Mars Exploration Program Overview

April 15, 2020
Presented to (virtual) MEPAG Spring Meeting

Jim Watzin
Director – Mars Exploration Program

Michael Meyer
Chief Scientist

NOTE ADDED BY JPL WEBMASTER: This content has not been approved or adopted by JPL or the California Institute of Technology. This document is being made available for information purposes only, and any views and opinions expressed herein do not necessarily state or reflect those of NASA, JPL, or the California Institute of Technology.

Mars Exploration Program (MEP) Introduction

MEP is a healthy and productive program,
making good progress on current obligations,
collaborating with our international partners,
actively working towards humanity's first roundtrip to another planet,
supporting NASA's M2M planning,
and preparing for a diverse program in the future.

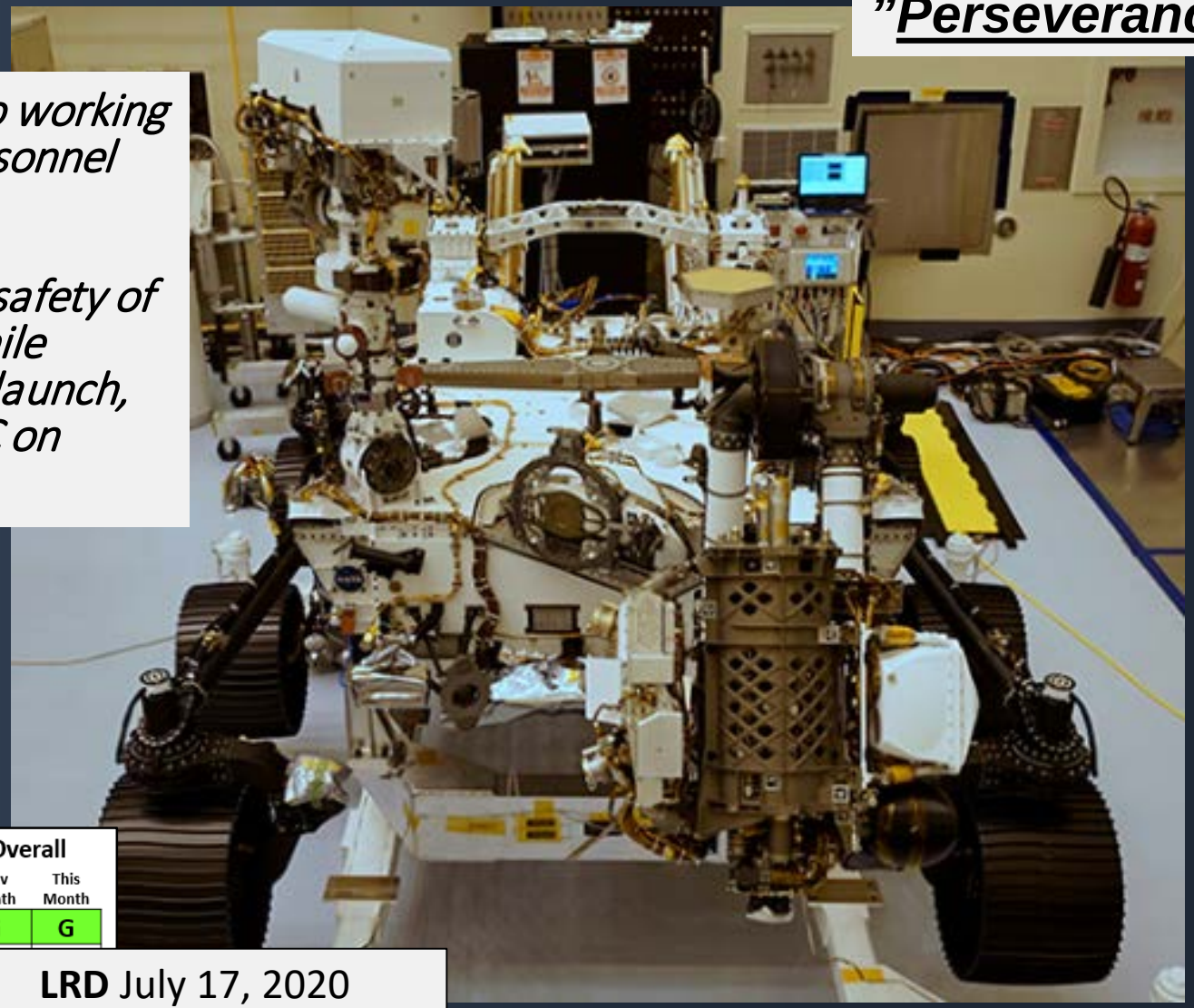
We have transitioned to a mostly virtual workplace and are working the adjustments as best we can. It's still too early to accurately forecast the impacts.

