



National Aeronautics and  
Space Administration

# EXPLORE MARS SAMPLE RETURN

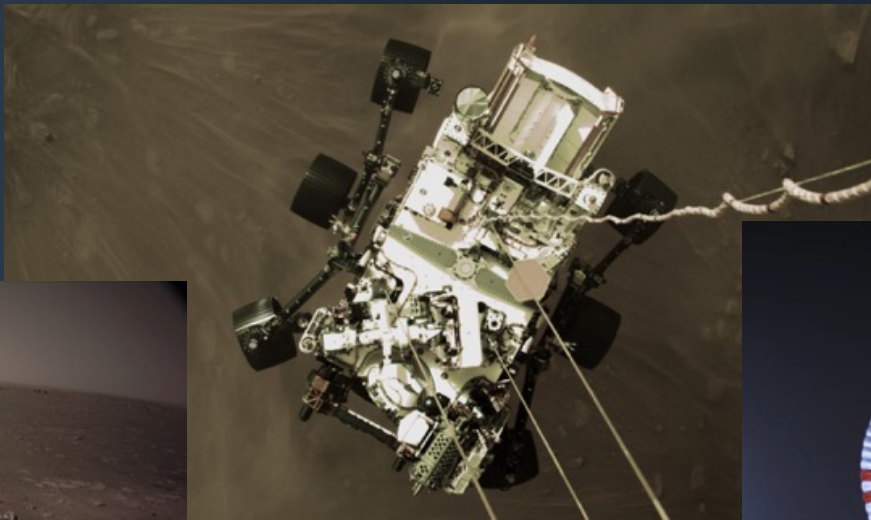
Jeff Gramling  
Director, Mars Sample Return Program  
NASA HQ

LPSC

March 18, 2021



Perseverance landing  
2/18/2021



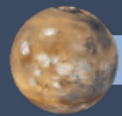


# Status

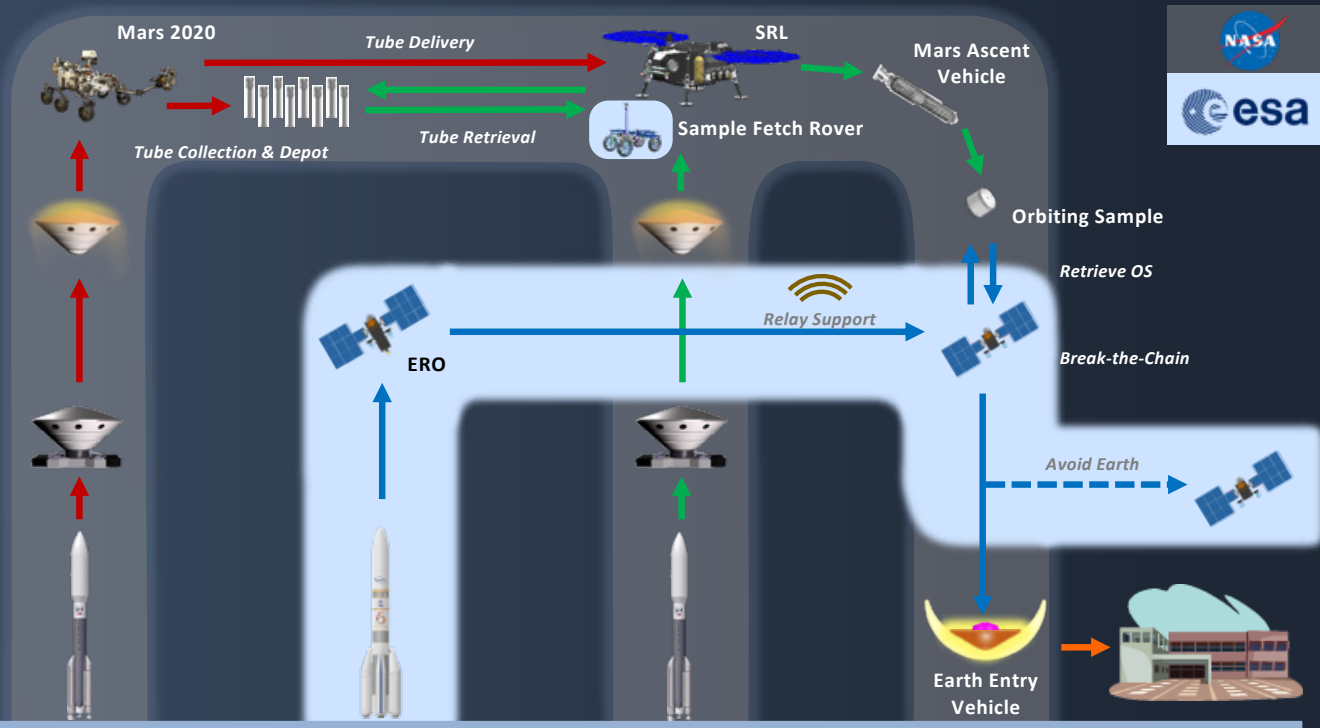
- Mars Sample Return (MSR) has been a priority of the past two National Academy Decadal Surveys
  - First “round-trip” to another planet, paving the way for future human exploration
- The first billion years and life’s beginning in the Solar System- the record is on Mars
  - The oldest known life on Earth existed ~3.5 billion years ago, a time when Mars was habitable
  - Today, <<1% of the Earth’s surface is 3 billion years or older, >50% of the Mars’ surface is 3 billion years or older
- Perseverance has landed and is capable of selecting and caching 43 samples
- MSR is a complex mission that is possible today because of a strong international partnership with ESA and the \$10+B investment made through the formulation, technology and operational projects of the past decades
- In recognition of the size, complexity, and technological and engineering advances required, MSR employed several processes much earlier in Pre-Phase A
  - Commissioned two Independent Cost/Schedule Estimates
  - Had an Independent Review Board (IRB) conduct a two-month examination of the program
  - Established the program’s Standing Review Board to conduct the MCR as an Agency review

