Eric Ianson
Mars Exploration Program, Director

Mitch Schulte
Mars EXploration Program, Lead Scientist (Acting)

NASA Planetary Science Advisory Committee (PAC) Meeting
March 4, 2024

Mars Exploration Program Highlights

- Ingenuity grounded after 72 flights, initially intended as technology demonstration for 5 flights
- Dr. Michael Meyer, Lead Scientist for MEP & MSR, retired in November 2023
- Request For Proposals to study concepts for commercial services at Mars released in January 2024
- Moon to Mars workshop held February 2024 – Future focus on community science priorities
- MEPAG DC hybrid meeting in April 2024 will be held in conjunction with a MEPAG/ExMAG workshop to discuss science that can be addressed by Mars samples from Jezero and elsewhere

The Martian horizon, including water-ice clouds and dust in the atmosphere, taken by THEMIS on Odyssey. Credit: NASA/JPL-Caltech/ASU

MEP Staffing Update

Dr. Michael Meyer retired November 2023

- Provided scientific guidance to multiple generations of Mars missions:
  - As a Program Scientist, managed two Phase I Shuttle/Mir experiments, the Mars Microprobe mission (DS-2), Mars Odyssey, and Curiosity
  - As MEP Lead Scientist, oversaw the science of Odyssey, MRO, MAVEN, Spirit and Opportunity, Curiosity, Perseverance, and new Mars mission concepts
  - As MSR Lead Scientist, ensured the scientific value of the returned samples
- Foundational to the development of the NASA Astrobiology Institute at NASA as the Senior Scientist for Astrobiology; organized the funding call as a Cooperative Agreement.

NASA is planning to competitively fill Dr. Meyer's position. His roles and responsibilities will be filled by the following individuals on an acting basis in the near-term:

- MEP Lead Scientist – **Dr. Mitch Schulte**
- MSR Lead Scientist – **Dr. Lindsay Hays**
- Moon to Mars & Human Exploration Interface – **Dr. Becky McCauley-Rench**

MEP Future Plan Activities

Search For Life Planning

- MEP is working with the Astrobiology program to charter a Search for Life (SFL) - Science Analysis Group (SAG)
  - Planning to begin SFL-SAG member selection in mid-2024
  - Terms of Reference (ToR) being finalized
- Considering workshop(s) focused on the specific science and technology needs later in 2024, with a draft report anticipated by the end of 2024 and final report in early 2025

Commercial Services for Future Exploration

- Request for Proposal to study concepts for commercial services released in January 2024
  - Exploring new commercial partnership models to provide services at Mars
- Multiple selections to assess cost, feasibility, and technological maturity of potential services
- Announcement of awardees expected in April 2024; study results anticipated in Summer 2024