M2020 Status at KSC

meet
"Perseverance"

A majority of the team has transitioned to working remotely, with limited mission-critical personnel working at Kennedy and JPL.

SMD is working to ensure the health and safety of mission critical project team members while continuing to maintain progress towards launch, including providing flights from JPL to KSC on NASA's aircraft.



	Technical		Cost		Schedule		Programmatic		Overall	
	Prev Month	This Month	Prev Month	This Month	Prev Month	This Month	Prev Month	This Month	Prev Month	This Month
PE	G/Y	G	G	G	G	G	G	G	G	G
Program	G	G	G	G	G	G	G	G		
Project	G	G	G	G	G	G	G	G		

LRD July 17, 2020
09:00 – 10:40 EDT

M2020 Highlights

- Sampling and Caching System installed
- Rover functional testing complete and stowed for flight (arm, mast, wheels, etc.)
- Helicopter and deployment system installed on the rover belly pan
- Parachute and mortar installed into the Backshell
- Descent Stage propellant loading complete

M2020 badge of honor - **Perseverance**

Flight wheels installed and rover stowed for launch

M2020 Upcoming Milestones

- Sampling system sterile flight hardware (tubes, seals, etc.) undergoing final cleaning in preparation for installation in April
- Final closeout of rover, descent stage, and cruise stage in April
- Readiness Reviews start May-June
- Stacking of spacecraft vehicle into launch/cruise configuration in May/June
- Integration with launch vehicle in late June/early July
- Launch Readiness begins on July 17

Adaptive Caching Assembly and Sample tube with seal

Enclosing MSL into the launch vehicle fairing in 2011

MEP Budget Status

- FY20 budget appropriation, though favorably marked, was significantly over-stressed supporting problem resolution in multiple areas on M2020
  - Required austerity measures across the entire portfolio, except R&A
  - M2020 cost has stabilized and mission is on-track for July 17, 2020 LRD

- FY21 President's Budget Request overall is very favorable for the MEP, but available funding for continued extended mission longevity is limited
  - Two new mission initiatives funded
  - Mars Odyssey at risk of close-out in FY21
  - MSL operations reduced in FY21

New MEP Mission Initiatives

President's FY21 Budget Request supports essential Mars precursors

*"The Budget also funds the robotic exploration of Mars, in **cooperation with international partners, as a precursor to human exploration**. In addition to performing cutting-edge scientific investigations, a new Mars Ice Mapper mission would provide data for potential landing sites, and a Mars Sample Return mission would demonstrate the ability to launch from Mars' surface."*

- **Mars Sample Return** - humanity's 1st roundtrip to another planet
  - Returning samples from an ancient habitable zone
  - NASA/European Space Agency (ESA) partnership
  - 6 year development cycle - 2026 LRD (2031 return)

- **Mars Exploration Ice Mapper** - searching for habitable environments and accessible ISRU resources
  - Joint NASA/Canadian Space Agency (CSA) Exploration initiative
  - Implementation assumes substantial partnership collaboration
  - 5 year development cycle - 2026 LRD

Mars Science

Mars Exploration Program

Two main science planning activities for MEP

- MSR Science Planning Group Phase-2, a NASA and ESA partnership
  - Later today
- Mars Architecture Strategy Working Group (MASWG)
  - Bruce Jakosky on Friday

