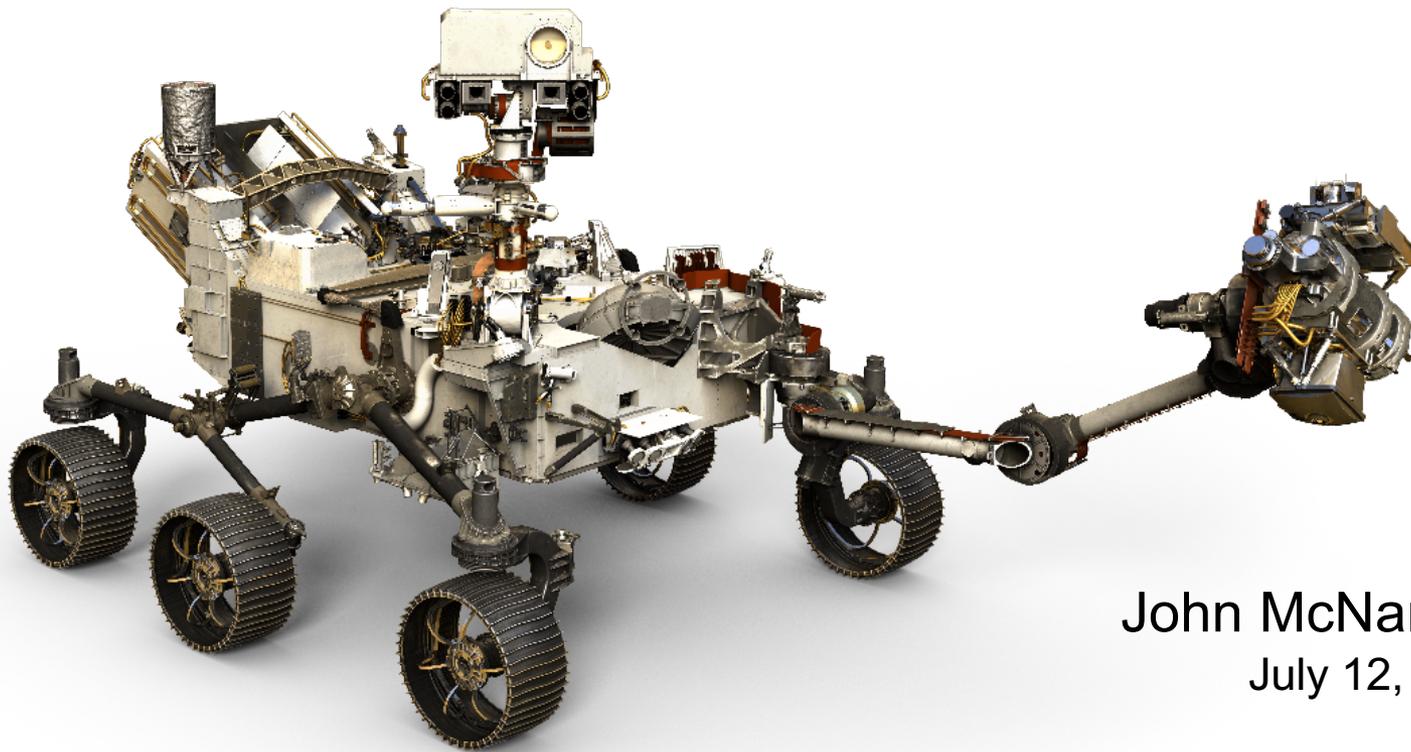


Mars 2020 Overview

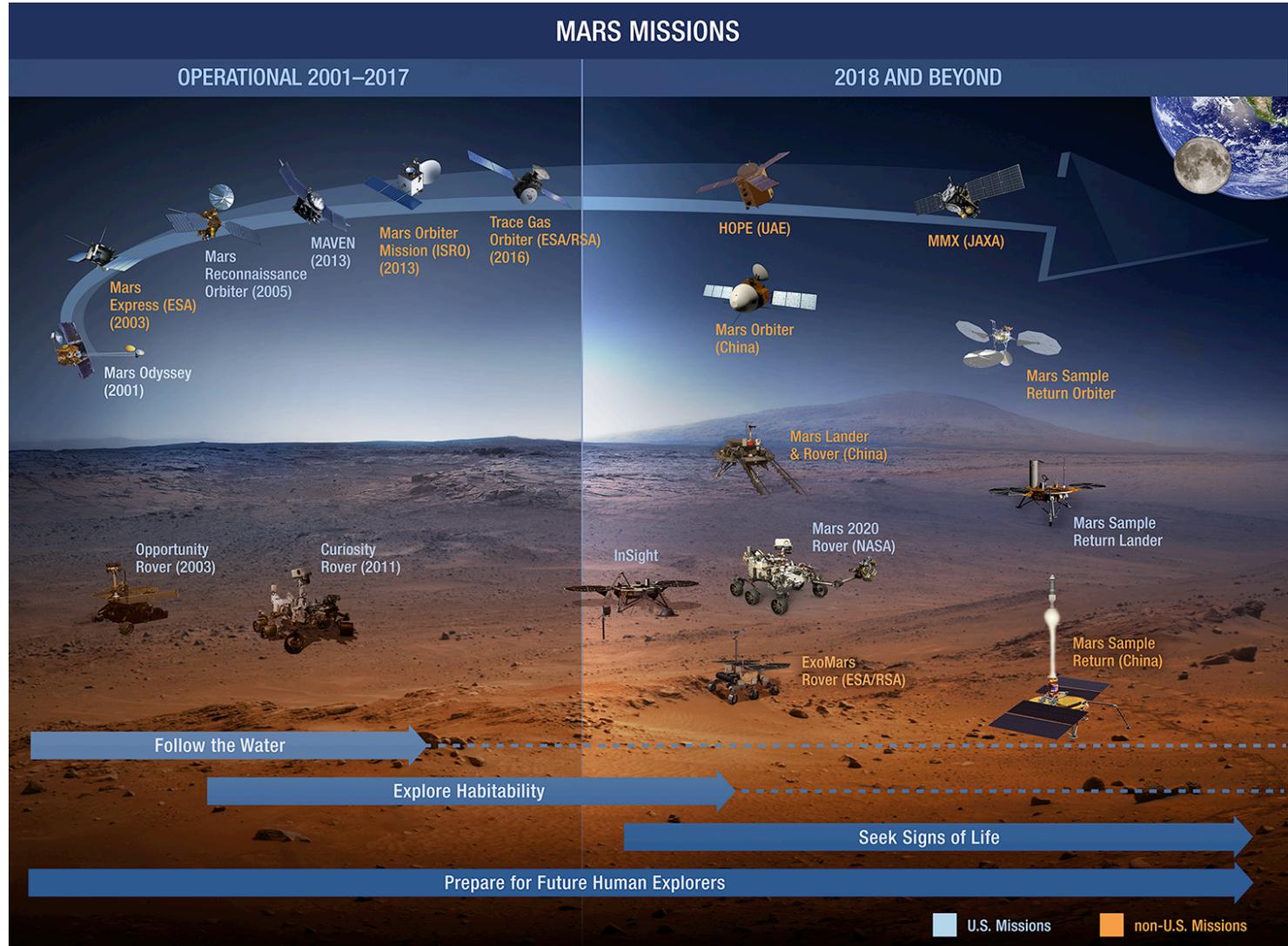


John McNamee
July 12, 2019

Mars Exploration in This Decade

Baseline Mars 2020 mission addresses the highest priority science

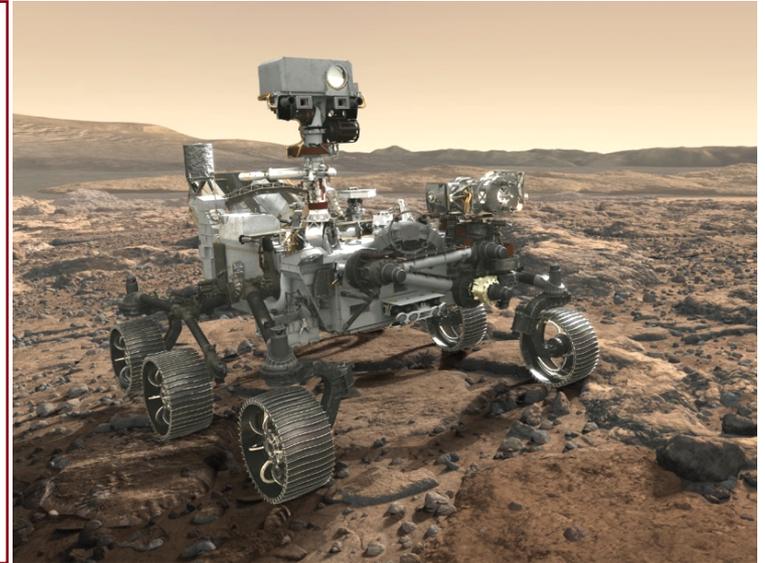
- Leverages MSL design, residual hardware, and experienced team
- Builds on Curiosity results by investigating a landing site for possible bio-signature preservation in full geologic context
