



National Aeronautics and
Space Administration

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MARS EXPLORATION PROGRAM

Update to the MEPAG

June 25,, 2018

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Lead Scientist – Mars Exploration Program

MEP News & Status

- All Operating Missions are doing well
 - Opportunity pending
- All Development Missions and systems are progressing
 - M2020 proceeding to Agency KDP-D
 - Helicopter included as Tech Demo
 - MOMA instrument delivered for ESA ExoMars
- MAVEN orbit to be adjusted to facilitate communications relay for M2020
 - Plan to reduce apoapsis for improved relay performance in 2019 & beyond
 - Apoapsis to be reduced from 6200 km to 4000/4500 km
 - Incorporating approaches to preserve fuel and to continue some key MAVEN science
- Progressing in our technology maturation program for key MSR technologies
- Preparing for the next Decadal; considering studies and roadmap activities, and exploring how to leverage nontraditional opportunities for Mars investigations
 - E.g., commercial and strategic mission launch opportunities; secondary & international payloads

MEP Budget News

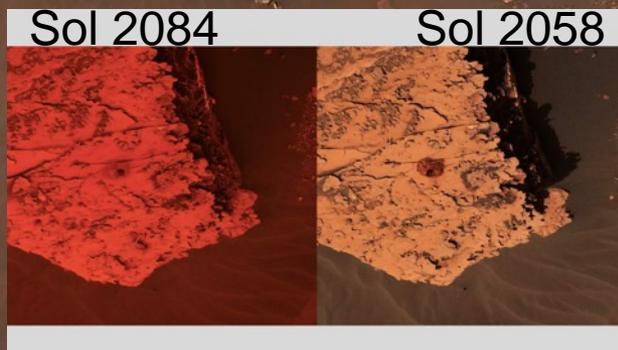
- FY18 Budget Appropriation was favorable for the MEP, receiving ~\$75M increase over President's request. Used to:
 - Maintain the high pace of development on M2020, preserving maximum schedule reserves for ATLO
 - Continue all our operating missions within FY18 budget
 - Continue our technology maturation activities
 - Fully fund R&A
- Included was additional funding to explore the feasibility and potential of diverse mission technologies for future application

More Mars News & Status

- InSight launched May 5, 2018 from VAFB!
 - Landing on Nov. 26, 2018
 - 2 MARCO cubesat fly-by's for EDL relay
- TGO now in its 400 km science orbit and finishing commissioning
- NASA providing payloads for JAXA MMX mission
 - MEGANE (JHUAPL) neutron and gamma-ray spectrograph
 - Pneumatic sampler on lander

Mission Updates

- MSL
 - Finished Duluth drilling campaign
 - first successful drilling without drill feed
 - Complex organics on Mars
 - vulcanization as a preservation mechanism
 - Background methane has a seasonal variation



Dust Storm

May 30: MRO MARCI spots a local dust storm, one of many in the polar jet stream at high northern latitudes

June 1: The local storm moves down the Acidalia storm track; MER alerted

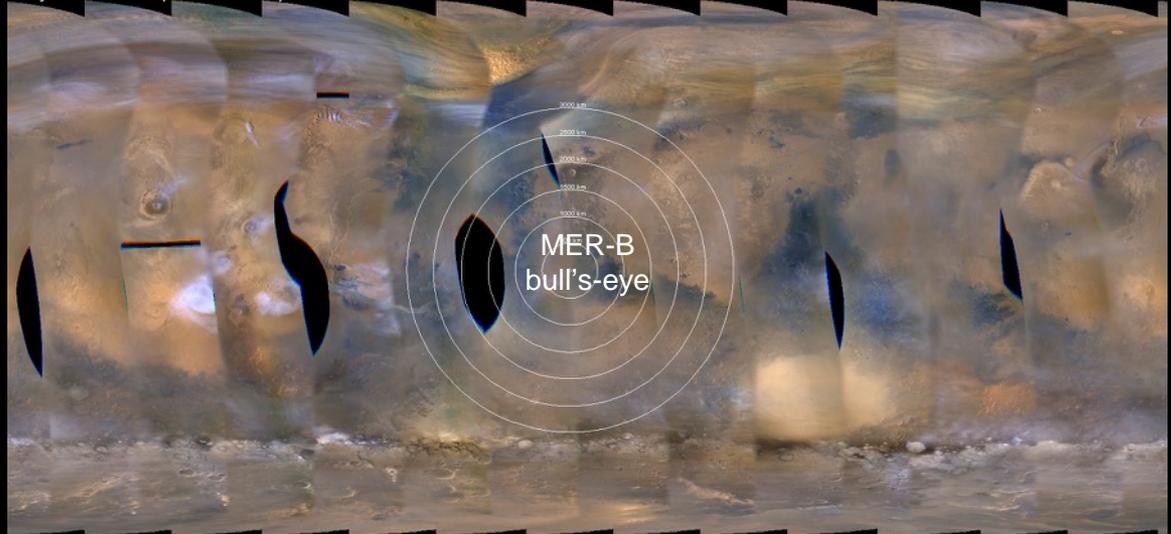
June 2-present: Local dust storm stalls over Meridiani and expands to the east

