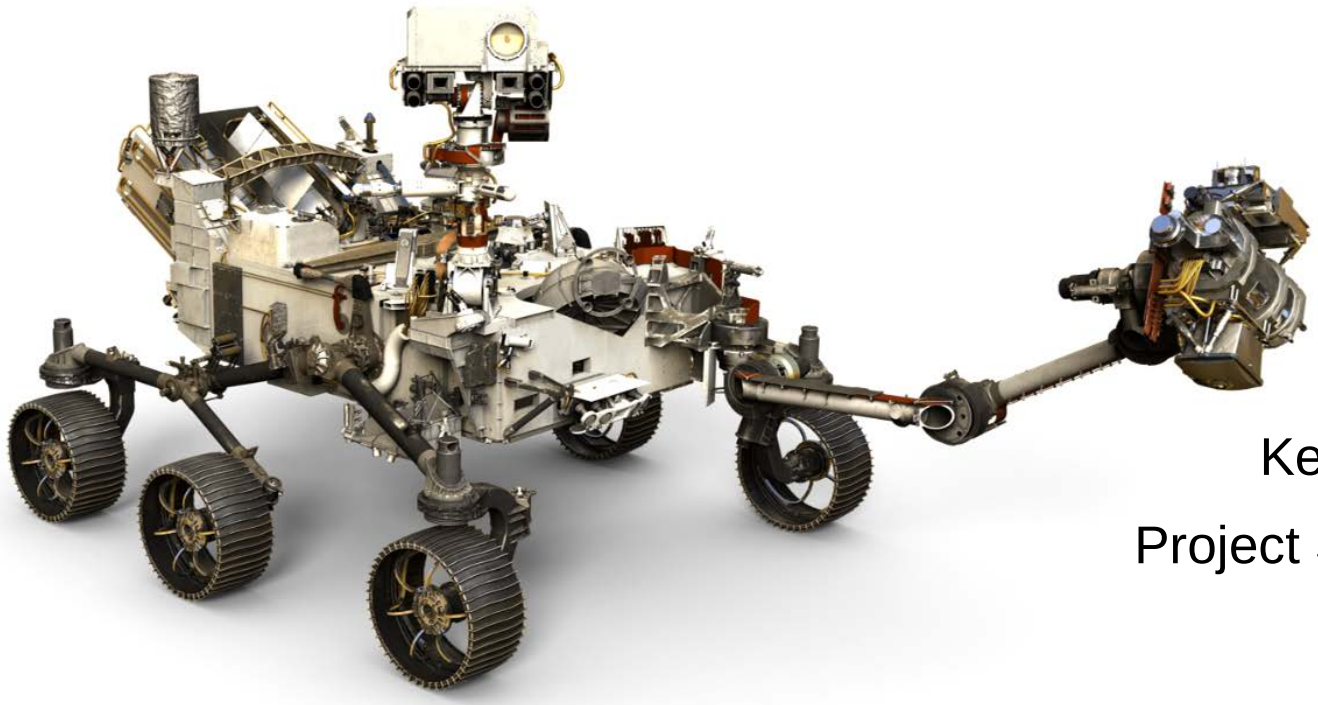
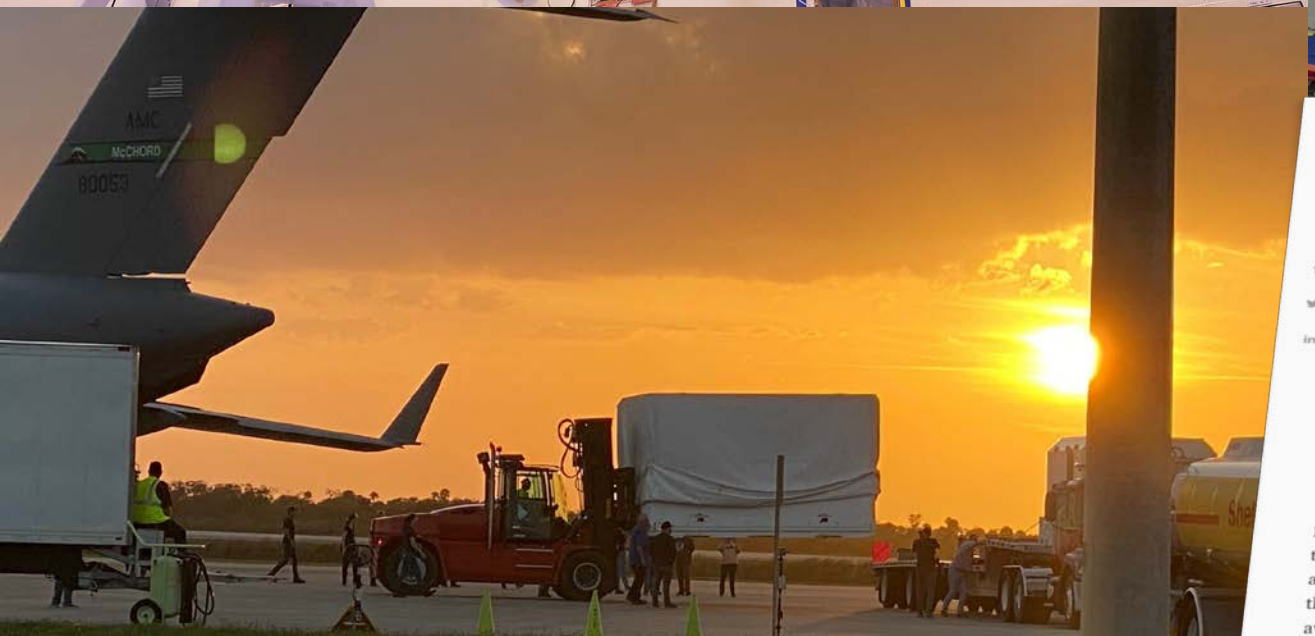
Jet Propulsion Laboratory
California Institute of Technology

