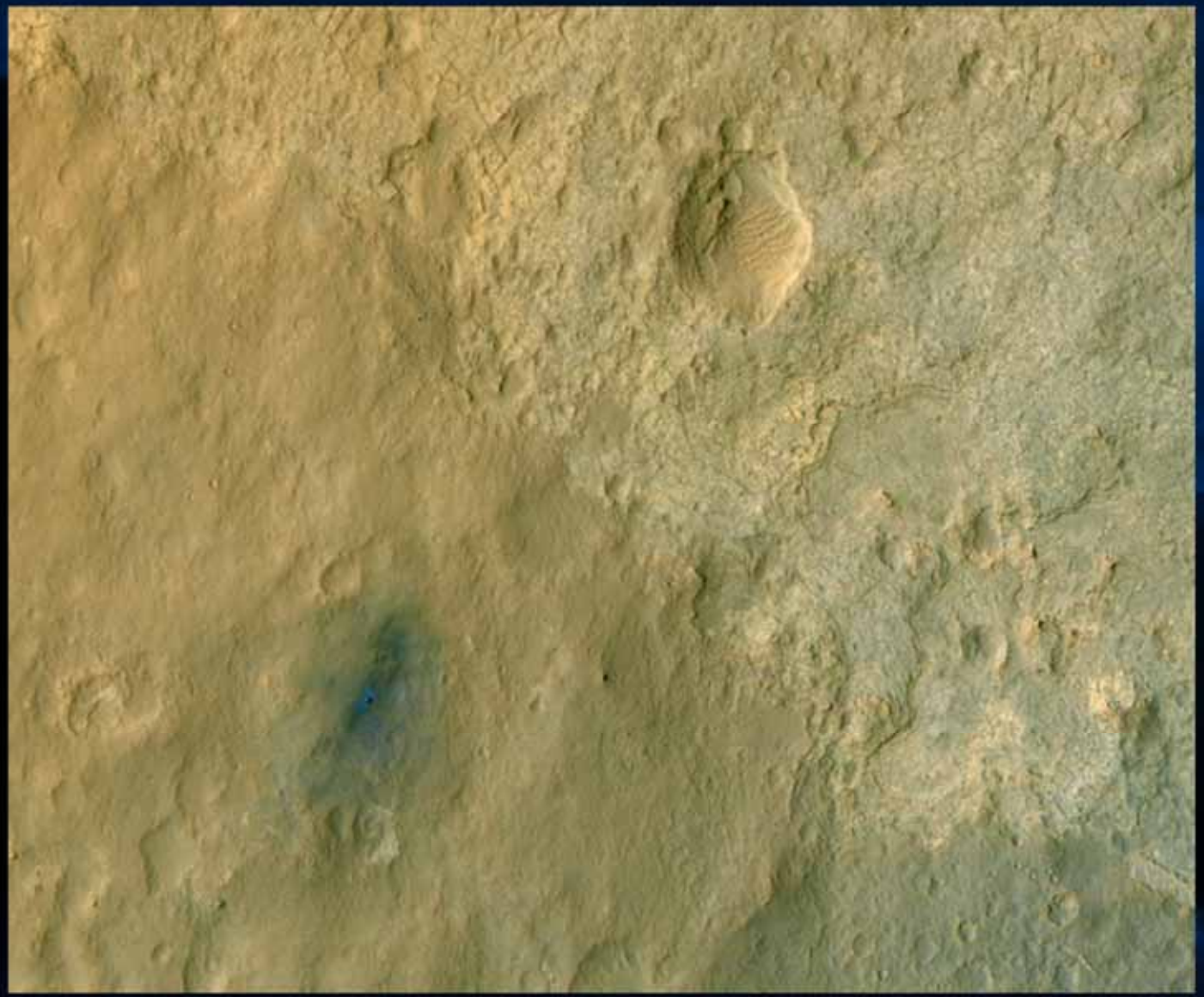
Giant
kaboom

Mars…or is it the Mojave Desert?