4 Priority Services & Design Reference Models (DRM)

1 SPACECRAFT DELIVERY (LARGE & SMALL)

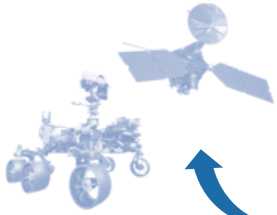
&

2 PAYLOAD HOSTING

NASA PROVIDES

INDUSTRY DELIVERS NASA S/C TO MARTIAN SYSTEM

DRM 1 & 2: Large & Small Payload(s) Delivery & Hosting Services



NASA + OTHERS "PLUG IN" INSTRUMENTS

3 RELAY & PNT (POSITIONING, NAVIGATION & TIMING)

NASA RECEIVES

INDUSTRY PROVIDES S/C & HIGH-VOLUME DATA

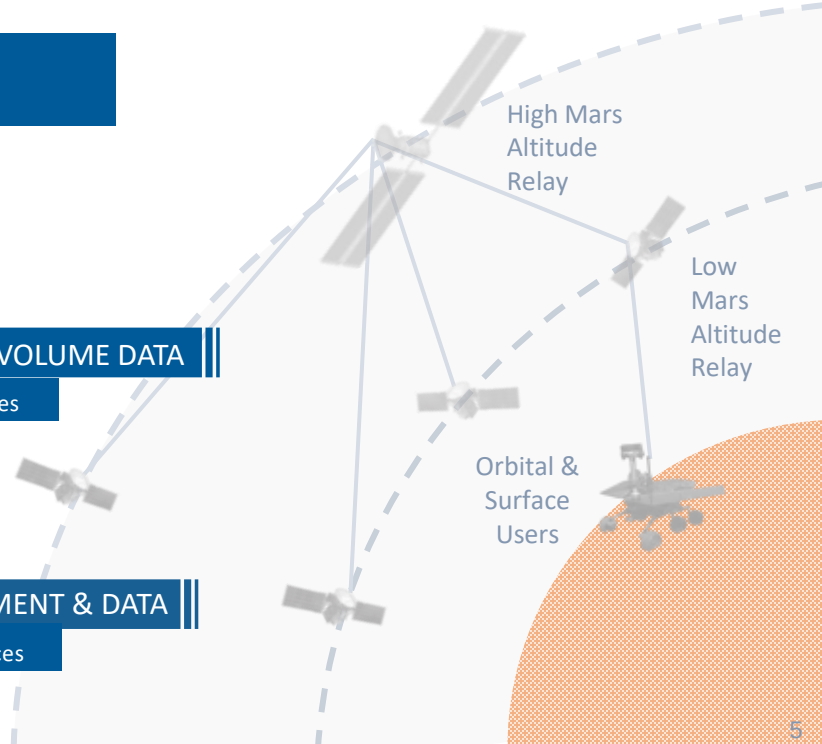
DRM 4: Next-Generation Relay Services

4 IMAGING *& WEATHER**

NASA RECEIVES

INDUSTRY PROVIDES S/C INSTRUMENT & DATA

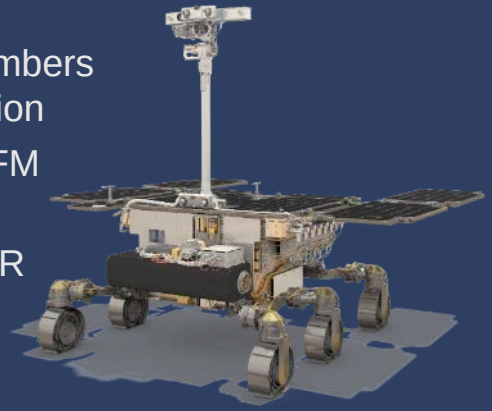
DRM3: Electro-Optical (Imaging) Services



MEP Pre-Formulation Efforts

Rosalind Franklin Mission

- Successfully passed a Check Point Review with ESA Council Members in November 2024; confirmed continued development of the mission
- Planning future opportunity for U.S. science team members on RFM instrumentation
- In Nov 2023, ESA announced UK Space Agency is supplying an IR spectrometer (Enfys) to replace the previous Russian unit (ISEM)



Credit: ESA

Sample Receiving Project

- Measurement Definition Team (MDT) developing set of instruments needed to accomplish sample safety assessment, curation, and initial science
- Sample Safety Assessment Protocol (SSAP) Tiger Team developing protocol to determine the necessary steps for sample release from high-containment laboratories
- First face-to-face meetings held Jan 31-Feb 2 for MDT and SSAP-TT, allowing for discussion and coordination between groups
- MDT and SSAP Tiger Team provided interim reports to project and program leadership in conjunction with face-to-face meetings

MEP Orbiters

Mars Relay Network (MRN)

- MEP successfully managing network activities with aging orbiters
  - Spacecraft are operating nominally
  - Projects are managing all consumables to extend science and relay operations

Odyssey

- Results of propellant investigation estimates remaining propellant at 3.7 kg +/- 2 kg; usage could be up to 1 kg/year

Mars Reconnaissance Orbiter (MRO)