June 5: Regional storm merges with southern hemisphere local storms to cover most of eastern hemisphere

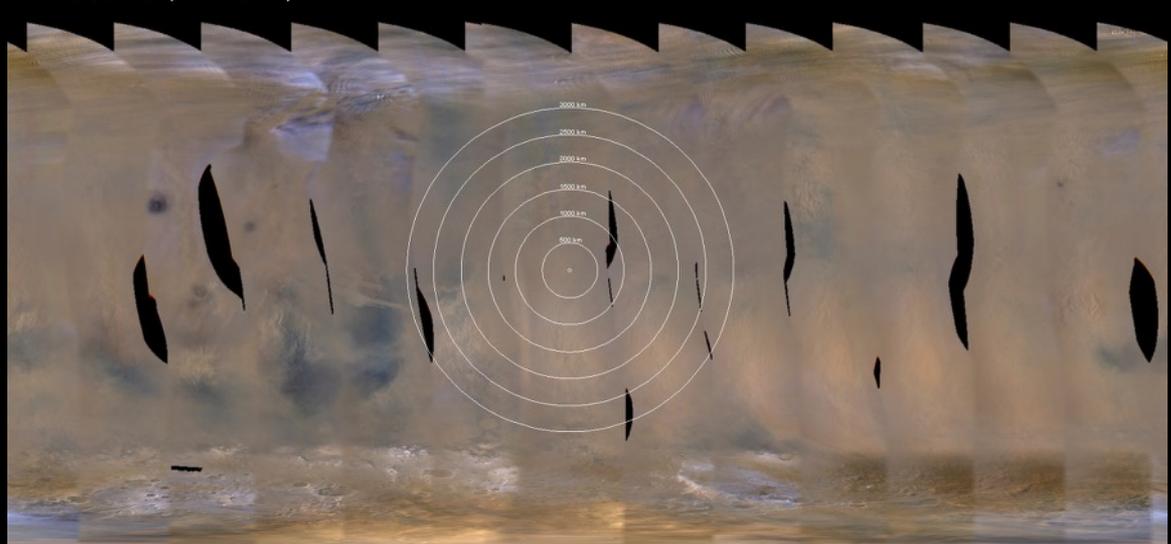
June 19: New activity in Solis-Sinai Planum pushes storm into the rare category of a Planet-Encircling Dust Event (PEDE 2018a)

Today: Dust-raising centers starting to wane; dust haze will last a month or more; *Opportunity* site still obscured

May 26, 2018 (Ls = 182.2)



June 19, 2018 (Ls = 196.0)



MRO MARCI (Daily global maps provided by B. Cantor, MSSS/JPL/NASA)

