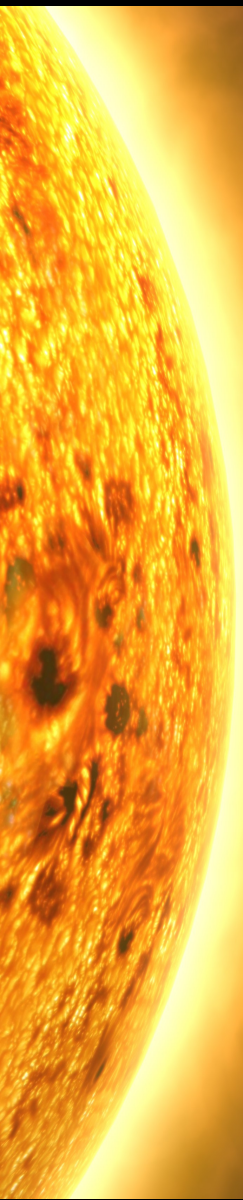


# A Mars és a Mars-utazás lehetősége

**Dr. Szalai Tamás**

csillagász, SZTE Optikai és Kvantumelektronikai Tanszék





**Mercury**

**Venus**

**Earth**

**Mars**

**Jupiter**

**Saturn**

**Uranus**

**Neptune**

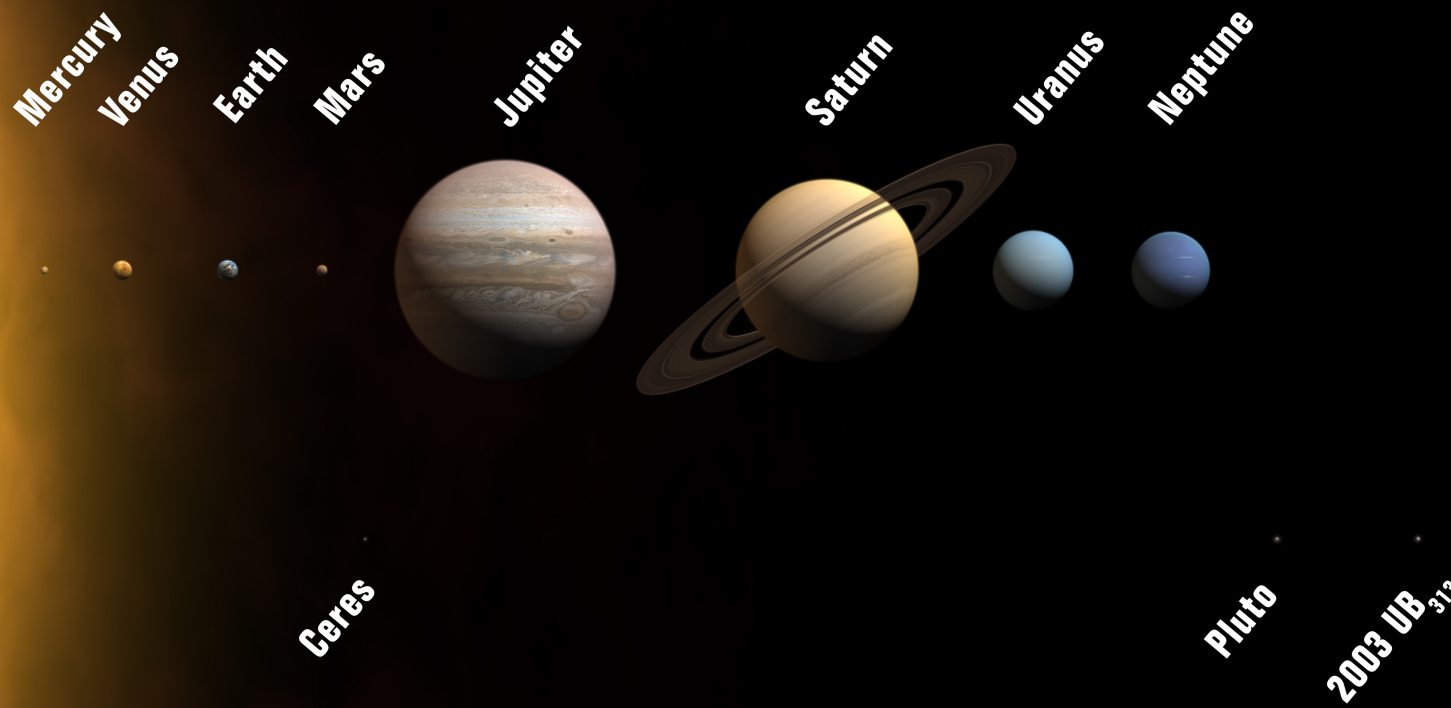
**Ceres**

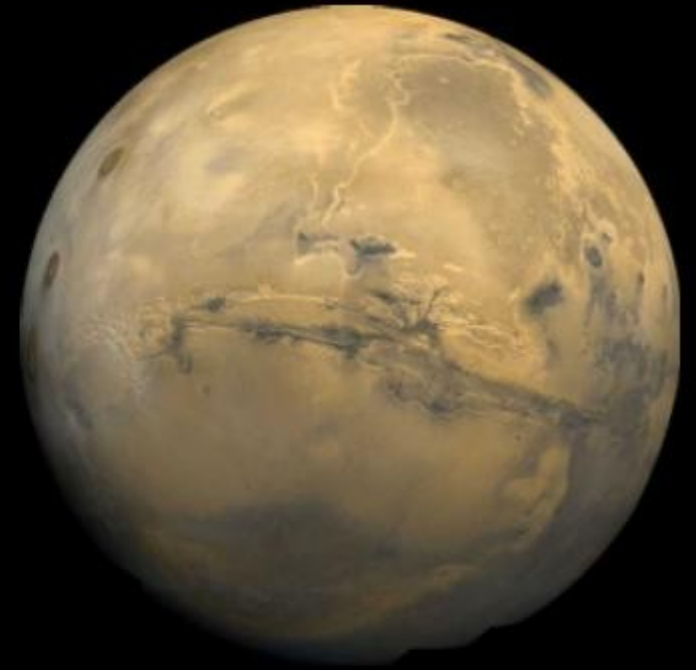
**Pluto**

**2003 UB<sub>313</sub>**

— **“Planets”**

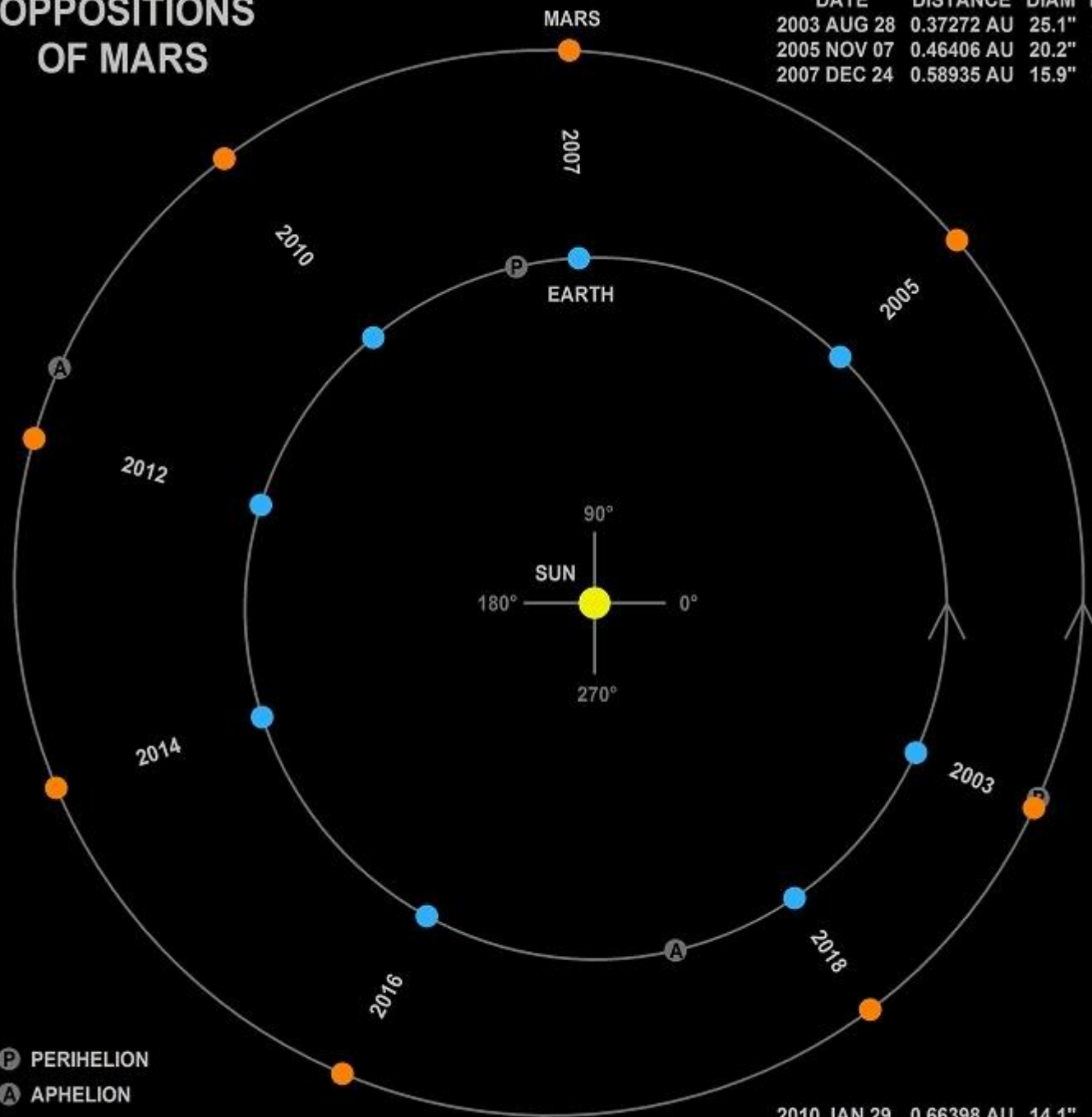
— **“Dwarf Planets”**



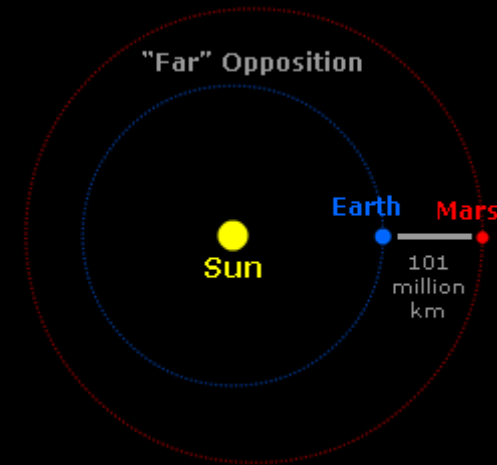


# OPPOSITIONS OF MARS

DATE	DISTANCE	DIAM	MAG	DECL
2003 AUG 28	0.37272 AU	25.1"	-2.9	S 15.8°
2005 NOV 07	0.46406 AU	20.2"	-2.3	N 15.9°
2007 DEC 24	0.58935 AU	15.9"	-1.6	N 26.8°

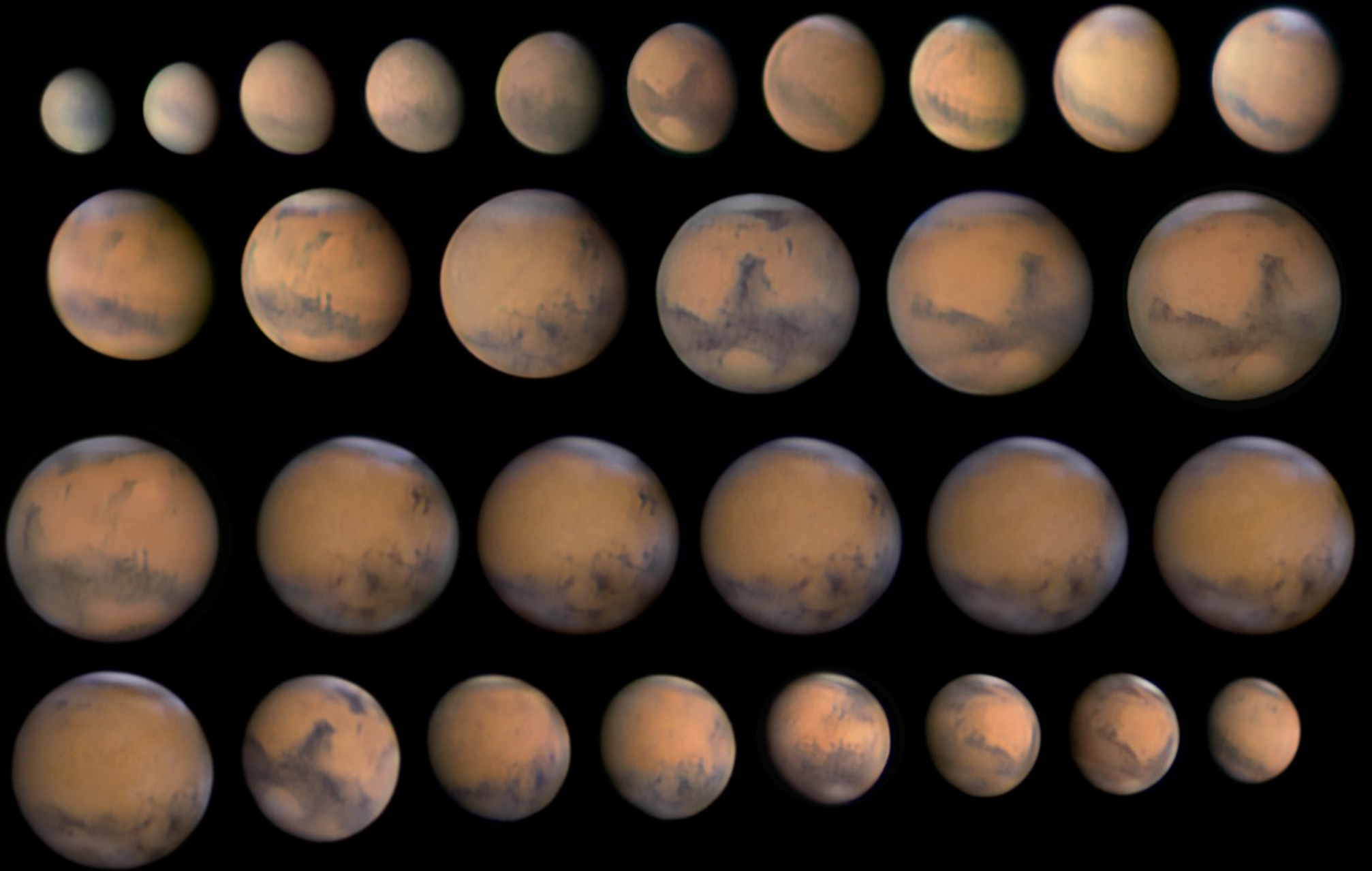


(P) PERIHELION  
(A) APHELION



2010 JAN 29	0.66398 AU	14.1"	-1.3	N 22.2°
2012 MAR 03	0.67368 AU	13.9"	-1.2	N 10.3°
2014 APR 08	0.61756 AU	15.2"	-1.5	S 05.1°
2016 MAY 22	0.50321 AU	18.6"	-2.1	S 21.7°
2018 JUL 27	0.38496 AU	24.3"	-2.8	S 25.5°

