National Aeronautics and Space Administration

MARS EXPLORATION PROGRAM

Virtual MEPAG Update

February 20, 2018

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MARS EXPLORATION PROGRAM – STATUS

- All Operating Missions are operating well
  - Restart drilling on Curiosity mid-Feb
- All Development Missions and systems are progressing
  - M2020 SIR - Feb 2018
  - MOMA instrument for ESA ExoMars Rover in environmental test campaign
- Progressing in our technology maturation program for key MSR technologies
  - MAV
  - Bio-Containment
- Supporting other Mars mission activities and technology developments
  - MMO “CubeSat”
  - Mars Helicopter
- Investigating new, leaner architectures in preparation for planning for a Mars Sample Return mission

Other Mars MISSION NEWS

- MAVEN orbit adjustment to facilitate comm relay for M2020
  - Plan to reduce apoapsis for improved relay performance in 2019
    - Apoapsis change from 6200 km to 4000/4500 km
    - Incorporating approaches to preserve fuel
- TGO nearing operational mission orbit
  - Aerobraking in process; plan to reach final 400 km orbit by ~ early March 2018
- InSight proceeding to launch
  - Shipment to VAFB Feb 28, 2018
- NASA providing payloads for JAXA MMX mission
  - MEGANE (JHUAPL) neutron and gamma-ray spectrograph
  - Pneumatic sampler

1 Year post-CDR: M2020 Development Well Along

Ready to proceed to System Integration Review (SIR) in February 2018

Flight Descent Stage

Flight Cruise Stage

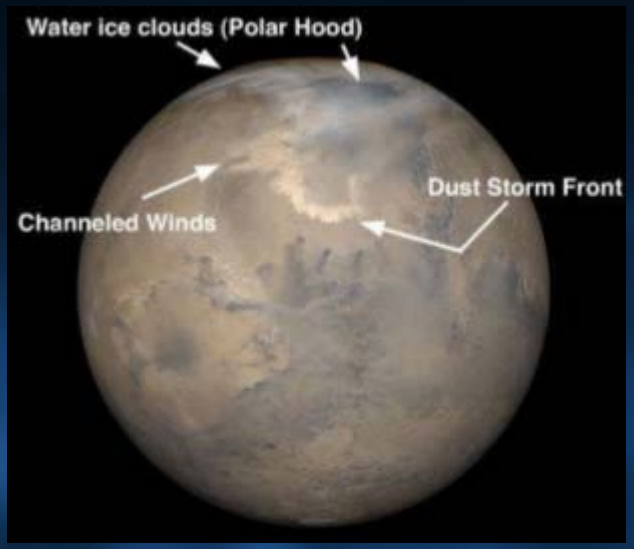
Sensors & Electronics

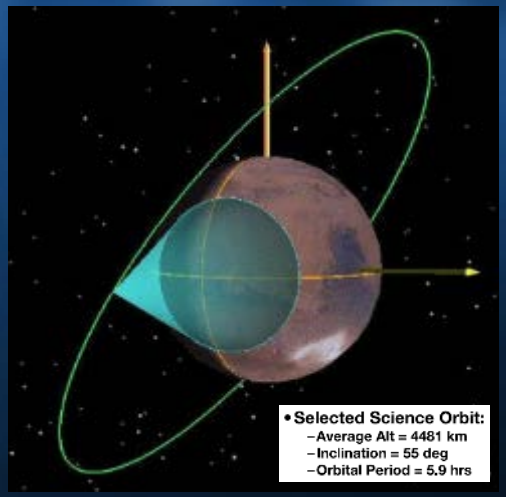
Parachute Testing

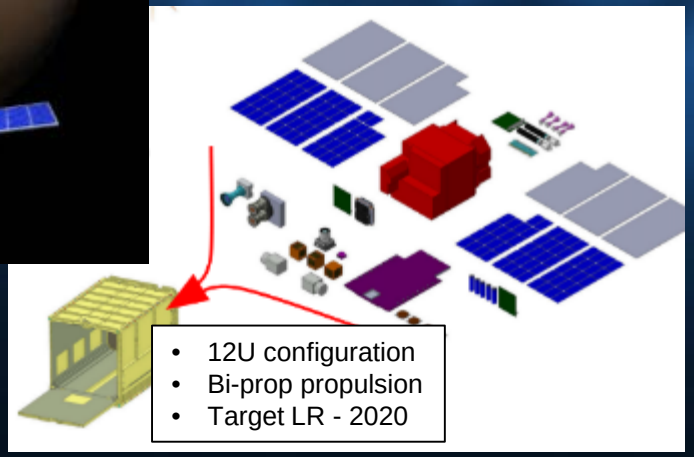
Flight Aeroshell

Mars Micro Orbiter (MMO)

- Highly Ranked SIMPLEx-2014: proposal selected for risk reduction funding. After first risk reduction study was completed, a second grant was issued for technical development
  - PDR – March 28-30, 2018
- PI: Michael Malin, MSSS
- Science Objective: Global environmental monitoring of Mars
- PI will brief at LPSC