Science Programmatics

- MDAP
- Participating Scientists

Science Highlights

- MRO
- MSL
- MAVEN

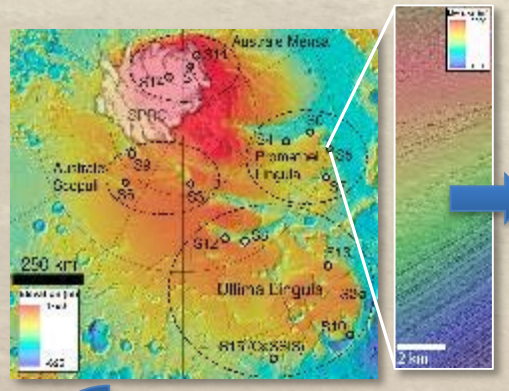
Michael Meyer
Chief Scientist

Science Programmatics

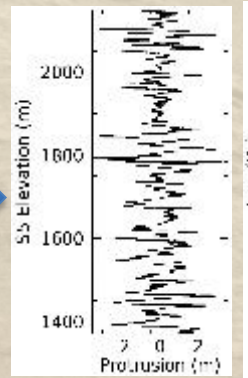
- All meetings and reviews are now virtual until . . .
- MDAP
  - Selections announced March 31
  - 21 of 101 proposals
- Perseverance
  - Proposals submitted March 12 for Participating Scientists
  - ESA released call for Return Sample Scientist Participating Scientist
    - Letters of Intent due April 15, 2020
    - Proposals due April 30, 2020
- Curiosity
  - Solicitation for Participating Scientists postponed for a year
    - Budget constraints in FY21, and lack of budget in FY22
- MOMA Participating Scientists call is postponed

MRO Science Highlights

Mars' South Pole Ice Layers Reveal Timescales of Climate Record[1]