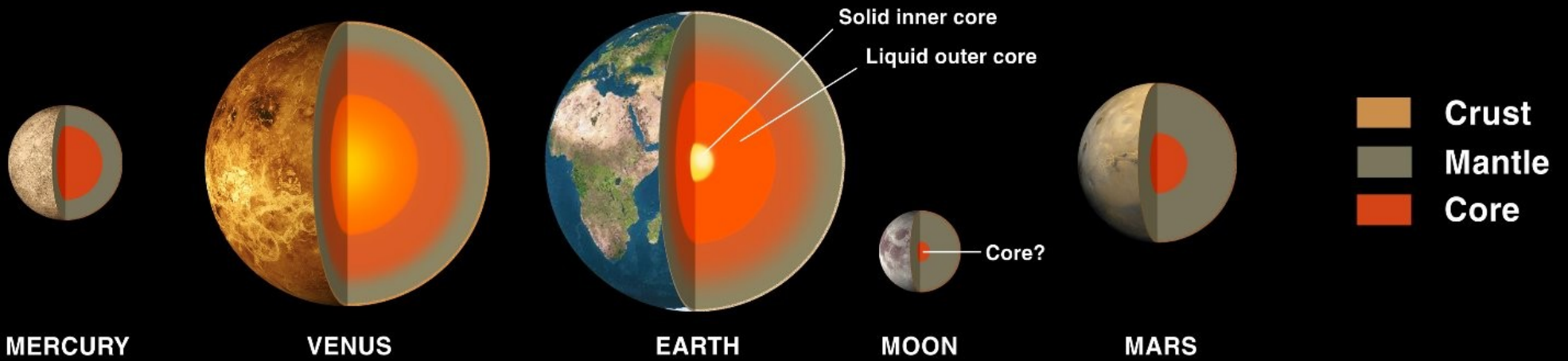
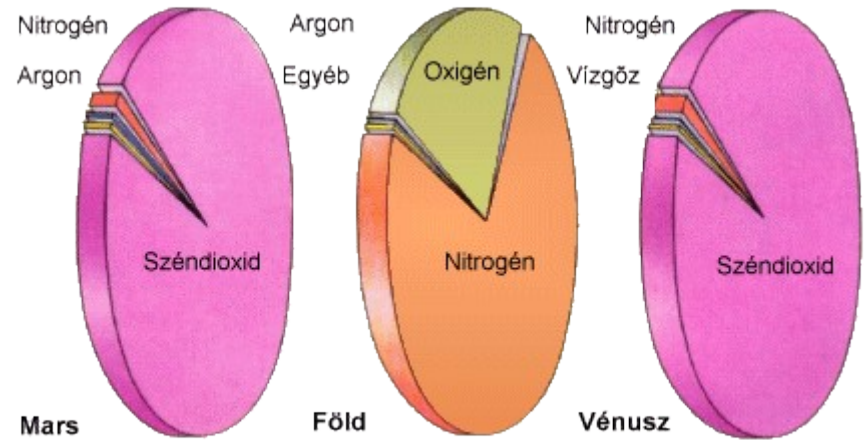
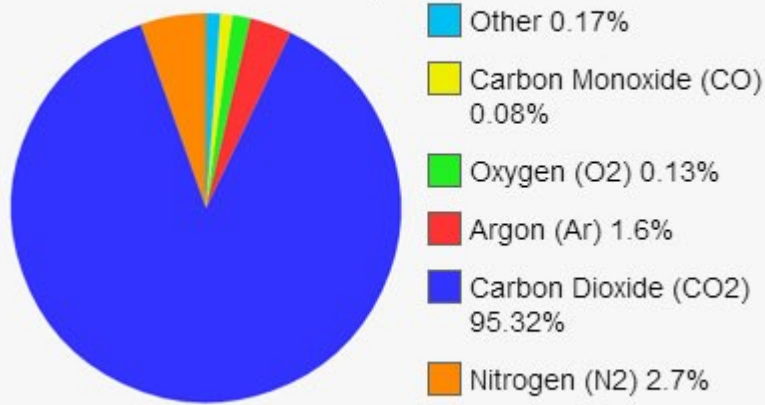
Mars 2007/2008



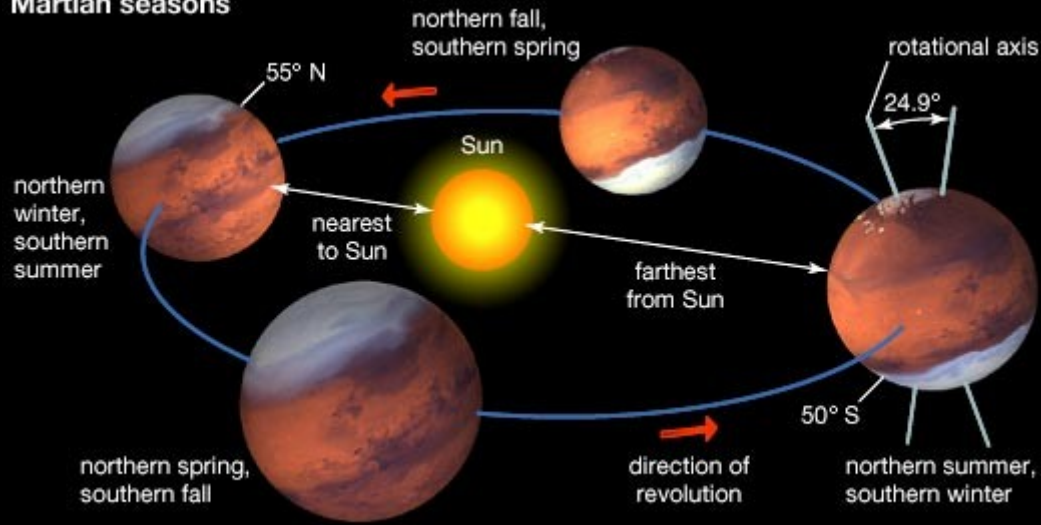
Richard Bosman Enschede Netherland



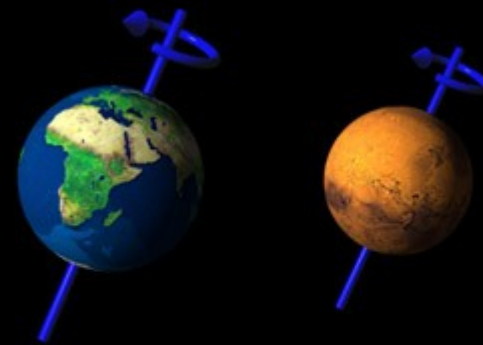
## Mars' Atmosphere Gasses



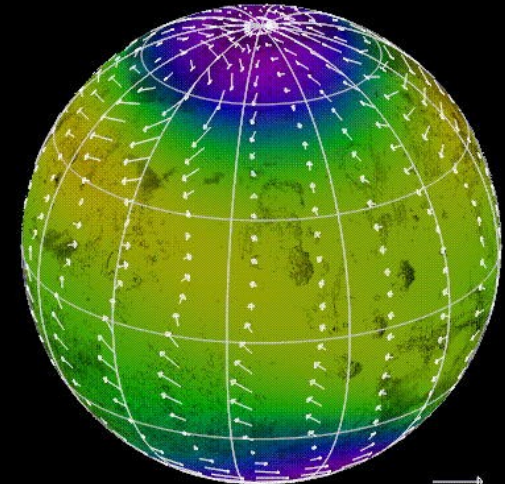
### Martian seasons



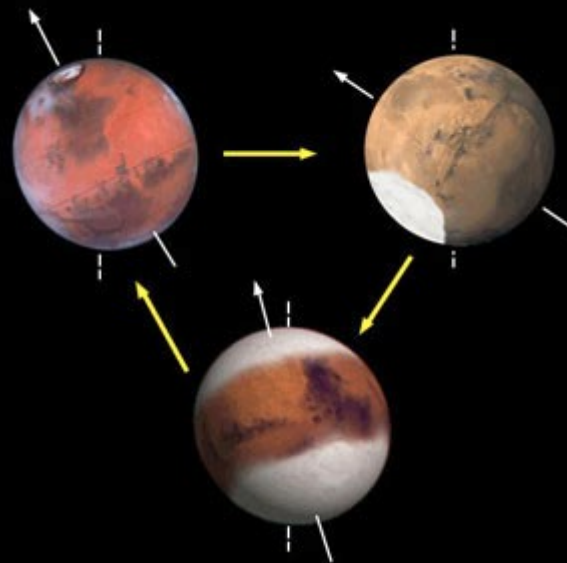
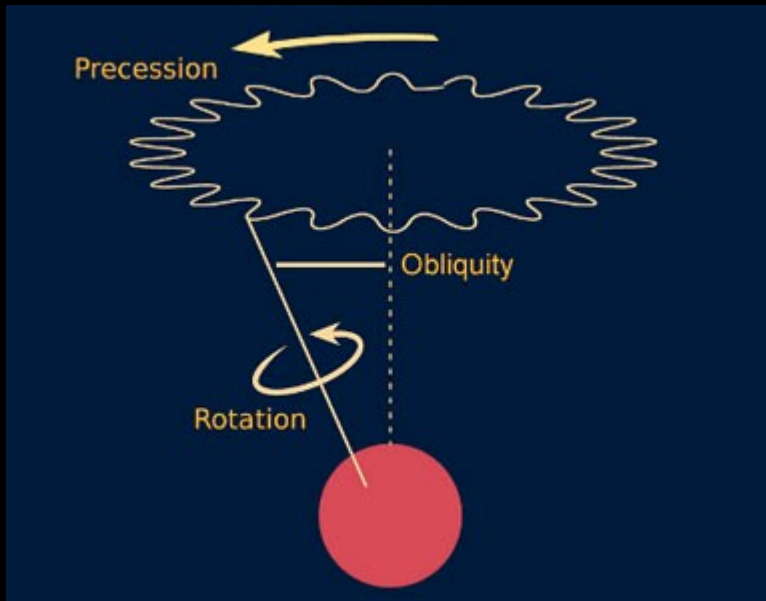
© 2003 Encyclopædia Britannica, Inc.



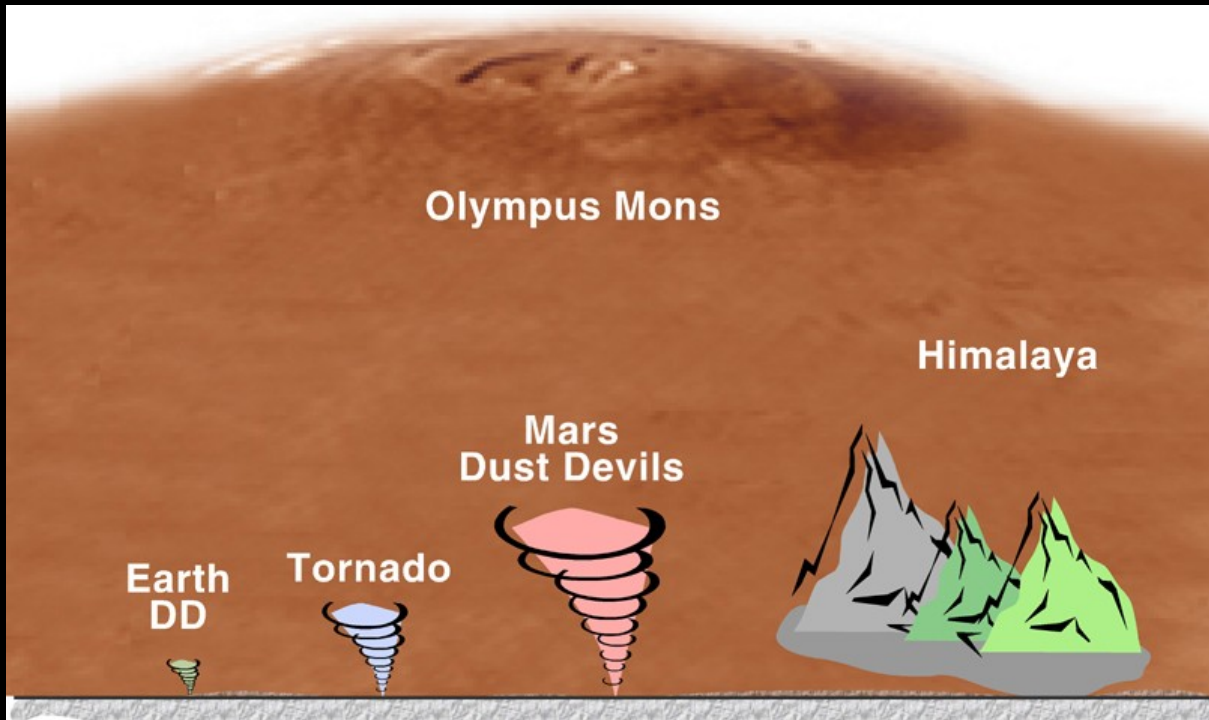
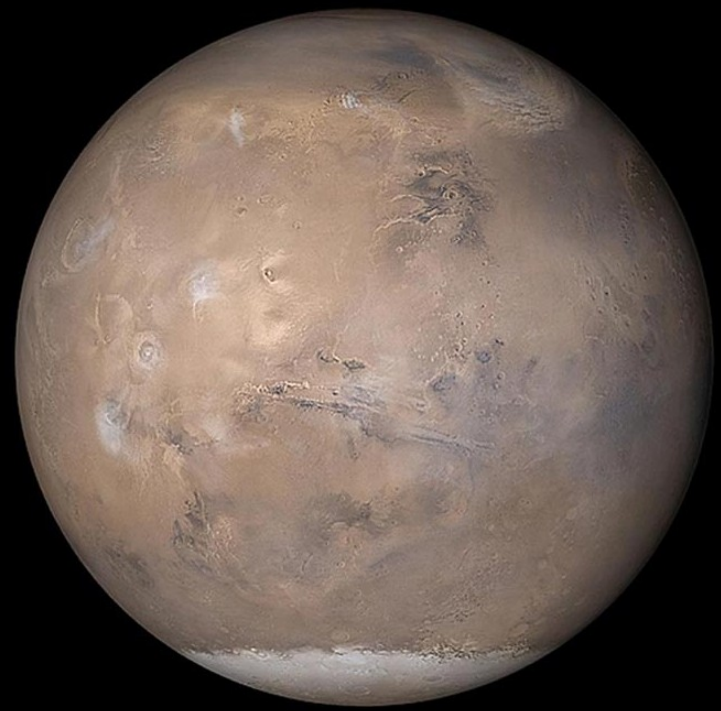
Earth  
 $23^\circ$

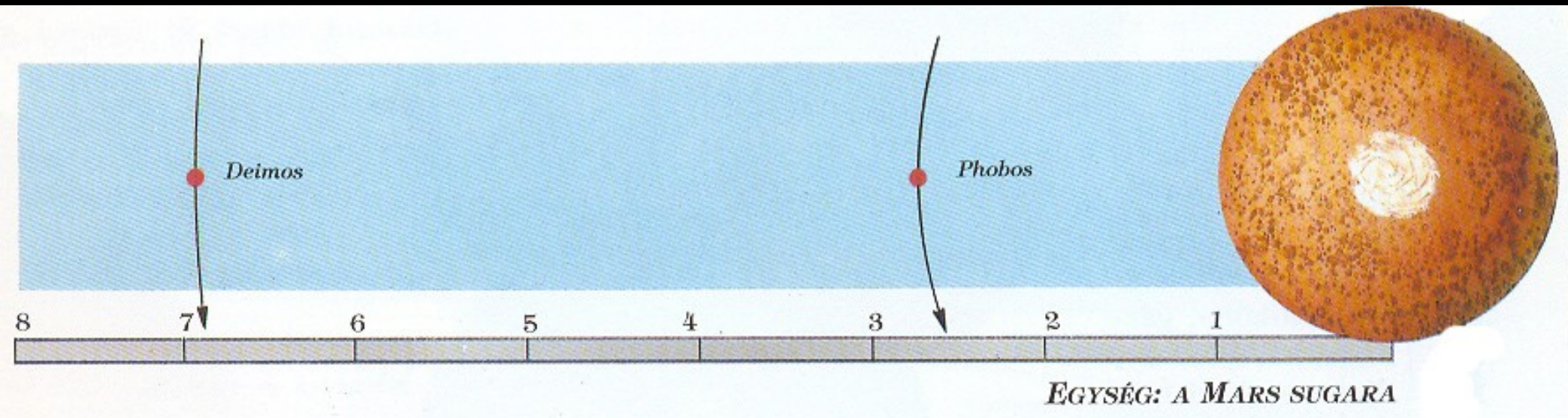
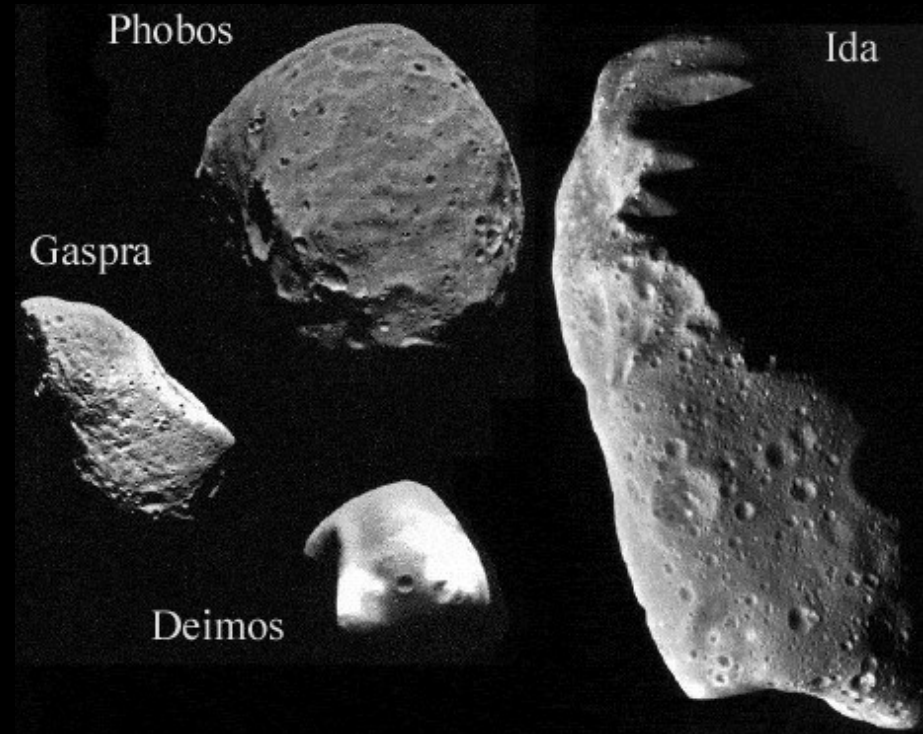