# Mars 2020: 90 Days to Launch



Ken Farley
Project Scientist
Caltech

MARS 2020 PERSEVERANCE




# NASA's Perseverance Rover Is The Inspiration We Need Right Now

**Forbes**

The plaque offers a stylistic nod to the Voyager record covers and the Pioneer plates. NASA

NASA's Perseverance rover is on track to launch this summer, and when it does, it will carry the names of nearly 11 million people to Mars.

Earlier this month, as communities around the country locked themselves down in an effort to slow the spread of the novel coronavirus, a team at Kennedy Space Center in Florida started the process of packing the rover for launch. They lowered and locked the rover's mast, stowed away its robotic arm, and retracted its wheels. But first, they fixed the

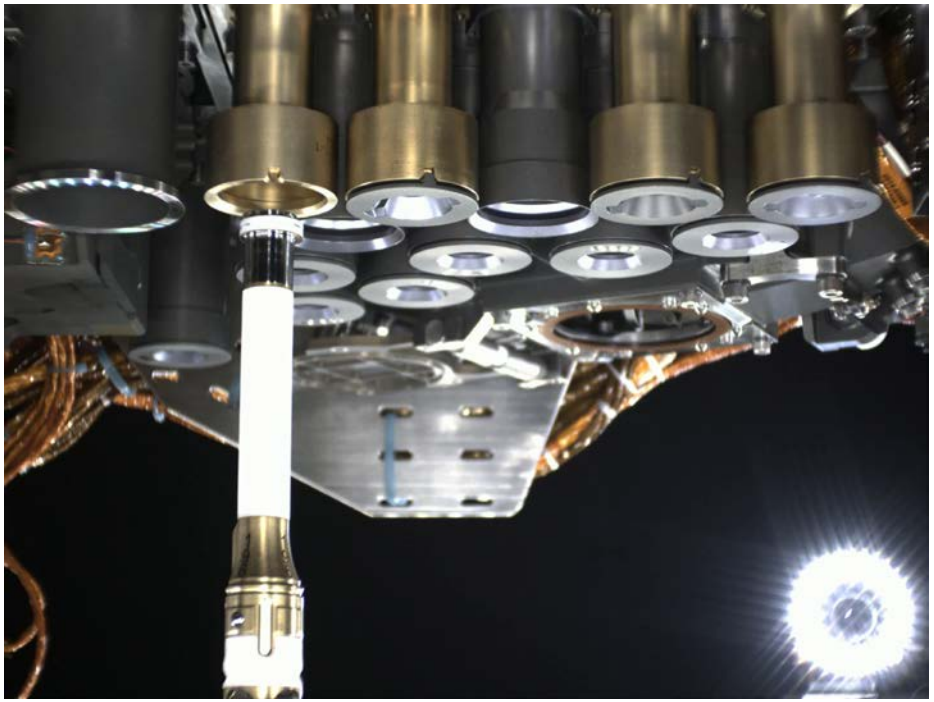
# Project Managers' Update

- The vehicles shipped on-time in early February from JPL to KSC
- All hardware including science instruments, technology payloads, and the sampling systems elements have completed rework, retest, re-installation and regression testing on the flight vehicle; with the exception of the final sample intimate hardware which is installed in mid-May per plan to minimize any contaminations threats.
- The rover functional and system testing at KSC is essentially complete. The team will initiate the spacecraft stack in about a week.
- Most of the team (85-90%) have transitioned successfully to teleworking conditions.
- The project, institution, and agency have coordinated on extensive cooperative measures to establish a safe working environment for those performing on-lab or hands-on spacecraft processing at KSC.
- The project remains on track for the July launch window. The primary consideration has been and will remain the health and safety of the teams.

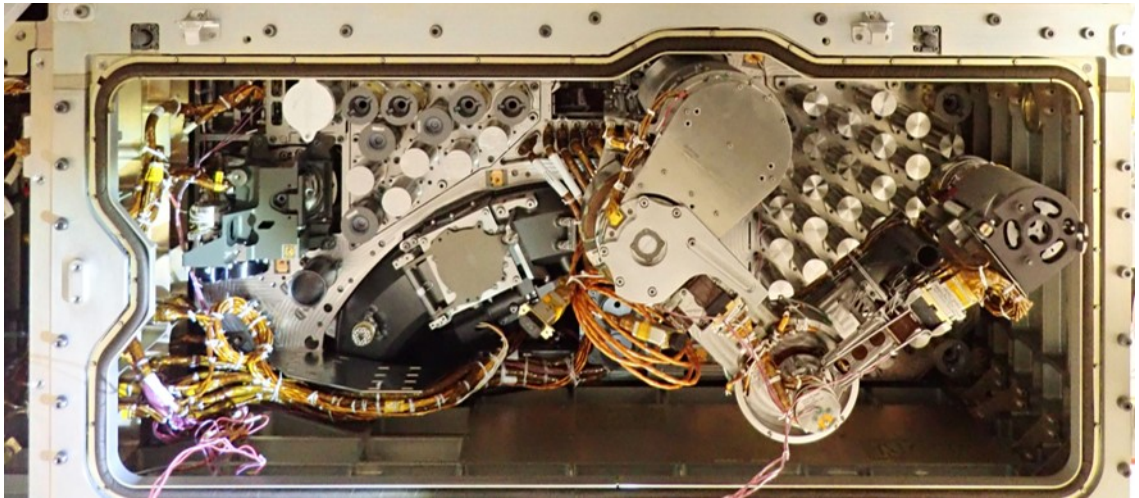
# Science Perspective

- Science Instruments
- Adaptive Caching Assembly
- Recent and Ongoing Science Activities
- Upcoming Events