- Incorporates HEOMD and STMD contributions and international collaboration
- Provides cached samples for possible future return



Mars 2020 Project Overview

Salient Features

- *Category: 1*
- *Risk Class: A-tailored*
- *Directed, JPL in-house implementation*
- *High heritage MSL design*
- *Modifications only as necessary to accommodate new payload and Sampling / Caching System (SCS)*
- *Planetary Protection Category V Restricted Earth Return per Level 1 Requirements*



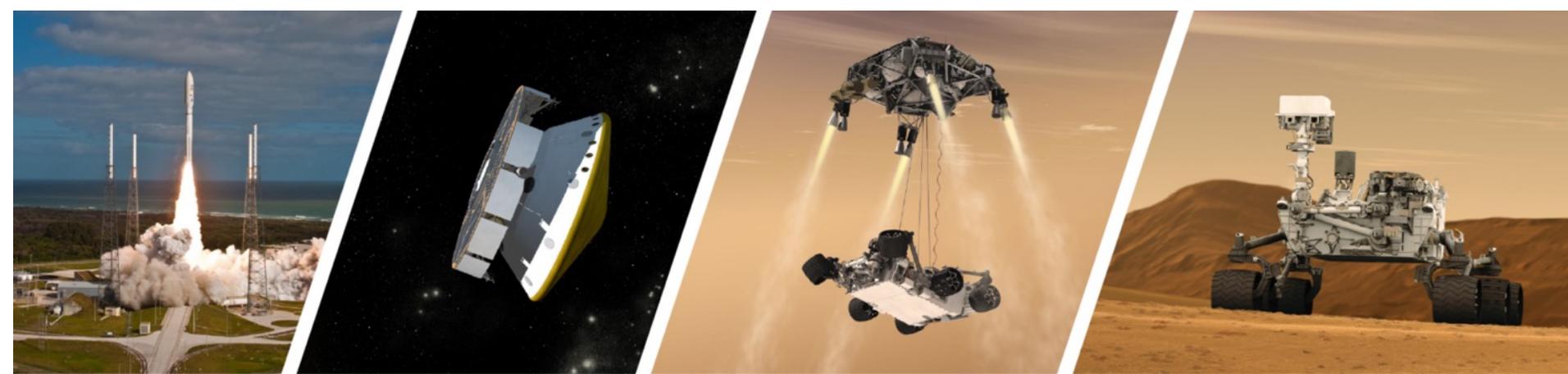
Science

- *Assess past habitability of an astrobiologically relevant ancient environment on Mars*
- *Assess biosignature preservation potential with the environment and search for biosignatures*
- *Assemble cached samples for possible future return to Earth*

Technology

- *Advance technologies with applications to future human and robotic explorations objectives*

Mars 2020 Mission Overview



LAUNCH

- Atlas V 541 vehicle
- Launch Readiness Date: July 2020
- Launch window: July / August 2020