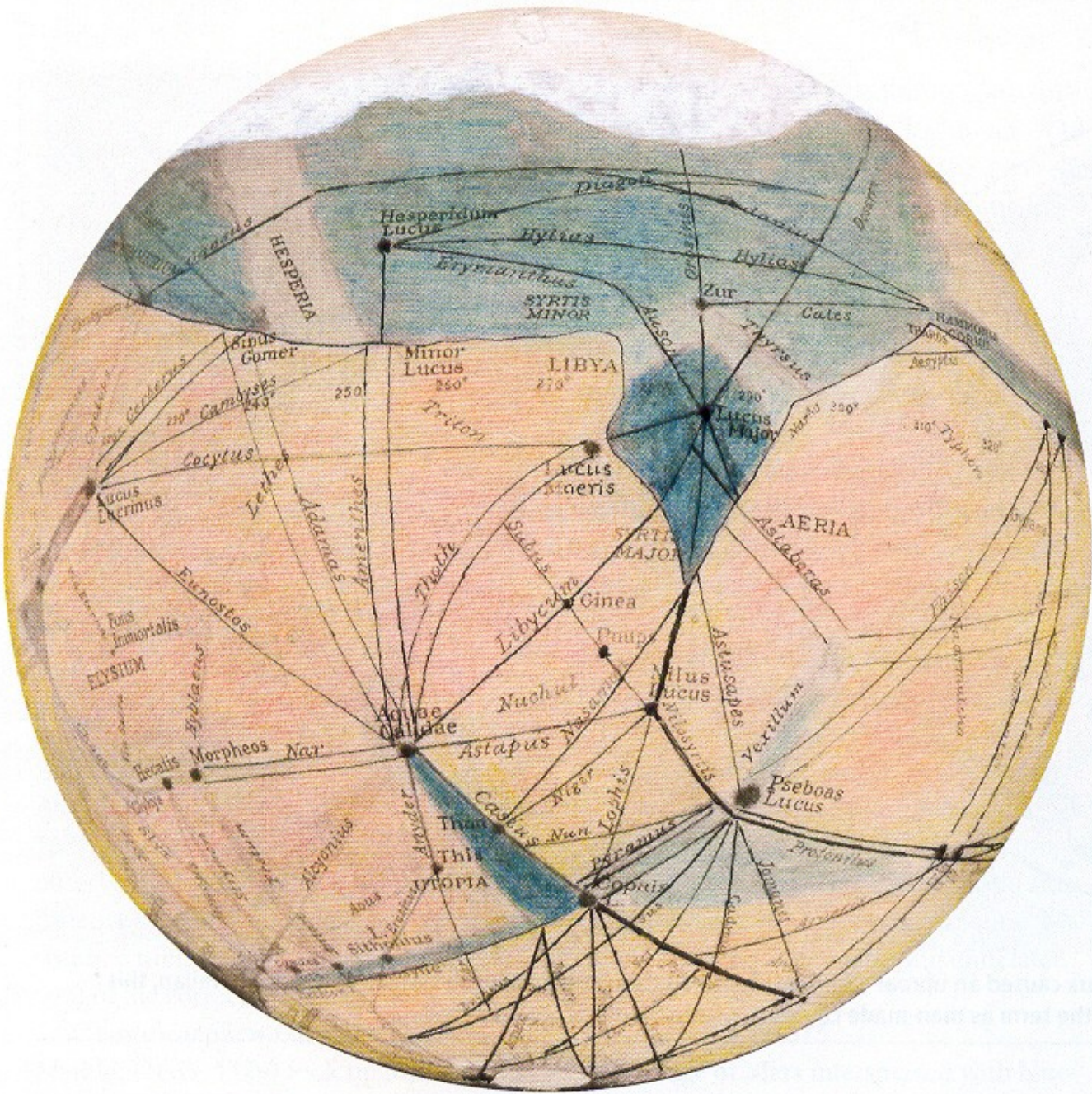
Hőmérséklet (K)



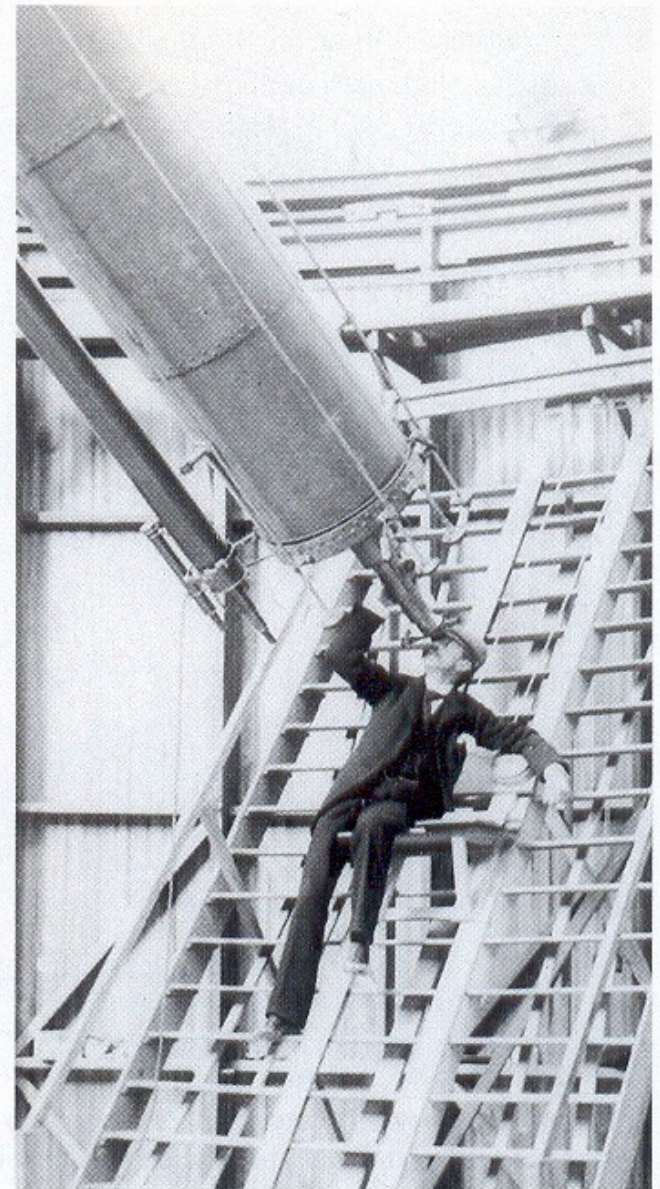




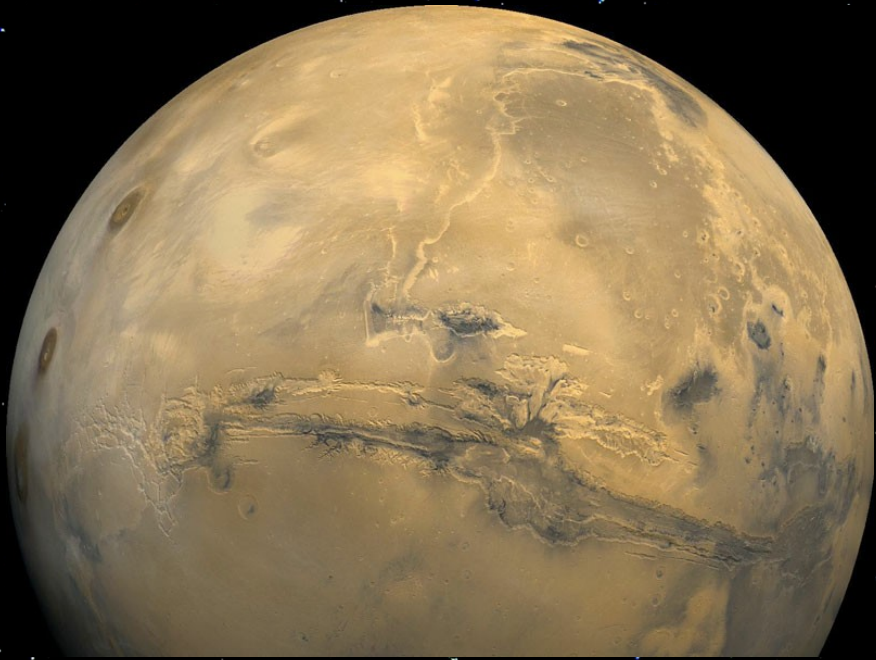




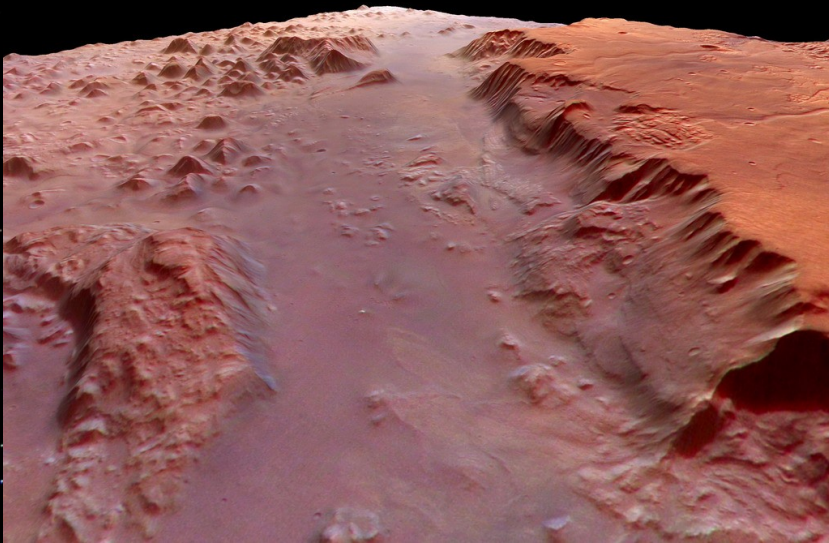
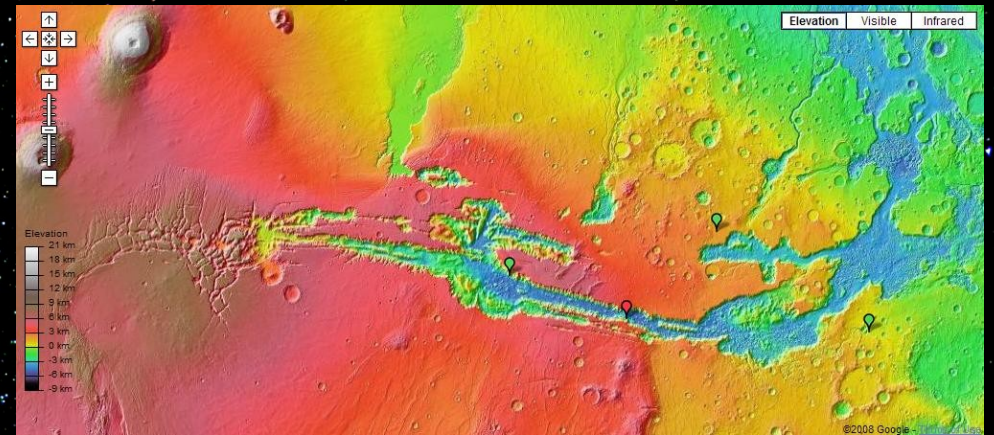
**Percival Lowell's Mars** included more canals than any previous astronomer had observed. He also believed that the dark areas on the Red Planet were vast tracts of vegetation.



**Percival Lowell** built an observatory in Flagstaff, Arizona, in 1894 for the sole purpose of searching for signs of life on Mars through a 24-inch refractor.



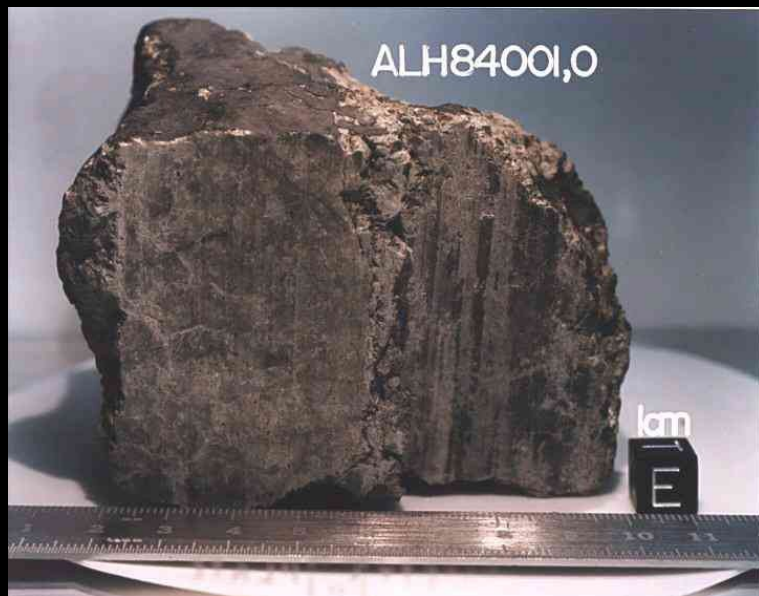
Valles Marineris:  
4000 km hosszú,  
200 km széles,  
7 km mély kanyon!