# Adaptive Caching Assembly



43 Sample Tubes
*including*
5 Witness Tubes



# Contamination Control Update

- Mars 2020 has very stringent organic, inorganic, and biologic cleanliness requirements on returned samples.

  see https://eos.org/science-updates/seeking-signs-of-life-and-more-nasas-mars-2020-mission

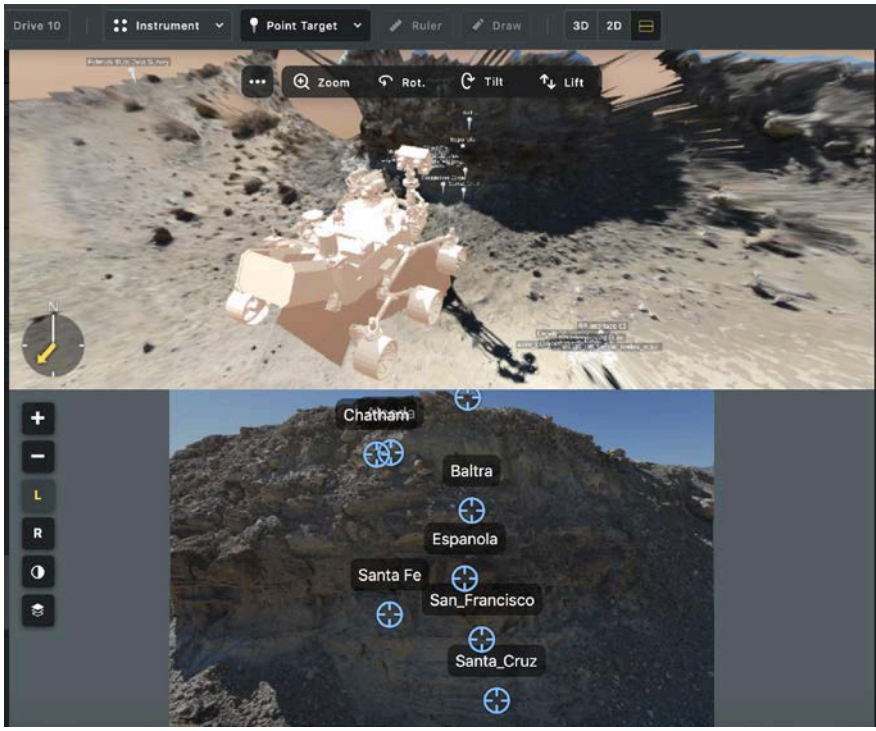
- Update on our progress
  - on track to meet inorganic cleanliness requirements with known exceptions like tungsten, an essential component of the WC drill bit
  - on track to meet the biological sterility requirement

# Contamination Control Update

- Organic Cleanliness
  - in late 2019 the project discovered that the planned 350 C combustion step of sample tubes and seals, designed to drive organic carbon contamination to a vanishingly low level, had unexpected and unacceptable consequences on the behavior of sliding surfaces associated with sample tube and seal manipulation.
  - in response, the bake-out temperature was reduced from 350 C to 150 C (24 hours, with purge cycles) and was augmented with a more rigorous set of cleaning steps involving multiple solvents and sonication steps. The efficacy of this process was established using witness materials prior to implementation on flight hardware.
  - the cleaning process of flight tubes and seals is nearing completion. Analysis of rinse solutions to assess organic contamination levels are nearly complete and indicate that **we are on track to meet the 1 ppb Tier 1 organic requirements and well within the threshold total organic contamination requirement of 40 ppb**. Full review of these results and the models needed to establish in-flight recontamination levels will occur later this month.
  - this change does not impact compliance with biological requirements

