Jet Propulsion Laboratory
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Mars 2020 Rover Mission Status in 2016

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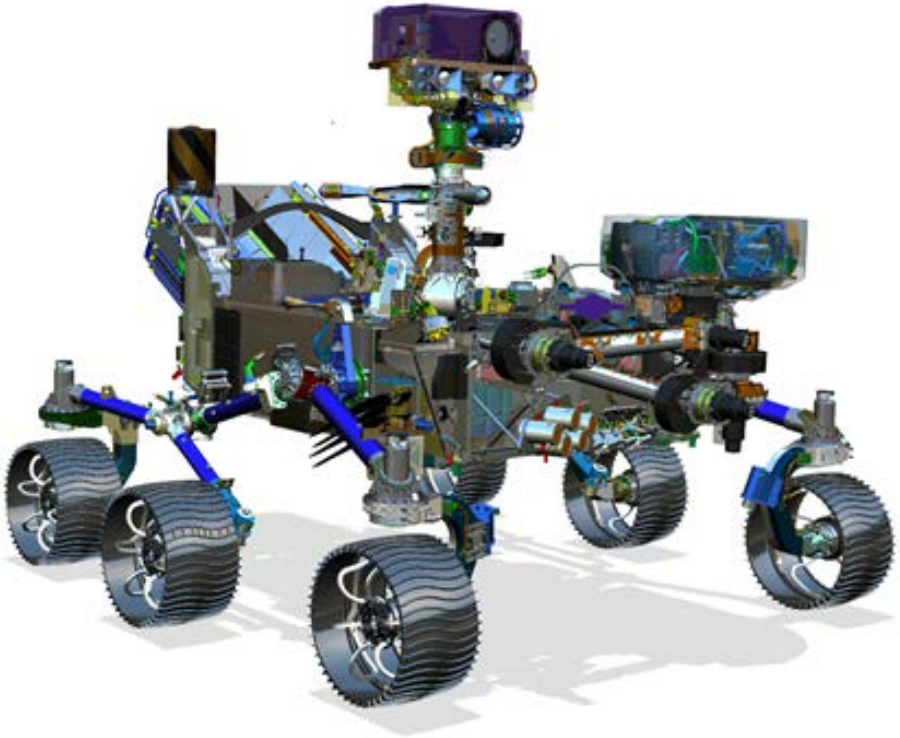

September 2016

IAC, Guadalajara

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Government sponsorship acknowledged

