Research and Exploration Goals at the JPL

SHPE Region 2 Conference

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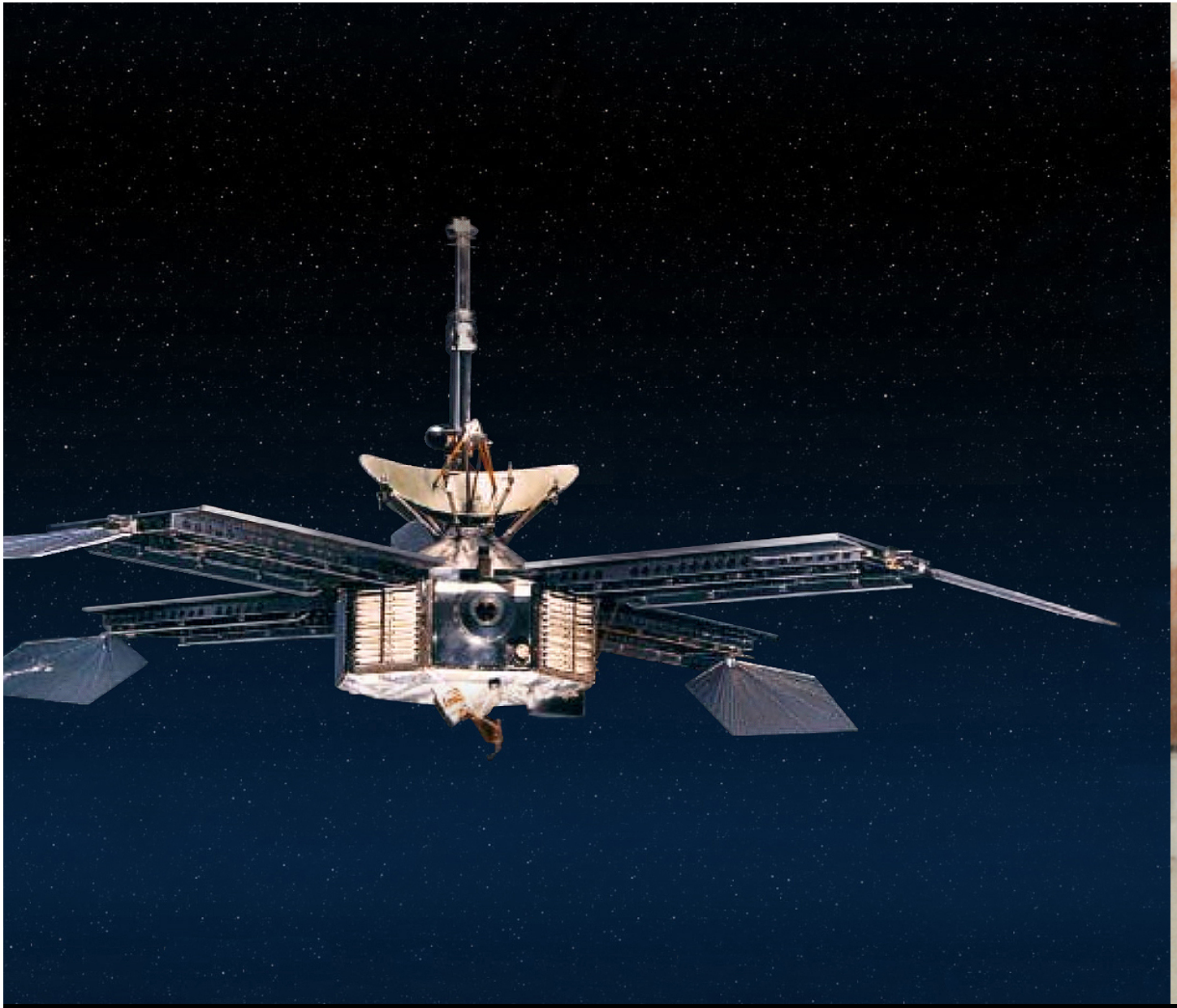
April 8, 2016

Jet Propulsion Laboratory
California Institute of Technology

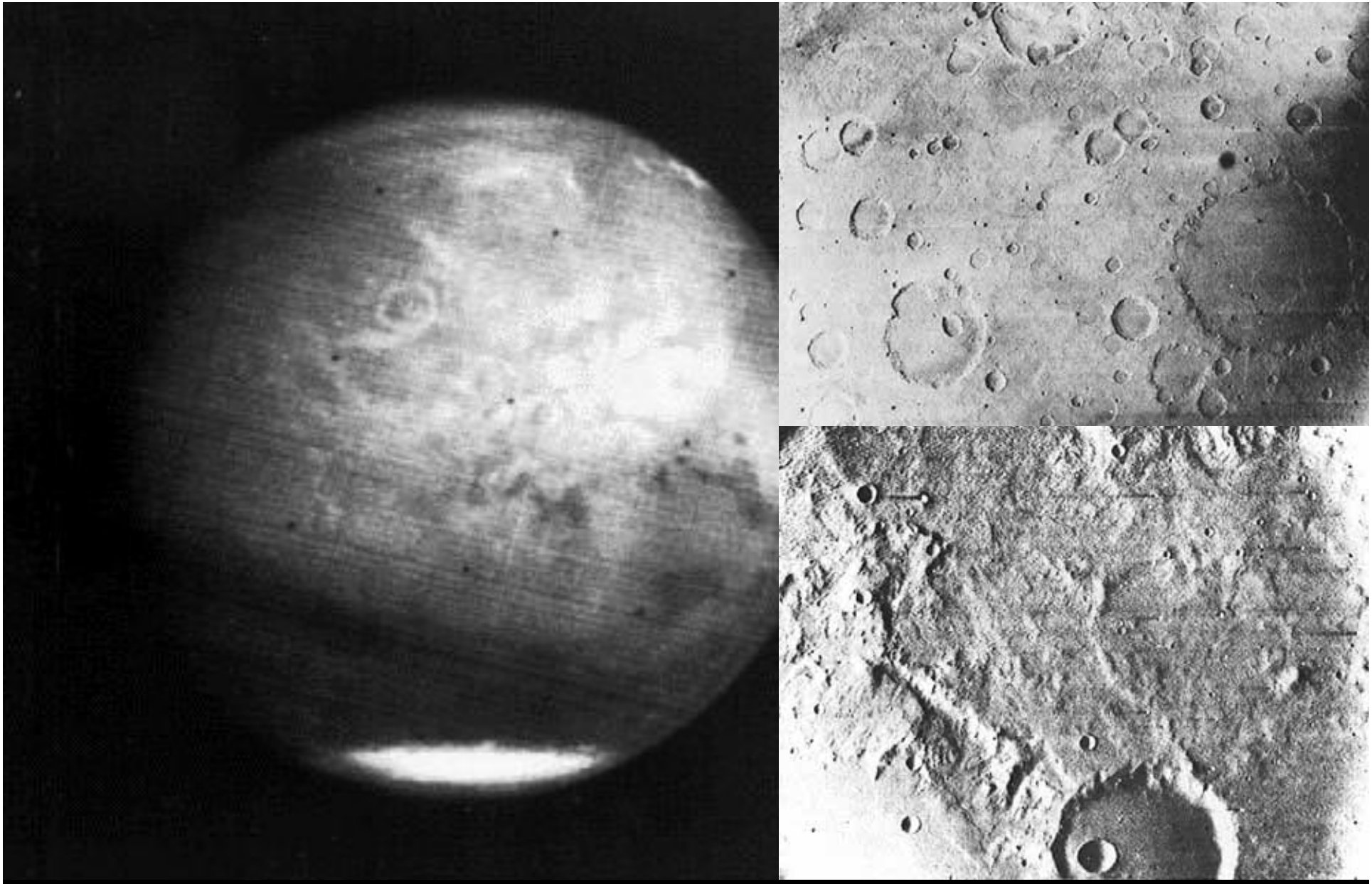
NASA's Jet Propulsion Laboratory (JPL) is a division of Caltech and is the leading U.S. center for the robotic exploration of the solar system. Working together, Caltech's and JPL's innovative researchers and technicians are shedding new light on our solar system's origins and are building knowledge not only of distant planetary environments, but of Earth and its atmosphere as well.

Exploring Mars

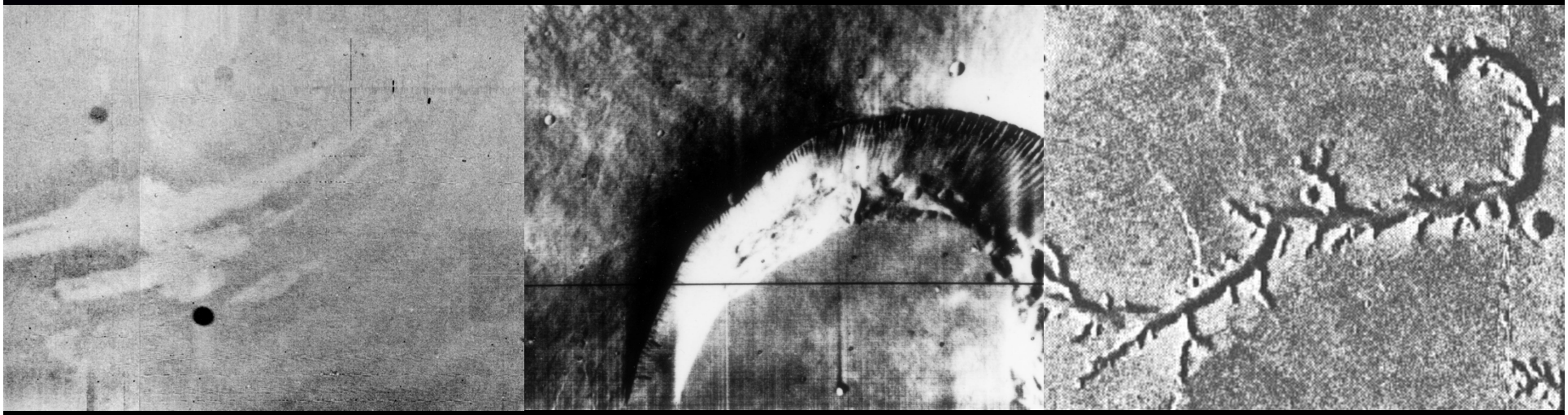
Follow the water, explore habitability, seek for signs of life and prepare for human exploration