# ROASTT-2020

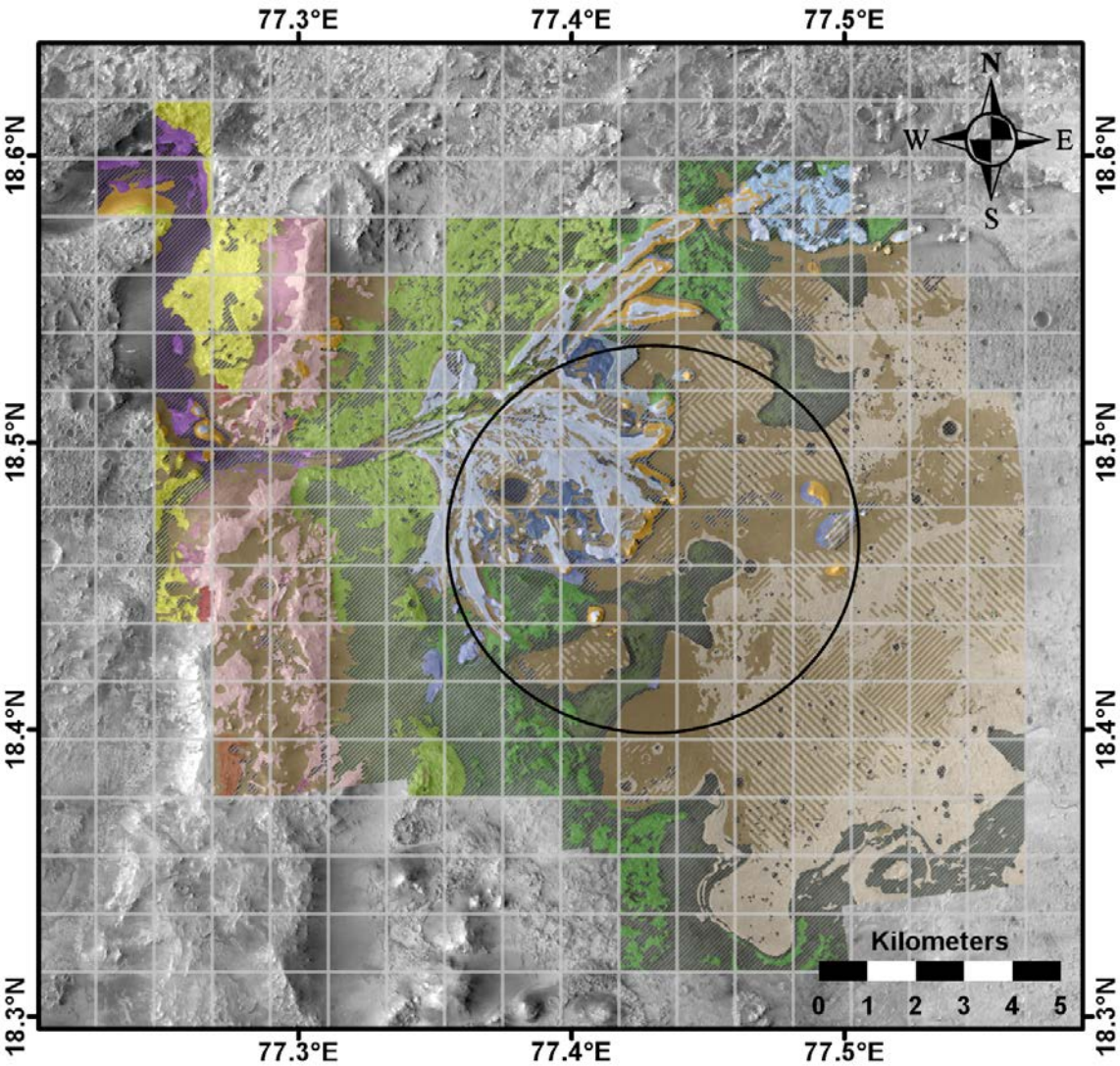
- Rover Operations Activities for Science Team Training
  - High-fidelity mission operations simulation using a terrestrial analogue site
  - Lakebed spring deposits in the Nevada desert
- Science Decision-Making in exploration, using:
  - Operations process for surface mission
  - Stand-in instruments for rover payload
  - Latest versions of M2020 ops software tools
- Over 150 participants
  - 2 weeks of live operations, plus pre/post work
  - 3rd of 3 exercises of this type for M2020