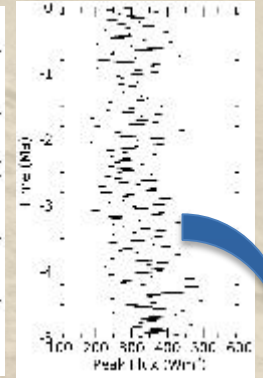


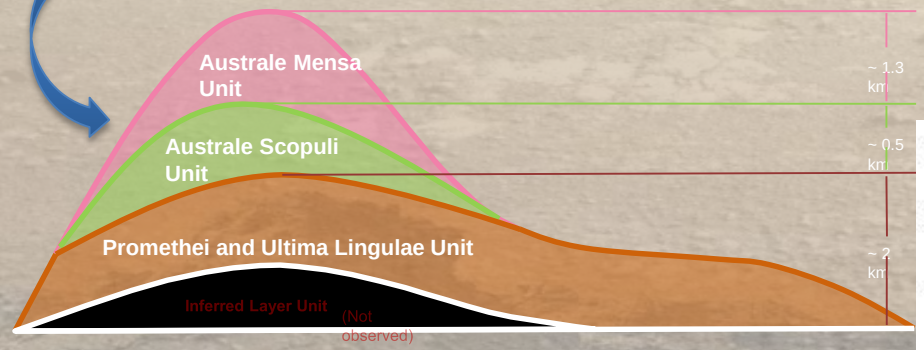
Martian South Polar Cap Topography



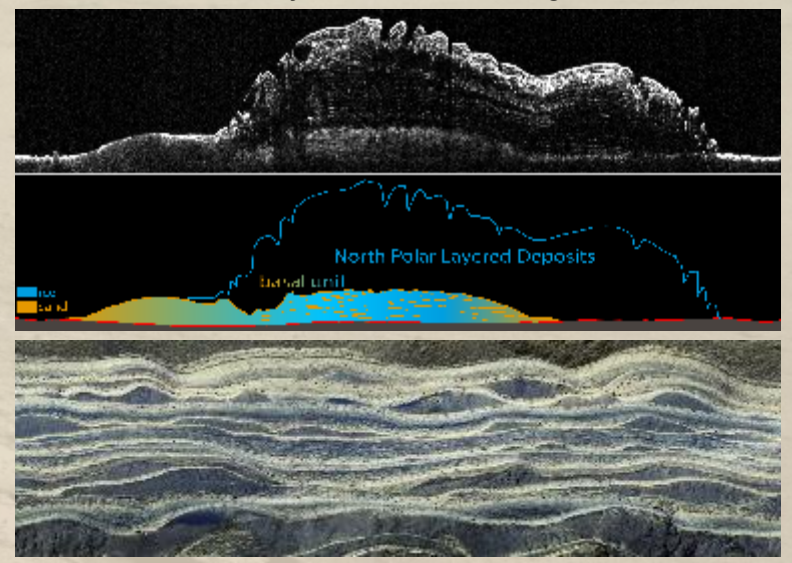
Patterns in the layers

Patterns in the insolation (i.e., climate)

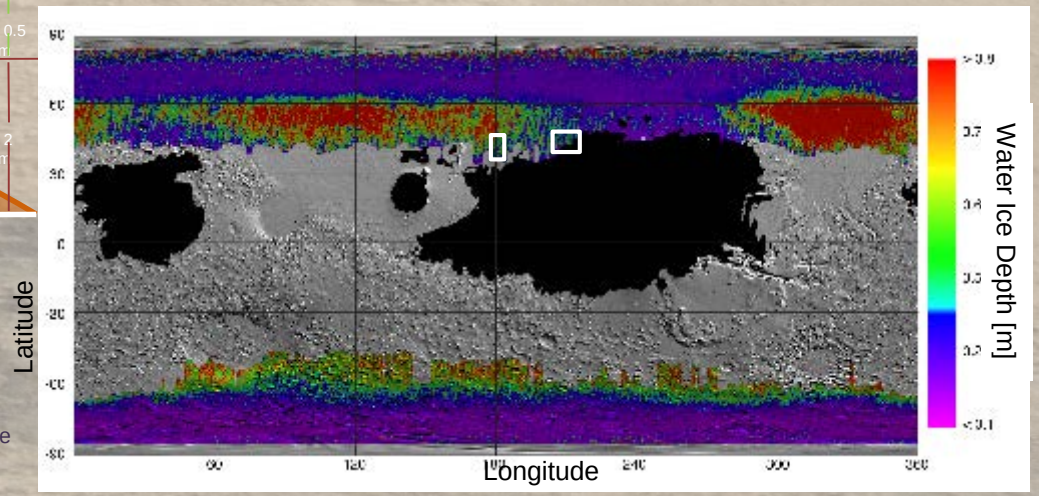




Ancient remnants of Mars' northern ice caps revealed by orbital sounding radar[2]