Mars Exploration in This Decade

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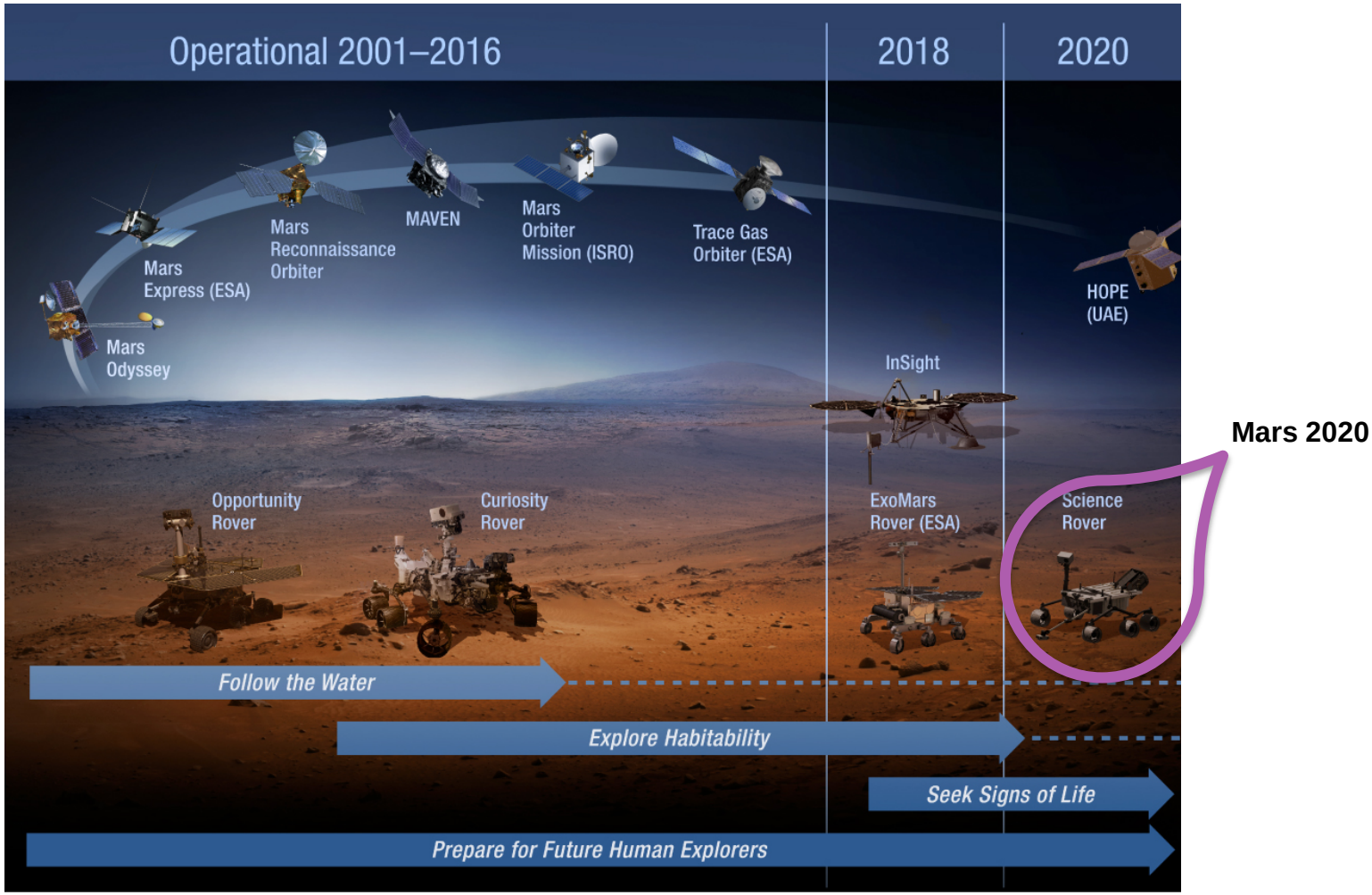
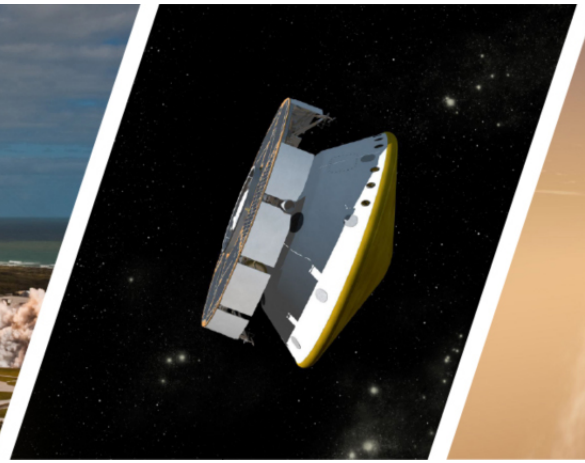


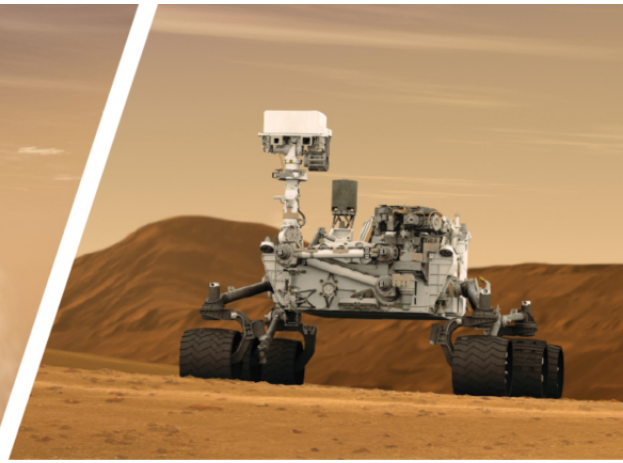
Mars 2020 mission builds on the legacy of NASA's Mars Exploration Program