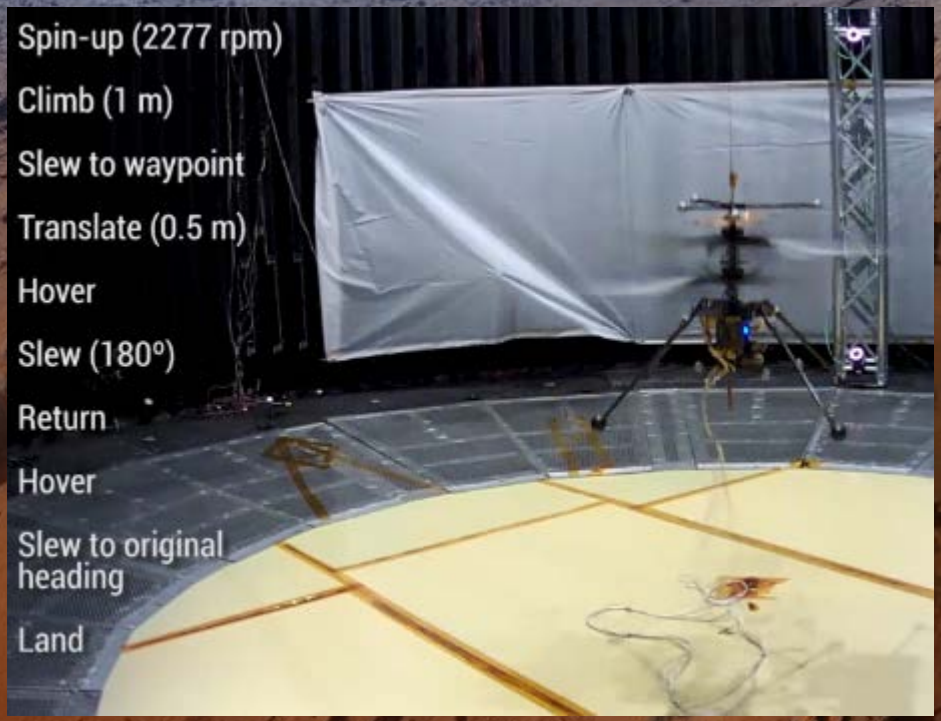




MARS HELICOPTER - TECHNOLOGY DEVELOPMENT

Objective - Explore utility of Mars aerial mobility

- Regional-scale high-resolution reconnaissance to facilitate surface operations of future robotic missions
- Access to extreme terrains, Rover scouting
- Mass ~ 1.8 kg, solar powered,300 m range on one charge, autonomous, dual cameras



Full-scale free flight testing in JPL Space Simulator

Technology Maturation Progress

- ✓ Controlled-flight feasibility demonstration – June 2016
- ✓ Engineering Model build & test complete – Feb 2018
  - ✓ 86 mins accumulated flight time in Mars environment
- o Decision on flight opportunity pending

Program Highlights

FY 2019 Budget

Program Highlights

Planetary Science

Exploration program supports commercial partnerships and innovative approaches to achieving human & science exploration goals

- New Planetary Defense program includes DART development
- Europa Clipper launch as early as FY25
- Plan a potential Mars Sample Return mission

Astrophysics

launch

- Given its significant cost within a proposed lower budget for Astrophysics and competing priorities within NASA, WFIRST terminated with remaining WFIRST funding redirected towards competed astrophysics missions and research

Heliophysics

strengthen cross-agency collaboration on Research-to-Operations/Operations-to-Research

- Provides for a balanced Heliophysics portfolio, including enhanced emphasis on small missions, technology development and expanded opportunities for R&A

Earth Science

science portfolio

- Maintains regular cadence of Venture Class missions and instruments solicitations
- Healthy research and applied science programs, and SmallSat/CubeSat investments

- ➢Continue all ongoing MEP Missions
- ➢Continue M2020 Development
- ➢Plan a potential **Mars Sample Return** mission, a decadal survey priority, leveraging international and commercial partnerships

STRATEGIC APPROACH FOR MSR IMPLEMENTATION

- *"Lean Sample Return"*
  - Retain flexibility on requirements; cost & risk are part of the essential trade-space
  - Focused scope
  - Capitalize on experience base
  - Limit new development
  - Make early technology investments to mature readiness and minimize cost risks
  - Leverage partnerships
  - Strong programmatic discipline in execution

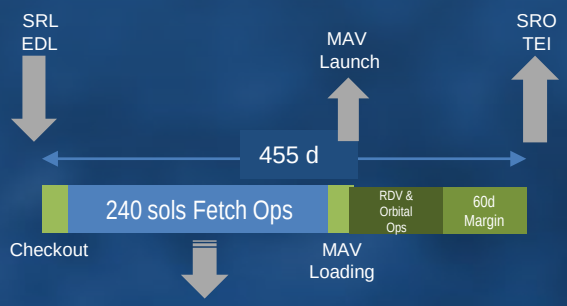
SAMPLE RETURN: KEY REQUIREMENTS

LAND in the right place

Land in small landing error ellipse (≤10 km) to access M2020 sites

COLLECT samples fast

Long traverse with tight timeline



- 130 sols for driving km (rover odometry)
- 20 sols for tube pickup (1 tube/sol)
- 90 sols for faults/anomalies/engineering activities

Get it BACK

Launch, rendezvous and return

MARS EXPLORATION PROGRAM – SUMMARY

- MEP is a healthy program
  - Current missions still productive
  - Development missions/systems doing well
  - Beginning early-stage work on a potential lower cost MSR mission, long a Decadal priority, leveraging international and commercial partnerships
- Upcoming meetings
  - MEPAG – April 3-5, 2018
  - IMEWG – April 23-24, 2018
  - ESA MSR Conference – April 25-27, 2018