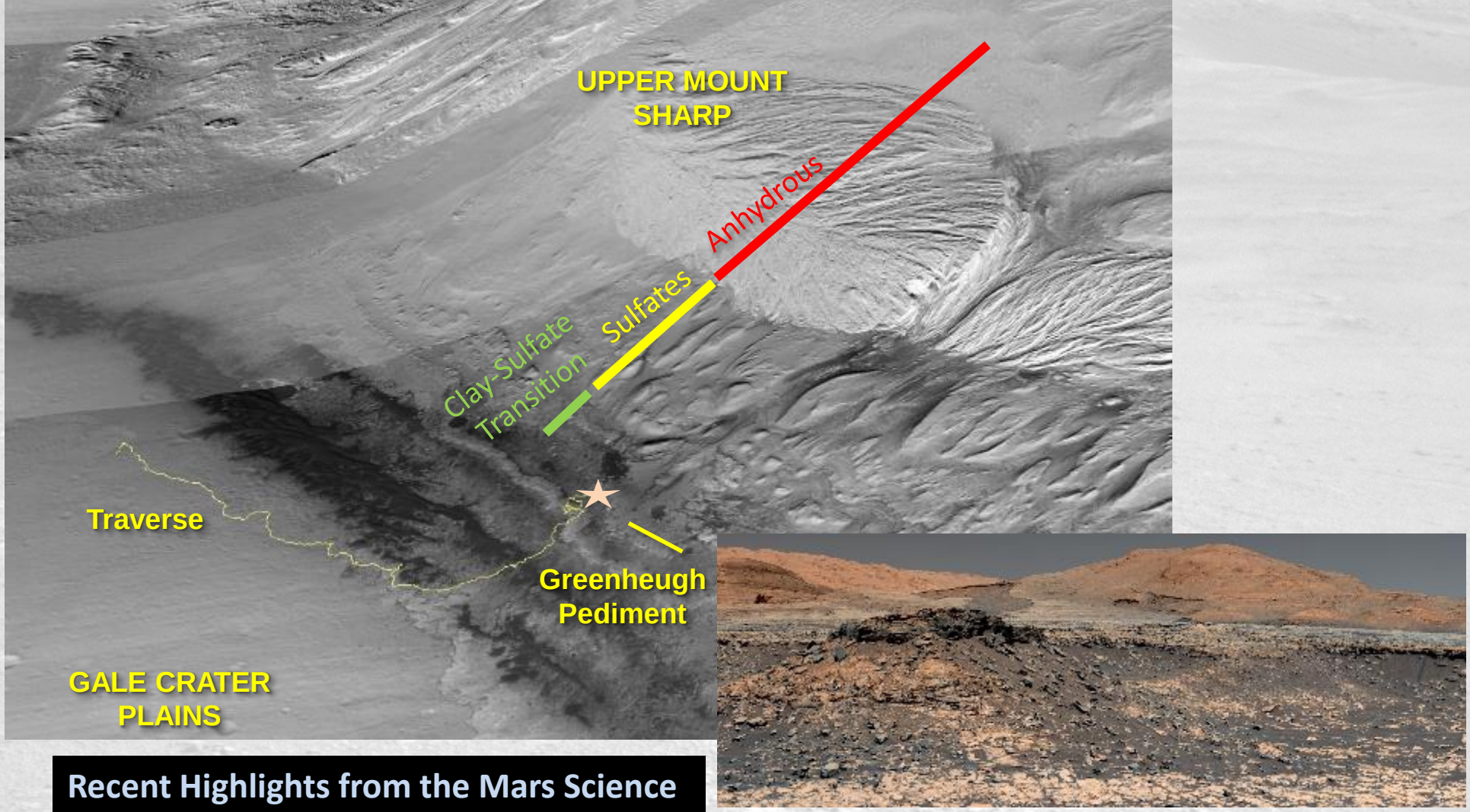
Shallow Water Ice at Mid-Latitudes[3]



1. Becerra, P., Sori, M. M., Thomas, N., Pommerol, A., Simioni, E., Sutton, S. S., et al (2019). Timescales of the climate record in the south polar ice cap of Mars. Geophysical Research Letters, 46. doi:10.1029/2019GL083588

2. Nerozzi, S., and Holt, J. W., (2019) Geophysical Research Letters; doi:10.1029/2019GL082114;. Ojha, L., Nerozzi, S., Lewis, K. (2019) Geophysical Research Letters; doi:10.1029/2019GL082294

3.S. Piqueux, J. Buz, C. S. Edwards, J. L. Bandfield, A. Kleinböhl, D. M. Kass, P. O. Hayne, the MCS and THEMIS teams, 2019, Widespread Shallow Water Ice on Mars at High and Mid Latitudes, GRL, doi:10.1029/2019GL083947.