Dust Storm

Tau = 1

3

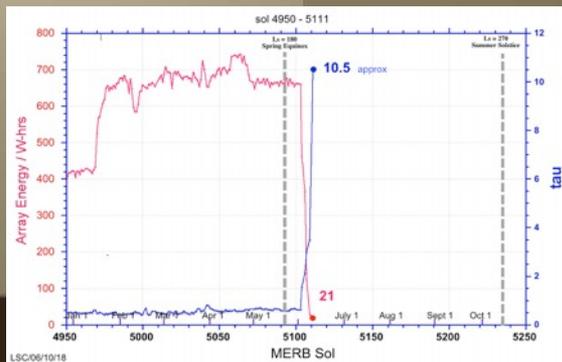
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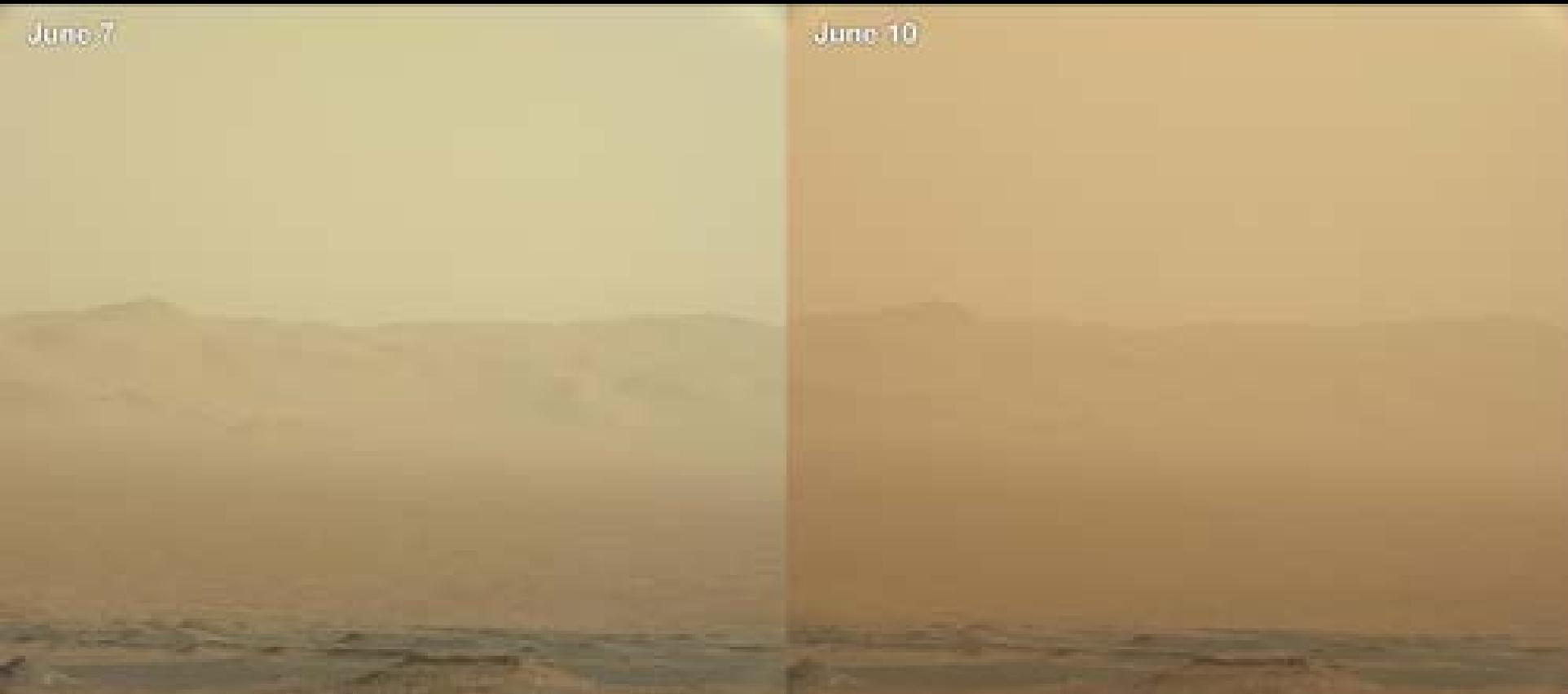
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← *Opportunity rover in survival mode*
Not expecting contact until dust haze clears →