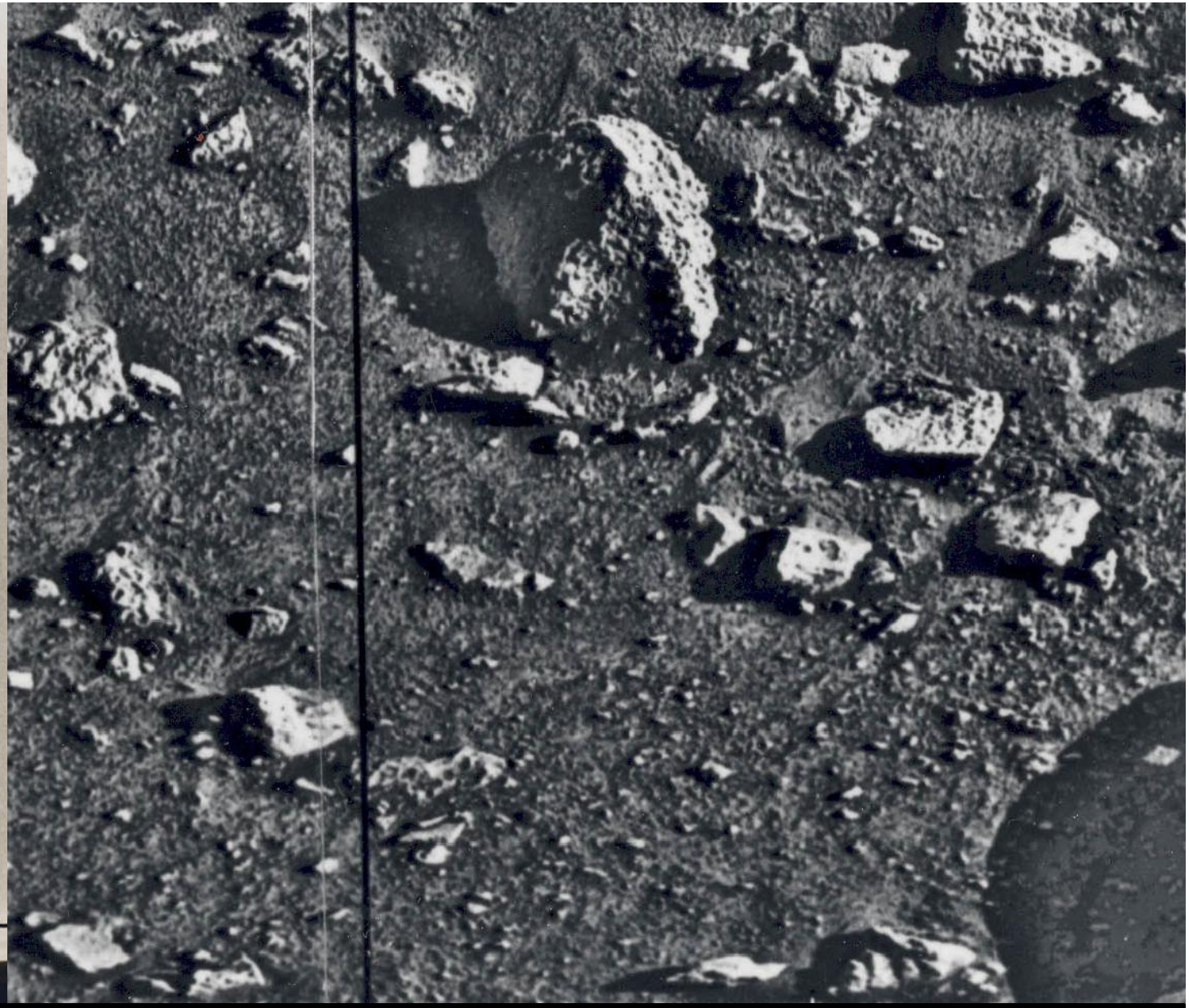
1965 Mariner 4 – world's first Mars mission