**Olympus Mons**

**27 km magas!  
600 km átmérőjű!**

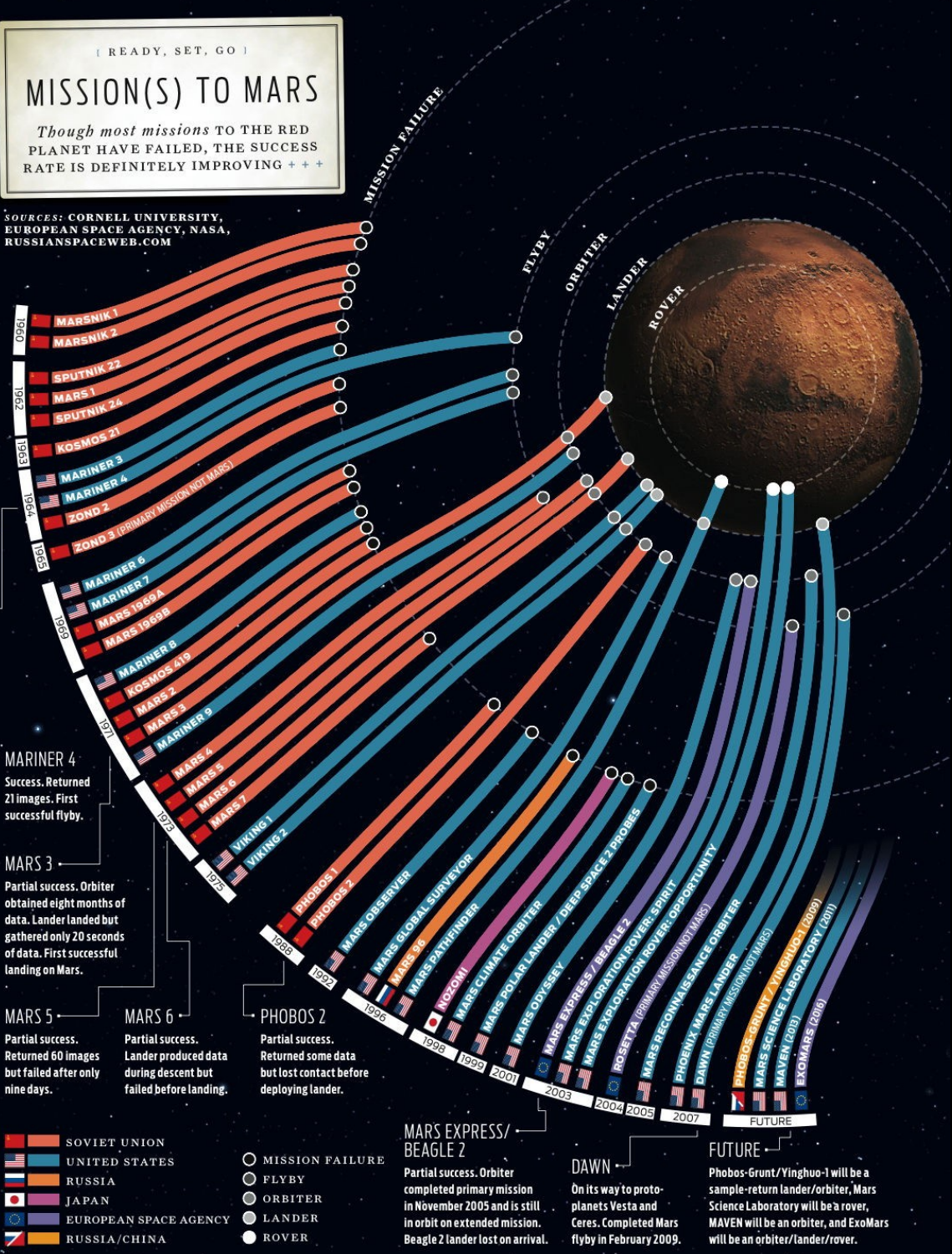


READY, SET, GO

# MISSION(S) TO MARS

Though most missions TO THE RED PLANET HAVE FAILED, THE SUCCESS RATE IS DEFINITELY IMPROVING + + +

SOURCES: CORNELL UNIVERSITY, EUROPEAN SPACE AGENCY, NASA, RUSSIANSPACEWEB.COM



**MARINER 4**  
Success. Returned 21 images. First successful flyby.

**MARS 3**  
Partial success. Orbiter obtained eight months of data. Lander landed but gathered only 20 seconds of data. First successful landing on Mars.

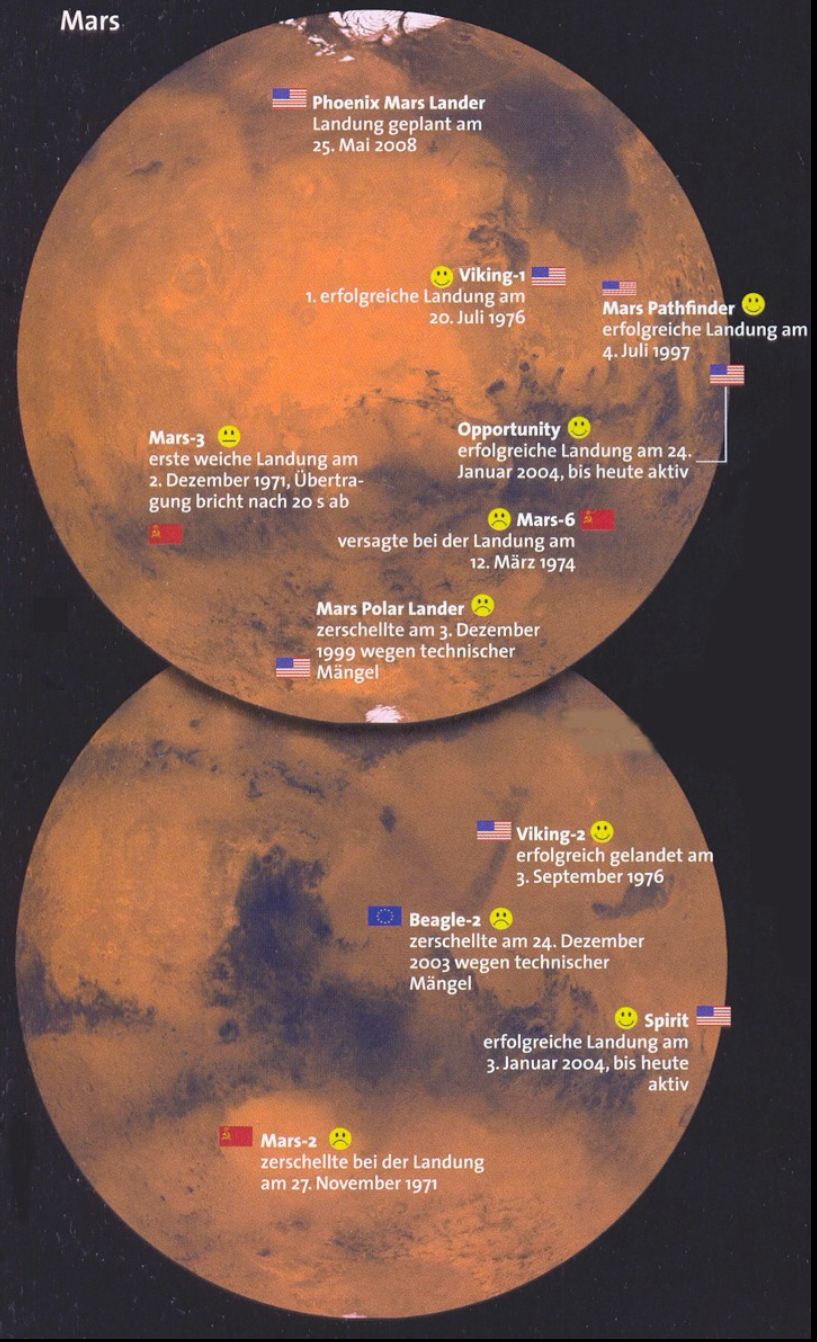
**MARS 5**  
Partial success. Returned 60 images but failed after only nine days.

**MARS 6**  
Partial success. Lander produced data during descent but failed before landing.

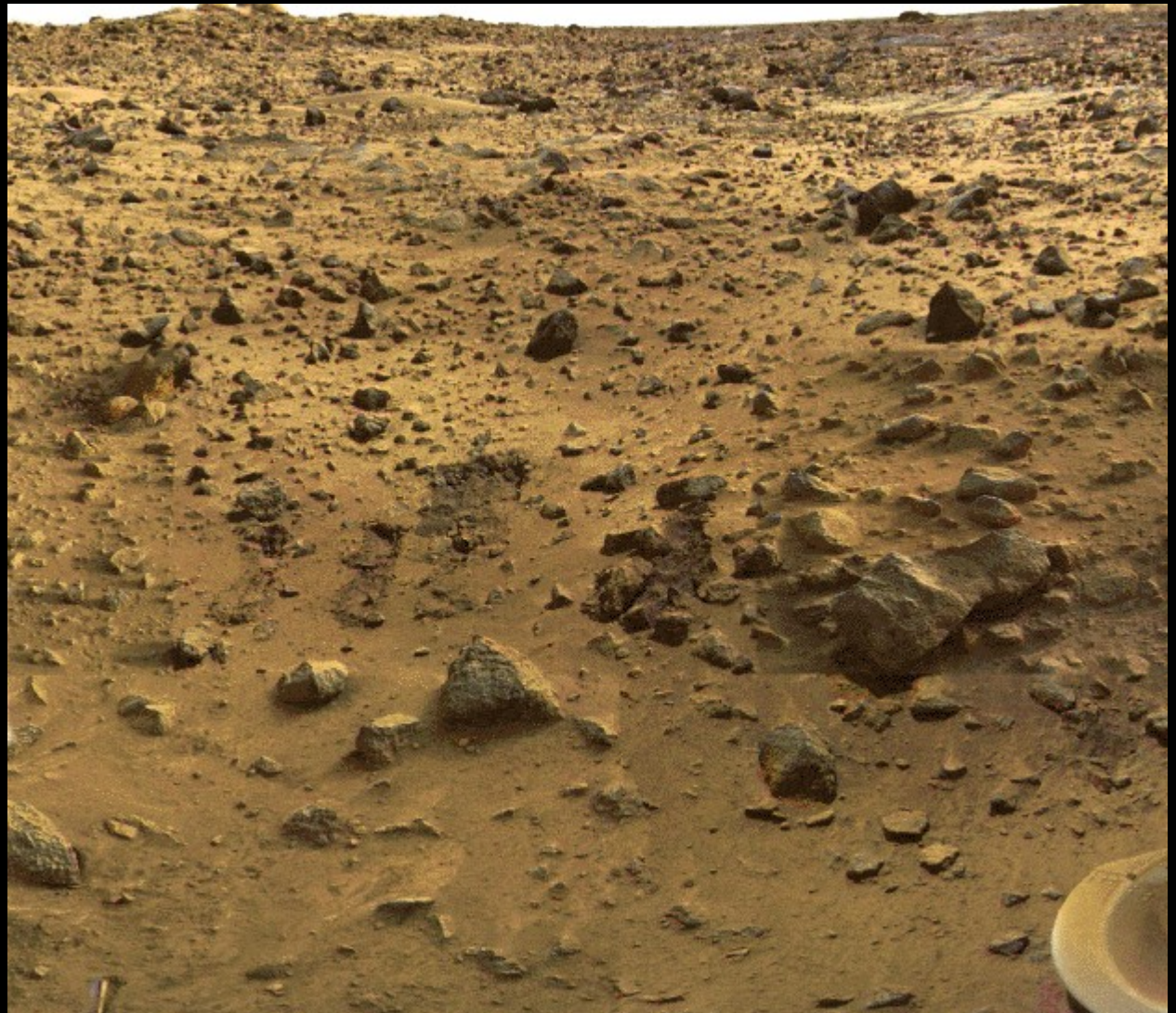
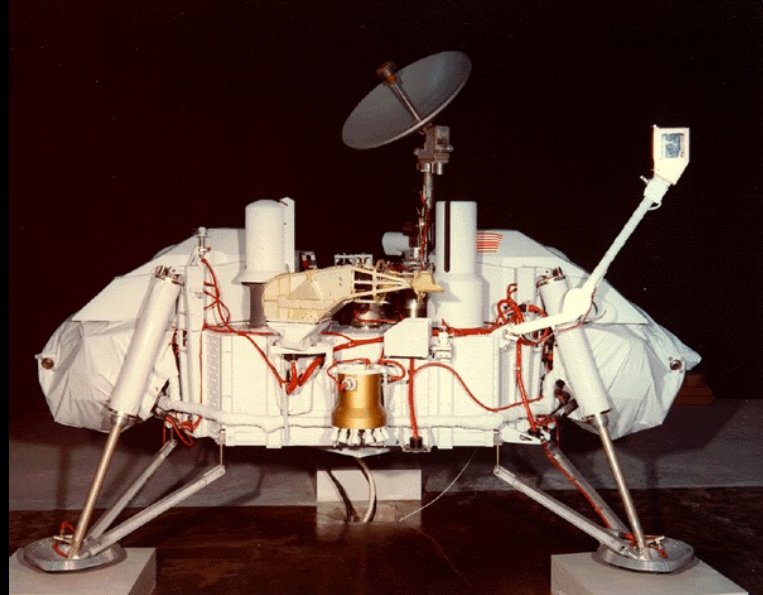
**PHOBOS 2**  
Partial success. Returned some data but lost contact before deploying lander.

- SOVIET UNION
- UNITED STATES
- RUSSIA
- JAPAN
- EUROPEAN SPACE AGENCY
- RUSSIA/CHINA
- MISSION FAILURE
- FLYBY
- ORBITER
- LANDER
- ROVER