**Mid-day skylight at Opportunity as simulated by M. Lemmon
from measurements MER / JPL / NASA**

Dust Storm



**Curiosity looking at Crater Wall
even before the main dust haze had arrived!**
MSL / MSSS / JPL / NASA



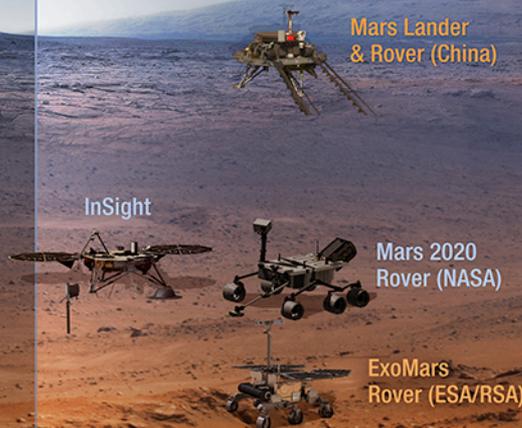
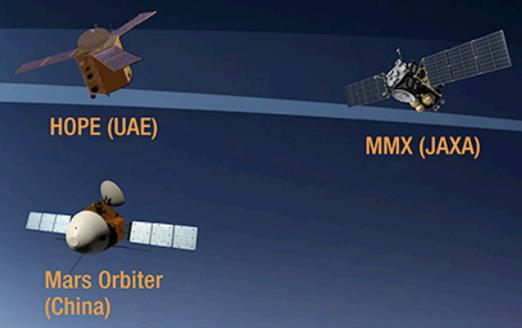
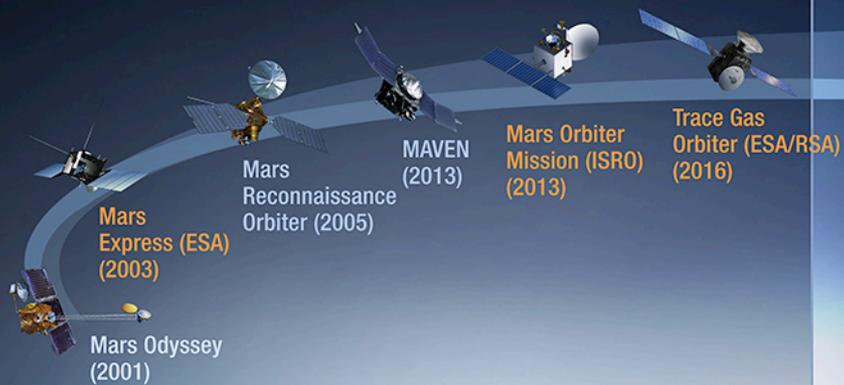
Launched May 5, 2018 – VAFB
Landing November 26, 2018 – Mars