Mars 2020 Mission Objectives

- **Conduct Rigorous *In Situ* Science**
  - **A.** **Geologic Context and History** Carry out an integrated set of measurements to characterize the geology of the landing site
  - **B.** **In Situ Astrobiology** Find **ancient** habitable environments, identify rocks with the highest chance of preserving **signs** of **ancient** Martian life if it were present, and within those environments, seek the signs of life
- **Enable the Future**
  - **C.** **Sample Return** Assemble rigorously documented and returnable cached samples for possible return to Earth
  - **D.** **Human Exploration** Facilitate future human exploration by making significant progress towards filling major strategic knowledge gaps and
- **Launch in the 2020 opportunity, arriving in 2021**

Mission Overview





LAUNCH

- Atlas V-541
- Period: Jul/Aug 2020

CRUISE/APPROACH

- 7.5 month cruise
- Arrive Feb 2021

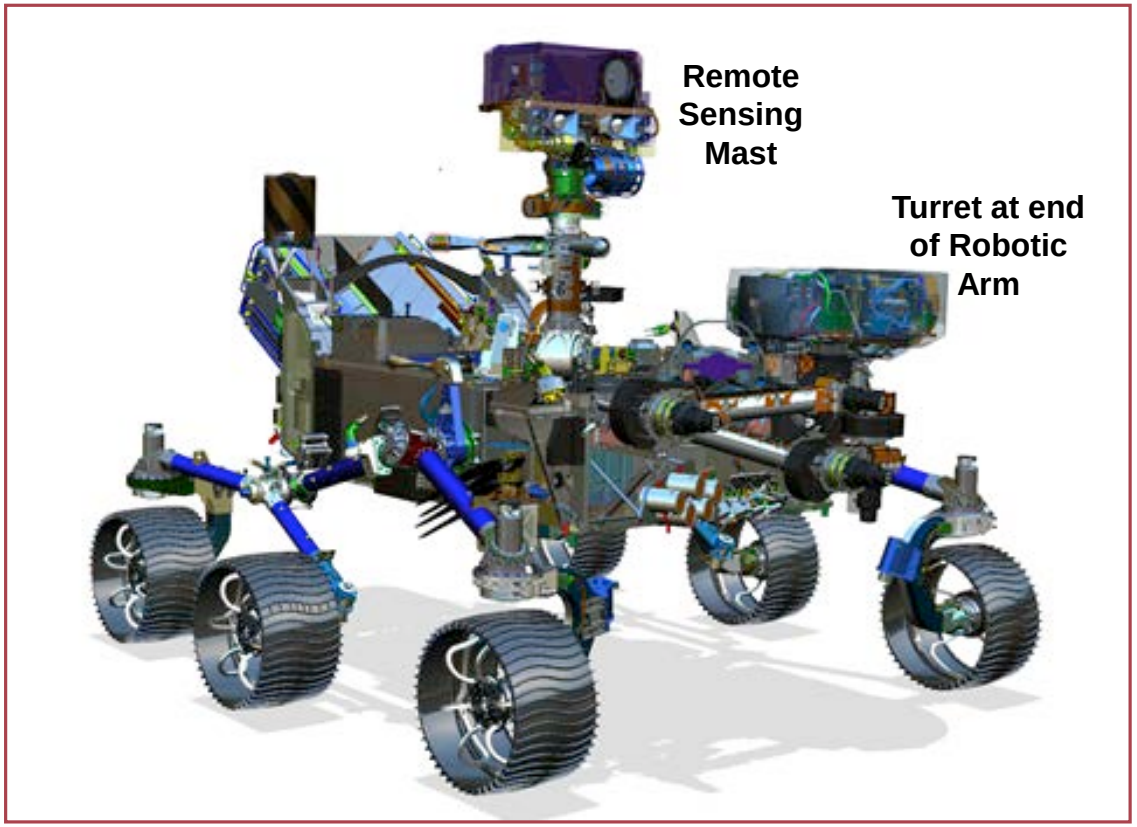
ENTRY, DESCENT & LANDING

- MSL EDL system augmented with Range Trigger and Terrain Relative Navigation: guided entry and powered descent/Sky Crane
- 16 x 14 km landing ellipse
- Access to landing sites ±30° latitude, ≤ -0.5 km elevation
- Curiosity-class Rover