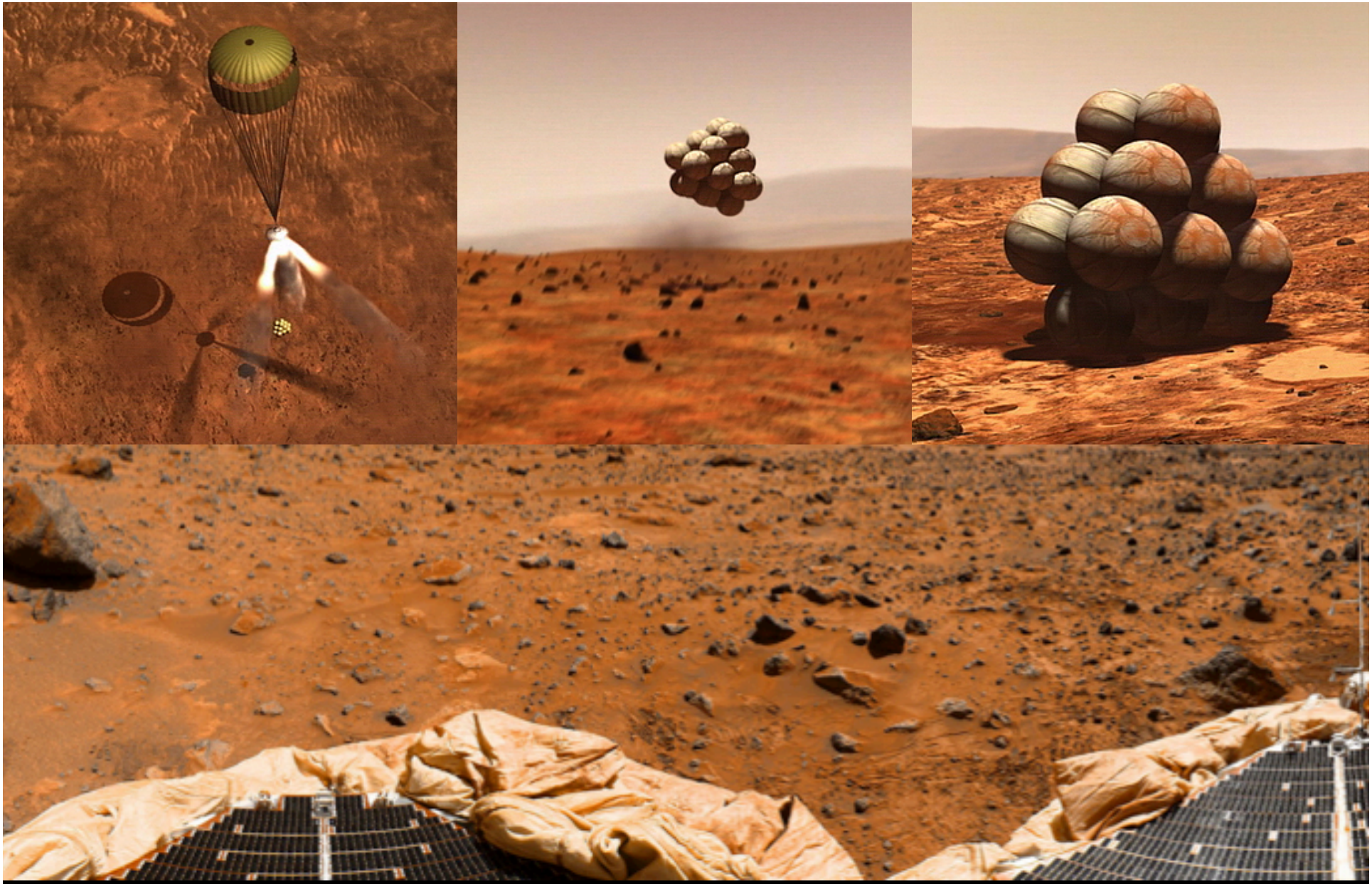
1969 Mariner 6 & 7 – flybys of Mars



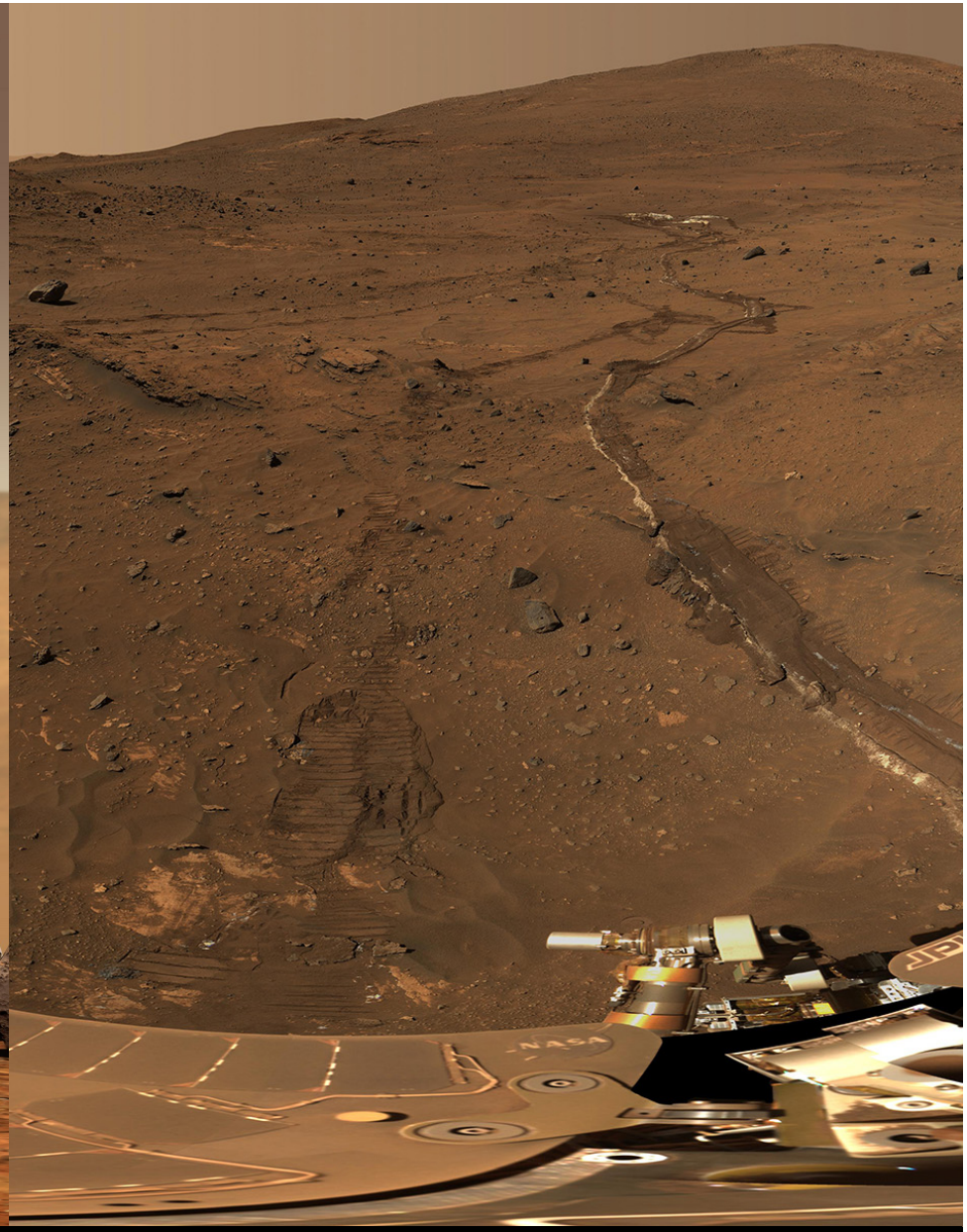
1971 Mariner 9 – first Mars orbiter



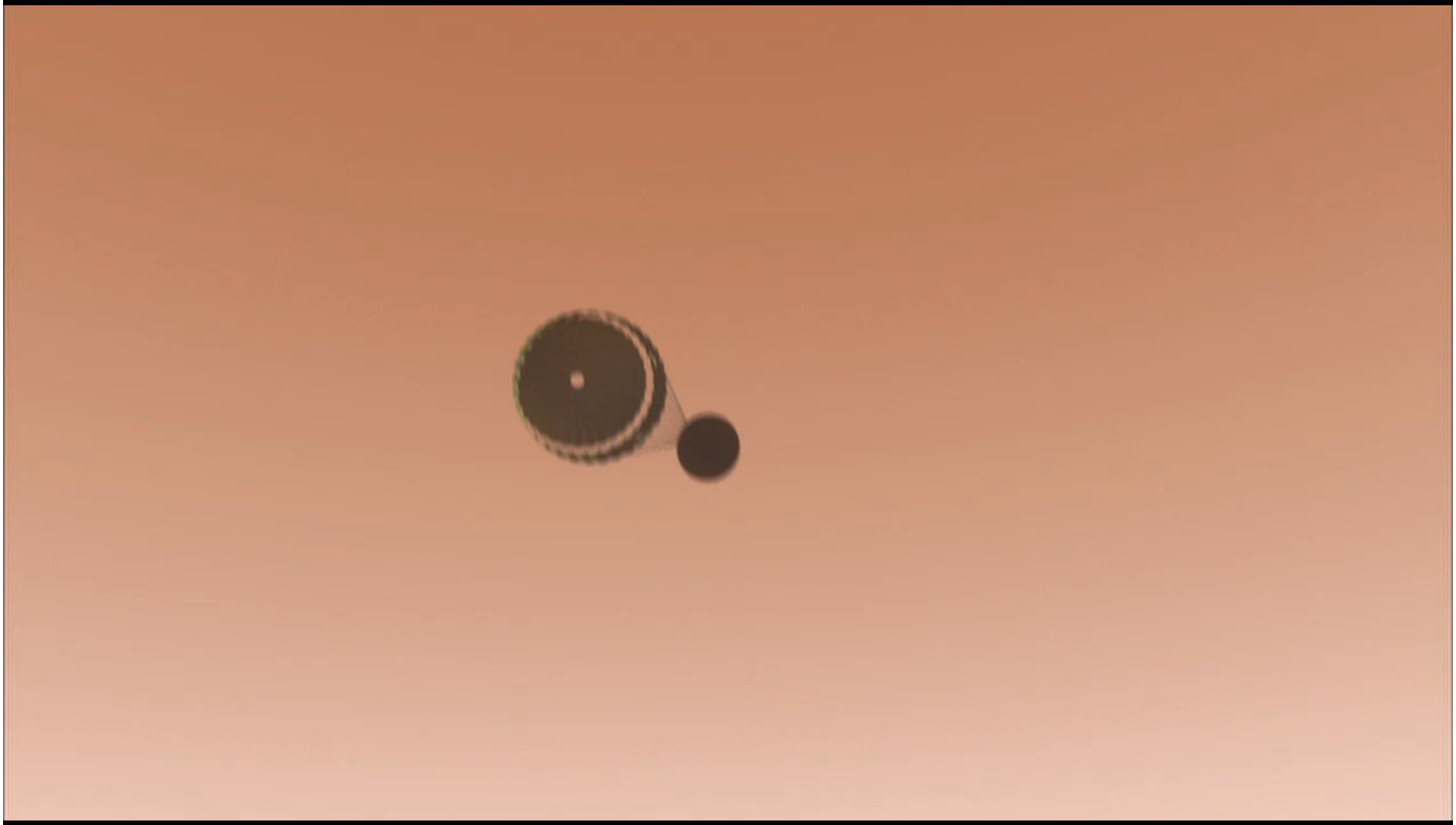
1976 Viking 1 & 2 – Mars orbiters and landers

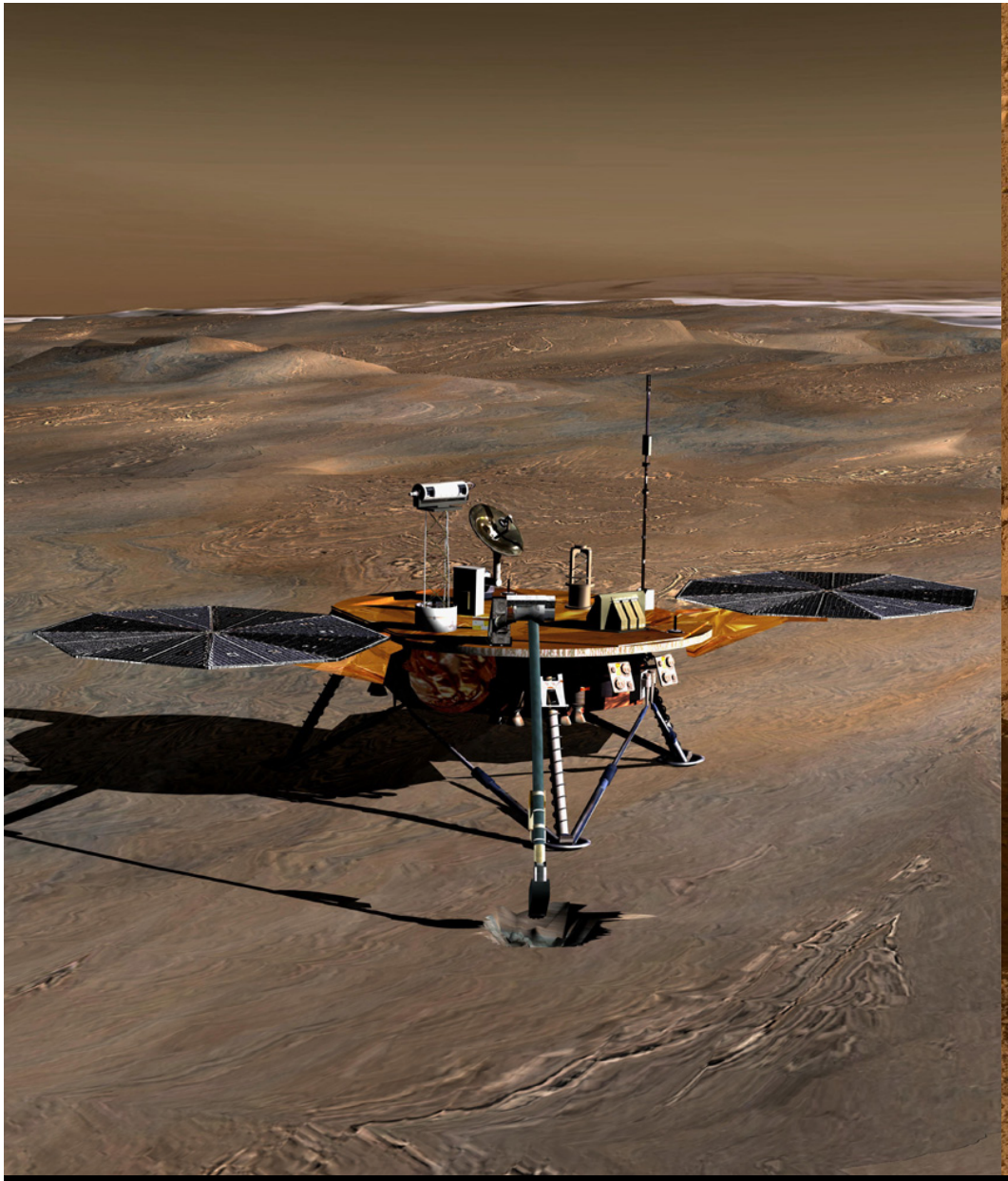


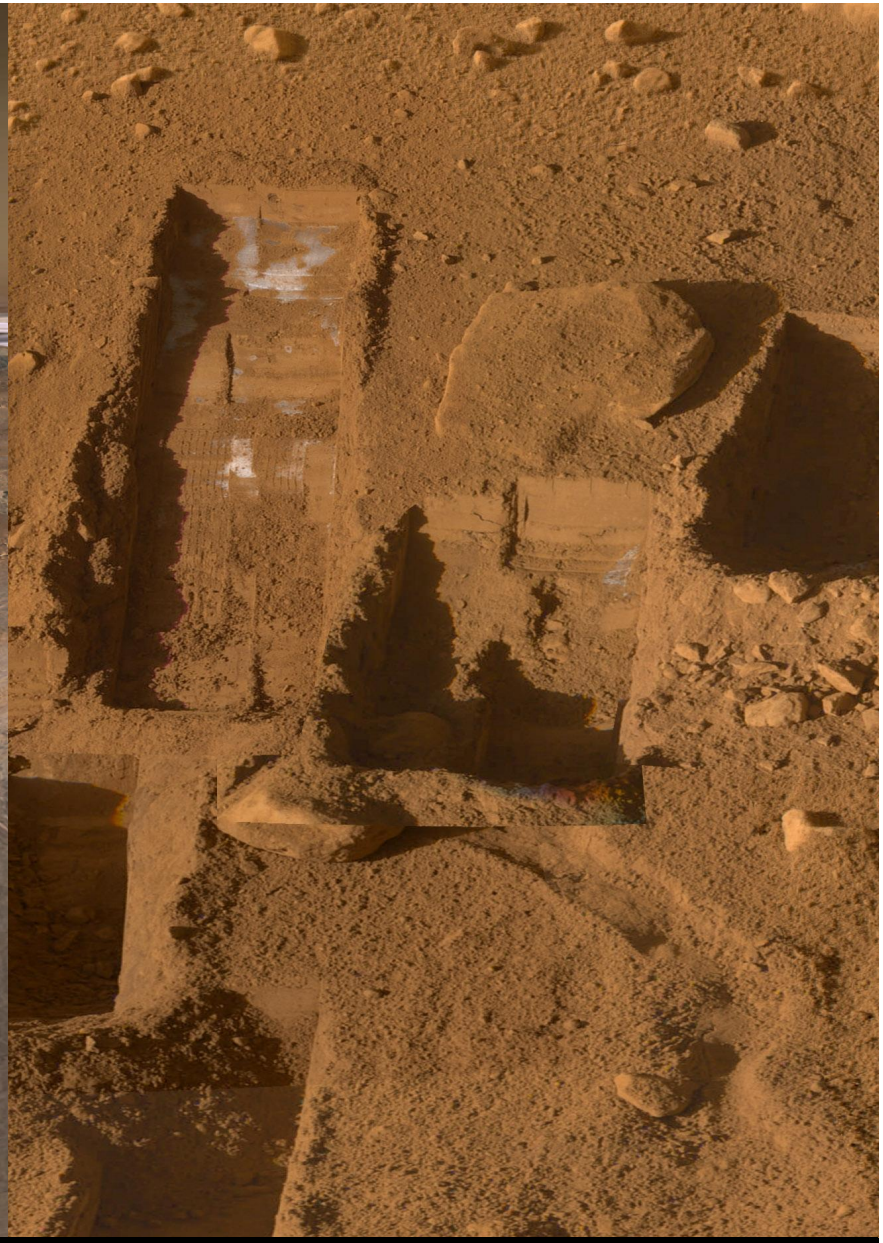
1997 Mars Pathfinder lander & Sojourner rover