InSight

MARS MISSIONS

OPERATIONAL 2001–2017

FUTURE 2018–2030



Planning
NASA
MSR

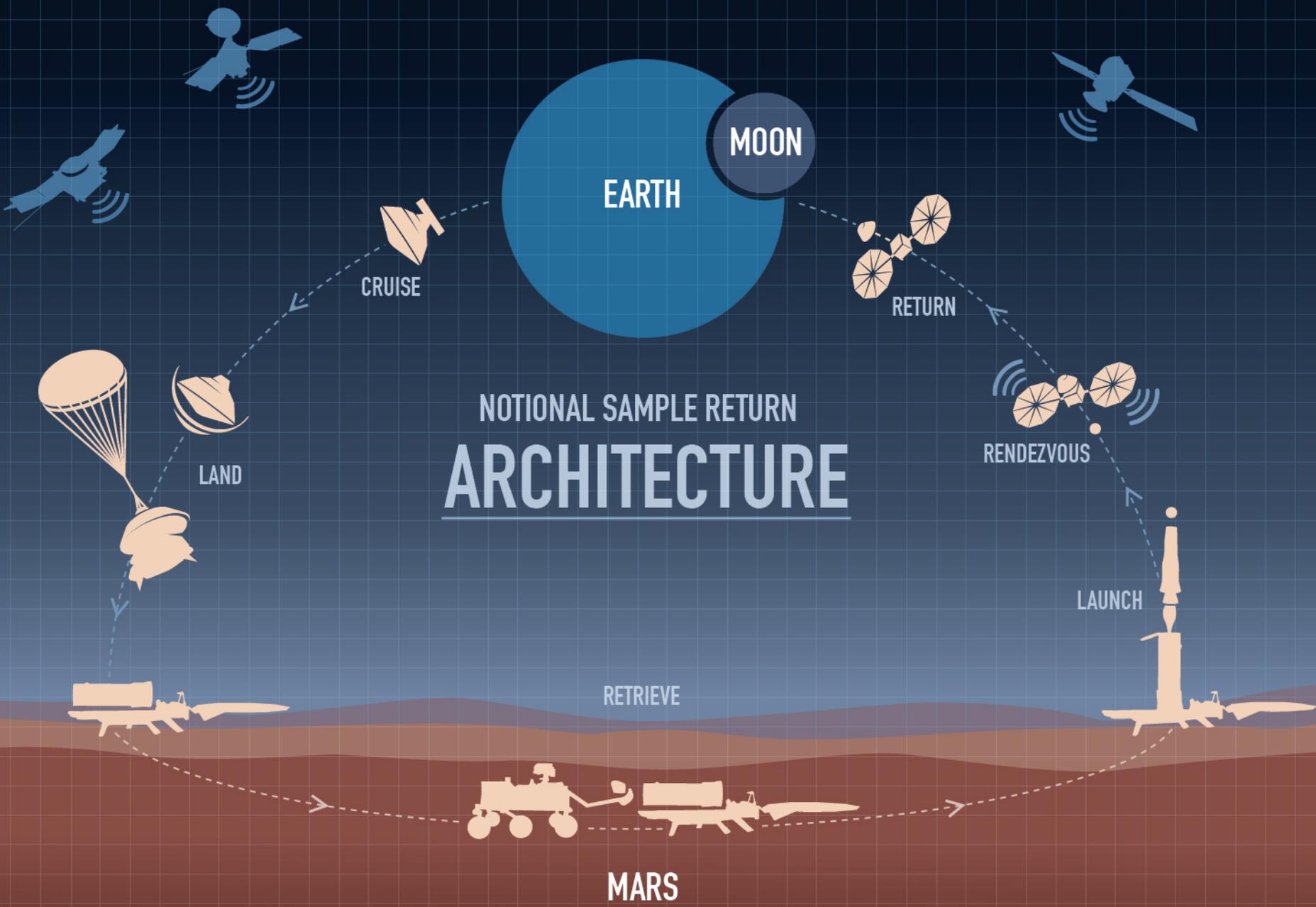
Follow the Water

Explore Habitability

Seek Signs of Life

Prepare for Future Human Explorers





NOTIONAL SAMPLE RETURN ARCHITECTURE

STRATEGIC APPROACH FOR MSR IMPLEMENTATION

“Lean Sample Return” – NOT a compromise on the returned sample science but an affordable approach to the mission set for returning samples

- Returning selected samples is the Level-1 requirement
- Cost & risk are part of the essential trade-space
- Focused scope; no ornaments
- Capitalize on experience base; Limit new development
- Continue early technology investments to mature readiness and minimize cost risks
- Leverage partnerships
- Strong programmatic discipline in execution

- Partnerships
 - IMEWG/IMSR
 - See later reports in this meeting on iMOST and 2nd International Conference on Sample Return (Berlin meeting, April, 2018)
- United Arab Emirates plans building a Mars City
 - Seeking input on requirements for science laboratory facility
- Mars 2020 sampling status
 - Fluid Mechanical Particle Barrier reviewed by Planetary Protection independent group – positive review and no show stoppers; report pending
- Tech investments continue
- Communications – TGO

MARS EXPLORATION PROGRAM – SUMMARY

MEP today is a healthy program

- Current missions highly productive
- Development missions/systems doing well
- Beginning early-stage work on a potential lower cost MSR mission,
 - A Decadal priority
 - Leveraging international and commercial partnerships
 - NASA-ESA Statement of Intent outlines approach, including roles
 - Agencies will develop technical plan over the next 18 months to better understand flight elements, interfaces and costs
 - Looking forward to agency commitments to next MSR mission steps in the next (FY20) budget cycle and by ESA (December, 2019)
- Beginning preparations for 2019 next Decadal activities
 - Still need to argue for the future: For the next steps in MSR and for opportunities to pursue additional compelling science at Mars