SURFACE MISSION

- 20 km traverse distance capability
- Enhanced surface productivity
- Qualified to 1.5 Martian year lifetime
- Seeking signs of past life
- Returnable cache of samples
- Prepare for human exploration of Mars

Mars 2020 Rover Concept



Stays the Same as MSL

- Avionics
- Power
- GN&C
- Telecom
- Thermal
- Mobility

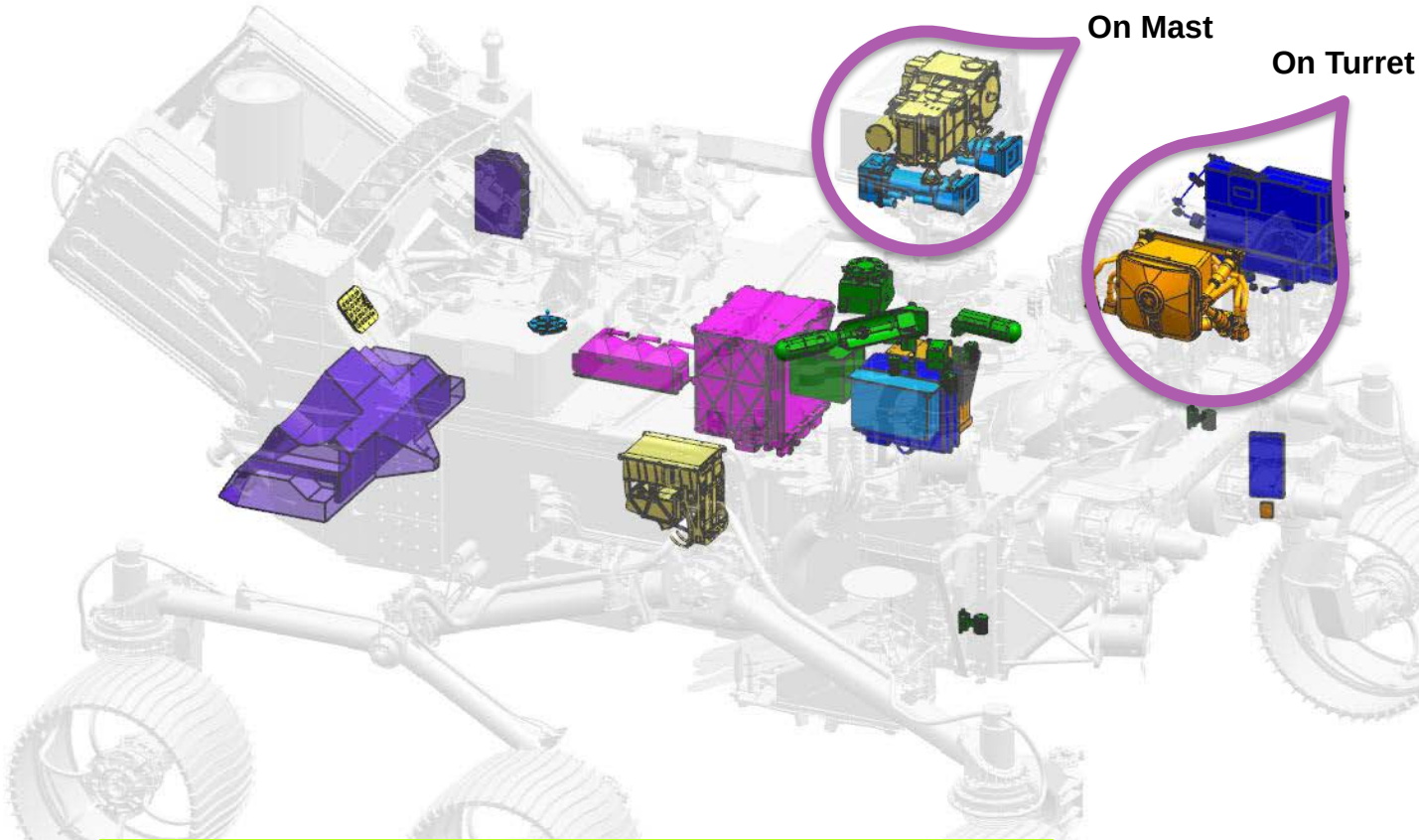
Changed

- New Science Instrument Suite
- New Sampling Caching System
- Modified Chassis
- Modified Rover Harness
- Modified Surface FSW
- Modified Rover Motor Controller
- Modified Wheels

Expected to Change

- Some Mobility components (to support wheel and/or Rover mass)

