# Mars Exploration Program Analysis Group (MEPAG)

*chartered by NASA HQ to assist in planning the scientific exploration of Mars*



# Welcome to MEPAG Meeting #34

Jeffrey R. Johnson, MEPAG Chair

July 10, 2017

Lindbergh Mound
Sol 4066 (July 2, 2015)
MER Opportunity Pancam
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# Introduction

- Rationale for virtual meeting
  - At MEPAG #33 we discussed ideas for more frequent, shorter, topical discussions held as webcasts to augment face-to-face meetings (https://mepag.jpl.nasa.gov/meeting/2017-03/16.%20Proposal_Quarterly_2.pptx)
  - **July 13**: National Academies of Sciences, Engineering, and Medicine (NASEM) committee "*Review of Progress Toward Implementing the Decadal Survey Vision and Voyages for Planetary Sciences*" will include presentation by R. Zurek on Next Mars Orbiter Science Analysis Group (NEX-SAG, 2016) and updated list of "MEPAG concerns"
    - Looking for feedback on draft, to be discussed here today
    - Committee's Statement of Task was updated to include assessment of Mars architecture/program (see below)
- Today's agenda includes work done since MEPAG #33 meeting (2/2017), NEX-SAG example, NASA remarks (M. Meyer), discussion of future Mars architecture concerns, and future MEPAG meetings/plans

# Agenda

| Start | Duration | Title/topic | Presenter |
|---|---|---|---|
| 8:30 | 0:30 | Past and ongoing MEPAG activities | J. Johnson, MEPAG Chair |
| 9:00 | 0:15 | Mid-Term Decadal Survey NEX/SAG presentation | R. Zurek |
| 9:15 | 0:10 | Mars HQ Perspectives | M. Meyer |
| 9:25 | 0:10 | MEPAG Perspectives on Future Architectures | J. Johnson |
| 9:35 | 0:40 | Discussion | J. Johnson, R. Zurek, D. Beaty |
| 10:15 | 0:10 | Upcoming MEPAG activities | J. Johnson, R. Zurek, D. Beaty |
| 10:25 | 0:05 | Wrap-up | J. Johnson |
| 10:30 | | Adjourn | |

- Please mute your phone
- Use chat box on WebEx; moderators will track questions
- Feedback/questions during and after meeting? → MEPAGmeetingqs@jpl.nasa.gov

# MEPAG Activities since February meeting #33 (1 of 2)

- Planetary Science Vision 2050 Workshop (Feb 27-Mar 1, 2017, Wash., DC)
  - http://www.lpi.usra.edu/V2050/presentations/Monday/4_8073_Johnson
  - Summary package (Beaty/Ehlmann): http://www.lpi.usra.edu/V2050/target-strategies/mars-strategy.pdf
- National Academies of Sciences, Engineering, and Medicine (NASEM) committee "*Review of Progress Toward Implementing the Decadal Survey Vision and Voyages for Planetary Sciences*" (May 4, 2017, Wash., DC)
  - http://sites.nationalacademies.org/ssb/currentprojects/ssb_177619
  - https://mepag.jpl.nasa.gov/meeting/2017-07/MEPAG_Johnson_MTDS_v04.pdf (previous MEPAG presentation)
  - Summary below of MEPAG concerns that were provided to the committee at that time
- Review of The Planetary Society's white paper "Mars in Retrograde"
  - http://planet.ly/MarsInRetrogradePaper
  - Summary included below

# MEPAG Activities since February meeting #33 (2 of 2)

- Submitted invited abstract to 12th Low-Cost Planetary Missions Conference (August 15-17, 2017, Pasadena)
  - *"The Role of Small Satellites in Addressing Mars Science Goals"*
- Summary of current citizen science Mars projects and NASA support:
  - https://mepag.jpl.nasa.gov/meeting/2017-03/MarsCitizenScience.pdf
- Goals Committee work on mapping of polar science questions to MEPAG goals
- Exit meeting for former Planetary Science Subcommittee (PSS) members held at Lunar and Planetary Science Conference (March 2017, The Woodlands, TX)
  - Analysis/Advisory Groups (AGs) no longer members of PSS but will be invited to brief the Planetary Science Advisory Committee (PAC)
  - Status of PAC unclear

# Mid-term Decadal Survey review committee new task: Mars

*"With respect to the Mars program within the planetary science program, the committee's assessment will include:*

- *the Planetary Science Division's Mars exploration architecture and its responsiveness to the strategies, priorities, and guidelines put forward by the National Academies' V&V and other relevant National Academies Mars-related reports;*
- *the long-term goals of the Planetary Science Division's Mars Exploration Program and the program's ability to optimize the science return, given the current fiscal posture of the program;*
- *the Mars exploration architecture's relationship to Mars-related activities to be undertaken by foreign agencies and organizations; and*
- *the extent to which the Mars exploration architecture represents a reasonably balanced mission portfolio."*