- Demonstrated much improved sensitivity to subsurface structure for the SHARAD radar by conducting two spacecraft rolls to improve antenna pointing
- The CRISM team delivered its final set of map tiles using reprocessed multi-spectral visible-near IR data to PDS

MAVEN

- MAVEN operating in all-stellar attitude sensing mode to preserve lifetime of remaining IMU

ExoMars/Trace Gas Orbiter (TGO)

- Continuing to support relay operations for MEP; returning >50% relay data of landed assets

These convoluted flow textures, imaged by Hi-RISE, are called "brain terrain" because they resemble the cerebral cortex of human brains. Credit: NASA/JPL-Caltech/University of Arizona

Mars 2020

Perseverance Odometer: 25.83 km*
Ingenuity Log: 72 flights, 17 km*
*** As of Feb. 28, 2024**

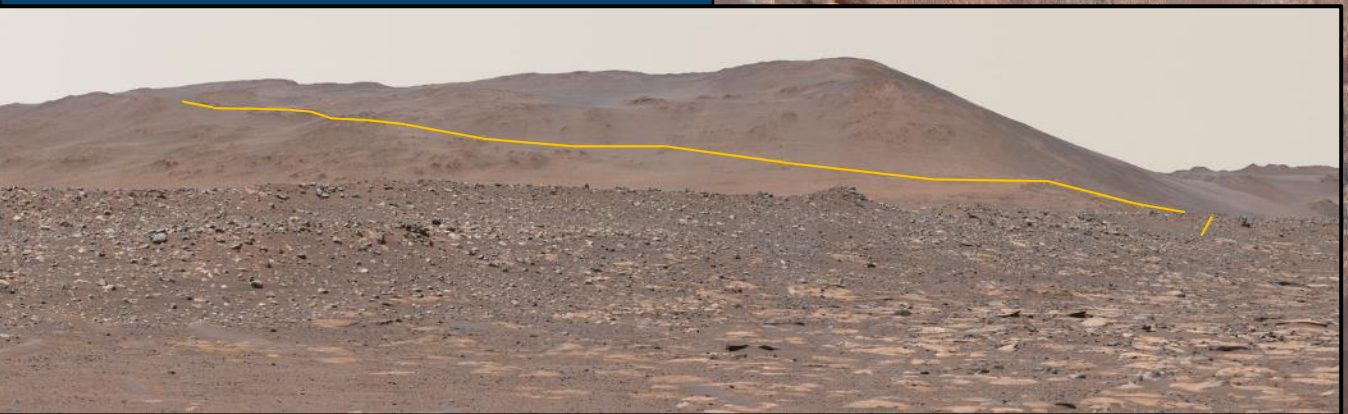
Logged 1,000 days on Mars!

Margin Campaign

Delta Top Campaign

Three Forks

The yellow line below indicates the intended route for Perseverance to make its ascent out of Jezero Crater. Credit: NASA/JPL-Caltech/ASU/MSSS