## Mars

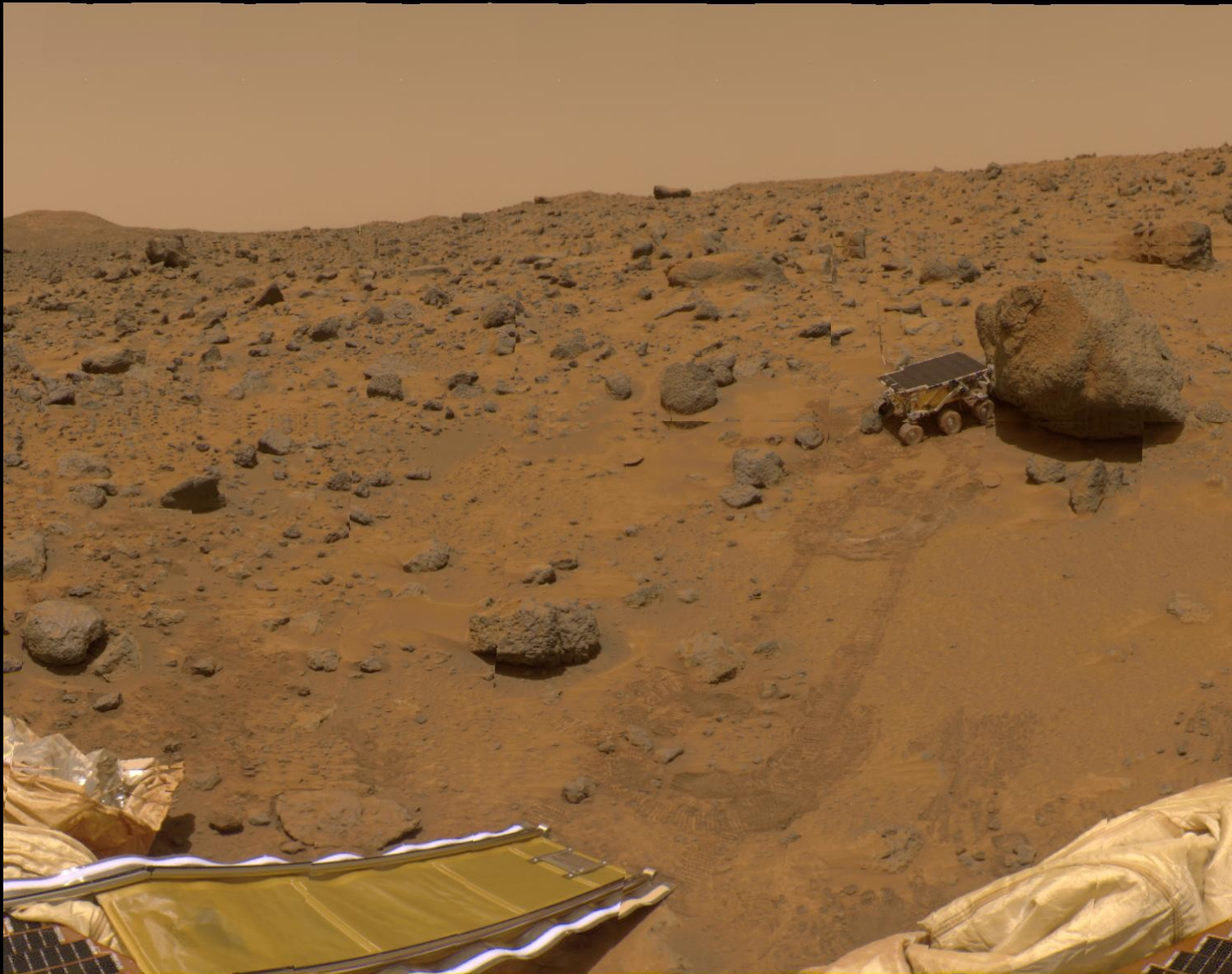


## Viking-1 és 2

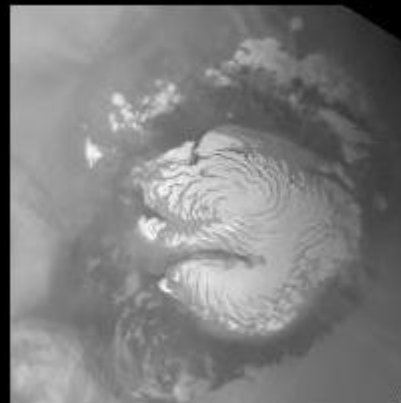
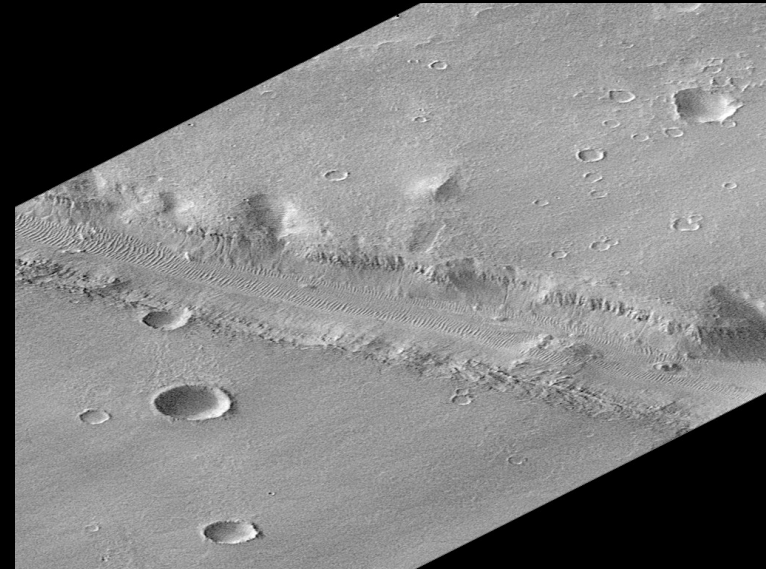