2004 Spirit & Opportunity rovers

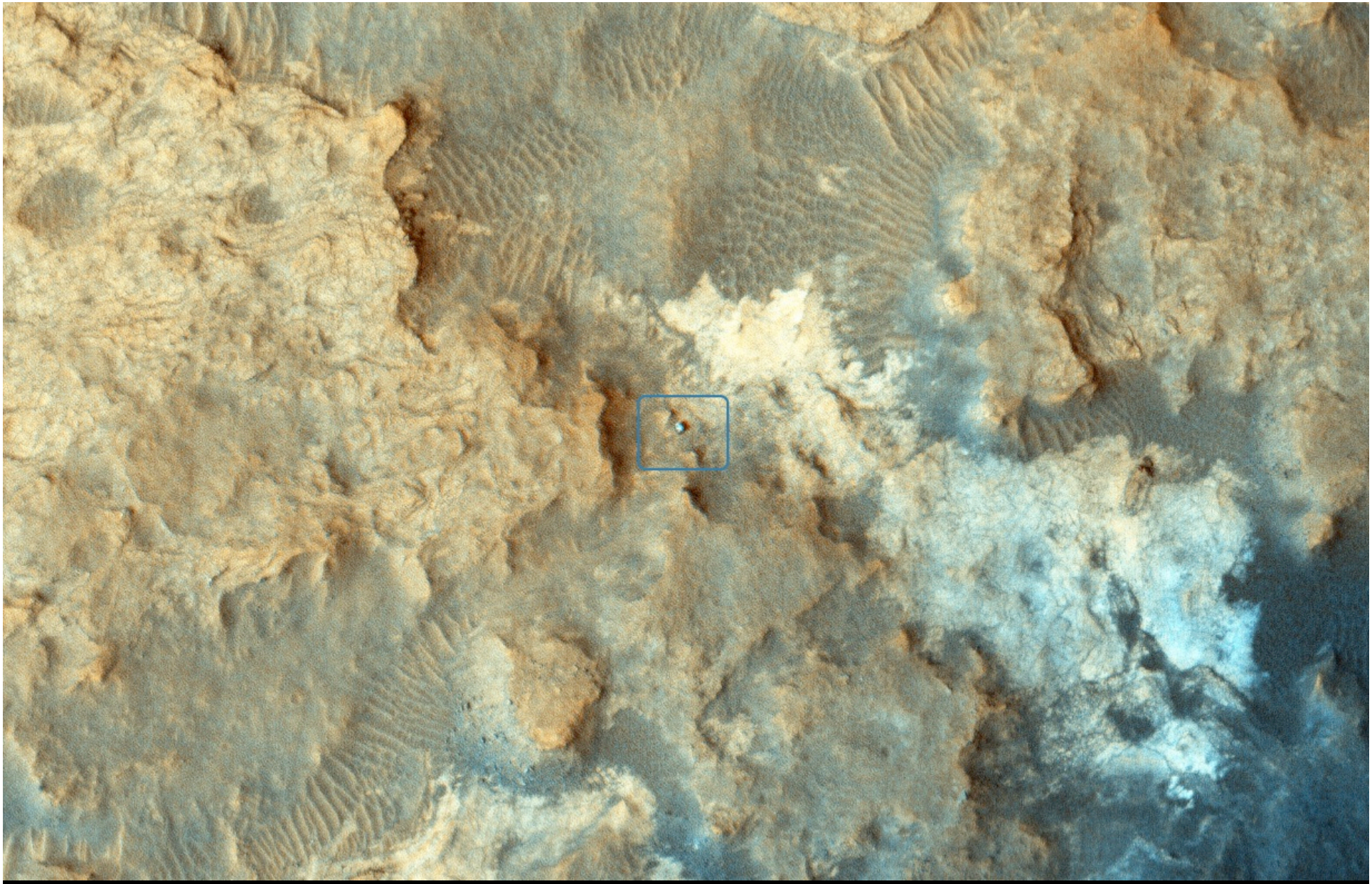






2008 Phoenix – Mars lander

TODAY Mars Odyssey orbiter



TODAY Mars Reconnaissance Orbiter

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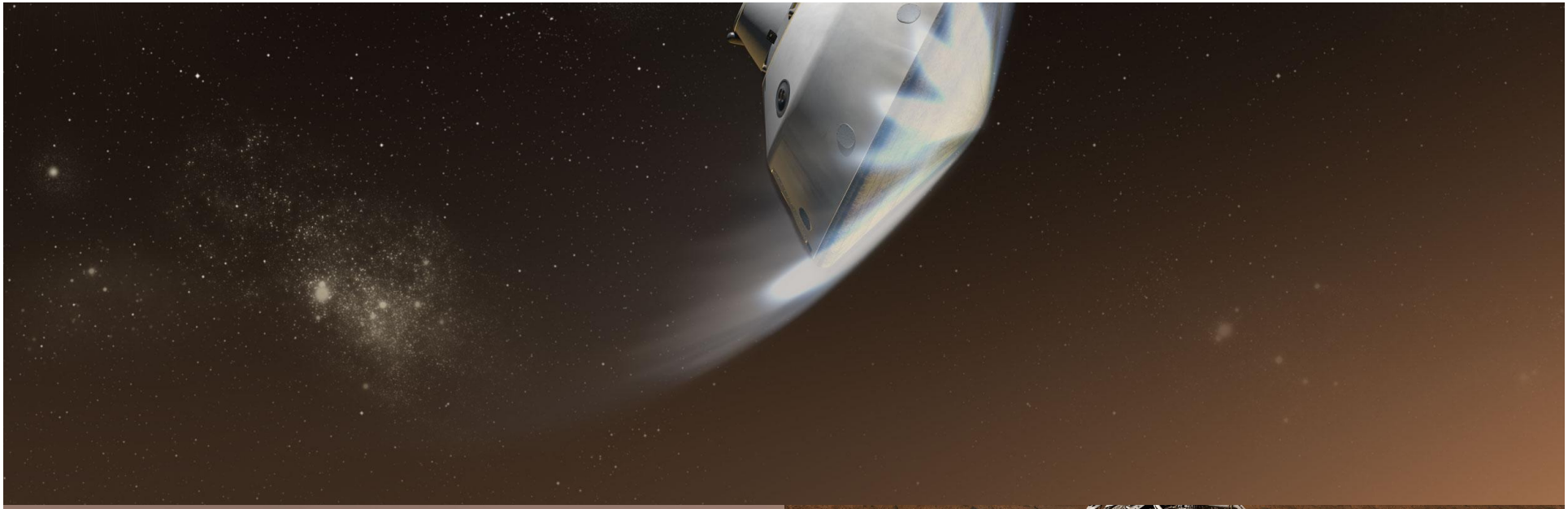
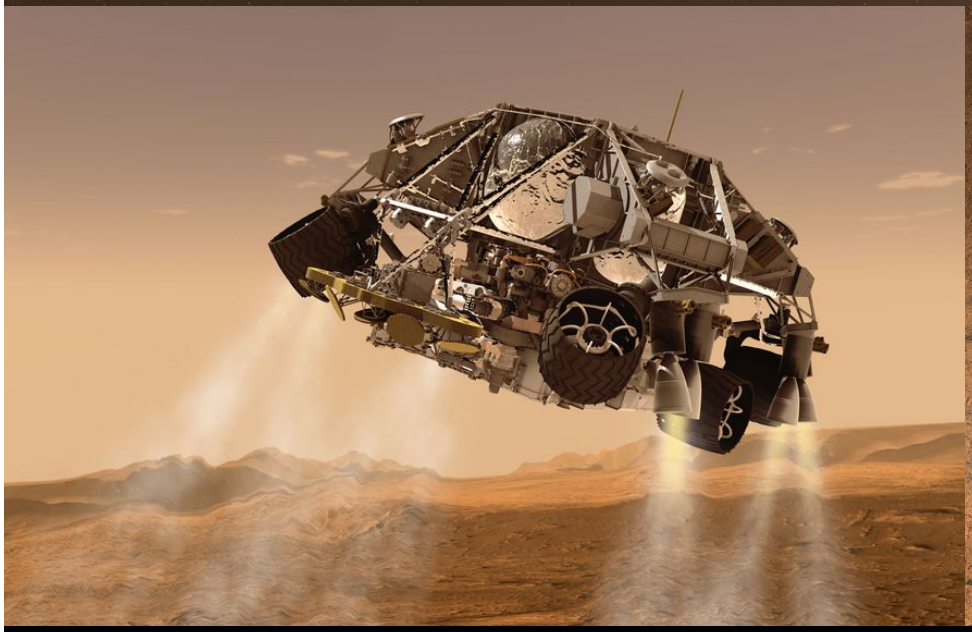
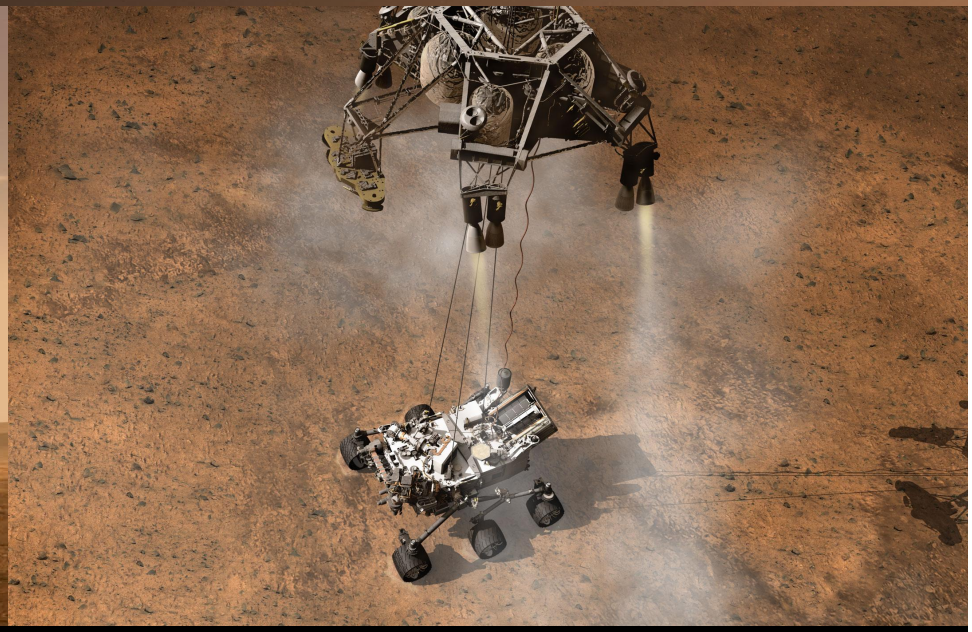
TODAY Opportunity rover