CRUISE / APPROACH

- ~7 month cruise
- Arrive Feb 2021

ENTRY, DESCENT & LANDING

- MSL EDL system (+ Range Trigger and Terrain Relative Navigation): guided entry and powered descent / Sky Crane
- 16 x 14 km landing ellipse (range trigger baselined)
- Access to landing sites $\pm 30^\circ$ 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

M2020 approach heavily leverages MSL in order to reduce cost and control risk

Mars 2020 Spacecraft Build Approach



Launch Vehicle

- KSC/Launch Services Program procurement

MMRTG

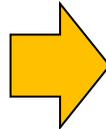
- DoE procurement to industry

Science & Exploration Technology Investigations

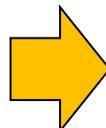
- Source per proposals via AO selection

MEDI2

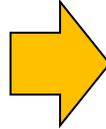
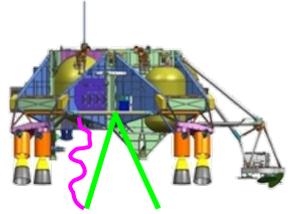
- NASA Centers (LaRC, ARC, and JPL)



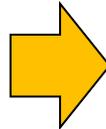
- Built in-house at JPL
- Lowest cost and risk per make-buy study and industry RFIs



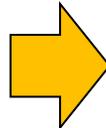
- Built by Lockheed-Martin/Denver
- Procure as sole source—most cost effective



- Built in-house at JPL
- Major industry subcontracts/components
- Rebuild in-house due to criticality of EDL and rover interface



- Built in-house at JPL
- Major industry subcontracts/components
- Spanish contributed High Gain Antenna
- Rebuild in-house due to complexity of vehicle, residual hardware, criticality of EDL and rover interface, operations experience