# Mars Pathfinder (Sojourner)

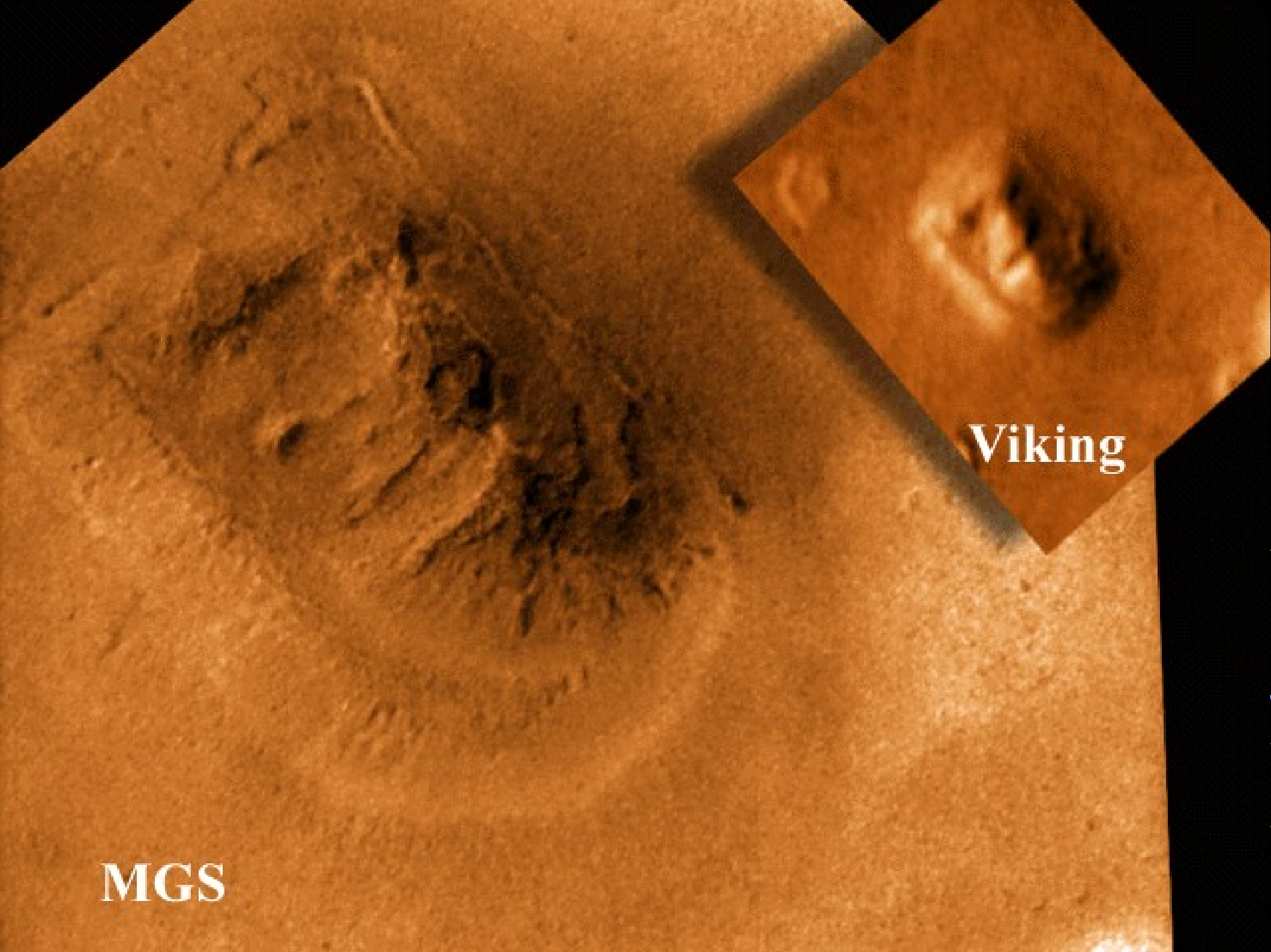


# Mars Global Surveyor



North Polar Cap, May 1, 1999

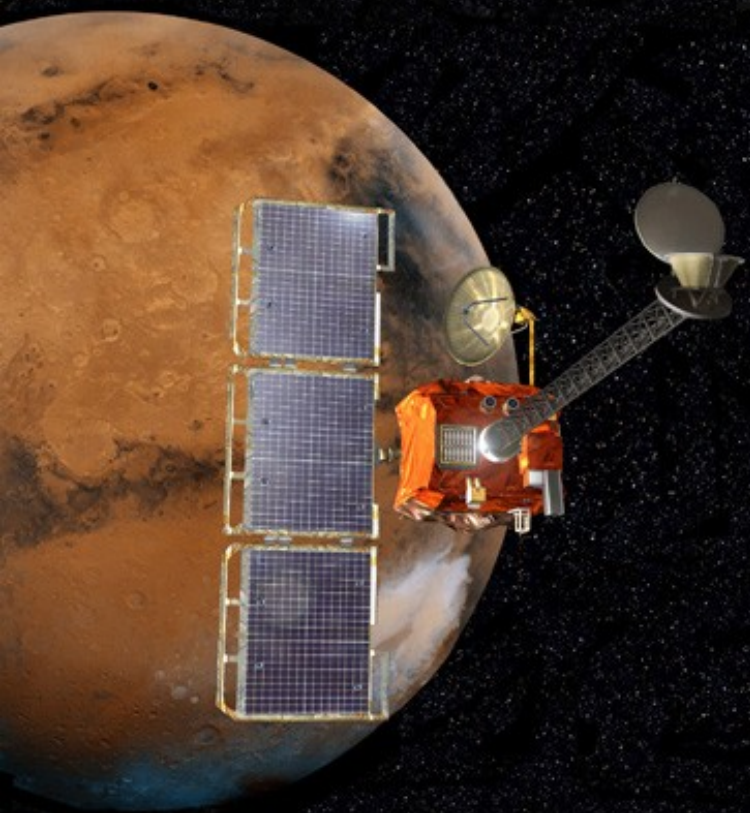
South Polar Cap, Feb. 25-26, 2000



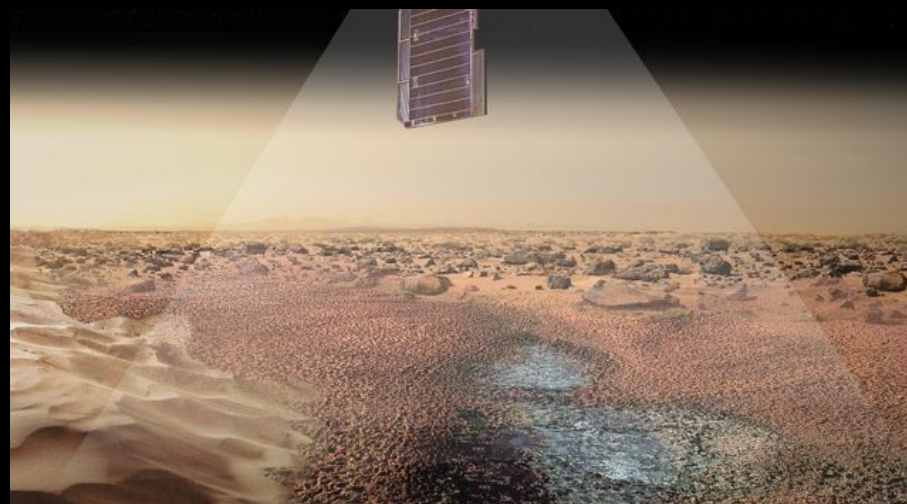
**MGS**

**Viking**

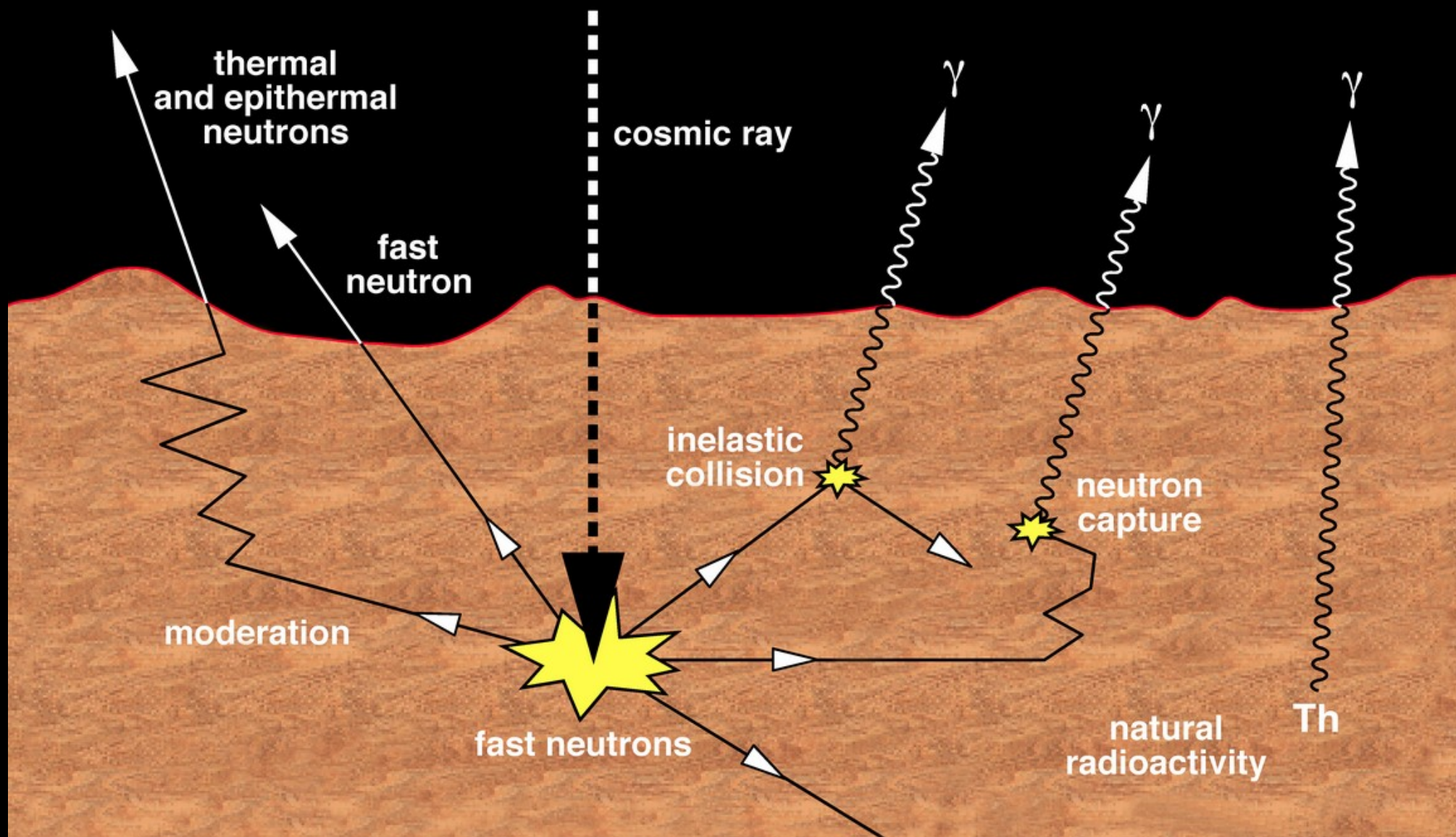
# Mars Odyssey

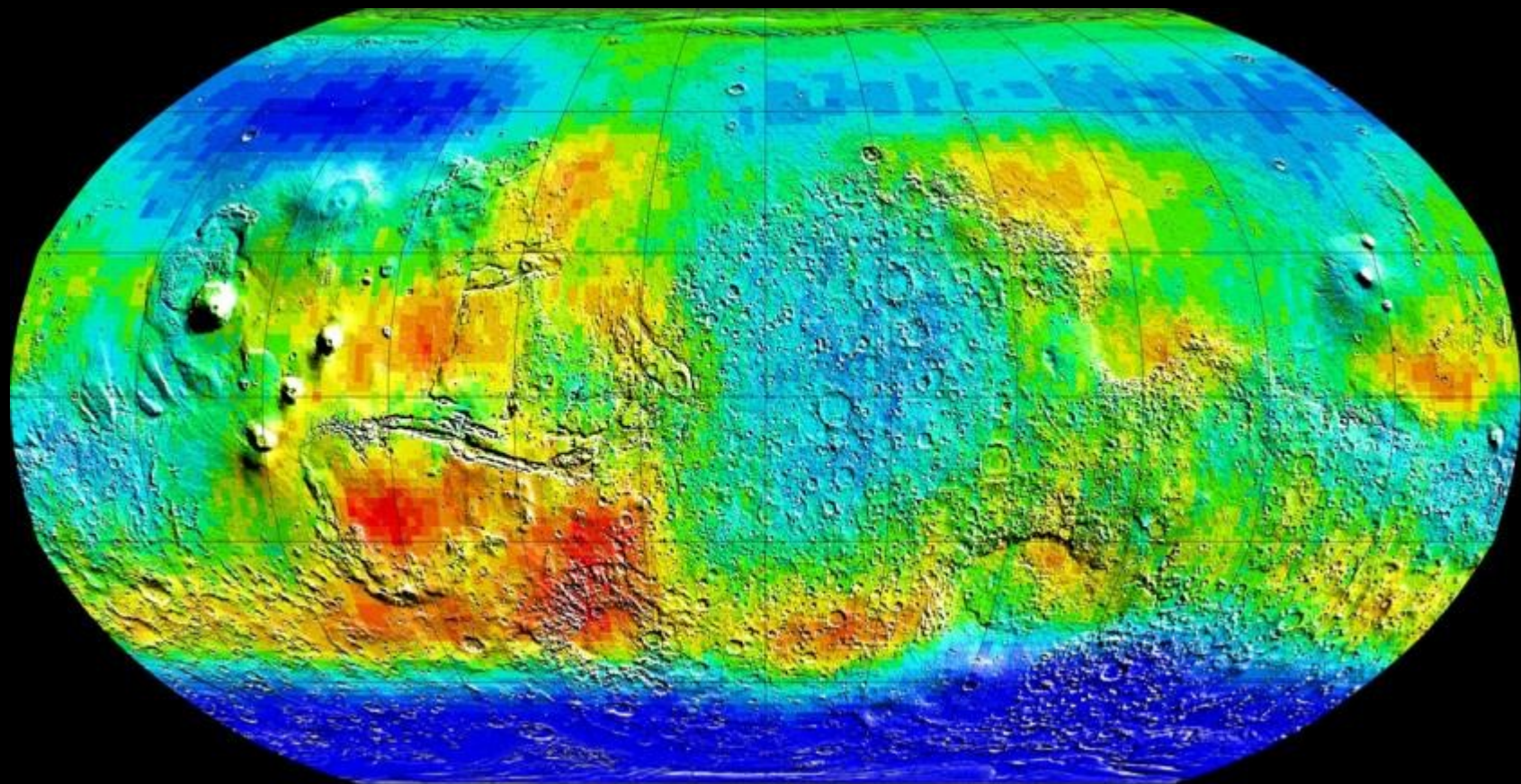


NASA/ARIZONA STATE UNIVERSITY, WPA GETTY IMAGES



# Nuclear Radiation from a Planetary Surface





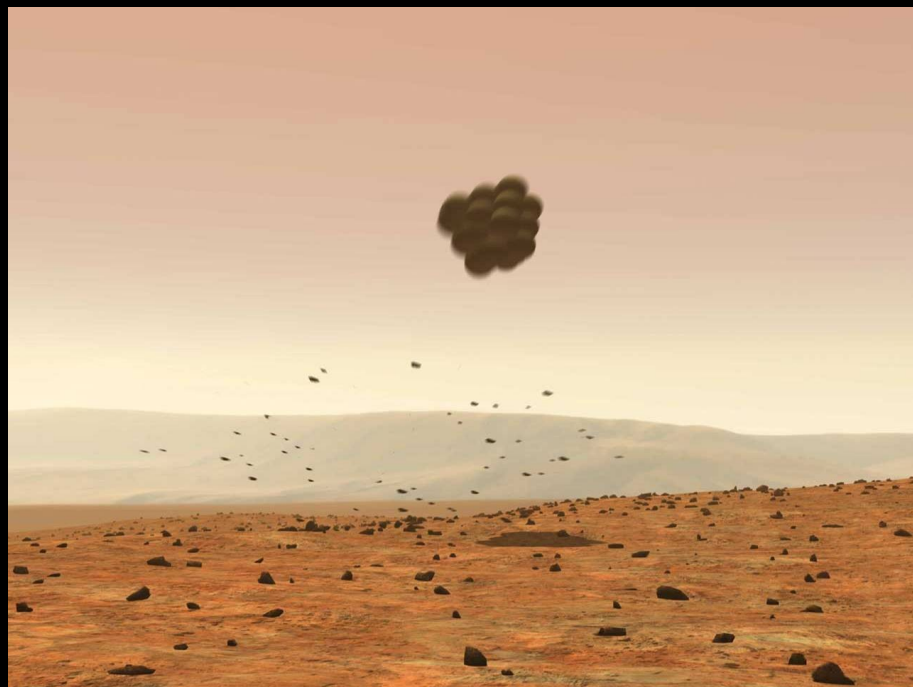
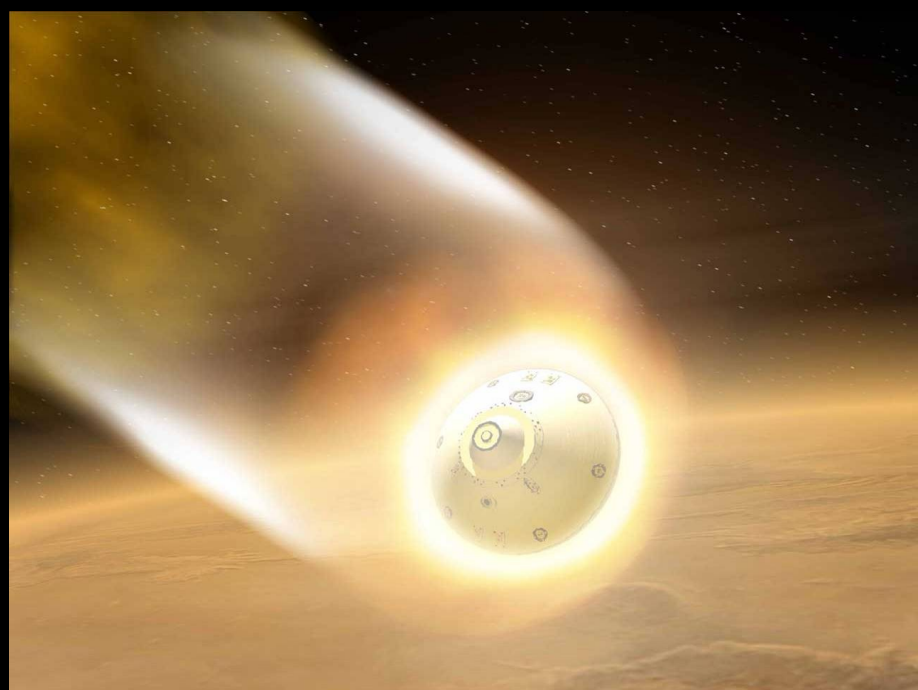
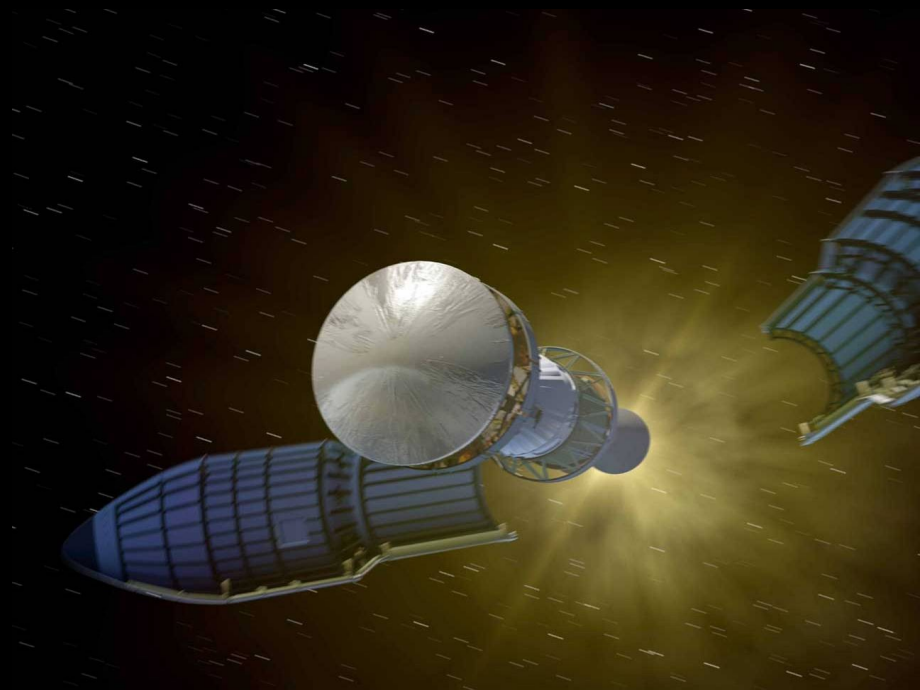


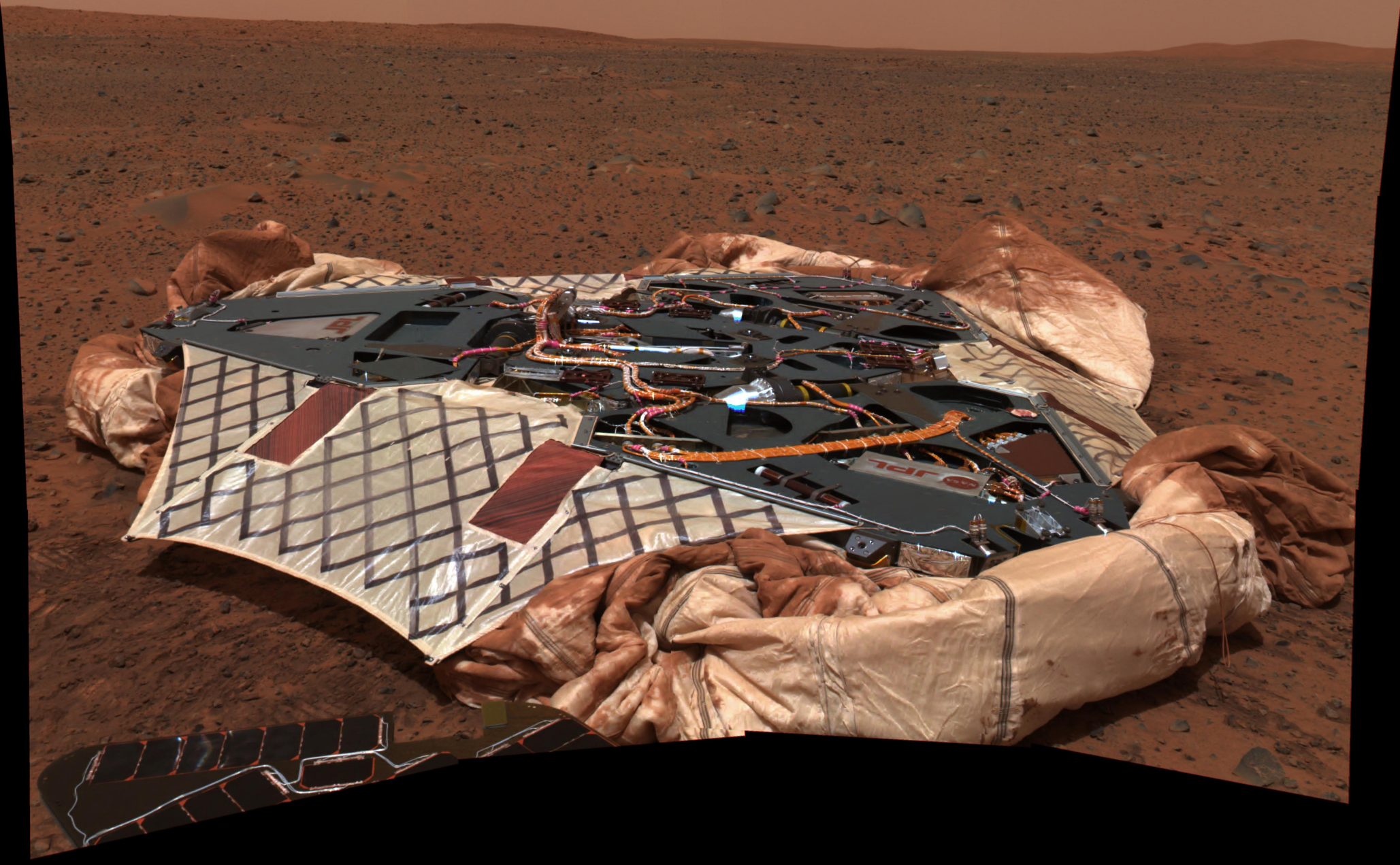




# Mars Exploration Rovers (A, B) (Spirit, Opportunity)

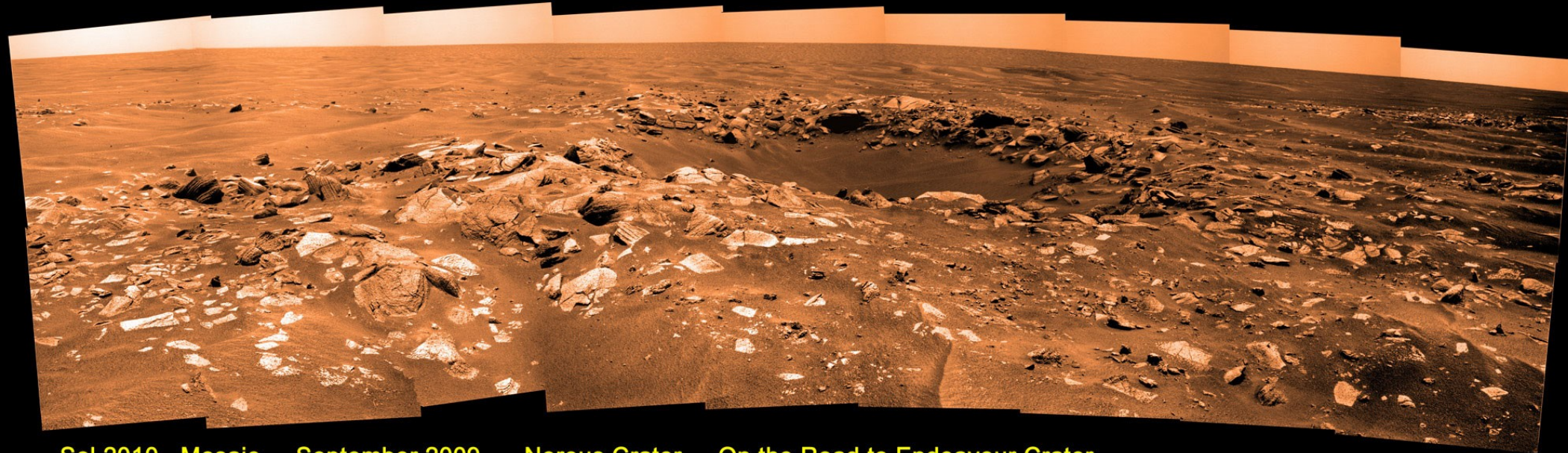




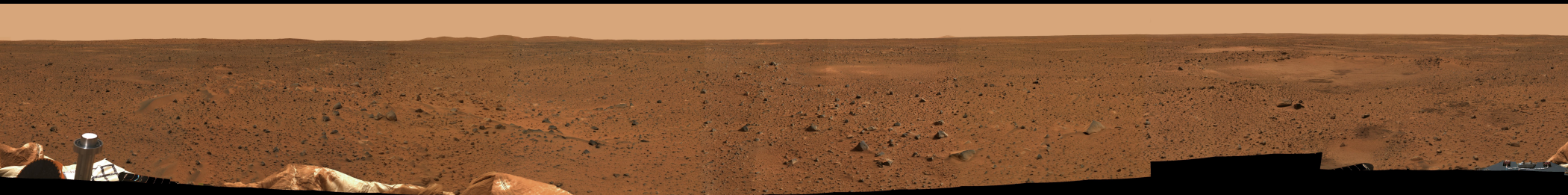




## Opportunity Mars Rover

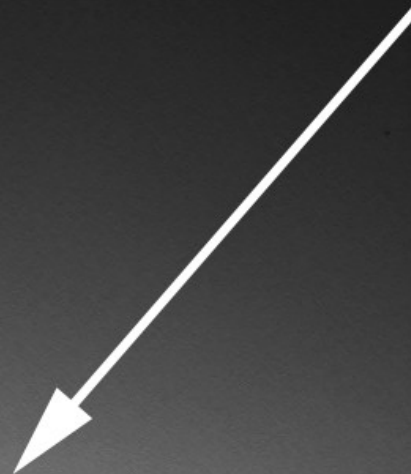


Sol 2010 Mosaic September 2009 Nereus Crater On the Road to Endeavour Crater  
Credit: NASA/JPL/Cornell/Spaceflight Now/ Ken Kremer