Map Scale

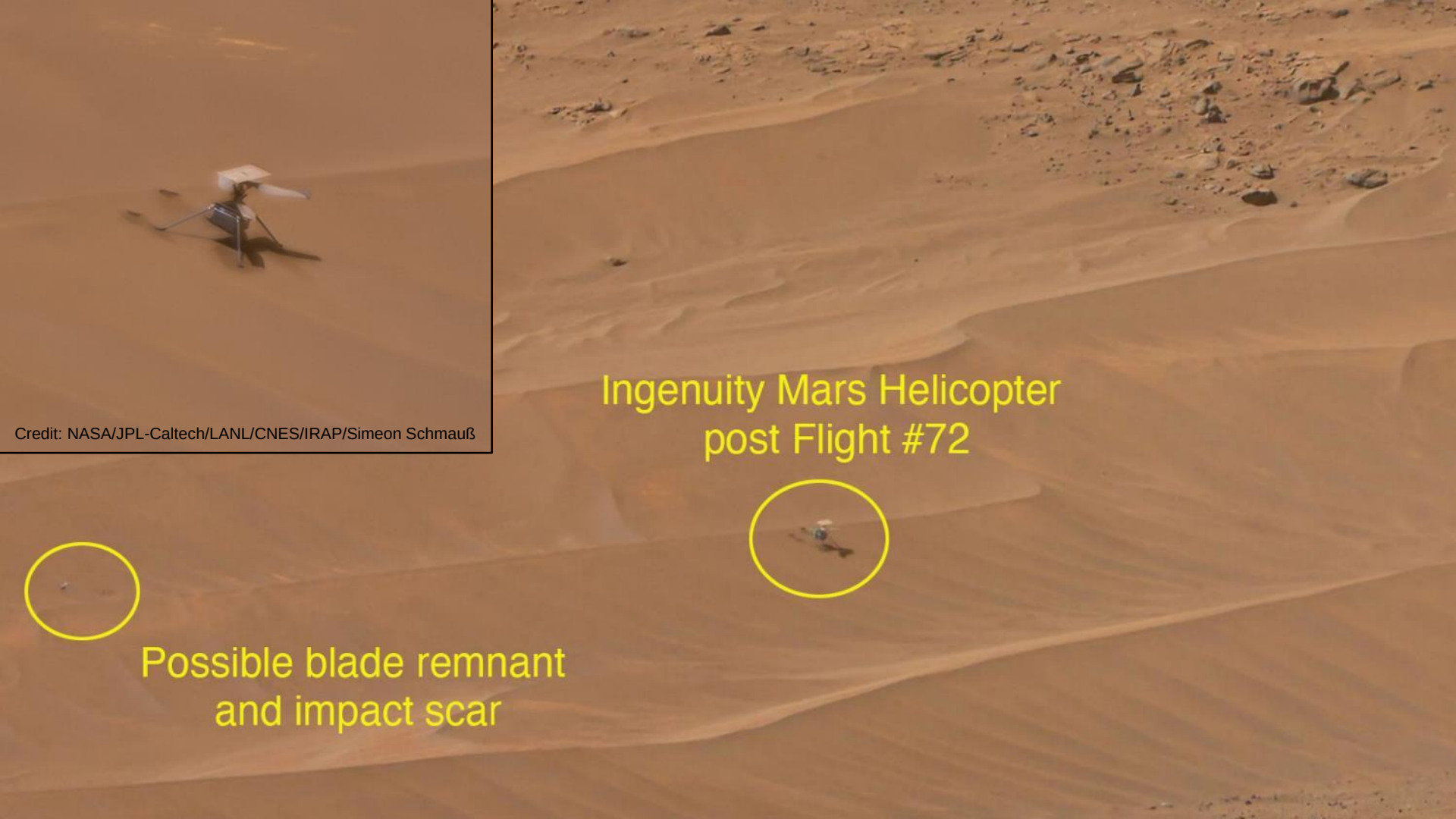
0 500m 1000m 2km

Longitude, Latitude 77.33997345°, 18.43238768°

Thanks to Ingenuity

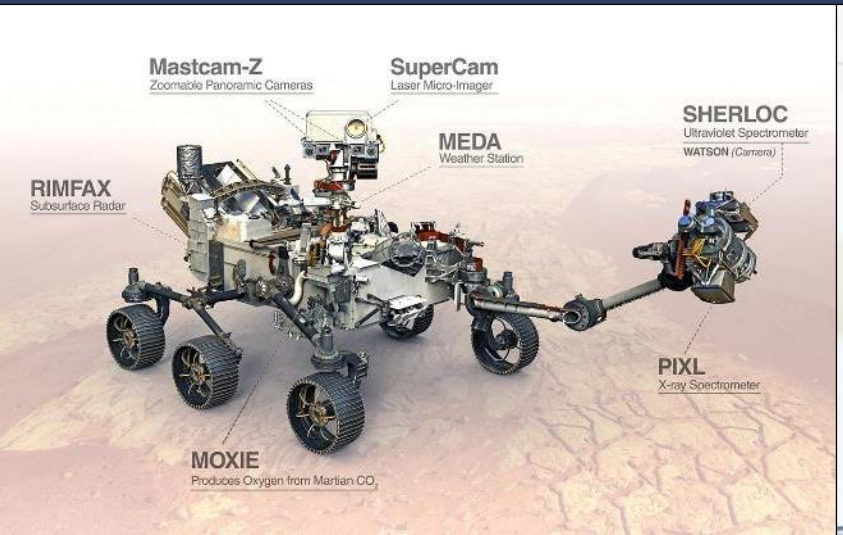
After 72 flights, Ingenuity's mission has ended due to rotor blade damage. Originally a pure tech demo, it exceeded expectations and became an operations demo, serving as an aerial scout for Perseverance scientists and rover drivers.