- Built by Lockheed-Martin/Denver
- Procure as sole source—most cost effective

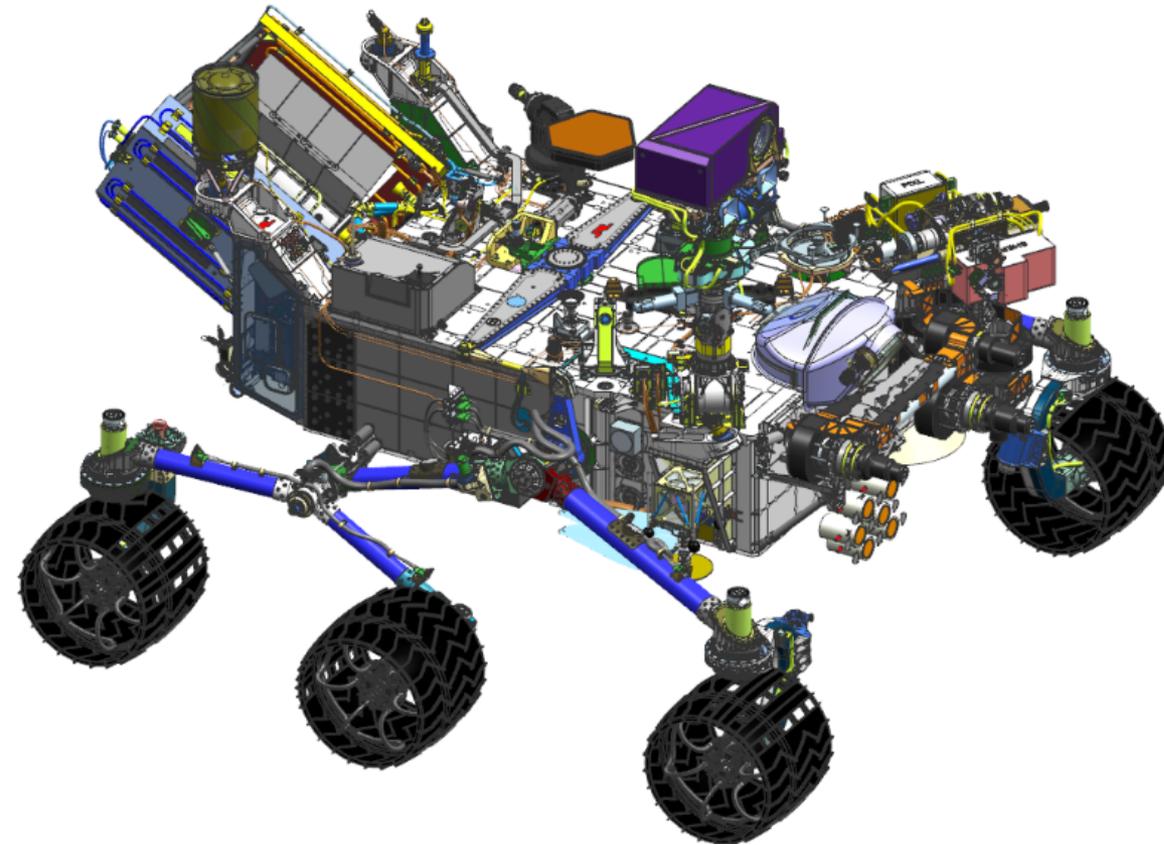
Mars 2020 Rover Concept

Stays the Same as MSL

- Avionics
- Power
- GN&C
- Telecom
- Thermal
- Mobility
- Forward contamination control