# Strategic Science Mission Plan

- Mars 2020 Science Team continues to develop its collective understanding of the landing site and its surroundings through our *Strategic Process*
- Goal is to develop a mission science plan that brings the science team together to:
  - interpret the geology and environment of the exploration region
  - refine and develop scientific interpretations, questions, and hypotheses
  - locate key outcrops that could be studied and sampled, with associated goals, hypotheses, and tests
  - update/refine the notional sample cache
  - develop and evaluate a possible traverse that could efficiently move *Perseverance* through the exploration region in a way that maximizes overall scientific return

# Mars 2020 Science Team Map




**Legend**

- Ellipse
- 1.2 km grid

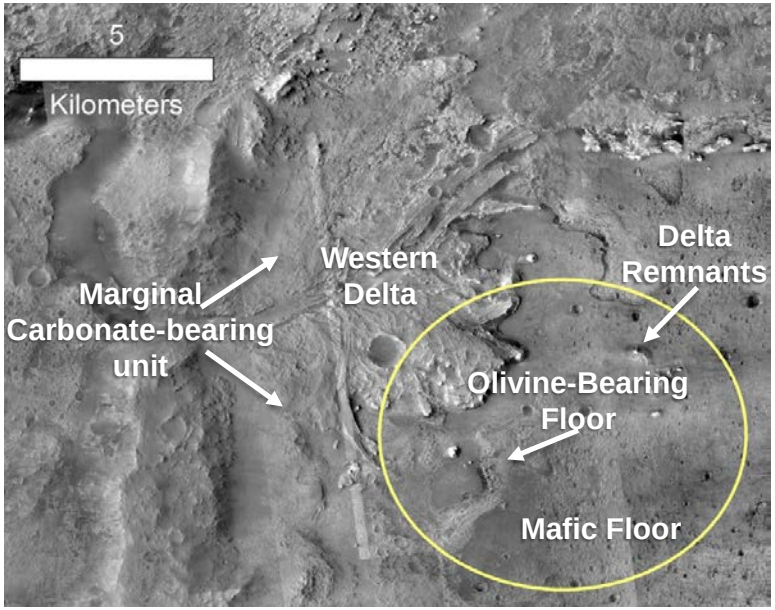
**Surficial Units**

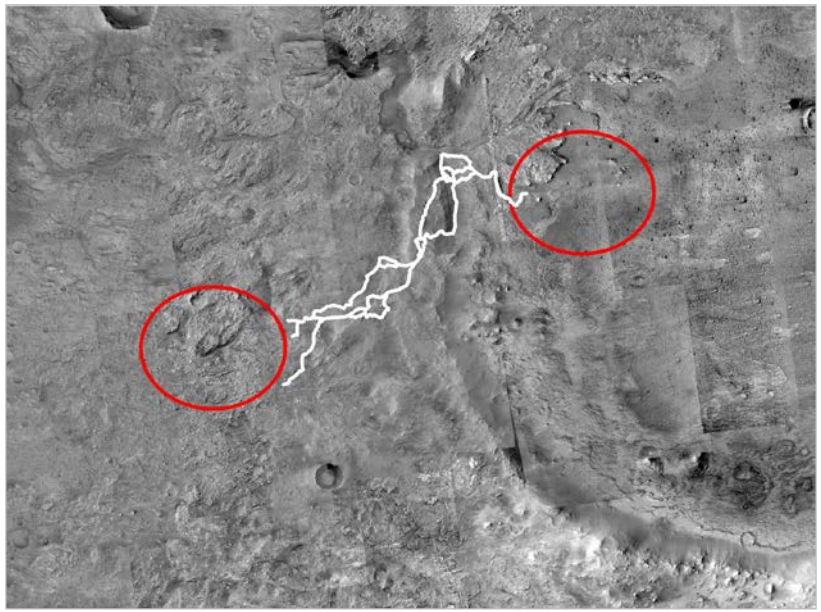
- Undifferentiated smooth (Us)
- Aeolian bedforms, large (Ab-l)
- Aeolian bedforms, small (Ab-s)
- Moderate Cover Us
- Minor Cover Us
- Talus (T)