- Flew up to 24 meters (79 feet) high
- Covered 17km (10.5 miles)
- 128.8 minutes accumulated in flight

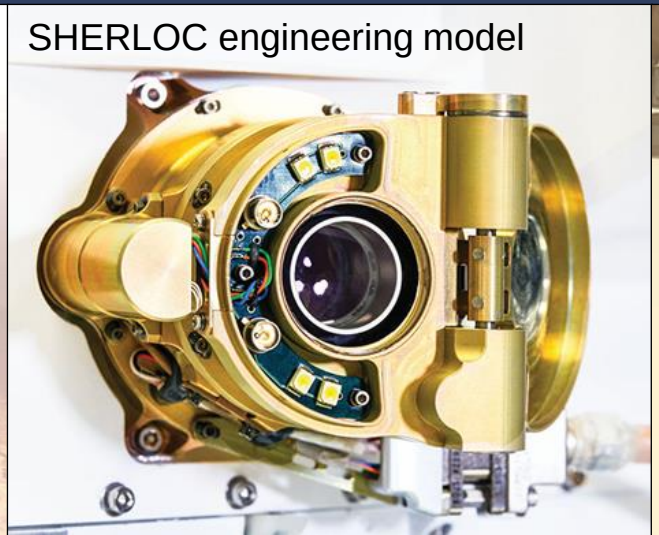

Credit: NASA/JPL-Caltech/LANL/CNES/IRAP/Simeon Schmauß
Ingenuity Mars Helicopter
post Flight #72
Possible blade remnant
and impact scar

SHERLOC Instrument Update

- SHERLOC dust cover remains partially open, interfering with data collection
- Currently, cannot use the laser or collect spectroscopy, but the WATSON camera can still conduct close-up microscopy
- Mission objectives can be met using other instruments onboard
  - While some overlap was built into Perseverance's instrument suite, the best scientific analysis will come from larger, highly-sensitive instruments in labs on Earth



SHERLOC engineering model

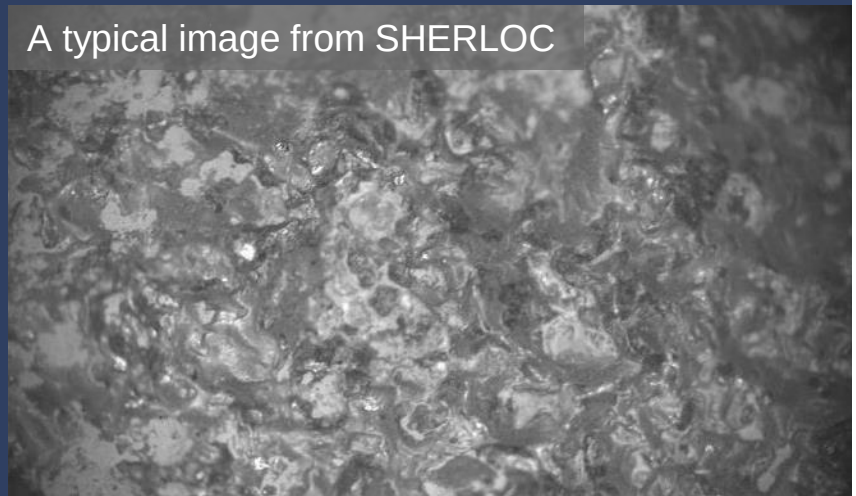


SHERLOC on Mars

SHERLOC Science

- Measures CHNOPS-containing mineralogy
- Measures the distribution and type of organics preserved at the surface
- Correlates measurements to textural features via a co-boresighted context imager