**MSR was approved to proceed into Phase A in December following the IBR and the Mission Concept Review**

# MSR Architecture Overview



Mars



Earth

Mars2020

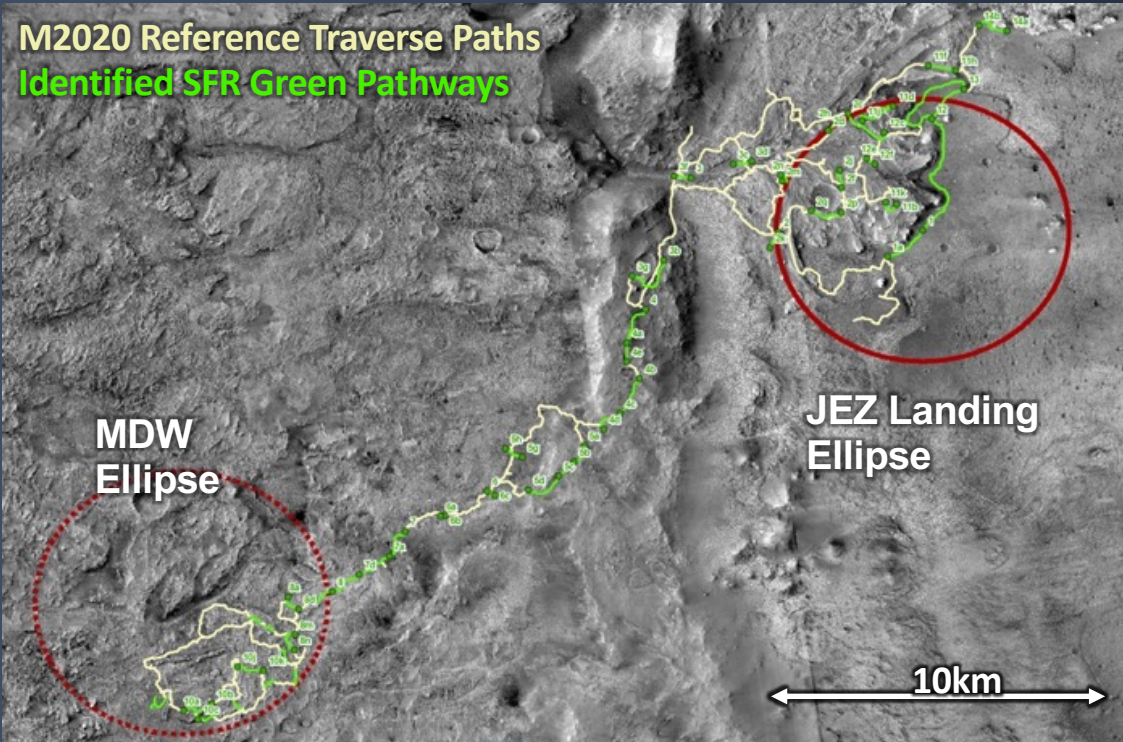
Earth Return Orbiter

Sample Retrieval Lander

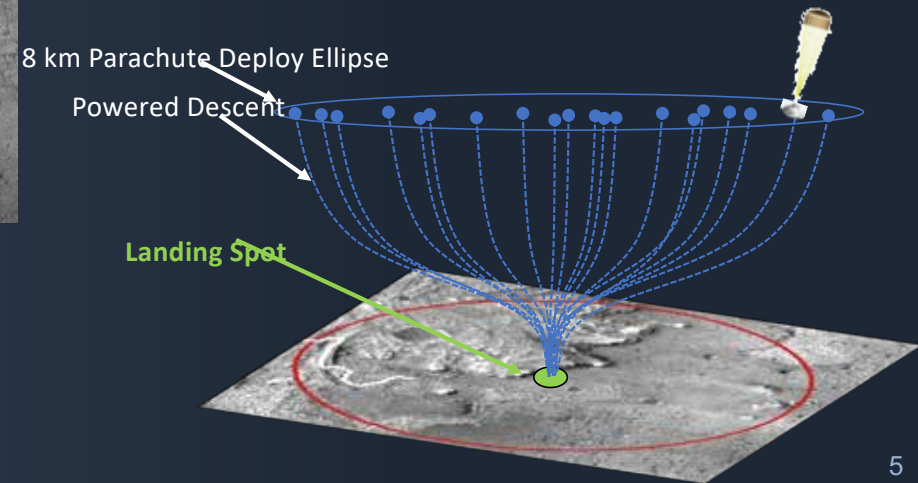
Sample Return and Science

# Overview of Green Pathways Across Jezero-Midway Region

M2020 Reference Traverse Paths  
Identified SFR Green Pathways

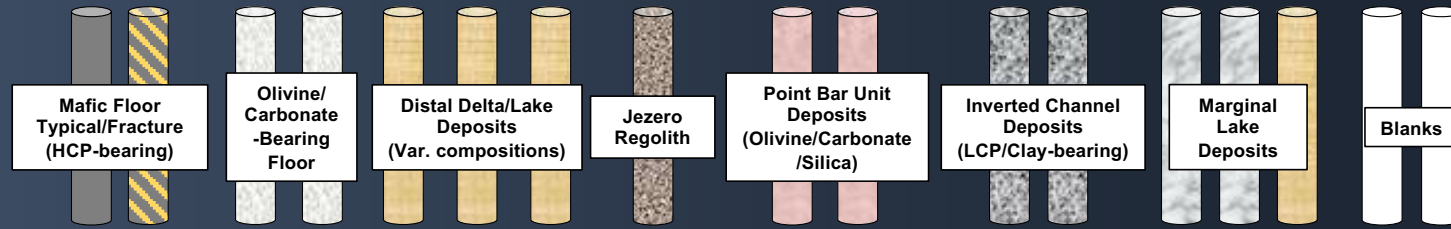