TODAY Curiosity rover

TOMORROW InSight Mars lander

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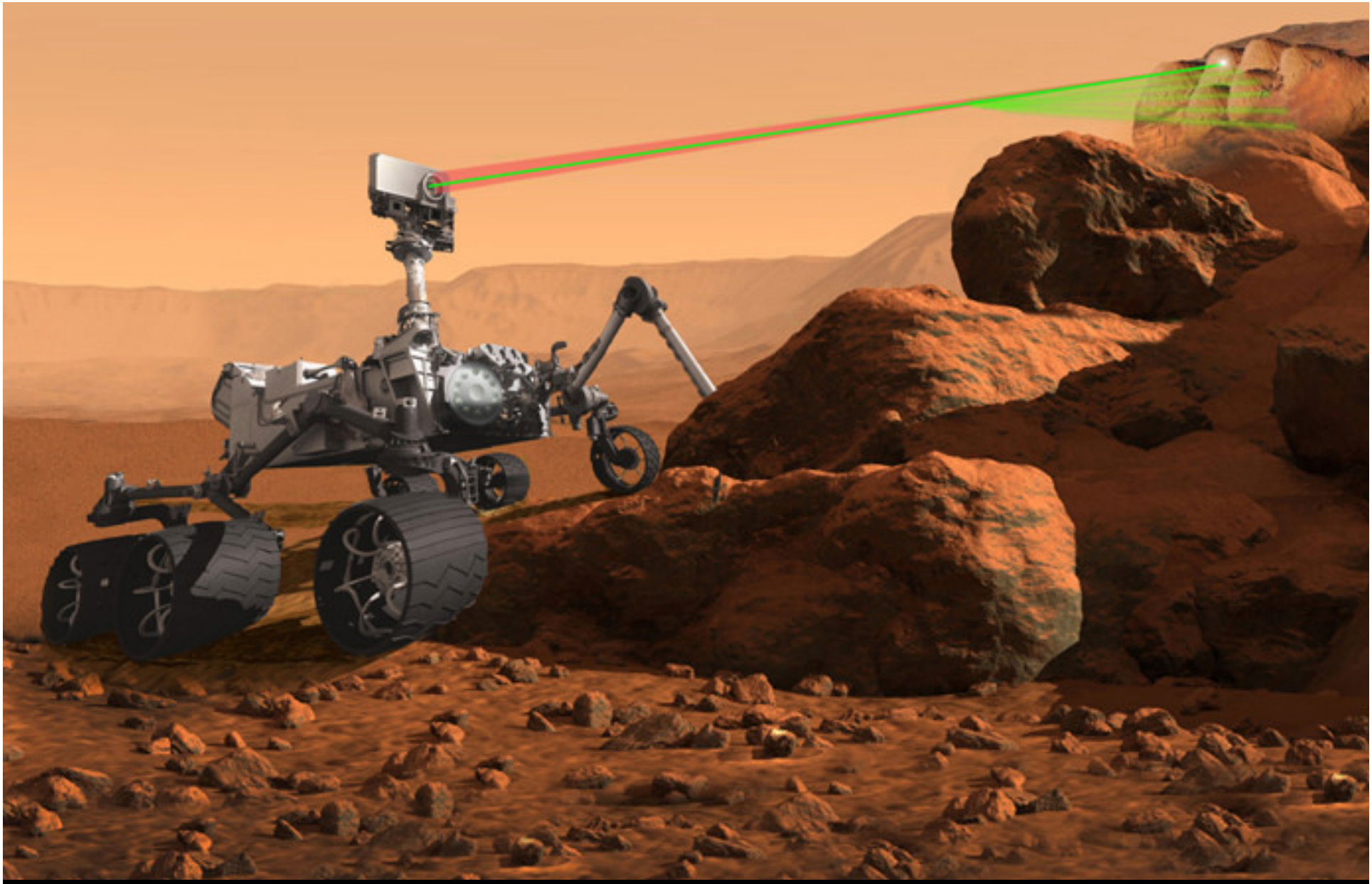
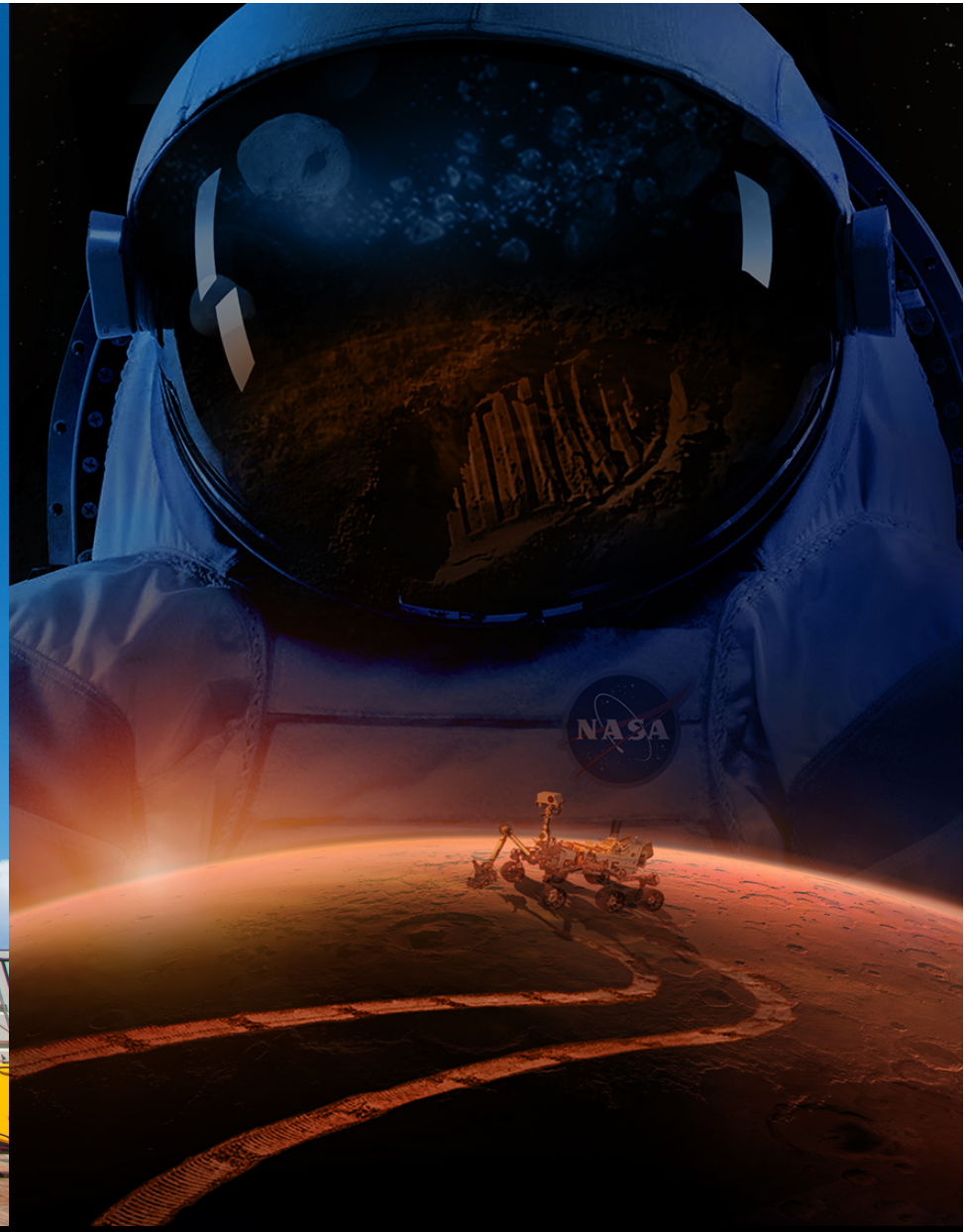
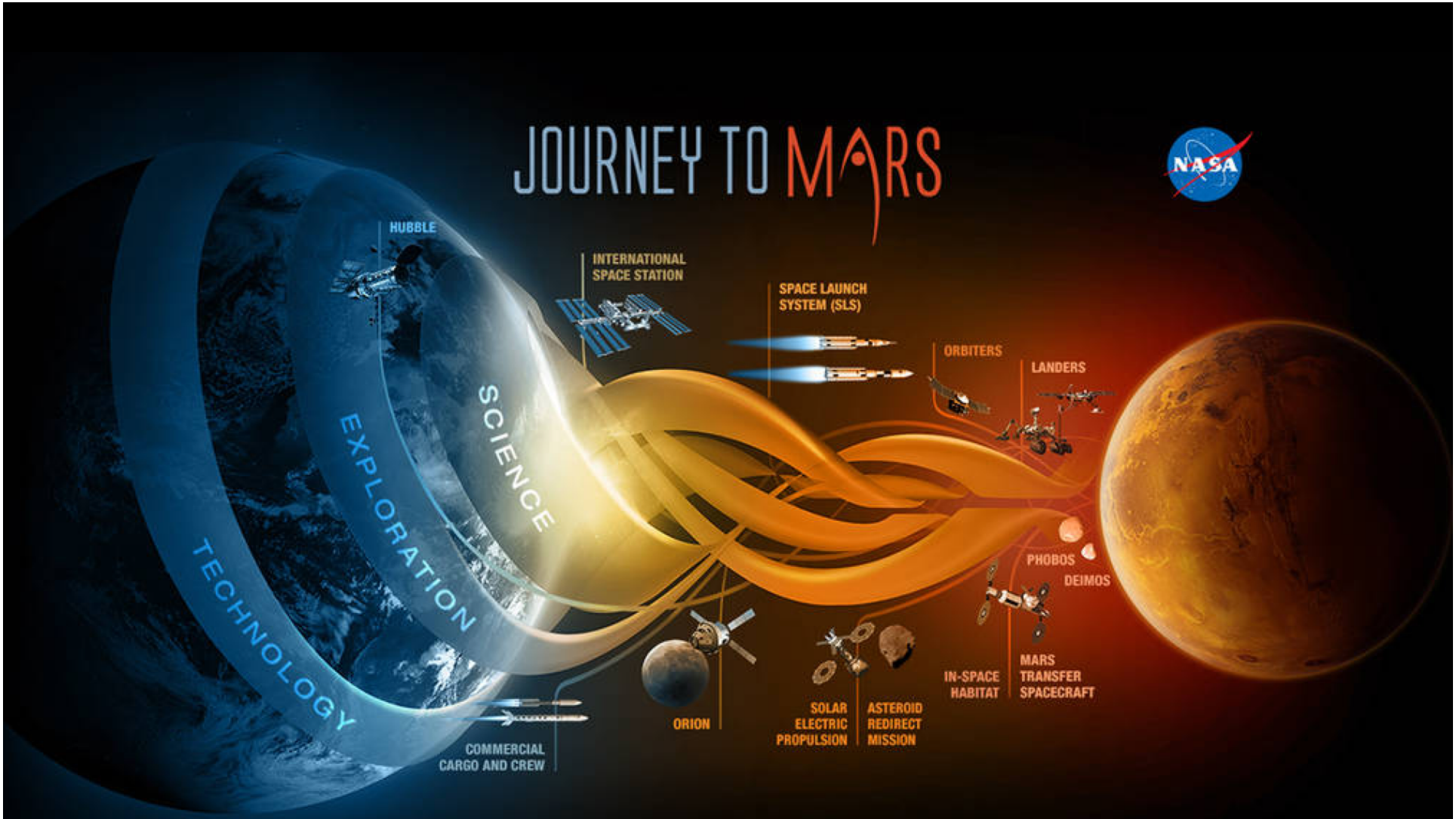


TOMORROW Mars 2020 rover



TOMORROW LDSD / Mars Flying Saucer



Every robotic missions to Mars has developed technologies that enabled the next mission. The orbiter missions provided the needed information for planning surface exploration. Each surface mission needed new landing technologies to bring larger robots to the surface. All these missions will enable NASA's next bold step to send humans to explore Mars.