A typical image from SHERLOC



Diverse organic-mineral associations in Jezero crater, Mars

Sunanda Sharma, Ryan D. Roppel, Ashley E. Murphy, Luther W. Beegle, Rohit Bhartia, Andrew Steele, Joseph Razzell Hollis, Sandra Siljeström, Francis M. McCubbin, Sanford A. Asher, William J. Abbey, Abigail C. Allwood, Eve L. Berger, Benjamin L. Bleefeld, Aaron S. Burton, Sergei V. Bykov, Emily L. Cardarelli, Pamela G. Conrad, Andrea Corpolongo, Andrew D. Czaja, Lauren P. DeFlores, Kenneth Edgett, Kenneth A. Farley, Teresa Fornaro, ... Anastasia Yanchilina

+ Show authors

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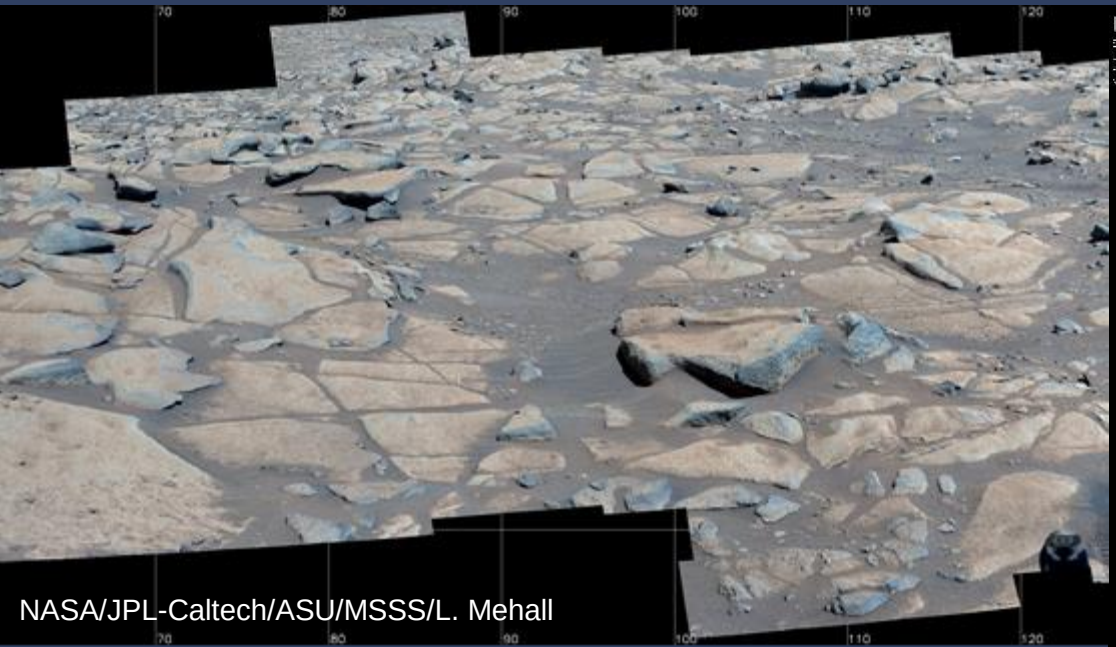
Margin Unit and the Crater Rim

- Investigating strong carbonate signatures seen from orbit
- Current area contains significant layering
- Heading toward ‘megabreccia’ seen on the crater rim, either originating from the Jezero Crater impact or from older ejecta from Isidis Basin