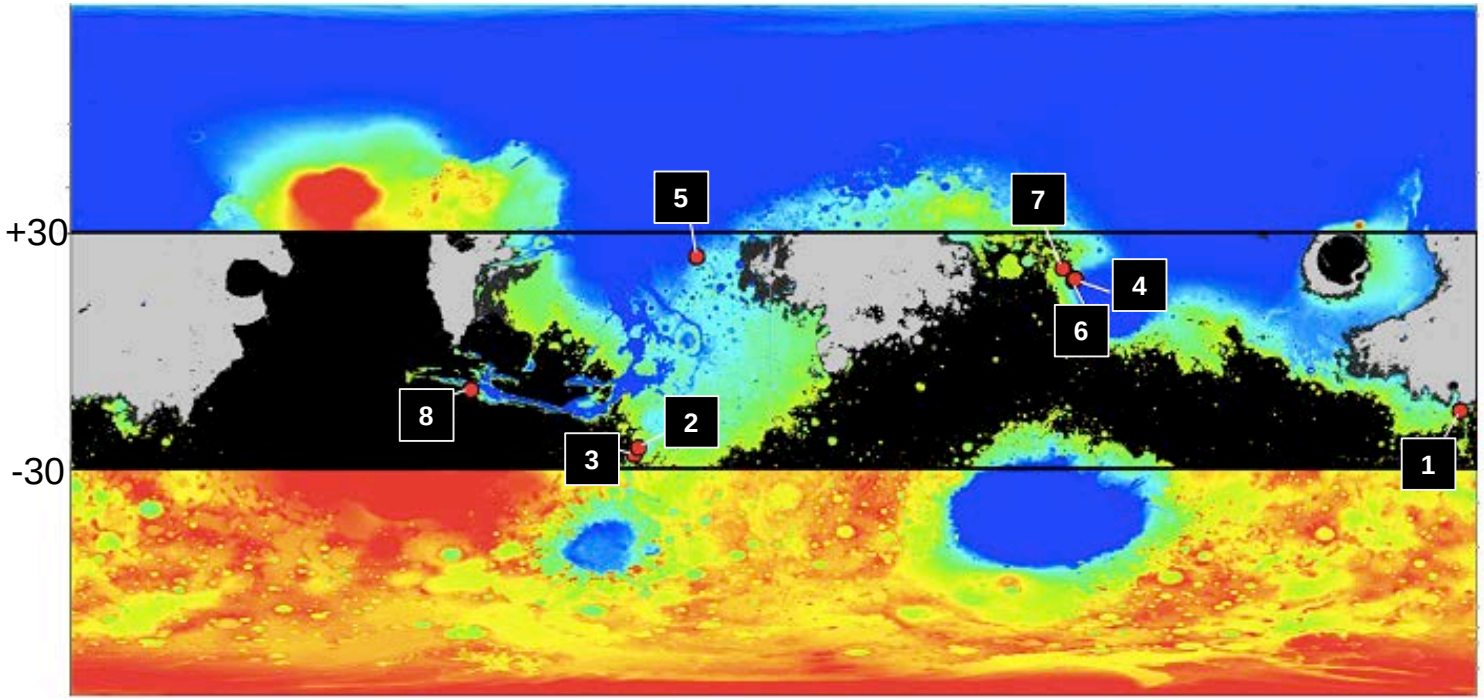
Mars 2020 Payload Family Picture



Instrument Key
Mastcam-Z Stereo Imager
MEDA Mars Environmental Measurement
MOXIE In-Situ Oxygen Production
PIXL Microfocus X-ray Fluorescence Spectrometer
RIMFAX Ground Penetrating Radar
SHERLOC Fluorescence and Raman Spectrometer and Visible Context imaging
SuperCam Laser-Induced Breakdown Spectroscopy and Raman Spectroscopy

International Contributions:
- MEDA – Spain
- RIMFAX – Norway
- SuperCam Mast Unit – France

Where Are We Going?



Candidate landing sites
in alphabetical order

1. Columbia Hills
2. Eberswalde
3. Holden
4. Jezero
5. Mawrth
6. NE Syrtis
7. Nili Fossae
8. SW Melas

- Eight landing sites are currently under consideration. The selected site must provide *clear opportunities to safely and efficiently explore and sample geologically diverse regions with high potential to preserve signs of* **ancient** *life and planetary evolution*.
- With no mission objective or capability to investigate **extant** life, “special regions” are not under consideration for exploration.

Key Challenges

- Sampling and Caching System (SCS)
- Contamination control of samples collected for possible future Earth return
- Achieve mission objectives within primary mission duration