Changed

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



Mars 2020 Payload Family Picture

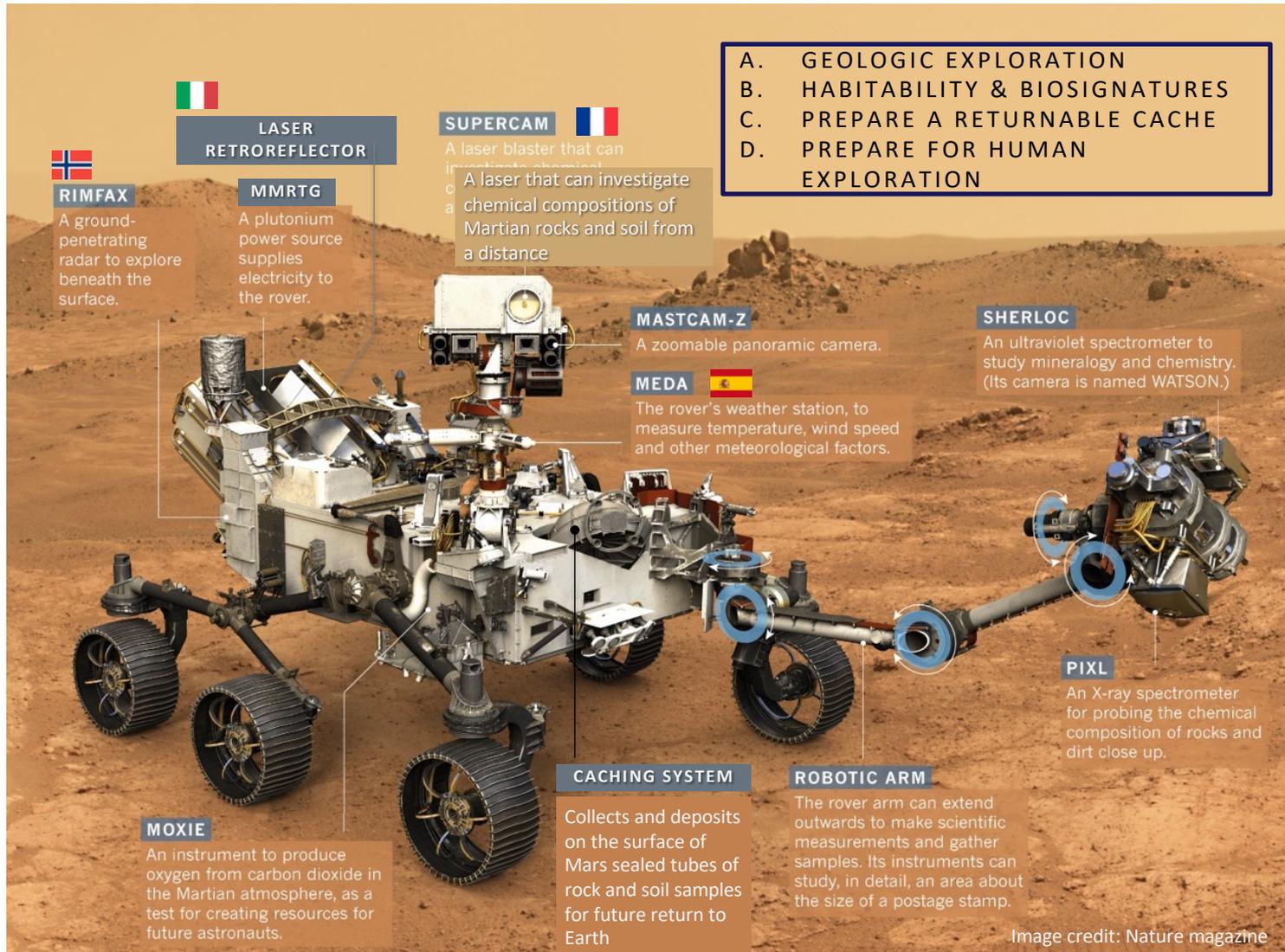


Image credit: Nature magazine

Cruise Stage, Descent Stage, Aeroshell

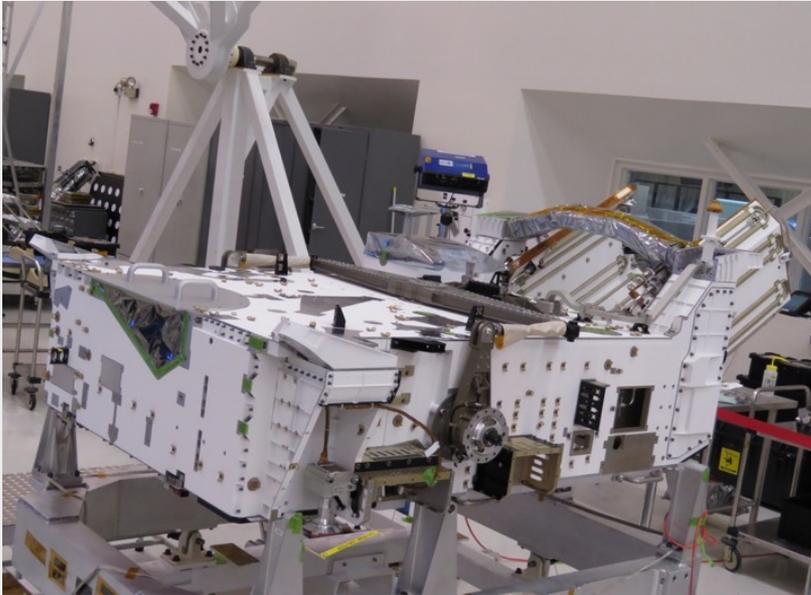


Area	Flight Elements	Status
CRUISE STAGE		
Power	Cruise Power Assembly	In Progress
Power	Cruise Power Analog Module A/B	FM Nearing Completion, Risk Low
Power	Cruise Solar Array	FM Nearing Completion, Risk Low
GNC	Sun Sensor Electronic & Heads A/B	FM Nearing Completion, Risk Low
GNC	Star Scanner-A/B	FM Nearing Completion, Risk Low
Mechanical	Cruise Stage Structure / LVA	FM Nearing Completion, Risk Low
Mechanical	Cruise Stage Harness	FM Nearing Completion, Risk Low
Propulsion	Cruise Stage Propulsion	FM Nearing Completion, Risk Low
Thermal	Cruise Heat Rejection System / HW	FM Nearing Completion, Risk Low
Telecom	Cruise Antenna's	FM Nearing Completion, Risk Low
AEROSHELL		
Mechanical	Backshell	In Progress
Mechanical	Heatshield (w/ MEDLI-2)	FM Nearing Completion, Risk Low
Mechanical	Parachute	FM Nearing Completion, Risk Low
Mechanical	Backshell Interface Plate	FM Nearing Completion, Risk Low
Mechanical	Parachute Support Structure	FM Nearing Completion, Risk Low
Telecom	UHF Antenna & Closeout Cone	FM Nearing Completion, Risk Low
DESCENT STAGE		
Power	Descent Power Assembly	In Progress
Power	Descent Power Analog Module A/B	FM Nearing Completion, Risk Low
Motor Control	Descent Motor Control Assembly	FM Nearing Completion, Risk Low
Power	Power Thermal Batteries (4)	FM Nearing Completion, Risk Low
GNC	Descent IMU-A/B	FM Nearing Completion, Risk Low
Telecom	Descent Stage X-Band - TWTA	FM Nearing Completion, Risk Low
Telecom	Descent Stage X-Band (SDST)	FM Nearing Completion, Risk Low
Telecom	DS Antennas	FM Nearing Completion, Risk Low
Radar	Radar / Terminal Descent Sensor	FM Nearing Completion, Risk Low
Thermal	Descent Stage Thermal Hardware	FM Nearing Completion, Risk Low
Mechanical	Bridle Umbilical Device	FM Nearing Completion, Risk Low
Mechanical	Descent Stage Structure	FM Nearing Completion, Risk Low