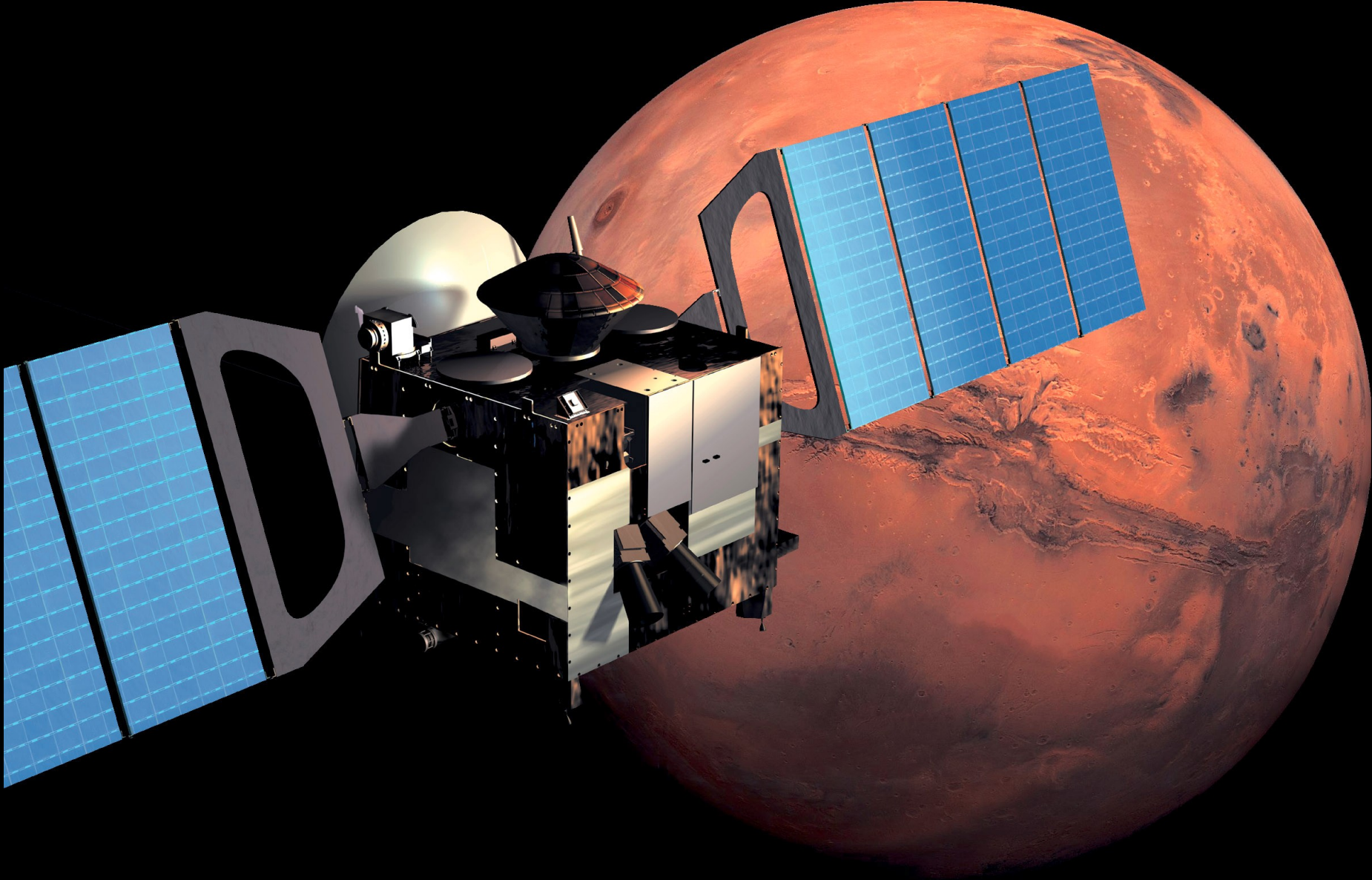




**You are here**

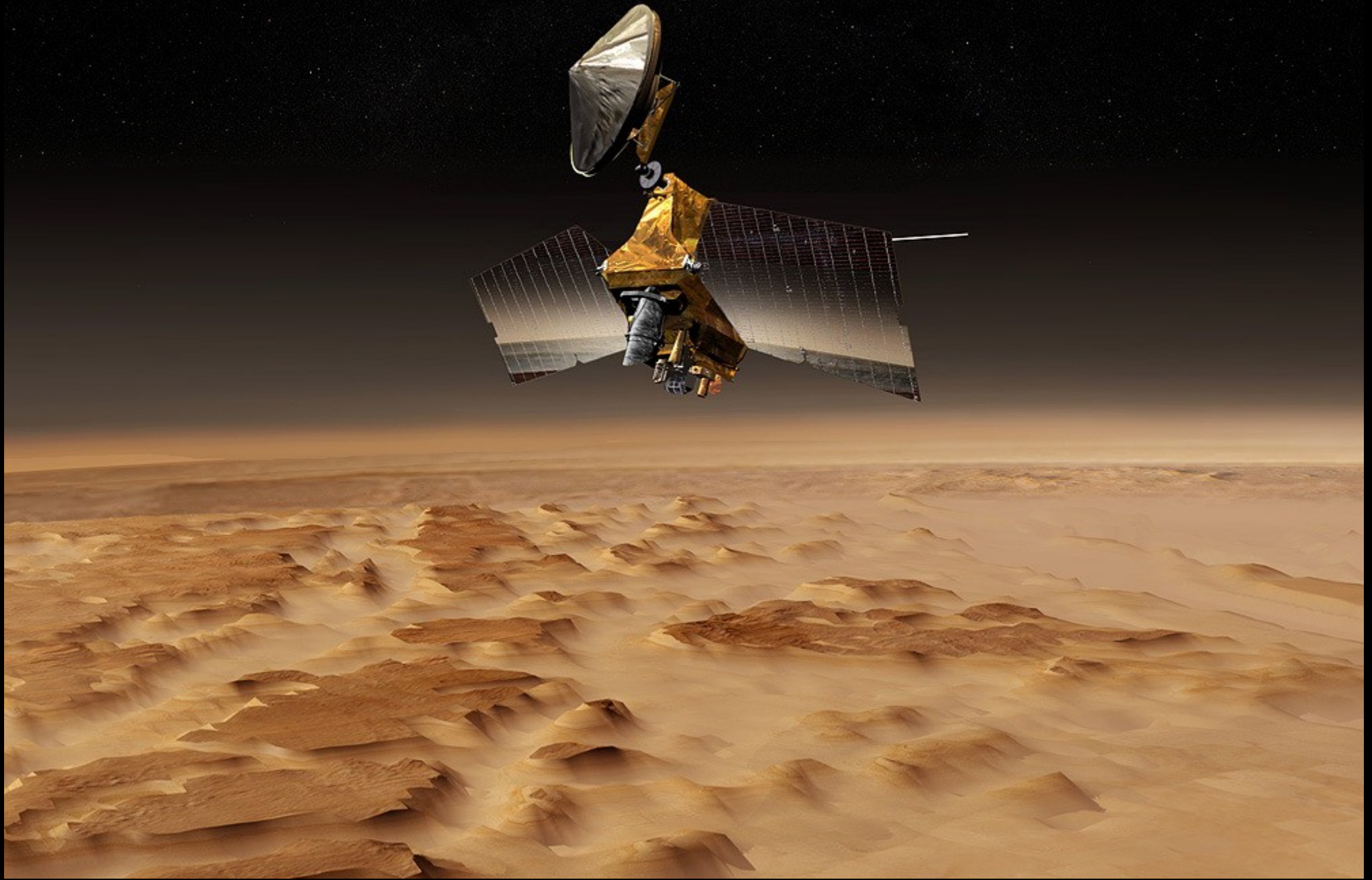


# Mars Express





# Mars Reconnaissance Orbiter (MRO)









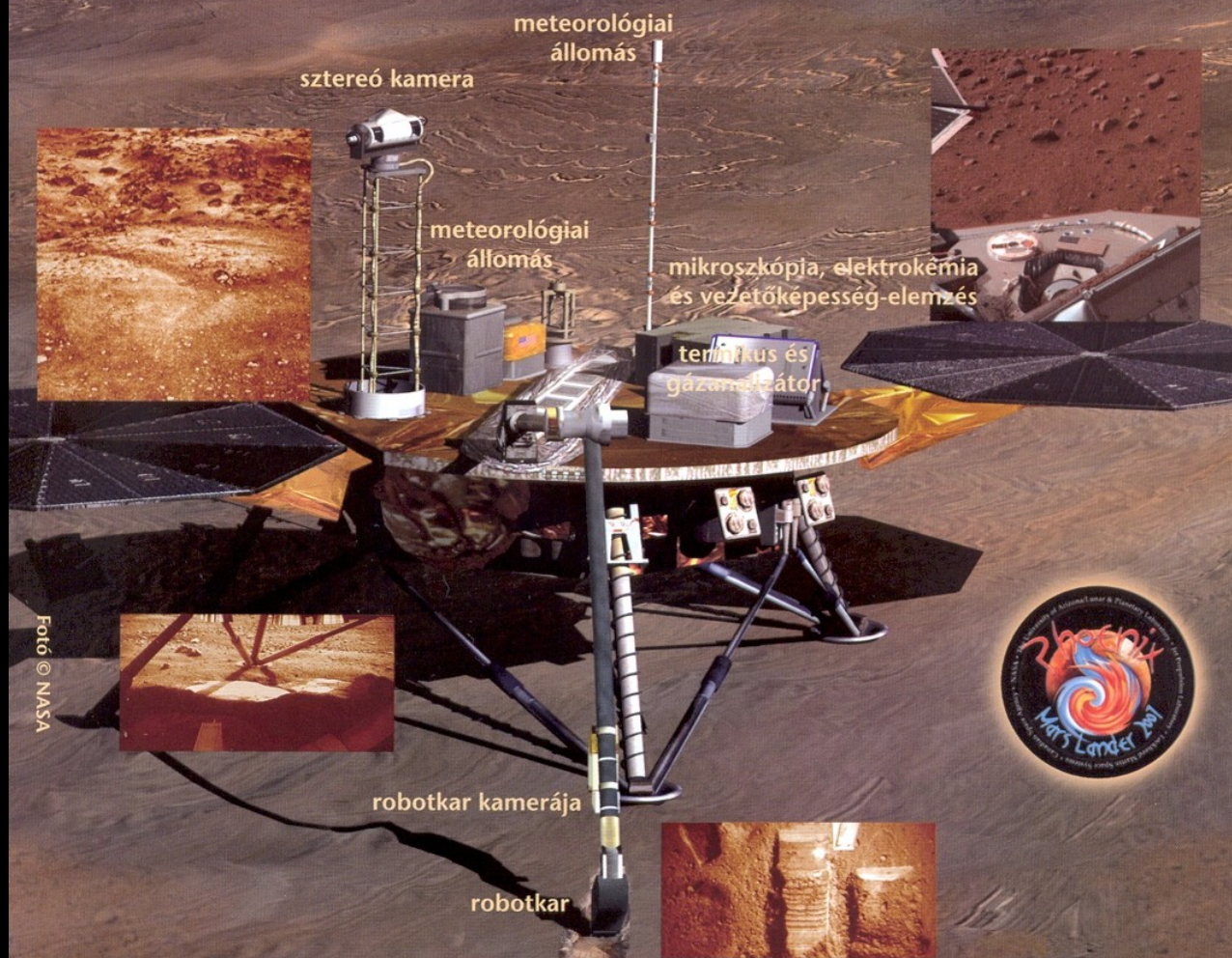
# A Phoenix-szondát

tavaly augusztusban indították útnak, és 679 millió kilométer megtétele után közép-európai idő szerint május 26-án kora hajnalban szállt le a Mars északi sarkköri vidékén.

A NASA az ejtőernyős-fékezőrakétás landolási műveletet választotta, amely ezúttal sikeres volt. A Phoenix elsődleges feladata az lesz, hogy a fagyott talajból vett jégminták megolvasztásával vizet nyerjen, s utánajárjon annak, hogy a marsi víz alkalmas volt-e valamikor akár a legprimitívebb életformák hordozására. A szonda több mint kétméteres robotkarja akár félméteres lyukat is képes fúrni a talajba, hogy jégmintát vegyen.

Az 1,52 méter magas, kiterjesztett napelemeivel együtt 5 méter széles Phoenix tömege 350 kilogramm, ebből 55 kilogrammot nyomnak a tudományos műszerek. Feladatának teljesítésére három hónap áll rendelkezésére a mínusz 73 és mínusz 33 Celsius fok között ingadozó hőmérsékletben.

Jelenleg két másik amerikai szonda, mégpedig két önjáró robot barangol a Mars felszínén immár több mint három éve. A Spirit és az Opportunity azonban a bolygó egyenlítőjének környékén, egy jóval szárazabb vidéken kószál, és ők nem a talajba fúrnak, hanem főként köveket csiszolnak, és az erről készült mikroszkopikus felvételeket küldik a földi irányító központba.