MRO “Crime Scene” Photo of MSL Landing Site



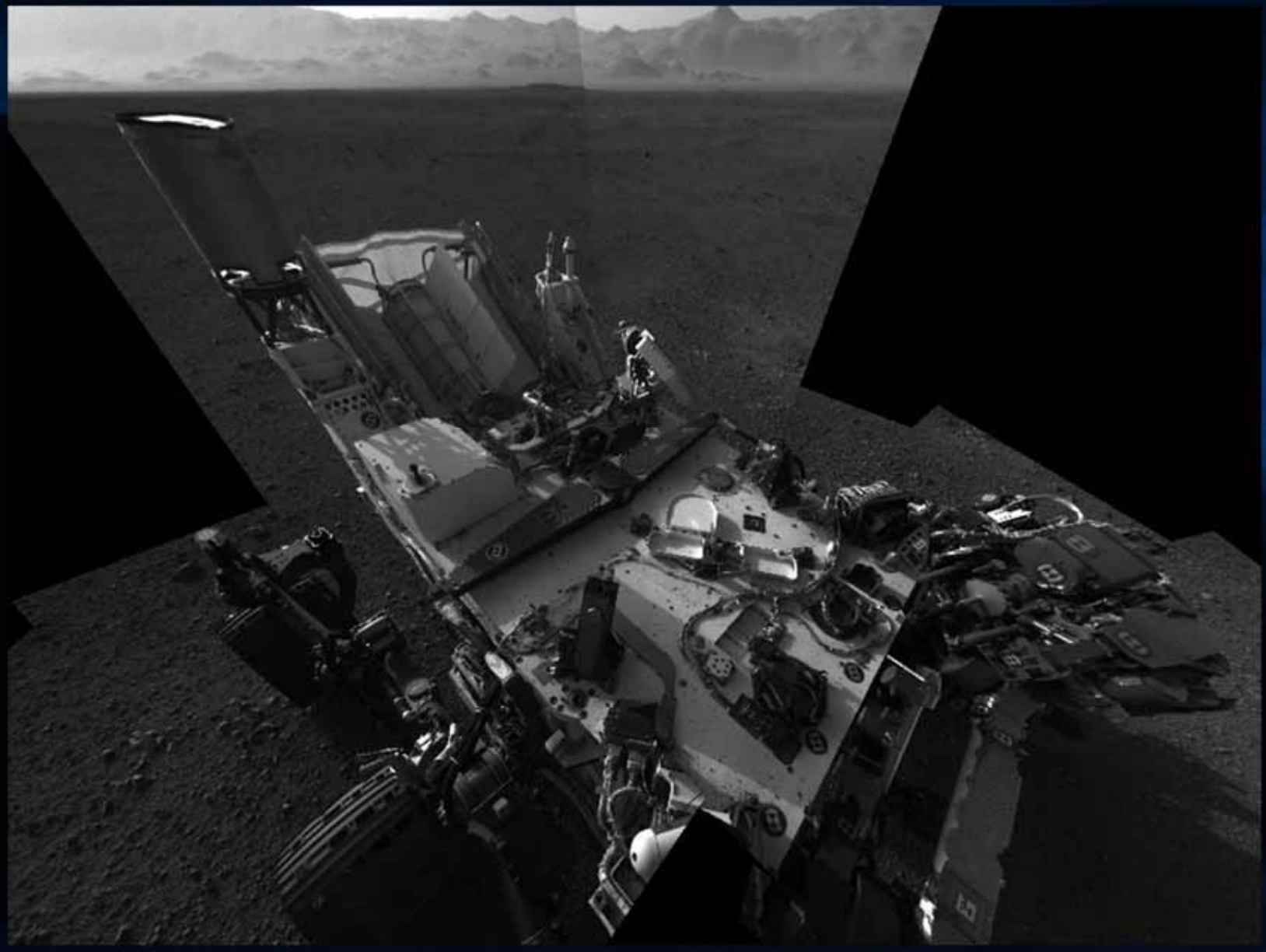
Another real pic from MRO (Curiosity & blast markings)



High-Resolution Color Image from Curiosity

Curiosity Color Photo: Mt. Sharp, rocket blast marks, wheel

Rover NavCam Self Portrait (nice backdrop!)