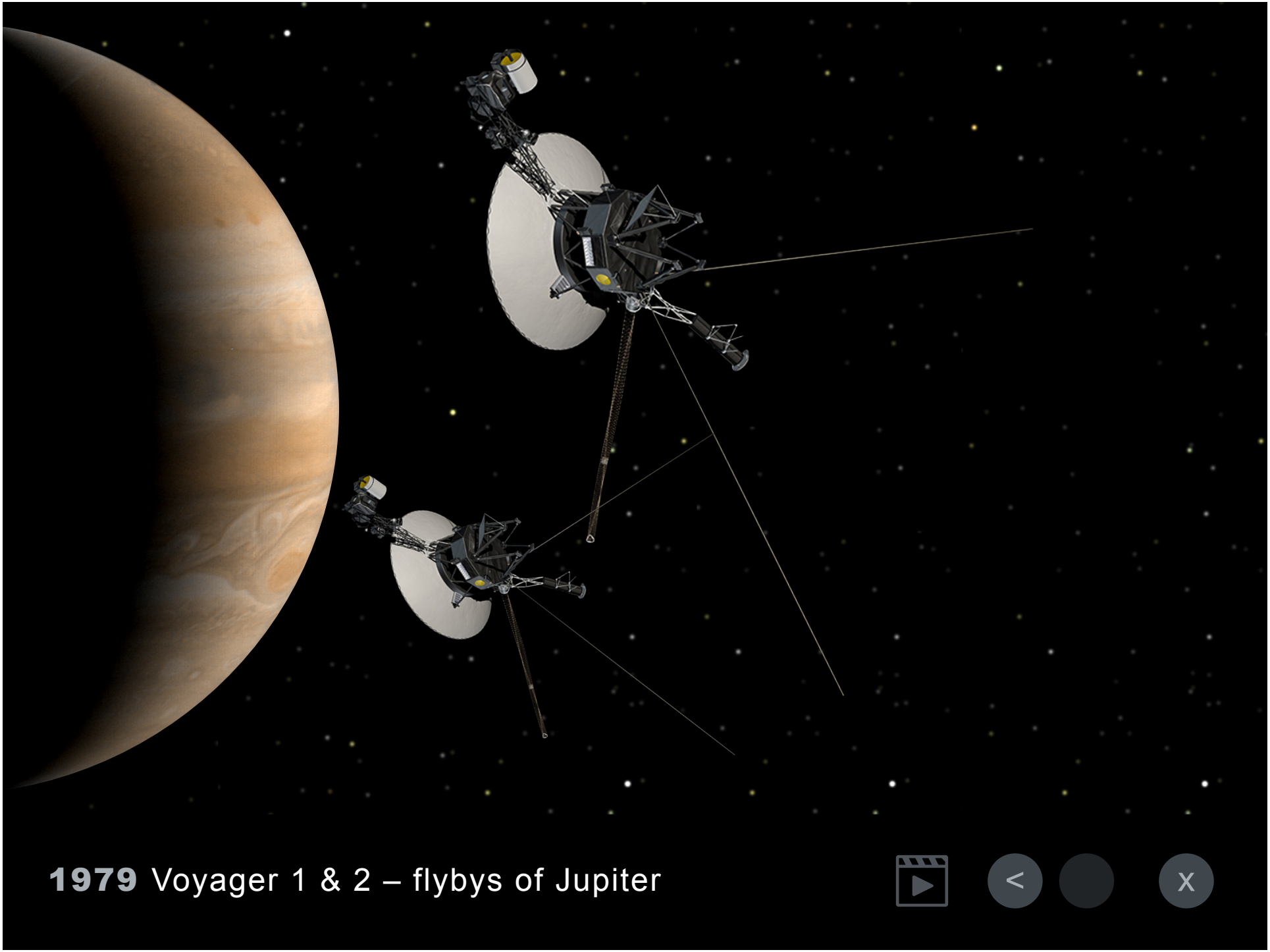
Exploring Mars

Research & Technology Goals

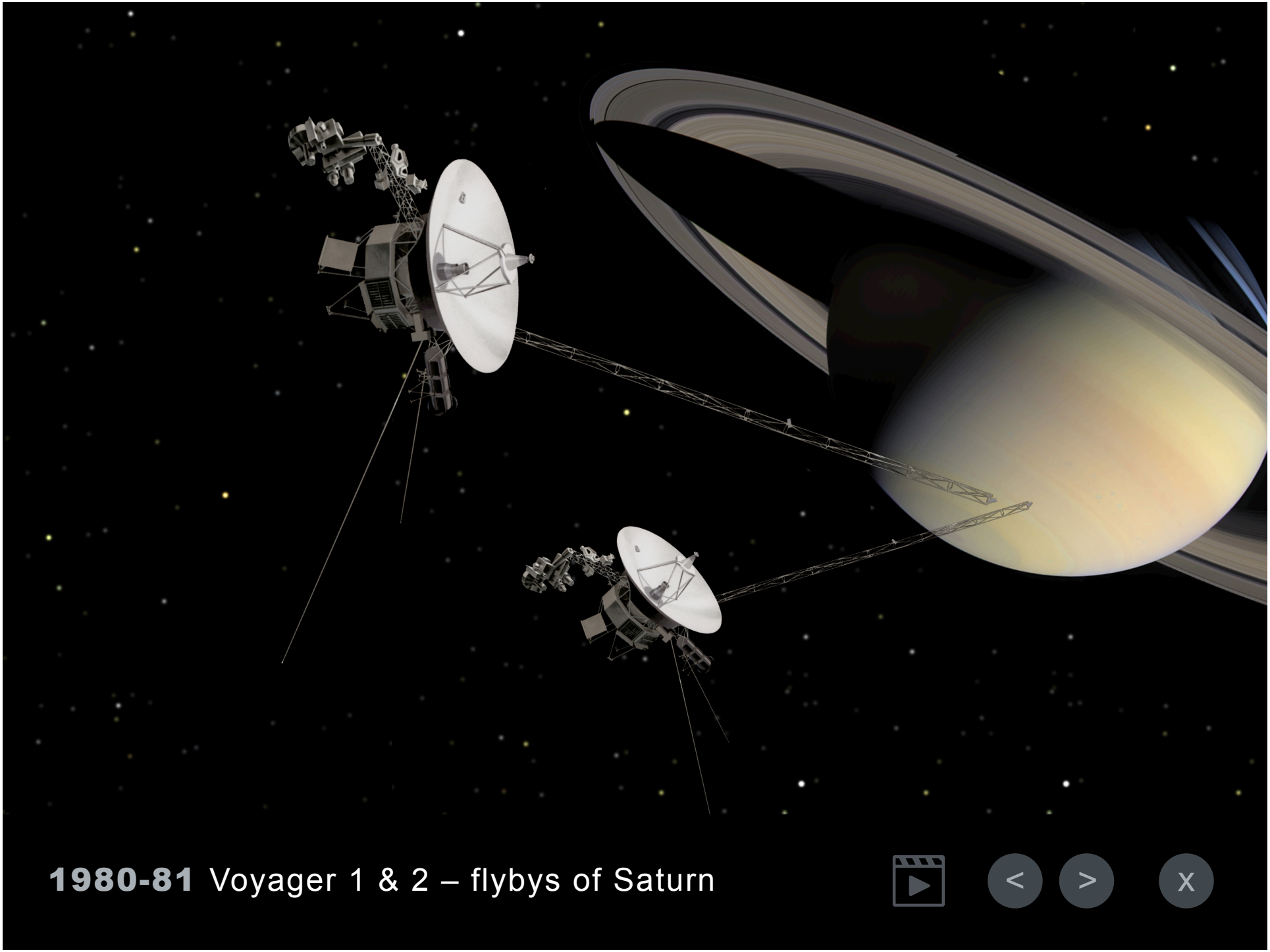
- Investigate Microorganisms in Arid Environments
  - Understand how to find life in low pressures and low humidity
- Miniaturize Biological Laboratory Equipment
  - Bio-sensors are 10% the volume and power of conventional
- Precision Landing Systems
  - Deceleration Systems
  - Computer Vision Systems
- Autonomous Mobility Systems
  - Computer Vision Systems
  - Hazard Avoidance System
  - Opportunistic Science Planning