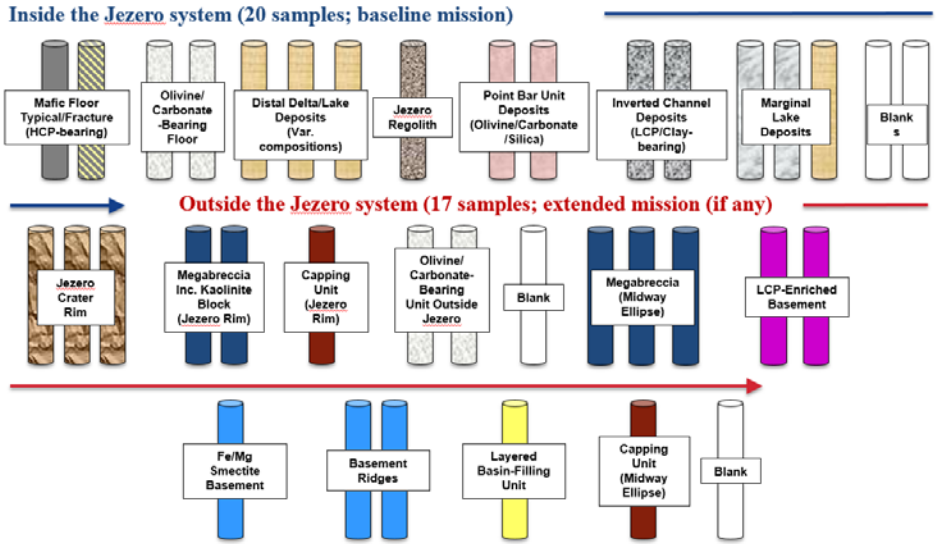
**Bedrock Units**

| | |
|---|---|
| *Cr-ltr* | Crater rim light-toned rough |
| *Cr-lt* | Crater rim light-toned |
| *NP-ltf* | Nili Planum light-toned fractured |
| *D-bl* | Delta blocky |
| *D-tnl* | Delta thinly layered |
| *D-tkl* | Delta thickly layered |
| *D-tcl* | Delta truncated curvilinear layered |
| *D-tcl* | Delta light-toned layered rough |
| *Cr-bl* | Crater rim blocky |
| *Cr-br* | Crater rim breccia |
| *NV-ltl* | Neretva Vallis light-toned layered |
| *M-ltr* | Margin light-toned rough |
| *Cf-ltf-1* | Crater Floor light-toned fractured 1 |
| *Cf-ltf-2* | Crater Floor light-toned fractured 2 |
| *Cf-ltr* | Crater Floor light-toned rough |

# Studying Jezero Crater (and Beyond)





# Upcoming M2020 Science Events

- Launch: July 17
  - team meeting planned for Cocoa Beach, but is uncertain due to COVID-19
- Participating Scientists (PS's)
  - About 25 total anticipated (out of total of about 120 mission co-I's)
  - 10 Existing Returned Sample Science Participating Scientists
  - "Regular" Participating Scientists;  selection process in progress
  - European Returned Sample Science PS's; selection process in progress

*we expect all PS's to be on board by mid-summer 2020*

- Space Science Reviews special issue on Mars 2020
  - expected to be completed, including book form, by landing day, Feb 18, 2021