Sampling & Caching System

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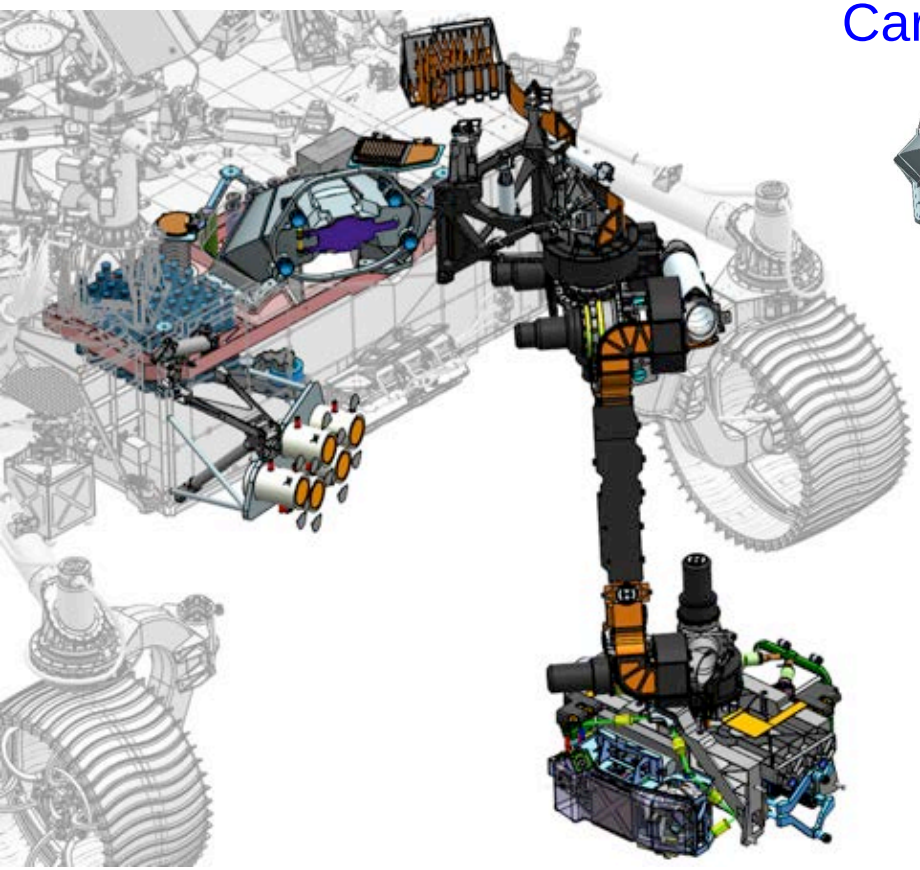
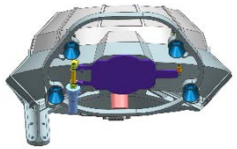
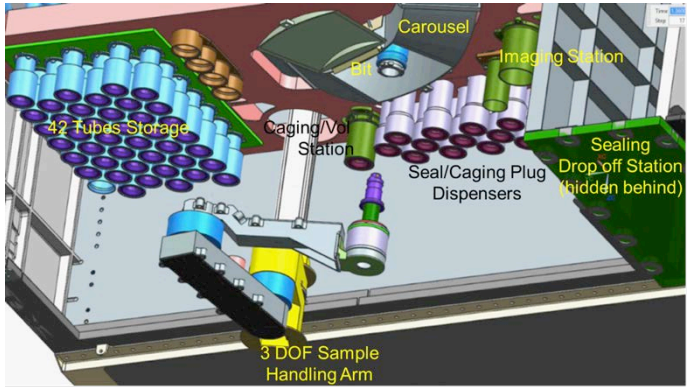
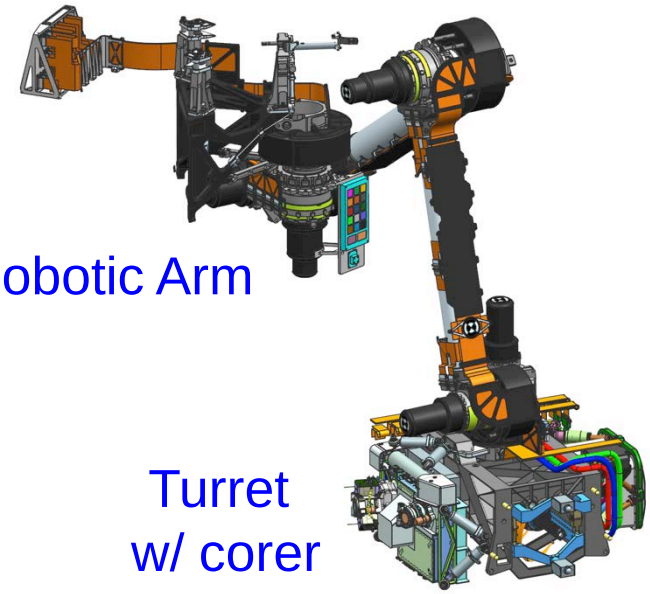


Bit Carousel



Caching Assembly





Robotic Arm

Turret w/ corer

Contamination control of samples collected for possible future Earth return

- Limit amount or likelihood of Earth-sourced contamination making the trip to Mars and and returning inside the sealed tube
  - Biological (e.g. spores or microbes)
  - Molecular Organic (e.g. Amino acids, DNA, glycerol, napthalene)
  - Inorganic (e.g. Pb, W, Co, Mn)

Achieve mission objectives within primary mission duration

- Mars 2020 required to take three times as many samples as MSL and possibly drive farther in the same time period
- Modifications from MSL for improved operations efficiency:

Characteristic	Curiosity (MSL)	Mars 2020
Driving Efficiency	One processor, alternate planning and driving	Two processors; allow planning while driving
On-board Autonomy	Basic	• Real-time resource estimation • Temperature-triggered wakeups • Planning and executing opportunistic activities • Pausing and resuming activities
Instrument Pointing	Includes ground operators	Closed loop on-board
Tactical Timeline for Operations Team	11 hours	5 hours
Prime Mission Duration	1.0 Mars Years	1.25 Mars Years (could be up to 1.5 Mars Years)

Future Path

- Some heritage elements already delivered, others in manufacturing
- Detailed Design for new elements thru January, 2017
- Instrument Delivery in 2018
- Ship to Florida, February 2020
- Launch, July, 2020
- Arrive at Mars, Feb 2021 (Entry Descent and Landing)
- 1.25 Mars Year prime science mission