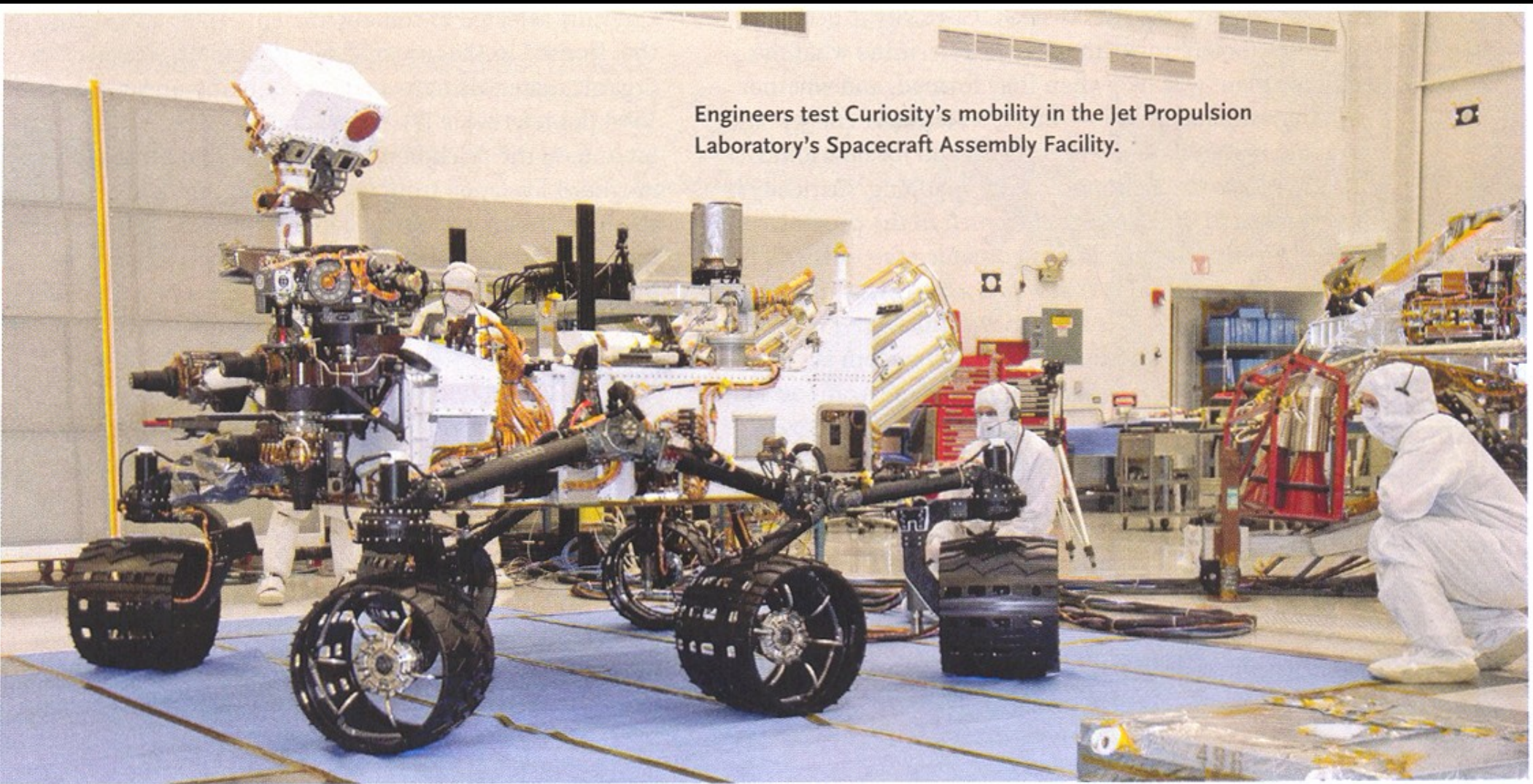
Sol 20

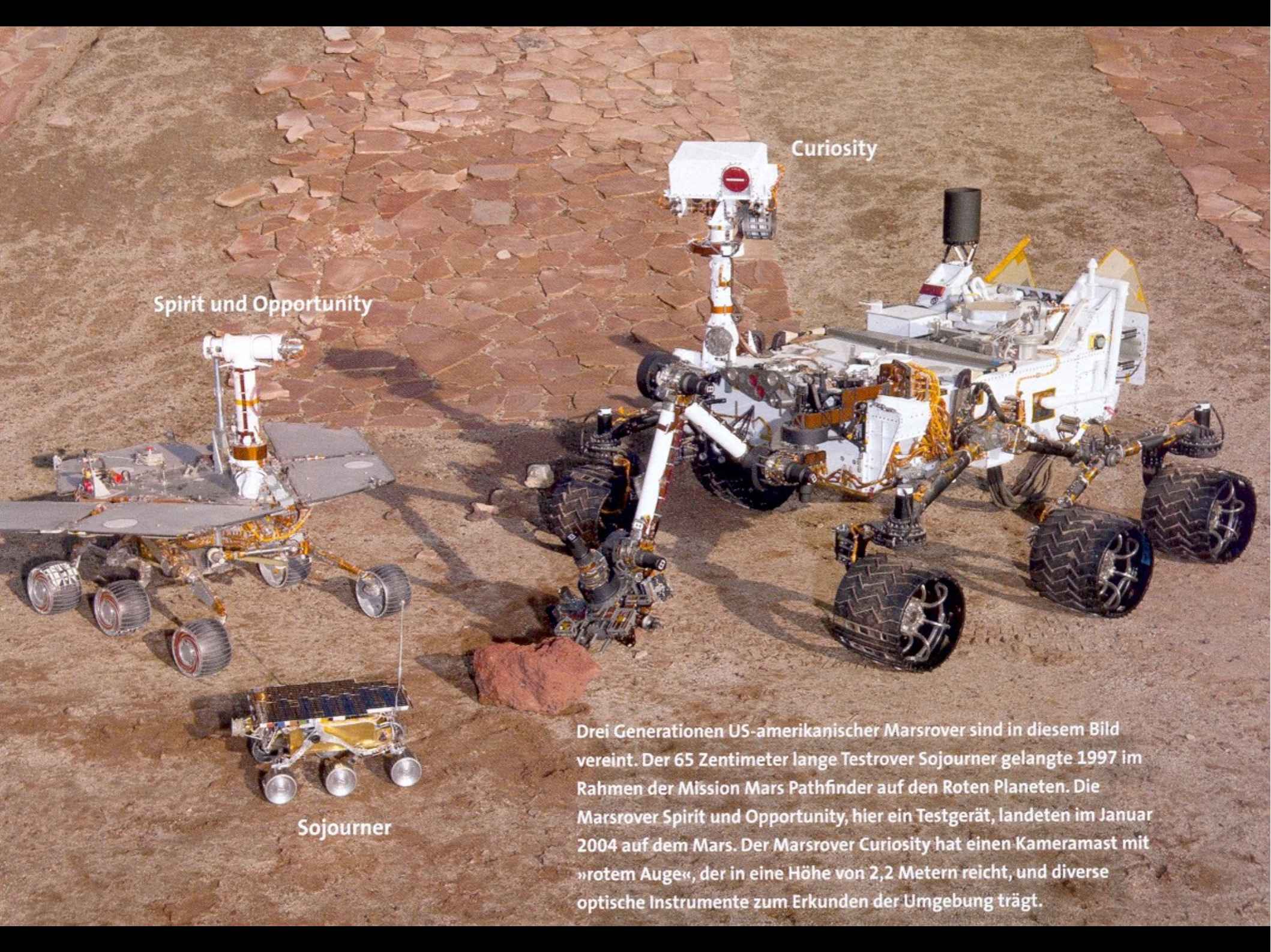


Sol 24



Engineers test Curiosity's mobility in the Jet Propulsion Laboratory's Spacecraft Assembly Facility.





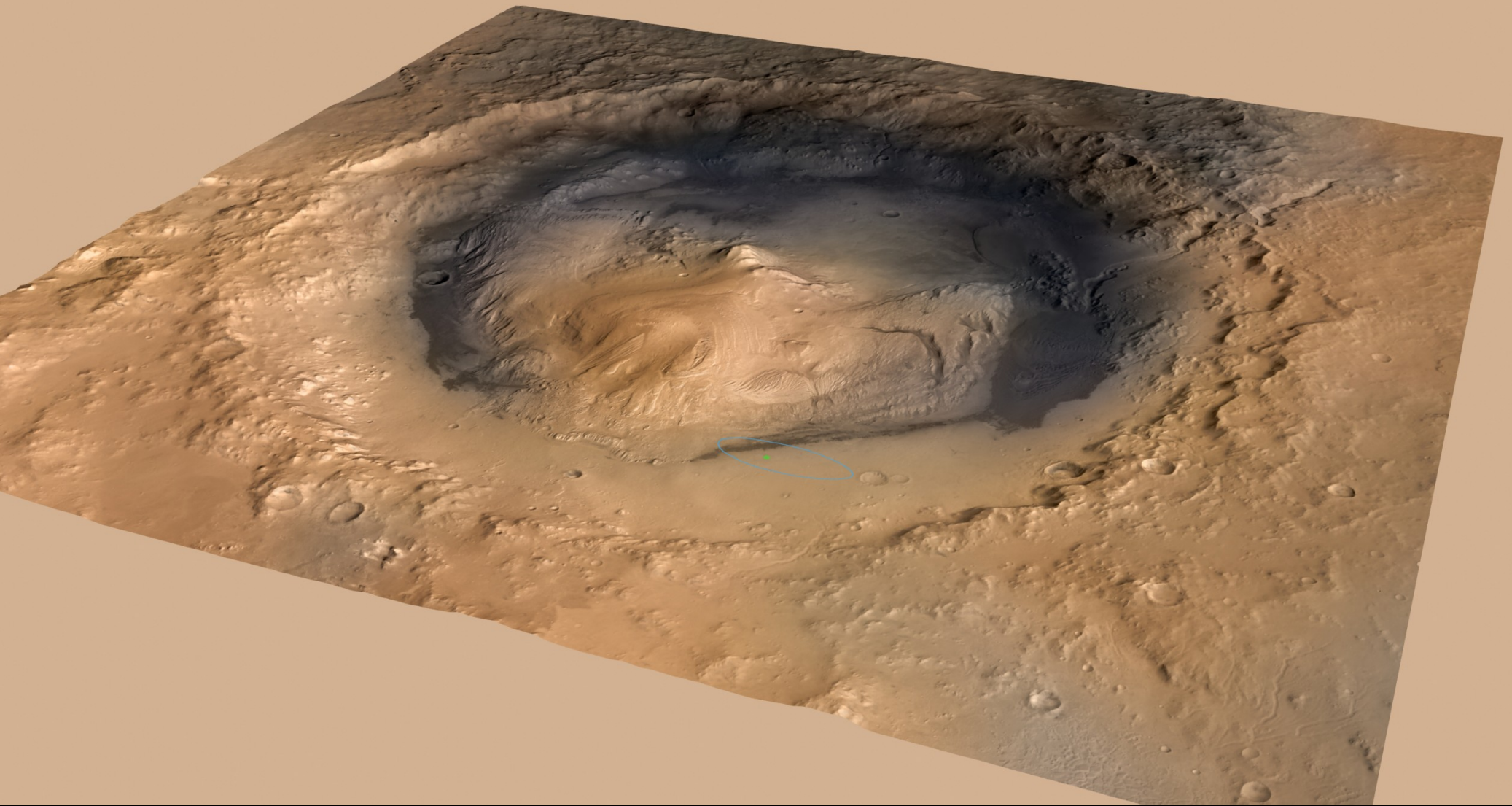
Spirit und Opportunity

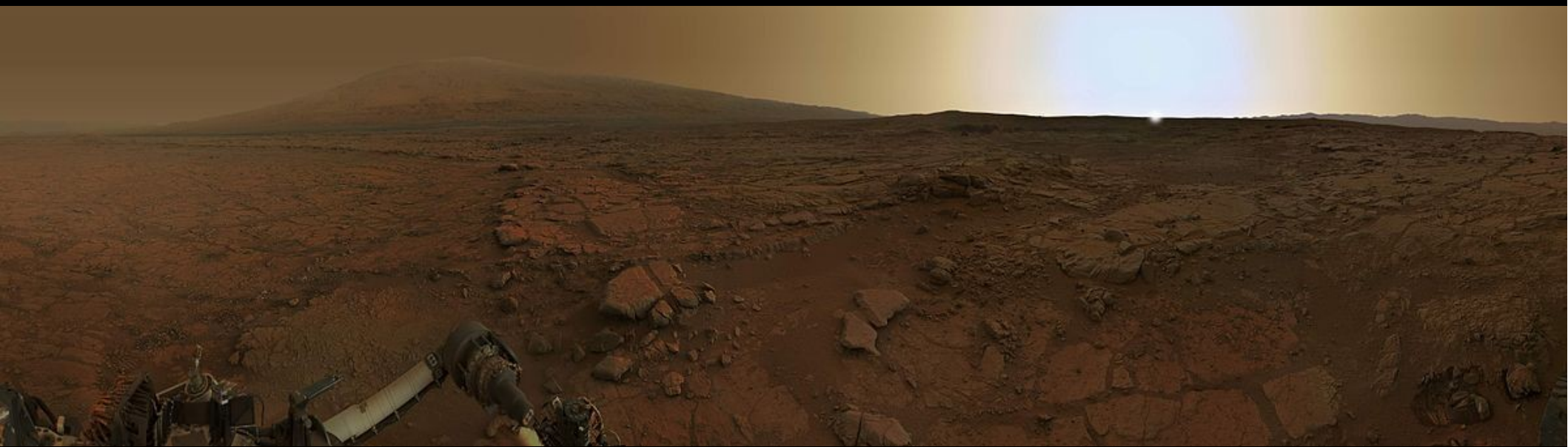
Curiosity

Sojourner

Drei Generationen US-amerikanischer Marsrover sind in diesem Bild vereint. Der 65 Zentimeter lange Testrover Sojourner gelangte 1997 im Rahmen der Mission Mars Pathfinder auf den Roten Planeten. Die Marsrover Spirit und Opportunity, hier ein Testgerät, landeten im Januar 2004 auf dem Mars. Der Marsrover Curiosity hat einen Kameramast mit »rotem Auge«, der in eine Höhe von 2,2 Metern reicht, und diverse optische Instrumente zum Erkunden der Umgebung trägt.










# THE MARTIAN

ANDY WEIR

A NOVEL



HELP IS ONLY 140 MILLION MILES AWAY

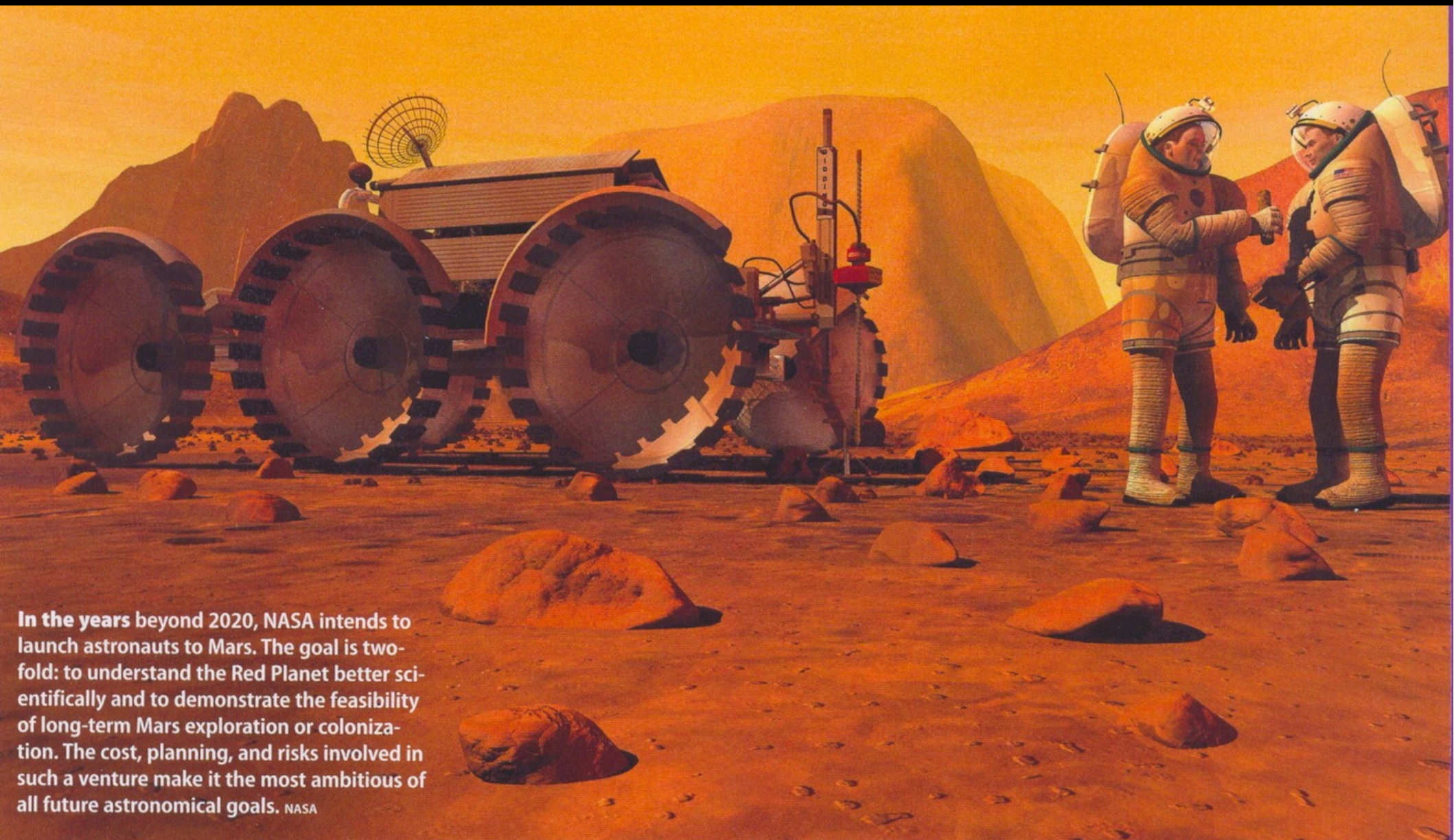
MATT DAMON

# THE MARTIAN

TWENTIETH CENTURY FOX PRESENTS A SCOTT FELZ / UNIVERSAL PICTURES PRODUCTION A HOLLY SCOTT FILM MATT DAMON "THE MARTIAN" JESSICA CHASTAIN KEVIN SPACEY JEFF DANIELS MICHELLE YEOH PAUL RAY MAHA  
SUNIL BANERJEE GREG KINNEAR ANDREW SCROTT LAURENCE FISHBURNE WILLEM DAFOE JEFFREY DIAZ JEFFREY WRIGHT JOSH WATKINS  
"THE MARTIAN" HOLLY SCOTT MICHAEL SCHUBERT ARIYA SOO MAHA RAJAM COSTUME DESIGNER ANDREW WOODS "THE MARTIAN" HOLLY SCOTT

IN CINEMAS SEPTEMBER 30 IN 3D





**In the years beyond 2020, NASA intends to launch astronauts to Mars. The goal is two-fold: to understand the Red Planet better scientifically and to demonstrate the feasibility of long-term Mars exploration or colonization. The cost, planning, and risks involved in such a venture make it the most ambitious of all future astronomical goals. NASA**