Mechanical	Descent Stage Harness	FM Nearing Completion, Risk Low
Propulsion	Descent Stage Propulsion	FM Nearing Completion, Risk Low



In Progress
FM Nearing Completion, Risk Low
FM Delivered / Complete

Rover Status



Area	Flight Elements	12/14/18 DPMC	05/08/19 Monthly	06/10/19 Current
ROVER				
Avionics	Rover Compute Element A/B			
Power	Rover Power Assembly / Shunts			
Power	Rover Power Analog Module-A/B			
Motor Control	Rover Motor Control Assembly			
Power	Rover Pyro Firing Assembly			
Power	Rover Battery			
Power	Rover MMRTG			
Mechanical	Rover Chassis			
Mechanical	Rover Harness			
Avionics	EDL FSW			
Avionics	Cruise FSW			
Mechanical	Mobility			
Thermal	Rover Heat Rejection System			
Telecom	RVR X-band - SSPA			
Telecom	RVR X-band (SDST)			
Telecom	Rover Low Gain & UHF Antennas			
Telecom	High Gain Antenna System			
Telecom	UHF Radio -A/B (Electra)			
GNC	RIMU-A/B (LN200)			
GNC	TRN VCE & Camera			
Imaging	Engineering Cameras			
Mechanical	Remote Sensing Mast		*	
Sampling	Adaptive Caching System			
Sampling	Robotic Arm Assembly		*	
Sampling	Coring Drill			
Payload	SHERLOC BU/TU			
Payload	PIXL BU/TU			
Payload	MOXIE			
Payload	MEDA			
Payload	RIMFAX			*
Payload	MastCam-Z BU/MU			
Payload	SuperCam BU/MU			

	In Progress
	FM Nearing Completion, Risk Low
	FM Delivered / Complete



Milestones to Launch

Date	Status/Description
August, 2019	Stack Rover and Descent Stage into Powered Descent Vehicle Configuration
August, 2019	Powered Descent Vehicle Random Vibe
September, 2019	De-Stack Powered Descent Vehicle
September, 2019	Rover Surface Thermal Test/System Test 4
October, 2019	Rover Electromagnetic Interference/Electromagnetic Compatibility Test
October, 2019	Rover Late Integration/Rework
October, 2019	De-Stacked Vehicle System Test #5
December, 2019	Pre-Ship Review
December, 2019	Aeroshell/Heatshield Shipment to KSC
February, 2020	Rover, Cruise Stage, Descent Stage Shipment to KSC
April, 2020	Operational Readiness Review
June/July, 2020	Launch vehicle fairing encapsulation and transport to launch pad
July, 2020	Flight Readiness/Launch Readiness Reviews
Jul 17, 2020	Launch period opens