

2001 Mars Odyssey

Status Report to MEPAG

Jeffrey J. Plaut

Project Scientist

Jet Propulsion Laboratory

California Institute of Technology

April 17, 2020

MEPAG 38 - April 2020



Jet Propulsion Laboratory
California Institute of Technology

Mission Status

- Odyssey is currently in the first year of a three-year Extended Mission #8
- Spacecraft and mission operations are "green" across the board
 - 3 of the 4 reaction wheels are functional
 - Attitude determination is by star camera to preserve inertial measurement units
 - 10 years of fuel remain
- Orbit local mean solar time node is 6:45 a.m./p.m.
 - Only orbiter with consistent morning dayside and post-sunset coverage
- Instruments are operating nominally with no degradation
 - THEMIS infrared and visible camera
 - Neutron Spectrometer and High Energy Neutron Detector
- Major element of communications infrastructure
 - ~2 contacts per day with InSight
 - Weekly contacts with Curiosity
- If the President's proposed budget were enacted, Odyssey's mission would end this calendar year
 - Senior Review gave Odyssey a favorable review and recommended an increase in funding over the proposed level (\$11.7M)

Extended Mission 8 Science Objectives Align with MEPAG Goal Areas



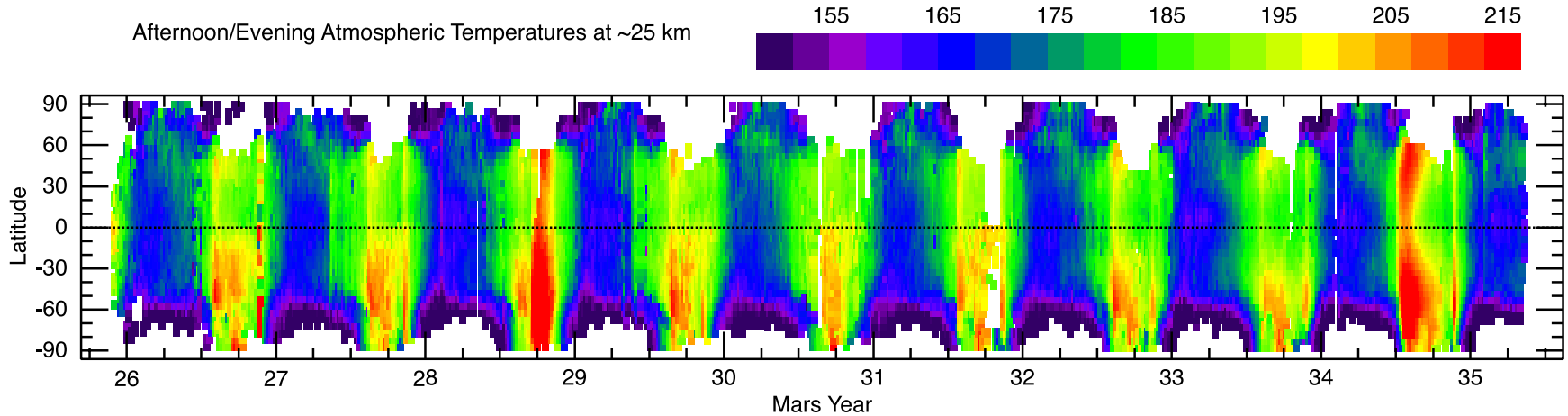
- Identify environments that may have been habitable in the past or present and characterize conditions and processes that influenced the habitability
- Provide an understanding of the distribution of water, carbon dioxide and dust, in the atmosphere and exchanging with the surface
- Generate a global picture of the Martian surface thermophysical and geomorphological properties
- Provide an understanding of the Martian radiation environment and its variability as a function of time