NASA/JPL-Caltech/ASU/MSSS/L. Mehall

NASA/JPL-Caltech/ASU/Henry Manelski

Mars Science Laboratory (MSL) Curiosity

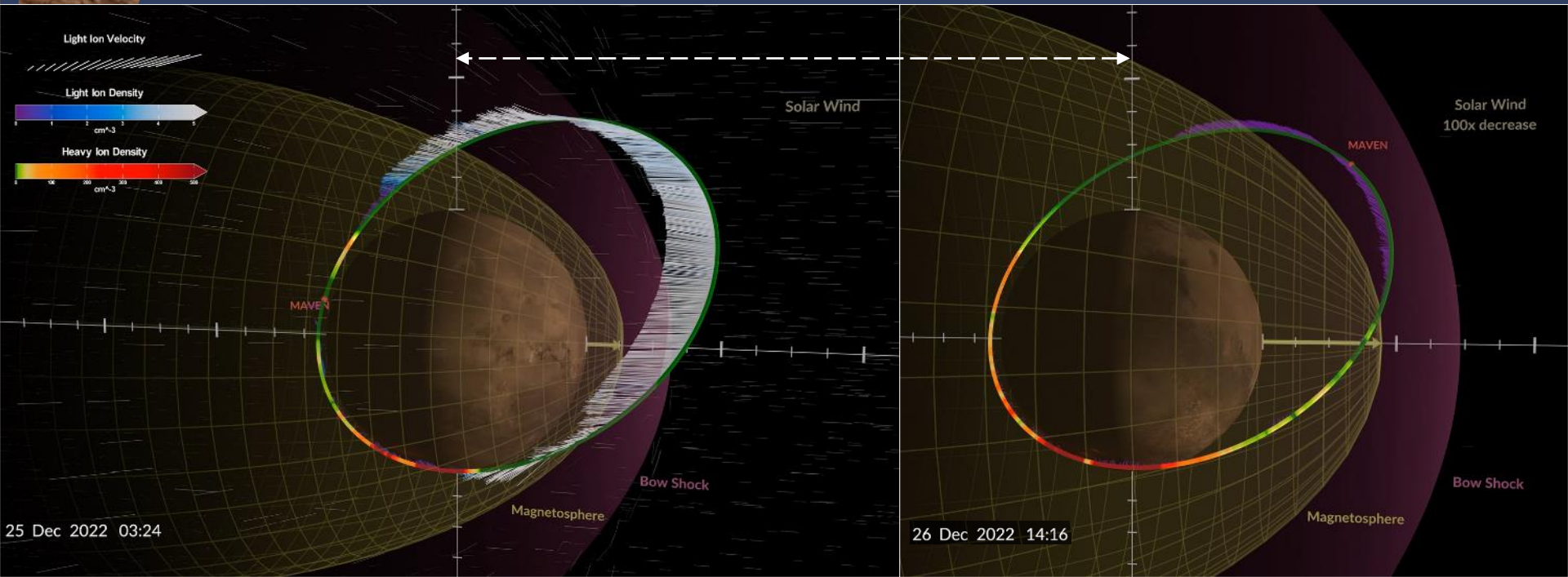
Curiosity continues to explore the Mg sulfate-bearing unit and Gediz Vallis ridge and channel!

- Recently collected 40th drilled sample (“Mineral King”) of a highly desired dark-toned rock layer in the sulfate unit
- Beginning a campaign to investigate the debris-filled channel-form in Gediz Vallis (right) that may hold the most recent evidence of surficial liquid water accessible to the mission
- Currently in Extended Mission 4; traversed 31.7 km and climbed 791 m in elevation
- 26 papers published by the MSL team in 2023

This mosaic was taken by the Right Navigation Camera onboard NASA's Mars rover Curiosity on Sol 4096. Credits: NASA/JPL-Caltech. Download mosaic ›

Maven Recorded “Disappearance” of Solar Wind

A strong solar burst overtook the slower solar wind, carrying it along more quickly and leaving a low-density area in its wake.




EXPLORE
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