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## Mid-term DS review committee: Mars agenda on May 4 (Washington, DC)

- MEPAG Update — Jeff Johnson
  - Progress and new discoveries/activities since V&V, MEPAG concerns and future roles
- Mars Exploration Program — Jim Watzin

## Mid-term DS review committee: Mars agenda on July 13 (Pasadena, CA)

- Early Mars as a key to understanding planetary habitability — Bethany Ehlmann
- What we have learned about the history of Mars' habitability from MAVEN — Bruce Jakosky
- Updates on research for shallow excess ground ice — Shane Byrne
- MEPAG Science Analysis Group updates on the Next Mars Orbiter (NEX-SAG) — Richard Zurek
- Mars 2020 Status and Updates — Ken Farley
- NASA Mars Exploration Program — Michael Meyer

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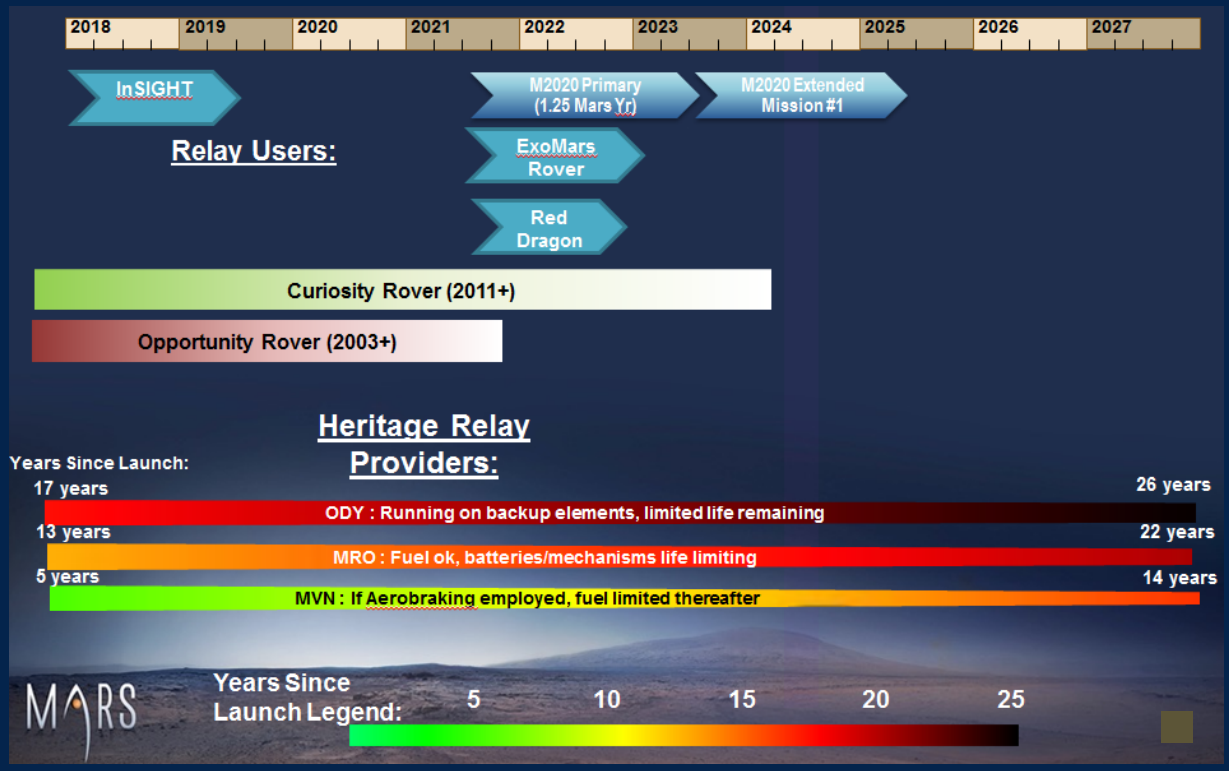
## MEPAG Concerns: 1--MEP Infrastructure is Nearing Exhaustion

***Presented to first meeting of mid-term DS Review committee on May 4, 2017***



## MEPAG Concerns: 2

- A prime frustration of the MEPAG community is the absence of high-level discussion of future Mars missions to follow the 2020 caching rover now in development. With the Agency seemingly unable or unwilling to even discuss next steps, sample return seems to be "on hold" indefinitely, and opportunities to further understand the diverse environments of a complex planet have not been pursued.

- A second major frustration of the U.S. portion of the MEPAG community is the seeming absence of competed opportunities for U.S. investigators to address outstanding questions in Mars science (e.g., polar climate science) in lieu of, or even as part of, the orbiter and rover missions required to return samples to Earth.