Unique Advantages to Odyssey

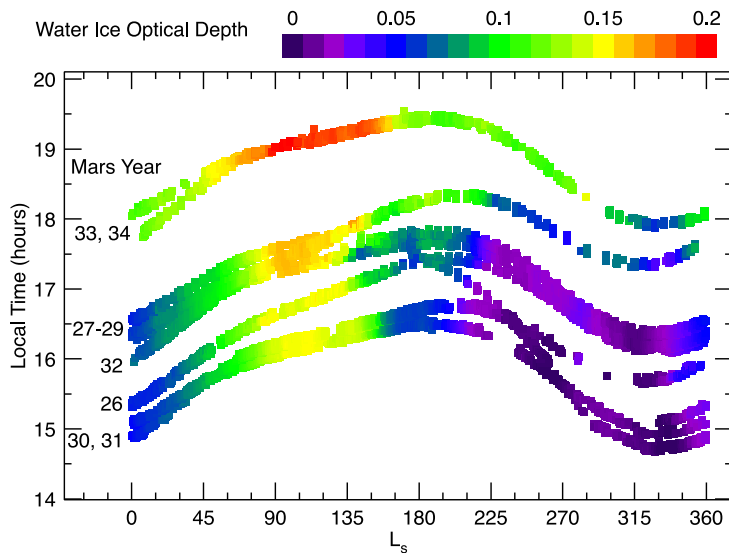
- Unique thermal capability: THEMIS (from Arizona State University) remains the only thermal camera in orbit around Mars
 - Thermal data collected by Odyssey are used by the community to determine surface properties such as composition, thermal inertia, grain-size, and degree of induration.
- Extension of long-baseline climate history (scheduled to reach 20 years of observations by the end of Extended Mission 8)
 - THEMIS measurements of the atmosphere
 - Neutron Spectrometer and HEND records of polar cap variability
 - Radiation and space weather
- View into an interesting slice of the Martian day: early morning, when clouds, frosts, and fogs are most active

THEMIS Long-Term Record of the Atmosphere

Afternoon/Evening Atmospheric Temperatures at ~25 km



Atmospheric temperature record over 10 Mars years, showing interannual repeatability and variability (e.g. major dust storms in red).

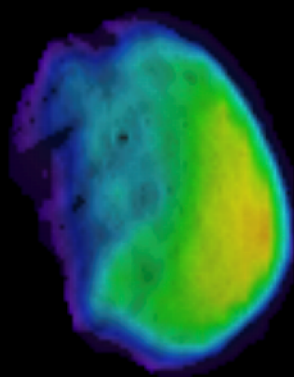


Local time variation of water ice clouds on Mars taking advantage of the shifting local time of the Odyssey orbit over the long duration of the mission. Greater cloud optical depth is seen at later evening hours.

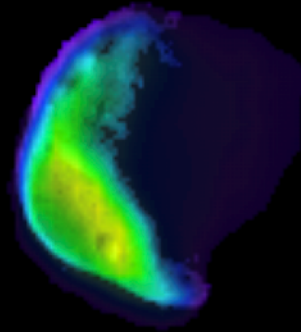
M. Smith (2019, JGR-P; 2019, Icarus)

Thermal IR Imaging of Phobos

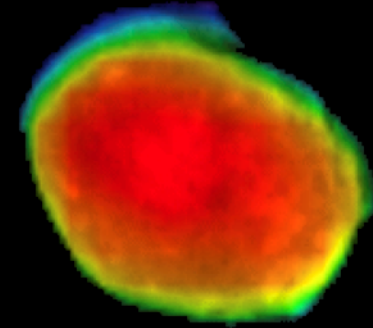
2001 Mars Odyssey THEMIS Phobos Observations



29 Sep 2017



15 Feb 2018



24 Apr 2019

Temperature



Surface temperature on Phobos at 3 phase angles. Acquisitions in recent months include during and post-eclipse by Mars.

Impact/Implication if Mission is Ended

- Termination of ongoing science investigations
 - THEMIS visible and IR camera observations of Mars' surface and atmosphere, and Phobos.
 - Neutron Spectrometer and High Energy Neutron Detector observations of neutral and charged particle fluxes, from Mars' surface and in the orbital environment.
- Termination of scientific research projects at universities, research facilities and NASA centers; including withdrawal of support for graduate and undergraduate students.
- Elimination of support at ASU for PDS sub-node, JMARS data analysis tool and widely-used Mars image data retrieval tools.
- End of Odyssey's role in the communications infrastructure for landed assets at Mars. Disruption in the relay network that supports planning and operational robustness.