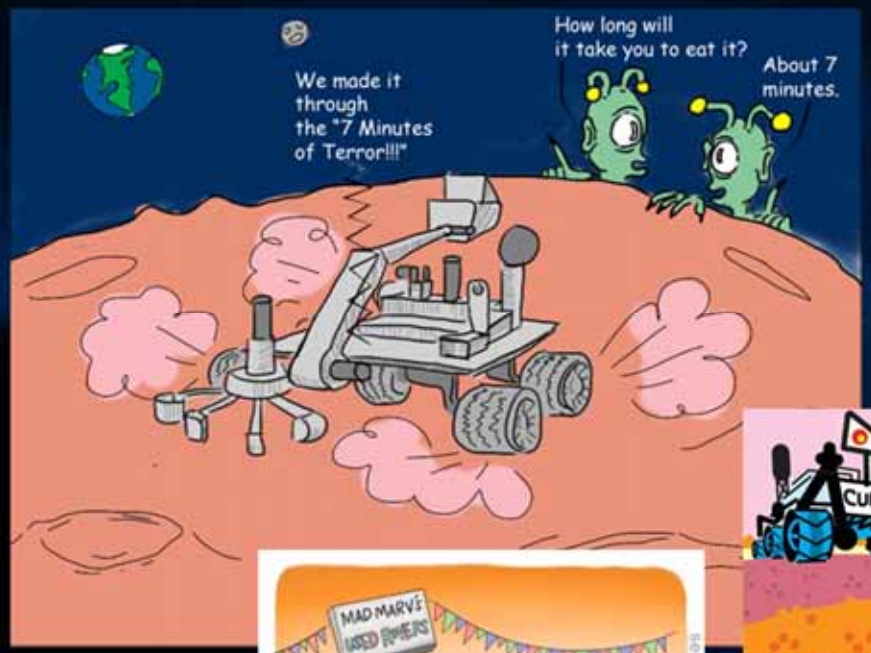
Mt. Sharp layered rock: a geological gold mine

High-Res
MastCam Image

Move over,
Grand Canyon!


THAT'S RIGHT...
KEEP SENDING PROBES OVER HERE...
MY SUPER-ROBOT ONLY NEEDS A FEW MORE PIECES BEFORE IT'S COMPLETE!


YOUR EXCUSE FOR ANYTHING TODAY:
"SORRY–
I WAS UP ALL NIGHT TRYING TO DOWNLOAD PHOTOS TAKEN BY A ROBOT LOWERED ONTO MARS BY A SKYCRANE."


We made it through the "7 Minutes of Terror!!!"
How long will it take you to eat it?
About 7 minutes.


Curiosity has landed on Mars
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CURIOSITY
"Run, here comes its mother!"


MAD MARV'S USED PAPERS
ONLY 12,000,000 MILES!
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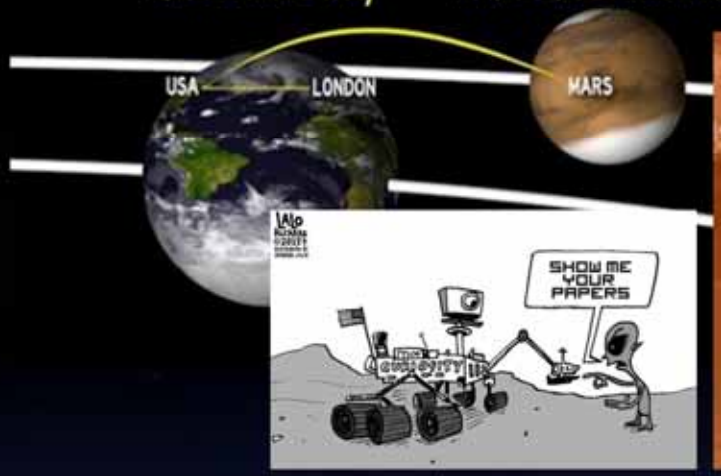
NBC
6 hour delay
for an event
3,500 miles away
NASA
14 minute delay
for an event
155,000,000 miles away
USA
LONDON
MARS
SHOW ME YOUR PAPERS


NASA


10 10 10
"REALLY STUCK THE LANDING!!"

Follow Curiosity!

Mission Website:
mars.jpl.nasa.gov/msl

Twitter: @MarsCuriosity

Be A Martian!
beamartian.jpl.nasa.gov

www.nasa.gov/msl