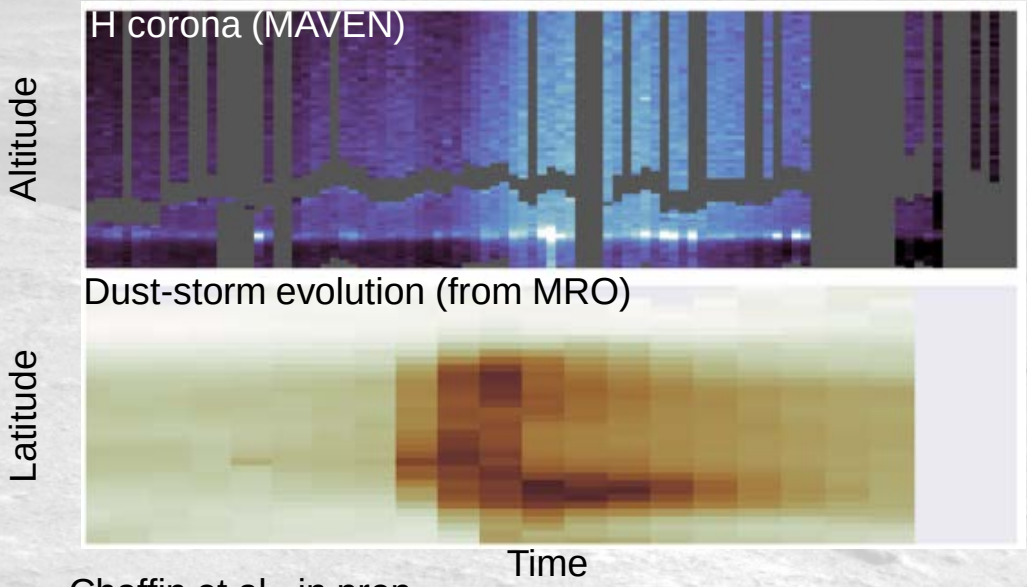


Recent Highlights from the Mars Science Laboratory

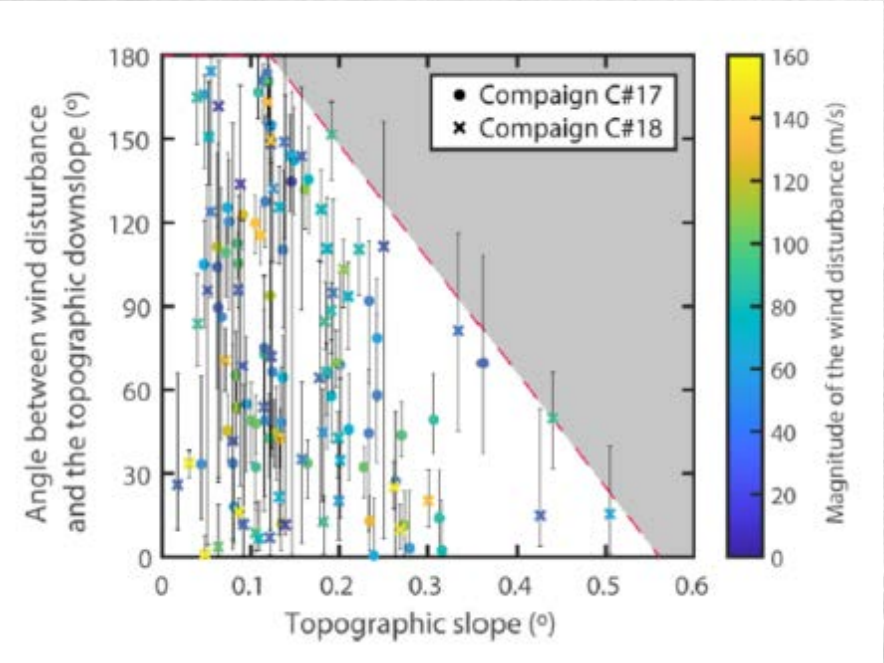
- Curiosity is nearing the transition from clay-bearing to sulfate-bearing strata on Mount Sharp, potentially marking a major environmental transition in Mars' history and one of the features identified from orbit that resulted in the selection of Gale crater for the mission's landing site

MAVEN

Dust storms drive water into the upper atmosphere, increasing hydrogen corona densities and H escape