Exploring Ocean Worlds

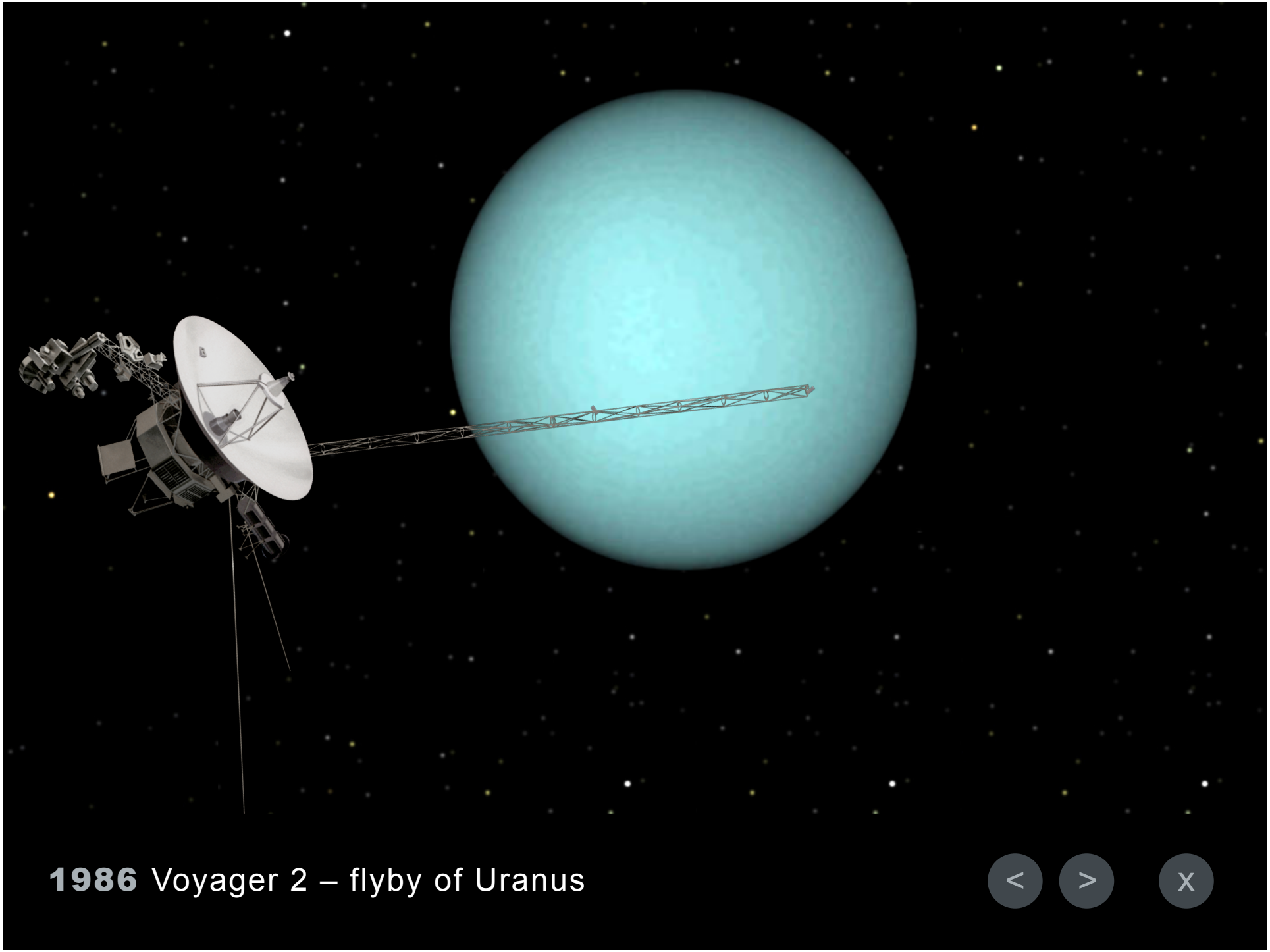
Seeking for signs of life in extraterrestrial oceans