- SRL will carry enough propellant to fly out the backshell separation ellipse (8 x 8 km) and land at a specific spot (~±20m accuracy)
- Enables new capability of landing at a specific site pre-scouted from the Mars surface

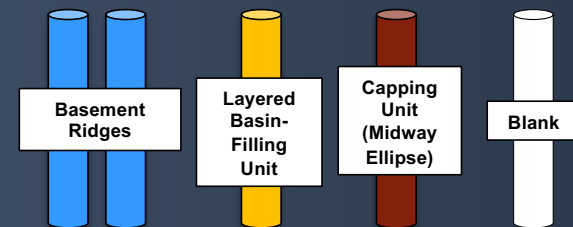
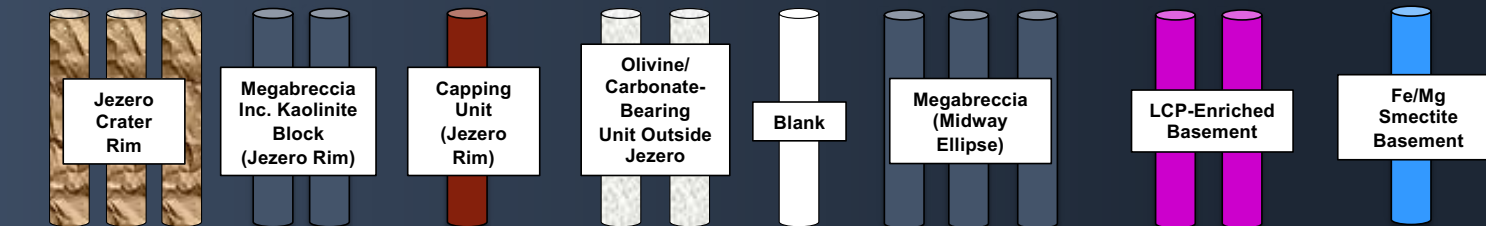


# Diversity of Samples

## Inside the Jezero system (20 samples)



## Outside the Jezero system (17 samples; extended mission, if any)



Adapted from Ken Farley (CAPS, 2019)



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with us