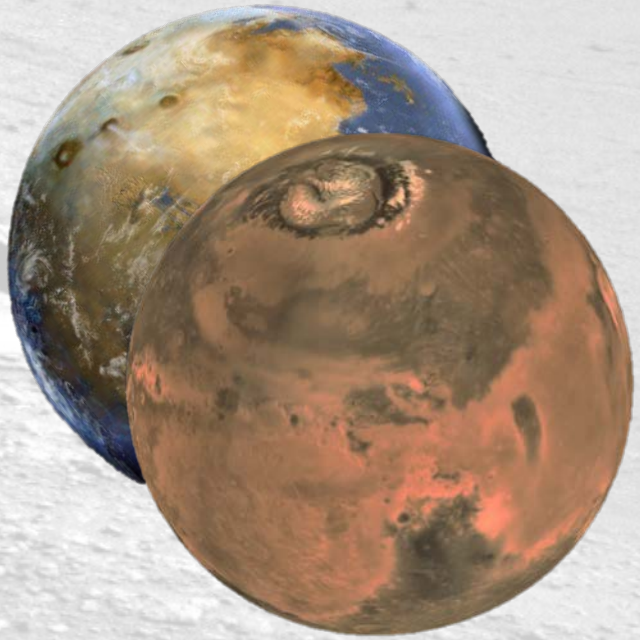


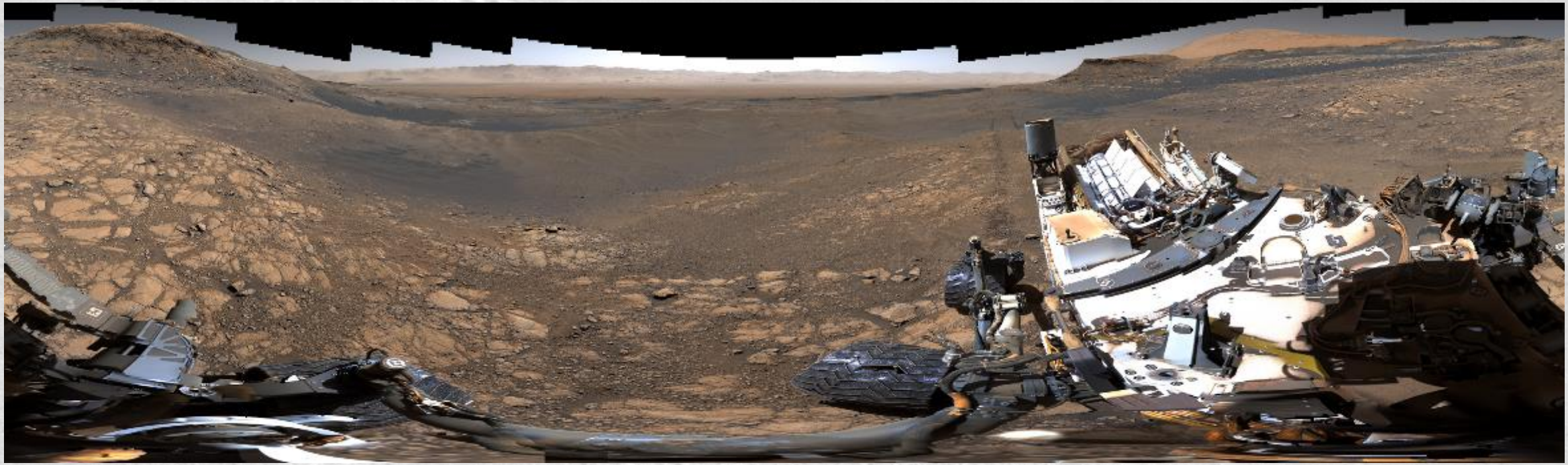
Chaffin et al., in prep.



Benna et al., *Science*, 2019

First-time measurement of upper-atmospheric winds shows strong correlation of winds with surface topography, showing coupling to lower atmosphere



Determination of integrated escape shows that the majority of Mars' CO_2 has been lost to space, driving changes in climate through time.

Jakosky 2019