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## MEPAG Concerns: 3

- MEPAG still supports the conclusion of past Decadal Surveys that well-characterized sample return is the highest-priority next step
  - Provides ability to address fundamental questions of past life, changing climate and planetary processes of a habitable terrestrial planet
- However, the absence of committed missions of any kind in a program architecture is most troublesome if we are to understand Mars and what it can tell us about all planets, including our own.
- The V&V 2011 recommendation for "major investment" in MSR technologies (MAV thermal control, autonomous launch operations, ascent/guidance in Mars conditions) has not yet been met ($10M+ reportedly spent thus far)

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## MEPAG Roles in the Next Mars Architecture (1 of 2)

- Continue support for the 2020 Mars rover and press for comprehensive planning of the next missions needed to complete Mars sample return
- Look for opportunities to pursue non-MSR science, including R&A
  - Mars is a complex planet. The scientific questions now being asked require new analysis, new laboratory work on volatile and aqueous processes, and continued work on/in Earth analog field sites, all of which the community is prepared/excited to pursue.
    - Presently, missions well past their prime phases are carrying some of the R&A load; this will change as these missions end and more will have to be done in the data analysis programs
  - Update the Goals Document to maintain consistency with new discoveries
  - Identify possible New Frontiers candidates to be approved in the next Decadal Survey
  - Study those candidates and the MSR follow-on missions, once defined, for opportunities to fly science instruments/investigations

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## MEPAG Roles in the Next Mars Architecture (2 of 2)

- Look for opportunities (*continued*)
  - Look at small satellite and commercial space opportunities for flight of science instruments; look to facilitate synergy and coordination
    - Study possibility of competed, PI-led small satellite missions carried to Mars by strategic missions with data returned through those missions (e.g., the next Mars orbiter, Red Dragon)
- In both the MSR and non-MSR mission context, help facilitate international cooperation at the payload and mission level
- Look for ways to assist planning for human missions, including dual missions supporting both science and exploration generally
  - The question is: What does the agency want to do?

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# Preparations for Humans

- ***Mars is the logical destination for humans in deep space***
  - What do we need to know to make that journey possible while minimizing cost and risk?
  - Can humans live on Mars? Where are the resources? What are the hazards?
    - Where can water be extracted? From shallow ice? From hydrated minerals?
    - Planetary protection policy must be addressed if these resources are to be used.
    - What are the nature of the hazards and how can they be mitigated?
  - What should humans do on Mars to advance our understanding of Mars, Earth, and all planets?

- ***MEPAG stands ready to assist in exploring answers to these questions***
  - A human flight architecture is needed to set priorities in precursor missions, but MEPAG feels strongly that analysis of returned samples would be a great benefit.
  - Joint workshops are an excellent way to bring the most relevant questions and plans into focus (e.g., the Human Landing Site workshop)
  - Existing and future orbital remote sensing can contribute
  - Much can be done with analysis and new approaches to existing data

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## MEPAG Roles in preparation for the next Decadal Survey (2023-2032)

- Involve the Mars/planetary/commercial community through SAGs and at least one annual face-to-face meeting per year
- Update the Goals Document as new discoveries and new research shape our understanding of Mars
  - Build on major conferences and topical analysis groups
- Investigate new ways of doing missions; e.g., with international partners, commercial entities, or missions of opportunity
- Debate and build consensus
- Suggest specific items for detailed study by MEP
- Encourage the community to participate as members of the Decadal Committees and as authors of white papers
  - this provided vital input to the Decadal committees during the last Decadal Survey

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# Summary

- New and ongoing discoveries have challenged many previous views of Mars–this will continue, given new and long-lived assets at Mars, supported by data analysis
- Progress is being made toward Mars Sample Return
  - 2020 Mars caching rover is on schedule and budget, with a capable payload for selecting samples and providing their geological context
  - Key technical studies are in progress to help lower the cost and cost risk of the future missions that are needed to complete sample return, but at low levels that need to be accelerated
- Major concerns for both sample return and Mars science are:
  - An aging infrastructure and a lack of a confirmed post-2020 architecture, including no identified opportunities for competed flight investigations that often make the key discoveries
  - The missing element seems to be the will to proceed on the part of the agency and administration
- There remains much exciting science to do at Mars, and community momentum is strong to address fundamental questions about planetary evolution and origin of life
  - MEPAG remains ready to respond to calls for assistance to help implement the plans


# Planetary Society "*Mars in Retrograde*" white paper

http://planet.ly/MarsInRetrogradePaper

- **Suggested Pathway**: Invest modest capital beginning in FY 2018 to maintain the scientific and technical capabilities that have taken decades to acquire while advancing the technological and surveying knowledge necessary for human exploration

- **Recommendations:**
  1) NASA should immediately commit to a Mars telecommunications and high-resolution imaging orbiter to replace rapidly aging assets currently at Mars.
  2) NASA should begin formulation of a sample retrieval rover and Mars Ascent Vehicle mission to continue the overall Mars Sample Return campaign.
  3) NASA should formulate a follow-on strategy to the Robotic Mars Exploration Strategy, 2007-2016 document.
     - https://mepag.jpl.nasa.gov/reports/3715_Mars_Expl_Strat_GPO.pdf