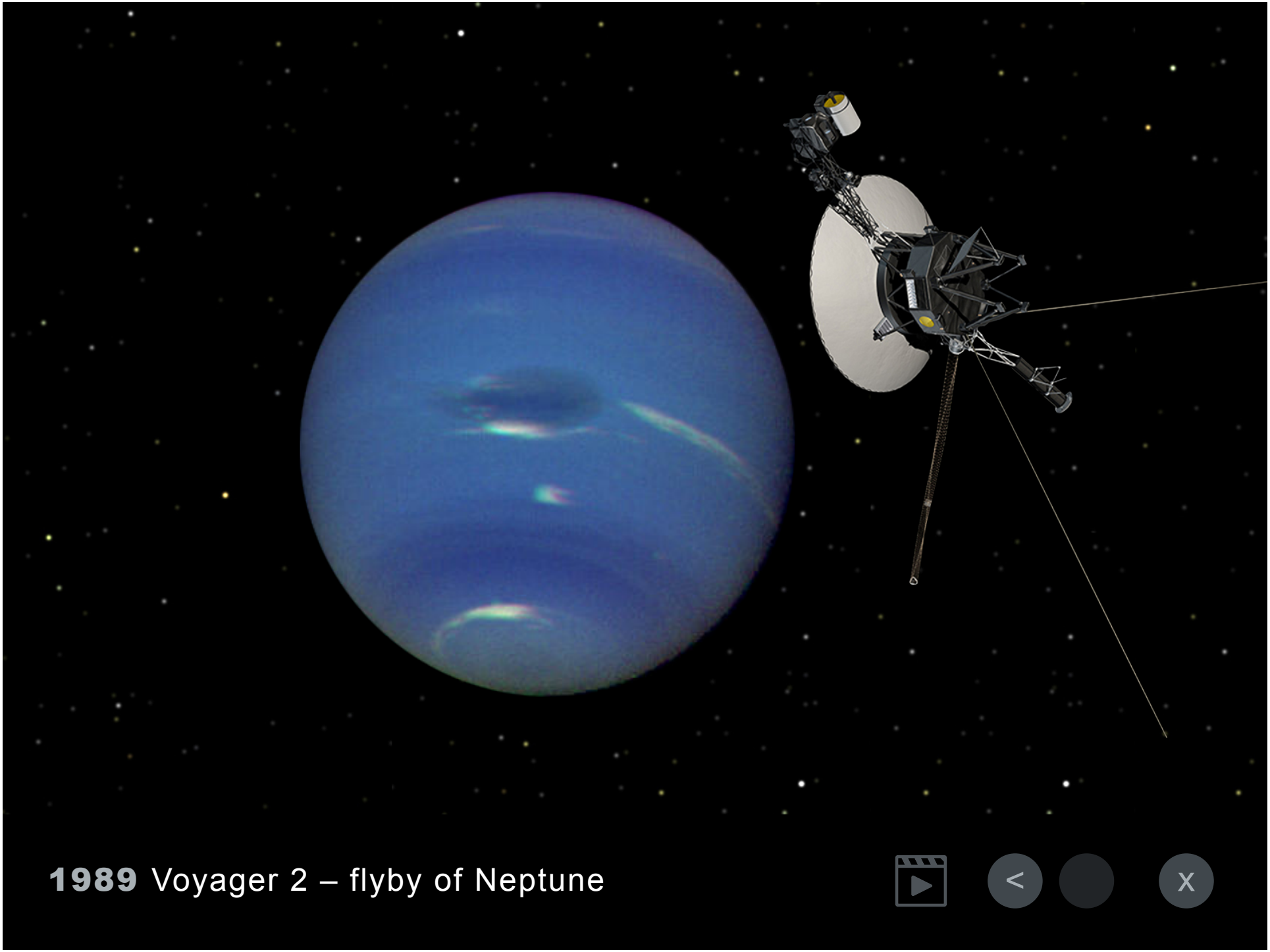
1979 Voyager 1 & 2 – flybys of Jupiter



1980-81 Voyager 1 & 2 – flybys of Saturn



1986 Voyager 2 – flyby of Uranus



1989 Voyager 2 – flyby of Neptune

1995 Galileo – first Jupiter orbiter

TODAY Cassini orbiter at Saturn

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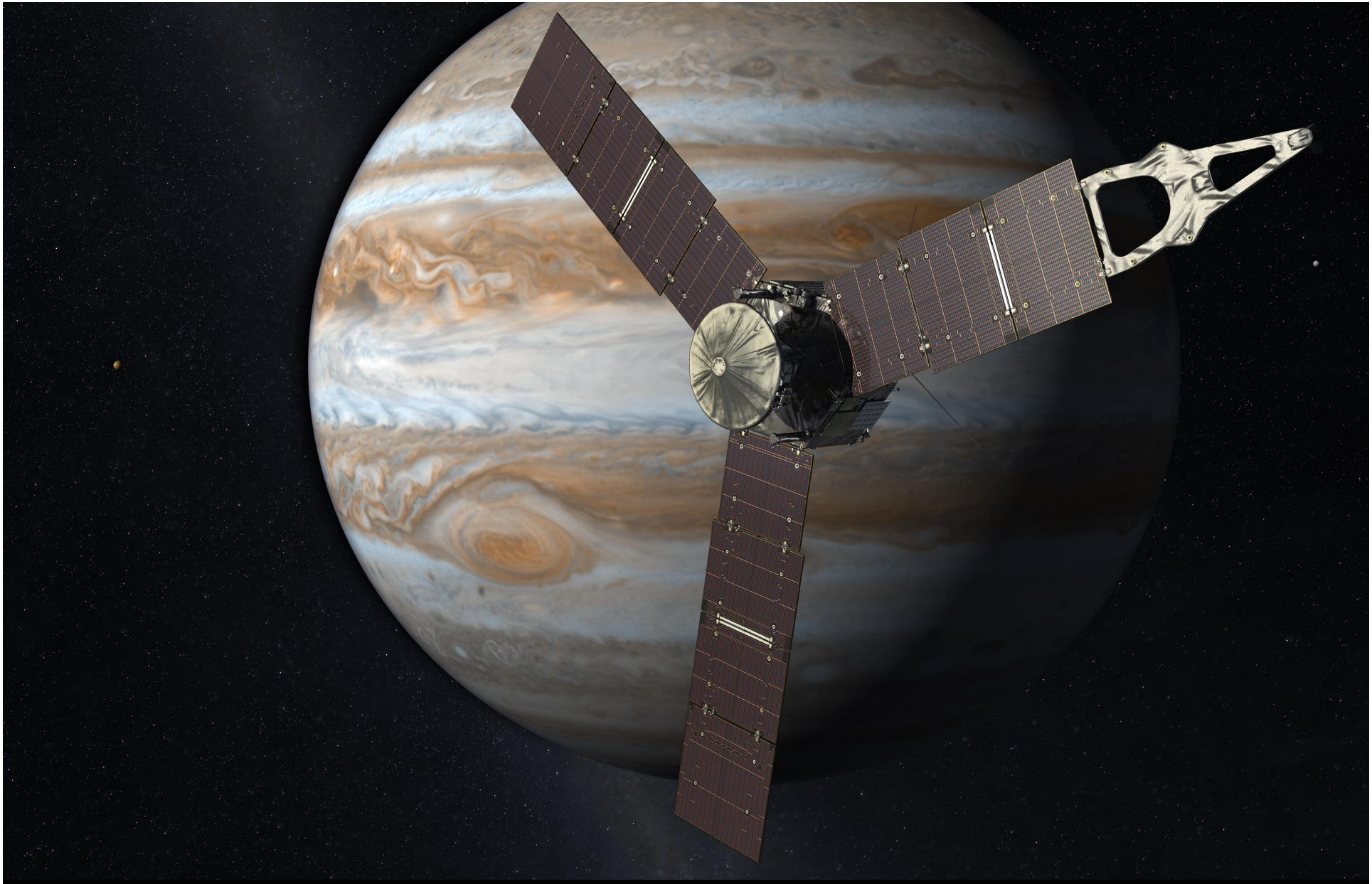
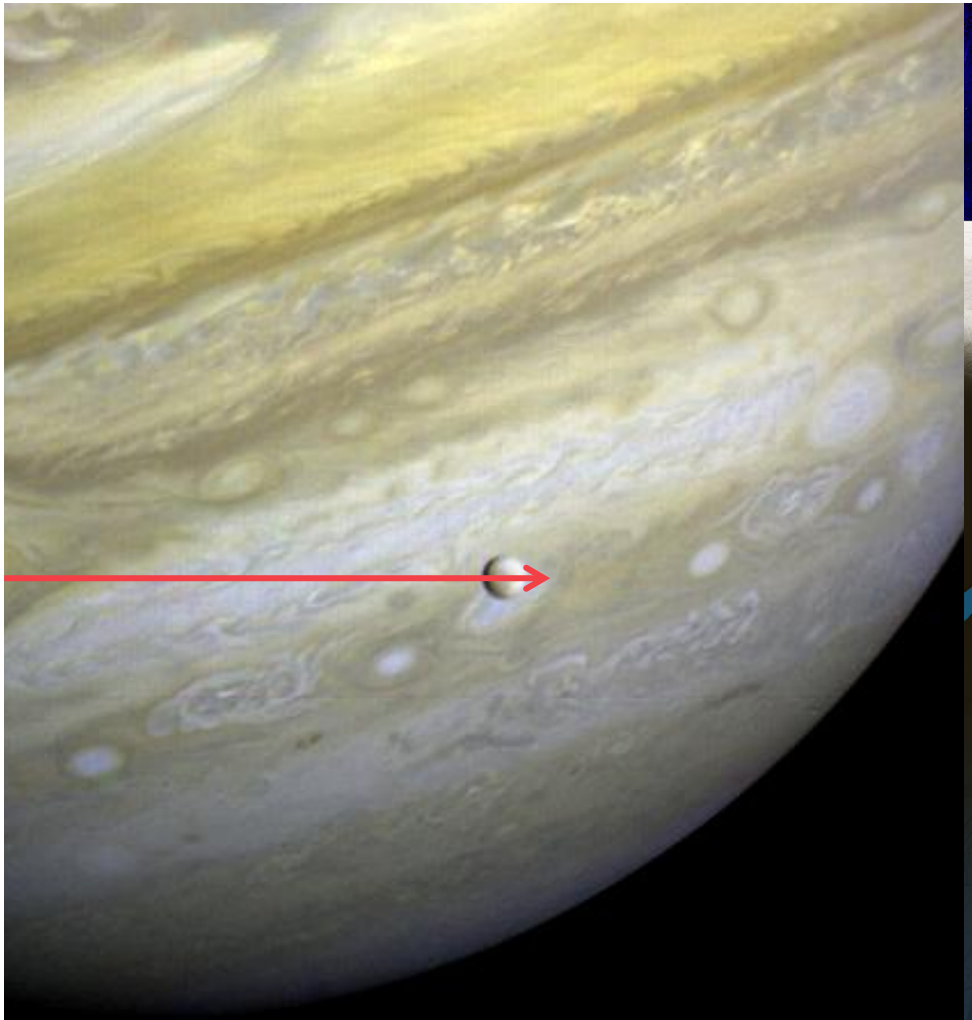
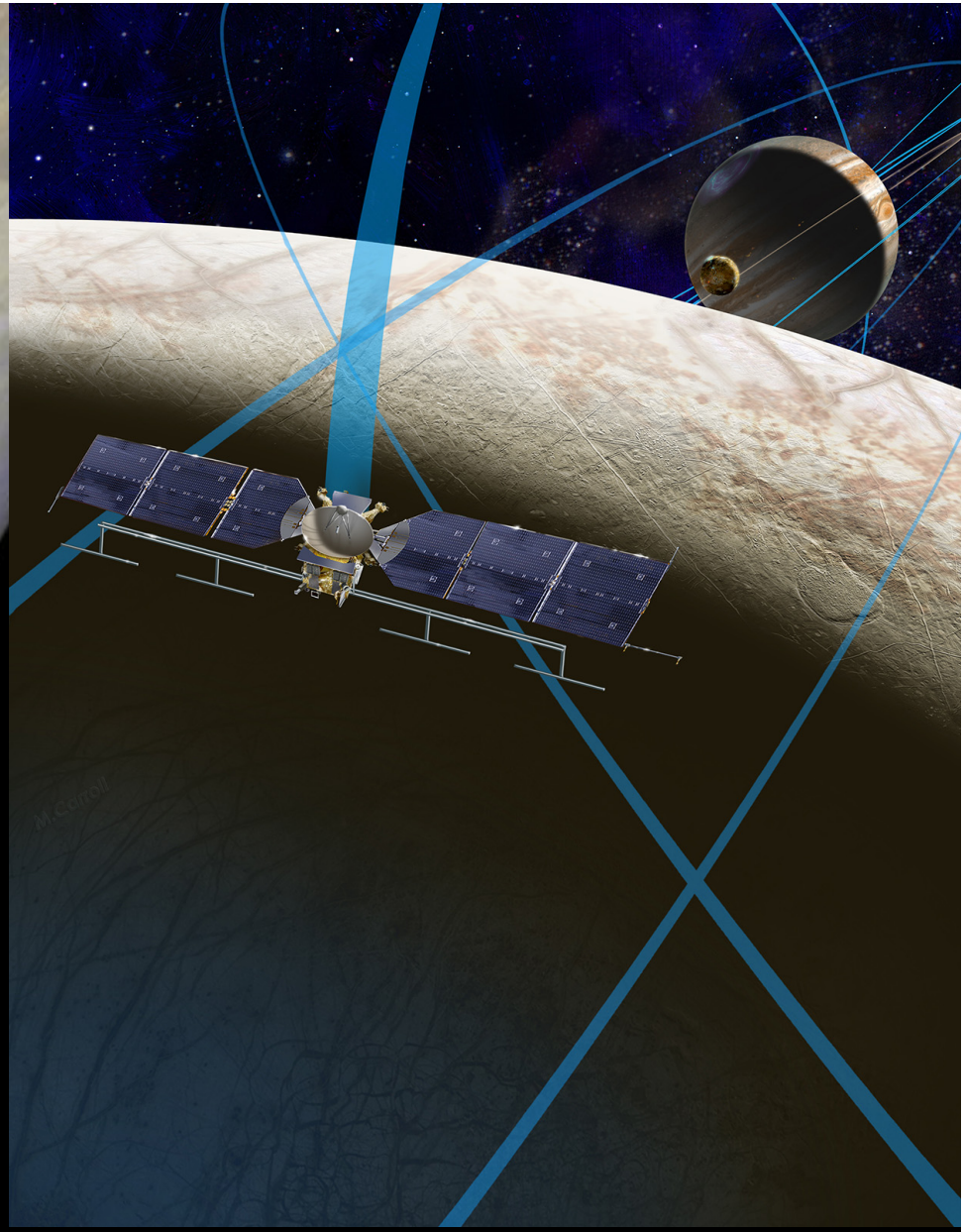


TODAY Juno orbiter at Jupiter





TOMORROW Europa mission

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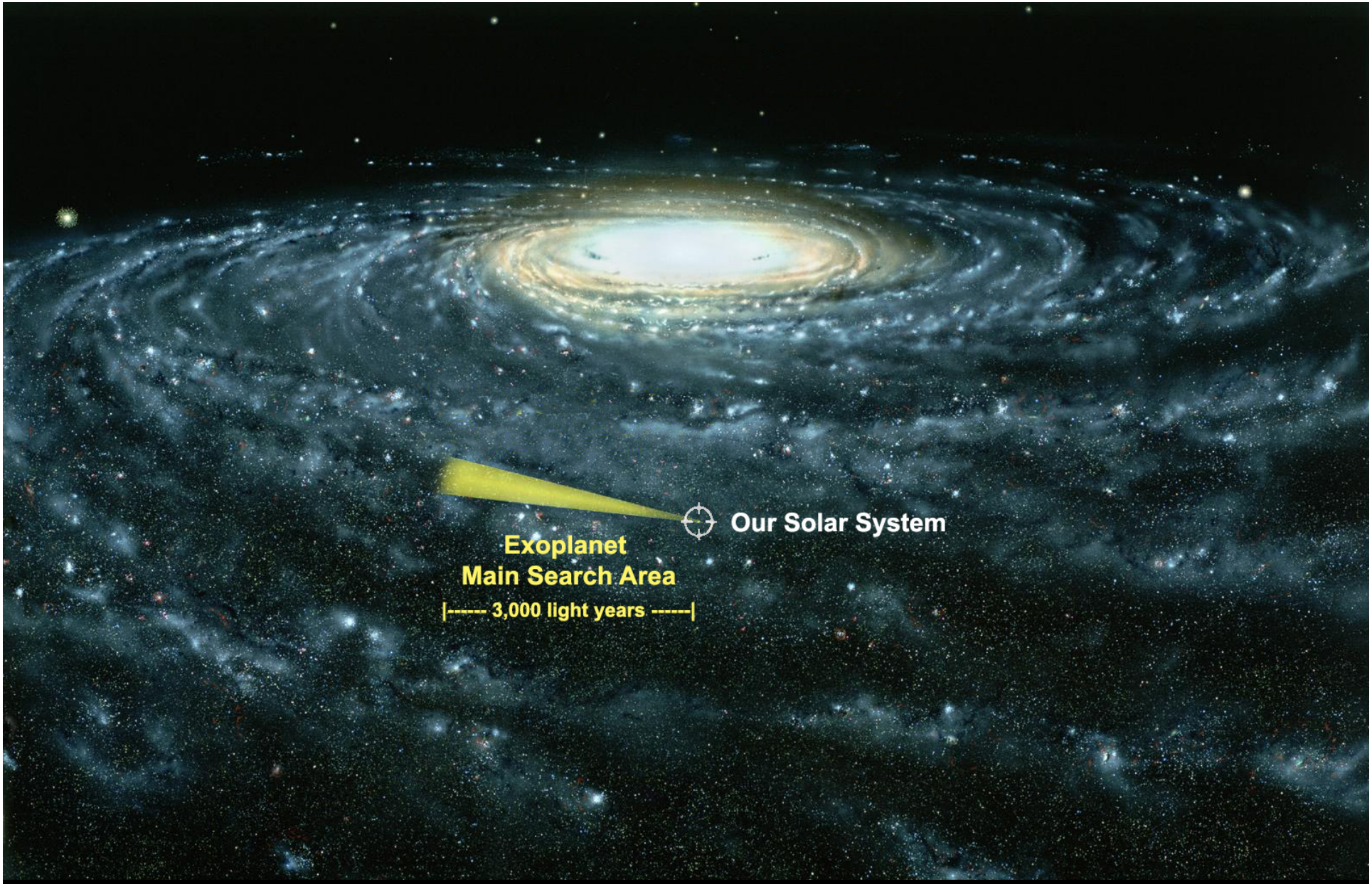

TOMORROW Exoplanets

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- Investigate Microorganisms in Frigid Environments
  - Understand how to find life in extreme cold
- Miniaturize Biological Laboratory Equipment
  - Bio-sensors are 10% the volume and power of conventional
- Low Power and Low Temperature Electronics
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  - New long duration power sources in extreme cold
- Precision Landing Systems
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